Calcasieu Estuary Remedial Investigation
Lake Charles, Louisiana

Draft Remedial Investigation Report

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Sections 1 – 6 with
Associated Tables and Figures
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DISCLOSURE

This disc contains Sections one through six with associated tables and figures of the Calcasieu Estuary Draft Final RI Report. The links in the table of contents are accessible only to the sections included on the disc. Sections seven through sixteen with associated tables and figures are on Disc Two. Appendices A through I are on Disc Three. As with Disc One, Discs Two and Three links are only accessible to the sections included on that disc.

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Acronyms

Ag	silver
ANOVA	Analysis of Variance
AOC	area of concern
ARARs	applicable or relavent and appropriate requirements
As	arsenic
ASTM	American Society for Testing and Materials
atm-m3/mol	atmospheres-cubic meters per mole
AVS	acid volatile sulfides
AWQC	ambient water quality criteria
BEHP	bis 2-ethylhexyl)phthalate
BERA	baseline ecological risk assessment
BEST	Biomonitoring of Environmental Status and Trends
BFI	Browning-Ferris Industries
bgs	below ground surface
BHS	benzene hexachloro cyclohexane
BI	Bayou d'Inde
BOD	biological oxygen demand
BRD	USGS/Biological Resources Division
BSAF	biota-sediment accumulation factors
BV	Bayou Verdine
CCME	Canadian Council of Ministers of the Environment
Cd	cadmium
CDF	confined disposal facility
CDM	CDM Federal Programs Corporation
CEC	cation exchange capacity
CEEAG`	Calcasieu Estuary Environmental Action Group
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
Certain-Teed	Certain-Teed Products Corporation
Cfs	cubic feet per second
Citgo	Citgo Petroleum Corporation
CLP	Contract Laboratory Program
cm	centimeter
CN	cyanide
CO	contract officer
COC	chain-of-custody
COD	chemical oxygen demand
Conoco	Conoco Inc. Lake Charles refinery
COPC	contaminant of potential concern
CRDL	contract required detection limit
CRQL	contract required quantitation limit
Cu	copper
CVOC	chlorinated volatile organic compound

DAT	Data Analysis Tool
DDD	1, 1-dichloro-2, 2-bis(p-chlorophenyl)ethane
DDE	1, 1-dichloro-2, 2-bis(chlorophenyl)ethylene
DDT	1, 1, 1-trichloro-2, 2-bis(p-chlorophenyl)thane
DO	dissolved oxygen
DOC	dissolved organic carbon
DOI	Department of Interior
DQOs	data quality objectives
EC	effective concentration
EDC	1,2-dichloroethane
EDD	electronic data deliverable
EDTA	ethelenediaminetetraacetic acid
Eh	electronic (or oxidation/reduction) potential
EMAP	Environmental Monitoring and Assessment Program
EPA	U. S. Environmental Protection Agency (Region 6)
ERA	ecological risk assessment
ERM	effects range median
ERM-Q	effects range median - quotient
FEMA	Federal Emergency Management Agency
FIELDS	Fully-Integrated Environmental Location Decision Support (software)
Firestone	Firestone Synthetic Rubber and Latex Company
FS	feasibility study
FSP	field sampling plan
ft	feet
g	gram
g/cm^3	gram per cubic centimeter
GIWW	Gulf Intracoastal Waterway
gpm	gallons per minute
GPS	global positioning system
HASP	health and safety plan
HCB	hexachlorobenzene
HCBD	hexachlorobutadiene
HDPE	high-density polyethylene
Hg	mercury
HHRA	human health risk assessment
HRS	Hazard Ranking System
Hwy	highway
HPAH	high molecular weight polycyclic aromatic hydrocarbons
IBI	index of biotic integrity
ICW	Intracoastal Waterway
I-10	Interstate Highway 10
I-210	Interstate Highway 210

IDW	investigation-derived waste
in	inch
K	hydraulic conductivity
km	kilometers
km^2	square kilometers
km/h	kilometers per hour
L	liter
L/kg	liters per kilogram
L/min	liters per minute
LA	Louisiana
LA-108	Louisiana Highway 108
LC	Lower Calcasieu Estuary
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDNR	Louisiana Department of Natural Resources
LGS	Louisiana Geological Society
LPAH	low molecular weight polycyclic aromatic hydrocarbons
m	meters
m/km	meters per kilometer
m^2/G	square meters per gram
m^3/sec.	cubics meters per second
MCL	maximum contaminant level
Me-Hg	methyl mercury
mg	milligram
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGPD	million gallons per day
mL	milliliter
mm/Hg	millimeters of mercury
mm	millimeter
mph	miles per hour
MSL	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolt
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substance Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFEC	Naval Facilities Engineering Command
NGD 83	National Geodetic Datum of 1983
NGVD	National Geodetic Vertical Datum
Ni	nickel

NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NS&T	National Status and Trends Program
NTU	nephelometric turbidity unit
NWS	National Weather Service
OHM	oil and hazardous materials
ORP	oxidation reduction potential
OxyChem	OxyChem Corporation
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
Pb	lead
PCA	principal components analysis
PCB	polychlorinated biphenyl
PEL	probable effects level
pg/g	picogram per gram
PID	photoionization detector
PO	project officer
POTW	publicly owned treatment works
PPE	personal protective equipment
PPG	PPG Industries, Inc.
Ppm	parts per million
ppt	parts per thousand
PRC	PRC Environmental Management, Inc.
PRG	preliminary remediation goal
PRP	potentially responsible party
psi	pounds per square inch
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QC	quality control
QMP	quality management plan
RAC	Response Action Contract
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act of 1976
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROS	regression on order statistics
RPD	relative percent difference

RTI	Research Triangle Institute
SAP	sampling and analysis plan
SCM	site conceptual model
SDG	sample delivery groups
SEM	simultaneously extracted metals
SERA	screening level ecological risk assessment
SNWR	Sabine National Wildlife Refuge
SOP	standard operating procedure
SOW	statement of work
SQG	sediment quality guidelines
SQT	sediment quality triad
SVOC	semivolatile organic compound
TADS	Technical Assistance Data System
TAL	Target Analyte List
TCA	1,1,2-trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TEF	Toxicity Equivalent Factor
TEQ	toxicity equivalent
TIE	toxicity identification evaluation
TKN	total Kieldahl nitrogen
TOC	total organic carbon
TPAH	total molecular weight polycyclic aromatic hydrocarbons
TPH	total petroleum hydrocarbons
TSS	total suspended solids
UC	Upper Calcasieu Estuary
UCL	upper confidence level
USA	United States of America
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Services
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
UV	ultraviolet
VCM	Vinyl Chloride Monomer
VOC	volatile organic compound
WAM	work assignment manager
WHO	World Health Organization
WRS	Wilcoxon Rank Sum
Zn	zinc

1,2-DCA	dichloroethane
±	plus or minus
%R	percent recovery
μohm/cm	microhm per centimeter
μg/Kg	micrograms per Kilogram
μg/L	micrograms per Liter
μm	micrometer

Executive Summary

U.S. Environmental Protection Agency (EPA) Region VI committed funding during 1999 under the EPA's Region VIII Response Action Contract (RAC) to conduct a remedial investigation (RI) portion of a RI/feasibility study (FS) for the Calcasieu Estuary in Calcasieu Parish, Louisiana. The RI was authorized to investigate the potential for impact to human health and the environment resulting from documented uncontrolled releases of organic and inorganic contaminants to the Calcasieu Estuary. This report is the result of three years of site characterization, data evaluation, technical analysis, and reporting, through the cooperation of numerous federal and state agencies, including EPA, and EPA's contractor CDM, U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), and the Louisiana Department of Environmental Quality.

This executive summary contains 15 sections that summarize the background and history (Section ES-1 and ES-2), the RI planning and implementation phases of work (Section ES-3 and ES-4), data evaluation and analysis for the reference area and four specific areas of concern (AOCs) (Section ES-5 through ES-11), summaries of the ecological and human health risk assessments (Section ES-12 through 14), and overall summary and conclusions (Section ES-15). Tables and figures that support the discussion are included in the text.

ES-1 Introduction

ES-1.1 General

The Calcasieu Estuary is located in the southwestern corner of Louisiana, predominately in Township 10 South, Range 9 West (Figure ES-1). The study area covers approximately 50 square kilometers (km^2) of the Calcasieu River basin, and extends from a constructed saltwater barrier on the Calcasieu River north of the city of Lake Charles, Louisiana south to Moss Lake, approximately 24 km south of Lake Charles. The estuary is created by saltwater migrating north from the Gulf of Mexico via the Calcasieu River Ship Channel and freshwater draining toward the Gulf from numerous inland rivers, bayous, and lakes. The estuary supports a diverse aquatic ecosystem, which is surrounded by a typical industrialized city.

As noted above, the RI/FS process for the Calcasieu Estuary was initiated by EPA Region VI under EPA's Region VIII Response Action Contract (RAC) No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. EPA is addressing threats to human health and the environment related to uncontrolled releases of organic and inorganic chemicals to the estuary under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). CERCLA provides the federal government with authority to develop long-term solutions for those sites that pose unacceptable levels of risk to human and ecological receptors and

to arrange for the restoration of damaged natural resources and determine distribution of cost of the actions to potentially responsible parties through cost recovery. It is important to note, however, that the Calcasieu Estuary is not a Superfund site by virtue of listing on the National Priorities List (NPL). Instead, CERCLA provisions allow for sites to progress through, but not beyond, the RI/FS process without a Hazard Ranking System (HRS) score

ES-1.2 Objectives of the RI

The RI objectives were:

- Define the nature and extent of chemical contamination in sediment, surface water, and biota within the Calcasieu Estuary
- Estimate the risk to ecological and human risk receptors in the Calcasieu Estuary

To meet these objectives, the RI included two phases of investigation, and ecological and human health risk assessments, as described in Section ES-4. The human health risk assessment estimated risk to residential, commercial/industrial worker, and recreational user populations, as discussed in Section ES-14. The ecological risk assessment used a weight of evidence approach including, hazard quotients, sediment quality triad data, and food chain modeling to estimate potential risk to ecological receptors (Section ES-13).

ES-1.3 Site History and Historical Site Characterization

Industrial development dominates much land within and around the Calcasieu Estuary. This development dates back to the late 1800s and is directly related to improvements of the Calcasieu River and subsequently the Calcasieu River Ship Channel. Major industry, including chemical manufacturing and petroleum refining companies first appeared in the Calcasieu Parish vicinity during the early 1920s, with the discovery of nearby petroleum and natural gas reserves. In 1938, Calcasieu River was expanded to include an inland ship channel from Lake Charles to the Gulf of Mexico. World War II and post-war years were a catalyst for further industrial development in the Calcasieu Estuary. Abundant raw materials, like crude oil and natural gas, coupled with acreage, water resources for manufacturing, and a commercially navigable access artery for ships and barges led to rapid industrial development.

Exhibit ES-1 summarizes the major industrial facilities located in the vicinity of the Calcasieu Estuary.

Exhibit ES-1 Major Industrial Facilities in the Study Area

Operating Facilities		
Conoco Refinery	PPG Industries	Firestone
Citgo Refinery	Citgo Refinery	CertainTeed
PPG Industries	W.R. Grace	OxyChem/Equistar
Entergy Inc.	Montell Inc.	LA Pigment
Westlake Petrochemicals	Westlake Polymers	Tetra Inc.
Lyondell/Olin	Sasol Condea Vista	

During the 1990s, many of the larger industrial facilities changed ownership or expanded. The region's industrial base has continued to grow, and today the Calcasieu Estuary supports more than 10 major petroleum refining and chemical manufacturing operations, producing a wide range of industrial chemicals, petroleum products, and commercial feedstock. In addition, the waterways of the estuary continue to support recreational activities, commercial fishing, materials transport, and a diverse ecosystem.

Industrialization is commonly associated with stresses on the environment, and the Calcasieu Estuary is no exception. A number of environmental investigations have been performed throughout the Calcasieu Estuary since the late-1980s to evaluate environmental stressors. Numerous reference documents have been used and cited in the development of this RI report. Exhibit ES-2 summarizes the documents used in this RI report. The reports are publicly available through LDEQ or EPA Region VI.

Exhibit ES-2 Previous Reports in the Study Area

Historical Report	Area Evaluated	Author / Year Completed
Ecosystem Analysis of the Calcasieu River/Lake Complex	Calcasieu River, including the RI Study Area	McNeese / 1987
Calcasieu Estuary Water Sampling Program	Calcasieu River, including the RI Study Area	LDEQ / 1987-1996
Toxics Study of the Lower Calcasieu River March 1990	RI Study Are	RTI / 1990
Bayou d'Inde Expanded Site Inspection - Final Report	Bayou d'Inde	PRC / 1993
Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River	Bayou Verdine, Coon Island Loop, and Calcasieu River	ChemRisk Division / 1994
Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report	Bayou d'Inde, PPG Canal, and Calcasieu River	ChemRisk / 1995
Findings Report for the Focused Site Assessment - Bayou d'Inde	Bayou d'Inde	Fluor Daniel / 1997
Calcasieu River Estuary Biological Monitoring Program: Annual Report April 1997 – January 1998 (Year 9)	RI Study Area	LDEQ / 1997
Bayou Verdine Investigation, Nature and Extent Investigation	Bayou Verdine	Entrix 1999

Detailed information on these reports, including a summary of the scope of the investigation, analytical protocols and detections, as well as figures showing the sample locations for each study is provided in Appendix A.

ES-2 Environmental Setting

ES-2.1 General

The estuary is the lower portion of the Calcasieu River drainage basin. The Calcasieu River begins in the hills west of Alexandria (in the vicinity of Kisatchie National Forest in Vernon Parish, LA, approximately 120 km to the northeast of the RI study area), and flows south into Calcasieu Lake, eventually emptying to the Gulf of Mexico.

Environmental Setting of Calcasieu Estuary

- Energy Areas
- Areas of Concern
- Reference Areas
- Regional Fauna and Flora
- Hydrogeology
- Dredging History
- Climate

The Calcasieu Estuary is located within the West Gulf Coastal Plain physiographic province. Geologically, the local area is comprised of young unconsolidated Quaternary (Pleistocene-age) sediments. Structurally, the area is a geosyncline that receives large quantities of sediment from multiple river discharges (Louisiana Geological Survey [LGS] 1984). Local soils and sediments typically consist of interbedded sands, gravels, silts, and clays.

ES-2.2 Energy Systems within the Estuary

Calcasieu Estuary is a complex interconnected system of bayous, marshes, open flats, and shallow lakes and dredged ship channels. To understand and evaluate flow characteristics and chemical fate and transport, an understanding of energy systems within the estuary is needed. The energy of a specific area influences surface water variability, sediment nature, and stability. Depositional environment, surface water conditions, and stability of the sediment in each area can be used to describe the behavior of the system. Further, there are areas within the estuary that are considered atypical with respect to their associated physical or chemical characteristics; this system is categorized as "other". Exhibit ES-3 summarizes the distribution of energy systems in the RI study area. A brief discussion of each follows. The four AOCs presented in this exhibit are discussed in section ES-2.3.

Exhibit ES-3 Energy System Distribution in the Calcasieu Estuary Study Area

Energy System	Bayou d'Inde	Bayou Verdine	Upper Calcasieu	Lower Calcasieu
Bayou	✓	✓	✓	✓
Marsh	✓		✓	
River			✓	
Shallow Lake			✓	✓
Ship Channel			✓	✓
Other				✓

Bayou
The bayou is the natural tributary to the estuary. The system is typically a low-flow system that serves ultimately as a sediment exporter. Sediments tend to be silty sands to clays and generally become finer upstream. Sediments are generally stable in the upper reaches of the bayou where vegetation is more prevalent, and tidal surge tends to be lowest. Sediment stability tends to be lower in shallow segments of the bayou, or where sediments are disturbed by traffic or intermittent higher flow rates.

Marsh
Estuarine marshes are typically sediment sinks. They are low energy, vegetated, and generally sheltered, slow draining basins. They receive and generally contain finer-grained sediments due to lower flow rates and increased sheltering vegetation along their margins. The low water levels within these marshes make them susceptible to dewatering under wind forcing conditions.

Shallow Lake
Shallow lakes differ from the marshes in overall size. The shallow lakes are generally 1 to 3 meters (m) deep, with an area of greater than 0.5 km^2. Vegetation within the shallow lakes is generally less than that of the marshes overall; however, substantial biota habitat is present in some areas. The salinity typically varies from intermediate to saline. As with the marshes, the shallow lakes are net sediment sinks.

Ship Channel
This energy system is a high flow, deep, wide channel (40 to 75 m wide and 10 to 15 m deep), routinely dredged to maintain shipping lanes for large, deep draft vessels. The area is a conduit for increased flood tide surge (flow from the Gulf of Mexico), and salinity is typically brackish. Flow within the ship channel is generally in the thousands of cubic meter per second compared to the single digit range reported for the upper river and bayous.

River
The river energy system is the undredged segment of the Calcasieu River, upstream of Lake Charles. The river resembles the low flow bayou, however, larger overall. The river is larger, 15 to 25 m wide and 4 to 5 m deep. The flow is proportionately greater as well. Salinity tends to be fresh to intermediate; however, it is still susceptible to tidal surge and wind forcing.

Other
The other designation is used to describe the Indian Marais Lagoon located on the edge of the Lower Calcasieu ship channel (Figure ES-2). The lagoon is partially open to ship channel flow and currents. It is bermed and does not receive significant overland run-off. The feature is not a shallow lake due to its size and lack of vegetation and habitat. Instead, it more resembles a marsh. However, it is classified separately as it is connected to the ship channel and is a potential sediment source.

ES-2.3 Estuary Areas of Concern

An overview of the characteristics and a description of the physical parameters of each of the energy systems present in the portions of the estuary identified as AOC is provided below. The four AOCs are Bayou Verdine, Bayou d'Inde and Upper and Lower Calcasieu. These AOC boundaries were developed in the early stages of the RI and were used to group regions of the estuary to aid in evaluation and management of the study area (Figure ES-2). Detailed findings for these AOCs are presented in Sections ES-7 through ES-10.

Four Areas of Concern:

- Bayou Verdine
- Bayou d'Inde
- Upper Calcasieu
- Lower Calcasieu

Bayou Verdine

Bayou Verdine is located between the City of Westlake and the community of Mossville, and north-northwest of Lake Charles in Calcasieu Parish, Louisiana (Figure ES-2). Bayou Verdine is approximately 7 km long and is the only major tributary to Calcasieu River-Coon Island Loop (Curry et al 1997). Its headwaters are fresh, and, as the water travels downstream, it mixes with intermediate to saline water of the Calcasieu River to the south. Water depths in Bayou Verdine range from 0.1 to 6 m, and are the deepest at the mouth in the area of PPG's North Dock area.

The land around Bayou Verdine is characterized by undeveloped land, mixed rural, residential, commercial, and heavy industrial use; however, industrial applications predominate in the southern section of the bayou. Several permitted industrial outfalls discharge to Bayou Verdine under Nation Pollution Discharge Elimination System (NPDES), as well three drainage ditches; Vista West Ditch, Faubacher Ditch , and Kansas City Southern Railroad (KCSRR) West Ditch, all of which drain industrial properties.

Bayou Verdine is classified exclusively as a bayou energy system. The bayou is a net sediment exporter, receiving runoff and sediments from the undeveloped land to the northwest and from industrial areas. At the confluence of Bayou Verdine and Coon Island Loop, the bayou discharges into a moderately swift, deep channel, which is a conduit for brackish to saline water from the ship channel (Figure ES-2). The engineered confluence is wider than the natural opening and allows for greater tidal influence and storm surge up the bayou.

Bayou d'Inde

Bayou d'Inde is located in the northern portion of the Calcasieu Estuary, west of the City of Lake Charles, Louisiana (Figure ES-2). Bayou d'Inde's headwaters originate in the western part of Sulphur, Louisiana and flow primarily east-southeast through heavy commercial and industrialized areas before emptying into the ship channel southwest of Coon Island. Bayou d'Inde is approximately 15 km long and is a major tributary of the Calcasieu River. It has a drainage area of over 1,000 acres (PRC 1993).

Bayou d'Inde headwaters are typically fresh. Its sinuous flow path passes near and through several small fringe marshes near Maple Fork Bayou.

The confluence of Bayou d'Inde and the ship channel is a large shallow flat area called Lockport Marsh. Lockport Marsh is a low-lying, intermediate to brackish broad shallow area with water depth generally less than 1 m. The area is categorized as a marsh to depict characteristics within protected areas. Parts of Lockport Marsh are also subjected to scouring due to storm surge and wind forcing.

The land around Bayou d'Inde includes undeveloped wooded marshland, rural residential, commercial, and heavy industrial properties. Rural residential and undeveloped woodland areas border the bayou northwest and upstream of the industrial area. Heavy industry dominates the area bounded by the PPG Canal and highway LA-108. Several of these industries have outfalls permitted under NPDES.

Bayou d'Inde contains two energy systems; bayou and marsh. Sediments within Bayou d'Inde are generally silty sands. This appears to be the combined result primarily of overland soil erosion and deposition of reworked material from the ship channel in the lower section. Bayou d'Inde sediments are generally coarser than Bayou Verdine, due in part to the broader confluence with the ship channel and deeper (dredged) bayou.

Development along Bayou d'Inde has altered the natural setting in the industrial area. Industrial discharges (current and historic), accidental releases, and storm water runoff have contributed to organic and inorganic impacts to surface water, sediment, and biota within the bayou.

Upper Calcasieu

The Upper Calcasieu AOC is defined as that region of Calcasieu Estuary that extends from the saltwater barrier on the Calcasieu River (north of Lake Charles), through Lake Charles, west to Clooney Island Loop, and southwest to Coon Island Loop (Figure ES-2). Coon Island Loop connects with the ship channel near the I-210 Bridge. The Upper Calcasieu area is approximately 25 km in length (Figure ES-2).

Water in Upper Calcasieu is intermediate to brackish and tidally influenced (up to 15 cm). Salinity stratification is noted during periods of the year, controlled primarily by density driven flow as a result of tidal influence and the saltwater barrier. From October to February, periods of generally high water levels, the gates are open, allowing free flow of water. When closed, the saltwater barrier effectively protects the upper Calcasieu River from saltwater intrusion.

Land use in the Upper Calcasieu AOC is primarily rural residential, municipal, and industrial. Tributaries include Bayou Verdine and Contraband Bayou. Bayou Verdine receives discharge from several major industrial properties, as noted above, and

discharges at the northern end of Coon Island Loop. Contraband Bayou receives Lake Charles municipal wastewater discharge and enters the ship channel between Clooney and Coon Island Loops.

Upper Calcasieu is a diverse segment of the estuary that consists of an element of every energy system present in Calcasieu Estuary. The AOC contains natural river, marshes, shallow lake areas, bayou, and shipping channel. Sediment character is as diverse as the energy systems.

Lower Calcasieu
The Lower Calcasieu study area comprises the portion of Calcasieu Estuary from the I-210 Bridge, just south of Coon Island Loop, to the outlet of Moss Lake; a distance of approximately 15 km (Figure ES-2). Lower Calcasieu is predominated by the ship channel, which is interconnected with shallow lakes and small lagoons. The ship channel is 125 m wide and 15 m deep and is routinely dredged (USACE 1976); however, the dredged portion is not included in the study area. Prien Lake is located on the east side of the ship channel; the mouth of the lake is located across from Lockport Marsh. Prien Lake lies within the old channel of the Calcasieu River. Indian Marais Lagoon is a 230,000-kiloliter capacity impoundment and associated drainage canal that exists along the west side of the ship channel midway between Prien Lake and Moss Lake. Moss Lake flows into the ship channel from the west and is fed by Bayou Olsen. Bayou Olsen drains the area south and west of Bayou d'Inde.

Much of the land use in the Lower Calcasieu AOC is undeveloped, but several industrial facilities have outfalls to the ship channel between Prien Lake and Moss Lake. The ship channel is used extensively throughout Lower Calcasieu, providing transport to over 40 million tons of product annually.

Four energy systems exist in Lower Calcasieu: shallow lakes (Prien and Moss Lakes), low-flow bayou (Bayou Olsen), the ship channel, and Indian Marais Lagoon. Overall, Lower Calcasieu is tidally influenced, with 6 to 12 inches of daily fluctuation (USACE 1976). Salinity in the area is typically higher resulting from is southernmost location.

ES-2.4 Reference Areas

A total of five areas were identified to represent reference conditions within the Calcasieu River watershed and surrounding environments. The areas are all south of the study area and include:

- Johnsons Bayou
- Willow Bayou
- Bayou Bois Connine
- Grand Bayou
- Bayou Choupique

The reference areas represent the bayou energy system. Salinities vary in the reference areas as they do in the study area, subjected to the same wind forcing, tidal surge and temperature driven density changes. Sediments composition is similar as well. Reference areas were added to the RI to provide "background" bayou areas for comparison. All five of these reference areas are relatively pristine and have been virtually unaffected by industrial activities (Ramelow et al. 1987).

ES-2.5 Regional Flora and Fauna

Calcasieu Estuary provides habitat to abundant wildlife, both aquatic and terrestrial. Critical habitat has not been designated for biota in the study area. The bottom hardwoods and cypress region includes the Calcasieu River around Lake Charles (Neyland 2000). Other trees common to the area include live oak, cottonwood, and willow. The region is also used as pastureland, and for the cultivation of rice and soybean crops. Marsh vegetation is typically brackish and common herbaceous plants include: *Spartina alterniflora, Distichlis spicata, Juncus* sp. and *Scirpus* sp (Neyland 2000).

The marshes and swamps of southern Louisiana are home to a variety animals, including white-tailed deer, and a few black bears. Resident small animals include muskrat, mink, raccoon, wildcat, gray fox, beaver, otter, weasel, opossum, cottontail, marsh rabbit, and gray squirrel.

Species of migratory wildfowl are abundant in the estuary. Many species of ducks and geese spend the winter on the tidal marshes along the Gulf Coast. Common water fowl include the laughing gull, royal tern, brown pelican, and black skimmer. Birds found in the marshes include the marsh wren, seaside sparrow, red-winged blackbird, Wilson snipe, woodcock, and species of sandpipers.

Alligators are common in the southern Louisiana swamps; one was noted in the Lower Calcasieu study area during the RI. Other reptiles in the state include turtles, lizards, and both poisonous and nonpoisonous snakes. The poisonous snakes found in Louisiana are the coral snake, western pygmy rattler, canebrake rattler, copperhead, and water moccasin.

Among the great variety of fish include red snapper, menhaden, gar, redfish, drum, sheepshead, jewfish, blue, jack, blue cat, yellow cat, paddlefish or spoonbill cat, striped bass, mullet, and sea trout. Many of these species are fished commercially in the estuary. Local crusteacean include blue crab and grass shrimp.

Correspondence with the U.S. Fish and Wildlife Service (USFWS) in 2001 notes that "there are no federally-listed threatened, endangered, or candidate species within the proposed project area" (USFWS 2001). However, the state bird, the brown pelican, is on the federal endangered species list and has been observed in the study area.

ES-2.6 Hydrogeology

Significant groundwater exists below the site. The shallow aquifer is comprised of unconsolidated sand units referred to as the 10-, 20-, and 36-foot sands (LGS 1984). Groundwater in this aquifer is unconfined and occurs as shallow as 0.3 to 1 m below ground surface (bgs). Recharge to the shallow aquifer is from infiltration of precipitation, impoundment leakage and commingling of surface water. Groundwater flow, fluctuation, and quality may influence surface water that intercepts the shallow groundwater across the study area (PRC 1993, PRC 1994).

Water levels in the shallow aquifer and surface water are tidally influenced with up 0.3 m of daily fluctuation. The groundwater quality is typically poor and unsuitable for domestic use. The major regional, hydrologic units for potable water in the Lake Charles area are the 200-, 500-, and 700-foot sands of the Chicot aquifer. The Chicot aquifer is the primary source of groundwater for public supply, irrigation and industrial use in the area. Recharge to the Chicot aquifer is primarily through infiltration of precipitation.

ES-2.7 Dredging History

Calcasieu Estuary has undergone significant engineering modifications centered on creation of the ship channel to allow larger barges and ships access to Lake Charles. Because of channel development, saltwater intrusion into the upper reaches of the estuary became a problem; thus, the saltwater barrier was constructed north of Lake Charles on the Calcasieu River.

ES-2.8 Climate

The climate in Calcasieu Parish is humid and temperate and is influenced by its proximity to the Gulf of Mexico. The average year-round temperature is 68°F, with an average daily high of 78°F and an average daily low of 58°F. The hottest months are July and August, while the coolest months are January and February respectively (NOAA 2002). The average annual precipitation is 54.05 inches. May, June, and July are typically the wettest months, whereas March and October are the driest months. The average wind speed is 8.6 miles per hour, from the south. Hurricane season officially runs from June to November, and this area is vulnerable.

ES-2.9 Demographics

Calcasieu is one of 64 parishes (counties) in Louisiana. Calcasieu Parish has a land area of 2,775 km^2 and is part of the Lake Charles metropolitan area, with a census

2000 population of 183,577-ranked 7th in the state (U. S. Bureau of the Census 2000). The largest employers in 2000 were the educational, health, and social services industry, 19.9 percent; the manufacturing industry, 14.9 percent; the retail trade industry, 11.5 percent; the art, entertainment, recreation, accommodation, and food services sector, 11.5 percent; and construction industry, 9.3 percent. Other principal cities and towns in the parish include Sulphur, Westlake, and Mossville

ES-3 Site Conceptual Model

ES-3.1 General

A site conceptual model (SCM) was developed to portray the dynamic nature of Calcasieu Estuary that includes numerous perennial wetland bayous and tributaries, marshes, and ship channel in a heavy industrial setting. The SCM is intended to describe the nature of the different environs of the estuary; identify the interrelationships between soil, sediment, surface water, and groundwater impacts to the system; and identify potential ecological and human receptors. Figure ES-3 presents a schematic overview of the estuary systems that exist in Calcasieu. It should be noted that the figure is intended to present general conditions schematically and does not represent a specific region of the estuary.

The term estuary is used to describe, "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage" (Pritchard 1967). Of the four types of estuaries defined by Pritchard, the Calcasieu Estuary is considered a drowned river valley system, which is "a wide coastal plain; only a portion of the area affected by tides [eg.] is estuarine, based on salinity diluted by freshwater"(Pritchard 1967).

Based on published information, the Calcasieu Estuary is classified as vertically homogeneous. The influence of strong winds and tidal energy, in conjunction with the generally shallow depth (about 2 m with the exception of the ship channel), result in a relatively high-energy environment with vertical mixing.

ES-3.2 Exposed Populations

Both humans and ecological receptors are important considerations in the SCM. Pathways of exposure and the relationships between receptors and affected media are discussed below.

Ecological Receptors

Identified exposure routes are those exposure pathways considered complete for receptors in the area and include ingestion of sediments by detritivores and bottom dwellers, ingestion of contaminated prey items by ecological receptors, and inhalation and direct contact with the surface water micro layer. Ecological pathways are

evaluated in Section ES-13. Additional detail on development of these pathways and receptors can be found in the, the Baseline Ecological Risk Assessment (BERA) Problem Formulation (CDM 2001).

Human Receptors
Potential human exposure to contaminants is presented in Section ES-14 of this document. Exposure routes of primary interest here are the direct contact (both human and ecological receptors), human consumption of impacted fish and shellfish, both by subsistence and recreational fishing receptors.

ES-4 Data Collection, Analysis, and Interpretation

ES-4.1 Data Collection

Phases I and II of the RI sampling are described in the following sections, including data collection, determination of COPC, analytical methods, and data usability and data analysis.

Phase I of the RI
Phase I of the RI was designed to determine the nature and extent of organic and inorganic contamination within the Calcasieu Estuary and to support risk characterization. This phase of investigation was conducted on an AOC-by-AOC basis.

Phase I was initiated with a detailed evaluation of the existing chemical data maintained by EPA and NOAA. Pre-1992 data, although maintained by EPA and NOAA, were not used in the RI planning because of unknown quality. These data were used to determine the occurrence, concentration, and mean and mean variance of COPCs as well as the number of samples with previously detected analytes. Data were also used to ascertain the number of samples needed for a statistically valid sampling program based on confidence interval/relative error ranges of 70/30 percent and 80/20 percent, which equate to 0.7 and 0.8 statistical power, respectively. Given a mean and a standard deviation, an iterative set of three equations, as described by Gilbert (1987), was used to calculate the number of samples required to achieve the pre-specified confidence and precision.

The number of samples calculated using the above-referenced method was then input into EPA's fully-integrated environmental location decision support (FIELDS) software to identify sample locations. Randomness was introduced through the selection of a random starting node within a grid cell.

Phase I RI sampling was conducted from December 1999 through March 2000. Field samples consisted 535 surface (0 to 10-cm) sediment samples, 16 multi-depth (0 to 10,

10 to 20, and 20 to 30-cm) sediment samples, and 65 surface water (mid-depth of the water column) samples throughout the estuary. Phase I data reduction and analysis identified the need for a second phase of sampling to minimize data gaps existing in Phase I, including resampling areas to obtain delineation and support the ecological risk assessment.

Phase I included an ecological assessment site reconnaissance was conducted April 2000 through May 2000. Forty-nine tissue sample locations were determined in the field based upon locations where fish are typically caught or collected in the various AOCs. Multiple locations were sampled in three of the four AOCs to determine a spatial distribution of some species. Bayou Verdine was not samples for tissue, because of Conoco's independent work.

Reference areas were also located. Data collected from a suitable reference areas would allow comparisons to be made between the Calcasieu Estuary and an area unaffected by industrial development. Three sediment and 1 surface water sample as well as 15 tissue samples were collected from reference areas.

Phase II of the RI
Phase II of the RI was a more focused characterization of contaminant levels in sediment, porewater, and biota tissue (i.e., fish and invertebrates), as well as evaluation of sediment toxicity, porewater toxicity, and benthic invertebrate community structure.

Several data gaps were identified in the Phase I data. Phase II surface sediment samples were collected at pre-selected locations to refine the horizontal extent of contamination around specific sites in the estuary and verify reported detections and non-detections. Thirty-three locations were sampled for nature and extent delineation purposes during Phase II (December 2000).

Sediment quality triad (SQT) integrates information on sediment toxicity, chemistry, and benthic community structure in an integrated weight-of-evidence approach (Ingersoll et al. 1997). The SQT provides for evaluation of the risks to sediment-dwelling organisms that are associated with exposure to contaminated sediments through whole-sediment and porewater toxicity effects on benthic invertebrate community. One hundered SQT locations were sampled (Section ES-12). Sediment chemistry and benthic community structure were determined at all 100 locations, whereas only 50 locations had matching porewater chemistry.

The Phase II tissue sampling (October 2000 and December 2000) was based on BERA and HHRA data needs to determine the type of species and the quantity to be collected. The types and quantity of species to be collected were based upon evaluating the feeding ecology of the fish and wildlife focal species and their likely foraging areas.

All tissue sample locations (724 samples), with the exception of blue crab locations, were paired as closely as possible to SQT locations. Whole body samples from each prey group were used for the BERA, whereas a subset of fish was filleted for the HHRA.

All sampling was conducted in accordance with the procedures specified in the Phase I Sampling and Analysis Plans (CDM 1999a-d), and Phase II Sampling and Analysis Plan (CDM 2000b).

ES-4.2 Determination of Contaminants of Potential Concern

COPCs are determined in the RI as those chemicals that exist at concentrations or impart unacceptable risk to human health or the environment**.** Initially, a statistical evaluation of historical data was used to determine COPCs for sediment, surface water, and tissue. After Phase I, retained COPCs were re-evaluated. In addition, initial preliminary remediation goals (PRGs) for protection of human health were developed based on data collected in Phase I. PRGs were estimated by re-arranging the hazard or risk equation to solve for concentration. An acceptable hazard quotient was set to one, and the acceptable risk level was set to 10^{-5}.

Table ES-1 lists the presently known COPCs for the Calcasieu Estuary based upon ecological and human health risks.

ES-4.3 Analytical Program

A variety of parameters were measured to evaluate the estuary, as well as determine the nature and extent of contaminants in sediment, surface water, and tissue. Table ES-2 lists the media and analytical protocol (i.e., analytes and methods). All Phase I and Phase II analytical methods were selected in accordance with the investigation's DQOs. Physical and chemical analyses were performed using validated and standard methods in the environmental laboratory industry, including

- Conventionals (physical parameters in sediment, surface water, porewater, and tissue)
- Inorganics (metals, TCLP, acid volatile sulfide and simultaneously extracted metals [AVS/SEM] in sediment, surface water, porewater, and tissue)
- Organics (VOCs, SVOCs, herbicides, pesticides, PCBs, PCB congeners TPHs, dioxins/furans in sediment, surface water, porewater, and tissue)
- Sediment toxicity tests (10 and 28-day survival tests at the 100 SQT locations)
- Microtox® (at the 100 SQT locations)

- A 28-day bioaccumulation test was conducted at 10 SQT locations
- Porewater toxicity tests

In addition, a benthic macroinvertebrate community survey was conducted across the entire estuary at the 100 SQT locations. An index of biotic integrity (IBI) was used to characterize benthic condition of the estuary. EPA conducted a parallel toxic inventory evaluation (TIE) study of whole sediment under the Clean Water Act at SQT selected locations. TIE evaluations typically consist of three phases: (1) characterize the physical/chemical properties of the toxicants; (2) identify the toxicants (typically non-polar organics, ethylene diamine triacetic acid (EDTA), chelatable metals, and ammonia); and (3) perform a final confirmation through a weight-of-evidence approach to effluent testing.

All fish selected for the HHRA, after collection and prior to filleting, were evaluated by the USFWS using the BEST program. Under the BEST program, USFWS examined fish for deformities, skin lesions, or tumors on the surface and within the specimen in accordance with several USGS/BRD guidance documents (USGS/BRD 1999 and USGS/BRD 2000). Results of USFWS's evaluations were not available for inclusion in this RI.

ES-4.4 Data Quality Assessment

The data used in this RI/FS and associated risk assessments were assessed through a data evaluation program that includes data validation and data evaluation in accordance with EPA's nationally recognized guidelines. Prior to data use, this evaluation ensures quality of the data used is defined and that a known confidence in data usability is ensured in accordance with procedures outlined in the DQOs, and quality assurance project plan (QAPP) (CDM 1999a-d and 2000b).

During this data validation/evaluation process, individual sample results are accepted, rejected, or qualified. Data that meet all the validation criteria are accepted as unqualified and were used without discretion. Data that are rejected (R) for not meeting one or more of the validation criteria were not used. Some data fall into the gray area between accepted and rejected. These data are qualified as estimated.

In Phase I, sample data from over 1,500 samples and 172 SDGs from six different CLP and subcontract analytical laboratories were received, reviewed, validated, and evaluated. Nearly 6,000 individual samples from Phase II were evaluated. Seventeen percent of these 6,000 samples were validated. Most data gathered from the RI investigation were determined usable via this data validation program.

ES-4.5 Data Analysis

The primary goal of the RI is to assess whether, and to what extent, sediments and surface water are contaminated or have the potential to adversely affect the environment or human health (EPA 1994). After the data were segregated by AOC and energy area, summary statistics were generated for each of the data sets using Microsoft Excel and the Caltrans Data Analysis Tool (DAT). The Caltrans DAT calculates summary statistics for data sets that include not detected data using regression on order statistics (ROS).

Then, multivariate analyses were completed. Multivariate refers to the analysis of data consisting of two or more random variables. Multivariate analysis was used for the RI data sets because the complex interactions between variables are difficult to isolate and study individually. Data sets were statistically analyzed using principal components analysis (PCA). PCA reduced the multidimensionality of the data sets by organizing multivariate data set into correlated factors. Exhibit ES 4-1 summarizes the data sets created for surface (0 to 10 cm) sediment.

Exhibit ES 4-1 Surface Sediment (0 to 10 cm) Data Sets for PCA

PCA Data Set	Area of Concern	Energy Area	Samples [1]	Constituents [2]
1	Bayou d'Inde	Bayou	100	140
2	Bayou d'Inde	Marsh	161	144
3	Bayou Verdine	Bayou	78	90
4	Lower Calcasieu	Bayou	18	33
5	Lower Calcasieu	Other	7	48
6	Lower Calcasieu	Shallow Lake	76	75
7	Lower Calcasieu	Ship Channel	52	63
8	Upper Calcasieu	Bayou	9	33
9	Upper Calcasieu	Marsh	8	35
10	Upper Calcasieu	River	12	32
11	Upper Calcasieu	Shallow Lake	46	79
12	Upper Calcasieu	Ship Channel	54	75
13	Reference Area	Bayou	18	37
	TOTAL		639	

[1] Number of samples with a result for at least one constituent in the AOC/Each data set.
[2] Number of constituents (variables) with a least 3 detections.

The above steps were necessary to accommodate the holes in the data sets due to samples not being analyzed for every constituent (i.e., sampling for only dioxin/furans at selected locations). The PCAs were conducted using SYSTAT Version 10.0 (SPSS Software).

The data were also compared to background or reference area concentrations using statistical tests. The Wilcoxon Rank Sum (WRS) test evaluates whether there is a

statistically significant difference between the medians of two data sets (i.e., the null hypothesis [H_0] that the populations from which the two data sets have been drawn have the same mean is tested against the alternative [H_A] that the populations have different means). The WRS Test is described in Gilbert (1987) and EPA (1992). The test was conducted on sediment samples using the computer program SYSTAT Ver.10.

The WRS test was selected (over the parametric *t* test equivalent) because the population distributions were unknown and the sample data sets were generally insufficient to recognize the shapes of the population distributions. In addition, the WRS test is capable of handling the moderate number of nondetect values present in the sample data sets, which is characteristic of the Calcasieu Estuary data set.

ES-5 Chemical Fate and Transport

An understanding of the fate and transport processes acting on the COPCs in the Calcasieu Estuary is critical when predicting the distribution of the COPCs between different media in the environment (i.e. sediment, water, soil, and air) under various conditions (pH, salinity, etc.).

As the conditions change in the estuary, the distribution of the COPCs in the media and the form of the COPCs can change (i.e., the oxidation state, molecular configuration, ionic charge, aqueous species), which can affect the mobility and toxicity of the compounds. Key geochemical processes affecting the rate of migration of the COPCs are adsorption and desorption, volatilization/condensation, precipitation and co-precipitation, and degradation/transformation. Additional processes impacting fate and transport processes in the estuary include: flushing/physical transport and chemical fate/transformation.

Important fate and transport processes acting on COPCs in the study area and the environmental factors influencing these processes are as follows:

- Adsorption is one of the most important fate and transport processes in the estuarine environment. It is influenced by salinity, pH, and grain size of the adsorbing sediments. It is a significant process for dioxins, pesticides, PCBs, SVOCs, and some metals.

- Precipitation/co-precipitation is an important removal process for some metals (chromium, copper, lead, and zinc). Co-precipitation tends to be led by the oxidation of iron (II) to iron (III) and is influenced by the presence of iron oxyhydroxides.

- Precipitation is controlled in estuaries by pH, oxidation-reduction potential, and salinity (via salting out). Precipitation of oxides typically occurs in oxygenated,

turbulent areas (flood tidal zones) while precipitation of sulfides occurs in anoxic low energy areas, such as marshes.

- Volatilization is important for VOCs. Volatilization is controlled by the turbulence of the water and the wind speed at the surface of the water. Volatilization is greatest in turbulent waters with high wind speeds. High turbulence areas within an estuary occur in the areas influenced by tidal energy while low turbulence areas are in marsh areas and embayments.

- Biotransformation is important for soluble organic compounds and compounds with easily broken bonds, such as aromatic compounds.

- Aerobic biotransformation is important in turbulent oxygenated waters, such as tidal zones, while anaerobic biotransformation is important in low energy marshes and embayments.

The residence time of a COPC within an estuary depends on the flushing time of the estuary and on the degree of attenuation imparted on the COPC by fate and transport processes.

ES-6 Reference Areas

Before evaluating the nature and extent of COPCs in the estuary, the chemistry of background or reference areas must be understood. A total of five areas were selected to represent reference conditions within the Calcasieu Basin. These areas included Choupique Bayou, Grand Bayou, Bayou Bois Connine, Willow Bayou, and Johnsons Bayou (Figure ES-4). Within the five areas, 18 reference sites were selected using a stratified random sampling design, whereby each of the five reference sub-areas (strata) are sampled individually by simple random sampling. The reference areas were selected for minimal sediment contamination while having similar sediment characteristic as the Calcasieu Estuary study area.

Because the reference sites were stratified into five different reference sub-areas, it was first necessary to determine whether all of the reference sites could be considered to come from the same population. The nonparametric one-way Analysis of Variance (ANOVA) is a commonly used statistical method to compare two or more groups, in this case reference sites, collectively. The nonparametric ANOVA is also called the Kruskal-Wallis test. For comparative purposes, only chemical constituents in the sediments were examined, because surface water tends to be fairly variable both spatially and temporally.

The Kruskal-Wallis test is described in detail in Gilbert (1987) and EPA (1992). The test was conducted on reference area sediment samples using the computer software SYSTAT Ver 10.

The results of the Kruskal-Wallis test indicate that measured concentrations are representative of variation in natural background, and since no significant differences exist for most chemical constituents, the five reference areas are considered similar and can be combined for the purpose of comparison with the other Calcasieu Estuary study areas/energy systems.

ES-7 Bayou d'Inde – Nature and Extent

This section summarizes the COPCs found in Bayou d'Inde AOC and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport.

ES-7.1 Summary of the RI Evaluations

Bayou d'Inde is divided into five geographic areas; four reaches in the bayou energy system and the marsh areas. Marshes are present in Reaches 1 and 2. The reaches are presented in Figure ES-5. Bayou d'Inde below highway LA-108 (Reach 2) can be characterized as a moderately-saline to saline, broad channelized ship channel with significant industrial development. The upper reach of Bayou d'Inde (Reach 4) is a less saline, steep-sided, narrow and vegetated low-flow system. The drainage area for the upper reach (Reach 4) is generally rural residential. The majority of Bayou d'Inde from Reaches 1 through 3 receives surface runoff and wastewater discharge from several industrial facilities (e.g., PPG, Westlake Polymers, Westlake Petrochemicals, Firestone, Citgo Petrochemicals and Equistar [formerly OxyChem]). Point and non-point sources are present in Reaches 1 through 3. Introduction of contaminants to the system appears to occur due to industrial release in three specific areas; (1) between Little Bayou d'Inde and highway LA-108 Bridge, (2) through anthropogenic release to Maple Fork Bayou, and (3) from industrial release to the PPG Canal.

Potential Sources to Bayou d'Inde:

Citgo, Equistar, Firestone, Westlake Polymers, Montell USA, and PPG

Contaminants of primary interest in Bayou d'Inde are those contaminants that increase human health or ecological risk. The occurrence of COPCs varies across Bayou d'Inde. The following is an overview of the condition of each of the four reaches and associated marshes, within Bayou d'Inde.

The majority of contaminants and generally the greatest concentrations are found in Reach 1 of Bayou d'Inde and Lockport Marsh. PPG operates three major process areas in the immediate vicinity: the Chlor-Alkali plant; the Derivatives plant and the Chlor-Alkali/Silicas area. All process areas drain to the PPG Canal. Further, three offsite facilities, Cetainteed, Jupiter and Big Three Industries also discharge to the PPG Canal. The non-PPG permitted design flows account for 1 MGPD of a 233 MGPD design flow capacity for the PPG Canal.

COPCs in Bayou d'Inde:

Dioxin/Furans,
PCBs,
Mercury,
HPAHs, LPAHs,
BEHP, HCB, and HCBD

Dioxin/furans are predominant in Reaches 1 through 3, Lockport Marsh and Maple Fork Bayou Marsh (the location of sample BIR3018) (Figure ES-6. Dioxin/furan concentrations are comparable where bayou and marsh locations are present. Dioxin/furan contamination is widespread throughout Bayou d'Inde. Primary impacted areas are in lower Reach 3 and Reach 1. No documented sources of dioxin/furans were noted in the regulatory record, however, it is noted that incomplete or uncontrolled combustion of PCBs may result in the production of dioxin or furan compounds and industrial incinerators in the area are used to burn chlorinated wastes.

Exhibit ES-6 summarizes the most significant AOIs by geographic location in the estuary, followed by COPC concentration compared to estuary-wide data population 95 percent UCL concentration, a general sediment stability ranking, potential contaminant sources to the study area, and a ranking of ecological risk (from the BERA) posed by sediment to the benthic invertebrate community. Human health risks are of equal importance. With PCBs and dioxin/furans in fish and shellfish being the primary drivers of risk to humans, any AOI with these associated COPCs contributes to total site risk.

Use of the 95 percent UCL is a standard statistical approach to identify the maximum values in a population. The data from all of the AOCs and individual energy systems were combined to generate the estuary-wide population statistics provided in Appendix J. The 95precent UCL was used to provide a collective summary of the entire study area, AOC boundaries notwithstanding. The statistical output is provided for all compounds, summation data is provided for total HPAHs, total LPAHs, and 2,3,7,8-TCDD TEQ.

It should be noted that Figure ES-6 presents only selected COPC data that exceed the 95 percent upper confidence limit (UCL) of the mean, in an effort to summarize the highest concentrations COPCs exclusively in Bayou d'Inde in a single figure. More detailed COPC occurrence is discussed in the RI report.

PCBs tend to occur in two primary groupings, those grouped with PCB-118 and those with PCB-15. The PCB-118 group appears to originate in lower Reach 3 and extends through to the middle Reach 2 marsh area (BIR3046). The PCB-15 impacted areas begin at PPG Canal and are prevalent up to BIR3046 in middle Reach 2 marsh and extend downstream through Reach 1 to the ship channel. Lockport Marsh contains the highest detection of PCBs at location BIR2018, near the mouth of PPG Canal. The occurrence of PCBs in Lockport Marsh is within the bermed area. No documented PCB releases were noted in the regulatory record, however it is important to note that

processes which combine carbon and chlorine at elevated temperatures may generate PCBs as a by-product (Hulting 2002).

Mercury tends to be found from Maple Fork Bayou through Reach 1 to the ship channel. The concentrations, however lower, extend into upper Reach 2. Mercury concentration is highest in the marshes. Potential sources to Lockport Marsh include the former PPG mercury-cell settling pond that was operated in the late 1960s. The pond was an unlined impoundment within the PPG Canal drainage area. Further, high, localized detections within Lockport Marsh may be due to the use of mercury manometers on local gas wells by the oil field industry. These manometers contain elemental mercury and are sometimes damaged or broken on-site, causing mercury release.

HPAHs are found in the highest concentration in Reach 1, Lockport Marsh, Maple Fork Bayou marsh (BIR3018) and the eastern Reach 2 marsh (BIR3036). PPG Canal, Maple Fork Bayou, lower Reach 3 and highway LA-108 appear to be the sources of these PAHs. Elevated concentrations are noted in the marshes upstream of PPG Canal and may indicate overflow conditions to this area and/or oil field-related activities. HPAHs tend to be slightly higher in concentration in the marshes than in the bayou sediments, overall. No known sources exist on Maple Fork Bayou, although numerous industrial pipelines, a highway and a railroad spur cross Maple Fork near the highest detections, release from these operations are unknown.

LPAH distribution is not as widespread in Bayou d'Inde as HPAHs. The LPAHs tend to be found in Lockport Marsh and concentrations are generally higher than HPAHs. The second highest concentration of LPAHs is in Maple Fork Bayou, in lower Reach 3 and near LA-108 in Reach 2. In general, LPAHs tend to increase with depth. Potential LPAH sources include feedstock compounds used in the processes at Citgo (LDEQ 1991).

BEHP is found throughout Bayou d'Inde and in Reaches 2 and 3. BEHP appears to accumulate in the Reach 2 marshes (predominantly the Middle and Lower Reach 2 marshes, areas identified by BIR3054 and BIR3062, respectively) in this area. However, in Reach 1 where significant levels of BEHP are found, the bayou contains the majority of the contaminant, not the marsh. The concentrations in the bayou are greater than the Lockport Marsh by an order of magnitude in Reach 1. The overall distribution of BEHP suggests that the compound is greatly influenced by the presence of suspended or colloidal phase material in the water column. The distribution of BEHP indicates the greatest degree of transport of any COPC in Bayou d'Inde and suggests that its concentration in sediment is an indicator of low surface water flow velocity (high settling rate) and high organic or detritus material, either particulate or suspended. Physical data to support flow velocity estimates in Reach 1

include the large population of soft-shell crabs that reside there. Species profile for crabs indicate their preference for slow moving, organic-rich waters.

ES-7.2 RI Conclusions for Bayou d'Inde AOC

The general distribution of COPCs in Bayou d'Inde is complex, given the multiple sources and flow dynamics. Industrial releases to Reaches 1 and 3 are a significant component of surface water flow volume in Bayou d'Inde. Permitted and unpermitted discharges mix with surface water in the bayou that migrate up and downstream via, natural pathways, wind and tidal fluctuation. Large storms may push water and sediment upstream in Bayou d'Inde perhaps explaining the isolated occurrence of COPCs in Reach 4.

In the upstream region, Region 4, the level of contamination is minimal; the primary contaminants noted are LPAHs, mercury, copper, BEHP, and PCBs. The detections were noted downstream of I-10 and in the lower portion of Reach 4 near Little Bayou d'Inde.

Reach 3 contained a number of COPCs and concentrations in the area tend to be the second highest observed in all of Bayou d'Inde. Two areas of possible sources were noted, the area near Citgo outfall 001 and near the LA-108 Bridge. Primary COPCs in Reach 3 are dioxin/furans, PCBs, BEHP, HPAHs, LPAHs, and mercury.

Reach 2 COPCs are essentially the same as Reach 3, however, PCBs mercury, HPAHs, and BEHP tend to dominate. Reach 2 marshes tend to show the highest concentrations for metals, dioxin/furans and most HPAHs. Concentrations tend to be about the same in the marshes and the bayou for PCBs and tend to be lower in the marshes in Reach 2 for LPAHs. The HPAH compound 1,2-BPA is absent from Reach 2 marshes even though 1,2-BPA is present in the bayou in Reaches 2 and 3, indicating rapid salting-out (chemical precipitation) upon release in lower Reach 3.

Reach 1 was the area with the greatest number of compounds detected and the highest COPC concentrations. Reach 1 COPCs are dioxin/furans, PCBs, BEHP, mercury, HPAHs, LPAHs, HCB, and HCBD.

Overall, contaminants appear to be highest in Reach 3, Maple Fork Bayou, Reach 1, and Lockport Marsh. The contaminant suite in each of these areas is similar, and may represent some source and transported sediment overlap. The data suggests that fine or suspended particle transport is active in Bayou d'Inde. Flocculation and suspended particle binding may be prevalent for some compounds (LPAHs, BEHP, and some metals). Distribution and concentration gradients of many of the COPCs indicate sediment movement into the marshes, however this is not the case for all compounds. Overall, sediment stability tends to be moderate to poor. Open areas of Lockport Marsh are susceptible to sediment mobilization. Reaches 2 and 3 tend to be net

sediment exporters. Sediment stability with in the fringe marshes in Reach 2 is typically good. Potential for mobilization from the marshes immediately upstream of PPG Canal is moderate given the increased flow potential in Reach 1. It appears that re-suspension of fine grained material (organic or inorganic) facilitates physical transport throughout Bayou d'Inde.

ES-8 Bayou Verdine - Nature and Extent

This section summarizes the COPCs found in Bayou Verdine AOC and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport.

ES-8.1 Summary of the RI Evaluations

Bayou Verdine is divided into five geographic reaches to facilitate data presentation and discussion (Figure ES-7). Bayou Verdine can be characterized as a moderately saline, channelized, low-flow system with significant industrial inflow in the lower three reaches (Reaches 1 through 3). The upper reaches (Reaches 4 and 5) are generally a less-saline, shallow and narrow vegetated low-flow system.

The drainage area for the upper reaches is generally rural to agricultural. The lower reaches of Bayou Verdine (Reaches 1 through 3) receive surface runoff and wastewater discharge from several industrial facilities (Sasol, Conoco, Lyondell, KCSRR and PPG). Contaminants appear to enter the bayou as overland flow or through outfalls. The lower three reaches of Bayou Verdine are subjected to daily tidal fluctuation, tidal storm surge, and seasonal salinity and flow fluctuations.

The greatest extent and concentration of contaminants are seen in Reaches 1 and 2, generally from the Vista West Ditch to below I-10 and from middle Reach 1 to the mouth of Bayou Verdine. The primary contaminant group is HPAHs, however Reach 2 is impacted by dioxin/furans and various VOCs. Concentrations of HPAHs are high as are VOCs, while dioxin/furans are moderately low, see Figure ES-8.

COPCs in Bayou Verdine:

PAHs,
Dioxin/Furans,
Metals,
EDC,
and various other Chlorinated Hydrocarbons

It should be noted that Figure ES-8 presents only selected COPC data that exceed the 95 percent UCL of the mean, in an effort to summarize the highest concentrations COPCs exclusively in Bayou Verdine in a single figure. More detailed COPC occurrence is discussed in the RI report.

LPAHs are found near the Conoco Lube Tank Farm in Reach 3. Concentrations are moderately high in this area and exceed levels noted historically. Zinc is the only metal that is consistently elevated above levels noted in the reference area. Zinc is found throughout Reaches 2 and 3 from New Trousdale Road to the Vista West Ditch.

Contaminant occurrence indicates that several sources are present throughout Bayou Verdine. The upstream reaches are relatively un-impacted by industry. The Conoco Lube Tank Farm area appears to be the source of LPAHs and minor HPAHs in Reach 3.

Reach 2 is primarily impacted by releases through the Vista West Ditch and Vinyl Chloride Monomer (VCM) wastewater treatment unit discharge, Fabaucher Ditch, releases via Conoco outfalls 001 and 004, and releases through KCSRR Ditch. Reach 2, near the I-10 Bridge is the most heavily impacted segment of Bayou Verdine.

Reach 1 appears to be impacted by releases through outfalls that discharged to the upper third of the reach from I-10 through the PPG Derivatives Area (Plant B). Potential sources include the former Conoco, Olin, and Lyondell outfalls that discharge into Bayou Verdine below I-10. Releases to the lower reaches (Reaches 1 and 2) appear to come from PPG outfall 004 and activities (periodic spills and releases) at the North Dock area.

ES-8.2 RI Conclusions for the Bayou Verdine AOC

The primary COPCs in Bayou Verdine are HPAHs, LPAHs, VOCs, dioxin/furans, and zinc. Minor PCBs, SVOCs, and pesticides are also present. Contaminants appear to be deposited into the bayou as dissolved constituents, much of which becomes locally adsorbed to sediments or particulate material. Distribution of these contaminants suggests that COPCs adsorb to sediment or particulates and may then be transported away from the area where the contaminants first entered the bayou.

Concentrations of HPAHs are similar to those observed in previous studies. Vertically, the concentrations of HPAHs tend to be highest in the 15 to 30-cm interval upstream, in Reaches 3 and 4. Meanwhile, HPAHs tend to be highest in the upper (0 to 15-cm) interval in Reaches 1 and 2.

LPAHs tend to be higher in concentration, however they appear to be occurring in Reach 3 more prevalently than in 1993/1994. It should be noted that the maximum detected value was from BVR2007, upstream of I-10, concentrations in Reach 3 were elevated but not as extreme as this maximum. Vertical distribution is similar to the HPAH distribution.

Historically, dioxin/furans were not analyzed, however dioxin sediment core analyses indicate that only the shallow interval (0 to 15-cm) is impacted, dioxin was not detected at depth.

PCBs were detected in previous studies throughout Reaches 1 and 2, the highest concentrations were noted at the KCSRR Ditch and near the PPG outfall 004 at the mouth of Bayou Verdine. This distribution correlates with current RI findings.

VOCs consisted primarily of EDC (i.e., 1,2-dicholorethane) and a suite of other chlorinated hydrocarbons including PCE, TCE, 1,2-DCE, chlorobenzene, 4-bromofluorobenzene, dibromofluoromethane and dichloromethane. The greatest concentration of EDC was found near the Vista West Ditch. The EDC appears to be concentrated in a small area, perhaps present as dense non-aqueous liquid (DNAPL) resting on top of a shallow clay layer. It has been reported that a shallow clay layer dips to the west (dipping upstream from the Vista West Ditch) possibly influencing the upstream extent of the EDC plume. Other noted VOCs extend throughout Reach 2. Concentrations of these other VOCs are moderately high, ranging up to 50,000 µg/kg. RI results are higher, compared to historic concentrations.

PAHs, SVOCs, and dioxin/furans are compounds that partition readily to sediments. The attraction to TOC particles or sediment sorption sites is generally strong. There is competition for available sorption sites, and a hierarchy among these chemical groups exists. Typically, compounds with higher partitioning coefficients will accumulate at higher concentration in the sediments or suspended particulate matter. Partitioning coefficients are most important for the following: HPAHs, dioxin/furans, PCBs, pesticides, LPAHs, and SVOCs. Partitioning is less important for most VOCs.

Once adsorbed, the compounds tend to migrate with the matrix material. Reductions in salinity can lead to increased turbulence and suspension of colloidal phase material. This effect can lead to re-suspension of contaminants. Likewise, physical transport of sediment by bed load shear forces appears to be occurring.

The predominantly silty sand media in Reaches 1 through 3 appears to be subjected to fresh and saline water inflow (some as significant, periodic events) that have been shown to affect sediment bed stability. Organic matter is known to promote flocculation of suspended sediments in estuarine waters (Eisma 1986) and this combined with inflow of freshwater (enough to reduce salinity to below 3 ppt) has been shown to facilitate sediment particle re-suspension. This results in transport of charge-stabilized colloidal suspensions to downstream portions of the bayou or estuary (Johnson and Leenheer 1989). Distribution of contaminants near the larger outfalls indicates that this phenomenon may be having an effect. The surface water salinities noted indicate that the conditions are right, and there appears to be localized decreases in many contaminant concentrations at the confluence of these freshwater outfalls or ditches. The sediment concentrations generally increase within 100 to 200 m of the confluence.

Surface water salinity is variable, both spatially and temporally. Salinity observations during the RI ranged from 0 to 21 ppt. In Bayou Verdine, the impact of freshwater inflow from Fabaucher and Vista West Ditch is seen to locally reduce salinity from 15 ppt to 4 ppt. These areas correspond to broad distribution of PAHs, dioxin/furans, indicating that re-suspension and partitioning is occurring throughout this area.

Sediment transport is evidenced by the broad distribution of HPAHs from New Trousdale Road in Reach 3 to the mouth of Bayou Verdine at Coon Island Loop. While multiple sources exist, the broad distribution (observed at BVR3001, BVR3007, BVR2002, BVR2007, BVR1002, BVR1B1CS and BVR1011) along the length of the bayou is indicative of contaminant transport and sediment movement.

The combined processes of adsorption of organic compounds onto suspended particles, salinity-induced flocculation of suspended particles and salting out from the aqueous phase effectively removes many hydrophobic COPCs from the water column. This correlates with the RI data where none of the primary COPCs were noted in surface water.

Tidal driven flow also appears to strongly affect contaminant distribution. Tidal surge has the combined effect of increased turbulence and shear forces facilitating physical transport and the conveyance of more saline waters into the bayou. Tidal surge associated with coastal storm systems generally create or add to a vertically stratified salinity regime whereby the lower saline body moves upstream while the freshwater layer at the top of the water column moves seaward. These same conditions tend to create strong shear forces along the sediment surface (Grabemann *et al* 1997). The areas most likely affected by tidal surge are Reaches 1 and 2. Reach 1 is closest to the ship channel and its geometry is such that there are no barriers to prevent storm surge in the lower 1,500 m (from Coon Island Loop to I-10). Tidal surge reworking of the sediment is apparent by variable grain size. Sediments in Reaches 1 and 2 are predominantly silty sands.

Multiple sources appear to have contributed to the contamination seen in Bayou Verdine. The data indicates that the release of PAHs, dioxins, and zinc are higher in shallow surface sediments indicating recent deposition versus burial of impacted sediments by clean sediments.

Releases from process areas or outfalls mix with the moderately saline waters of Bayou Verdine, where contamination partitions to the solid or particulate material present. Initial deposition is likely localized, however, tidal surge or freshwater inflow from process waters tends to facilitate sediment transport. The distribution in Reach 2 is an excellent example of how effective freshwater inflow, turbulent flow bed mixing, and particle re-suspension can be in transporting contamination over a relatively large area. The resulting direction of movement is downstream. The addition of tidal surge conditions (increased salinity and re-suspension of sediments) sets the stage for impacted sediment transport to the Calcasieu Ship Channel.

ES-9 Upper Calcasieu Nature and Extent

This section summarizes the COPCs found in Upper Calcasieu AOC and presents an overview of their relation to historic data, reference areas results, spatial distribution,

sediment stability, and chemical fate and transport. Upper Calcasieu is divided into five energy systems: bayou, marsh, river, shallow lake, and ship channel. The energy systems are presented in Figure ES-9.

ES-9.1 Summary of the RI Evaluations

Contraband Bayou represents the bayou system in Upper Calcasieu and is a moderately saline low-flow bayou. Low salinity marsh areas are present in the river above Lake Charles. The shallow lakes areas include Lake Charles, the West Slip of Clooney Island Loop, and the eastern portion of Coon Island Loop; they are confined and shallow low-flow systems, with generally limited circulation. The ship channel includes the main ship channel from the I-210 Bridge to Lake Charles and the slightly smaller limbs of Clooney Island Loop and western Coon Island Loop.

The areas that define the Upper Calcasieu portion of the estuary represent a mixture of land uses and energy systems. The portions of the river above Lake Charles are considerably less saline and are protected somewhat from storm surge and tidal influence, which increase salinities throughout the rest of the estuary. Lake Charles and the natural river segment between Lake Charles and the saltwater barrier experience seasonal salinity shifts, and the installation of the saltwater barrier is evidence of the severity of saltwater intrusion in the region.

Industrial facilities (Lyondell, Conoco, and PPG) in Coon Island Loop and Clooney Island Loop release surface runoff and wastewater discharge to Upper Calcasieu AOC. Contraband Bayou receives effluent from the Lake Charles POTW. Additional non-point sources are present throughout. Primary introduction of contaminants to the system appears to occur in Clooney Island Loop and Coon Island Loop.

Potential Sources to Upper Calcasieu:

Lyondell (formerly ARCO, Olin),
Conoco
PPG, and
Lake Charles POTW

Contaminants of primary interest in Upper Calcasieu are those contaminants that increase human health or ecological risk. The varied settings of Upper Calcasieu result in rather isolated occurrence of COPCs. The majority of contaminants and generally the highest concentrations are found in the shallow lake portion of Coon Island Loop and the Clooney Island Loop West Slip area. Discharges from Lyondell, Conoco and PPG have impacted these sediments with PAHs, dioxin/furans, and various metals.

ES-9.2 RI Conclusions for the Upper Calcasieu AOC

The distribution of COPCs in Upper Calcasieu is generally limited to Clooney Island Loop, Coon Island Loop, and the ship channel between them. Evidence of flow driven transport is noted in the ship channel, with limited constituents noted upstream. The presence of COPCs in the remainder of Upper Calcasieu, e.g., the bayou, river, marsh energy areas, and Lake Charles are minimal. Contaminants in Clooney Island Loop

and Coon Island Loop appear to impact the region of Upper Calcasieu from the ship channel at Coon Island Loop up to the confluence with Lake Charles.

COPCs in Upper Calcasieu:

HPAHs, LPAHs, Dioxin/Furans, PCBs, Copper

COPCs of interest in Clooney Island Loop are PAHs (HPAHs and LPAHs), dioxin/furans, copper, and Aroclor 1254 (Figure ES-10). The highest concentrations are found in the West Slip area through the Conoco Dock area. The primary contaminants in the Coon Island Loop shallow lake area are low-level concentration of metals, noted throughout the shallow lake area. Limited various low-level HPAHs were also noted. It should be noted that HPAH distribution indicates extensive salting out of these contaminants from their entry into Coon Island Loop and the concentrations seen in the adjacent ship channel portion of Coon Island Loop. Historic data indicates that this distribution is consistent for the shallow lake area.

It should be noted that Figure ES-10 presents only selected COPC data that exceed the 95 percent UCL of the mean, in an effort to summarize the highest concentrations COPCs exclusively in the Upper Calcasieu AOC in a single figure. More detailed COPC occurrence is discussed in the RI report.

Distribution of the highest concentration of HPAHs is found in Clooney Island Loop from the West Slip area to the Conoco Dock area (sample location UCR2026). The concentrations decrease at UCR2026, but the extent of HPAH contamination in surface sediments continues well into the ship channel.

In general, PAH distribution in Upper Calcasieu sediment tends to concentrate in the shallow lake energy system. HPAH distribution extends to the area between Coon Island Loop and Contraband Bayou. This distribution appears to be due to the physical transport and settling of adsorbed particulate matter.

A limited number of detections, some with elevated concentrations of BEHP, were noted in the upper Coon Island Loop area near the confluence of Bayou Verdine. Lead detections correlated with these BEHP concentrations and although lead levels were not particularly elevated, they appear to be associated with BEHP deposition.

Potential sources to contamination in Upper Calcasieu are the distribution, storage, and transportation of products and waste in these three industrial areas. The elevated concentrations at the Conoco Docks are consistent with product storage and distribution activities associated with the site, as well as the site releases history. Elevated concentrations at the Lyondell/ARCO outfall 019 may indicate either repeated small quantity releases or impacted sediment accumulation in this area as available data does not indicate major releases through this outfall. Releases through PPG outfalls 002 through 004 are documented and appear to have contributed to

current sediment quality. Impacted groundwater in the area may have been an additional source of contaminants to the estuary.

Low-level concentrations between the West Slip and the confluence of Clooney Island Loop with the main ship channel, the main ship channel between Clooney Island Loop and Lake Charles, and the area between Coon Island Loop and Contraband Bayou are indicative of adsorbed particle transport. The distribution indicates surge driven sediment transport.

Available information indicates that the PAHs entering the upper portion of Coon Island Loop readily salt out upon contact with waters of the loop. The data suggests that the HPAHs are generally immobile, with LPAHs having a slightly greater lateral distribution.

Overall, the highest COPC concentrations appear to occur in the West Slip of Clooney Island Loop and the eastern portion of Coon Island Loop. The data indicates that moderate fine or suspended particle transport is occurring in the ship channel portions of Clooney Island Loop and Coon Island Loop in Upper Calcasieu. Distribution and concentration gradients of the COPCs indicate sediment accumulation in the shallow lake portions of Clooney Island Loop and Coon Island Loop. Overall, sediment stability tends to be moderate. It appears that re-suspension of fine grained material (organic or inorganic) facilitates physical transport throughout Upper Calcasieu.

ES-10 Lower Calcasieu – Nature and Extent

This section summarizes the COPCs found in Lower Calcasieu AOC and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport. Lower Calcasieu is divided into four energy systems: bayou, shallow lake, other (Indian Marais Lagoon), and ship channel. The energy systems are presented in Figure ES-11.

ES-10.1 Summary of the RI Evaluations

Bayous Olsen and Guy represent the bayou system in Lower Calcasieu. Both bayous are saline, low-flow systems. Bayou Guy receives runoff from predominantly rural residential areas. Bayou Olsen receives industrial discharge from W. R. Grace Inc. and rural residential runoff. Both systems are net sediment exporters, and receiving bodies are Moss Lake for Bayou Olsen and the Old Calcasieu River channel below Prien Lake to Bayou Guy. The shallow lake areas include Prien Lake and Moss Lake; they are semi-confined shallow

Potential Sources to Lower Calcasieu:

Citgo, Montell USA, LA Pigments, Westlake Petrochemicals, Vinyl, and Strene

low-flow systems with limited circulation. Moss Lake tends to have the larger opening to the ship channel. The ship channel system includes the main ship channel from the I-210 Bridge south the southern end of Moss Lake.
The areas that define Lower Calcasieu represent a mixture of land uses and point and non-point contaminant sources. Additional input to the Lower Calcasieu system includes flow from Upper Calcasieu, Bayou Verdine, and Bayou d'Inde sources. The most significant introduction of contaminants to the system appears to occur near the Citgo facility. The accumulation of low-level sediments in the bend south of Indian Marais Lagoon may come from any of the various sources upstream. Presence of material in this area appears to be the result of velocity drops and sediment particle settling.

COPCs in Lower Calcasieu:

Dioxins/Furans, HPAHs, LPAHs, BEHP and various metals

Contaminants of primary interest in Lower Calcasieu are those contaminants that increase human health or ecological risk. The layout of Lower Calcasieu tends to lead to somewhat isolated occurrence of COPCs. Overall, the most impacted area within Lower Calcasieu is the Indian Marais Lagoon. (Figure ES-12). The majority of contaminants and highest concentrations are found in the lagoon. Former discharge has impacted lagoon sediments. Primary COPCs are PAHs and selected metals, primarily lead, copper, chromium, and zinc.

It should be noted that Figure ES-12 presents only selected COPC data that exceed the 95 percent UCL of the mean, in an effort to summarize the highest concentrations COPCs exclusively in the Lower Calcasieu AOC in a single figure. More detailed COPC occurrence is discussed in the RI report.

The shallow lake areas, specifically Prien Lake, tend to have broad distribution of moderate-, to low-level concentrations of dioxins/furans, PAHs and some metals. Copper, lead, mercury, nickel, and zinc were present in Prien Lake in the surface water. Sediment concentrations were similar to background values. Copper exceeded the ambient water quality criteria set for acute and chronic marine exposure and chronic freshwater exposure limits. Mercury exceeded the chronic ambient water quality criteria for freshwater systems.

Data from the ship channel portion of Lower Calcasieu had limited detections of dioxins/furans, PAHs, BEHP, and mercury. The distribution is primarily associated with the Citgo facility and the Indian Marais Lagoon. Distribution appears to represent some degree of sediment transport downstream of the potential sources, e.g., the Citgo outfalls 004 and 006 or the Indian Marais Lagoon, to a shallow shelf on the eastern side of the ship channel where velocities appear to decrease and settling occurs.

ES-10.2 RI Conclusions for the Lower Calcasieu AOC

The distribution of COPCs in Lower Calcasieu is mostly concentrated in the Indian Marais Lagoon and is present in generally disperse, low-level concentrations in the ship channel and Prien Lake. Minor distribution of PAHs and various metals are present in Moss Lake.

Evidence of flow-driven transport is noted in the ship channel, with select COPC distribution noted between LCR1055 to LCR1036 (from Citgo facility to the ship channel bend south of the Citgo facility) and in Prien Lake. Distribution of dioxins/furans and BEHP in Prien Lake appear to be the result of sediment accumulation in the southern end of the lake. The specific origin of the COPCs is unknown, but based upon observed surface water circulation patterns associated with Prien Lake, it is likely that the contaminants have originated outside of the lake. The presence of COPCs in the remainder of Lower Calcasieu, e.g., the Bayou Guy, Bayou Olsen, and Moss Lake, are minimal.

COPCs of interest in Lower Calcasieu are PAHs (HPAH and LPAH), dioxins/furans, and various metals. The highest concentrations are found in the Indian Marais Lagoon, and lower levels of a subset of COPCs are noted in Prien Lake. It should be noted that minor sediment transport and deposition appears to be occurring downgradient of the Citgo facility and within Prien Lake. Limited historic data is available for use in evaluating sediment stability over time. Vertical core data indicates that recent releases of various constituents have deposited in Indian Marais Lagoon. Likewise, cores indicate the sediment scouring has occurred in Indian Marais Lagoon. PAH data in the subsurface indicates material is present in the shallow surface sediments, but that concentration levels are lower than in the past. Subsurface data is limited to the Indian Marais Lagoon in Lower Calcasieu.

In general, PAH and dioxin/furan distribution in Lower Calcasieu sediment tends to be concentrated in the Indian Marais Lagoon. Minor miscellaneous detections are also noted in the shallow lakes, primarily Prien Lake. Minor PAH distribution extends a short distance to the area downstream of the Citgo facility within the ship channel. This distribution appears to be due to physical transport of fine-grained material and subsequent settling due to velocity drops in downstream bends of the ship channel. Concentrations indicate that the ship channel effectively exports much of the sediment that enters.

Overall, contaminants appear to be highest in the Indian Marais Lagoon, with lesser contribution for Bayou d'Inde and outfalls within the area (e.g., Citgo or upstream industrial releases to Upper Calcasieu).

The data suggests that moderate fine or suspended particle transport is occurring, with limited deposition occurring within the ship channel near station LCR1033.

Overall, sediment stability appears to be dynamic. Current conditions have led to accumulation; however, the site is susceptible to storm surge scouring. It appears that material moves out of the lagoon into the ship channel during periods of high flow and that once material enters the ship channel the compounds are carried out of the system. The data indicate that in Lower Calcasieu deposition along the shoulder of the ship channel is minor; the ship channel is an effective sediment exporter.

ES-11 Nature and Extent of Biota Contamination

Tissue samples from a variety of aquatic biota were collected and analyzed for COPCs. This section discusses the tissue data by AOC and by biota group. The four AOCs in the estuary are Upper Calcasieu, Bayou d'Inde, Lower Calcasieu, and the reference area. Bayou Verdine is not included in this evaluation, as it was evaluated independently by Conoco. A description of the 11 biota groups evaluated is presented as Exhibit ES-3.

Exhibit ES-3 Description of Biota Groups for the Calcasieu Estuary

Type	Group	Description of Group	Size Class (cm)
Fish	1	Small sedentary species – low trophic level (<2.5)	<15 cm
Invertebrates	1A	Small sedentary bivalves	<7.5 cm
Invertebrates	1B	Small sedentary crustaceans	<7.5 cm
Invertebrates	2A	Small migratory crustaceans	<12.5 cm
Invertebrates	2B	Large migratory crustaceans	>12.5 cm
Fish	2A	Small migratory species - low trophic level (<2.5)	<15 cm
Fish	2B	Small migratory species - high trophic level (>2.5)	<15 cm
Fish	3A	Medium migratory species - low trophic level (<2.5)	15 to <30 cm
Fish	3B	Medium migratory species – high trophic level (>2.5)	15 to <30 cm
Fish	4A	Large migratory species - low trophic level (>2.5)	30 to 90 cm
Fish	4B	Large migratory species - high trophic level (>2.5)	30 to 90 cm

In addition, the relationships between COPC concentrations in sediment and in biological tissues are evaluated for small sedentary bivalves (Group 1A biota) that are directly and continuously exposed to potentially contaminated sediments. These relationships are expressed as biota-sediment accumulation factors (BSAFs) that are based on the following equation:

$$BSAF = COPCs\ concentration\ in\ biota / COPCs\ concentration\ in\ sediment$$

COPC concentrations are expressed as mg/Kg dry weight sediment and mg/Kg wet weight biota. The BSAFs presented in this section are not normalized for biota lipids or for sediment organic carbon content. BSAFs are not calculated for other biota groups because of more less direct contact with potentially contaminated sediments. For example, most fish accumulate contaminants as a result of direct water contact

rather than sediment exposure. Also, other mobile invertebrates (e.g., crustaceans) will be exposed to sediments over a wider spatial area. The mobility of these types of organisms precludes an accurate determination of relationships between COPCs concentrations in sediment and biota.

Site-wide Results for Biota Groups 2A – 4B

Site-wide results include the results of sampling of migratory/mobile biota throughout the study area. This approach is appropriate because little difference was observed in the tissue COPCs concentrations of Groups 2, 3, and 4 migratory/mobile fish and crustaceans. The site-wide results are presented by COPCs class and by mobile/migratory biota group (Exhibit ES-4).

Exhibit ES-4 Site-wide Summary of Biota Tissue Data, Groups 2A to 4B

Biota Group	Metals	SVOCs/PAHs	PCBs	Pesticides	Dioxins/ Furans
2A Invertebrates	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	9 DET, MFD = benzaldehyde at conc ~RA	MFD = PCB-118 at conc >> RA	ND, and ND in RA	10 DET, MFD = 2,3,7,8-TCDF at conc >>RA
2B Invertebrates	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	3 DET, MFD = benzaldehyde at conc< RA	MFD = Aroclor 1254 (ND in RA) and PCB-118	MFD = DDT and beta-BHC	8 DET, MFD = 2,3,7,8-TCDF at conc > RA
2A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	2 DET, MFD = benzaldehyde at FD and conc~RA	MFD = Aroclor 1254 (ND in RA) and PCB-118 at conc ~ to RA	Few DET at low FD and conc	18 DET, MFD = 2,3,7,8-TCDF at conc ~ RA
2B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	6 DET, MFD = benzaldehyde	MFD = Aroclor 1254 and PCB-118	MFD = beta-BHC and DDE	21 DET, MFD = 2,3,7,8-TCDF
3A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	5 DET, MFD = benzaldehyde at conc ~RA	MFD = Aroclors 1254 and 1260 at conc ~ RA and PCB-118 at conc > RA	8 DET, MFD = DDD and beta-BHC	20 DET, MFD = 2,3,7,8-TCDF at conc < RA
3B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	7 DET, MFD = benzaldehyde at conc ~RA	MFD = Aroclors 1254 and 1260 at conc > RA and PCB-118 at conc ~ to RA	8 DET, MFD = beta-BHC	7 DET, MFD = 2,3,7,8-TCDF at conc ~ RA
4A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	4 DET, MFD = benzaldehyde. Only 1 SVOC detected in RA	MFD = Aroclors 1254 and 1260 (only 1254 DET in RA) and PCB-118 at conc > RA	Few DET at FD<50%, MFD = DDE and beta-BHC	FD ~ RA, but at conc > RA
4B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	Several DET, MFD = benzaldehyde, BEHP, and diethylphthalate	MFD = Aroclors 1254 and 1260 at FD and conc ~ RA and PCB-118 at conc > RA	Few DET at low FD and conc, MFD = beta-BHC, pesticides ND in RA	10 DET, MFD = 2,3,7,8-TCDF at conc > RA

MFD = Most frequently detected "X", DET = Number of analytes detected, RA = reference area
Conc = concentrations, FD = frequency of detection, < = less than,
> = greater than, >> = much greater than, and ~ = Similar to

In general, there is little difference in the types of analytes detected and the most frequently detected analytes from one biota group to another. These summary data encompass all the data from the three areas and, where available, the reference area.

In a few cases, comparisons of the summary data from the three areas to reference area data indicate significant differences. Two types of differences are observed. Contamination of reference areas by unknown sources can be concluded where reference area COPCs concentrations exceed the area concentrations in similar biota. This situation is observed occasionally with benzaldehyde and infrequently with 2,3,7,8-TCDF. On the other hand, significant AOC contamination can be interpreted where the concentrations of COPCs in AOC biota substantially exceed those of reference area biota. This case is observed more commonly with the PCB congener PCB-118 and 2,3,7,8-TCDF. These COPCs were commonly detected in AOC biota at concentrations that substantially exceeded those of the reference area. These are important findings because of the high toxicity and bioaccumulation potential of these COPCs. In general, the frequencies of detection and the concentrations of other COPCs, such as metals, were similar in both the reference area biota and the AOC biota, based on the overall data for all three AOCs.

In summary, only relatively minor differences are observed in the COPC concentrations in tissues taken from the AOCs and the reference area for the migratory or mobile biota. Therefore, area-specific data for these more mobile organisms are unlikely to provide useful information with regard to the identification of source areas or areas in need of remediation. Instead, area-specific data are best evaluated for less mobile organisms, primarily biota from Groups 1, 1A, and 1B. These data are summarized below.

AOC-Specific Results for Biota Groups 1, 1A, and 1B

The results summarized in this section are based on sedentary or less mobile organisms. These organisms, especially the invertebrates in Groups 1A and 1B, have more constant and direct contact with potentially contaminated sediments. Tissue COPC concentrations for these organisms are, therefore, more likely to be better linked to sediment quality, as indicated by COPCs concentrations. Because the sediment quality and tissue COPCs concentrations have direct association, these data are presented on a by-area, as well as a by-COPCs and by-biota group basis.

As shown in the summary presented below (Exhibit ES-5), there are some important findings based on location-specific data. Results for Group 1 sedentary fish reveal several locations where the frequency of detection and/or the mean concentration of metals COPCs exceed that of the reference area. This is true for Lower Calcasieu, Bayou d'Inde, and Upper Calcasieu. The most important finding within this group is the high mean concentration of mercury in Upper Calcasieu relative to the mean for the reference area. A second important finding is revealed by the comparison of the number of dioxin/furan compounds detected in each area. Twenty-one of these compounds were found in Lower Calcasieu while 25 and 18 were detected in the Bayou d'Inde and Upper Calcasieu, respectively. In contrast, only six dioxin/furan compounds were detected in the reference area. Comparisons of location-specific data

for SVOCs/PAHs, PCBs, and pesticides reveal only relatively minor differences between reference area results and results from other AOCs.

Exhibit ES-5 Site-wide Summary of Biota Tissue Data, Groups 1, 1A, and 1B

Biota Group	Areas of Concern	Metals	SVOCs/ PAHs	PCBs	Pesticides	Dioxins/ Furans
1 Fish	LC	FD>RA (Ni) Conc>RA (Hg, Se, Zn)	9 DET, MFD = benzaldehyde (FD and conc<RA) and phenol. HCBD DET but not in RA.	Aroclor 1254 (FD~RA, conc<RA) and 18 congeners (FD and conc ~RA) DET.	endosulfan sulfate DET but not in RA. None DET in LC also found in RA.	21 DET, MFD = 2,3,7,8-TCDF.
	BI	FD>RA (As, Cr, Cu, Pb, Hg, Ni, Se, Zn). Conc >RA (Cr, Cu, Pb, Hg, Se, Zn).	9 SVOCs/1 PAH DET. Benzaldehyde MFD, but conc <RA.	Aroclor 1254 and 19 congeners DET. Aroclor 1254 FD >>RA, conc > RA. Congeners FD~RA.	3 DET at low FD and conc.	25 DET. Of 6 also DET in RA, FD~RA, conc >RA.
	UC	FD>RA (none), conc >RA (As, Pb, Zn). Mean conc Hg 2X RA mean.	5 SVOCs DET, MFD = 2- and 4-methylphenol (neither DET in RA). Phenol FD and conc>RA	Aroclor 1254 only Aroclor DET, at conc>RA. MFD congener = PCB-118, conc of congeners <RA	Not Detected	18 DET at low FD and conc. MFD=2,3,7,8-TCDF (mean=0.307 pg/g), ~RA
	RA	Similar elements DET	See above	See above	Few DET	6 DET
1A Bivalves	LC	FD >RA (none), conc >RA (Cu, Se, Zn).	3 SVOCs/3 PAHs DET. MFD = benzaldehyde and BAP	No Aroclors DET. MFD congener = PCB-118.	Not Detected	21 DET, FD~RA, conc>RA
	BI	FD>RA (none), conc >RA(Cu, Hg, mHg, Ni, Se, Zn).	1 SVOC/18 PAHs DET	Aroclor 1254 and 1260 DET, MFD congener = PCB-118. Congener FD~RA, conc >RA.	12 DET, MFD = beta-BHC. None DET in BI were DET in RA.	24 DET, FD~RA, mean conc >RA.
	UC	MFD=As, Cr, Cu, Hg, mHg, Ni, Se, Zn	5 SVOCs/18 PAHs DET, MFD = BAP (mean=1.066 ug/Kg)	Aroclors 1254 and 1260 FD<10%. Congeners not analyzed	14 DET, MFD=DDE (max=2.7 ug/Kg)	13 DET, compounds ~ RA
	RA	No sample collected	NS	6 DET	4 DET	11 DET
1B Crusta-ceans	LC	DET = Cu, Pb, Hg, Se, Zn.	Not Detected	Not Detected	3 DET	Not Analyzed
	BI	MFD = As, Cu, Pb, Hg, Ni.	No SVOCs DET, 18 PAHs DET	Aroclors 1254 and 1260 DET, MFD congener = PCB-129.	12 DET, MFD = beta-BHC.	34 DET, MFD = 2,3,7,8-TCDF.
	UC	MFD = As, Cu, Hg, Ni	No SVOCs, 18 PAHs	Aroclor 1254 and 1260, No congeners analyzed	3 DET	13 DET
	RA	NS	NS	NS	NS	NS

MFD = Most frequently detected analytes detected
Upper Calcasieu
FD = frequency of detection
LC = Lower Calcasieu
BI = Bayou d'Inde
Conc = concentrations
NS = Not sampled
"X" DET = Number of
RA = reference area UC =
RA = reference area
< = less than

> = greater than >> = much greater than ~ = similar to

Biota-Sediment Relationships for Group 1A Biota
Geometric mean biota-sediment relationships for Group 1A shellfish (Bayou d'Inde and Upper and Lower Calcasieu) and Group 2A crustaceans (reference area), expressed as BSAFs rounded in most cases to two significant digits. The ranges of these BSAFs are presented below for each class of COPCs (e.g., metals, PAHs) or for an individual PAH where only one PAH was detected in both sediment and biota. The number of samples refers to paired (co-located) samples of both sediment and biota. Appendix H presents all COPCs-specific and AOC-specific BSAFs for Group 1A biota based by sample.

Lower Calcasieu (Group 1A shellfish - 1 sample)
Geometric mean BSAFs for metals other than mercury range from 0.0006 (lead) to 1.5 (zinc). Geometric mean BSAFs for mercury and methyl mercury are 0.013 and 0.4, respectively. Geometric mean BSAFs for PAHs range from 0.0023 (benzo(k)fluoranthene) to 0.0045 (benzo(a)pyrene).

Bayou d'Inde (Group 1A shellfish - 1 sample)
Geometric mean BSAFs for metals other than mercury range from 0.0002 (lead) to 0.05 (cadmium). Geometric mean BSAFs for mercury and methyl mercury are 0.060 and 9.3, respectively. The geometric mean BSAF for phenanthrene is 0.098.

Upper Calcasieu (Group 1A shellfish - 5 samples)
Geometric mean BSAFs for metals other than mercury range from 0.0056 (lead) to 1.0 (silver). Geometric mean BSAFs for mercury range from 0.007 to 0.28 in the five samples. Geometric mean BSAFs for PAHs range from 0.01 (benzo(a)pyrene and indeno(1,2,3-cd)pyrene) to 0.06 (anthracene).

Reference area (Group 2A crustaceans - 1 sample)
Group 1A shellfish were not sampled in the reference area. Data on Group 2A crustaceans, which are more mobile than Group 1A shellfish, are used to generally describe the sediment/biota relationships within the reference area. PAHs were not detected in the reference area. Geometric mean BSAFs for metals other than mercury range from 0.02 (lead) to 1.09 (cadmium). The geometric mean BSAF for mercury is 0.105. These data probably do not describe the sediment/biota relationships as well as the data based on Group 1A shellfish because of crustacean mobility. However, most of the Group 2A crustaceans sampled in the reference area are not expected to range widely over the estuary and are in fact likely to remain within the described reference area. These biota are, therefore, considered reasonable representatives of benthic biota having direct contact with reference area sediments.

BSAF Summary

COPCs that are easily bioaccumulated and not easily or rapidly depurated are expected to accumulate to the highest concentrations in exposed biota. Such COPCs include mercury and, for Group 1A bivalves, PAHs. Mercury can be converted to methyl mercury in sediment and in biological tissues, so mercury BSAFs can be viewed somewhat similarly to methyl mercury BSAFs. It is noted, however, that methyl mercury is more rapidly accumulated and accumulates to a higher degree than inorganic mercury. The highest overall BSAF was determined for methyl mercury in Bayou d'Inde (9.3). With a very few exceptions, geometric mean BSAFs for most other metals remained below 1.0. In most cases, the lowest geometric mean BSAFs were for lead, which is not unexpected given the low solubility and bioavailability of lead in sediments. BSAFs for PAHs generally remained low, in all cases less than 0.1. Other than the single high geometric mean BSAF for methyl mercury in Bayou d'Inde (9.3), the BSAFs determined for this site appear to be similar to those determined for other contaminated sites where BSAFs commonly approximate unity (1.0) for most COPCs.

The BSAFs presented here can be used to evaluate in a general sense the bioavailability of site COPCs. The identification of COPCs that occur in forms that are accumulated in biological tissues is reflected in the BSAF data presented. Also, these BSAFs can be used as input parameters to food chain modeling to derive predicted COPCs doses via ingestion of food items. This use is relevant only if it is determined that food chain modeling is indicated for this site.

ES-12 Toxicity Testing and Benthic Community Survey

This section summarizes the data generated from sediment and porewater toxicity tests. A total of 100 sediment samples were collected from the Calcasieu Estuary in November and December of 2000. A more comprehensive interpretation of these tests can be found in the BERA (CDM 2002c).

Sediment is a major repository for many of the more persistent chemicals that are introduced into surface waters and provides habitat for many aquatic organisms. In the aquatic environment, most anthropogenic chemicals and waste materials, including toxic organic and inorganic chemicals, eventually accumulate in sediment.

Concentrations of contaminants in sediment may be several orders of magnitude higher than in the overlying water. However, bulk sediment concentrations may not always be strongly correlated to bioavailability. Because relationships between concentrations of contaminants in sediment and their bioavailability are poorly understood, determining effects of contaminants in sediment on aquatic organisms requires controlled toxicity and bioaccumulation tests and measures of effects on benthic communities inhabiting sediments (SETAC 1997).

The testing was explicitly designed to provide the information that is required to evaluate the risks to sediment-dwelling organisms that are associated with exposure to contaminated sediments.

Whole-Sediment Hyalella Azteca Toxicity Tests
Whole-sediment toxicity tests were conducted on 100 samples with the amphipod *Hyalella azteca* following procedures outlined in ASTM (2000), EPA (2000), and Ingersoll *et al.* (1997). Exposures were conducted for 10 and 28 days, and endpoints measured at the end of these exposures included survival and length of amphipods. Mean survival of amphipods in the control sediment for both the 10 and 28-day (d)tests was at or above 92 percent for the first and second batches of samples. However, wide ranges in mean survival and length of amphipods were observed with exposure to the Calcasieu sediments in the 10 and 28-d tests. In both the 10 and 28-d tests, survival of amphipods exposed to Calcasieu sediments ranged from 0 to 100 percent.

Whole-Sediment Toxicity Test Using *Ampelisca Abdita*
Amphipods were exposed to test sediments for 10 days under static conditions, following ASTM procedures. The results were then put into three categories, low risk (survival > 55 percent), indeterminate risk (Survival 49.4 percent – 55.5 percent), and high risk (Survival < 49.4 percent). The results show that out of 100 percent of the samples tested, 46 percent of the samples tested had a survival rate of greater than 55 percent The majority of the mortality was experienced in Bayou d'Inde (21 out of 31).

Bioaccumulation Tests Using *Nereis Virens*
Bioaccumulation is the net accumulation of a substance by an organism as a result of uptake from an environmental source. A 28-d bioaccumulation test was conducted with site sediment from 12 locations (within the Calcasieu Estuary and the reference areas using the polychaete *Nereis virens* as the test organism. The polychates were allowed to live in 2 cms of sediment for 28 days, then removed, cleaned, frozen, and sent for analysis. Survival data for the *Nereis virens* in the bioaccumulation tests in the laboratory control sediment were 99 percent. Survival of *Nereis virens* in the site sediments ranged from 87 percent (sample station 00BI2-ST030-NSD-010) to 98 percent.

Bioaccumulation tests were conducted at six whole sediment sample locations in Bayou d'Inde. COPCs detected in the test organisms and sediments were total PCB congeners, dioxin/furans, and SVOCs. Metals detected in test organism were all within the range of metals detected in tissue from the reference areas.

Solid-Phase Microtox® Toxicity Tests
The Microtox® Solid-Phase Toxicity test (SPT test) was conducted on 100 whole sediment samples collected during the Phase II sampling. The SPT test determines the bioavailability of chemicals in sediment by exposing bioluminescent bacteria (*Vibrio*

fisheri; B-NRL 1117, Azur Environmental, Carlsbad, CA) directly to sediment suspended in solution for a period of 25 minutes (Johnson 1998; Johnson and Long 1998). A log-linear model was then used to calculate EC-50 values. The bioluminescence of bacteria at the start of the exposures was always within the acceptability limits for the test (90 to 110 percent in the control). Therefore, the Microtox® tests met the acceptability criteria recommended in Johnson and Long (1998).

A wide range in the EC50 values was observed with exposure to the Calcasieu sediments in the Microtox® test (0.15 to 37). The results were put into three categories, low risk (EC-50 less than 1.12), indeterminate risk (EC-50 between 1.12 and 1.26), and high risk (EC-50 greater than 1.26). The results indicate that exposure to whole sediments from the Calcasieu estuary poses variable risks to the microbial community, with the highest posed to the microbial community in Bayou Verdine, followed by Bayou d'Inde, and Lower Calcasieu. (CDM 2002c).

Porewater Toxicity Testing
Fifty of the 100 stations were selected for porewater toxicity evaluation to determine if there were adverse effects to survival, growth, and reproduction of aquatic plants, benthic invertebrate, and benthic or pelagic fish associated with porewater from contaminated sediments from the Calcasieu Estuary. The three tests that were conducted and their endpoints included:

- **Porewater toxicity testing with Algal zoospores –** 96-hour (h) porewater toxicity test determined with Algal zoospore using sea lettuce, *Ulva fasciata, thalli*; endpoint: germination or growth

- **Porewater toxicity testing with sea urchins –** 30-minute or 48-h toxicity test determined using the sea urchin *Arbacia punctulata*; endpoint: fertilization test and the embryological development

- **Porewater toxicity testing with redfish embryos –** 48-h porewater toxicity tests with redfish (*Sciaenops ocellatus*) embryos; endpoint: hatching success and survival

When considered together, the three lines of evidence indicate that exposure to porewater is generally not adversely affecting the survival, growth, and reproduction of aquatic plants, benthic invertebrate, and benthic or pelagic fish.

Benthic Community Survey
Estuaries of southwestern Louisiana may be characterized as vertically well mixed, with wide annual salinity fluctuations, weak tidal flushing, fine sediments (often approaching 100 percent silt/clay content), and widespread low oxygen of bottom waters during warm months (Gaston and Nasci 1988). There were 3,408 macrobenthic organisms identified during the present study, distributed among 62 taxa. Most of the

organisms were annelids (26 taxa; 77.8 percent of the specimens) and arthropods (22 taxa; 11.3 percent of the specimens). Only 11 taxa of molluscs were collected (7.7 percent of the specimens). No echinoderms were collected. Nemerteans, hydroids, and urochordates made up the remaining organisms (3.3 percent).

Abundance data for this study were comparable to values reported for the region by previous investigators (Gaston and Nasci 1988, Gaston and Young 1992). Data by station, however, ranged widely in the current study. For instance, many of the samples from Bayou d'Inde had very few organisms or very low mean total abundance per site, while one station on that bayou supported 4,258 organisms/0.5 m^2). Gaston and Young (1992) also reported that many sites in Bayou d'Inde were devoid of macrofauna and attributed this paucity to contaminant effects. They also collected fewer organisms in Bayou d'Inde than elsewhere (Bayou Verdine and Contraband Bayou).

Highest densities of macrobenthos occurred at reference sites (Choupique Bayou = 2,267/0.5 m^2; Johnson Bayou = 2,651/0.5 m^2) and Moss Lake (3,140/0.5 m^2), Prien Lake (2,207/0.5 m^2), upper Calcasieu River – Clooney Island to Coon Lake (2,059/0.5 m^2), and lower Bayou d'Inde – (2,049/0.5 m^2). Lowest densities of macrobenthos occurred in upper Bayou d'Inde (56/0.5 m^2), lower Bayou d'Inde (123 organisms/0.5 m^2), lower Bayou d'Inde – lower PPG Canal (130/0.5 m^2), and a reference site in Grand Bayou (141/0.5 m^2).

The IBI was assessed by region to make predictions of likelihood of contaminant effect on macrobenthic communities. Lowest values for the index (i.e., likelihood of contaminant effect) occurred at sites in upper Bayou d'Inde, middle Bayou d'Inde, and lower Bayou d'Inde; Bayou Olsen; and Coon Island Loop. Most of these sites supported very few organisms; and nearly all of the specimens collected were indicators of the highest levels of contamination.

Highest values for the IBI (i.e., low levels of contamination) occurred at reference sites on Johnsons Bayou, two sites in Clooney Island Loop and single sites in Moss Lake, Prien Lake, upper Calcasieu River, lower Bayou d'Inde, and Coon Island Loop. Most of these sites supported a moderate diversity of species and relatively high abundances of macrobenthos.

Toxicity Identification Evaluation

Phase II sediment samples were collected from seven locations in support of EPA Region 6 TMDL study as part of the current 303(d) listing. The purpose of the TMDL is to determine the pollutant loading that a water body can assimilate without exceeding the water quality standard for that pollutant. In support of the TMDL, a TIE was performed. The TIE method aids the TMDL determination by identifying which compound(s) result in toxicity to test organisms (AppendixI).

Toxicity results indicate that six of the seven sediments exhibited toxicity to both species. TIE findings for amphipods and mysids are generally in good agreement, and the results are consistent with sediment toxicity results. TIE results also indicate that specific contaminant classes caused acute toxicity and that sediment loads (via porewater flux) may be considered sources that may contribute to toxicity in the water column. The TIE study provides evidence relating site-specific contaminants and contaminant classes to observed adverse effects in benthic species. The TIE results may be applied to determine load limit requirements for protection of benthic habitat.

ES-13 Baseline Ecological Risk Assessment Summary

This section summarizes the evaluation of the risks to ecological receptors (i.e., aquatic organisms and aquatic-dependent wildlife) posed by exposure to water, sediment, or biota in the study area. More specifically, risks to the microbial community associated with exposure to COPCs in whole sediments were evaluated. In addition, risks to the aquatic plant community associated with exposure to COPCs in surface water or porewater from Calcasieu Estuary sediments were assessed. The risks to the benthic invertebrate community associated with exposure to COPCs in whole sediments and porewater were also evaluated. Furthermore, risks to benthic and pelagic fish associated with exposure to COPCs in surface water, porewater, whole sediments, and prey organisms were assessed. Finally, risks to aquatic-dependent wildlife (i.e., birds and mammals) were evaluated based on their potential exposure to COPCs in prey organisms.

ES-13.1 Study Objectives

The primary objectives of this study were to:

- Determine if adverse effects on ecological receptors are occurring, or are likely to be occurring, within the Calcasieu Estuary
- Evaluate the nature, severity, and area extent of any such effects
- Identify the COPCs that are causing or substantially contributing to effects on aquatic receptors

A step-wise approach was used to assess the risks to aquatic organisms (i.e., microorganisms, aquatic plants, benthic invertebrates, and/or fish) and aquatic-dependent wildlife associated with exposure to COPCs. The five main steps include:

- Identification of assessment endpoints, risk questions and testable hypotheses, and measurement endpoints
- Collection, evaluation, and compilation of the relevant information on environmental conditions in the Calcasieu Estuary

- Assessment of the exposure of aquatic organisms and aquatic-dependent wildlife to COPCs
- Assessment of the effects of COPCs on aquatic organisms and aquatic-dependent wildlife
- Characterization of risks to the aquatic organisms and aquatic-dependent wildlife

Assessment endpoints, risk questions and testable hypotheses, and measurement endpoints were identified. The assessment endpoints that were considered in the BERA included:

- Activity of the aquatic microbial community
- Survival, growth, and reproduction of aquatic plants
- Survival, growth, and reproduction of benthic invertebrates
- Survival, growth, and reproduction of benthic and pelagic fish
- Survival and reproduction of aquatic-dependent birds
- Survival, growth, and reproduction of aquatic-dependent mammals

ES-13.2 Integrated Risks to Aquatic Receptors

The results of this investigation indicated that exposure to COPCs is adversely affecting a variety of ecological receptors in the Calcasieu Estuary. More specifically, activity of the microbial community has been impaired in portions of the estuary due to exposure to sediment-associated COPCs. In addition, the survival, growth, and/or reproduction of aquatic plants have also been adversely affected in portions of the estuary through exposure to COPCs in surface water and porewater. Furthermore, exposure to whole sediments or porewater have been adversely affected the survival, growth, and/or reproduction of benthic invertebrates. Finally, the survival, growth, and/or reproduction of benthic fish have been impaired due to exposure to COPCs in whole sediments and/or porewater (Figures ES-13 to ES-15 summarize the risks to each receptor group throughout the Calcasieu Estuary).

For each of the four aquatic receptor groups, the information for various measurement endpoints and lines of evidence were integrated by calculating a final risk score for each location sampled. Subsequently, the final risk scores that were calculated for the various receptor groups for each location were averaged to obtain an overall risk score for the four-receptor groups for each location. Then, risks to microorganisms, plants, benthic invertebrates, and fish were classified into three categories for each location, based on the overall risk score that was calculated. Locations with overall risk scores of <2, 2 to 3, and >3 were classified as posing low, indeterminate, and high risks to aquatic receptors, respectively. In this way, it was

possible to integrate information on the risks posed to multiple aquatic receptors by exposure to COPCs in the estuary.

The results of this assessment indicated that risks to aquatic receptors are generally low throughout the Calcasieu Estuary. Of the 634 locations that were sampled within the three AOCs, 377 (59 percent) were classified as posing low risks to microorganisms, aquatic plants, benthic invertebrates, and/or fish. By comparison, 11 percent (69 of 634) and 30 percent (188 of 634) of the locations sampled were classified as posing indeterminate and high risks, respectively . Among the three AOCs, the highest risks to aquatic receptors were evident in Bayou d'Inde. Risks to aquatic receptors were classified as low throughout the reference areas.

In general, there was good correspondence among the risk classifications for the four groups of aquatic receptors. For example, risks were classified as low within the three AOCs for 58 percent of the locations sampled for fish to 72 percent of the locations sampled for aquatic plants. With the exception of microorganisms, the frequency of classification of indeterminate risks was generally low (i.e., 5 to 9 percent) for the various receptor groups. Similarly, the frequency of classification of high risks was comparable for three of the four aquatic receptor groups (i.e., 23 to 37 percent, with microorganisms being the exception). Risks to the microbial community were generally classified as being lower than those for the other three aquatic receptor groups because confidence in the information on the selected measurement endpoints tended to be lower for microorganisms. The degree of correspondence among the risk classifications for the various receptor groups is illustrated in Figures ES-16 to ES-19. These figures also show that correspondence was lower in certain locations, particularly within the more contaminated areas within the estuary (e.g., Clooney Island barge slip, Lockport Marsh).

Upper Calcasieu River AOC – In general, risks to aquatic receptors were low throughout the Upper Calcasieu, as indicated by the average overall risk score of 0.81 that was calculated for this AOC. Of the 155 locations that were sampled within this AOC, 131 (85 percent) were classified as posing a low risk to microorganisms, aquatic plants, benthic invertebrates, and/or fish. Nevertheless, 15 percent (i.e., 24 of 155) of the locations within this AOC were classified as posing indeterminate (5 percent; 7 of 155) or high (11 percent; 17 of 155) risks to aquatic receptors. All of the locations that posed a high risk to aquatic receptors were encountered in the Clooney Island Loop (n=7) or the Coon Island Loop (n=10). The locations that posed the highest risk to aquatic receptors included the Clooney Island barge slip, the northern and north eastern portions of Clooney Island Loop, the northern and central portions of Coon Island Loop, and the mouth of Bayou Verdine (Figure ES-20).

Bayou d'Inde AOC – Risks to aquatic receptors were generally as high within Bayou d'Inde. The average overall risk score that was calculated for this reach was 2.4 (n=

316). Forty-nine percent of the locations sampled within the AOC (i.e., 156 of 316) were classified as posing a high risk to microorganisms, aquatic plants, benthic invertebrates, and/or fish. By comparison, 33 percent (i.e., 104 of 316) and 18 percent (i.e., 56 of 316) of the locations sampled were classified as posing low or indeterminate risks to aquatic receptors, respectively. The locations that posed the highest risk to aquatic receptors (i.e., overall risk score >3) were collected in the lower portion of upper Bayou d'Inde (i.e., between the CitCon facility and the highway LA-108 Bridge), the mainstem and wetland areas within middle Bayou d'Inde, throughout Lockport Marsh, the lower and middle portion of PPG Canal, and lower Bayou d'Inde mainstem in the vicinity of the confluence with PPG Canal and throughout the mainstem (Figure ES-13).

Middle Calcasieu River AOC (aka Lower Calcasieu) – Risks to aquatic receptors were generally classified as low with Lower Calcasieu. An average overall risk score of 0.73 was calculated for this portion of the study area. Based on the results that were obtained for microorganisms, aquatic plants, benthic invertebrates, and/or fish, 87 percent of the locations sampled (i.e., 142 of 163) within this AOC were classified as posing a low risk to aquatic receptors. Nevertheless, 13 percent (i.e., 21 of 163) samples from this AOC were classified as posing indeterminate (4 percent; 6 of 163) or high (9 percent; 15 of 163) risks to aquatic receptors. The samples that posed the highest risk to aquatic receptors were collected along the western shoreline of the middle Calcasieu River in the vicinity of the Citgo property, in Indian Marais Lagoon, Prien Lake and the central portions of Moss Lake (Figures ES-13 and ES-14).

Reference Areas – Risks to aquatic receptors were classified as low for all of the locations sampled within the reference areas. An average overall risk score of 0.55 was calculated for this portion of the study area (Table 13-6). All of the locations sampled were classified as posing low risks to aquatic receptors (Figure ES-15).

Contaminants of Concern – In this the BERA, the COPCs that were considered to be causing or substantially contributing to adverse effects on aquatic receptors were termed COCs. The results of this assessment indicated that there are a number of substances that are adversely affecting microorganisms, aquatic plants, benthic invertebrate and/or fish. In surface water, ammonia, dissolved copper, and total and dissolved nickel are considered to be COCs. In whole sediments, the COCs are considered to include metals (chromium, copper, lead, mercury, nickel, and zinc); 18 individual PAHs; total LMW-PAHs; total HMW-PAHs; total PAHs; total PCBs; aldrin; dieldrin; BEHP; HCB; HCBD; and, TCDD TEQs. The porewater COCs are considered to include hydrogen sulfide, total nickel, total zinc, 1-methlynaphthalene, benz(a)anthracene, and benzo(a)pyrene.

All of these substances occurred in whole-sediment, surface-water, and/or porewater samples from the Calcasieu Estuary at concentrations in excess of those observed in

samples from reference areas and in excess of the selected benchmarks. In addition, the concentrations in the effects distribution (i.e., toxic samples) were generally higher than the concentrations in the no effects distribution (i.e., non-toxic samples) for one or more of the measurement endpoints (e.g., survival of *Ampelisca abdita* in 10-d toxicity tests). This latter evaluation was conducted to assess concordance between the chemistry and biological effects data. Many of these substances or groups of substances also accumulated in the tissues of polychaetes (*Nereis virens*) in 28-d bioaccumulation tests and were shown to be associated with toxicity to amphipods (*Ampelisca abdita)* in toxicity identification evaluations.

ES-13.3 Assessment of Risks to Aquatic-Dependent Wildlife

The risks to five groups of aquatic-dependent wildlife posed by exposure to COPCs in the Calcasieu Estuary were assessed. The receptor groups included sediment probing birds, carnivorous wading birds, piscivorus birds, piscivorus mammals, and omnivorous mammals. For each receptor group, an assessment was conducted to determine if adverse effects are occurring, or are likely to be occurring, in the Calcasieu Estuary. To the extent possible, the nature, severity and areal extent of such effects were evaluated, and the COPCs contributing to such effects were identified (i.e., COCs).

The risks to sediment probing, carnivorous wading, and piscivorus birds from exposure to contaminated aquatic prey were assessed for the Calcasieu Estuary. A conservative, deterministic screening ERA identified AOCs and COCs in the Calcasieu Estuary (Appendix G). The COCs identified in the deterministic assessment for birds included TCDD-TEQs, selenium, mercury, total PCBs, and lead.

The results of the assessment for aquatic-dependent birds indicated that there is a high risk that small hypothetical sediment probing birds will be adversely affected by exposure to selenium in the middle Calcasieu River. The risk of adverse effects are indeterminate for average-sized and small sediment probing, carnivorous wading, and piscivorus birds exposed to lead and TCDD-TEQs in all AOCs and selenium in AOCs other than the middle Calcasieu River. Mercury poses a low risk to average-sized and small sediment probing, carnivorous wading, and piscivorus birds, except for Bayou d'Inde where it poses indeterminate risks to small piscivorus birds. Accordingly, selenium, lead, mercury, and TCDD-TEQs were identified as COCs in the Calcasieu Estuary for aquatic-dependent birds.

The risks to piscivorus and omnivorous mammals from exposure to contaminated aquatic prey were assessed for the Calcasieu Estuary. A conservative, deterministic screening ERA identified AOCs and COCs in the Calcasieu Estuary. The COCs identified in the deterministic assessment for mammals included TCDD-TEQs, selenium, mercury, and PCBs.

The risk characterization results showed that there is a low probability that exposure to methylmercury, TCDD-TEQs, and selenium will cause adverse effects to piscivorus and omnivorous mammals foraging in the Calcasieu Estuary. There is also a low probability of adverse effects to omnivorous mammals exposed to total PCBs. However, there is a high risk that total PCBs are causing adverse effects to average-sized and small piscivorus mammals inhabiting the Bayou d'Inde AOC. Based on the deterministic ecological risk assessment, total PCBs pose low risks to piscivorus mammals in other parts of the estuary. Accordingly, total PCBs were identified as COCs in the Calcasieu Estuary for aquatic-dependent mammals.

ES-13.4 Conclusions of the Ecological Risk Assessment

In accordance with EPA (1997) guidance, the BERA of the Calcasieu Estuary was conducted following an eight-step process. The first two of these steps (i.e., the SERA) was completed in 1999 (CDM 1999). The results of the final six steps of the process are described in the BERA. The HHRA describes the risks to human health associated with exposure to COPCs in the Calcasieu Estuary (CDM 2002b).

The results of this assessment indicated that the presence of COCs in surface water, whole sediments, porewater, and/or the tissues of aquatic organisms pose a risk to ecological receptors. Exposure to contaminated sediment and porewater pose risks to microorganisms, aquatic plants, benthic invertebrates, and/or fish throughout portions of the Calcasieu Estuary. Consumption of contaminated fish and shellfish also poses risks to aquatic dependent wildlife, including sediment-probing birds, carnivorous wading birds, piscivorus birds, omnivorous mammals, and/or piscivorus mammals. Collectively, the information compiled, evaluated, and analyzed to support the BERA provides a weight-of-evidence that clearly demonstrates that the presence of ammonia; hydrogen sulfide; metals (chromium, copper, lead, mercury, nickel, and zinc); PAHs (1,1-biphenyl, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, total LMW-PAHs, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, total HMW-PAHs, and total PAHs); PCBs (total PCBs), chlorinated benzenes (HCB and HCBD); phthalates (BEHP); OC pesticides (aldrin and dieldrin) and PCDDs and, PCDFs (total 2,3,7,8-TCDD TEQs) in environmental media pose unacceptable risks to ecological receptors. The information contained in this BERA and companion documents (i.e., CDM 2001; 2002c) is intended to support decisions regarding the need for remedial actions within the Calcasieu Estuary.

ES-14 Human Health Risk Assessment

This assessment quantifies potential carcinogenic and noncarcinogenic health risks from exposure to contaminants in the Calcasieu Estuary, following the Risk

Assessment Guidance for Superfund (RAGS; EPA 1989a). This assessment evaluates both current and future risks to individuals living and working near the estuary based on the assumption of no remediation or institutional controls (i.e., baseline conditions). The baseline risk estimates, developed using conservative or health protective assumptions, are used to determine which contaminants and exposure pathways pose the greatest risk, and whether remediation is likely to be required, and to provide a baseline against which any future remedial action can be evaluated.

ES-14.1 Overview of Risk Assessment Approach

In the HHRA for the Calcasieu Estuary, contaminants in sediment, surface water, fish tissue, and shellfish tissue were quantitatively evaluated for potential health threats to human receptors via the ingestion and dermal pathways. Recreational users, commercial fishers, and residential fish and shellfish consumers were evaluated under present and potential future land use conditions. The estimates of risk and hazard and the greatest chemical contributors to these estimates are presented and discussed.

COPCs were selected based on screening levels that are presented in the HHRA (CDM 2002b). The chemicals of potential concern included SVOCs, pesticides, PCBs, dioxins/furans, and inorganic analytes. The essential nutrients (i.e., calcium, magnesium, potassium, and sodium) were not quantitatively addressed as their potential toxicity is significantly lower than other inorganics at the site, and most existing toxicological data pertain to dietary intake.

Exposure routes and human receptor groups were identified, and quantitative estimates of the magnitude, frequency, and duration of exposure were made. Exposure points were estimated using the minimum of the 95 percent UCL and the maximum concentration. Chronic daily intakes for the ingestion route were calculated for reasonable maximum exposures.

In the toxicity assessment, current toxicological human health data (i.e., reference doses and slope factors) were obtained from various sources. Risk characterization involved integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. Specifically, chronic daily intakes were compared with concentrations known or suspected to present health risks or hazards. The carcinogenic risks and noncarcinogenic hazard index values calculated for the site are based on the reasonable maximum exposure (RME; the highest exposure reasonably expected to occur at a site). The intent is to estimate a conservative exposure case that is still within the range of possible exposures.

In accordance with NCP Section 300.430 (e)(2) for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-6} and 10^{-4}. Per RAGS

Part B: Development of Risk-Based Preliminary Remediation Goals (EPA 1991c), for noncarcinogenic effects, it is generally appropriate to assume a hazard index equal to 1 as the threshold values for potential human health impacts.

ES-14.2 Summary of Site Risks

The carcinogenic risks and noncarcinogenic hazards for sediment and surface water exposures in the Calcasieu Estuary fell within EPA's target risk range of 10^{-4} to 10^{-6} and below a hazard index of 1. However, the carcinogenic risks and noncarcinogenic hazards for fish and shellfish consumption exceeded EPA's target risk range and hazard index.

Estuary-wide Risk Drivers:

Shellfish Tissue
- PCBs
- Dioxin/Furans
- Arsenic
- Pesticides

Fish Tissue
- Dioxin/Furans
- Arsenic

Total excess lifetime cancer risks from consumption of fish and shellfish from the estuary were above the range of 10^{-6} to 10^{-4}. The cancer risks associated with fish and shellfish ingestion from the areas of Bayou d'Inde, Upper Calcasieu, and Lower Calcasieu were all above 1×10^{-4} (1 in 10,000) for residential exposure and 1×10^{-3} (1 in 1,000) for subsistence exposure. The highest cancer risks were associated with ingestion of fish and shellfish ingestion from Bayou d'Inde. The chemicals that contributed most significantly to risk estimates include PCBs, dioxins/furans, arsenic, and pesticides in shellfish tissue and dioxins/furans and arsenic in fish tissue. Several pesticides, including aldrin, dieldrin, heptachlor epoxide, heptachlor, and BHCs, also contributed to the total cancer risk estimate.

Total excess lifetime cancer risks from ingestion of dioxins/furans in fish and shellfish from Bayou Verdine were also above the range of 10^{-6} to 10^{-4}. The cancer risk estimates were 1×10^{-4} (1 in 10,000) for residential exposure and 6×10^{-4} (6 in 10,000) for subsistence exposure. The estimated risks for residential fish/shellfish consumption were dominated by fish ingestion (1×10^{-4} for fish ingestion, 2×10^{-6} for shellfish ingestion). Similarly, for subsistence fish/shellfish ingestion, the estimated risks were due primarily to fish ingestion (5×10^{-4} for fish ingestion, 7×10^{-5} for shellfish ingestion). Only dioxin/furan concentrations were used to estimate these risks. Risks associated with other chemicals present in fish and shellfish were estimated in ENTRIX (2001) for Bayou Verdine. When the risks associated with dioxin/furan are added to the risks from the ENTRIX report, the total cancer risks for all chemicals in fish/shellfish are 4×10^{-4} for residential consumption and 2×10^{-3} for subsistence consumption.

The total hazard indices for both residential and subsistence fish/shellfish consumption from Bayou d'Inde, Upper Calcasieu, and Lower Calcasieu were all greater than the threshold of one for noncancer effects. These hazard indices indicate

that there is a potential for noncancer health effects to occur from ingestion of fish and shellfish from these AOCs. The chemicals that contributed most significantly to the noncancer hazard index include PCBs and manganese in shellfish tissue and PCBs in fish tissue. PCBs may adversely affect the eyes, skin, and nails of individuals consuming fish and shellfish from the estuary at the rates assumed in this risk assessment. In addition, elevated levels of PCBs may cause immunological and developmental effects. Manganese may impact the nervous system of shellfish consumers.

As in any risk assessment, the estimates of potential health threats (carcinogenic risks and noncarcinogenic health effects) have associated uncertainties. The key uncertainties in this assessment that could influence the risk estimates are the following:

- Chemical concentrations in the estuary are likely to fluctuate and decrease over time. The risk estimates assume long-term (i.e., up to 30 years) exposure to a constant concentration and, therefore, may overestimate risks.

- Some of the risks noted in the assessment were based on limited data (e.g., limited tissue samples for dioxins/furans analysis). Additional data may need to be collected to provide technical support for any cleanup decisions that are based primarily on these chemicals in fish/shellfish tissue.

- For several COPCs, concentrations measured in reference area samples were similar to or higher than concentrations measured in the Calcasieu Estuary. Cancer risks estimated for dioxins/furans in reference area biota represent 5 to 44 percent of the risks estimated for dioxins/furans in the estuary, depending on the AOC. Cancer risks estimated for arsenic in reference area biota were higher than those estimated for the estuary.

- There is some uncertainty in the toxicity value for dioxin/furans. EPA has proposed a cancer slope factor for dioxins/furans that is seven times higher than the value applied here to 2,3,7,8-TCDD equivalents. Risks associated with these chemicals could be almost an order of magnitude higher.

As a result of these uncertainties, this risk assessment should not be construed as presenting absolute risks or hazards. Rather, it is a conservative analysis intended to indicate the potential for adverse impacts to occur based on a reasonable maximum exposure.

ES-15 Comprehensive Summary of the RI

Industrial development, including chemical manufacturing and distribution, and petroleum refining has been prevalent in the Lake Charles area since the early 1920s

and has impacted the estuary through the release of hazardous chemicals. Additionally, facility discharges, urban and agricultural activities, dredging, storm water runoff, and accidental releases have contributed to contaminated surface water and groundwater in and around the industrial areas. These same activities also have resulted in contaminated sediments within the various surface waters in the estuary. Further, fish and shellfish within the estuary have been impacted by industrial contaminants, prompting the State of Louisiana to issue health advisories related to the consumption of fish and shellfish in the Calcasieu Estuary (LDEQ 1999 and Louisiana Department of Health and Hospitals [LDHH] 2000).

Localized hot spots occur throughout the study area and are the result of historical spills, releases, and/or current activities attributed primarily to industries surrounding the Calcasieu Estuary. The RI summary has attempted to narrow the original study area, which started at the saltwater barrier and extended south to Moss Lake to more focused Areas of Interest (AOIs). The AOI are based on the frequency of detects and the elevated concentration of COPCs and the result of the PCA as discussed in Sections 7 through 10.

ES-15.1 Summary of AOIs Using 95 Percent UCL Exceedences

Exhibit ES-6, (located at the end of this section) summarizes the most significant AOIs by geographic location in the estuary, followed by COPC concentration compared to estuary-wide data population 95 percent UCL concentration, a general sediment stability ranking, potential contaminant sources to the study area, and a ranking of ecological risk (from the BERA) posed by sediment to the benthic invertebrate community. Human health risks are of equal importance. With PCBs and dioxin/furans in fish and shellfish being the primary drivers of risk to humans, any AOI with these associated COPCs contributes to total site risk.

Use of the 95 percent UCL is a standard statistical approach to identify the maximum values in a population. The data from all of the AOCs and individual energy systems were combined to generate the estuary-wide population statistics provided in Appendix J. The 95precent UCL was used to provide a collective summary of the entire study area, AOC boundaries notwithstanding. The statistical output is provided for all compounds, summation data is provided for total HPAHs, total LPAHs, and 2,3,7,8-TCDD TEQ.

This summary organic data are shown graphically on Figure ES-21. Inorganic data are shown on Figure ES-22. These figures and Exhibit ES-6 present the data points where the 95 percent UCL was exceeded for the select group of compounds. They illustrate the areas impacted by the highest concentrations measured in the estuary (i.e., the areas of highest risk to human and ecological receptors). They show correlation to physical conditions that influence contaminant occurrence and transport with the

estuary as a whole. The COPC list presented is based on those compounds that are most prevalent, most concentrated and/or are a concern from human health and ecological risk perspectives.

It is important to note that the AOIs described below are not the only areas in the Calcasieu Estuary that warrant consideration under the CERCLA process, but they are the locations where the most significant risk reduction could be accomplished. The graphical presentation is not based on clean-up standards (site-specific standards have not been established in this report), but on standard statistical approaches to enable stakeholders and risk managers to evaluate the status of the study area as a whole. The following paragraphs discuss each AOI presented in Exhibit ES-6.

Clooney Island Loop West Slip
The Clooney Island Loop West Slip area sediments are impacted by PAHs (high [HPAHs] and low [LPAHs] molecular weight), BEHP, mercury, zinc, and Aroclor-1254. Each of these compounds exceeds the estuary-wide population 95 percent UCL. The highest concentrations are located in the West Slip area at UCR2028, and UCR2026 at the Conoco Dock. This AOI has also been identified as a high risk to benthic invertebrate and fish (CDM 2002c). Overall, sediment stability tends to be moderate, however, there is potential for the sediments to mobilize, particularly under heavy storm conditions. The sources of contaminants within this AOI are primarily attributed to Lyondell/Olin and Conoco. Conoco, through transport, is potentially responsible for PAHs in the northern Clooney Island Loop area. Elevated concentrations appear to be associated with current and historical outfall discharge, uncontrolled releases, as well as various non-point source releases associated with industrial operations.

Coon Island Loop (PPG North Dock Area and western portion of the Loop)
Various PAHs, BEHP, metals, and PCBs were noted in the upper Coon Island Loop area near the confluence of Bayou Verdine and the Coon Island Loop turning basin. Lateral distribution extends approximately 1200 m downstream along the western Coon Island Loop from the mouth of Bayou Verdine. A metal that exceeds the 95 percent UCL is lead, which is detected mid-way through the loop to station UCR 1-13-SD; however, it is also a background metal.

Potential sources are the distribution, storage, and transportation of products and associated wastes generated locally by PPG. Releases through the PPG outfalls 002 through 004 and the North Dock area are documented and may have contributed to current sediment quality, as well as impacted flow from Bayou Verdine. Additionally, oil field activities on on the Olin Chemical owned Coon Island may be a potential source of PAHs and lead.

The BERA (CDM 2002c) indicates this is a high-risk area for benthic invertebrates and fish. The HHRA also indicates high risk from PCB and dioxin/furans, which exist in this area.

Overall, sediment stability in this region of Coon Island Loop appears to be moderate with a potential to remobilize. Sediment migration would be drawn to the deeper ship channel and shallow lake areas, particularly under heavy storm conditions.

Bayou Verdine Reach 1
The primary contaminants in the lower portion of Bayou Verdine include HPAHs, BEHP, PCBs, dioxin/furans, and metals. Contaminant extent is concentrated around I-10 and PPG outfall 004 located upstream of the North Dock area. Reach 1 has historically received discharge from multiple industrial outfalls. It may also be impacted by releases associated with the KCSRR drainage ditch and/or runoff from I-10. Release from these process areas mix with the saline waters of Bayou Verdine contaminants noted in overlapping areas. PAH distribution appears to be due primarily to "salting-out". The PAH concentrations tend to indicate that localized areas with higher concentrations are present along Reach 1. The NPDES compliance data does not indicate significant release to these areas; therefore, the drainage ditches and upstream impacts (i.e., Condea Vista, Conoco, Tetra Technologies, Lyondell) are the suspected sources of COPCs this area. Reach 1 sediments contamination may be related to industrial spills, released through impacted subsurface soil or other media discharge.

Sediment stability in Reach 1 of Bayou Verdine is susceptible to tidal surge or storm scouring. While multiple sources exist, the broad distribution along the length of Reach 1 is indicative of contaminant transport and sediment movement. Based on this assumption, the sediment stability for this portion of Bayou Verdine is considered low. In addition, ecological risk evaluations conducted for Conoco (Entrix 2001) indicate that this area is a high-risk area for benthic invertebrates and fish. Existing PCBs and dioxin/furans are attributable to unacceptable risk to humans via fish/shellfish consumption (CDM 2002b).

Bayou Verdine Reach 2
The contaminants that exceed the 95 percent UCL in Reach 2 of Bayou Verdine include LPAHs, EDC, and zinc. PCBs and PAHs were detected in previous studies and in the RI throughout Reach 2; however, the concentrations do not exceed the 95 percent UCL. The data indicates that most contaminant concentrations are higher in shallow surface sediments, indicative of recent deposition. Reach 2 has received discharge from multiple industrial outfalls (i.e., CONDEA Vista and Conoco). Surface run-off from industrial ditches and the distribution of contaminants indicate that the in-flow alters distribution locally. Release may also be impacted in lower Reach 2 by release associated with the KCSRR drainage ditch and/or runoff from I-10.

Tidal surge or high freshwater inflows tend to facilitate sediment transport in Reach 2. Based on this transport mechanism and shallow sediment concentrations, the sediment stability within this area is moderate. In addition, ecological risk evaluations conducted for Conoco (Entrix 2001) indicate that this area is a high-risk area for benthic invertebrates and fish.

Bayou Verdine Reach 3

The primary contaminants that exceed the 95 percent UCL in Reach 3 of Bayou Verdine are PAHs, PCBs, zinc, and VOCs (EDC). LPAHs in Reach 3 tend to be more concentrated than other areas throughout the estuary. Vertically, the concentrations of PAHs consisting of LPAHs and HPAHs tend to be highest in the subsurface in Reach 3. Sediment transport is evidenced by the broad distribution of PAHs from New Trousdale Road downstream in Reach 3. Primary contaminant sources to Reach 3 appear to be the Conoco Lube Tank Farm and CONDEA Vista via the Vista West Ditch. While multiple sources exist, the broad distribution along the length of the bayou is indicative of moderate contaminant transport and sediment movement. Potential sources include CONDEA Vista and Conoco.

Bayou d'Inde - Lockport Marsh

The primary contaminants that exceed the 95 percent UCL in Lockport Marsh include dioxin/furans, PCBs, BEHP, HPAHs, LPAHs, copper, mercury, lead, and zinc. The potentially responsible industries discharging these contaminants include PPG, and the oil and gas industry. The areas with significant contamination are generally within the upper, bermed portion of Lockport Marsh. The distribution of most contaminants throughout Lockport Marsh indicate a similar pattern. Mercury and BEHP distribution in Lockport Marsh varies.

The BERA (CDM 2002c) identifies areas throughout Lockport Marsh as high-risk to benthic invertebrates and fish. The presence of elevated PCBs and dioxin/furans suggest unacceptable contribution to human health risk (CDM 2002b).

Sediment stability is poor in the lower portion of the area, outside of the levees. Circulation through the area can be substantial and contaminant distribution indicates that impacted sediments have been transported out of the area. Overall, Lockport Marsh is not considered a significant sink for contaminated sediments exported by upper reaches. The upper portions of Lockport Marsh appear to receive contaminant input from PPG Canal and sediment stability in these areas is moderate. Protection by the levees however, would be compromised by high storm surges or flooding. Release to Lockport Marsh appears to be primarily from waste storage or discharge activities.

Bayou d'Inde Reach 1
Reach 1 was the Bayou d'Inde area with the greatest number of detections and the highest COPC concentrations. Reach 1 contaminants that exceed the 95 percent UCL include dioxin/furans, PCBs, BEHP, mercury, lead, and zinc. The HPAHs, LPAHs, HCB, and HCBD concentrations are also elevated, however, they are not shown on Figure 15-1. The contaminant concentrations and distribution in this reach warrant further evaluation.

The major potential source of contaminants within Reach 1 is PPG. Reach 1 also appears to receive minor amounts of impacted sediment (primarily BEHP and possibly Aroclor-1254) from upper reaches. Reach 1 may, under specific flow conditions, act as a sink for contaminated sediments exported by upper reaches. The primary contaminant source to Reach 1 is the PPG Canal. Sediment stability in Reach 1 is generally considered low and storm surges or wind forcing would likely mobilize sediments.

The BERA (CDM 2002c) identified areas throughout Reach 1 as high-risk to benthic invertebrate and fish. The presence of elevated PCBs and dioxin/furans suggest unacceptable contribution to human health risk (CDM 2002b).

Bayou d'Inde Reach 2 Bayou and Marshes
The Reach 2 COPCs that exceed the 95 percent UCL include metals, PCBs, and dioxin/furans. The contaminant concentrations of metals are highest for copper, chromium, mercury, lead, and zinc. Reach 2 marshes tend to exhibit the highest concentrations for metals, dioxin/furans, and most HPAHs. Lead and zinc do not exceed the 95 percent UCL for the marshes; however, they are present in Reach 2 of the bayou at elevated concentrations.

Similarly, the HPAH compound 1,2-BPA is absent from Reach 2 marshes even though 1,2-BPA is present in the bayou, possibly indicating rapid chemical precipitation when it was released. Potential sources of contaminants within Reach 2 include Citgo, Westlake Polymers, Equistar, and PPG. Reach 2 appears to receive impacted sediment from Reach 3 industrial releases. Reach 2 bayou is a net sediment exporter and its marshes act as sinks for contaminated sediments exported by Reaches 2 and 3. Evidence of flow both up and down stream is noted for Reach 2, specifically from contaminant gradient and compound presence.

Sediment stability in Reach 2 is low to moderate as supported by contaminant distribution. Sediments may be mobilized by storm surges or wind forcing throughout lower Reach 2.

The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrate and fish. The presence of elevated PCBs and dioxin/furans suggest unacceptable contribution to human health risk (CDM 2002b).

Bayou d'Inde Reach 3
Reach 3 contained a limited number of COPCs that exceed the 95 percent UCL, specifically PCBs, copper, zinc, and lead. However, concentrations of PAHs, BEHP, mercury, and dioxin/furans in Reach 3 tend to be the second highest of all detections observed in Bayou d'Inde. Two areas of possible contaminant sources are observed; the area between the uppermost Cit-Con outfall and the Firestone outfall, and the area between OxyChem outfall 001 and Westlake outfall 002B near the LA-108 Bridge.

Reach 3 is a net sediment exporter. Reach 2 marshes appear to receive contaminated sediments exported by Reach 3. Sediment stability in Reach 2 is low to moderate as supported by contaminant distribution, and is likely mobilized by barge traffic near the docks at LA-108. Further, it appears likely that the shallow depth of Reach 3 makes the area susceptible to turbulence driven mixing due to strong winds or tidal forces.

The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrates and fish. The occurrence of PCBs and dioxins/furans supports unacceptable risk identified in the HHRA (CDM 2002b).

Maple Fork Bayou
Contaminants that exceed the 95 percent UCL in Maple Fork Bayou include Aroclor-1254, chromium, and zinc. Mercury and dioxin/furans are also present at elevated levels. No major contaminant sources are known to exist for Maple Fork Bayou. Anthropogenic releases from the railroad and industrial pipelines that cross Maple Fork Bayou appear to be a possible contaminant source. Contaminant concentrations indicate local release within the bayou.

Maple Fork Bayou appears to be a net sediment exporter. Sediment stability in Maple Fork Bayou is moderate given the limited temporal data available to evaluate the contaminant entry into Maple Fork Bayou. Storm surge or wind forcing may mobilize sediments.

The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrates and fish.

Indian Marais Lagoon
The primary contaminants in Indian Marais Lagoon that exceed the 95 percent UCL include PAHs (HPAH and LPAH), PCBs, lead and zinc. Vertical core data indicate that sediment scouring has occurred in Indian Marais Lagoon.

The leading potential source of contaminants appears to be the former waste handling activities in the Indian Marais Lagoon. Overall, sediment stability appears to be low to moderate. Current conditions have led to sediment accumulation, however, historically the site has been susceptible to storm scouring. It appears that material

moves out of the lagoon into the ship channel during periods of high flow or heavy rainfall.

The BERA (CDM 2002c) has indicated that Indian Marais Lagoon is a high risk area for benthic invertebrate and fish.

Clooney Island Loop East
Sources of contaminants within this area potentially include Lyondell/Olin and Conoco. However the highest concentrations do not exceed the 95 percent UCL. Low-level contaminants include BEHP, dioxin/furans, copper, and Aroclor-1254. This distribution appears to be due to the physical transport and settling of adsorbed particulate matter. Overall, sediment stability tends to be moderate. It appears that re-suspension of fine grained material facilitates physical transport throughout the Clooney Island Loop. Concentrations appear to be associated with release from current and historical outfalls as well as various non-point source releases associated with these operations.

Coon Island Loop East
The primary contaminants in the eastern Coon Island Loop shallow lake include chromium, lead, and copper. It should be noted that significant HPAH concentrations are detected at the mouth of Bayou Verdine adjacent to this area. However, distribution gradients indicate salting-out of these PAHs as they enter Coon Island Loop. Lateral extent of PAHs is limited as distance increases from the mouth of Bayou Verdine. The extent of elevated metals within this area is greater than PAHs. The highest lead and chromium concentrations are detected mid-way through the loop to station UCR 1-23-SD. The source of these contaminants is not fully understood, Overall, sediment stability is moderate, however, there is potential for the sediments to mobilize, particularly under heavy storm conditions. The data suggest that particle deposition and secondary re-mobilization may occur, which tends to move sorbed metals laterally.

The BERA (CDM 2002c) indicates this is a high-risk area for benthic invertebrates and fish.

ES-15.2 Conclusions

Calcasieu Estuary represents a mixture of land uses and energy systems. It is a complex system consisting of numerous perennial wetland bayous and tributaries in a heavy industrial setting. Development along the banks of the estuary has resulted in point and non-point discharge to the system that has detrimentally impacted sediments and surface water to a point where sediments pose an unacceptable risk in a number of areas to ecological and human receptors.

The figures in this section illustrate the primary areas impacted by the highest concentrations. They show correlation to physical conditions that influence contaminant occurrence and transport with the estuary as a whole. The summary is based on those compounds that are most prevalent; most concentrated and/or are a concern from a human health or ecological risk perspective.

The estuary is worth improving and protecting through, at a minimum, implementation of short term and long term management practices. Remedial measures are believed to be warranted in some areas (e.g., Lockport Marsh, Bayou d'Inde, and the Olin West Slip). Active remedial strategies in selected areas would likely catalyze sustainability of the estuary. Further, active remedial strategies may be mutually beneficial; e.g., removal of elevated COPCs for risk minimization and channel improvement for flood control and improved navigation. In addition to diverse habitat and fauna and flora, the estuary supports a number of recreational activities and commercial operations that without environmental diligence will suffer in the short and long term.

Exhibit ES-6 Areas of Interest and Chemicals of Concern for the Calcasieu Estuary - Conclusions

Areas of Interest	PAHs	SVOCs[1]	VOCs	Metals[2]	PCBs	2,3,7,8-TCDD TEQ	Sediment Stability	Potential Sources	Human Health Risk Subsistence/Residential	BERA RISK
Upper Calcasieu										
▪ Clooney Island West Slip	A	A	B	A (Hg, Zn)	A	B	2	Lyondell/Olin, Conoco	High/Indeterminate	High
▪ Clooney Island Loop (East)	C	B	B	B	B	B	2	Conoco, Lyondell		High
▪ Coon Island Loop (East, shallow lake)	B	B	B	A (Cr, Pb); C (Cu)	B	B	2	PPG, Conoco, CONDEA Vista, Oil field Activities		High
▪ Coon Island Loop (PPG North Dock Area and west loop)	A	A	B	A (Pb); C (Cu)	A	C	1	PPG, Conoco, CONDEA Vista, Oil field Activities		High
Bayou Verdine										
▪ Reach 1	A	A	B	A (Zn)	B	B	1	Conoco, CONDEA Vista	High/Indeterminate	High[3]
▪ Reach 2	C	B	A	A (Zn)	B	B	2	Conoco, CONDEA Vista		High[3]
▪ Reach 3	A	B	A	A (Zn)	B	B	1	Conoco, CONDEA Vista		High[3]
Bayou d'Inde	A	A	B	A (Cu, Hg, Pb, Zn)	A	A	1	PPG, Oil Field Activities	High/High	High
▪ Lockport Marsh	C	A	B		A	A	1	PPG		High
▪ Reach 1	B	B	B	A (Hg, Pb, Zn)	A	A	2	Citgo, Equistar, Westlake Polymers		High
▪ Reach 2	C	C	B	A (Cu, Cr, Hg, Pb, Zn)	A	C	2	Citgo, Equistar, Westlake Polymers		High
▪ Reach 3	C	B	B	A (Cu, Zn)	A	C	2	Unknown (incl. Railroad activities, interstate runoff, industrial pipelines)		High
▪ Maple Fork Bayou	C	A	B	A (Cr, Zn)	A	A	3	Citgo, Equistar, Westlake Polymers, PPG		High
▪ Reach 2 Marshes				A (Cr, Cu, Hg)						
Lower Calcasieu										
▪ Indian Marais Lagoon	A	B	B	A (Pb, Zn)	A	B	1	Citgo	High/Indeterminate	High

Concentration Level Classes and Footnotes

A = Area Mean Exceeds the Estuary-wide 95 percent UCL

B = Area Mean does not exceed the Estuary-wide 95 percent UCL

C = Area Mean does not exceed the Estuary-wide 95 percent UCL but area remains AOI due to distribution or compound nature.

[1] - BEHP

[2] - Cr, Cu, Hg, Pb, Zn

[3] - Ecologic Risk for Bayou Verdine performed by Entrix, Inc., 2001 for Conoco

Stability

1 – High potential to re-mobilize

2 – Moderate potential to re-mobilize

3 – Low potential to re-mobilize

BERA (CDM 2002a)

Low Risk = Low

Indeterminate Risk = Ind.

High Risk = High

HHRA (CDM 2002b)

Low risk = excess risk > 1X 10^{-6}

Indeterminate risk = 1 X 10^{-4} to 1 X 10^{-6}

High risk = <1 X 10^{-4}

Exhibit ES-6
Areas of Interest and Chemicals of Concern for the Calcasieu Estuary - Conclusions

Section 1
Introduction

This document is the remedial investigation (RI) portion of an RI/feasibility study (FS) that was conducted for the Calcasieu Estuary in Calcasieu Parish, Louisiana. The Calcasieu Estuary is located in the southwestern corner of Louisiana, predominately in Township 10 South, Range 9 West (Figure 1-1). The study area covers approximately 50 square kilometers (km^2), extending from the saltwater barrier located north of Lake Charles to Moss Lake, and is situated north of the intersection of the Calcasieu River Ship Channel with the Intracoastal Waterway (ICW). The City of Lake Charles, Louisiana (LA) is located within the study area, as well as several other smaller neighboring cities. The estuary is created by saltwater migrating north from the Gulf of Mexico via the Calcasieu River and freshwater draining toward the Gulf from numerous inland rivers, bayous, and lakes. The estuary supports a diverse aquatic ecosystem, which is surrounded by a typical industrialized city.

The RI/FS process has been initiated for the Calcasieu Estuary by the U.S. Environmental Protection Agency (EPA) Region VI under EPA's Region VIII Response Action Contract (RAC) No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. EPA is addressing threats to human health and the environment related to uncontrolled releases of organic and inorganic chemicals to the estuary under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). It is important to note, however, that the Calcasieu Estuary is not a Superfund site by virtue of listing on the National Priorities List (NPL). Instead, CERCLA provisions allow for sites to progress through, but not beyond, the RI/FS process without a Hazard Ranking System (HRS) score. RI Phase I sampling and analysis was conducted between December 1999 and March 2000, and RI Phase II sampling and analysis, described in detail in Section 4, was conducted between November 2000 and January 2001.

Industrial development, including chemical manufacturing and distribution, and petroleum refining has been prevalent in the Lake Charles area since the early 1920s and has impacted the estuary through the release of hazardous chemicals (Curry et al. 1997). Facility discharges, urban and agricultural activities, dredging, stormwater runoff, and accidental releases have contributed to contaminated groundwater and surface water in and around the industrial areas. These same activities also have resulted in contaminated sediments within the various surface waters in the estuary. Further, fish and shellfish within the estuary have been impacted by industrial contaminants, prompting the State of Louisiana to issue health advisories for the Calcasieu Estuary (Louisiana Department of Environmental Quality [LDEQ] 1999 and Louisiana Department of Health and Hospitals [LDHH] 2000). These health advisories inform people of the activities (e.g., swimming, boating, fishing, and wading) that may be unsafe for a certain water body. The advisories also inform

people of certain types of fish or shellfish from that water body that may not be safe to eat or consume in large quantities.

1.1 Purpose of the Remedial Investigation

The purpose of the RI is to gather sufficient information to define the nature and extent of chemical contamination in sediment, surface water, and biota within the Calcasieu Estuary and to support ecological and human risk assessments. The RI was conducted in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). Data generated in conjunction with the RI will also be used to support the FS and the design and implementation of any remedial actions within the Calcasieu Estuary. The RI was conducted in two phases of investigation. The specific objectives of Phases I and II of the RI include:

Phase I

- Use historical data to identify contaminants of potential concern (COPCs) and develop the analytical protocol to evaluate the nature and extent of contamination in the estuary
- Conduct a statistically-based sampling program for sediment and surface water across the estuary that will support RI and FS reporting and human health and ecological risk assessments
- Use Phase I data to identify specific areas of varying degrees of contamination for evaluating contaminant gradients (if present) during Phase II

Phase II

- Conduct focused sampling of sediment and surface water to minimize Phase I data deficiencies (e.g., elevated reporting limits)
- Evaluate contaminant gradients in sediment
- Collect sediment and surface water samples to characterize selected sources of organic and inorganic COPCs to the estuary
- Collect biota samples to characterize potential impacts to selected groups of fauna within the estuary
- Collect sediment, surface water, and biota samples to characterize localized reference areas that are outside the industrial impacts of the study area
- Assess risk to human health using reasonable maximum exposure and central tendency exposure calculations for residential, commercial/industrial worker, and recreational user populations

- Assess risk to ecological receptors using hazard quotients, sediment quality triad data, and food chain modeling

1.2 Regulatory Framework

On November 7, 1997, EPA, LDEQ, National Oceanic and Atmospheric Administration (NOAA), and the Department of the Interior (DOI) met with nine industries, later to be known as the Calcasieu Estuary Environmental Action Group (CEEAG), to discuss a potential cooperative agreement where industry would commit to performing an RI/FS for the estuary and funding EPA and LDEQ RI/FS oversight costs and community involvement activities. The CEEAG agreed and documented their commitment in a November 14, 1997 letter to EPA. The commitments by industry included: (1) providing oversight costs to EPA, LDEQ, and all natural resource trustees; (2) providing costs for community outreach; (3) signing a tolling/standstill agreement with NOAA and DOI; and (4) entering into a cooperative investigation/remedial process using an EPA enforceable agreement (consent decree or administrative order of consent). The CEEAG asked that a detailed, negotiated statement of work (SOW) be attached to this enforceable agreement. They further requested that all natural resource damage assessment (NRDA) claims and NPL scoring/listing of the Calcasieu Estuary be halted during this period of negotiations.

By January 1999, the CEEAG membership that began with nine industries had been reduced to three and no agreement between EPA and industry potentially responsible parties (PRPs) was in place. Therefore, EPA decided, in the interest of the public health, welfare, and the environment, to implement a government-lead RI/FS under CERCLA.

CERCLA provides the federal government with authority to develop long-term solutions for those sites that pose unacceptable levels of risk to human and ecological receptors and to arrange for the restoration of damaged natural resources then determine who is liable for the cost of the actions through cost recovery. The RI/FS process under CERCLA for the Calcasieu Estuary includes:

- **RI**: The RI serves as the mechanism for collecting data to characterize site conditions, determine the nature and extent of environmental impacts, and assess associated risk to human health and the environment.

- **FS:** The FS is the mechanism for the development, screening, and detailed analysis of remedial alternatives.

In addition to EPA's use of the data to promote cleanup, NOAA trustees will use the RI data to conduct an NRDA. The NRDA enables natural resource trustees to focus on significant environmental injuries, plan and implement efficient and effective restoration of the injured natural resources, and encourage public and responsible party involvement in the restoration process.

The NRDA process is divided into three phases:

- **Preassessment:** The trustees evaluate injury and determine whether they have the authority to pursue restoration and if it is appropriate to do so.
- **Restoration Planning**: The trustees evaluate and quantify potential injuries and use that information to determine the appropriate type and scale of restoration actions.
- **Restoration Implementation**: The trustees and/or responsible parties implement restoration, including monitoring and corrective actions.

1.3 Site History

Industrial development dominates much land within and around the Calcasieu Estuary. This development dates back to the late 1800s and is directly related to improvements of the Calcasieu River and the Calcasieu River Ship Channel. Initially, Calcasieu Lake had a single major freshwater inflow at the north and a single outflow to the Gulf of Mexico at the Calcasieu Pass. The Calcasieu River had a natural channel that meandered through Calcasieu Lake with a maximum depth of 4 meters (DeRouen and Stevenson 1987). A shallow bar, about 1 meter below the water surface at Calcasieu Pass, effectively prevented saltwater intrusion into the Calcasieu River/Lake Complex (DeRouen and Stevenson 1987). This barrier was removed in 1871 to allow ship traffic to Lake Charles. The first record of commercial navigation on the river of any consequence is for the period following the Civil War (Shutts 1946). The early inhabitants of Lake Charles used schooners and other vessels to navigate the Calcasieu River as a path of commerce to obtain merchandise, deliver lumber, and float timber (Kaufman 1948). Soon after the Civil War, Lake Charles officially became a port when the Calcasieu pass was made a port of entry by an act of Congress, and a customs office was established at Cameron (Shutts 1958) (Figure 1-1). Just before 1900, the Calcasieu Pass was improved and jetties were constructed, thus, opening the river to larger schooner traffic carrying lumber from numerous sawmills in this area to Mexico, the east coast of the United States, and continental Europe (Shutts 1946).

Chemical manufacturing and petroleum refining companies first appeared in the Calcasieu Parish vicinity during the early 1920s, with the discovery of nearby petroleum and natural gas reserves. Access to water transportation provided further incentive for industrial development. To retain industrial strength, the people of Lake Charles wanted a seaport. In 1921, after being denied federal funding, the people of Lake Charles decided to build a ship channel and port facilities with their own money (Shutts 1946). By 1926, Calcasieu Parish was served by the Port of Lake Charles with two outlets to the Gulf: (1) the Calcasieu River Ship Channel to the intersection with Intracoastal Canal to the Sabine River and thence to sea through Port Arthur, Texas and (2) the new Calcasieu Channel crossing Calcasieu Lake. As the business of the Port doubled, the War Department officially took over maintenance of the ship channel in 1928.

In 1934, a formal request was made to Congress to construct (i.e., improve) a direct channel approximately 56 km south from Lake Charles to Calcasieu Pass. In 1937, the approval of the engineer board of the Chief of Engineers and the River and Harbors Committees of Congress was secured. Work was started in 1938. The ship channel from Lake Charles to the Gulf of Mexico was to have a depth of 10 meters (m), a width of 75 m, and a turning basin 150 m wide and 605 m long at Lake Charles. The estimated cost of ship channel construction was $96,600,000 (Manufacturers' Record 1940).

In addition, the onset of World War II was a catalyst for further industrial development in the Calcasieu Estuary. Abundant raw materials, like crude oil and natural gas, coupled with acreage, water resources for manufacturing, and a commercially navigable access artery for ships and barges led to rapid industrial development. Among the facilities whose growth was driven largely by wartime demand are the Conoco refinery, completed in 1941, the Firestone synthetic rubber plant, which began production in 1943, and the Cities Service refinery (now Citgo), brought on line in 1944.

Economic prosperity in the postwar years continued to spur growth in manufacturing, leading several to choose the Lake Charles industrial corridor for their facilities. Among those was the caustic soda and chlorine plant opened in 1947 by the Columbia-Southern Company, a subsidiary of Pittsburgh Plate Glass Company (now PPG Industries [PPG]). PPG still owns and operates the much-expanded plant. Another example of the area's immediate postwar industrial development was Cit-Con Oil Company (1949), a lubricants and wax plant built and operated jointly by Cities Service Company and Conoco.

Industrial development in the area has been steady since those postwar years. The Davison Chemical Company catalyst plant (now Grace Davison) opened in 1953, as well as the 1959 completion of the Gulf States Utilities Nelson Power Station (now owned and operated by Entergy, Inc.).

In 1961, the Hercules polyolefins plant (now Montell, Inc.) began operation, followed also in 1961 by the formation of Conoco Chemicals (changed to Vista in 1984, now known as Sasol North American Inc. (Sasol), which took over in 1984 as owner and operator of the Conoco complex chemical manufacturing facility. Air Liquide began operations on the estuary in 1963 as Lincoln Big Three. Reynolds Metals opened their local facility in 1969.

In the mid-1970s, several companies started up operations in Lake Charles. Jupiter Chemicals opened its doors in 1975, followed closely that same year by Tetra, Certain-Teed, and SRI (now Chemical Waste Management). The Gulf Oil Company calcined coke plant, now Venco, opened in 1978.

Recent years brought additional changes to the Lake Charles industrial landscape. Trunkline LNG opened its facility in 1981. In 1984, the Cities Service Company was

bought out by Occidental Petroleum. This venture ultimately resulted in the operation of the OxyChem facility in Lake Charles, which was later transformed into a joint venture with Lyondell Chemical Company and Millennium Chemicals, called Equistar Chemical, LP. The Westlake Group also began local operations after purchasing, from OxyChem, the original Cities Service polymer plant in 1986. Major expansions followed for the Westlake Group, including the commissioning of the polyethylene plant in 1988 and the petrochemicals plant in 1989.

The 1990s have seen expansion or transfer of many of the larger industrial facilities already in operation. Specifically, Louisiana Pigment (1992) and BioLab (1994) began operations in the area. BioLab occupies part of the original Olin/Lyondell Chemical facility. The region's industrial base has continued to grow, and today the Calcasieu Estuary supports more than 10 major petroleum refining and chemical manufacturing operations, producing a wide range of industrial chemicals, petroleum products, and commercial feedstock. In addition, the waterways of the estuary continue to support recreational activities, commercial fishing, materials transport, and a diverse ecosystem.

1.4 Previous Investigations/Site Reference Documents

A number of environmental investigations have been performed throughout the Calcasieu Estuary since the late-1980s. Numerous reference documents have been cited in the development of this RI report. The reports are publicly available through LDEQ or EPA Region 6. A brief overview of the scope and findings is presented below.

More detailed information on these reports, including a summary of the scope of the investigation, analytical protocols and detections, as well as figures showing the sample locations for each study is provided in Appendix A.

Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report, Prepared by McNeese State University for the Louisiana Department of Wildlife and Fisheries, June 1987.

The Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO) study was prepared for the Louisiana Department of Wildlife and Fisheries. The purpose of the study was to evaluate the effects of human activities on the local ecology. The study involved surveying in the Calcasieu Estuary, from the saltwater barrier to the mouth of the Calcasieu River (near Cameron at Monkey Island).

The study concluded that the influence from the urban environment was significant in Contraband Bayou and Bayou d'Inde, with the latter bayou showing greater alterations to water quality compared to other water systems throughout the Calcasieu Estuary.

Calcasieu Estuary Water Sampling Program, Louisiana Department of Environmental Quality, 1987-1996.

LDEQ has measured ambient water conditions in the Calcasieu Estuary on a monthly basis since 1987. LDEQ collects water samples from the saltwater barrier near Lake Charles to the southern end of Calcasieu Lake and includes Bayou d'Inde, Prien Lake, and portions of the Calcasieu River and ship channel. These samples were analyzed for volatile organic compounds (VOCs) and conventional parameters such as dissolved oxygen and salinity. LDEQ did not analyze the data for Semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), or inorganic compounds.

Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency-Region VI, Louisiana Department of Environmental Quality and U.S. Geological Survey, March 1990.

The Toxics Study of the Lower Calcasieu River summarizes the results of a toxics study conducted by EPA Region VI, LDEQ, and the U. S. Geological Survey (USGS). The study area included the Lower Calcasieu River, Bayou d'Inde, Bayou Verdine, Prien Lake, Lake Charles, Moss Lake, and Calcasieu Lake. Samples were collected in June and July of 1988 and April 1989. The report concluded that a variety of organic and inorganic constituents exist in the various media, which resulted in high mortality rates of benthic species within the estuary.

Bayou d'Inde Expanded Site Inspection - Final Report, Prepared by PRC Environmental Management, Inc. (PRC) for the U.S. Environmental Protection Agency-Region VI, September 1993.

The Bayou d'Inde Expanded Site Inspection was prepared for EPA as part of the CERCLA Hazard Ranking System screening process. The objectives of this study were to document contamination in Bayou d'Inde and to build on previously collected data by further defining site waste characteristics, contaminant sources, and exposure pathways. Samples were collected in November and December 1992.

Samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and inorganic elements. Numerous inorganic and organic contaminants were documented in Bayou d'Inde, specifically concentrated from the industrial areas to its confluence with the Calcasieu River. Similar contaminants were also documented in the PPG Canal.

Site Inspection for Bayou Verdine, Prepared by PRC Environmental Management, Inc. for the U.S. Environmental Protection Agency - Region VI, May 1994.

The Site Inspection for Bayou Verdine was focused on areas of elevated contaminant concentrations. The study objective was to document the presence of hazardous substances in surface water and sediments from PPG's North Dock (the northern section of Coon Island Loop) and Bayou Verdine. Samples were collected from 27

stations in July 1993. Sediments were analyzed for VOCs, SVOCs, PCBs, pesticides, and inorganic compounds.

The primary COPCs identified were benzo(a)pyrene; dibenz(a,h)anthracene; 1,2-dichloroethane; 1,1,2-trichloroethane; vinyl chloride; benzene; chromium; lead; and mercury.

Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River, Prepared by McLaren/Hart Environmental Engineering - ChemRisk Division for PPG Industries, Inc., 1994.

The study characterized the nature and extent of chemical contamination in Coon Island Loop (including the PPG North Dock facilities) and a section of Bayou Verdine (from Interstate Highway 10 to the Coon Island Loop) for PPG. The study included 58 sampling stations evenly distributed within the study area. Samples were collected in October 1993. Analytical results showed elevated concentrations of organic and inorganic contaminants in the areas sampled.

Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report, Prepared by McLaren/Hart Environmental Engineering - ChemRisk Division for PPG Industries, Inc., June 1995.

The sampling report was prepared for PPG with the objective to assess sediment and water quality in Bayou d'Inde, the Lower PPG Canal, and a portion of the Calcasieu Ship Channel. Water and sediment samples were tested for VOCs, SVOCs, PCBs, chlorinated pesticides, total petroleum hydrocarbons (TPHs), total and dissolved inorganic compounds, ammonia, and major anions. The report concluded that although many constituents were detected in surface water, there were no organic or inorganic contaminants that warranted additional characterization. However, for sediment, most organic and inorganic constituents were detected and warranted additional investigation to fully characterize the area.

Findings Report for the Focused Site Assessment - Bayou d'Inde, Prepared by Fluor Daniel, Inc. for U.S. Environmental Protection Agency - Region VI, August 1997.

The Bayou d'Inde Focused Site Investigation was conducted for EPA Region VI as part of the CERCLA site investigation process. The sampling was initiated in response to a proposed dredging permit within the lower 1,000 feet of Bayou d'Inde. All samples were analyzed for VOCs, SVOCs, inorganic compounds, PCBs, and pesticides. Five sediment samples were also analyzed for dioxin. The findings suggest contaminated sediment to a maximum depth of 16.5 feet; however, the majority of the contaminants occurred in the upper 4 feet. Elevated concentrations of three dioxins were reported. The report estimated approximately 65,000 cubic yards of contaminated sediment in the area proposed for dredging.

Calcasieu River Estuary Biological Monitoring Program: Annual Report April 1997 – January 1998 (Year 9) Prepared by QST Environmental Inc. for PPG Industries, Inc., Louisiana Department of Health and Hospitals, and Louisiana Department of Environmental Quality, July 1998.

Quarterly field sampling and chemical analyses has been conducted by PPG since 1989. Aquatic organisms where collected from 11 stations from the Calcasieu River above Lake Charles to the Gulf of Mexico. The study targeted seven species of fin and four species of shellfish. Fish and shellfish samples were analyzed for chlorinated hydrocarbon compounds and PCBs.

The principal findings of the study indicated that Bayou d'Inde and the PPG Canal contained the most contaminated fish and shellfish in the Calcasieu Estuary. The contaminants with the highest concentrations included hexachlorobenzene, hexachlorobutadiene, PCB Aroclor 1254, and pentachlorobenzene. Blue catfish, channel catfish, brown shrimp, black drum, blue crab, and spotted sea trout were the most contaminated species within the estuary.

Bayou Verdine Investigation, Nature and Extent Investigation, Lake Charles, Louisiana, prepared by Entrix, Inc., for Conoco, Inc., October 1999.

The Bayou Verdine Investigation, Nature and Extent Investigation was completed on the behalf of Conoco to characterize the nature of chemical constituents in Bayou. Sampling included VOCs, pesticides, inorganic compounds, Polynuclear aromatic hydrocarbon (PAHs), SVOCs, dioxins/furans, and PCBs. Ninety-six sediment samples and associated water samples were collected. The data indicated the highest concentrations of many of the chemical constituents were found in the lower reaches of Bayou Verdine.

1.5 Report Organization

This RI report consists of the following sections:

Section 1 - Introduction

Section 2 - Environmental Setting

Section 3 – Conceptual Site Model

Section 4 - Data Collection, Analysis, and Interpretation

Section 5 - Chemical Fate and Transport

Section 6 – Reference Area Comparison

Section 7 - Bayou d'Inde Nature and Extent of Contamination

Section 8 - Bayou Verdine Nature and Extent of Contamination

Section 9 - Upper Calcasieu Estuary Nature and Extent of Contamination

Section 10 - Lower Calcasieu Estuary Nature and Extent of Contamination

Section 11 – Biota Nature and Extent

Section 12 – Toxicity Testing and Benthic Community Survey

Section 13 - Baseline Ecological Risk Assessment (BERA) Summary

Section 14 – Human Health Risk Assessment (HHRA) Summary

Section 15 – Nature and Extent - Summary and Conclusions

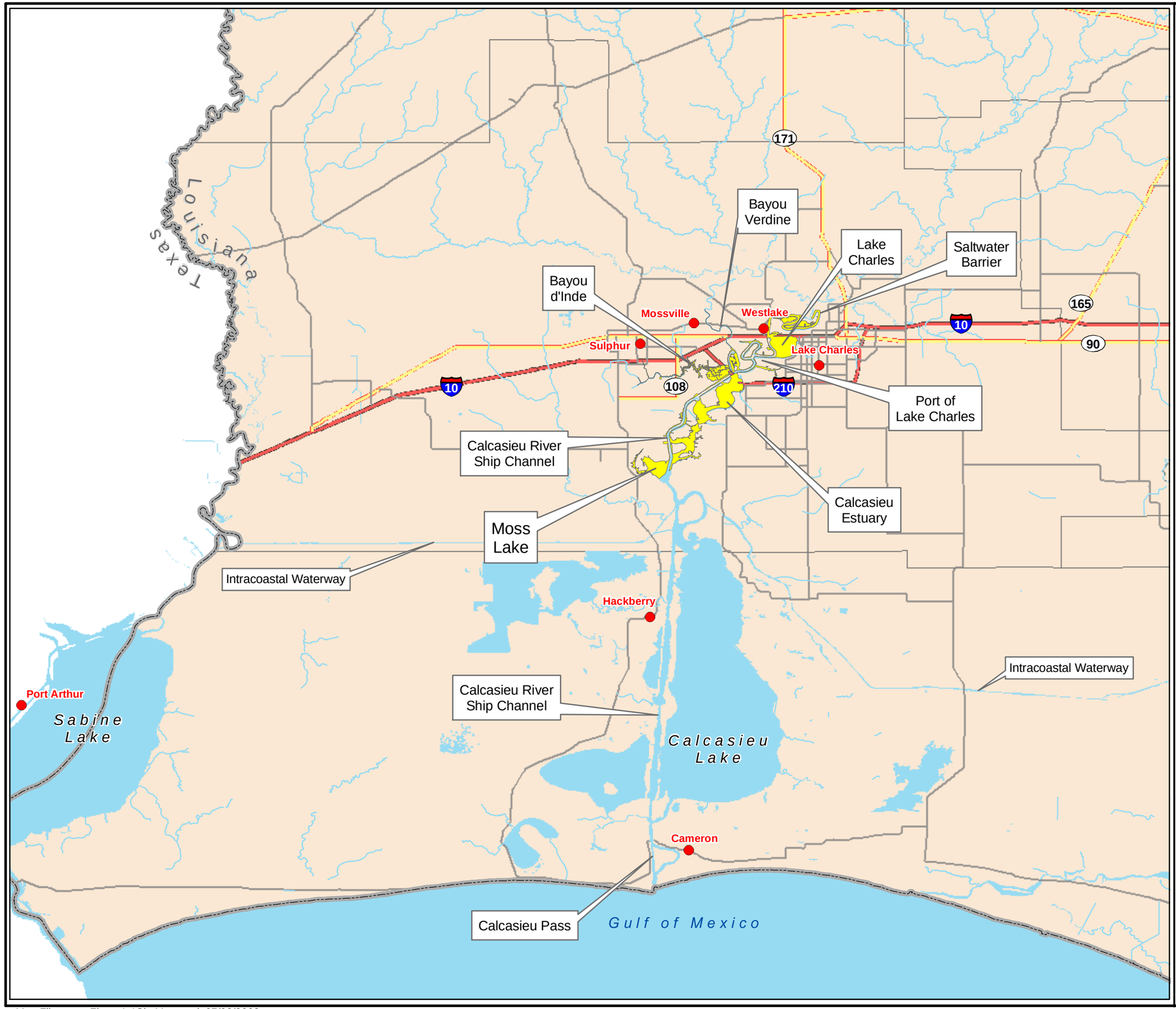
References

Figures

Tables

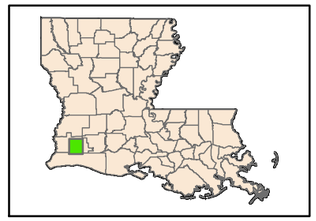
Appendices

Figure 1-1
Site Location Map
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Calcasieu Estuary
- State Border
- Interstate Highway
- Highway
- Local Roads
- Rivers/Streams
- Water
- City



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Section 2
Environmental Setting

The waterways comprising the Calcasieu Estuary have been modified substantially to accommodate the demands of modern civilization. An analysis of the land-use patterns in southwestern Calcasieu Parish displays the close association among the urban, industrial, and agricultural users and the surface water system. An aerial survey of the region reveals a labyrinth of gullies, ditches, canals, bayous, channels, lakes, marshes, and ponds–all ultimately connected to the Calcasieu Estuary (DeRouen and Stevenson 1987).

The estuary is the lower portion of the Calcasieu River drainage basin. The Calcasieu River begins in the hills west of Alexandria (in the vicinity of Kisatchie National Forest in Vernon Parish, LA, approximately 120 km to the northeast), and flows south into Calcasieu Lake, eventually emptying to the Gulf of Mexico (Figure 2-1). Because of the geographic extent of the Calcasieu Estuary, it has been divided into areas of concern (AOCs) for the purpose of this discussion (Figure 2-2). The four AOCs include:

- Bayou Verdine
- Bayou d'Inde
- Upper Calcasieu
- Lower Calcasieu

Key geographic features in the estuary and of primary interest are the ship channel (the portion from I-10 bridge through Moss Lake), Bayou Verdine, Bayou d'Inde, Lake Charles, Lockport Marsh, Contraband Bayou, Prien Lake, Indian Marais Lagoon, Moss Lake and Bayou Olsen (Figure 2-2). In addition, several reference areas have been identified. Reference areas are locations that have physical settings similar to an AOC but lack significant anthropogenic impacts (e.g., industrial discharges). Reference areas may also be considered background areas. Reference areas for the RI include Willow Bayou, Johnsons Bayou, Bayou Bois Connine, Grand Bayou, and Bayou Choupique (Figure 2-1). Further details on the AOCs, including key geographic features, are provided in this section and in Sections 7 through 10. The reference areas are evaluated in Section 6.

2.1 Physiographic Features

Calcasieu Estuary is located within the West Gulf Coastal Plain physiographic province. This plain, west of the Mississippi Alluvial Plain, occupies the western half of Louisiana. Hilly regions, often with steep bluffs 25 m high, mark the transitional zone between this region and the Mississippi Alluvial Plain. The local area is comprised of geologically young unconsolidated Quaternary (Pleistocene-age)

sediments (Figures 2-3). Structurally, the area is a geosyncline that receives large quantities of sediment from multiple river discharges (Louisiana Geological Survey [LGS] 1984).

The northern and north central portions of the West Gulf Coastal Plain are primarily areas of rolling hill country, much of it heavily forested. The southern end consists of extensive areas of prairie grasslands. These grasslands lie along the middle course of the Calcasieu River. In the southern part of the West Gulf Coastal Plain, marshlands rim the coast and extend inland as much as 30 km. They are generally separated from the Gulf by low sandy ridges referred to as the Louisiana Chenier Plain. The Chenier Plain predominates the area south of the Intracoastal Waterway. The Chenier Plain is south of the RI area of interest; it is referenced to complete the discussion on physiographic setting.

The Chenier Plain extends from the western bank of the Freshwater Bayou Canal located in the Vermilion-Teche basin in southern Louisiana westward to the Louisiana-Texas state border, from the Intracoastal Waterway to the north to the Gulf of Mexico. Deltaic mud deposited in the area by the Mississippi River 3,000 to 4,000 years ago underwent erosion and was reworked, creating the gulf shoreline beach ridges known as Cheniers. Over time, shifting of the Mississippi channel from east to west resulted in the shore-parallel ridge and swale topography that comprises the Chenier Plain. Intermediate to brackish marshes, bayous, and lakes characterize the plain Louisiana Department of Natural Resources ([LDNR] 2002).

2.2 Geology and Soils

As noted, the southwest Louisiana area is comprised of geologically young, unconsolidated Quaternary (Pleistocene-age) sediments. They are Pleistocene-age terraces deposited on the Gulf Costal Plain during glacial retreats (LGS 1984). The Pleistocene surface is characterized by a series of entrenched valleys, which are separated by broad, gently rolling divides. An illustrated geological history of the development and the filling of the Calcasieu entrenched valley system (derived from the LeBlanc 1949 study) is provided in Figure 2-4.

These sediments are typically composed of interbedded sands, gravels, silts, and clays. Four distinct terrace deposits have been identified in Calcasieu Parish: the Williana, Bentley, Montgomery, and Prairie.

The surficial deposits in the Lake Charles area are clays, silts, fine sand, and shells of the Prairie Terrace (LGS 1984). The Prairie Terrace varies in elevation from approximately 20 feet in the latitude of Lake Charles to about 2 to 3 feet in the latitude of Hackberry Ridge (Calcasieu Lake and points south, Figure 2-3), where the terrace passes under the recent marshland deposits (LeBlanc 1949). The gradient of the Prairie Terrace slopes toward the Gulf of Mexico at a mean declination of 0.2 meters per kilometer (m/km).

The Pleistocene terrace deposits include the 200, 500, and 700-foot sands that comprise the Chicot aquifer that underlies the site. These units generally thicken with depth toward the south. Faulting associated with local Lockport and Sulphur Mines piercement salt domes cause local variations in thickness and dip.

Shallow groundwater is present in the Calcasieu drainage basin and occurs in similarly named units; the 10-foot, 20-foot, 30-foot, 50-foot, and 70-foot sands. These shallow units are typically interbedded and interconnected. The nomeclature is relative; the depth that the units occur is generally within 100 feet of the ground surface (IT Corporation 1995).

In some locations, the Pleistocene terrace deposits may be overlain by Holocene alluvium consisting of sandy and gravelly channel deposits mantled by sandy to muddy natural levee deposits, with organic-rich muddy backswamp deposits in between them (LGS 1999). The local soils consist of Basile and Guyton silt loams. These soils are frequently flooded, low permeability, poorly drained silt loams (LGS 1984). Previous investigations within the estuary (from 1944 through 2001) describe the surficial sediments as silt with varying amounts of sand, clay, and organic matter. The silt is typically black with plant and shell fragments.

In summary, the nature and distribution of the sedimentary deposits of the young coastal plain of southwestern Louisiana is closely related to the topographic features formed by the depositional and erosional processes associated with the continental, deltaic, and marine environments within which the coastal plain was constructed (Fisk 1944).

2.3 Regional Flora and Fauna

Calcasieu Estuary has historically provided habitat to abundant wildlife, both aquatic and terrestrial. Lush vegetation (Section 2.3.1) provides forage and protection to numerous terrestrial species (Section 2.3.2) and aquatic species (Section 2.3.3) that populate the marshes and prairies associated with the Calcasieu Estuary and surrounding area. Critical habitat has not been designated for biota in the study area.

2.3.1 Vegetation

Trees once covered nearly all of Louisiana, but since the late 18th century, large areas have been cleared for agriculture, residential, and industrial development. Much of the forestland is covered by second growth or third-growth timber (Neyland 2000).

The bottom hardwoods and cypress region occurs along most of the Calcasieu River in the coastal prairie region from Lake Charles to points north (Neyland 2000). The region is used as pastureland, and for the cultivation of rice and soybean crops.

Regional Vegetation

Common Trees: Cypress, Live Oak, Gum, Elm, Sycamore, Cottonwood, Hackberry, Willow.

Native Grasses: Bluestem, Indiangrass, Eastern gamagrass, Switchgrass, Big Bluestem, Brownseed paspalum.

Marsh vegetation is typically brackish and common herbaceous plants include: *Spartina alterniflora, Distichlis spicata, Juncus* sp. and *Scirpus* sp. In the marshes upstream of the saltwater barrier freshwater herbaceous plants were reported, and include: *Alternanthera philoxeroides, Eichhornia crassipes, Typha latifolia, Potederia cordata* and *Sagittaria* sp. (Neyland 2000).

On the poorly drained land found in the coastal marsh areas south of Calcasieu Lake, grasses and sedges provide primary habitat, typically *Sapium sebiferum* and *Zanthoxylum clava-herculis* (Neyland 2000).

2.3.2 Terrestrial Biota

The southern marshes and swamps of southern Louisiana are the home of a wide variety of animals. White-tailed deer are abundant throughout the state. A few black bears remain in the more remote parts of the swamp; muskrat, mink, and raccoon are also found there. Among the scarce small mammals are the wildcat, gray fox, beaver, otter, and weasel. Correspondence with the U.S. Fish and Wildlife Service (USFWS) in 2001 notes that "there are no federally-listed threatened, endangered, or candidate species within the proposed project area" (USFWS 2001). However, the state bird, the brown pelican, is on the federal endangered species list. Common small mammals include the opossum, cottontail, marsh rabbit, and gray squirrel.

Regional Terrestrial Biota

Mammals: Mink, muskrat, raccoon, opossum, rabbit, squirrel, deer, beaver.

Migratory Water Fowl: Pelicans, ducks, geese, terns, sandpipers, marsh wren, seaside sparrow, wilson snipe.

Reptiles: Alligator, canebreak rattler, copperhead, water moccasin, turtle

More than one-half of the species of birds in North America are resident in the state or spend a portion of their migration there. Species of migratory wildfowl are the most abundant. They include several species of ducks and geese that spend the winter on the tidal marshes along the Gulf Coast. The most common of the state's water birds include the laughing gull, royal tern, brown pelican, and black skimmer. Birds found in the marshes include the marsh wren, seaside sparrow, red-winged blackbird, Wilson snipe, woodcock, and species of sandpipers.

Alligators are common in the southern Louisiana swamps; one was noted in the Lower Calcasieu study area during the RI. Other reptiles in the state include turtles, lizards, and both poisonous and nonpoisonous snakes. The poisonous snakes found in Louisiana are the coral snake, western pygmy rattler, canebrake rattler, copperhead, and water moccasin.

2.3.3 Aquatic Biota

Among the great variety of fish in the waters off the coast are red snapper, menhaden, gar, redfish, drum, sheepshead, jewfish, blue, jack, blue cat, yellow cat, and paddlefish or spoonbill cat. Many of these species are fished commercially in the estuary.

Regional Aquatic Biota

Fish: Snapper, drum, flounder, catfish, bass, gar, menhaden, mullet

Crustacean: Shrimp, crab, clams, oysters

The estuary is a natural hatchery for many of these species. Various species migrate up the protected bayous to spawn and hatch their young. The quiet, less saline upper reaches of the estuary provide habitat for these hatchlings, nurturing them into juveniles. The hatchlings return to the gulf as young adults to complete their growth cycle (USFWS Species Profiles; various years). Species found in the estuary during the RI include grass shrimp, striped bass, blue crab, mullet, and sea trout.

2.4 Hydrogeology

Significant groundwater exists below the site. Within the upper 300 m of Quaternary sediments, local aquifers include a shallow unconfined aquifer and the deeper confined Chicot aquifer. These aquifers typically consist of sand and gravel units separated by clay aquitards (LGS 1984).

The shallow aquifer is comprised of unconsolidated sand units referred to as the 10-, 20-, and 36-foot sands (LGS 1984). Groundwater in this aquifer is unconfined and occurs as shallow as 0.3 to 1 m below ground surface (bgs). Recharge to the shallow aquifer is from infiltration of precipitation, impoundment leakage and commingling of surface water. Groundwater flow, fluctuation, and quality may be influenced by surface water that intercepts the shallow groundwater, as noted in Bayou Verdine, Faubacher Ditch, and Vista West Ditch (PRC 1994).

Water levels in the shallow aquifer are tidally influenced with up to several inches of daily fluctuation. Because of the local influences, groundwater flow directions are irregular and vary seasonally. The groundwater quality is typically poor and unsuitable for domestic use. There are no known water supply wells completed in the shallow aquifer in the vicinity of the study area.

The major regional, hydrologic units for potable water in the Lake Charles area are the 200-, 500-, and 700-foot sands of the Chicot aquifer. These sands, like the units described above are locally named for the approximate depth where they occur. The Chicot aquifer is the primary source of groundwater for public supply, irrigation and industrial use in the area. Yields from wells completed in the 200-foot sand range from 25 to 450 gallons per minute (gpm); in the 500-foot sand from 19 to 3,800 gpm; and in the 700-foot sand from 27 to 2,200 gpm. Specific capacity of the Chicot aquifer ranges from 2 to 23 gpm per foot. The hydraulic conductivity ranges from 40 to 220 feet per day (LGS 1984).

Recharge to the Chicot aquifer is primarily through infiltration of precipitation in outcrop areas in northern Calcasieu Parish. Some hydraulic connection of the 200-, 500- and 700-foot sands is evident, with downward movement of water from the 200- to 500-foot sands and upward movement from the 700-foot sand. The 700-foot sand is recharged from the underlying Evangeline Aquifer (LGS 1984).

Groundwater from the Chicot aquifer 200-foot sand generally occurs at 110 to 120 feet bgs. Water levels in the Chicot aquifer within the Lake Charles area have been steadily declining at a rate of about one foot per year. Heavy pumping in the area has created a cone of depression in the 200-foot zone, such that groundwater flows towards Lake Charles in a concentric pattern from surrounding areas (LGS 1984).

Surface water hydrogeology is integral to each of AOCs (Bayou Verdine, Bayou d'Inde, Upper and Lower Calcasieu) and is therefore discussed in more detail in the following subsections.

2.5 Estuarine Conditions

Calcasieu Estuary is a complex interconnected system of bayous, marshes, open flats, and shallow lakes and dredged ship channels. Flow within specific segments of the estuary is governed by geometry, distance from open water, inflow, total depth, vegetation and tidal influence in the area. Habitat of the areas further defined by water salinity, which ranges from fresh to saline. Section 2.5.1 discusses the various sub-systems and their occurrence within the AOCs.

The estuary receives drainage and discharge from various developed, agricultural, and rural areas. Section 2.5.2 introduces the various industries present in the estuary. The section identifies the areas that may be impacted by industrial discharge or accidental release. A more detailed discussion of these elements is provided below.

2.5.1 Energy Systems

Calcasieu Estuary is made up of five general sub-areas as defined here as energy settings: bayou (ranging from shallow to depth areas), marsh, shallow lake, shipping channel, and river. Energy system classification is primarily based upon flow with a focus on sediment stability; however, as noted above, the overall quality of each area is dependant upon many conditions, and will be addressed by the physical and chemical composition of the areas and evaluation in the human health and ecological risk assessments.

The energy of a specific area influences surface water variability, sediment nature, and stability. Depositional environment, surface water conditions, and stability of the sediment in each area can be used to describe the behavior of the system. In addition, there are areas within the estuary that are considered atypical with respect to their associated physical or chemical characteristics; this system is categorized as "other".

Detail on each of the energy systems, system interaction, and their response to natural and manmade impacts is provided in Section 3.0. The impact of system energy on

chemical fate and transport is discussed in Section 5.0. The following subsections provide a brief overview of the energy systems that comprise the Calcasieu Estuary.

Exhibit 2-1 summarizes the distribution of energy systems in the RI study area.

Exhibit 2-1 Energy System Distribution in the Calcasieu Estuary Study Area

Energy System	Bayou d'Inde	Bayou Verdine	Upper Calcasieu	Lower Calcasieu
Bayou	✓	✓	✓	✓
Marsh	✓		✓	
River			✓	
Shallow Lake			✓	✓
Ship Channel			✓	✓
Other				✓

Bayou

The bayou is the natural tributary to the estuary. The system is typically a low-flow system that serves ultimately as a sediment exporter. The bayous in Calcasieu Estuary receive surface run-off from multiple areas, including industrial, rural, municipal, and agricultural areas. The amount of sediment loading is dependent upon the composition of the bayou drainage area.

Sediments tend to be silty sands to clays and generally become finer upstream. Sediments are generally stable in the upper reaches of the bayou where vegetation is more prevalent, and tidal surge tends to be lowest. Bayou sediments are subject to disturbance under scouring (strong flood tide or high wind) conditions. Sediment stability tends to be lower in shallow segments of the bayou or where sediments are disturbed by traffic. Sediment stability is diminished where the water surface turbulence approaches the sediment surface.

Marsh

Estuarine marshes are typically sediment sinks. They are low energy, vegetated and generally sheltered, slow draining basins. They receive and generally contain sediments due to the higher degree of vegetation within their margins. The low water levels within these marshes make them susceptible to dewatering under wind forcing conditions. Lockport Marsh is grouped with the marshes but differs in the degree of vegetation and the volume of the area that is sheltered or protected from inflow. Lockport Marsh tends to receive flow from the ship channel intermittently under high flow conditions. The remaining areas classified as marsh under this study generally receive less circulation. Lockport Marsh was not grouped with the shallow lakes due to the overall shallow depth and the number of levees that provide protection to the north and eastern areas of Lockport Marsh.

Shallow Lake
Shallow lakes differ from the marshes in overall size. The shallow lakes are generally 1 to 3 meters, with an area of greater than 0.5 square kilometers (km^2). Vegetation within the shallow lakes is generally less than that of the marshes overall; however, substantial biota habitat is present in some areas. The salinity varies from intermediate to saline in the study area.

As with the marshes, the shallow lakes are net sediment sinks. They receive sediment from various sources: overland, terrestrial soil erosion, and water borne sediment transport.

Ship Channel
The dredged portion of the estuary is commonly referred to as the ship channel. The areas include Clooney Island Loop, western Coon Island Loop, the Lyondell West Slip, the PPG North Dock area of Bayou Verdine, lower Bayou d'Inde, and the main ship channel. This energy system is a high flow, deep, wide channel routinely dredged to maintain shipping lanes for large, deep draft vessels. The area is a conduit for increased flood tide surge (flow from the Gulf), and salinity is typically brackish. Flow within the ship channel is generally in the thousands of cubic meter per second compared to the single digit range reported for the upper river and bayous.

River
The rivers designation is the undredged segment of the Calcasieu River, upstream of Lake Charles. The river resembles the low flow bayou, however, larger overall. The river is larger, 15 to 25 m wide and 4 to 5 m deep. The flow is proportionately greater as well. Salinity tends to be fresh to intermediate. The geometry is typical for a meandering stream, with broad elbows that contain finer sediments. The river is located above Lake Charles and is protected somewhat by the lake; however, it is still susceptible to tidal surge and wind forcing.

Other
The other designation is used to describe the Indian Marais Lagoon located on the edge of the Lower Calcasieu ship channel (Figure 2-2). The lagoon is partially open to ship channel flow and currents. It is bermed and does not receive significant overland run-off. The system is not a shallow lake due to its size and lack of vegetation and habitat. Its habitat, geometry, and depth limit its classification as a marsh. It is classified separately as it is connected to the ship channel and is a potential sediment source and exporter.

2.5.2 Industry and Permitted Discharge

In addition to the natural landforms, industry comprises much of the land surface. Over 20 major industrial facilities exist in the area (Figure 2-5) and many have or have had permitted National Pollutant Discharge Elimination System (NPDES) effluent discharge outfalls to the estuary. The NPDES program is administered by the State of Louisiana, as noted in the permit numbers presented below. Some of the facilities do not have permitted discharge facilities but have operations that have had spills or

other releases that potentially impacted the estuary in the past. A summary of the industries, their outfalls, and the region of the estuary where the facility resides are provided in Exhibit 2-2.

Exhibit 2-2 Major NPDES Permitted Facilities and Outfalls

Industry	LPDES Permit Number	Current or Historical Outfalls	Receiving Water
Lyondell/ARCO/ Olin Chemical	LA005347	001, 008, 010, 011, 016, 017, 019, 020, 022, 025 - 030, 032, 033, 034, 410	BV, UC
Conoco Refinery [1]	LA0003026	001 – 050, 101	BV, UC
Conoco – Clifton Ridge	LA0003026	001, 002	LC
Conoco – Coke Handling	LA0003026	001	LC
Conoco – Pipeline[2]	LA0003026	010-013, 103	IM
Condea Vista	LA0003336	001 - 004, 009, 018, 028, 029A, 030, 053, 054, 201, BAC1	BV, UC
PPG	LA0000761	001, 003, 004, 010, 011, 014, 017 - 021, 101, 101A, 103Q, 110, 111, 118, 201, 201A, 301, 401, 501, 501A	BI, BV, UC
Citgo	LA0005941	001 - 004, 006, 006A, 006B, 008 - 010, 106, 011 - 013	BI, LC
Equistar/ OxyChem	LA0069850	001 - 003, 102	BI
Firestone	LA0003824	001, 003, 004	BI
Westlake Polymers	LA0071382	001 - 011, 101, BAC1	BI, LC
Louisiana Pigment	LA0071382	001 - 005A, 101, 101A, 201	LC
Westlake Petrochemicals	LA0082511	001 - 008, 010, 010A, 101 - 104, BAC1	LC

BV – Bayou Verdine, BI – Bayou d'Inde, UC – Upper Calcasieu, LC – Lower Calcasieu, IM – Indian Marais Bayou
LPDES – Louisiana Pollutant Discharge Elimination System permit number
[1] Conoco Refinery primary Outfall 001 was re-routed from BV to the Calcasieu River, just upstream of Clooney Island Loop in June 1997.
[2] Pipeline Outfalls Conoco 001-013 and 103 were reported as active from 1993 through 1998.

Discharge compounds, concentrations, flow, and physical parameter conditions are specified under NPDES. Table 2-1 presents the average and maximum permitted limits for the facilities mentioned in Exhibit 2-2. The NPDES permitting process requires that facilities characterize effluent streams and sources (pre- and post-treatment, as applicable). Once approved, discharge is monitored on a set frequency, measured at compliance points (typically where the outfall empties into surface water although this may vary with flow conditions) and reported to LDEQ and EPA. Flow and/or concentration exceedances require LDEQ notification and initiation of response actions. If the release is a chronic leak or similar long-term release, the LDEQ may require that the owner determine extent of contamination and conduct remediation activities.

2.6 Estuary Areas of Concern

An overview of the characteristics and a description of the physical parameters of each of the energy systems present in the portions of the estuary identified as AOC is provided below. The AOCs are Bayou Verdine, Bayou d'Inde and Upper and Lower Calcasieu. As mentioned previously, the AOC boundaries were developed in the early stages of the RI and were used to group regions of the estuary to aid in evaluation and management of the site. Data is presented by AOC; however, data interpretation is not bound by these groupings. Instead, the information is evaluated by examination of site conditions and the impacts to sediments and sediment stability. Detailed findings for these areas are presented in Sections 7 through 10.

2.6.1 Bayou Verdine

Bayou Verdine is located between the City of Westlake and the community of Mossville, and north-northwest of Lake Charles in Calcasieu Parish, Louisiana (Figure 2-2). Bayou Verdine's headwaters originate in the farmland north of the city of Westlake and flow primarily south-southeast, entering the ship channel on the north side of Coon Island Loop, north of the Interstate 210 (I-210) bridge. Bayou Verdine is approximately 7 km long and is the only major tributary to Calcasieu River-Coon Island Loop (Curry et al 1997) although other industrial discharge also enters western Coon Island Loop directly.

Bayou Verdine

- Energy Systems
  - Bayou
- 7 km long
- Major Industry
  - Conoco
  - CONDEA Vista
  - PPG
  - Sasol
- Undeveloped land
- Documented releases

2.6.1.1 Physical Setting

Relief in the area of the bayou ranges from 1 to 5 m above mean seal level (MSL). The bayou and surrounding area are located within the 100-year and 500-year flood plains of the Calcasieu River Basin (Figure 2-6). Its headwaters are fresh, and, as the water travels downstream, it mixes with intermediate to saline water of the Calcasieu River to the south. According to the USFWS National Wetland Inventory Map, the upper reaches of Bayou Verdine (from point of origin to Interstate 10 [I-10]) are comprised of a palustrine wetland system that is periodically flooded during storm events and a riverine segment that is permanently flooded.

The upper reaches of the bayou have water depths ranging from 0.1 to 1.0 m, and the lower reaches have depths of up to 6 m at the North Dock area. Throughout the Conoco facility and downstream of I-10, water depths are 1.2 to 2.1 m.

Bayou Verdine is tidally influenced throughout, with up to 3 to 6-inches of daily water level fluctuation (U.S. Army Corps of Engineers [USACE] 1976), The bayou has an estimated average rate of flow of approximately 8 cubic feet per second (cfs) in its southern reaches (USACE 1976). Near the confluence of Bayou Verdine and Coon

Island Loop, Bayou Verdine and the shallow groundwater are in direct communication (IT Corporation 1995).

2.6.1.2 Land Use

The land around Bayou Verdine is characterized by undeveloped land, mixed rural, residential, commercial, and heavy industrial use; however, industrial applications predominate in the southern section of the bayou. Permitted industrial discharges to Bayou Verdine under NPDES include those outfalls located on property owned or utilized by Sasol North American Inc. (Sasol) formerly CONDEA Vista Company (CONDEA), Conoco Inc. (Conoco) Lake Charles refinery, and PPG (Figure 2-5). Conoco and PPG each have either material transport, storage, or discharge activities that potentially impact middle to lower Bayou Verdine and/or Coon Island Loop.

Three drainage ditches discharge to Bayou Verdine. The Vista West Ditch passes through Sasol and the northern portions of Conoco; the Faubacher Ditch passes through Sasol and Conoco properties east of the Vista Ditch, both are approximately 1.6 km long (Figure 2-5). Faubacher Ditch begins in the residential area east of Conoco and flows west through Conoco's land treatment area and Sasol's chemical plant. Faubacher Ditch turns south and enters Bayou Verdine at the Conoco Refinery, north of the Kansas City Southern Railroad (KCSRR). The third ditch entering Bayou Verdine is the KCSRR West Ditch, parallel to the railroad tracks, discharging into Bayou Verdine south of Faubacher Ditch. Conoco Outfall 004 discharges into the KCSRR West Ditch. Impacted groundwater has been found in the shallow sand units around the West Ditch (Curry et al 1997).

These drainage ditches are typically narrow 0.1 to 1.0 m, channels with less than 0.5 m of water flowing in them. Historically, analytical data show elevated COPCs in all of the ditches, with the highest concentrations in the Vista West Ditch.

Industrial development along Bayou Verdine has had a significant impact on the local system. During the 1950s, the southernmost 1,000 m of the bayou were rerouted to the west when Olin Corporation (Olin) built the West Pond over the original bayou. The former route of Bayou Verdine downstream of I-10 was to the east of its present course; however, the confluence with the Coon Island Loop was near its present mouth (PRC 1994). Following the initial plant build-up, the only reported dredging on Bayou Verdine was performed by PPG in the North Dock Area (at the confluence of Bayou Verdine and the Coon Island Loop) in 1992. During 1992, the area was dredged to a depth of 6 m to accommodate barge traffic (PRC 1994).

2.6.1.3 Spills and Releases

Uncontrolled industrial releases from the companies along Bayou Verdine have been reported. Various releases from Sasol (formerly CONDEA Vista) chemical manufacturing processes have occurred, potentially impacting Bayou Verdine. Contaminants were primarily 1,2-dichloroethane (EDC) and 1,1,2- trichloroethane (TCA). The releases impacted soil and shallow groundwater, prompting LDEQ to

issue an Administrative Order in 1986 requiring an assessment of the impact of releases at the facility (Curry et al 1997).

Conoco has reported various releases during the facility; history, no significant releases are noted for Bayou Verdine. Chronic periodic releases appear to contribute to the chemical impact to sediments (Pope-Reid Associates/A. T. Kearney, Inc. 1987).

2.6.1.4 Energy System

Bayou Verdine is classified exclusively as a bayou energy system. The bayou is a net sediment exporter, receiving sediments from the undeveloped land to the northwest and from industrial areas associated with Conoco, Sasol, and PPG. Flow in Bayou Verdine is generally sustained by runoff from industrial sources with minor run-off from municipal, agricultural and rural residential areas. Shallow groundwater appears to enter the bayou under gaining stream conditions (IT Corp. 1995). The upper portions of the bayou are generally undisturbed in geometry and vegetation; the lower reaches have been re-routed as noted above, creating an industrial canal. The lower portions of Bayou Verdine are not routinely dredged. Overall, Bayou Verdine is a low-flow system.

At the confluence of Bayou Verdine and Coon Island Loop, the bayou discharges into a moderately swift, deep channel, which is a conduit for brackish to saline water from the ship channel. The engineered confluence is wider than the natural opening and allows for greater tidal influence and storm surge up the bayou.

Sediments within Bayou Verdine tend to be silts and silty sands. This appears to be the combined result of overland soil erosion. In addition, black coke fines from the Conoco Refinery are widespread in the lower portion of the bayou. Sediments in the upper reaches of the bayou tend to become finer grained, indicating the approximate extent of tidal surge deposition.

Development along Bayou Verdine has defined the current nature of the bayou. Industrial discharges (current and historic), accidental releases, and stormwater runoff have contributed to organic and inorganic impacts to surface water, sediment, and biota within the bayou.

2.6.2 Bayou d'Inde

Bayou d'Inde is located in the northern portion of the Calcasieu Estuary, west of the City of Lake Charles, Louisiana (Figure 2-5). Bayou d'Inde's headwaters originate in the western part of Sulphur, Louisiana and flow primarily east-southeast through heavy commercial and industrialized areas before emptying into the ship channel southwest of Coon Island. The confluence of Bayou d'Inde and the ship channel is a large shallow flat are called Lockport Marsh. The area is approximately 1.2 km^2. Substantial mixing of water from Bayou d'Inde and the ship channel likely occurs in Lockport marsh, given the low-lying levees separating these features. Areas in the northeastern portion of Lockport Marsh appear to be protected from significant mixing, based upon the physical and chemical nature of the sediments.

2.6.2.1 Physical Setting

Bayou d'Inde is approximately 15 km long and is a major tributary of the Calcasieu River (Curry et al 1997). The bayou, which originates near the I-10 bridge in Sulphur, has a drainage area of over 1,000 acres (PRC 1993). Bayou d'Inde has both bayou and marsh energy systems. The confluence with the ship channel is a major factor in sediment erosion and deposition. Several smaller tributaries, the largest of which is Maple Fork, located between the PPG Canal and Louisiana Highway 108 (LA-108), join Bayou d'Inde. The second identifiable fork is the upper fork, or headwaters, located to the west and north of LA-108.

Bayou d'Inde

- Energy Systems
  - Bayou
  - Marshes
- 15 km long
- Major Industries
  - PPG
  - Citgo
  - Firestone
  - Westlake Polymers
  - Equistar/OxyChem
- Undeveloped land
- Documented releases

The surface elevation in the area of the bayou averages about 3.1 m above MSL. The area surrounding Bayou d'Inde is located within the 100-year and 500-year floodplains of the Calcasieu River Basin (Figure 2-6). Bayou d'Inde headwaters are typically fresh. These waters mix with intermediate to saline water from the ship channel in the lower sections of the bayou. Bayou d'Inde flows through several small fringe marshes near Maple Fork Bayou. These marshes are typical estuarine fringe marshes, with generally intermediate surface water salinities.

Geometry of the lower portions of the bayou includes a width that ranges from 24 to 46 m wide and 2.5 to 5 m deep and is tidally influenced with up to 3 to 6- inches of daily water fluctuation (USACE 1976). Depth is greatest from the ship channel to LA-108 where the bayou has been dredged to accommodate barge traffic. The remainder of the bayou is relatively shallow. It is subjected to tidal surge, varying salinity effects, and turbulence due to barge traffic. Significant bottom scouring (flood tide currents) during periods of salt-wedge salinity stratification have been noted in the deeper portions of the bayou. Salinity can vary significantly and is dependant upon season, rainfall, tide, recent storm surge, winds, and other conditions. Upper reaches above LA-108 are typically low-flow areas.

Lockport Marsh is a low-lying, intermediate to brackish broad shallow area with water depth generally less than 1 m. Lockport Marsh is subject to overbank flow from PPG Canal to the west, Bayou d'Inde from the south, and the ship channel to the east during periods of high wind or water flow. Vegetation is limited, and combined with the less protected nature of the southeastern portion of the area, flow through the area can be significant. Lockport Marsh is considered a marsh by name and is grouped with the remaining fringe marshes in Bayou d'Inde due primarily to its shallow depth and protected nature of the upper portion of the area.

2.6.2.2 Land Use

The land around Bayou d'Inde includes undeveloped wooded marshland, rural residential, commercial, and heavy industrial properties. Rural residential and undeveloped woodland areas border the bayou northwest and upstream of the industrial area. Heavy industry dominates the area bounded by the PPG Canal and LA-108. Several of these industries have wastewater outfalls permitted under NPDES. Permitted industrial discharges to Bayou d'Inde include outfalls owned or utilized by to Citgo Petroleum Corporation (Citgo), Equistar/OxyChem Corporation (Equistar/OxyChem), Firestone Synthetic Rubber and Latex Company (Firestone), Westlake Polymers Corporation (Westlake Polymers), Certain-Teed Products Corporation (Certain-Teed), and PPG, which all enter Bayou d'Inde (Figure 2-5). The NPDES permitted discharges vary; however, the largest flow appears to be from the PPG canal, with a design capacity of 233 million gallons per day (MGPD).

2.6.2.3 Spills and Releases

Various releases to the bayou have occurred. Some of the more significant releases, with potential to impact Bayou d'Inde, are noted below.

PPG operated earthen ponds in the south terminal area at the east end of the PPG canal that received "kettle" bottom wastes. These wastes contained hexachlorobutadiene (HCBD), hexachlorobenzene (HCB), EDC and other organics. Leachate from the ponds drained to the PPG Canal. The pits operated from the mid 1960s to late 1970s when the ponds were closed. Groundwater has been impacted and remedial actions were initiated by PPG in the early 1980s (PPG 1989).

PPG operated a mercury-settling pond in the early 1970s to treat Mercury Cell Chlorine Unit wastewater. The unit was an unlined earthen pond (IT Corp. 1992). Various operations related activities are referenced in the literature and may have impacted the upper reaches of Bayou d'Inde between Little Bayou d'Inde and LA-108. In general, long-term, or chronic releases to the bayou appear to be the primary impact to sediments in Bayou d'Inde.

2.6.2.4 Energy Systems

Bayou d'Inde contains two energy systems, bayou and marsh. The bayou is divided into an upper residential area and a lower industrial region. The upper segment extends from the headwaters to just above the LA-108 Bridge. The industrial segment extends from LA-108 to the confluence with the ship channel. Marshes are present in Bayou d'Inde, a series of small intermediate marshes located near Maple Fork and in Reach 2 of Bayou d'Inde. Lockport Marsh, located at the confluence of Bayou d'Inde and the ship channel, is identified as a marsh but differs primarily due to periodic flow through the lower portion of the area. Classification as a marsh is based upon the shallow depth and the relatively isolated areas in the northeastern portion of Lockport Marsh.

The bayou contains both natural and modified segments; however, the geometry and depth of the natural channel has generally been maintained. The lower segment of

Bayou d'Inde from the PPG Canal to the ship channel has been dredged in the past. The bayou is characterized by low-flow conditions and moderate vegetation. Salinity varies from intermediate to brackish.

Industrial development along the lower segments has affected the system, namely by the introduction of barge traffic and moderate dredging; however, the primary characteristics of the energy system are intact. Westlake Polymer barge traffic traverses the lower segment from the ship channel to their dock located at LA-108. Barge traffic up Bayou d'Inde is a source of turbulence, mobilizing finer grained sediments, due to the overall shallow depth of the bayou. The shallow depth of the traffic zone is a primary element in re-suspension of these sediments. Transport of the suspended material is affected by many factors as discussed in Section 5.0.

Sediments within Bayou d'Inde are generally silty sands. This appears to be the combined result primarily of overland soil erosion and deposition of reworked material from the ship channel in the lower section. Bayou d'Inde sediments are generally coarser than Bayou Verdine, due in part to the broader confluence with the ship channel and deeper (dredged) bayou. Sediments in the area above LA-108 tend to become finer grained silts, indicating the general extent of tidal surge. Typical interaction of the energy systems is discussed in Section 3.0.

Development along Bayou d'Inde has altered the natural setting in the industrial area. Industrial discharges (current and historic), accidental releases, and stormwater runoff have contributed to organic and inorganic impacts to surface water, sediment, and biota within the bayou.

2.6.3 Upper Calcasieu

The Upper Calcasieu area is defined as that region of Calcasieu Estuary that extends from the saltwater barrier on the Calcasieu River north of Lake Charles and flows southwest into Lake Charles, west to Clooney Island Loop, and southwest to approximately 155 m south of Coon Island Loop (Figure 2-5). Coon Island Loop connects with the ship channel near the I-210 Bridge.

2.6.3.1 Physical Setting

The Upper Calcasieu area is approximately 25 km in length and receives discharges from several sources along its banks. Bayou Verdine and Contraband Bayou are the two major tributaries that discharge into the Upper Calcasieu area.

The surface elevation in the area around Upper Calcasieu averages about 3 m above MSL and the area is located within the 100-year and 500-year floodplains of the Calcasieu River Basin (Figure 2-6). The Calcasieu River above Lake Charles ranges from 62 to 372 m wide. Lake Charles is approximately, 1,860 m wide.

Upper Calcasieu

- Energy Systems
  - River
  - Marsh
  - Ship channel
  - Shallow lake
  - Bayou
- 25 km long
- Major Industries
  - Lyondell/Olin
  - Montell
  - Conoco
  - PPG
- Undeveloped land
- Documented releases

The ship channel depth ranges from 4.6 to 14 m in depth below the I-10 Bridge. Sampling of the ship channel was limited to the shallow (4.6 m) shelf as the USACE routinely dredges the deeper portions of the ship channel. Periodic dredging is required to remove accumulated sediments and debris, maintaining the ship channel at its authorized depth (USACE 1976).

Water in Upper Calcasieu is intermediate to brackish and tidally influenced. Salinity stratification is noted during periods of the year, controlled primarily by density driven flow as a result of tidal influence and salinity stratification. Density-driven flood tide (upstream flow) currents have been observed regardless of tide stage in previous studies (DeRouen and Stevenson 1987). Dredging of the ship channel through to the Port of Lake Charles has accentuated these effects. A salinity control structure was installed by USACE in 1968. The saltwater barrier is a tainter gate structure constructed in a short channel 17 m wide. The sill of the structure is 4 m below mean low Gulf level. The barrier is operated between March and October, with navigation and retaining structures closed, except for vessel passage. From October to February, periods of generally high water levels, the gates are open allowing free flow of water. The saltwater barrier effectively protects the upper Calcasieu River from saltwater intrusion. The barrier effectively divides the river into an upstream, fresh water system and a downstream, estuarine system. The extensive river modifications have resulted in a complex system of interlaced natural and artificial barriers, channels, marshes, and lakes.

2.6.3.2 Land Use

Land use of properties along the Upper Calcasieu segment of Calcasieu Estuary is rural, residential, municipal, and industrial. Bayou Verdine receives discharge from several industrial properties, as noted above, and discharges at the northern end of Coon Island Loop. Contraband Bayou receives Lake Charles municipal wastewater discharge and enters the ship channel between Clooney and Coon Island Loops, passing through primarily residential and light industrial properties (Curry et al 1997).

2.6.3.3 Spills and Releases

Permitted discharge and uncontrolled spills and releases have occurred within Upper Calcasieu. Industrial development along Clooney Island and Coon Island Loops is extensive. Residential and rural development surrounds the upper river, Lake

Charles and Contraband Bayou. Numerous permitted NPDES outfalls enter Upper Calcasieu as follows:

- Clooney Island Loop – Lyondell/Olin Industries, Inc. (Lyondell) and Conoco
- Contraband Bayou – Publicly owned treatment works (POTW) discharge from the City of Lake Charles
- Coon Island Loop - Conoco, Lyondell/Olin, PPG, and Sasol

Various releases to Upper Calcasieu have been reported, some of the more noteworthy are presented below.

The most notable are two EDC releases that occurred at the Conoco facility in 1987 and 1994. In 1987, an EDC (alias 1,2-dichloroethane [1,2-DCA]) release occurred in the southwestern portion of the facility. The release was the result of a crack in the sump of a storage tank. The crack has since been repaired. In 1994, a release of EDC was discovered in the northwestern part of the property from a leak in a pipeline following an unloading event. Emergency response actions were initiated which included removal of contaminated soil and water from a stormwater drainage ditch. Sediments [in Bayou Verdine] were sampled and impacted sediments were dredged.

Vista Chemical has released EDC and TCA from the Vinyl Chloride Monomer (VCM) Unit that has impacted media in Vista West ditch and Bayou Verdine. The extent of contamination has been assessed by CONDEA in response to an Administrative Order issued by LDEQ in 1986. Impacted water and sediments may have entered Coon Island Loop in Upper Calcasieu.

2.6.3.4 Energy Systems

Upper Calcasieu is a diverse segment of the estuary that consists of an element of every energy system present in Calcasieu Estuary. The AOC contains natural river, marshes, shallow lake areas, bayou, and shipping channel.

The river is approximately 17 m wide and 4.6 m deep. Salinity in the upstream segment is generally fresh and is controlled by the saltwater barrier. The river experiences moderate tidal fluctuation. Flood tide currents (upstream flow) have been observed throughout the segment during salinity-stratified conditions. This density-driven current generally increases salinity in the area and makes the segment a net sediment exporter (DeRouen and Stevenson 1987). Coon Island Loop and Clooney Island Loop and the ship channel represent the dredged, brackish, salt-wedge salinity regime portion of Upper Calcasieu.

The Lake Charles area (undredged, natural lake portion) is generally shallow and is a net sediment sink. The western side of the lake, where the river is dredged, increases flow, salinity and tidal influence. Tidal activity and salinity generally increase downstream throughout the area.

Contraband Bayou is a low-flow natural bayou that receives discharge from the Lake Charles POTW. The geometry of Contraband Bayou allows for moderate tidal fluctuation and intermediate to saline salinity conditions.

Sediment character is as diverse as the energy systems. Section 9.0 provides details on the condition of sediments in Upper Calcasieu. Discharges (current and historic), stormwater runoff, and accidental releases (documented and undocumented) have contributed to organic and inorganic impacts to surface water, sediment, and biota within Upper Calcasieu.

2.6.4 Lower Calcasieu

The Lower Calcasieu study area comprises the portion of Calcasieu Estuary from the I-210 bridge, just south of Coon Island Loop, to the outlet of Moss Lake – a distance of approximately 15 km (Figure 2-5).

2.6.4.1 Physical Setting

Lower Calcasieu is characterized predominantly by the ship channel interconnected to shallow lakes and small lagoons. The ship channel is 125 m wide and 15 m deep and is routinely dredged (USACE 1976). Prien Lake is located on the east side of the ship channel; the mouth of the lake is located across from Lockport Marsh. The lake runs parallel to the ship channel, re-entering the ship channel north of Indian Marais Lagoon. Prien Lake lies within the old channel of the Calcasieu River. The Prien Lake segment is approximately 4.8 km in length.

Lower Calcasieu

- Energy Systems
  - Ship channel
  - Shallow lake
  - Bayou
  - Other (Indian Marais)
- 15 km long
- Major Industries
  - Citgo
  - W.R. Grace
  - OxyChem
- Undeveloped land
- Documented releases

Indian Marais Lagoon has a 230,000-kiloliter capacity and is partially contained within an earthen embankment built-up along the west side of the ship channel midway between Prien Lake and Moss Lake. Indian Marais Lagoon received flow from Citgo Outfall 003, the primary refinery wastewater outfall until 1992, when Outfall 003 was re-directed directly to Calcasieu River. The lagoon is about 3 m deep, with a 300 m pier separating it from the ship channel. The lagoon is partially bermed (2 to 3 m) and may occasionally receive stormwater run-off. The lagoon is in communication with the ship channel and is subject to sediment scouring during high tides.

Moss Lake flows into the ship channel from the west and is fed by Bayou Olsen. Bayou Olsen drains the area south and west of Bayou d'Inde. The Bayou Olsen and Moss Lake segment is approximately 9.6 km in length.

Elevation in the lower portion of the Calcasieu Estuary ranges from 1.6 to 4.6 m above MSL. The area surrounding Lower Calcasieu is located within the 100-year and 500-year floodplains of the Calcasieu River Basin (Figure 2-6).

2.6.4.2 Land Use

Much of the adjacent land in the Lower Calcasieu study area is undeveloped, but several industrial facilities (Citgo and W.R. Grace and Co.) have outfalls to the ship channel between Prien Lake and Moss Lake. Citgo owns and operates the Lake Charles Complex located along the west bank of the Calcasieu River south of Bayou d'Inde. The Citgo lubrication plant is located in the northwest portion of the refinery. Equistar/OxyChem, which operates the Citgo propylene fractionation unit, is located in the northeast portion of the refinery property.

W.R. Grace operates a manufacturing facility located on the west side of the ship channel, south of Citgo. The facility produces silica-alumina petroleum cracking catalyst. Facility surface drainage is to the south to Bayou Olsen.

The ship channel is used extensively throughout Lower Calcasieu, providing transport to over 40 million tons of product annually. The channel is dredged to 125 m wide and 15 m deep (USACE 1976). Dredging of the ship channel is routine and occurs on average about every 2 to 4 years. The USACE maintains the design geometry of the channel to accommodate large, deep draft vessel passage. Design of the ship channel in Lower Calcasieu has remained constant since the channel was enlarged to its current size in the 1960s.

2.6.4.3 Spills and Releases

Various industrial releases have occurred within the Citgo and Equistar/Oxychem complex on the west side of the ship channel. Soil and groundwater have been impacted, and the facilities monitor several areas. The most significant potential impact to Lower Calcasieu appears to be from impacted sediments in Indian Marais Lagoon. Sediment stability when the lagoon is in direct communication with the ship channel during storms or other high-energy conditions may be impacted.

2.6.4.4 Energy Systems

The Lower Calcasieu area contains four energy systems: shallow lakes (Prien and Moss Lakes and the areas to the south of Prien Lake and east of the ship channel), low-flow bayou (Bayou Olsen), the ship channel, and Indian Marais Lagoon. Indian Marais Lagoon is considered a sediment source and is susceptible to sediment scouring and breaching, thereby acting as a sediment source.

The ship channel is a high flow, tidally influenced saline environment. The channel is routinely (every 2 to 4 years) dredged to clear accumulated sediment and debris. Increased water salinity and vegetation losses have weakened soils, leading to increased sloughing.

Prien Lake is located on the east side of the ship channel; the mouth of the lake is located across from Lockport Marsh. The lake runs parallel to the ship channel, re-entering the ship channel north of Indian Marais Lagoon. Rhodamine dye tests indicate that Prien Lake receives flow from the mouth of Bayou d'Inde (Curwick 1988). Flow through Prien Lake may exit through two openings to the ship channel;

however, flow rates through the shallow lake are low and the geometry is such that circulation is limited. The Prien Lake segment is approximately 4.8 km in length.

Indian Marais Lagoon has a 230,000-kilometer capacity and partially contained within an earthen embankment built-up along the west side of the ship channel midway between Prien Lake and Moss Lake. The former lagoon is open to the ship channel via a bridge pier approximately 300 m long. The lagoon is bermed with an embankment (2 to 3 m high) that separates Indian Marais Lagoon from the surrounding area.

Moss Lake flows into the ship channel from the west and is fed by Bayou Olsen. Bayou Olsen drains the area south and west of Bayou d'Inde. Moss Lake is generally a higher flow body with greater circulation and tidal influence. The Bayou Olsen and Moss Lake segment is approximately 9.6 km in length. The bayou is generally a vegetated low-flow system. The bayou is subject to tidal surge, and salinity is brackish.

Overall, Lower Calcasieu is tidally influenced, with 6 to 12 inches of daily fluctuation (USACE 1976). Salinity stratification tends to be density driven and seasonal. Observations during the RI indicated a mixed salinity regime; however, during warmer months, a salt-wedge regime has been reported (Duke 1985). Density-driven flood tide (upstream) currents have been noted along the bottom of the ship channel, generally 6 m below the surface (Duke 1985; DeRouen and Stevenson 1987). Salinity of the Lower Calcasieu area surface water ranges from brackish to saline.

These systems are interconnected, yielding a network of sediment sources, transports, and sinks. The higher salinities and geometry of Lower Calcasieu tend to make this portion of the estuary a net sediment transporter, as is evidenced by contaminant occurrences noted in Section 10.0 of this report.

2.7 Climate

The climate in Calcasieu Parish is humid and temperate and is influenced by its proximity to the Gulf of Mexico. The average year-round temperature is 68°F, with an average daily high of 78°F and an average daily low of 58°F. The hottest months are July and August with average high and low temperatures of 91°F and 73°F, respectively. The average high and low temperatures for the coolest months, January and February are 63°F and 41°F, respectively (NOAA 2002).

Precipitation is relatively uniform from year to year. The average annual precipitation is 54.05 inches, with an average number of 103 rainy days National Weather Service ([NWS] 1999). May, June, and July typically experience the most precipitation, whereas March and October are the driest months. Average monthly precipitation is

Climate Highlights

Average Annual Temperature: 68°F

Average Annual Precipitation: 54.05 inches

Hurricane Season: June - November

approximately 4 inches per month. The average wind speed is 8.6 miles per hour, from the south.

Hurricane season officially runs from June 1st to November 30th. The Gulf Coast is vulnerable to hurricanes because of its proximity to tropical waters and because the warm water of the Atlantic Ocean and the Gulf of Mexico facilitate storm growth. The last hurricane to actually traverse Lake Charles was Hurricane Audrey in 1957. From 1886 through 1997, 71 tropical storms, 34 of which were hurricanes, came within 150 nautical miles of Lake Charles (NWS 1998).

2.8 Dredging History

Calcasieu Estuary has undergone significant engineering modifications centered on creation of the ship channel. These changes were enacted to allow larger barges and ships access to Lake Charles and portions of the river for trade and industrialization. The primary events were the widening of Calcasieu Pass to the Gulf of Mexico in 1871, the construction of the Calcasieu Ship Channel from Lake Charles to the Intracoastal Waterway in 1926, and the construction of the ship channel from Calcasieu Lake to Calcasieu Pass in 1938 (USACE 1976).

In 1946, the ship channel was enlarged to about 10 m deep and 80 m wide. In the 1960s, the ship channel was again enlarged, widened to about 130 m, and bottom depth increased to 15 m (USACE 1976).

In 1970, the western side of the Coon Island Loop (2,300 linear meters) was deepened to 10 m. The channel was widened to 80 m, and the turning basin at the dock area was enlarged to 250 by 330 m (USACE 1976).

Because of channel development, saltwater intrusion into the upper reaches of the estuary became a problem; thus, a saltwater barrier was constructed north of Lake Charles on the Calcasieu River.

2.9 Reference Areas and their Characteristics

Reference Areas Sampled
Willow and Johnsons bayous
Bayou Bois Connine and Grand Bayou
Bayou Choupique

A total of five areas were sampled to represent reference conditions within the Calcasieu River watershed and surrounding environments (Figure 2-7). These areas include Johnsons Bayou, Willow Bayou, Bayou Bois Connine, Grand Bayou, and Bayou Choupique. Willow and Johnsons bayous drain into Sabine Lake while Bayou Bois Coninne and Grand Bayou drain into Calcasieu Lake. All of the reference areas are south of the Intracoastal Waterway, with the exception of Bayou Choupique.

The reference areas represent the bayou energy system. Bayou Bois Coninne and Grand Bayou are similar to Bayou Verdine and Contraband Bayou. While Bayou Choupique and Johnsons Bayou have been dredged by the USACE in the past, they

are the deepest waterways, ranging from approximately 2.5 to 3 m and are comparable to Bayou d'Inde. Salinities vary in the reference areas as they do in the study area, subjected to the same wind forcing, tidal surge and temperature driven density changes. Sediments composition is similar as well. Reference areas were added to the RI to provide "background" bayou areas for comparison. All five of these reference areas are relatively pristine and have been virtually unaffected by industrial activities (Ramelow et al. 1987). The following sections provide a brief overview of area characteristics.

2.9.1 Willow Bayou and Johnsons Bayou

Willow Bayou and Johnsons Bayou are located in Cameron Parish along the southeast edge of Sabine Lake and are within the Sabine National Wildlife Refuge (SNWR) (Figure 2-7). SNWR is a major nursery area for estuarine-dependent marine species (i.e., shrimp, crab, menhaden, redfish, etc.), as well as being the habitat for alligators and other reptiles, mammals, and numerous water, wading, and marsh birds. The area is comprised of marsh meadows and shallow brackish marshes. The dominant plants are Marsh hay and Gulf cordgrass, Three-square, Leafy three-square and Spikerushes. Public use includes recreational boating, fishing, and wildlife observation.

Johnsons Bayou is located 102 km southwest of Lake Charles on LA Highway 82. Willow Bayou is located approximately 0.5 km north of the mouth of Johnsons Bayou and is only accessible by boat via Sabine Lake. Both Willow Bayou and Johnsons Bayou are tributaries to Sabine Lake and discharge into the lake along its southeastern shoreline.

2.9.2 Bayou Bois Connine and Grand Bayou

Bayou Bois Connine and Grand Bayou are located on the southeast side of Calcasieu Lake approximately 48 km south of Lake Charles in Cameron Parish (Figure 2-7). Bayou Bois Connine and Grand Bayou provide habitat for estuarine-dependent marine species (shrimp, crab, menhaden, redfish, etc.), as well as being the habitat for alligators and other reptiles, mammals, and numerous water, wading, and marsh birds. The bayous are in a shallow marsh area, with the dominant plants being [Leafy three-square and Spikerushes]. Public access in these areas is restricted, with some of the property privately owned, but human activities include hunting and wildlife observation.

Bayou Bois Connine and Grand Bayou are tributaries to Calcasieu Lake, emptying into the lake along its eastern shore. Both bayous are joined to the Calcasieu Lake via USACE locks to help prevent saltwater intrusion upstream in the bayou. Access to both Bayou Bois Connine and Grand Bayou is limited to travel by boat, via canals.

2.9.3 Bayou Choupique

Bayou Choupique is located off the Intracoastal Waterway, with the mouth of the bayou between LA Highway 27 and the ship channel (Figure 2-7). The bayou is

mostly dominated by sawgrass vegetation. Land use is predominantly residential. The bayou is the habitat for estuarine-dependent marine species (shrimp, crab, menhaden, redfish, etc.), as well as providing habitat for alligators and other reptiles, mammals, and numerous water, wading, and marsh birds. Public use includes recreational boating, fishing, and wildlife observation.

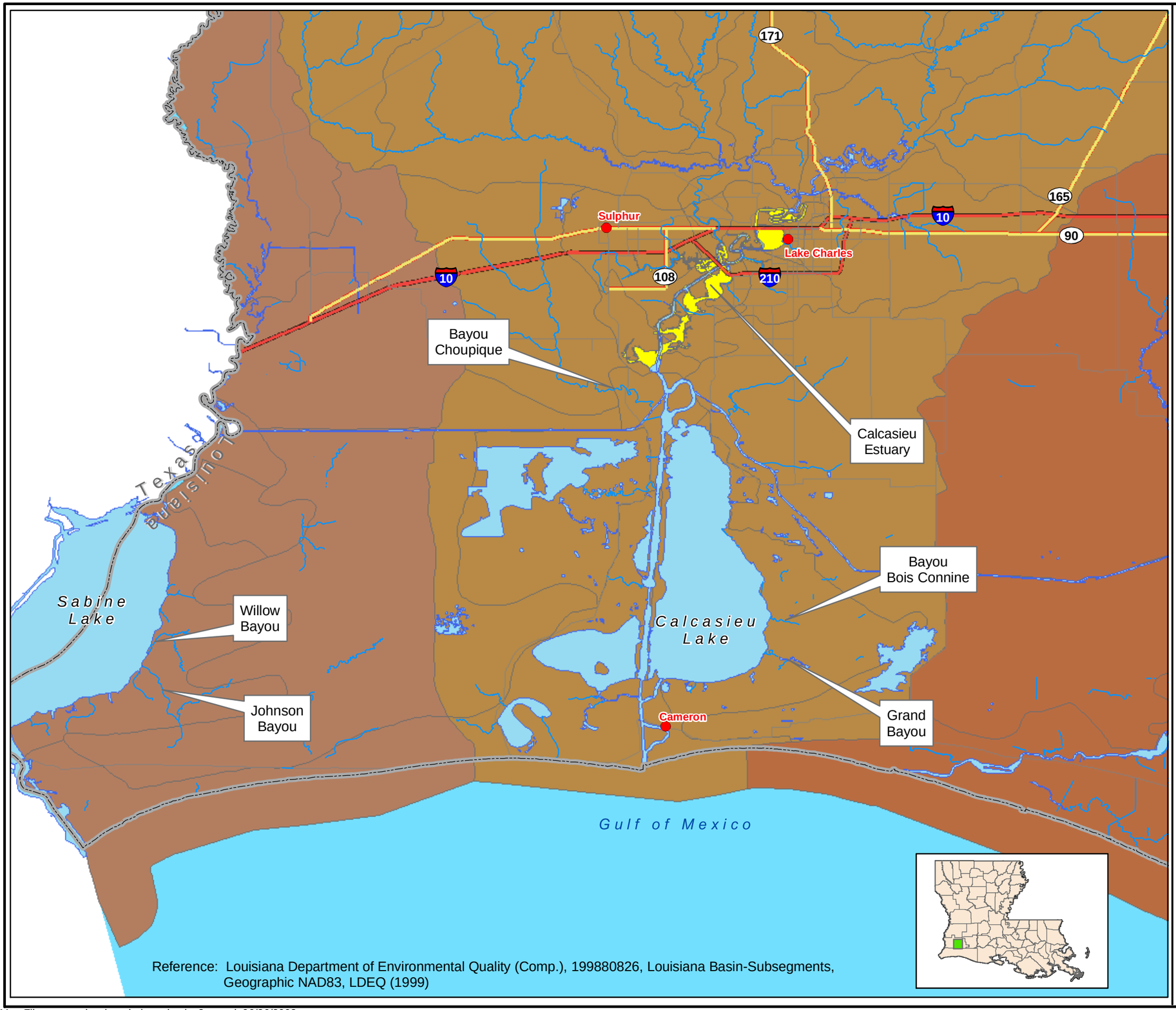
Bayou Choupique was dredged in 1954. Modifications included 4.3 km of channel enlargement, 4 km of diversion channel between the Intracoastal Waterway and river, and construction of the automatic drainage gate in the diversion channel near its mouth to limit saltwater intrusion into the bayou through the diversion channel (USACE 1998).

2.10 Demographics

Calcasieu is one of the 64 parishes (counties) in Louisiana. Calcasieu Parish has a land area of 2,775 km^2 and is part of the Lake Charles Metropolitan Area, with a census 2000 population of 183,577-ranked 7th in the state (U. S. Bureau of the Census 2000). Table 2-2 provides a summary of the local demographics. Other principal cities and towns in the parish include Sulphur, Westlake, and Mossville (Figure 2-8).

The largest employers in 2000 (Table 2-2) were the educational, health, and social services industry, 19.9 percent; the manufacturing industry, 14.9 percent; the retail trade industry, 11.5 percent; the art, entertainment, recreation, accommodation, and food services sector, 11.5 percent; and construction industry, 9.3 percent. Table 2-3 provides a summary of the economic characteristics of Calcasieu Parish.

Figure 2-1
Drainage Basins
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- City
- State Border
- Interstate Highway
- Highway
- Local Roads
- Rivers/Streams
- Calcasieu Estuary
- Water

Drainage Basin

- Calcasieu
- Mermentau
- Sabine

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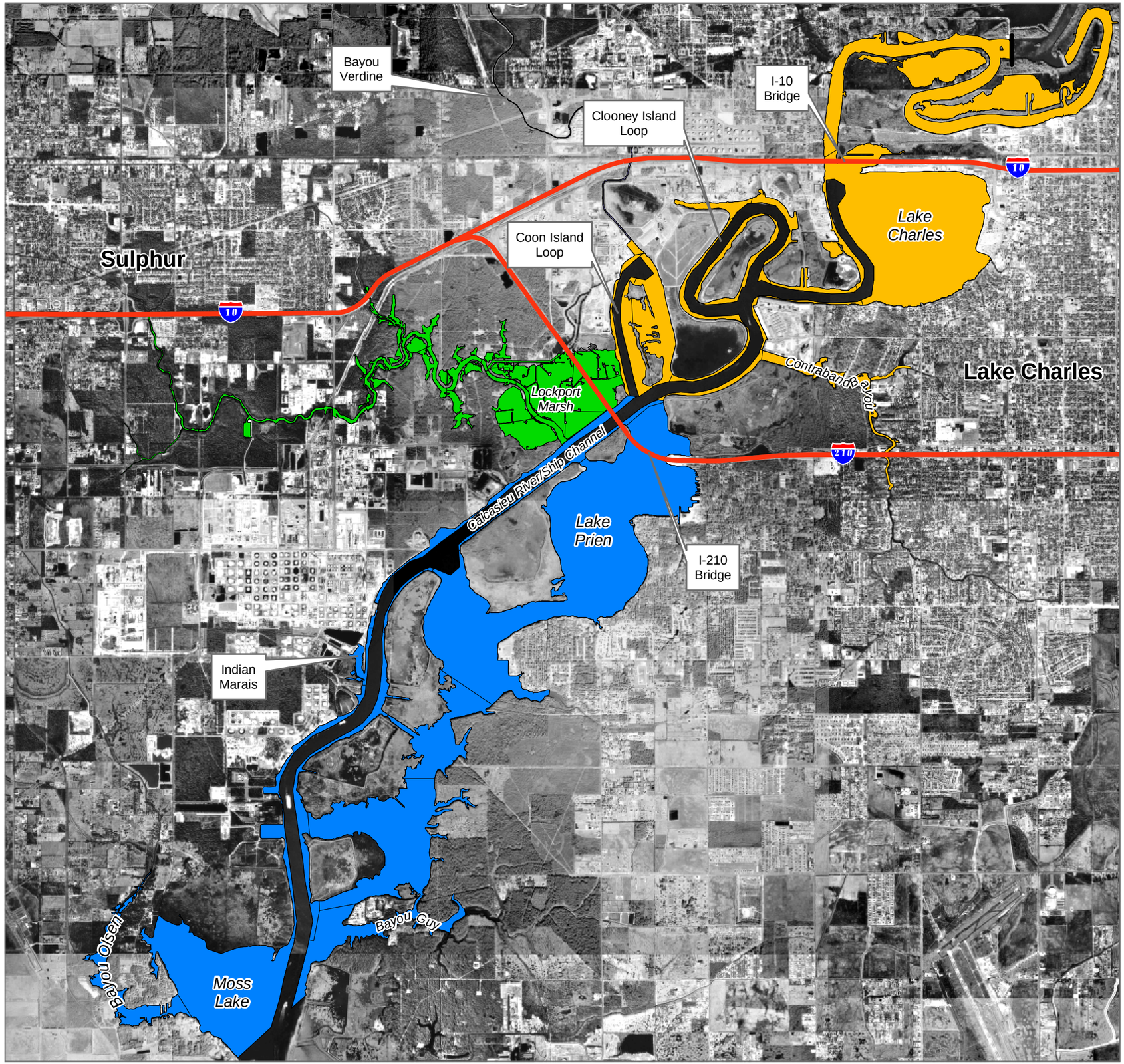
0 2.5 5 10 15 20

CDM

Map Filename: calcasieu_drainagebasins2-x.mxd 06/26/2002

Figure 2-2
Areas of Concern
and
Major Water Features
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

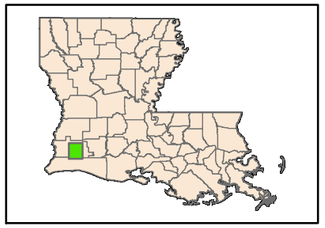


Legend

Interstates

Area of Concern

- Bayou Verdine
- Bayou d'Inde
- Lower Calcasieu
- Upper Calcasieu



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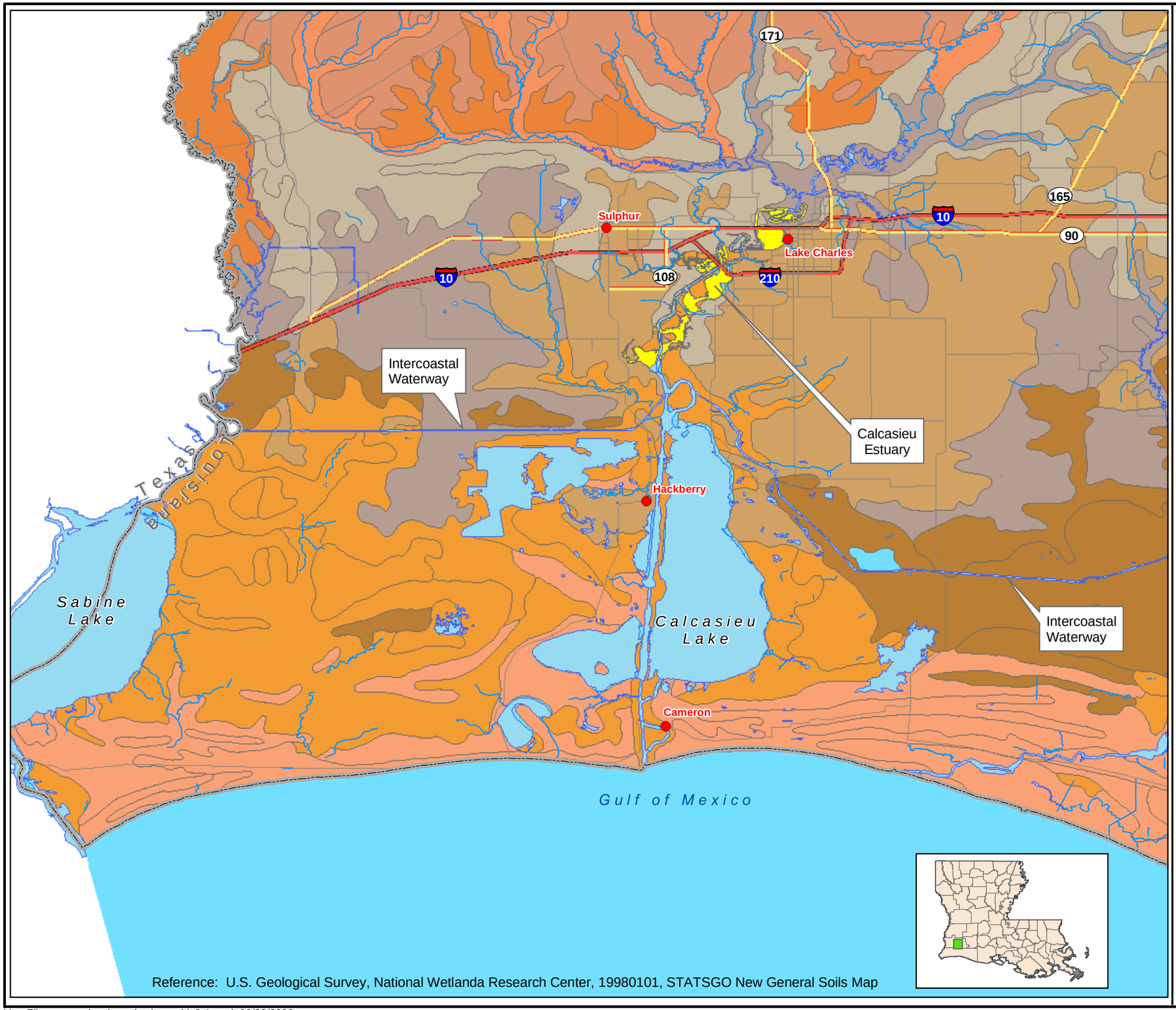
Map Filename: figure2-2AreasofConcern.mxd 03/06/2002

Figure 2-3
Physiographic Features
of
Southwest Louisiana
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- City
- State Border
- Interstate Highway
- Highway
- Local Roads
- Rivers/Streams
- Calcasieu Estuary
- Water

Soil Types

- Gulf Coast Chenier Marsh - Brackish
- Gulf Coast Chenier Marsh - Fresh
- Gulf Coast Chenier Marsh - Saline
- Gulf Coast Prairies - Depressions and Floodplains
- Gulf Coast Prairies - Terraces
- Western Gulf Coast Flatwoods - Floodplains
- Western Gulf Coast Flatwoods - Terraces
- Western Pleistocene Terraces - Floodplains
- Western Pleistocene Terraces - Terraces
- Western Tertiary Uplands - Floodplains

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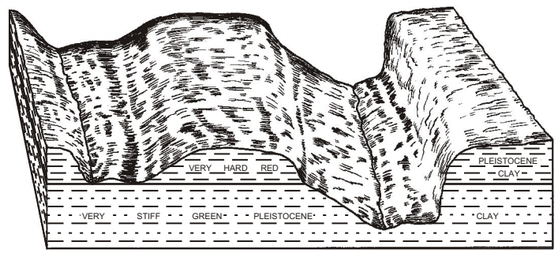
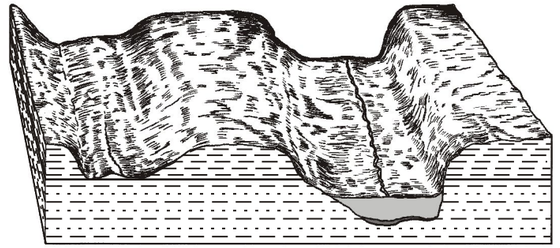
0 2.5 5 10 15 20

Reference: U.S. Geological Survey, National Wetlanda Research Center, 19980101, STATSGO New General Soils Map

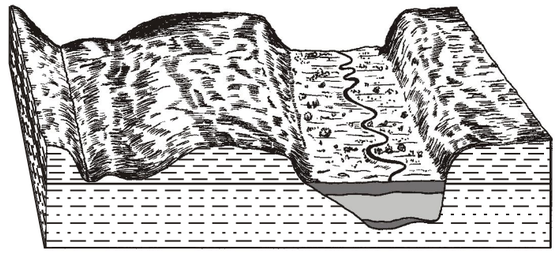
Map Filename: calcasieu_physiographic2-1.mxd 06/26/2002



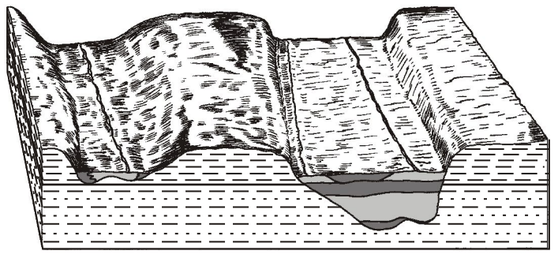
A. Final stage in development of Calcasieu River entrenched valley system during late Pleistocene time. Sea level approximately 450 feet below present level, and shore line about 100 miles seaward of present position.



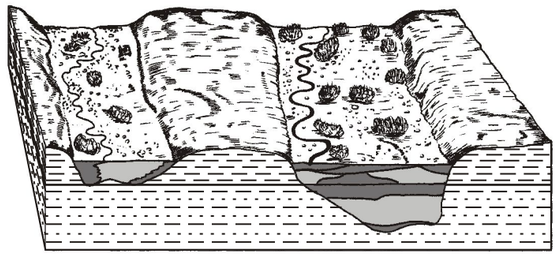
B. Initial Stage of Valley Filling. As sea level was rising during early Recent time, the Calcasieu River was overloaded, braided and carrying coarse sand. Tributary valley entrenching.



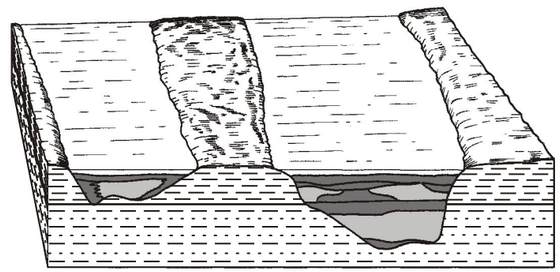
C. Second Stage of Valley Filling. Calcasieu Valley slope greatly reduced, meandering river carrying mostly fine clays. Tributary valley still being entrenched.



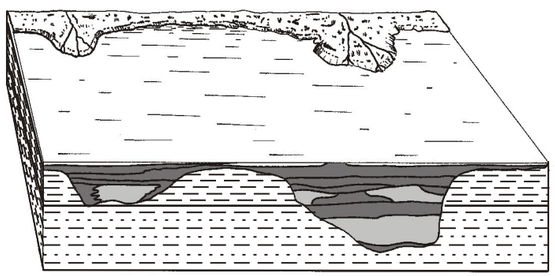
D. Third Stage of Valley Filling. Initial stage of tributary valley filling. Calcasieu River and tributary stream overloaded, braided and carrying sand. Deposition of clays restricted to basins flanking rivers.



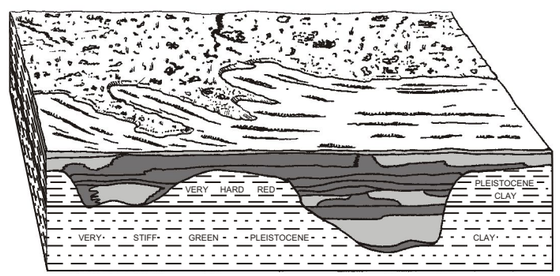
E. Fourth Stage of Valley Filling. Calcasieu River valley slope greatly reduced; deposition of organic-rich clays, formation of peat, etc., in swamp environment.



F. Fifth Stage of Valley Filling. Transgression of sea into Calcasieu Valley and development of Calcasieu Estuary. Deposition of marine clays over swamp deposits in valleys. Divide areas still being eroded.



G. Sixth Stage of Valley Filling. Gradual outbuilding of Calcasieu deltaic plain. Deposition of deltaic sediments in valleys and marine clays over divide areas.



H. Present Stage. Following Stage G, Calcasieu River was diverted to west and deltaic environment was replaced by marine beach and related environments. As sea regressed, series of beach and intervening mud-flat deposits were laid down over older gulf bottom sediments.

Stages in the Development and Alluviation of the Calcasieu River Entrenched Valley System

SAND

CLAYS and SILTY CLAYS

Source Information:
Geology by R.J. Leblanc
Originally Drawn by B.Gray & J.Lawson
Re-illustrated by J.Yeary

Figure 2-4

Calcasieu River Entrenched Valley System

CDM

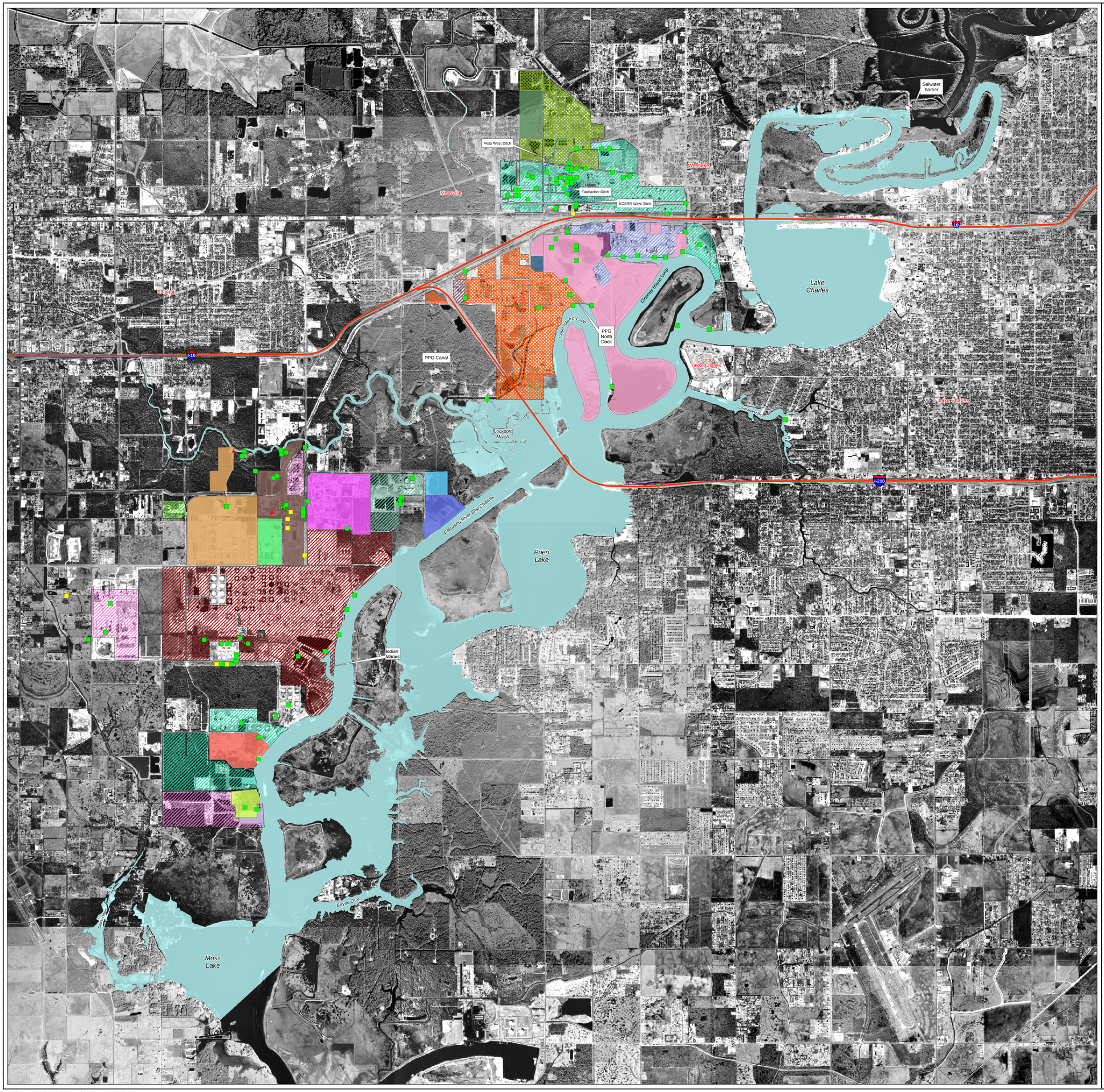


Figure 2-5
Industry and NPDES Locations

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Current and Historical Outfall Locations

NPDES Outfall Status

- Unknown
- Active
- Inactive
- Interstate
- Ditches
- Water

Industrial Area

- Arch Chemical
- Bridgestone Firestone
- Certainteed
- CitCon
- Citgo
- Condea Vista
- Conoco
- Conoco/Citgo
- Entergy
- GA Gulf
- Himont
- LA Pigment
- LC Harbor/terminal
- Lyondell
- Olin
- OxyChem
- PPG
- Tetra
- Venco
- WR Grace
- Westlake

Note: NPDES outfall locations are based on information provided as of 1998. Outfalls may be currently inactive or relocated.

Locations shown are based on coordinates supplied in the permits or information provided by the respective companies. The location represent sampling locations and may not be the point of entry into the surface water body (e.g. Bayou d'Inde, Bayou Verdine, Upper or Lower Calcasieu).

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure2-5calc_industryoutfalls-Esize.mxd 07/02/2002

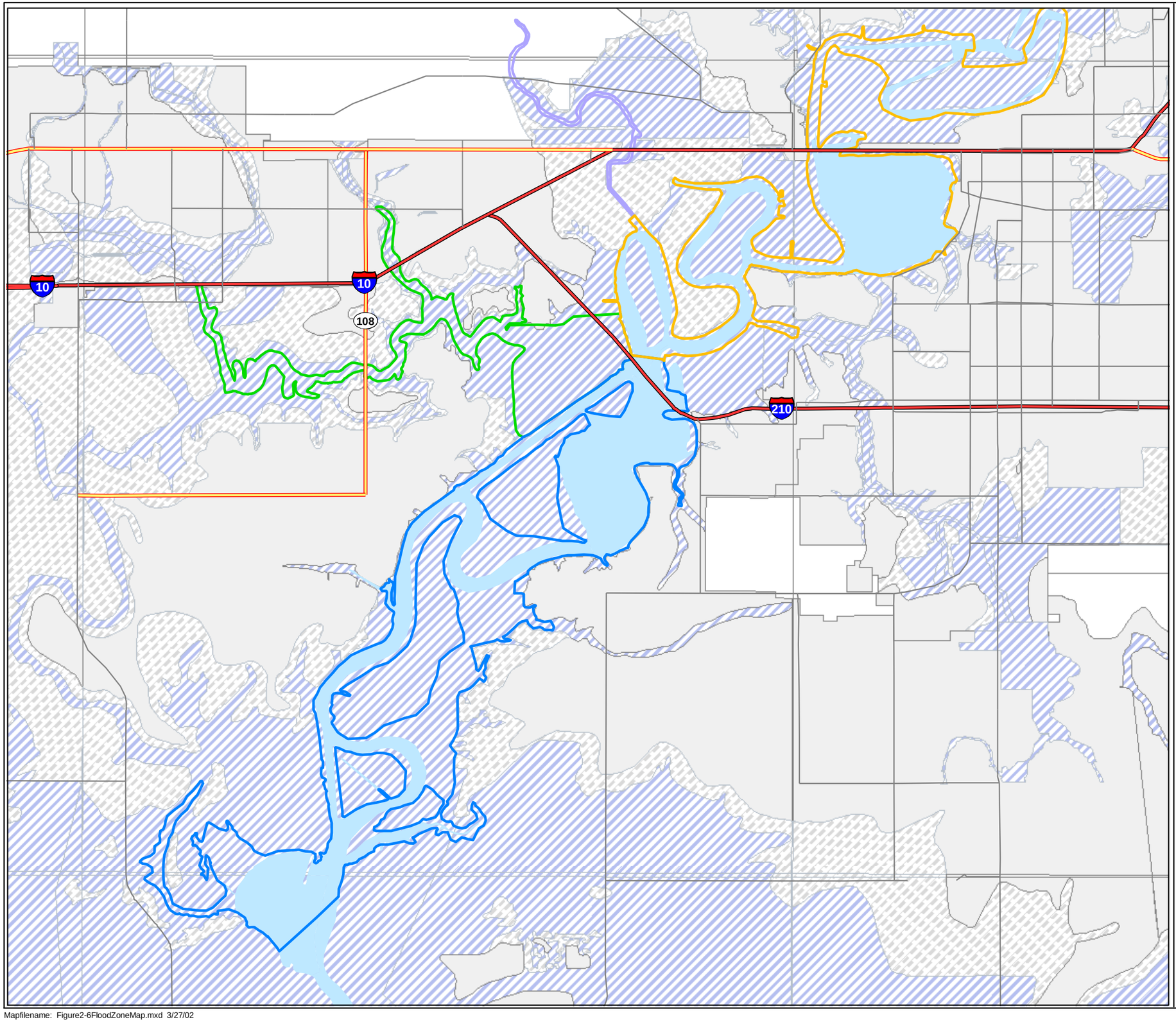

Figure 2-6
FEMA Flood Map
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- State Highway
- Local Roads
- Major Surface Water Feature
- Zone A (100 Year Flood Zone)
- Zone D
- Zone X
- Zone X500 (500 Year Flood Zone)
- Bayou Verdine
- Bayou d'Inde
- Lower Calcasieu
- Upper Calcasieu

Flood Zone data obtained from:
"Atlas: The Louisiana Statewide GIS"
http://atlas.lsu.edu/

Zone A
Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone D
The Zone D designation on NFIP maps is used for areas where there are possible but undetermined flood hazards. In areas designated as Zone D, no analysis of flood hazards has been conducted. Mandatory flood insurance purchase requirements do not apply, but coverage is available. The flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

Zones X and X500
Zones X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

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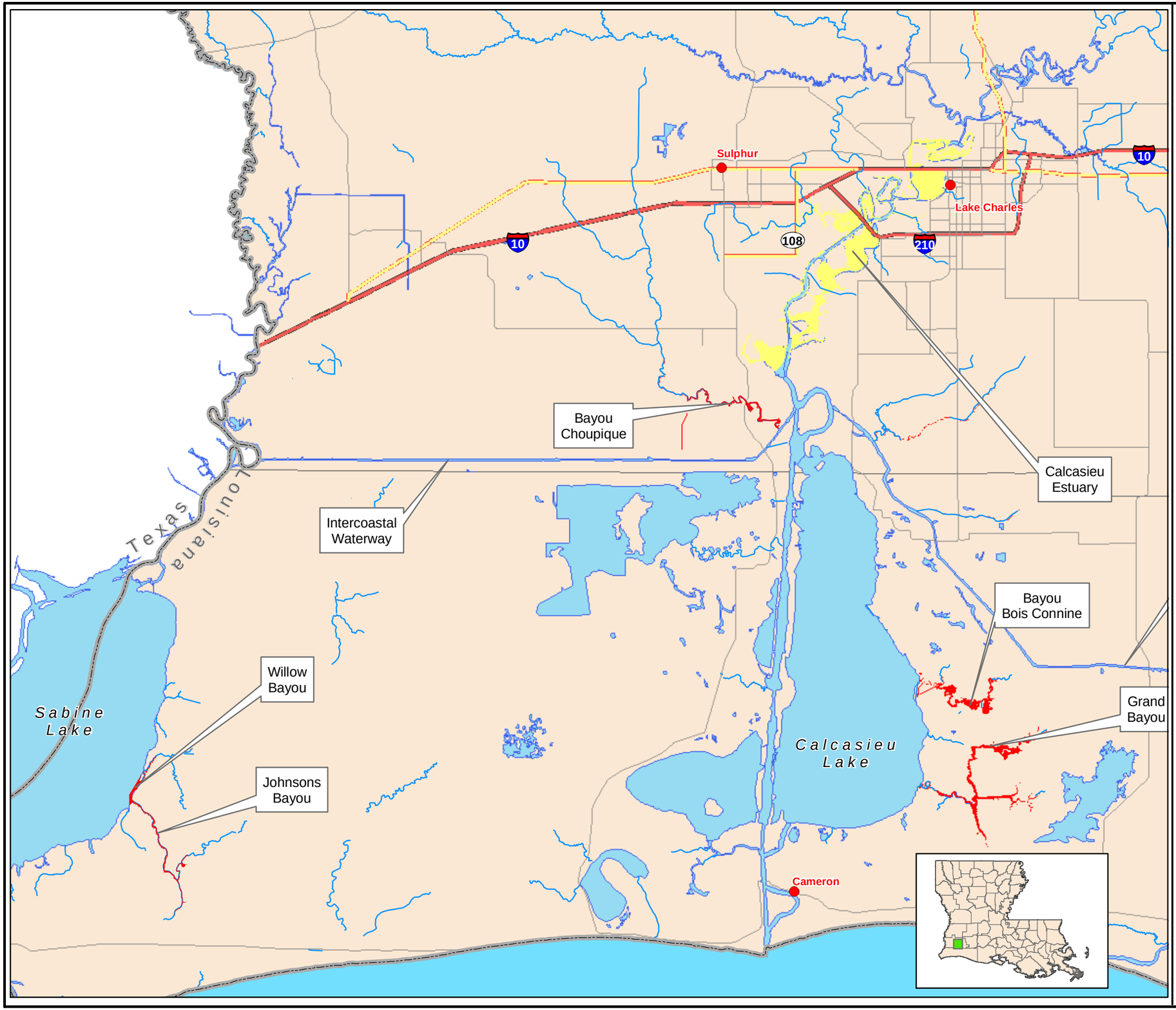
Mapfilename: Figure2-6FloodZoneMap.mxd 3/27/02

Figure 2-7
Calcasieu Estuary RI Reference Areas
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- City
- State Border
- Interstate Highway
- Highway
- Local Roads
- Rivers/Streams
- Water
- Calcasieu Estuary
- Reference Areas

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Kilometers

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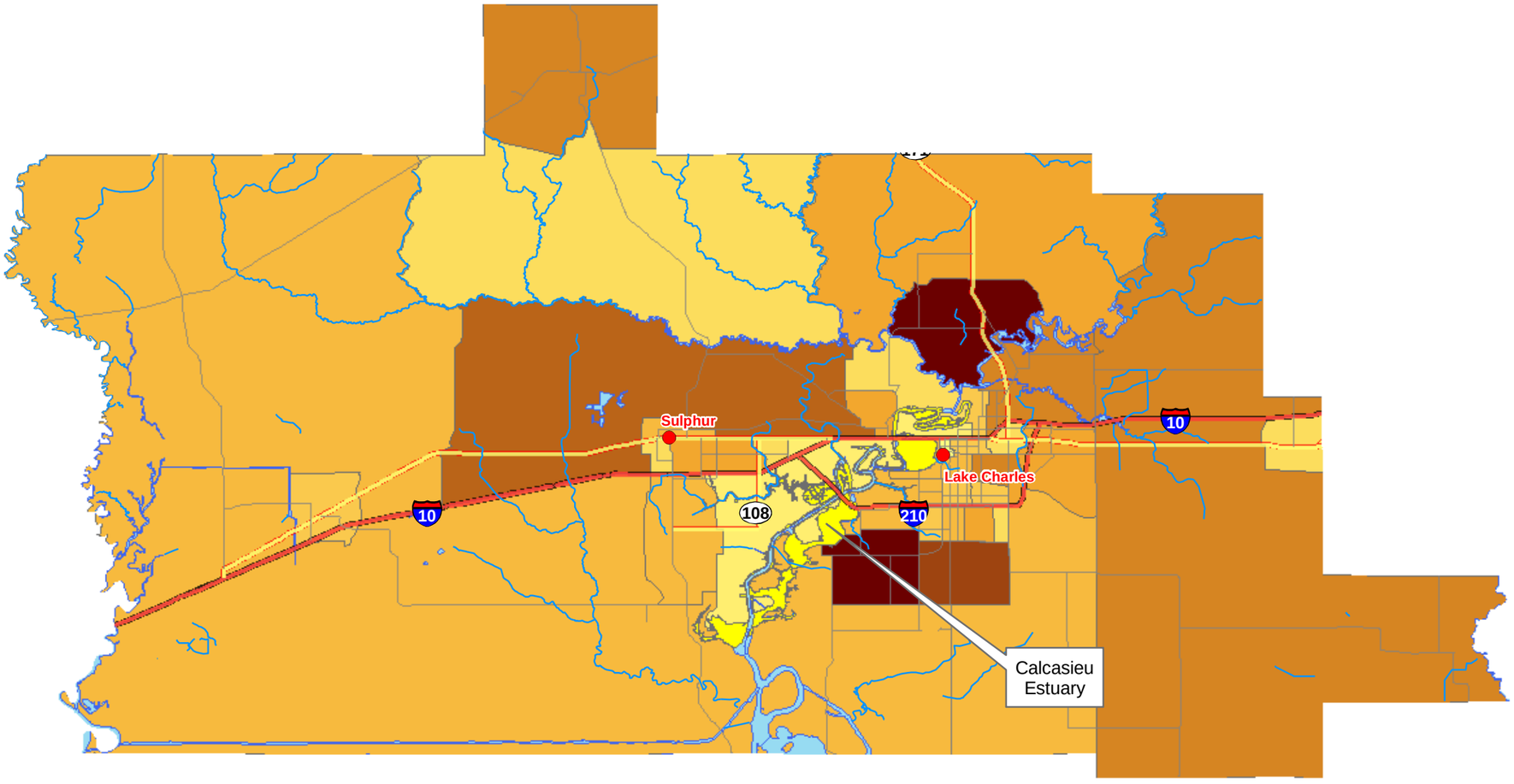
Map Filename: Figure2-7calcasieu_referenceareas.mxd 07/17/02

Figure 2-8
Calcasieu Parish Demographics
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- City
- Interstate Highway
- Highway
- Local Roads
- Rivers/Streams
- Water
- Calcasieu Estuary

Calcasieu Parish 2000 Population

- 0 - 1000
- 1001 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 5000
- 5001 - 6000
- 6001 - 7000
- 7001 - 8000
- 8001 - 9000
- 9001 - 10000
- 10001 - 10500

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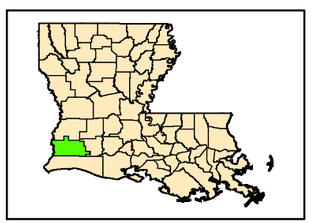
Kilometers

01.53 6 9 12



CDM

Map Filename: Figure2-8calcasieu_population.mxd 07/15/2002

Table 2-1
Summary of Dicharge Data And Permit Limits

Facility	Chemical	Mean Load (pounds/day)	Maxium Load (pounds/day)	Average Permitted Load (pounds/day)	Maximum Permitted Load (pounds/day)
Lyondell NPDES # LA0005347	1,2-dichloroethane	ND	ND	2.24	7.1
	Ammonia	263	514	1,820	4,732
	Anthracene	ND	ND	0.14	0.37
	Benzo(a)anthracene	ND	ND	0.14	0.37
	Benzo(a)pyrene	ND	ND	0.14	0.38
	Chrysene	ND	ND	0.14	0.37
	Copper	2.839	5.489	monitor	monitor
	Flow (mgd)	2.86	3.33	NA	NA
	Nickel	2.12	3.08	9.85	23.1
	Zinc	4.01	9.54	88	176
Citgo Petroleum NPDES # LA0005941	Ammonia	263	656	1,695	3,701
	BOD	874	1,611	NA	NA
	Cadmium	0.0835	0.0835	NA	NA
	Chromium	4.13	5.29	NA	NA
	Chromium VI	0.93	1.17	NA	NA
	Flow (mgd)	11.3	15	NA	NA
	Oil and Grease	422	793	NA	NA
	Phenolics	2.1	4.76	19.6	57
	Sulfide	5.28	11.5	NA	NA
	Total Organic Carbon	3,342	5,132	NA	NA
	Total Suspendid Solids	1,198	2,237	NA	NA
	Zinc	3.63	5.51	13	25.9
Conoco Refinery NPDES # LA0003026	1,2-dichloroethane	0.384	1.24	none	none
	Ammonia	45.5	109	1,152	2,516
	Flow (mgd)	3.86	5.76	NA	NA
	Phenolics	0.307	1.04	13.3	43
	Zinc	14.4	14.8	monitor	monitor
Condea Vista NPDES # LA0003336	1,2-dichloroethane	0.932	4.05	3.18	4.14
	Ammonia	5.42	13.4	41	88
	Flow (mgd)	1.96	2.72	NA	NA
	Zinc	15.9	22.4	79.6	177
PPG Industries NPDES # LA0000761	1,2-dichloroethane	0.98	3.03	monitor	monitor
	Bromoform	8.95	30.9	41	81
	Copper	5.78	14.8	28	73.2
	Flow (mgd)	16.2	18.9	NA	NA
	Hexachlorobenzene	0.00155	0.0162	0.0001	0.00034
	Hexachlorobutadiene	0.0351	0.487	0.0675	0.203
	Mercury	0.0153	0.0492	0.13	0.3
	Nickel	6.25	16.4	17.6	46.1

NA - Not Analyzed (not a pollutant of concern)

ND - No data or not detected and reported as 0

Table 2-1
Summary of Dicharge Data And Permit Limits

Facility	Chemical	Mean Load (pounds/day)	Maxium Load (pounds/day)	Average Permitted Load (pounds/day)	Maximum Permitted Load (pounds/day)
OxyChem NPDES # LA0069850	Flow (mgd)	0.95	1.19	NA	NA
Firestone NPDES # LA0003824	Ammonia	12.6	31.3	92.5	185
	Flow (mgd)	1.27	1.87	NA	NA
Westlake Polymers NPDES # LA0071382	1,2-dichloroethane	ND	ND	0.49	1.57
	Anthracene	ND	ND	0.05	0.13
	Benzo(a)anthracene	ND	ND	0.05	0.13
	Benzo(a)pyrene	ND	ND	0.05	0.13
	Chrysene	ND	ND	0.05	0.13
	Flow (mgd)	0.93	1.24	NA	NA
	Fluoranthene	ND	ND	0.06	0.15
	Hexachlorobenzene	ND	ND	0.00013	0.0003
	Hexachlorobutadiene	ND	ND	0.019	0.043
	Phenanthrene	ND	ND	0.05	0.13
	Phenol	ND	ND	0.05	0.13
	Pyrene	ND	ND	0.05	0.13
	Zinc	0.434	0.571	none	none
Westlake Petrochemicals NPDES # LA0082511	1,2-dichloroethane	ND	ND	0.32	1.01
	Anthracene	ND	ND	0.1	0.28
	Benzo(a)anthracene	ND	ND	0.1	0.28
	Benzo(a)pyrene	ND	ND	0.11	0.29
	Chrysene	ND	ND	0.1	0.28
	Flow (mgd)	0.94	1.23	NA	NA
	Fluoranthene	ND	ND	0.12	0.32
	Fluorene	0.0143	0.136	0.1	0.28
	Hexachlorobenzene	ND	ND	0.005	0.01
	Hexachlorobutadiene	ND	ND	0.1	0.23
	Phenanthrene	0.0325	0.205	0.1	0.28
	Phenol	ND	ND	0.07	0.12
	Zinc	ND	ND	0.12	0.32
Louisiana Pigment NPDES # 0080829	1,2-dichloroethane	0.000109528	ND	monitor	monitor
	Copper	0.0586	0.324	none	6
	Flow (mgd)	1.13	1.48	NA	NA
	Lead	0.154	0.224	none	1.8
	Mercury	0.00145	0.0143	none	0.06
	Nickel	0.495	1.13	none	6
	Zinc	ND	0.838	none	11.9

NA - Not Analyzed (not a pollutant of concern)

ND - No data or not detected and reported as 0

Table 2-2
Calcasieu Parish Demographics Summary

Profile of General Demographics		
Total Population		
	Calcasieu Parish	183,577
	Lake Charles	71,757
	Sulphur	20,512
	Moss Bluff	10,535
	Westlake	4,668
	Dequincy	3,398
	Vinton	3,338
	Iowa	2,663
	Unincorporated	66,706
Sex		
	Male	89,326
	Female	94,251
Age		
	Under 15 years	41,081
	15 to 24 years	28,072
	25 to 54 years	76,925
	55 to 65 years	15,740
	Over 65 years	21,759
Race		
	White	135,107
	Black	44,025
	Native American	616
	Asian	1,172
	Other	754
	Two or more races	1,903

Source: U.S. Census Bureau, Census 2000

Table 2-3
Calcasieu Parish Economics Summary

Profile of Selected Economic Characteristics		
Occupation (16 years old and over)		
	Management, professional and related	21,588
	Service	14,414
	Sales and administrative	20,367
	Farming, fishing and forestry	241
	Construction, extraction, and maintenance	11,020
	Production, transportation, and material moving	11,778
Industry (16 years old and over)		
	Agriculture, forestry, fishing and hunting, and mining	1,668
	Construction	7,418
	Manufacturing	11,822
	Wholesale trade	2,255
	Retail trade	9,142
	Transportation and warehousing, and utilities	3,870
	Information	1,799
	Finance, insurance, real estate, and rental and leasing	3,417
	Professional, scientific, management, administrative, and waste management services	5,325
	Educational, health and social services	15,837
	Arts, entertainment, recreation, accommodation and food services	9,147
	Other services	4,378
	Public administration	3,330

Source: U.S. Census Bureau, Census 2000

Section 3
Site Conceptual Model

A site conceptual model (SCM) discussion presented here is intended to describe the dynamic nature of Calcasieu Estuary. By definition, an estuary is a complex set of interacting systems where change and variability is commonplace. The following sections will identify the primary elements from which to build an understanding of the complex interactions and relationships inherent to the estuarine system. Understanding these components and interactions will assist stakeholders in identifying impacts and potential receptors. The SCM will introduce the dynamic features of a generic estuary followed by a discussion of the features specific to the Calcasieu Estuary.

3.1 Introduction

Calcasieu Estuary is a complex estuarine system, consisting of numerous perennial wetland bayous and tributaries in a heavy industrial setting (Section 2). Surface water and sediment character (salinity, flow energy, sediment grain size, etc.) define the behavior of the estuarine environment.

The SCM is intended to describe the nature of the different environs of the estuary; identify the interrelationships between soil, sediment, surface water, and groundwater impacts to the system; and identify potential ecological and human receptors. Figure 3-1 presents a schematic overview of the estuary systems that exist in Calcasieu. The legend lists elements shown on Figure 3-1. The elements illustrate the site conditions, common activities, historic impacts to the system, and potential receptors.

It should be noted that the figure is intended to present general conditions schematically and does not represent a specific region of the estuary. The SCM provides an overview of the conditions and system dynamics that may control the presence or absence of chemicals throughout the estuary.

3.2 Nature of Calcasieu Estuary

The Calcasieu River is a major tributary in southwestern Louisiana, with its headwaters in Vernon Parish approximately 344 km north of its entry into the Gulf of Mexico. The estuary consists of numerous perennial wetland bayous and other tributaries. Calcasieu River in the area of interest (approximately 54 km from the saltwater barrier to the Gulf) empties into Calcasieu Lake and exits through Calcasieu Pass into the Gulf of Mexico. The history and environmental setting of Calcasieu Estuary are described in Sections 1 and 2.

The term estuary is used to describe, "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage" (Pritchard 1967). Pritchard

defines four types of estuaries based upon physical characteristics and geologic setting: drowned river valley, fjord, bar-built, and tectonic.

Calcasieu Estuary is a drowned river valley system. Pritchard's description of the drowned river valley is "a wide coastal plain; only a portion of the area affected by tides [eg.] is estuarine, based on salinity diluted by freshwater"(Pritchard 1967). This description is valid for Calcasieu as tidal activity, although minor, is sometimes experienced well into the upper portions of the estuary where salinity ranges from 1 to 10 parts per thousand (ppt).

Estuaries may be further defined based on salinity of the system (Chapman 2001). Classification is based upon the relationship between fresh and saltwater. There are effectively three types of estuaries based on salinity regime: salt-wedge, partially mixed systems, and vertically homogeneous (Chapman 2001).

Salt Wedge Estuaries

Salt-wedge estuaries are characterized by a freshwater/saltwater interface located near the mouth of the estuary. The saltwater is in the form of a wedge, with low salinity water located on top of and upgradient of the saltwater.

Salt-wedge estuaries are characterized by a large river flow compared to the tidal flow. The wedge forms when the freshwater flows seaward and encounters the denser seawater. The freshwater flows on top of the denser saltwater. The freshwater/saltwater interface is simultaneously pushed seaward due to shear in the fluid flow. When the shear reaches a critical threshold, waves form and break on the interface, and a thin layer of saltwater is mixed with the overlying freshwater. The process is termed "entrainment". A compensating landward flow occurs within the upper surface of the salt wedge. With the exception of the upper surface of the wedge, the salinity is nearly constant within the wedge. During flood tide, the salt wedge flows landward while the low salinity surface water continues to flow seaward. During ebb tide, the flow within the wedge can be reversed and flow seaward. Temperature appears to have an influence in development of the salt-wedge salinity regime, adding to the density stratification of the water column (Duke 1985). Salt-wedge estuaries tend to be narrow, which has the effect of decreasing the tidal prism (or total volume of water introduced by the tide) for a given tidal range compared to a wide estuary.

Partially Mixed Estuaries

Partially mixed estuaries have a greater tidal influence (compared to river influence) than highly stratified estuaries. The tidal influence causes the water within the estuary to oscillate, which has the effect of introducing a large amount of energy into the system. The energy is dissipated within the estuary by working against frictional forces on the bottom. The resulting turbulence works against the density gradients, producing partial mixing. Saltwater eddies mix with the overlying freshwater, which adds to the volume of the surface water, resulting in an enhanced seaward flow

within the upper waters. The volume of water lost from the lower layer is compensated by landward flow of seawater. The result is a characteristic flow pattern within partially mixed estuaries.

In partially mixed estuaries with the appropriate depth and width, the tides can enter the mouth, propagate up the estuary, and reflect from the upstream end, either interfering with or amplifying the incoming waves. The tidal patterns can influence the flow velocities and can be used to explain turbidity maxima and deposition patterns within the estuary (Dyer 1972).

Vertically Homogeneous Estuaries

Vertically homogenous estuaries are characterized by very strong tidal influences compared to river flow and a high width to depth ratio. Like the partially mixed estuary, the tidal energy is dissipated by friction with the bottom. However, in the vertically homogenous estuary, a greater proportion of the bottom is in contact with the water (due to the high width to depth ratio), resulting in greater turbulence and more thorough mixing.

Salinity Fluctuations in Calcasieu Estuary

Salinity also fluctuates seasonally. On average, salinity freshens during winter and spring months, driven by increased groundwater recharge, wind forcing, precipitation, and decreased tidal surge. The bayous tend to be gaining streams, with groundwater discharge to the bayous from the saturated 10-foot, 20-foot, and 30-foot sands. The groundwater inflow, combined with the effect of offshore winds, tends to freshen the bayous.

As these conditions decrease or reverse by April or May, salinity increases, generally peaking around June or July. Salinity is generally higher during summer months due to tidal flooding associated with the cyclone season. Saltwater brought landward during flood tide is thought to become trapped in the system and slowly bleed out over subsequent ebb tides. Tidal flooding effects tend to predominate over precipitation.

The Calcasieu Ship Channel alters the salinity regime of the estuary by providing a greater avenue for saltwater intrusion. The effect can be noted in the salinity increases and the changes in vegetation present in the marshes throughout the estuary (LDNR 2002).

Surface water salinity measurements from various studies indicate that the Calcasieu Estuary system varies vertically, laterally, and spatially as noted in Figure 3-2, becoming fresh in the upstream segments of the bayous and approaching 20 ppt salinity in Moss Lake. The vertical component, however, is variable; it ranges from salt wedge to homogeneous, and varies notably with each season. RI sampling indicated a homogeneous salinity regime; this is in contrast to mid summer investigations which observed a salt-wedge regime (Duke 1985).

Calcasieu Estuary is a major hatchery; however, from 1948 through 1969, the estuary underwent significant habitat change (salinity increases and vegetation loss). The changes were the result of combined events. Hurricane Audrey, common oilfield drilling practices, a series of droughts, and nutria herbivory all attributed to the habitat changes noted in the early 1960s. Various habitat shifts have been noted for 1949, 1968, 1978, 1988, and 1997 using digital versions of coastal vegetation maps (Chabreck 1972; LDNR 2002). The greatest shift was noted from 1949 to 1960. Habitat shifts from intermediate to brackish and back to intermediate within Calcasieu marshes indicate the system is dynamic and sensitive to change.

Flow Rates

The three main types of estuaries can be described by the water balance, flow and salinity patterns, and the width to depth ratio of the cross section. However, a quantitative method for classifying an estuary based on stratification has been developed (Simmons 1955) by use of a parameter called the flow ratio. The flow ratio is simply the river flow per tidal cycle divided by the tidal prism. Simmons defined a highly stratified estuary as having a flow ratio greater than or equal to 1.0, a partially mixed estuary as having a flow ratio approximately equal to 0.25, and a vertically homogeneous estuary as having a flow ratio less than 0.1. While the quantitative classification is useful, it should not be used blindly without considering the other characteristics of the different estuary types. Exhibit 3-1 summarizes the criteria used to define each type.

Exhibit 3-1 Characteristics of Estuary Type[1]

Parameter	Highly Stratified Salt Wedge	Partially Mixed	Vertically Homogeneous Laterally Homogeneous
Flow Ratio	≥ 1.0	≈ 0.25	< 0.10
River Flow	High	Low-Intermediate	Low
Tidal Prism	Low	Intermediate-High	High
Width/Depth	Low	Intermediate	Intermediate
Depth	Shallow	Shallow-Intermediate	Shallow
Circulation Type	Seaward above interface Landward below interface	Seaward (surface) Landward (deep)	Seaward
Energy	Low	Intermediate	Intermediate - High

1. Characteristics are based on Pritchard (1955).

Based on published information, the Calcasieu Estuary is classified as vertically homogeneous. The influence of strong winds, tidal energy, and the overall shallow depth (about 2 m with the exception of the ship channel) result in a relatively high-energy environment and vertical mixing. The flow of the Calcasieu River is also generally low (~30 cubic meters per second [m^3/sec.] Lee et al. 1990) while the tidal prism is large (3.91 x 10^7 m^3 [Lee 1990]). The flow ratio is calculated to be 0.03 (30 m^3/sec./[3.91 x 10^7 m^3/44,760 sec.] = 0.03 unitless). The flow ratio, along with the estuary characteristics, strongly indicates a vertically mixed estuary (see Exhibit 3-1).

However, in the early summer, the river flow can reach 300 to 400 m^3/sec., resulting in a flow ratio of 0.46, which is intermediate between partially mixed and highly stratified. This corresponds to observations by Duke in the summer of 1985 and the RI observations during the winter of 1999 and 2000.

In estuaries where the ratio of river flow to tidal flow changes seasonally, the estuary type can change from one time of the year to the next. For example, Calcasieu Estuary tends to become highly stratified in early summer due to a general reduction in precipitation and increase in water temperature that amplifies the water density effects, increasing salinity stratification.

Estuary type can also change from one portion of an estuary to another. For example, a partially mixed salinity profile near the mouth may give way to a salt-wedge structure toward the head of the estuary where tidal forces are less pronounced. Constrictions such as bridge abutments can also change the stratification patterns by forcing a given tidal flow through a smaller cross sectional area, which results in a greater flow velocity and degree of turbulence and mixing. Conversely, widening of the estuary can cause the degree of stratification to increase due to a decrease in the flow velocity; this effect is notable as the bayous enter the ship channel.

Wind forcing can affect estuary stratification and circulation patterns by enhancing or restricting surface water flows. The effect can be pronounced within shallow estuaries where the surface water makes up a greater fraction of the total volume of the estuary. Geyer (1997) studied wind effects on two shallow estuaries in Cape Cod and found that during offshore wind events the outward flow to the sea was enhanced and that the overall salinity of the estuary decreased as a result. Onshore winds resulted in an increased salinity. The effects of wind were less in areas with constrictions, which was evidenced by strong salinity fronts in these areas.

3.3 Energy System Classification

The nature of Calcasieu Estuary is best described by total energy. Specific regions of the estuary have been grouped into one of five energy system classes, including bayous, marshes, shallow lakes, shipping channels, and river (Figure 3-3). One small area that does not fit these broad energy system descriptions has been categorized as "other". The energy of a specific area will influence surface water variability and sediment nature and stability. Each system influences the nature and behavior of surface water and sediment differently.

Depositional environment, surface water conditions, and stability of the sediment can be used to group the energy regimes observed in the estuary and to describe the behavior of the system as a whole. Sediment stability was not measured directly but is inferred by total suspended solids (TSS), grain-size, relative surface water flow, and geometry. An overview of the characteristics and a description of the physical parameters of each of the energy systems are provided below. Detailed discussion of the physical parameters associated with each of the specific areas will be provided in Sections 7 through 10.

3.3.1 Bayou

The bayou is the natural tributary portion of the estuary (Figure 3-1; Item 1). The bayous of interest in this RI may contain fresh to intermediate salinity water and may flow into or through higher salinity marshes prior to connecting with a larger body of water (e.g., the ship channel, shallow lake, or river). In the undisturbed setting, each has similar flow and geometry characteristics. In the current industrialized setting, the primary bayous: Bayou Verdine, Contraband Bayou, Bayou d'Inde, Bayou Olsen, and Bayou Guy are receiving waters for NPDES industrial or municipal outfalls (Figure 3-1; Item 5). Some of the bayous receive run-off from rice or soybean fields or urban neighborhoods (Figure 3-1; Item 14). The bayou drainage basins are host to various industrial, municipal, and agricultural developments.

The upper reaches of Bayou Verdine and Bayou d'Inde (upstream of LA Hwy-108) are areas not heavily impacted by industrial development. These areas are typically steep sided, vegetated, supporting fresh to intermediate habitat, shallow tributaries (water column generally less than 3 m thick), with thick layers of soft, clayey silt sediments. The bayous are not dredged for ship traffic, and they receive the majority of their surface water input from natural sources (e.g., surface run-off and groundwater discharge). The upper reaches of the bayous and interior marshes provide extensive nursery habitat for estuarine-dependent species such as blue crabs, grass shrimp, black drum, striped bass, mullet, and killifish. Historically, the bayous are sediment transporters.

Data specific to the southern reach of Bayou Verdine has an estimated average flow of 8 cfs (Curry et al 1997). NPDES outfall flow data are also available and offer partial information on inflow to portions of the estuary. A summary of NPDES outfall data is available in Sections 7 through 10, depending upon the location of the outfall.

The areas are influenced by tidal changes. The tidal cycles have an important influence on sediment transport and deposition. During ebb tides, sediment is suspended and carried seaward while during flood tides sediments are suspended and carried landward. Marine sediments can be carried into the estuary and mixed with land-derived sediments during the flood tide. The degree of tidal influence is relatively small when compared to wind forcing or storm events. Tidal range in the bayous is generally less than 6 inches from high to low tide (USACE 1976). Flow velocities and flow direction are reported for the ship channel; values are not available for the individual bayous.

Lateral gradients in salinity (upstream to downstream) are observed, ranging from 0.1 to 3.3 ppt; however, vertical stratification (a salt-wedge regime) has not been reported in the upper portions of the bayou as was noted in the ship channel. Upper bayou salinity was found to be vertically homogeneous during the winters of 1999 and 2000.

Surface water flow rates are not available in Bayou Verdine or Bayou d'Inde; the nearest gage is at the saltwater barrier in the ship channel. The long-term annual mean measured at the saltwater barrier (Figure 3-1; Item 15) is 2600 cfs (USACE,

1976). Seasonal lows were reported for April and averaged 147 cfs up to a high in December of 3,100 cfs (Duke 1985). Flow within the bayous is significantly lower.

The sediment typically consists of undisturbed, fine-grained silt and clay sediments in the upper reaches, becoming coarse in the lower portions. Sediment thickness ranges from 11 to 19.5 feet thick in lower Bayou d'Inde (Fluor Daniel, Inc. 1997); this is probably typical of the bayous given the source of sediment is terrestrial in origin (Duke 1985). Dredging does not occur in these areas, and channel geometry is un-altered. Sediment deposition is from overland soil erosion. LDNR has estimated total solids loading rates for various segments of the entire Calcasieu River drainage basin (Plummer and Associates 1984). The rate is estimated at 6.1 million pounds of total solids per inch of rainfall (for the portion of the Calcasieu River from the saltwater barrier to the northern inlet of Calcasieu Lake). Sediment dating indicates that sedimentation rates are constant (Mueller 1987). Areas with narrowed openings, such as areas where bridge abutments force the tides through a smaller cross sectional area, also tend to amplify tidal surge.

Sediment movement occurs with each change in tide; however, scouring is most prevalent during major storms. Strong winds and/or tide significantly alter water levels, turbidity, and salinity.

Numerous major rain events occur each year in the area (Figure 3-1; Item 6), and the net effect is a general increase in sediment loading due to flooding of tilled farmland, predominantly rice and soybean fields (Plummer and Associates 1984). Industrial storm run-off from areas associated with spills or material storage may be a possible source to some bayous.

3.3.2 Shallow Lakes

Lake Charles, Prien Lake, and Moss Lake are each members of the shallow lake energy system (Figure 3-1; Item 3). They are each connected to the Calcasieu River Ship Channel, receiving water from the channel, but having limited flow and/or circulation energy. They are shallow by nature, ranging from a 3- to 30- m water column.

The geometry of these lakes is similar; however, salinity and inflow sources vary. Lake Charles is the most upgradient and largest of the three lakes. Lake Charles has the lowest salinity, and a portion of the lake is dredged to support boat traffic on the western side of the lake. Prien Lake salinity is low to moderate; its sediments are thick and silty, with well-established vegetation, marginal marsh edges, and a shallow sloping bank. The ship channel and a municipal POTW outfall feed the lake. Prien Lake receives direct inflow from the mouth of Bayou d'Inde across the Calcasieu River Ship Channel, as indicated in recent USGS rhodamine dye tests.

Moss Lake is also shallow, but salinity tends to be the highest, measured at a maximum of 20 ppt during the RI. The ship channel and Bayou Olsen feed the lake. Moss Lake sediment contains a higher percentage of sand, possibly indicating that it

receives more marine sediment than Prien Lake or the bayous. Vegetation is also marginal to brackish in nature. The land area adjacent to the each of the lakes varies in the degree of development, industrial or otherwise. Input from adjacent sources has an impact on sediment and water chemical characteristics.

The degree of influence imparted by tides varies across the lakes, Moss Lake flow being the most impacted by tides; the mean range is about 4 m. Prien Lake and Lake Charles experience about 6 inches fluctuation each day (Duke 1985). Each of the lakes is influenced by wind; predominant northerly winds during winter can significantly lower water levels in Prien and Moss Lakes. Tides affect salinity within the lakes, increasing during flood tide. Wind effects on salinity are less in Prien Lake given the smaller cross section open to the ship channel. None of the lakes showed salt-wedge salinity stratification in the RI although stratification was noted in both Moss Lake and Prien Lake by Duke in 1985.

The lakes are sediment sinks, receiving bodies for both marine and fluvial sediments. Sediment deposition rates are not available but are estimated to be among the highest in the estuary. This is magnified by the fact that transport out of these shallow lakes is typically limited. Moss Lake tends to have the greatest degree of circulation or flushing and likewise the lowest sediment retention. Sediment sorting (well-sorted sediments) tend to be an indicator of a greater degree of flushing or circulation.

3.3.3 Estuarine Marsh

Marshes within Calcasieu Estuary are shallow, partially inundated, inland swamps (Figure 3-1; Item 2). They tend to vary in salinity, ranging from brackish to fresh. Marshes are defined as sediment sinks, having shallow depth, thick sediment layer, vegetation and aquatic habitat with limited water circulation. Conditions are often reducing and anoxic. Lockport Marsh is the most familiar; however, marshes are identified along Prien Lake, Coon Island Loop, at the mouth of Maple Fork along Bayou d'Inde, and the old river above Clooney Island.

Marshes are affected by tides; overall daily effect ranges from 6 to 12 inches. The most significant effect is on salinity and water level within the marshes. Ebb tides, combined with offshore winds during winter, lower the water surface 1 to 2 feet effectively dewatering shallow marshes (USFWS 1957). These conditions were observed during the RI.

Salinity varies across the various marshes; the mouth of Maple Fork (as it enters Bayou d'Inde) and the two marshes located on the old river are considered fresh to intermediate salinity marshes. Prien Lake marshes and Lockport Marsh tend to be intermediate to brackish salinity bodies and are susceptible to storm surge flooding. The areas were noted as requiring several months to drain saline floodwater infused by Hurricane Audrey (Morgan et al 1958).

Lockport Marsh, located in lower Bayou d'Inde, is an intermediate to saline marsh. Petroleum drilling and production in the estuary has impacted Lockport Marsh with

levee and road building activities that create shallow embayments, further limiting flow (Figure 3-1; Item 16). Oil field production water (typically brackish and containing petroleum byproducts) is often discharged directly to the marsh.

Lockport Marsh is connected to Bayou d'Inde and the ship channel through several small openings in the levees; however, the size of the openings limits circulation. During high rainfall events, the levees are inundated, with the marsh receiving flow from Bayou d'Inde, the ship channel and the PPG Canal. The flow rate within Lockport Marsh is low, which is typical of each of the marsh areas.

Physical parameters for sediment within the marshes indicate that the sediment is generally anoxic and organic rich. The sediment is also very fine grained, in the clay to silty clay range, with generally higher total organic carbon (TOC) values and reducing conditions due to decomposition of organic detritus. The marshes generally provide excellent habitat for clams and blue crabs.

3.3.4 Ship Channel

The ship channel is that portion of the estuary that has had significant modification to the natural geometry of the drainage (Figure 3-1; Item 4). This group includes the Calcasieu Ship Channel from Lake Charles to the Gulf, the Coon Island Loop turning basin, and Clooney Island Loop. The ship channel has been expanded such that it is 40 times larger than when first dredged in the late 1800s. The effect of dredging is significant on the estuary in three principal ways: channeling of saltwater into a formerly low-salinity estuary, increased drainage of riverine inflow when tide ebbs, and increased tidal amplitude within the estuary (LDNR 2002).

Tidal fluctuation tends to range from 30 to 60 centimeters (cm) per day. Storm surge tides can range up to 2 m, as noted at the saltwater barrier during Hurricane Audrey in 1957 (Morgan et al 1958).

The salinity regime in the ship channel varies from vertically homogenous to salt wedge. During the RI, conditions were generally low-water conditions, and the ship channel salinity was homogenous, but readings from summer months in previous studies indicate a distinct salt-wedge regime (Duke 1985).

Dredged sections of the estuary are routinely maintained to meet design characteristics. Maintenance schedules vary depending upon the reach and the uses of the area, but they currently run on a 2- to 4-year cycle. The 40 to 45 km segment was last dredged in 2001. The areas of interest to this RI are Clooney Island Loop, Coon Island Loop, and the Calcasieu Ship Channel from Lake Charles to the southern end of Moss Lake (Figure 2-2).

The geometry of these sections has changed over time; the channel has been widened and deepened from 40 m to 75 m wide, and from 10 m to 15 m deep. A bank-edge ledge has been maintained and is typically 6 m to 12 m wide and under about 0.6 m to 3 m of water. The shallow ledge tends to be a settling point for sediments throughout

the ship channel and is considered representative of settle-able sediment in these areas. This ledge was the area sampled during the RI. Historically, samples were collected from the bottom of the ship channel; however, dredging removes this sediment on average every 4 years.

Given the extent of the ship channel and the spatial distribution of the areas of interest throughout the estuary, natural and anthropogenic variations in water chemistry exist. Salinity, temperature, pH, TSS, dissolved oxygen content, sediment grain size, and oxidation-reduction potential (ORP) vary in the dredged portions of the channel when compared to nearby un-modified areas.

Sediment stability is a function of sediment characteristics, water energy, and salinity. Flow direction within the estuary is governed by various conditions; tide is the primary influence, followed by wind forcing and flood tide surge. Surface water flow rates vary widely across the estuary; reported values ranged from 300 to 65,000 cfs above tidewater (USFWS 1957). During non-storm periods, the upstream and downstream flows are roughly equivalent in magnitude and balanced in duration. Flow direction is governed by tide. Exhibit 3-2 provides a snapshot of flow characteristics during a non-storm day, as measured in the main ship channel at the I-10 Bridge.

Exhibit 3-2 Calcasieu River Ship Channel Surface Water Flow Rates at the I-10 Bridge

Date and Time Measured	Surface Water Flow Rate (cfs)	Date and Time Measured	Surface Water Flow Rate (cfs)
June 18 0522 hrs	+9098	June 18 1708 hrs	+1458
June 18 0700 hrs	+12163	June 18 1800 hrs	+4650
June 18 0800 hrs	+10623	June 18 1915 hrs	+5042
June 18 0910 hrs	+4515	June 18 2000 hrs	+4853
June 18 0955 hrs	-2737	June 18 2130 hrs	+7550
June 18 1100 hrs	-2712	June 18 2210 hrs	+5387
June 18 1203 hrs	-2882	June 18 2300 hrs	+4692
June 18 1321 hrs	-2808	June 19 0056 hrs	+8019
June 18 1509 hrs	-196	June 19 0300 hrs	+3537
June 18 1630 hrs	+831	June 19 0525 hrs	+12287

Note: (+) indicates downstream flow, (-) indicates upstream flow. Taken from Duke 1985.

Sediment is transported by each of the tributaries and eventually deposited into the ship channel. Sediment that accumulates within the channel tends to be larger grained material, silts, and sands. Ship channel sediments are generally moderately to well sorted. Tidal cycles have an important influence on sediment transport and deposition; during ebb tides, sediment is suspended and carried seaward while during flood tides sediments are suspended and carried landward.

The channel receives and transports significant amounts of sediment based upon the maintenance dredging records. Alteration of the channel banks and subsequent sloughing to the channel may artificially increase the apparent sedimentation rate, and so examination of the USACE dredging information, provided in Table 3-1, in the tables section at the end of this report, should be carefully considered.

An empirically derived sedimentation rate for the smaller ship channel in middle Bayou d'Inde, near the PPG Canal (Mueller 1987), was calculated at 0.74 cm/year or 0.29 inches/year. The rate was calculated using two radioisotope dating methods, ^{137}Cs and ^{210}Pb, with good correlation.

3.3.5 River

The upstream sections of the estuary above Lake Charles are considered the old river (Figure 3-1; Item 21). This energy system differs from the ship channel and bayous in its geometry and total flow. The river tends to be wider and deeper than the bayous, with a higher flow rate. This section of the estuary provides fresh to intermediate salinity conditions for aquatic vegetation and biota.

Tidal influence is minor, typically less than 0.3 m fluctuation per day. Sediment accumulates in the natural bends of the river, with equal percentages of sand, silt, and clay in the channel and predominately silt on the channel margins. Flow rates are not available for the area; nearest measurements are from the ship channel at the I-10 Bridge. The area is susceptible to tidal surge, the effects of wind forcing, and flood tide.

3.3.6 Other

Indian Marais Lagoon is a confined shallow embayment, receiving limited inflow. The lagoon is connected to the ship channel through a pier or levee along most of its length. During low flow, this levee serves as a barrier; however, during high tide or winds, water moves over or through the levee.

Salinity tends to be intermediate to saline. The water column is 1 to 2 m thick. The water body is void of significant vegetation or aquatic species.

Sediment thickness is disturbed by storm events where the pier levee is breached and the pond is in communication with the ship channel. Tidal surge is minor during low tide; however, during storms, tidal impact is amplified by the breached narrow opening to the ship channel.

During low-flow conditions, the pond is a sediment sink isolated from the ship channel, receiving input primarily from the Citgo facility. However, during storms it is a source of sediment and suspended solids.

3.4 Interactions among Energy Systems

Investigators have found that the vast majority of the contaminant distribution within estuaries can be explained by evaluating suspended particulate matter and sediment erosion and deposition patterns. The deposition/erosion of sediments is controlled by the following:

- Energy of the environment
- Salinity
- Turbidity of the river flow
- Impacts to the system (storms/drought conditions, dredging, releases)

The following sections describe these processes in greater detail.

3.4.1 Energy Environments

High-energy environments within an estuary result in suspension of sediment while sediments are deposited within low-energy areas. The tidal cycles have an important influence on sediment transport and deposition. During ebb tides, sediment is suspended and carried seaward while during flood tides sediments are suspended and carried landward. Marine sediments can be carried into the estuary and mixed with land-derived sediments during the flood tide. The larger than normal tidal range seen during spring tide increases sediment suspension (Grabemann et al 1997). The energy is increased during spring tide due to the larger than normal tidal range. Grabemann observed maximum turbidity within similar estuaries during spring tide.

Other high-energy environments include areas where the estuary narrows, such as where constrictions such as bridge abutments force the tides through a smaller cross sectional area. Dams can trap coarse sediment while allowing finer sediment to continue downstream, resulting in fine-grained sediment deposits in the lower reaches (Menon et al 1998). High winds can increase the energy of otherwise stagnant bodies of water, resulting in re-suspension of sediment especially in shallow estuaries.

Low energy environments include marshes, holding ponds, or lagoons (e.g., Indian Marais Lagoon), and embayments. Deposition of sediment can occur following the flood and ebb tides during periods of slack water. Grabemann (1997) found that slack tide velocities are typically only about 0.2 m/sec, which allows for flocculation and settling of silt to clay size particles (up to 200 micrometers [μm] in diameter).

During periods of low tide, the water within marshes can be isolated from the rest of the estuary, resulting in a very low energy environment. Tidal flats and salt marsh areas above the high tide line can be inundated during storms and during spring tides. However, under normal conditions, these areas are stagnant and poorly drained, which often results in hypersaline conditions and even the precipitation of salts and metal sulfate minerals due to evaporation (Borrego et al 2002).

Dredging of the ship channel and the associated river traffic can stir up sediment within the estuary. One of the major effects of dredging on the individual systems is the removal of available sediment (depravation) to the marshes and shallow lakes.

Removal of enough dredged sediment can change the sediment mass balance in the system and produce a sediment-limited system as was observed by Grabemann et al. (1997) for the Weser estuary.

3.4.2 Settling Energy and Salinity Effects

Salinity can have a major impact on the suspended sediment load within estuaries, as well as on the deposition of contaminated sediment. Suspended particles with a specific gravity greater than water (>1 gram per cubic centimeter [g/cm^3]) would be expected to settle out. The repulsive forces between negatively charged particles lessen settling. Adsorption of positively charged ions from high-salinity seawater can neutralize the surface charge on the particles, alternately increasing settling.

Investigators have found that turbidity maxima occur within the freshwater portions of estuaries due to salinity induced settling (Grabemann et al 1997; Menon et al 1998). Often, the maximum turbidity area is just upgradient of the freshwater/saltwater interface where salinity is low and tidal energy is relatively high. While the tidal energy typically increases seaward, the effect is neutralized by salinity induced settling. The location of the saltwater/freshwater interface and the zone of maximum turbidity can change seasonally due to changes in flow. Grabemann et al (1997) found that the zone of maximum turbidity moves up-estuary during low flow in the Weser and Tumar estuaries due to the relative dominance of tidal inflows compared to river flows.

3.4.3 Turbidity

The sediment load within the river and bayou inflow is the primary source of sediment into an estuary. Sediment loads can be an order of magnitude higher than normal during flood and storm events.

3.4.4 Impacts to the System

Other impacts to the system occur via natural occurrences such as seasonal changes, rain/drought cycles, tropical storms, hurricanes, or activities initiated by man such as dredging. These impacts are discussed below.

3.4.4.1 Seasonal Changes

The major effects of seasonal changes are temperature driven salinity/water density changes and the freshwater recharge to the system. During the warm summer months, water temperatures increase significantly, resulting in strong salinity stratification (Duke 1985). Salt-wedge conditions were noted across the lower portions of Bayou d'Inde and throughout the ship channel during the July 1985 fieldwork. Conceivably, during the drier spring months, surface-water levels drop and groundwater discharge to the bayous increases until the hydraulic head equilibrates. This results in increased groundwater recharge to the bayous.

3.4.4.2 Rain/Drought Cycles

The RI sampling (both Phase I and Phase II) was conducted during winter (November 1999 through February 2000, and November 2000 through February 2001). February 2000 and December 2000 were each considered drought periods. February 2000 was one of the driest Februarys on record, receiving less than 2 cm of rain. January and February precipitation, combined, measured only 5cm. Precipitation averages 10 cm or more per month.

Conditions observed during the RI included moderate northerly winds (average 9 to 15 kilometers per hour [km/h]). Depressed water levels were noted across the estuary as a result of wind forcing. Dewatering of some of the marshes and shallow lakes was noted.

3.4.4.3 Tropical Storms

Calcasieu Estuary is subjected to tropical cyclone and hurricane activity that enters the Gulf of Mexico (Figure 3-1; Item 6). In general, the estuary receives heavy rainfall, storm tidal surge (reported ranges of 1 to 3 m of surge), high winds, and depressed barometric pressures. Overall, this tends to result in net sediment transport. Storms can have a mixed net effect on sediment thickness, the rains bring increased soil erosion and sediment deposition while storm surge tends to scour the channel. The rains add significant freshwater to the system, lowering salinity, while the tidal surge pushes seawater further up the estuary. Manmade modification to the river system has removed some of the natural barriers, which protected or dampened the effect of tidal surge in the past, effectively magnifying the impact of storm surge.

Table 3-1 summarizes the hurricane history for the region, indicating the duration of the storm, the total rainfall amounts, the maximum storm surge and maximum sustained wind, where available.

This chronology indicates that major storms have occurred in the region every 4 to 5 years. Heavy rain-producing tropical storms in 1979, 1980, and 1989 have likely brought significant sediment into the estuary.

Hurricane Audrey, a large hurricane that made land at the mouth of Calcasieu Estuary, created an enormous saltwater flooding of the inland marshes and bayous. Calcasieu Lake historically served as a large freshwater reservoir for the estuary, preventing direct flow through and allowing salinity conditions to equilibrate, buffering the upstream river, lakes and bayous. Heavy tides associated with Hurricane Audrey caused significant storm surge flooding of Calcasieu Lake and most inland marshes throughout the estuary. The inland sediments are poorly drained, and the fine-grained materials slowed drainage of the water, compounding the effect of the increased salinity in terms of vegetative impact (LDNR 2002).

3.4.4.4 Dredging Events

As noted in Section 2, major dredging has occurred since the 1930s. Dredging of the ship channel (Figure 3-1; Item 8) was initiated in 1938 and continued through

deepening of the channel in 1943 and 1946. The USACE performs routine maintenance dredging. Significant maintenance dredging occurred in 1967, 1973 (Coon Island Loop enlargement), and 1975 (Table 3-2). The most recent major dredging event was completed in 2001. One of the major effects of dredging on the individual systems is the removal of available sediment (depravation) to the marshes and shallow lakes.

Dredging increases water flow rate and salinity throughout the channel. This tends to result in loss of surface layers of organic material (U.S. Department of Agriculture [USDA]-Natural Resources Conservation Service [NRCS] 2001]), potentially impacting both the channel and lower sections of the bayous. Turbulence throughout the ship channel is increased, associated with larger water-craft (shipping barges and tankers), potentially impacting biota habitat and bank stability. Maintenance dredging removes any natural barriers that may impede water flow and associated sand bar development. In general, these activities increase saltwater intrusion and impede sediment and water exchange within interior mashes and lakes.

3.5 Exposed Populations

Both humans and ecological receptors are important considerations in the SCM. Pathways of exposure and the relationships between receptors and affected media are discussed below.

3.5.1 Ecological Receptors

Identified exposure routes are those exposure pathways considered complete for receptors in the area and include ingestion of sediments by detritivores and bottom dwellers, ingestion of contaminated prey items by ecological receptors, and inhalation and direct contact with the surface water micro layer. Ecological pathways are evaluated in Section 13.0, the Baseline Ecological Risk Assessment (BERA). The ecological receptors identified are believed to frequent the region, and behavior models support the selected exposure routes. Additional detail on development of these pathways and receptors can be found in the BERA Problem Formulation (CDM 2001).

3.5.2 Human Receptors

Potential human exposure to contaminants is presented in Section 14.0 of this document. Exposure routes of primary interest here are the direct contact (both human and ecological receptors), human consumption of impacted fish and shellfish, both by subsistence and recreational receptors (Figure 3-1; Item 9). These are important considerations of the SCM.

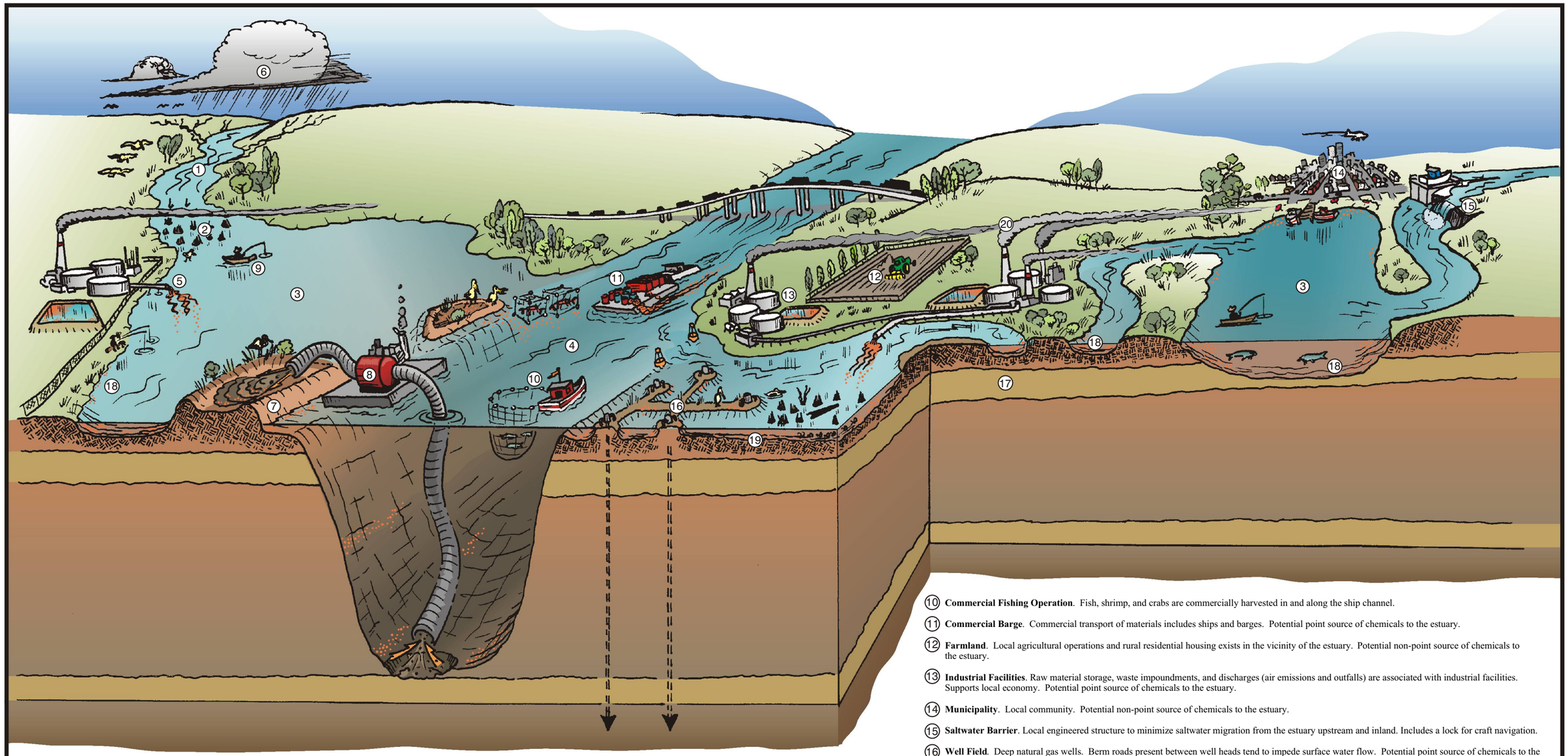
3.6 Summary of Sources Addressed in RI

The RI media of concern include sediments and surface water (Figure 3-1; Item 18). Understanding and reporting the impacts specific to each media, as well as their interactive relationships, are the focus of this RI.

Groundwater (Figure 3-1; Item 19) and air (Figure 3-1; Item 20) were not evaluated under this RI as they are regulated under separate congressional acts. Impacted groundwater in the industrial area is addressed under other State and Federal regulations, and no further investigation of groundwater was conducted under this RI. Historic release evaluations have been considered in evaluating sources and fate and transport of contaminants.

Air releases are addressed under Title V of RCRA and National Emission Standards for Hazardous Air Pollutants (NESHAP) and were not further addressed under this RI. Potential impacts from air releases were addressed with the reference area and sampling design.

This SCM provides an overview of the nature of the various impacted media. An understanding of the behavior of each of these impacts is necessary to effectively manage the Calcasieu Estuary system.



① **Bayou**. Low-flow energy system. Originates inland as a narrow, shallow freshwater conveyance. Commonly associated with inland marsh areas. Supports recreational fishing and limited barge transport (in larger sections).

② **Marsh**. Broad, shallow, low-energy system. Sediment depositional area. Partially drained. Supports diverse fauna and flora including clams, birds, fish, and aquatic plants.

③ **Shallow Lake**. Broad, low-energy system. Supports both input and output to bayous, marshes, and ship channel. Supports larger fish and recreational fishing and boating. Attractive for residential development.

④ **Ship Channel**. Engineered (deep, wide) commercially navigable surface water. High-energy system. Supports ship traffic from the Gulf of Mexico and Intracoastal Waterway. Routinely dredged to maintain configuration. Commercially fished. Supports recreational boating and fishing. Receiving waters for bayous. Portions comprise the Calcasieu River.

⑤ **Industrial Outfall**. Process discharge point. Commonly pre-treated and permitted under National Pollution Discharge Elimination System (NPDES). Routinely monitored for compliance. Potential point source of chemicals to the estuary that create human health and ecological receptor concerns.

⑥ **Storm Event**. Hurricane, tropical storm, or thunderstorm. Source of freshwater input to the estuary. Increases surface water flow and sediment transport.

⑦ **Confined Disposal Facility (CDF)**. Islands created by stockpiling dredge material. Partially submerged. Supports vegetation and wildlife.

⑧ **Dredge Operations**. Performed routinely (every 5 years) by US Army Corps of Engineers to maintain the ship channel.

⑨ **Recreational Fisherman**. Common past-time in the estuary from land, bridges, or boats.

⑩ **Commercial Fishing Operation**. Fish, shrimp, and crabs are commercially harvested in and along the ship channel.

⑪ **Commercial Barge**. Commercial transport of materials includes ships and barges. Potential point source of chemicals to the estuary.

⑫ **Farmland**. Local agricultural operations and rural residential housing exists in the vicinity of the estuary. Potential non-point source of chemicals to the estuary.

⑬ **Industrial Facilities**. Raw material storage, waste impoundments, and discharges (air emissions and outfalls) are associated with industrial facilities. Supports local economy. Potential point source of chemicals to the estuary.

⑭ **Municipality**. Local community. Potential non-point source of chemicals to the estuary.

⑮ **Saltwater Barrier**. Local engineered structure to minimize saltwater migration from the estuary upstream and inland. Includes a lock for craft navigation.

⑯ **Well Field**. Deep natural gas wells. Berm roads present between well heads tend to impede surface water flow. Potential point source of chemicals to the estuary. (Arrows indicate wells are hundreds to thousands of feet deep.)

⑰ **Shallow Aquifer**. Primarily clayey subsurface soils with several distinguishable water-producing sand layers commonly referred to as the 10- and 30-foot sands.

⑱ **Sediment and Surface Water**. Environmental media in bayous, marshes, shallow lakes, and ship channel that is being investigated in the RI.

⑲ **Groundwater**. Environmental media not being considered in the RI.

⑳ **Air Emissions**. Environmental media not being considered in the RI

Figure 3-1

Conceptual Site Model

CDM

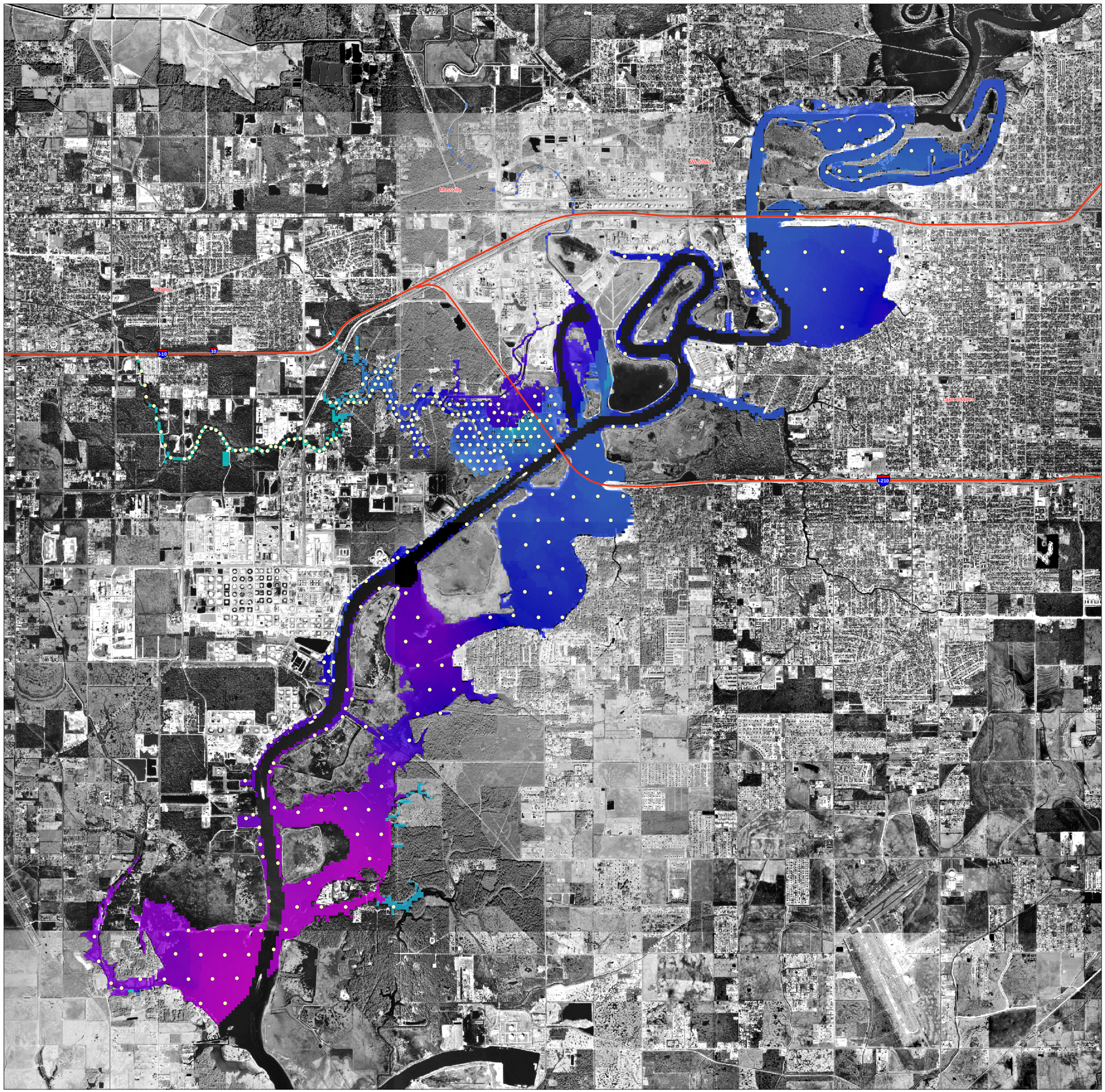


Figure 3-2
Phase I Salinity
(December 1999 - March 2000)
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Sample Location

Interstate

Value

High : 26.7

Low : 5.5

N
W E
S

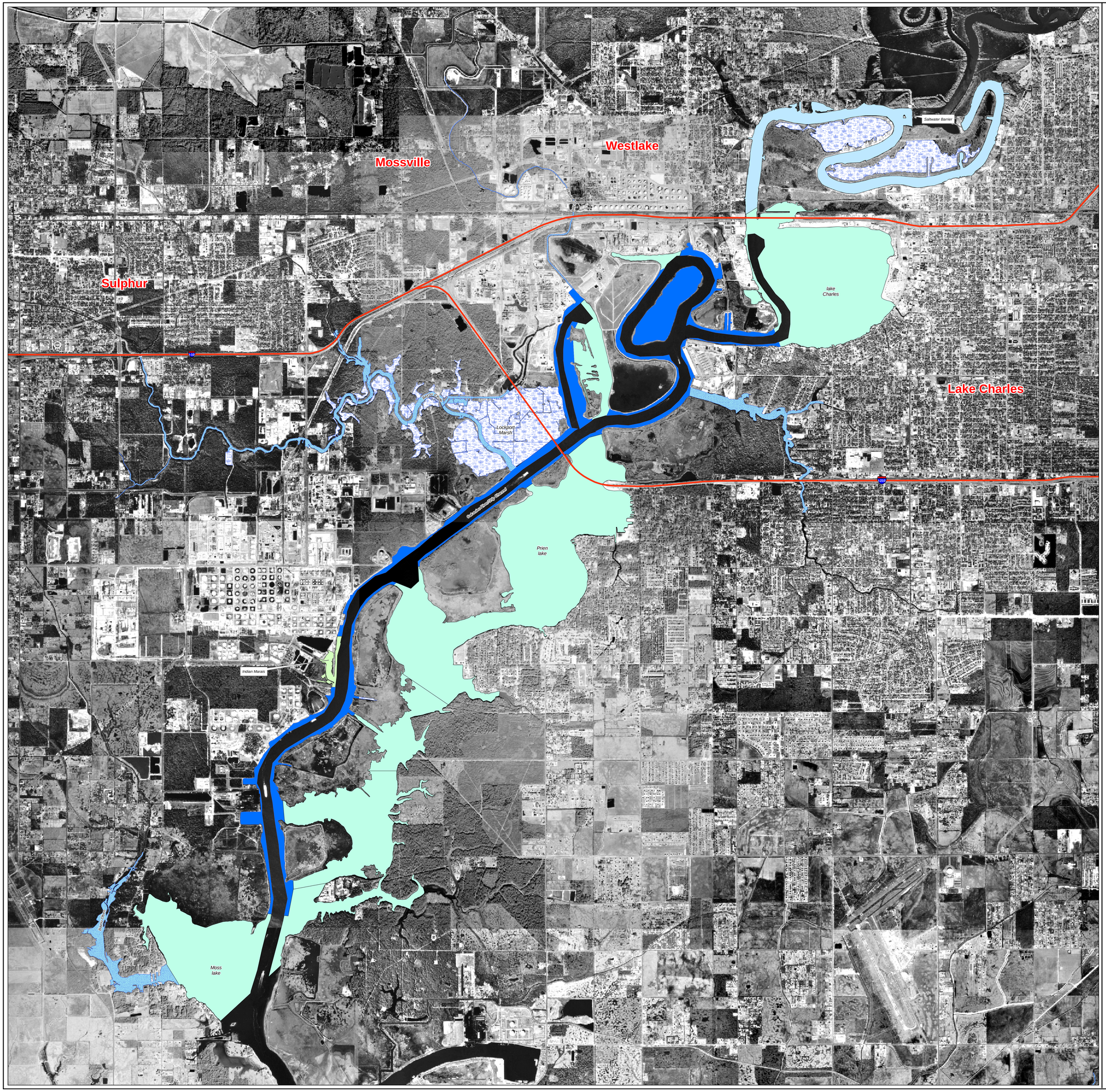
Kilometers

0 0.35 0.7 1.4 2.1 2.8

CDM

Map Filename: calcasieu_salinity_P1-Esize.mxd 06/26/2002

Figure 3-3
Calcasieu Estuary Energy Systems
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Interstate

Energy Areas

- Marsh
- Bayou
- River
- Shallow Lake
- Ship Channel
- Other

N
W E
S

Kilometers
0 0.5 1 2

CDM

Map Filename: Fig3-3_energy_areas-Esize.mxd 04/22/2002

Table 3-1
Chronology of Major Dredging Events
Calcasieu Estuary

Date	Event	Description
September 1937 to July 1941	Formally opened to deep draft traffic July 12, 1941 (USACE 1968).	Dredged the 30-feet deep x 250-feet wide ship channel from the Gulf to Lake Charles.
March 1945	Created Clooney Island Loop, (USACE 1951).	Dredged 250-feet wide and 30-feet deep shipping lane.
July 1946	Deepened the Clooney Island Loop.	Dredged channel to 35 feet deep (USACE 1951).
July to November 1967	Maintenance dredging of channel between mile 15.5 and 29.2.	Removed 2,149,400 cubic yards (cy) of material (USACE 1968).
1973 - 1974	Construction of Coon Island Channel and turning basin.	40-feet deep x 200-feet wide canal with a 40 x 750 x 100-foot long turning basin. (USACE 1998)
July 1973 to April 1974	Coon Island Loop ship channel enlargement.	A 40-feet deep x 200-feet wide channel and a 40 x 750 x 1000 basin.
July 1975 to April 1976	Maintenance dredging of the channel, mile 15.5 to 36.	Removed a total of 9,352,396 cy (USACE 1976).
1976 - 1978	Construction of the industrial canal through Devil's Elbow.	40-feet deep x 400-feet wide canal with a 40 x 1200 x 1400-feet long turning basin. (USACE 1980)
October 1994 to May 1995	Maintenance dredging of the channel, mile 24 to 36.	Dredged material was placed on the Sabine National Wildlife Refuge for wetlands development. (USACE correspondence 2002).
October 1994 to May 1995	Maintenance dredging of the channel, mile 24 to 36.	Removed a total of 4,000,000 cy (USACE correspondence 2002).
1996	Maintenance dredging.	Dredged material was placed on the Sabine National Wildlife Refuge for wetlands development.
December 2000 to December 2001	Maintenance dredging of the channel, mile 24 to 30.3.	Removed a total of 1,000,000 cy. (USACE correspondence 2002).
Proposed 2003	Maintenance dredging of the channel, mile 24 to 32.	Estimated removal of 1,500,000 cy (USACE correspondence 2002).

Table 3-2
Chronology of Major Tropical Storms and Hurricanes
Calcasieu Estuary

Date	Event	Description
August 1940	Hurricane No. 2	Hurricane dropped 18.72 inches of rain over 5 days.
July 1943	Hurricane No. 1	Produced 10.34 inches of rain over 24 hours.
1949	Hurricane No. 10	Produced 16.92 inches of rain over 6 days.
June 1957	Hurricane Audrey	Produced 6.9 inches of rain over 22 hours.
July 1959	Hurricane Debra	Produced 15.47 inches of rain over 5 days.
September 1963	Hurricane Cindy	Generated 17.52 inches of rain over 4 days.
1973	Tropical Storm Delia	Produced 9.99 inches of rain over 3 days.
1979	Tropical Storm Claudette	Produced 22.01 inches of rain over 7 days.
1980	Tropical Storm Danielle	Generated 17.17 inches of rain over 2 days.
October 1985	Hurricane Juan	Produced 20.17 inches over 11 days.
1989	Tropical Storm Allison	Generated 30.01 inches over 12 days.

Section 4
Data Collection, Analysis, and Interpretation

Section 4 presents an overview of the RI data collection efforts and the methods of data analysis. Sections 4.1 and 4.2 discuss the two phases of the data collection. The general procedures for data collection are outlined in Section 4.3. Section 4.4 summarizes how COPCs were determined. The analytical program is discussed in Section 4.5. Section 4.6 discusses the data quality assessment. Deviations from the Phase I and II sampling events and their impacts are presented in Section 4.7. Data set development and interpretation for the nature and extent investigation is presented in Section 4.8.

4.1 Phase I of the RI

4.1.1 Program Overview

Phase I of the RI was designed to determine the nature and extent of organic and inorganic contamination within the Calcasieu Estuary and to support risk characterization. This phase of investigation was conducted on an AOC-by-AOC basis and included:

- Historical data evaluation
- Sample location selection using EPA's fully-integrated environmental location decision support (FIELDS) software
- Sediment and surface water sampling
- Data analysis

4.1.1.1 Historical Data Evaluation

Numerous historical data exist from a variety of characterization programs conducted by state and local agencies, as well as private industry within the Calcasieu Estuary. Phase I was initiated with a detailed evaluation of the existing chemical data maintained by EPA and NOAA (Section 1.2). A decision was made by the stakeholders to use all of the post-1992 data. It was assumed that these data were collected and analyzed under more stringent collection and analytical testing protocols. Pre-1992 data, although maintained by EPA and NOAA, were not used in the RI planning because of unknown quality.

The data were used to determine the occurrence, concentration, and mean and mean variance of COPCs as well as the number of samples with previously detected analytes. Data were also used to ascertain the number of samples needed for a statistically valid sampling program based on confidence interval/relative error ranges of 70/30 percent and 80/20 percent, which equate to 0.7 and 0.8 statistical

power, respectively. Given a mean and a standard deviation, an iterative set of three equations, as described by Gilbert (1987), was used to calculate the number of samples required to achieve the pre-specified confidence and precision.

4.1.1.2 Sample Location Selection

The number of samples calculated using the above-referenced method was then input into FIELDS as criteria to identify sample locations. For logistical considerations, the four AOCs (i.e., Bayou d'Inde, Bayou Verdine, Upper Calcasieu, and Lower Calcasieu [Figure 2-2]) were subdivided into multiple reaches. These reaches were arbitrary subdivisions based on general physical characteristics (e.g., industrial area, associated marshes, incised channel, etc.). To locate sampling points, FIELDS subdivided each AOC into equal area grids based either on the number of available samples or on the maximum diameter of an area with unacceptable concentrations of contaminants (i.e., hot spots) that would be left uncharacterized by the sampling effort. Once subdivided into grids, FIELDS selected a sampling point in the center of each equi-area grid cell. Randomness was introduced through the selection of a random starting node within a grid cell. The same node was then applied to all grid cells (a systematic-stratified sampling approach). FIELDS established coordinates for each sampling location. Sampling locations for Phase I are shown in Figures 4-1 through 4-3 and are labeled based on the AOC and reach in which the sample was located.

4.1.1.3 Sediment and Surface Water Sampling

Phase I RI sampling was conducted from December 1999 through March 2000. Field samples consisted primarily of sediment samples. Surface water samples were collected (and co-located with sediment samples) at approximately 20 percent of the

Phase I Surface Sediment Locations

- 63 in Bayou Verdine
- 235 in Bayou d'Inde
- 137 in Lower Calcasieu
- 100 in Upper Calcasieu

535 Total Locations

Phase I Multi-Depth Sediment Locations

- 7 in Bayou Verdine
- 3 in Bayou d'Inde
- 6 in Upper Calcasieu

16 Total Locations

sediment sample locations. Sediment samples for chemical and physical analyses were collected from the surface (0 to 10 cm) and subsurface at multiple–depth intervals (0 to 10, 10 to 20, and 20 to 30 cm). Multi-depth sediment sample locations were determined from historical data and SVOC data. Bayou Verdine was the exception where surface samples were collected from 0 to 15 cm, and multi-depth locations were collected at intervals of 0 to 15, 15 to 30, and 30 to 45 cm to coincide with a previous nature and extent investigation conducted by one of the private industries located along the bayou.

Surface water samples were collected from a mid-depth of the water column or from multiple depths (i.e., one-third/two-thirds depth of the water column). Multi-depth surface water samples were collected if stratification of the water column was evident at any location based upon field measurements (salinity, dissolved oxygen, and conductivity). Analyses included both chemical and physical parameters. More detailed information can be found in the site-specific sampling and analysis plans (SAPs) for each AOC (CDM 1999a, 1999b, 1999c, and 1999d).

Phase I Surface Water Locations

- 12 in Bayou Verdine
- 21 in Bayou d'Inde
- 22 in Lower Calcasieu
- 10 in Upper Calcasieu

65 Total Locations

Phase I data reduction and analysis identified the need for a second phase of sampling to minimize data gaps existing in Phase I, including resampling areas of poor data quality and supporting the ecological risk assessment.

4.1.2 Ecological Assessment Site Reconnaissance

An ecological assessment site reconnaissance was conducted April 2000 through May 2000 to:

- Determine ecological tissue sampling methods appropriate for the estuary conditions
- Evaluate the nature of biota, sediment, and surface water within an ecological reference site
- Locate a suitable reference site to compare background conditions with the Calcasieu Estuary
- Collect tissue, in both the Calcasieu Estuary and reference sites, to determine the presence or absence of specific species and better understand the various trophic level relationships

4.1.2.1 Calcasieu Estuary Sampling

Tissue sampling locations were determined in the field based upon locations where fish are typically caught or collected in the various AOCs. Multiple locations were sampled in three of the four AOCs to determine a spatial distribution of some species (Figure 4-4).

Phase I Ecological Recon Tissue (T) Samples Collected

- 17 in Bayou d'Inde
- 18 in Lower Calcasieu
- 14 in Upper Calcasieu

Sediment and surface water samples were collected at the same locations and were co-located with shellfish sample locations. Sediment was collected to a depth of 15 cm whereas surface water was collected at midway of the water column.

Phase I Ecological Recon
Sediment (SE)/Surface Water (SW) Samples Collected

- 1 SE/SW in Bayou d'Inde
- 1 SE/SW in Lower Calcasieu
- 1 SE/SW in Upper Calcasieu

4.1.2.2 Reference Area Selection and Sampling

An objective of the ecological reconnaissance was to locate a suitable reference area for Phase II of the RI. Requirements for the reference area were:

- Similar habitat, substrate, and water quality conditions to the Calcasieu Estuary
- No known industrial point sources of contaminants in the area

Data collected from a suitable reference area would allow comparisons to be made between the Calcasieu Estuary and an area unaffected by industrial development. This provided another screening level in addition to screening levels used in the HHRA and the BERA. The reference areas are further discussed in Section 6 where data are presented that describe the physical and chemical characteristics and discuss the suitability of using these areas for comparisons.

Phase I Ecological Recon
Reference Area Samples Collected

- 3 SE / 1 SW in Reference Area
- 15 T in Reference Area

During the field investigation, Johnsons Bayou (Figures 2-1 and 4-5) exhibited conditions similar to Calcasieu Estuary and was chosen as the location to collect tissue, sediment, and surface water.

4.2 Phase II of the RI

4.2.1 Program Overview

Phase II of the RI was a more focused characterization of contaminant levels in sediment, porewater, and biota tissue (i.e., fish and invertebrates), as well as evaluation of sediment toxicity, porewater toxicity, and benthic invertebrate community structure. The objectives of the Phase II RI were to:

- Minimize data gaps identified in the Phase I nature and extent data collection
- Collect additional information from designated reference areas
- Support the BERA and HHRA
- Conduct a sediment quality triad (SQT) to determine the relationship between sediment chemistry and toxicity to support an evaluation of the ability of the

sediment quality guidelines (SQGs) to correctly classify sediments in the study area as toxic or not toxic

- Provide data necessary to evaluate the risks to sediment-dwelling organisms associated with exposure to contaminated sediments

- Provide data necessary to evaluate the risk to fish and wildlife resources that are associated with consumption of contaminated prey items

4.2.1.1 Minimize Data Gaps

Several data gaps were identified in the Phase I data. Elevated detection limits, confirming reported data in some areas, and refinement of vertical and horizontal extent of contamination in specific areas required the collection of additional samples. Phase II surface sediment samples were collected at pre-selected locations to refine the horizontal extent of contamination around specific sites in the estuary and verify reported detections and non-detections. Vertical profile samples (multi-depth) were collected to determine vertical extent of contamination at intervals of 0 to 10 cm, 10 to 20 cm, and 20 to 30 cm. These determinations allow evaluation of the impact that remediation (e.g., excavation), dredging, or natural processes (e.g., storms) may pose through re-suspension of COPCs. The multi-depth samples were collected at pre-selected Phase I locations where elevated COPCs were detected. Sample locations are shown in Figure 4-6.

Phase II Data Gap Sample Locations

- 18 (14 multi-depth) from Bayou d'Inde
- 6 (2 multi-depth) from Upper Calcasieu
- 9 (1 multi-depth) from Lower Calcasieu

33 (17 multi-depth) Data Gap Locations

Thirty-three locations were sampled for nature and extent delineation purposes during Phase II. Surface sediment samples were collected at the 10-cm interval. Multi-depth samples were collected at intervals of 0 to 10 cm, 10 to 20 cm, and 20 to 30 cm. Samples were collected during December 2000.

4.2.1.2 Sediment Quality Triad

The SQT integrates information on sediment toxicity, chemistry, and benthic community structure in an integrated weight-of-evidence approach (Ingersoll et al. 1997). The SQT was designed to provide the information that is required to evaluate the risks to sediment-dwelling organisms that are associated with exposure to contaminated sediments. This is accomplished from the evaluation of whole-sediment and porewater toxicity effects on benthic invertebrate community status, both of which support direct evaluations of the effects of contaminated sediments on benthic organisms. In addition, the information generated will be used to evaluate if the SQGs developed for the Calcasieu Estuary correctly classify sediments in the study area as toxic or not toxic. Importantly, the data collected will provide the information to develop site-specific linkages between sediment chemistry and biological effects.

The field effort involved the collection of samples from 100 SQT locations. Sediment chemistry and benthic community structure were determined at all 100 locations, whereas only 50 locations had matching porewater chemistry.

The locations of the sampling stations were determined using a quasi-stratified random sampling design. The study area and candidate reference areas were divided into 51 reaches, which typically represented a recognizable topographic feature, such as a lake, a waterway, or a portion of a waterway in which conditions were expected to be relatively consistent. In the lakes, deeper waters (> 1 m) were excluded from consideration to facilitate co-location of the sediment sampling stations with the fish sampling stations. Subsequently, roughly 100 samples were distributed among the various reaches in a manner that provided broad geographic coverage of the study and reference areas.

In total, 31 areas within the estuary (Figure 4-7 through 4-11) and reference areas were sampled (Figures 4-12 though 4-13). The 31 areas and their corresponding sample locations (including reference areas) were designed by considering the distribution of sediment samples with various chemical characteristics (i.e., using data from the Phase I sampling program, historical data, and evaluating the sediment chemistry data using mean effects range–medium [ERM] quotients). As such, the sediment samples were collected to have a broad range of chemical characteristics. This broad distribution of sediment chemistry will support logistic regression modeling of the matching sediment chemistry and sediment toxicity data, thereby facilitating comparison to the models that have been established for other areas in North America (Field et al. 1996; MacDonald et al. 2000a,b). For a more detailed explanation of the sampling design and strategy, see the *Phase II Sampling and Analysis Plan, (*CDM 2000a*).*

Phase II SQT Sample Locations

- 31 from Bayou d'Inde
- 10 from Bayou Verdine
- 15 from Lower Calcasieu
- 29 from Upper Calcasieu
- 15 from Reference Areas

100 SQT Locations

4.2.1.3 Tissue Collection

The objectives for collecting tissue during the Phase II sampling included (1) evaluating the risks to human health by quantitatively measuring contaminant concentrations in fish and invertebrates likely to be consumed and (2) evaluating the risk to ecological receptors by quantitatively measuring the contaminant concentrations.

The Phase II sampling design evaluated the BERA and HHRA data needs to determine the type of species and the quantity to be collected. The types and quantity of species to be collected were based upon evaluating the feeding ecology of the fish and wildlife focal species and their likely foraging areas.

Phase II Tissue Samples

- 251 from Bayou d'Inde
- 133 from Lower Calcasieu
- 202 from Upper Calcasieu
- 138 from Reference Areas

724 Tissue Samples

The prey groups were selected based on assessment endpoints developed from the ecological assessment data quality objective (DQO) workshop (MacDonald et al 2000a), the *Problem Formulation Technical Memorandum, Baseline Ecological Risk Assessment - Calcasieu Estuary* (CDM 2001), input from the human health risk assessors, and USFWS.

The estuary supports a large variety of fish and invertebrate species that are prey for the wildlife focal species. The area where these species feed and live varies (e.g., sheltered bayous versus open water). Likewise, the degree to which they travel the estuary to breed also varies. To ensure these variables were represented, the prey groups were separated into groups as shown in Table 4-1. The species in each of the identified prey groups were interchangeable as the focal species predators since they will be unlikely to have distinct preferences for one species over another.

Sampling of prey that may move from one area of the estuary to another (i.e., groups 2 through 5) was needed to estimate exposure estimates for other wildlife focal species (e.g., osprey, dolphin). As the prey from these groups feed from larger areas across the estuary and their tissue concentration is less variable, a less detailed (estuary-wide collection versus area specific) sampling was needed for both the BERA and HHRA.

All tissue sample locations, with the exception of blue crab locations, were paired as closely as possible to SQT locations. At each of the stations (Figure 4-10, 4-11, and 4-13), multiple samples of group 1 fish and invertebrates (i.e., 3 to 5 samples of each sub-group) were collected within a 100-m radius of the SQT coordinates. The area sampled for groups 2, 3, 4, and 5 was expanded to 500 m. Several SQT sample locations did not provide adequate fish populations; so pre-selected alternate locations in that area were used.

Whole body samples from each prey group were used for the BERA, whereas a subset of group 4B fish was filleted for the HHRA.

Tissue collection occurred between October 2000 and December 2000. All sampling was conducted in accordance with the *Phase II SAP for RI/FS of Calcasieu Estuary Cooperative Site* (CDM 2000b).

4.3 Data Collection Methods

Collection methods used in Phases I and II of the RI varied by the analyses required (chemical and/or bioassays), types of media, and depth of sediment to be collected. All sample locations (with the exception of the ecological assessment reconnaissance) were determined prior to field mobilization using FIELDS. Universal transverse mercator (UTM) coordinates for each sample location were uploaded from FIELDS to

a differential global positioning system (GPS) receiver that allowed navigation to each sample station. Actual UTM coordinates were established while sampling at each sample location with a positional accuracy of the GPS unit of less than 1 m.

General sampling procedures included the following steps for sediment, surface water, and tissue:

- All field monitoring equipment was calibrated daily in accordance with manufacturers' instructions and CDM standard operating procedures (SOPs) (CDM 2000b). All calibration information was recorded either in the applicable logbook or on calibration sheets.

- Sampling locations had predetermined coordinates that were navigated to using a differential GPS unit. Daily sampling efforts generally progressed from downstream to upstream locations to avoid cross contamination of the water samples. In isolated cases, this was not possible, but care was taken to limit the potential for cross contamination.

- Low-draft boats were stabilized by deploying a metal rod (spud) into the sediment on opposite corners of the boat if sediment and surface water samples were to be collected. Sampling was conducted away from where spuds may have disturbed sediment. If the locations were inaccessible from the boat due to low water, samplers would walk to the location. Boat stabilization was not needed for tissue sampling.

- The surface water column thickness was measured from a downstream location on the boat.

The samples were then collected as described in Sections 4.3.1 through Section 4.3.5.

4.3.1 Sediments

All sampling was conducted in accordance with the procedures specified in the *Phase I Sampling and Analysis Plans for Bayou Verdine* (CDM 1999a), *Bayou d'Inde* (CDM 1999b), *Lower Calcasieu* (CDM 1999c) and *Upper Calcasieu* (CDM 1999d), and *Phase II Sampling and Analysis Plan* (CDM 2000b) unless otherwise noted in Section 4.7 Deviations from Sampling and Analysis Plans.

Sediment sampling followed these general steps:

- Sediment sampling equipment was set up as described in CDM SOP 1-1 Section 5.4 (CDM 2000b). The top of sediment and sample interval to be collected was initially marked on the push rod so that the deployment depth could be defined.

- Sediment was collected at predetermined depths in accordance with CDM SOP 1-1 Section 5.4 (CDM 2000b). If the sample was for whole chemistry only, the sample was placed in a stainless steel bowl prior to sub-sampling.

- If VOC analysis was required, an aliquot of the sample was immediately placed in appropriate containers. Otherwise, the samples for whole chemistry (only) were homogenized using stainless steel mixers and bowls prior to placement in appropriate containers.

- An aliquot was also set aside for physical testing. All sediment samples were screened for VOCs using a photoionization detector (PID).

- If the sample was for the SQT, each replicate was sub-sampled for benthic community surveys prior to placement in acid washed, high-density polyethylene (HDPE) containers. SQT samples were sealed in containers and transported to the field office for homogenization and sub-sampling into containers for whole sediment chemistry and toxicity testing.

- Once sub-sampled, all sample containers were placed in ice chests or the sample refrigerator and cooled to 4°C plus or minus 2°C.

- Sediment lithology was logged in accordance with CDM SOP 3-5 (CDM 2000b). Physical parameters were logged on field sheets and/or the logbooks.

- Sediment sampling equipment, upon completion of a station, was rinsed in the surface water at the sampling location. Once rinsed, equipment was decontaminated on the boat in accordance with CDM SOP 4-5 (CDM 2000b) and wrapped in foil. All decontamination and rinse waters were retained for disposal at a Lake Charles POTW.

- Shallow sediment samples were collected using a 15-cm or 23-cm Eckman Dredge grab sampler from the upper 10 cm of the sediment surface. The 15-cm sampler was used to collect sediment for sediment chemistry only, whereas the 23-cm sampler was used for the sediment chemistry, porewater chemistry, and toxicity testing.

- Penetration into the substrate was accomplished by pushing the Eckman to the desired depth, not to exceed 10 cm. On average, one to four grabs were required to obtain sufficient volume for the SQT.

- Sediment samples collected from the 0 to 30-cm depth were obtained with a decontaminated, stainless steel push tube sampler. Sample was extruded from the coring device and separated into multi-depths (0 to 10 cm, 10 to 20 cm, 20 to 30 cm). Multiple replicates were homogenized to collect adequate volume for analyses. Because of the small diameter of the coring device, on average, 4 to 10 grabs were required to obtain sufficient volume.

4.3.2 Surface Water

Both shallow and deep surface water samples were collected from the Calcasieu Estuary based upon salinity concentration gradients. Surface water samples were

collected midway in the water column unless salinity stratification was measured (i.e., 0 to 0.5 ppt, 0.5 to 5 ppt, 5 to 18 ppt, 18 to 30 ppt, and > 30 ppt). If salinity stratification existed, a sample was collected from the middle of each zone. All surface water samples were co-located with surface sediment samples. Surface water samples were collected prior to sediment sampling and followed these general procedures:

- A peristaltic pump with clean tubing was set up as described in CDM SOP 1-1 Section 5.3.2 (CDM 2000b). The length of the tubing from the pump was either equal to the depth of water column, if more then one salinity zone existed, or to the mid depth of the water column if unstratified. Tubing was marked for depth control.

- Salinity was measured prior to sampling to determine if a salinity gradient existed.

- Other conventional parameters (e.g., TSS, dissolved oxygen [DO], ORP, etc.) were measured at the location where the sample was collected. In some instances, multiple measurements were recorded if determining a salinity gradient.

- The pump was allowed to purge for at least 2 minutes prior to collecting a sample for physical testing beginning with the shallow surface water sample. Samples were collected at an approximate pumping rate of 1 liter/minute (L/min).

- Samples were collected at the determined depths in accordance with Sections 5.2 and 5.3 of CDM SOP 1-1 (CDM 2000b). All appropriate sample jars were filled directly from tubing except for dissolved metals. The sample for dissolved metals was collected last after placing a 0.45- µm filter in line with the tubing.

- Surface water samples were recorded in accordance with SOP 3-5 (CDM 2000b) and placed in a cooler with ice at 4°C plus or minus 2°C. Physical parameters were logged on field sheets and/or the applicable logbook.

- Sampling equipment was decontaminated on the boat in accordance with SOP 4-5 (CDM 2000b). All decontamination and rinse water were retained for disposal at a POTW.

All sampling was conducted in accordance with the procedures specified in the *Phase I Sampling and Analysis Plan for Bayou Verdine* (CDM 1999a), *Bayou d'Inde* (CDM 1999b), *Lower Calcasieu* (CDM 1999c), *Upper Calcasieu* (CDM 1999d), and *Phase II SAP* (CDM 2000b) unless noted in Section 4.7 Deviations from Sampling and Analysis Plans.

4.3.3 Porewater

Porewater is the interstitial water present in the sediment. Porewater samples were collected at 50 locations as part of the SQT in Phase II. Sediment aliquots for

porewater collection followed the general procedures for sediment collection as described in Section 4.3.1.

Following collection, sediment for porewater analysis was placed into six 3.8-liter plastic containers and was sent to the laboratory to be extracted. Porewater was extruded by mechanical squeezing at the laboratory until the desired volume was collected. Samples were recorded in accordance with SOP 3-5 (CDM 2000b) and placed in a cooler with ice at 4°C plus or minus 2°C.

4.3.4 Benthic Community Survey

Benthic community survey samples were collected by using a sub-core from a 23-cm Eckman Dredge grab sampler used for the collection of SQT sediment samples. The cores were 6.72 cm diameter, covering an area of 35.4 cm^2. Five replicates were collected per SQT sample location, or one core was taken from each Eckman grab sample. Each replicate was then placed in a polyethylene container and transported to the field laboratory where samples were cleaned using a 0.5-millimeter (mm) sieve that prevented any loss of macrofauna. The remaining sample was then containerized and fixed with 5 percent buffered formalin solution, labeled, properly stored, and shipped to the laboratory. Once received in the laboratory, macrofauna were extracted and removed by hand sorting. The retained organisms were identified to the lowest possible taxa (generally species) and counted. Biomass was measured by combining the organisms into the following higher taxonomic groups: Crustacea, Mollusca, Polychaeta, Nemertinea, Ophiuroidea, and others, which includes all other rare taxa. Samples were placed on a tared aluminum pan, dried at 55°C for 24 hours, and weighed to the nearest 0.01 milligram (mg). No chemical analysis was performed on collected biomass. All quality assurance and quality control (QA/QC) procedures followed EPA's Environmental Monitoring and Assessment Program (EMAP) protocol (CDM 2000b).

4.3.5 Fish and Invertebrate Collection

Fish and invertebrate collection required the use of many different techniques and flexibility to collect the quantity of tissue required for the RI. The sampling methods included minnow traps, dip nets, mini-trawls, small oyster dredges, small-mesh seines, small trap nets, gill nets, and angling.

Samples to be used for the HHRA and BERA were conducted simultaneously. Fish samples needed for the HHRA were filleted, whereas samples needed for BERA were whole body. All samples were frozen and stored until the collection was completed to assess the need to collect additional samples to meet DQOs or to ensure that enough mass was collected for analysis.

Fish collected for the HHRA were also evaluated by the USFWS using the Biomonitoring of Environmental Status and Trends (BEST) program methods. These evaluations were done to support the USFWS natural resource damage assessment program. BEST methods identify contaminant effects on aquatic species. This

assessment program uses various methods (see Section 4.5.7 for further detail) to evaluate environmental stress on aquatic species.

4.4 Determination of Contaminants of Potential Concern

COPCs are determined in the RI as those chemicals that exist at concentrations or impart unacceptable risk to human health or the environment**.** COPCs for sediment, surface water, and tissue were initially identified by using historical data to evaluate human health risks associated with the release of hazardous chemicals into the Calcasieu Estuary (CDM 1999). This process involved the following steps using historical data:

- A statistical summary of the data for each medium was compiled, including range of detected concentrations, range of detection limits, and detection frequency of all chemicals analyzed**.**
- The maximum detected concentration was used as the screening concentration. If the constituent was not detected in any samples, the maximum reported detection limit was used as the screening concentration**.**
- Screening concentrations were compared to toxicity screening values to determine exceedences**.** Surface water toxicity screening values were selected from the lesser of the National Recommended Water Quality Criteria (Human Health Consumption of Organism Only) and Louisiana Ambient Water Quality Criteria. Tissue toxicity screening values were selected from EPA Region III risk-based concentrations for fish tissue. Sediment was not compared to a toxicity screening value. (Regional background values and applicable or relevant and appropriate requirements [ARARs] were not available at the time.)
- Chemicals with screening concentrations greater than the toxicity screening value were retained as COPCs.
- Contaminants detected at concentrations less than toxicity screening values, or with detection limits less than toxicity screening values, were eliminated as COPCs.
- Contaminants that did not have toxicity screening values were retained as COPCs for further evaluation unless these contaminants were not detected in any samples.

Upon conclusion of Phase I, the retained COPCs were re-evaluated using the recent data collected during the RI. Phase I chemicals were re-evaluated during a BERA workshop (MacDonald et al. 2000) by comparing measured concentrations to ecological water and sediment quality benchmarks to determine which COPCs and areas of potential concern would be investigated during Phase II. It was determined during the workshop that:

- For water-borne constituents, the contaminants that occurred in water samples at concentrations (i.e., total concentrations in unfiltered water samples) in excess of the final chronic value were considered ecological COPCs.

- Contaminants that occurred in whole sediments at concentrations in excess of ERMs or probable effect levels (PELs) (MacDonald et al. 1996; Canadian Council of Ministers of the Environment 1999) were considered ecological COPCs.

In addition, initial preliminary remediation goals (PRGs) for protection of human health were developed based on data collected in Phase I and identified by the Calcasieu Estuary Team (CDM 2000b). PRGs were estimated by re-arranging the hazard or risk equation to solve for concentration. An acceptable hazard quotient was set to one, and the acceptable risk level was set to 10^{-5}. The constituents identified in the BERA workshop and PRG developments were considered COPCs for Phase II.

Upon completion of Phase II, retained COPCs in sediment for human health risk were further refined in the draft HHRA (CDM 2002b). The COPC selection for the HHRA was accomplished using the following steps:

- For surface sediment (0 to 10 cm), all detected chemicals were carried forward to the evaluation.

- Chemicals that were detected very infrequently (i.e., in less than 5 percent of the samples) were not selected as COPCs.

- Chemicals that are essential nutrients (i.e., calcium, magnesium, potassium, sodium) were not selected as COPCs.

- Chemicals that were detected in greater than 5 percent of the samples and are not essential nutrients were screened against toxicity-based screening levels to identify the COPCs.

- Chemicals were considered COPCs if the maximum detected concentration exceeded the screening level or if there was no toxicity-based screening level available for comparison.

Table 4-2 lists the presently known COPCs for the Calcasieu Estuary based upon ecological and human health risks. Section 13 (BERA) and Section 14 (HHRA) provide detail into the development of contaminants that pose a risk to the ecology or human health.

4.5 Analytical Program

A variety of parameters were measured to evaluate the Calcasieu Estuary as well as determine the nature and extent of contaminants in sediment, surface water, and tissue. Table 4-3 lists the media and analytical protocol (i.e., analytes and methods). Table 4-4 lists sample volume/containers and the required preservation methods.

Phase I analytical methods were selected in accordance with the investigation's DQOs involving EPA's Contract Laboratory Program (CLP). Phase II analytical methods were determined by the DQOs. Physical and chemical analyses were performed using validated and standard methods in the environmental laboratory industry. A detailed description of the analytical protocols is presented in the following subsections.

4.5.1 Conventionals

Most media were analyzed for conventional and physical parameters in the laboratory and by field instruments. The physical analysis of sediments included examination of several parameters that included grain size, cation exchange capacity (CEC), and TOC. In addition, various field parameters were measured that included monitoring for VOCs by PID, ORP, soil stiffness, and color.

The physical parameters measured for surface water included pH, temperature, conductivity, salinity, DO, turbidity, ORP, total dissolved solids (TDS), and specific gravity. All of these parameters were quantified using a multi-function Horiba water quality meter.

Other conventional parameters for surface water that were analyzed include alkalinity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), hardness, TOC, TDS, TPH, bromide, chloride, fluoride, ortho-phosphate, sulfate, total Kjeldhal nitrogen (TKN), ammonia, and nitrate/nitrite.

Porewater was analyzed for dissolved organic carbon (DOC), ammonia, and hydrogen sulfide.

All tissue samples were analyzed for the percentage of lipids in the sample.

4.5.2 Inorganics

Inorganics were measured in sediment, surface water, porewater, and tissue for the RI. Various methods (Table 4-3) were used to quantify inorganics found in the estuary. The following inorganic analyses were performed for the RI:

- In Phase I, sediments were analyzed for Target Analyte List (TAL) metals and cyanide.
- In Phase II, sediments were analyzed for total recoverable metals (nickel [Ni], copper [Cu], zinc [Zn], silver [Ag], cadmium [Cd], and lead [Pb]).
- In Phase II, a limited number of predetermined sediment sampling locations were analyzed for toxicity characteristic leaching procedure (TCLP) metals and total recoverable metals.
- Acid volatile sulfide and simultaneously extracted metals (AVS/SEM) analysis was performed in Phase II at all sediment locations.

- Surface water samples were analyzed for total and dissolved TAL metals and cyanide by CLP. In addition, total and dissolved arsenic (As), Cu, Pb, and mercury (Hg) were analyzed using SW-846 7000-series analytical procedures (Table 4-3) (CDM 2000b).

- In Phase II, porewater samples were analyzed for total recoverable and dissolved metals.

- Tissue was analyzed for TAL metals and total Hg.

4.5.3 Organics

Various organics were measured in sediment, surface water, porewater, and tissue for the RI (Table 4-3). The following organic analyses were performed:

- Sediments were analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, PCB congeners (20 percent of Phase II sediment samples), TPHs, dioxins/furans (20 percent of sediment samples), methyl-mercury (Me-Hg), and TCLP SVOCs at predetermined locations.

- Surface water samples were analyzed for VOCs, SVOCs, herbicides, pesticides, and PCBs in Phase I.

- Porewater samples were analyzed for SVOCs, pesticides, and PCBs in Phase II.

- Tissue samples were analyzed for SVOCs, pesticides, and PCBs. Selected tissue samples were also analyzed for PCB congeners and dioxin/furans.

Required sample volume and container types are presented in Table 4-4. Due to the low sample volume in Phase I, some samples had elevated detection limits, which rendered data unusable. Analytical procedures were modified for Phase II such that a 50-gram (g) sample was used versus a 35-g sample (Phase I) for SVOCs for sediments (Method 8270) to meet the required detection limits.

4.5.4 Toxicity and Bioaccumulation Tests

Sediment toxicity tests were conducted for sediment collected at the 100 SQT locations. These tests were used to measure 10- and 28-day survival and growth endpoints with the amphipod *Hyalella azteca* and acute 10-day tests with the amphipod *Ampelisca abdit,* to measure survival. Sediment bioaccumulation tests were conducted with the polychaete *Nereis virens* to determine the bioavailability of sediment-associated contaminants.

The 10-day whole sediment tests were conducted following the procedures outlined in EPA's *Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (EPA/600/R-025; EPA 1994a). The 28-day bioaccumulation tests were conducted in accordance with the EPA and the USACE

Standard Testing Manual entitled: *Evaluation of Dredged Material for Proposed Ocean Disposal - Testing Manual* (EPA/503/8-91/001, February [EPA 1991]).

Microtox® was also applied to each SQT sediment sample to quantify potential effects on decomposers in sediments. This test determines the bioavailability of chemicals in sediments. The Microtox® solid-phase test exposes glowing luminescent bacteria (*Vibrio fisheri*) directly to sediment-bound chemical contaminants in an aqueous suspension of the test sample (Johnson and Long 1998). The endpoint measured in the solid-phase test with Microtox® is the EC50 (expressed as sediment wet weight/milliliter [mL]). An EC50 is the effective concentration value where an impact to 50 percent of the test population is observed.

A 28-day bioaccumulation test was conducted at 10 SQT locations (Figures 4-7 through 4-9) with the polychaete *Nereis virens*. The levels of metals, PAHs, PCBs, organochlorine pesticides, and other SVOCs were measured in the polychaete tissues at the conclusion of the test. Samples were sent to the laboratory where they were homogenized prior to analysis and were subjected to the same analyses as other tissue samples. The 28-day bioaccumulation test data will be used with the corresponding sediment chemistry data to estimate sediment-to-biota accumulation factors for the sediment areas.

Porewater toxicity tests conducted included sea urchin (*Arabcia punctulata*) fertilization and embryological development assays, macrophyte algal germination and growth (*Ulva spp.*) assays, and embryo-larval growth and survival assays with red drum (*Sciaenops ocellatus*). Methods for conducting porewater tests follow procedures described in Carr et al. (1996a,b; 1997) and Hooten and Carr (1998), and the American Society for Testing and Materials (ASTM 2000).

Results for the toxicity and bioaccumulation tests are summarized in Section 12 and presented in Section 13.

4.5.5 Benthic Community Survey

The benthic macroinvertebrate community survey was conducted across the entire estuary taken at the 100 SQT locations. The sample methods and analysis procedures were published in the *EPA-EMAP Protocol* (Paul et al. 1992).

An index of biotic integrity (IBI) was used to characterize benthic condition of the Calcasieu Estuary. This is a multi-metric index used widely by benthic ecologists to integrate numerous biotic responses, account for natural-habitat variations, and define reference conditions (Weisburg et al. 1997). Such indices have found wide acceptance among biologists and have been adopted for analyses of estuaries throughout the United States (Fore et al. 1996; Weisburg et al. 1997; van Dolah et al. 1999; Dauer et al. 2000; Llanso 2001; Alden et al. in press; Ranasinghe et al. in press).

Results for the benthic community structure are summarized in Section 11 and presented in Section 13.

4.5.6 Toxicity Identification Evaluation (TIE)

A parallel study was conducted by EPA under the Clean Water Act using TIE tests at SQT selected locations. The tests were limited to nine whole sediment locations across the estuary. Methods used are based upon the following EPA guidance: *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I*, EPA/600/6-91/005 (EPA 1991b).

TIE evaluations typically consist of three phases: (1) characterize the physical/chemical properties of the toxicants; (2) identify the toxicants (typically non-polar organics, ethylene diamine triacetic acid (EDTA), chelatable metals, and ammonia); and (3) perform a final confirmation through a weight-of-evidence approach to effluent testing.

The whole sediment TIE methods performed on these samples consisted of three manipulations: (1) addition of a cation resin to remove metals, (2) addition of a powdered coconut charcoal to remove organics, and (3) exposure to the sea lettuce (*Ulva lactuca*) to remove ammonia. Results of the TIE are summarized in Section 11.

4.5.7 BEST Program

Fish selected for the HHRA, prior to fillet, were evaluated by the USFWS using the BEST program at the time of collection. BEST is a national program of the Biological Resources Division (BRD) of the USGS. BEST is specifically designed to focus on the response of biological resources to environmental contaminants. Under the BEST program, USFWS examined fish for deformities, skin lesions, or tumors on the surface and within the specimen in accordance with several USGS/BRD guidance documents (USGS/BRD 1999 and USGS/BRD 2000). Results of USFWS's evaluations were not available for inclusion in this RI.

4.6 Data Quality Assessment

The data used in this RI/FS and associated risk assessments were assessed through a data evaluation program that includes data validation and data evaluation in accordance with EPA's nationally recognized guidelines. Prior to use, this evaluation measure ensures quality of the data used is defined and that a known confidence in data usability is ensured. The data validation process addresses these needs.

This section provides a data quality review of the data collected for the RI report and addresses data usability. The study design, DQOs, and quality assurance project plan (QAPP) are outlined in the approved SAPs (CDM 1999a, 1999b, 1999c, 1999d, and 2000b).

4.6.1 Data Validation and Evaluation

Data validation was conducted to assess the quality of the laboratory data and to determine if it satisfies the project's DQOs. Data are compared to established criteria for categories such as data package and laboratory completeness and is completed after the laboratory has finished their review. During this process, individual sample

results are accepted, rejected, or qualified. Data that meet all the validation criteria are accepted as unqualified and can be used without discretion as needed. Data that are rejected (R) for not meeting one or more of the validation criteria cannot be used. Some data fall into the gray area between accepted and rejected. These data are qualified as estimated (J) to indicate that one or more of the validation criteria were not met (EPA 1994). Data validation may determine possible analytical error, but more importantly, it assesses data usability. Data are presented in sample delivery groups (SDGs) that typically includes:

- A narrative describing the samples analyzed, data and time of receipt, temperature and pH, and the presence of a chain-of-custody (COC) form
- A listing of procedures used in preparing the sample for analysis and the analysis methods
- Results of analyses
- Technical difficulties encountered that may affect the quality of the result
- Any instances where a sample may have been re-prepared or re-analyzed due to not meeting method or contract requirements
- Deviations from standard protocols
- An explanation of laboratory qualifiers used
- Signature of laboratory designee(s) for ensuring data quality and data package content

Data validation was performed in accordance with EPA's *Contract Laboratory Program National Functional Guidelines for Data Review* (both organic and inorganic) (EPA 1994a, b). Data collected for this RI were validated at different levels. Full data validation includes review of the raw data with error checks on laboratory performance, preparation of standards and samples, analyte identification, and re-quantification from raw data. Data evaluation (limited data validation) consisted of evaluating a set of quality control samples including laboratory control sample (LCS) analyses; matrix spike/matrix spike duplicate (MS/MSD) analyses; and method, field, and trip blanks. Data evaluation is an assessment of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. PARCC goals were established and defined for the project in the various SAPs. The following sections define and discuss these PARCC parameters, as well as sensitivity.

In Phase I, sample data from over 1,500 individual samples and 172 SDGs from six different CLP and subcontract analytical laboratories were received, reviewed, validated, and evaluated. One hundred percent validation and evaluation was performed on Phase I data. In Phase II, validation was reduced to SDGs if errors or problems were found during the data evaluation. This resulted in nearly 6,000

individual samples from Phase II being 100-percent evaluated. Seventeen percent of the 6,000 samples were validated. Table 4-5 and Table 4-6 summarize the data validation and evaluation of Phases I and II samples.

The data gathered from the RI investigation were determined usable through this data validation program and comply with EPA Region VI's *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, 1996*. Full documentation of the validation process is located in CDM's Data Evaluation Summary Reports (CDM 2000a, CDM 2002a). Appendix B specifies the validation and evaluation criteria and percent recoveries for the Calcasieu Estuary RI.

4.6.1.1 Precision

The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision of the analysis is assessed by comparing original and duplicated sample results, where applicable. The relative percent difference (RPD) was calculated for each pair of applicable duplicate analyses using the following equation:

$$\text{Relative Percent Difference} = |S - D| / ((S+D) / 2) \times 100$$

Where:

S = First sample value (original value)
D = Second sample value (duplicate value)

Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability, depending on the type of quality control (QC) sample. Data were evaluated for precision using the following types of samples (in order of priority): field duplicates, laboratory duplicates, LCS/laboratory control sample duplicates (LCSDs), or MS/MSDs, whichever are analyzed.

The acceptable RPD limits, established in the SAPs (CDM 1999a through d, CDM 2000a, CDM 2000b) for duplicate measurements are in accordance with the laboratory-specific limits; laboratory and analytical methodology; EPA *CLP National Functional Guidelines for Inorganic Data Review* (EPA 1994a); and/or EPA *CLP National Functional Guidelines for Organic Data Review* (EPA 1994b), whichever are applicable.

4.6.1.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the percent recovery (%R) of a sample result. Percent recovery is calculated as follows:

$$\text{Percent Recovery} = SSR - SR / SA \times 100$$

Where:

SSR = Spiked sample result
SR = Sample result
SA = Spike added

Ideally, it is desirable that the reported concentration equals the actual concentration present in the sample. Data may be evaluated for accuracy using (in order of priority) LCS/LCSDs, MS/MSDs, and/or surrogates as specified by Appendix B.

The acceptable %R limits are also presented in the projects' SAPs and are in accordance with the laboratory-specific limits, laboratory or analytical methodology, EPA National Functional Guidelines for Inorganic Data Review (EPA 1994a), and/or EPA National Functional Guidelines for Organic Data Review (EPA 1994b), whichever are applicable.

4.6.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent:

- The characteristic being measured
- Parameter variations at a sampling point
- An environmental condition

Representativeness is a qualitative and quantitative parameter that is most concerned with the proper sampling design and the absence of cross contamination of samples. Acceptable representativeness is achieved through: (1) careful, informed selection of sampling sites, (2) selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits, (3) proper gathering and handling of samples to avoid interferences and prevent contamination and loss, and (4) collection of a sufficient number of samples to allow characterization. Representativeness was assessed qualitatively by reviewing the selection of sampling sites, testing methods, sensitivity, and number of samples and quantitatively by reviewing the holding times, preservation, and blank samples. If an analyte is detected in a method, preparation, trip, or rinsate blank, any associated positive result less than five times (10 times for common laboratory contaminants) may be considered a false positive. Holding times and preservation were evaluated to determine if analytical results are representative of sample concentrations.

For the RI, samples were collected and analyzed in accordance with the governing SAPs and, therefore, the location, number, and testing methods of the samples were approved by EPA and the stakeholders. Through this review and approval process, it is assumed that the location, number, and testing methods will provide a statistically sound quantification of chemical conditions in the estuary and is representative of actual conditions.

4.6.1.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability was determined by evaluation of the PARCC parameters, excluding completeness. Those data that are validated or evaluated and are not considered estimated or are qualified as estimated or non-detect are usable. Rejected data are not usable. A completeness goal of 90 percent was established for the entire project. Completeness is calculated using the following equation:

$$\% \text{ Completeness} = (DO/DP) \times 100$$

Where:

DO = Data obtained and usable
DP = Data planned to be obtained

After review, a completeness of 92 percent was calculated, which achieved the 90 percent completeness goal for the RI.

4.6.1.5 Comparability

Comparability is a qualitative parameter. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Data developed under this investigation were collected and analyzed using standard EPA analytical methods and QC to ensure comparability of results with other analyses performed in a similar manner. Therefore, the data for this RI are considered comparable to the post–1992 historical concentration data. Comparability to the historical data is limited in that detection limits and reporting limits for the historical data are typically not available.

4.6.2 Data Quality Objectives Summary

The final step of the data quality assessment is to determine if the data collected satisfy the project's DQOs and goals. The DQO process is described in the Calcasieu RI SAPs (CDM 1999a, 1999b, 1999c, 1999d, 2000a, 2000b).

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures that the resources required to generate the data are justified. The DQO process consists of seven steps of which the output from each step influences the choices made. Tables 4-7 through 4-10 illustrate the target detection limits for Phases I and II and the target detection limits achieved. Table 4-11 summarizes the project DQOs and provides an assessment of how the project DQOs were met.

4.7 Deviations from Sampling and Analysis Plans

Due to the extent, variability, and complexity of the Calcasieu Estuary RI, unexpected field conditions or other extenuating circumstances required field changes or variances outlined in the SAPs. Program modifications were typically discussed and approved by EPA prior to implementation. Those not discussed with EPA did not affect the project's DQOs for any of the field investigations. Table 4-12 outlines these deviations and impacts, if any, upon the various field investigations.

4.8 Data Interpretation and Analysis

Data generated from the RI were collected in order to describe the concentrations, fate, transport, and impacts of contaminants within the Calcasieu Estuary. In the following sections, subsets of the data based on media, AOC, and energy area were examined to describe the geochemical fate and transport of contaminants in the estuary.

Section 4.8.1 addresses key issues in development of the data sets, and Section 4.8.2 discusses the technical approach to interpret and present the data.

4.8.1 Data Set

The following key issues concerning the data set are discussed in this section:

- Data validation results
- Data collection time frame
- Handling of duplicate samples
- Handling of re-sampled locations
- Handling of split samples
- Handling of sample depths
- Handling of non-detection and estimated concentration values
- Handling of missing total organic carbon and grain size information

4.8.1.1 Data Validation Results

Data validation results were addressed in Section 4.6, Data Validation. A summary of data acceptance and rejection from analysis is provided in the data evaluation summary reports (CDM 2000a, 2002a).

4.8.1.2 Time Frame

Data obtained for the Calcasieu Estuary RI was collected from December 1999 through December 2000, with three distinct sampling events: Phase I (December 1999 to March 2000), sitewide ecological reconnaissance (April to May 2000) and Phase II

(November 2000 to December 2000). For the purpose of nature and extent characterization, all the data collected is considered from the same time period.

4.8.1.3 Duplicate Samples

Duplicate samples were collected and analyzed to provide a check for sampling and analytical error. Duplicate samples are split samples of one homogenized sample volume. Conducting statistical or geostatistical analyses of both the normal and duplicate samples in an area would bias the chemistry at that location by counting the value twice for one location.

To remove this bias, the duplicate sample can be removed, the two values averaged, or a rule created to use the highest detection or lowest non-detect value. For this data set, highest detection/lowest non-detection was used. Therefore, for any sample location where there are two results reported, the highest detected value for each analyte will be used for analysis. Also, for any given location, if it has two values for an analyte that were non-detected, the lowest non-detected value will be used. All remaining duplicate results were removed from the data set.

4.8.1.4 Re-Sampled Sediment Locations

Selected sample locations may have been re-sampled to determine vertical extent, achieve a lower detection limit, or confirm detections. Since sampling was considered collected over the same period, the guideline for re-sampled locations is the same as for duplicate samples with the data set, including either the highest detection or lowest non-detection value.

4.8.1.5 Split Samples

At the request of stakeholders and PRPs, some samples were split externally between PRPs and internally to different laboratories. The results from those analyses resulted in multiple data sets for a single location.

Split samples with PRPs were excluded from the data set since they were not validated by CDM and the detection limits tended to be higher. Internal splits (splits collected by CDM but sent to different laboratories) were handled as regular samples and followed the guidelines of highest detection or lowest non-detection value to be included in the data set.

4.8.1.6 Sampling Depths

Samples were collected at various depths throughout the estuary with surface sediment samples defined as either 0 to 10 or 0 to 15 cm. Multi-depth samples were typically defined as 0 to 10, 10 to 20, and 20 to 30 cm, with the exception of Bayou Verdine. Samples in Bayou Verdine were primarily collected by Conoco who chose to sample at 0 to 15, 15 to 30, and 30 to 45 cm.

For the purpose of horizontal extent, surface sediment was defined as those sediments collected between 0- and 15-cm interval across the entire estuary. For vertical extent, each AOC will be analyzed separately based upon the intervals sampled.

4.8.1.7 Non-detects and Estimated Values

Data generated from chemical analysis may include analyte concentration results that fall below the detection limit of the instrument. These values are described as non-detections of non-detects, and the appropriate detection limit is listed for its value. These non-detects are generally considered to fall somewhere between zero and the detection limit. Approaches to handle non-detects include:

- Set the concentration of the non-detect equal to zero
- Set the concentration of the non-detect equal to the detection limit or
- Non-detect values are assigned one-half the detection limit

Each of the above approaches tends to bias the data either lower, with values equal zero, or higher, with values equal to the detection limit.

Typically for risk assessment purposes, non-detect values are assigned one-half the detection limit. For the nature and extent characterization, one-half the detection limit was used as well to limit as much bias as possible. This approach is recommended by EPA (EPA 1989, 1992) for other types of statistical analysis.

Due to high moisture content in the sediment, many of the non-detected values were extremely high. The guideline for these results was to exclude any results where one-half the detection limit was higher then the minimum value of the detected population. Although these samples may have contaminants present, using extremely high non-detects would add bias to any statistical analysis of the data.

As previously noted, estimated concentrations (i.e., values qualified as J) are considered detects. Their values are usually used with some caution in any manipulation or assessment of the data.

4.8.1.8 Handling of Limited Total Organic Carbon and Grain Size

TOC and grain size are important sediment characteristics in determining the fate and transport of sediment contamination. However, these parameters were not analyzed at every location. These parameters were assumed consistent over a small area typically defined by a reach. The geometric means of these parameters are considered representative of that reach. If a sample had TOC and grain size values, these values were used for that location.

4.8.1.9 Summation of Compounds

Contaminants within a particular chemical group (such as PAHs) are frequently summed to describe a large number of contaminants. In this RI, total PCBs, low molecular, high molecular and total PAHs, (LPAHs, HPAHs, and TPAHs) and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin toxicity equivalents (2,3,7,8-TCDD TEQ) are used to present the data observed in the estuary.

4.8.1.9.1 PCBs

Total PCBs were calculated by summing the aroclors measured at that location. Non-detects were included in the summation as one-half the detection limit.

4.8.1.9.2 PAHs

LPAHs, HPAHs, and TPAHS are calculated by summing the detected compounds in a particular group. Table 4-13 presents the classification of PAHs. TPAHs are the summation of both the LPAH and HPAH. Non-detects were excluded due to high detection limits at several locations in the estuary. The high detection limits would have introduced a high bias to the summation results.

4.8.1.9.3 Dioxins/Furans

Dioxins/furans are frequently presented as 2,3,7,8-TCDD TEQ in risk assessments and are useful to describe the distribution of dioxins observed. The TEQ is developed by multiplying the concentration for the dioxin or furan by a factor (Table 4-14) and then summing up the results. Non-detects were included in this calculation at one-half the detection limit.

4.8.2 Technical Approach

The primary goal of the RI is to assess whether, and to what extent, sediments and surface water are contaminated or have the potential to adversely affect the environment or human health (EPA 1994). To achieve this end, this document follows the technical approach described below.

- Identify energy areas within each AOC
- Summarize statistics of results within each energy area in an AOC
- Perform multivariate analyses based on media and energy areas
- Perform a statistical comparison between the reaches and/or energy areas and reference areas

Presentation of data and interpretation results include:

- Summary statistic tables
- Spatial plots using geostatistical methods such as kriging

Interpretation of results will be presented in Sections 7 through 10, which discuss the nature and extent of contamination in each of the AOCs and Section 11, which discusses the results of the tissue analysis.

4.8.2.1 Energy Areas

As stated in Sections 2 and 3, the site was divided into five primary energy settings: bayous, marshes, shallow lakes, shipping channels, and river. The energy of a specific area will influence surface water variability, sediment nature, and stability.

Depositional environment, surface water conditions, and stability of the sediment can be used to describe the behavior of the system as a whole. Exhibit 4-1 lists the data sets created for sediment and surface water. Tissue data sets were based on AOC and grouping as discussed in Section 4.3.

Exhibit 4-1 Data Sets for Sediment and Surface Water

Area of Concern	Energy Area
Bayou D'Inde	Bayou
Bayou D'Inde	Marsh
Bayou Verdine	Bayou
Lower Calcasieu	Bayou
Lower Calcasieu	Other
Lower Calcasieu	Shallow Lake
Lower Calcasieu	Ship Channel
Upper Calcasieu	Bayou
Upper Calcasieu	Marsh
Upper Calcasieu	River
Upper Calcasieu	Shallow Lake
Upper Calcasieu	Ship Channel
Reference Area	Bayou

4.8.2.2 Summary Statistics

Summary statistics were generated for each of the data sets using Microsoft Excel and the Caltrans Data Analysis Tool (DAT). The Caltrans DAT calculates summary statistics for data sets that include not detected data using regression on order statistics (ROS). The DAT includes a Visual Basic program that models the statistical procedures presented in Shumway and Azari (2000), Helsel (1990), and Helsel and Cohn (1988). The DAT has been verified against results published in those references.

The ROS method develops probability-plotting positions for each data point (censored and uncensored) based on the ordering of the data. A least squares line is then fit by regressing the log transformed concentrations to the uncensored probability plotting positions. The censored data points are assigned concentrations for calculation of summary statistics based on their probability plotting positions and the regression line equation. Summary statistics are calculated based on the uncensored data points and the "filled-in" censored values. Variance summary statistics are calculated using a Tukey-Jackknife algorithm. The jackknife procedure is performed by sequentially removing one point from the data set, running the analysis, and calculating the variance estimators as the average of each of the "n" runs of data.

4.8.2.3 Multivariate Analyses

Multivariate refers to the analysis of data consisting of two or more random variables. Multivariate analysis was used for the RI data sets because the complex interactions between variables are difficult to isolate and study individually. The sediment data

sets were statistically analyzed using principal components analysis (PCA). PCA will be used to reduce the multidimensionality of the data sets (Chapman 1996) and is a type of exploratory data analysis technique designed to:

- Study the correlations of multivariate data sets by grouping variables or loadings (e.g., pH and zinc in sediment) that show similar tendencies in factors. The first factor accounts for as much of the variability in the data as possible and each succeeding component accounts for as much of the remaining variability as possible.

- Reveal a simple underlying structure within a set of multivariate data. Such interpretation may provide useful information regarding geochemical fate and transport.

- Summarize many variables by a few factors. Essentially this is a data reduction technique whereby several original variables may be represented by one or a few indicator variables or by the factor itself that may be used as a predictor or criterion in subsequent analysis.

The goal of PCA is to summarize a multivariate data set as accurately as possible using a few factors. Each factor is a new axis through the multivariate data that represents the best association between a number of the variables (similar to a regression line). PCA provides the correlations between each factor and each variable and the relative amount of the total data set variance apportioned to or explained by each factor. Thus, in practice, PCA results are used to identify the original variables that load high within a particular factor and the percentage of the total variance explained by that factor. Exhibit 4-2 summarizes the data sets created for surface (0 to 10 cm) sediment.

Exhibit 4-2 Surface Sediment (0 to 10 cm) Data Sets for PCA

PCA Data	Area of Concern	Energy Area	Samples [1]	Constituents [2]
1	Bayou D'Inde	Bayou	100	140
2	Bayou D'Inde	Marsh	161	144
3	Bayou Verdine	Bayou	78	90
4	Lower Calcasieu	Bayou	18	33
5	Lower Calcasieu	Other	7	48
6	Lower Calcasieu	Shallow Lake	76	75
7	Lower Calcasieu	Ship Channel	52	63
8	Upper Calcasieu	Bayou	9	33
9	Upper Calcasieu	Marsh	8	35
10	Upper Calcasieu	River	12	32
11	Upper Calcasieu	Shallow Lake	46	79
12	Upper Calcasieu	Ship Channel	54	75
13	Reference Area	Bayou	18	37
	TOTAL		639	

[1] Number of samples with a result for at least one constituent in the AOC/Each data set.
[2] Number of constituents (variables) with a least 3 detections.

4.8.2.3.1 Steps in PCA

For each data set shown in Exhibit 4-2, PCA involved the following steps:

- A Pearson correlation matrix was generated to evaluate the numbers of data pairs for each constituent in the data set.
- Starting with the constituents with the highest number of data points, an initial PCA was conducted.
- Constituents with lower numbers of data points were added iteratively and additional PCAs conducted. The additional constituents were retained in subsequent PCAs if the requirement of a minimum of three data pairs was maintained.
- The PCA that allowed the largest number of constituents was retained as the result. In some cases, this meant removing a constituent with a larger number of cases in lieu of several constituents with lower numbers of cases.

The above steps were necessary to accommodate the holes in the data sets due to samples not being analyzed for every constituent (i.e., sampling for only dioxin/furans at selected locations). The PCAs were conducted using SYSTAT Version 10.0 (SPSS Software) with the following parameters:

- *Pairwise* deletion of missing cases to allow inclusion of the maximum number of variables (constituents).
- *Varimax* rotation of factors to minimize the number of variables that have high loadings on each factor (also known as factor simplification).
- Number of factors = 5. This number was selected based on preliminary PCA results that indicated at least 80 percent of the total variance was explained by the first five factors.

4.8.2.3.2 PCA Result Presentation

The PCA results for each of the 13 data sets were tabulated and graphed for ease of interpretation. Results included the percentage of the total variance explained and the factor 1 through factor 5 loadings for each constituent. In addition, a constituent ranking system was developed to support selection of indicators for subsequent statistical analysis. The ranking system consisted of the following:

Rank = (variance explained by factor) x (factor loading) x (relative sample size)

In this expression, "variance explained by factor" is the fraction of the total variance, and "relative sample size" is the number of results for the constituent in the data set divided by the total number of samples. For each data set, five sets of ranks were determined for each constituent (one set for each of the five factors), and the five ranks for each constituent were then summed. Thus, one set of ranks was developed

for each of the 13 data sets. Results of the PCA will be presented in Sections 7, 8, 9, and 10.

4.8.2.4 Comparison of Data to Reference Areas

Deciding whether site concentration levels tend to be larger than background or reference area concentrations can be answered by using statistical tests. Selecting the appropriate statistical test should look at the number of samples required for each of the various tests to achieve DQOs, the particular distribution (normal or lognormal) expected of the data to be collected, and information in published statistical papers that demonstrate the performance of the candidate tests for various data distributions and contamination scenarios (Naval Facilities Engineering Command [NFEC] 1999).

The Wilcoxon Rank Sum (WRS) Test evaluates whether there is a statistically significant difference between the medians of two data sets (i.e., the null hypothesis [H_0] that the populations from which the two data sets have been drawn have the same mean is tested against the alternative [H_A] that the populations have different means). The WRS Test is described in Gilbert (1987) and EPA (1992). The test was conducted on sediment samples using the computer program Systat V.10.

The WRS Test is a nonparametric statistical test that does not require the assumption that the data sets are derived from a normal population distribution. The only assumption is that the distributions of the two populations have the same shape, although they need not be symmetric. The WRS test was selected (over the parametric *t* test equivalent) because the population distributions were unknown and the sample data sets were generally insufficient to recognize the shapes of the population distributions. In addition, the WRS test is capable of handling the moderate number of nondetect values present in the sample data sets.

To ensure consistency, the sediment sample data sets used for the WRS testing were obtained using the same protocols used in the PCA. As with the PCA, the data sets were 13 groups as presented in Exhibit 4-1. The constituents selected for the WRS testing were determined from the PCA results. Essentially, those constituents with the highest PCA rankings (most important) were selected, with the exception of 2,3,7,8-TCDD TEQ, which was not used in the PCA.

At the conclusion of Sections 7, 8, 9, and 10, results from this analysis will be presented.

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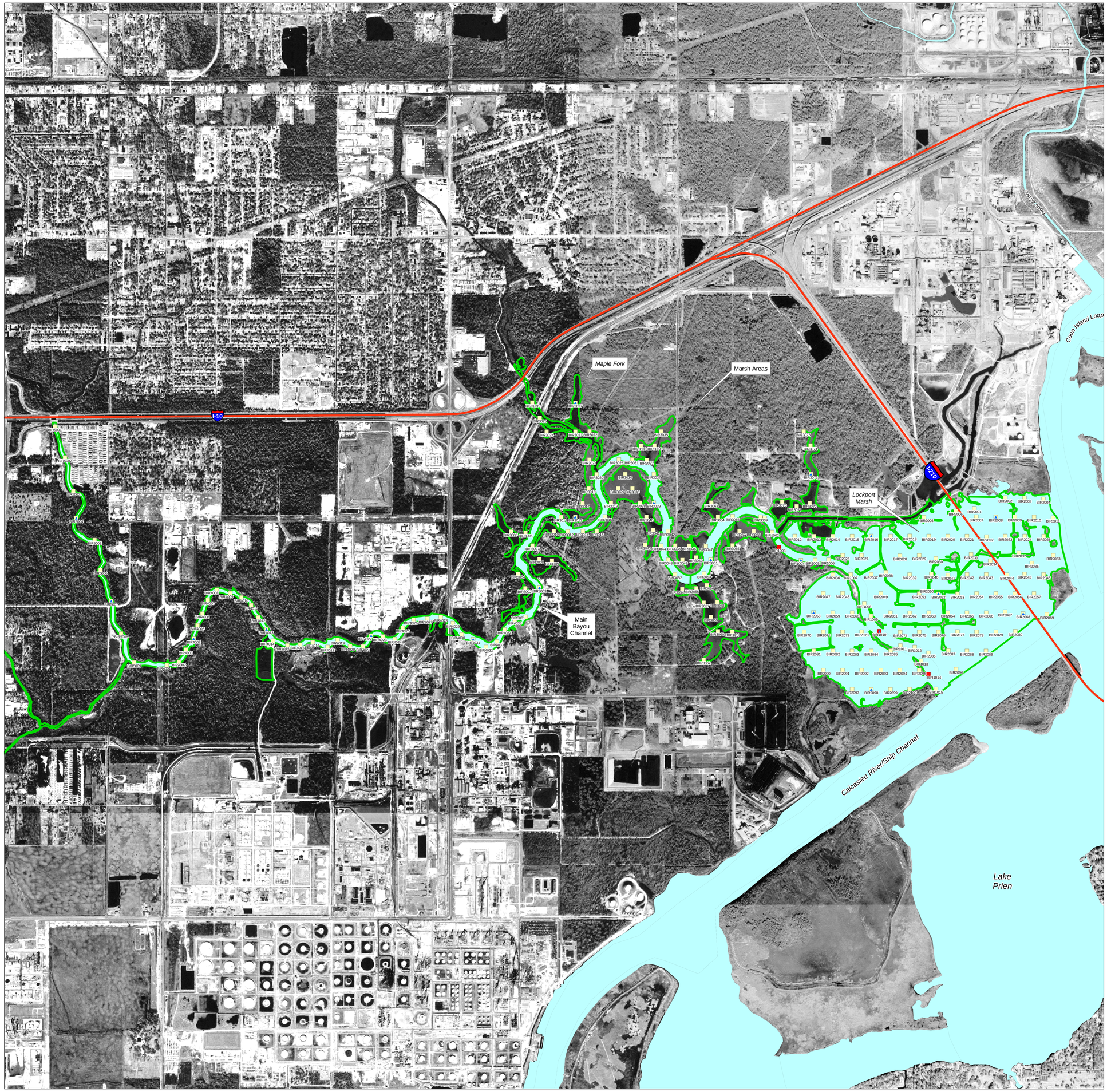
Figure 4-1
Phase I
Sediment and Surface Water Sample Locations
Bayou d'Inde AOC
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Surface Water Sample Location
- Sediment (Multi-Depth) Sample Location
- Sediment (Surface Sediment) Sample Location
- Interstate
- Bayou d'Inde AOC Boundary
- Water

Surface sediment samples are collected to a depth of 15 centimeters (cm). Multi-depth sediment samples are collected at 10 to 15 cm intervals up to a maximum depth of 45 cm.



N
W E
S

Kilometers
0 0.25 0.5 1

CDM

Map Filename: P1BISampleLocations.mxd 07/10/2002

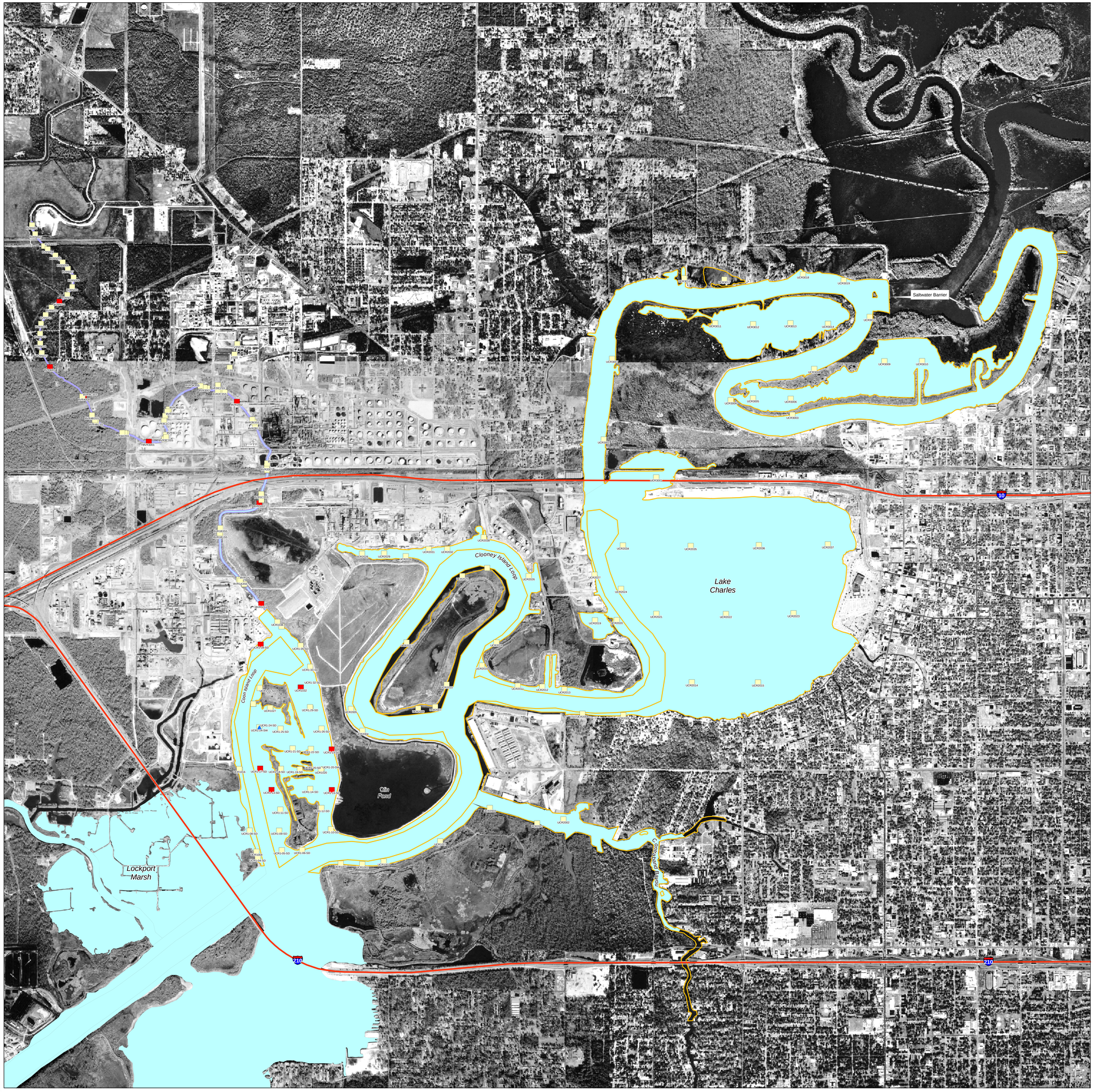


Figure 4-2
Phase I
Sediment and Surface Water Sample Locations
Upper Calcasieu AOC and Bayou Verdine AOC
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Surface Water Sample Location
- Sediment (Multi-Depth) Sample Location
- Sediment (Surface Sediment) Sample Location
- Interstate
- Bayou Verdine AOC Boundary
- Upper Calcasieu AOC Boundary
- Water

Surface sediment samples are collected to a depth of 15 centimeters (cm). Multi-depth sediment samples are collected at 10 to 15 cm intervals up to a maximum depth of 45 cm.

N
W E
S

Kilometers
0 0.25 0.5 1

CDM

Map Filename: fig4-2_PIUCandBVSampleLocations.mxd 05/29/2002

Figure 4-3
Phase I
Sediment and Surface Water Sample Locations
Lower Calcasieu AOC
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Surface Water Sample Location
- Sediment (Surface Sediment) Sample Location
- Interstate
- Lower Calcasieu AOC Boundaries
- Water

Surface sediment samples are collected to a depth of 15 centimeters (cm). Multi-depth sediment samples are collected at 10 to 15 cm intervals up to a maximum depth of 45 cm.

N
W E
S

Kilometers
0 0.25 0.5 1

CDM

Map Filename: fig4-3_P1LCSampleLocations-Esize.mxd 07/10/2002

Figure 4-4
Ecological Reconnaissance Sediment, Surface Water, and Tissue Sample Locations in Reference Areas
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Water Sampling Location
- Tissue (Fish) Sampling Location
- Sediment (Surface Sediment) Sampling Location
- Interstate
- Bayou Verdine AOC Boundary
- Bayou d'Inde AOC Boundary
- Lower Calcasieu AOC Boundary
- Upper Calcasieu AOC Boundary
- Water

N
W E
S

Kilometers
0 0.375 0.75 1.5

CDM

Map Filename: P:\EcoSampleLocations-Esize.mxd 07/15/2002

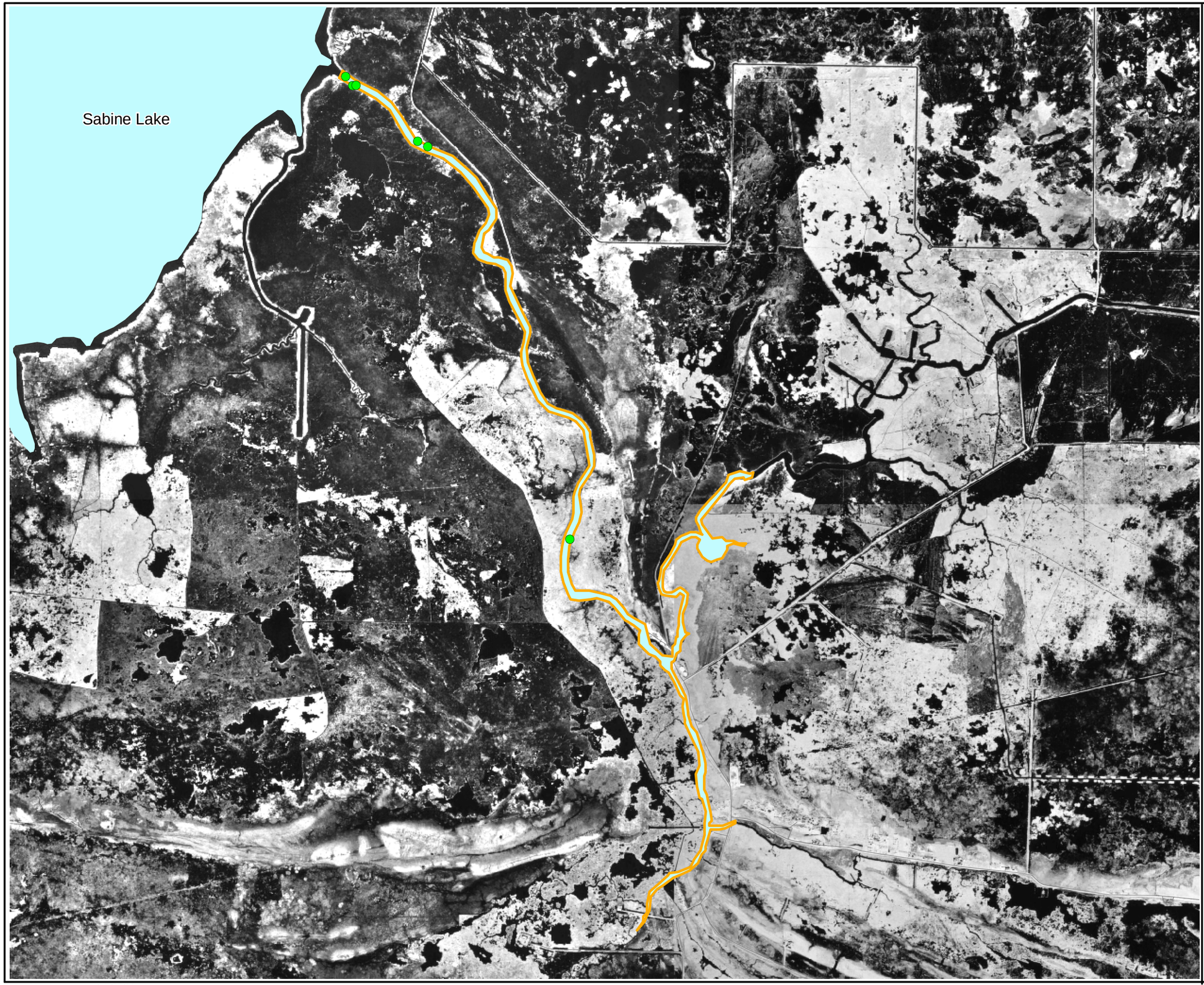


Figure 4-5
Ecological Reconnaissance
Sediment, Surface Water, and Tissue
Sample Locations in Reference Areas
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Surface Water Sample Location
- Johnsons Bayou
- Water

N
W E
S

Kilometers

0 0.5 1 2

CDM

figure4-5reference.mxd 7/17/02

Figure 4-6
Phase II
Data Gap Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Surface Water Sample Location
- Sediment (Subsurface Sample) Sample Location
- Sediment (Multi-Depth) Sample Location
- Sediment (Surface Sediment) Sample Location
- Interstate
- Bayou Verdine AOC Boundary
- Bayou d'Inde AOC Boundary
- Lower Calcasieu AOC Boundary
- Upper Calcasieu AOC Boundary
- Water

Surface Sediment are collected to a depth of 15 centimeters (cm). Multi-depth sediment samples are collected at 10 to 15 cm intervals up to a maximum depth of 45 cm. Subsurface samples are collected to a depth greater than 15 cm.

N
W E
S

Kilometers
0 0.5 1 2

CDM

Map Filename: PIIDataGapSampleLocations-Esize.mxd 07/15/2002

Figure 4-7
Phase II
Bayou d'Inde SQT Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Bioaccumulation Sample Location
- Porewater Sample Location
- SQT Sample Location
- Interstate
- AOC Boundaries
- Water

SQT Sample Location - Location where a sediment quality triad samples was collected for sediment chemistry, sediment toxicity tests, and benthic community survey.

Porewater Sample Location - Location where sediment was collected to extract porewater for chemistry and toxicity tests.

Bioaccumulation Sample Location - Location where sediment was collected for bioaccumulation tests.

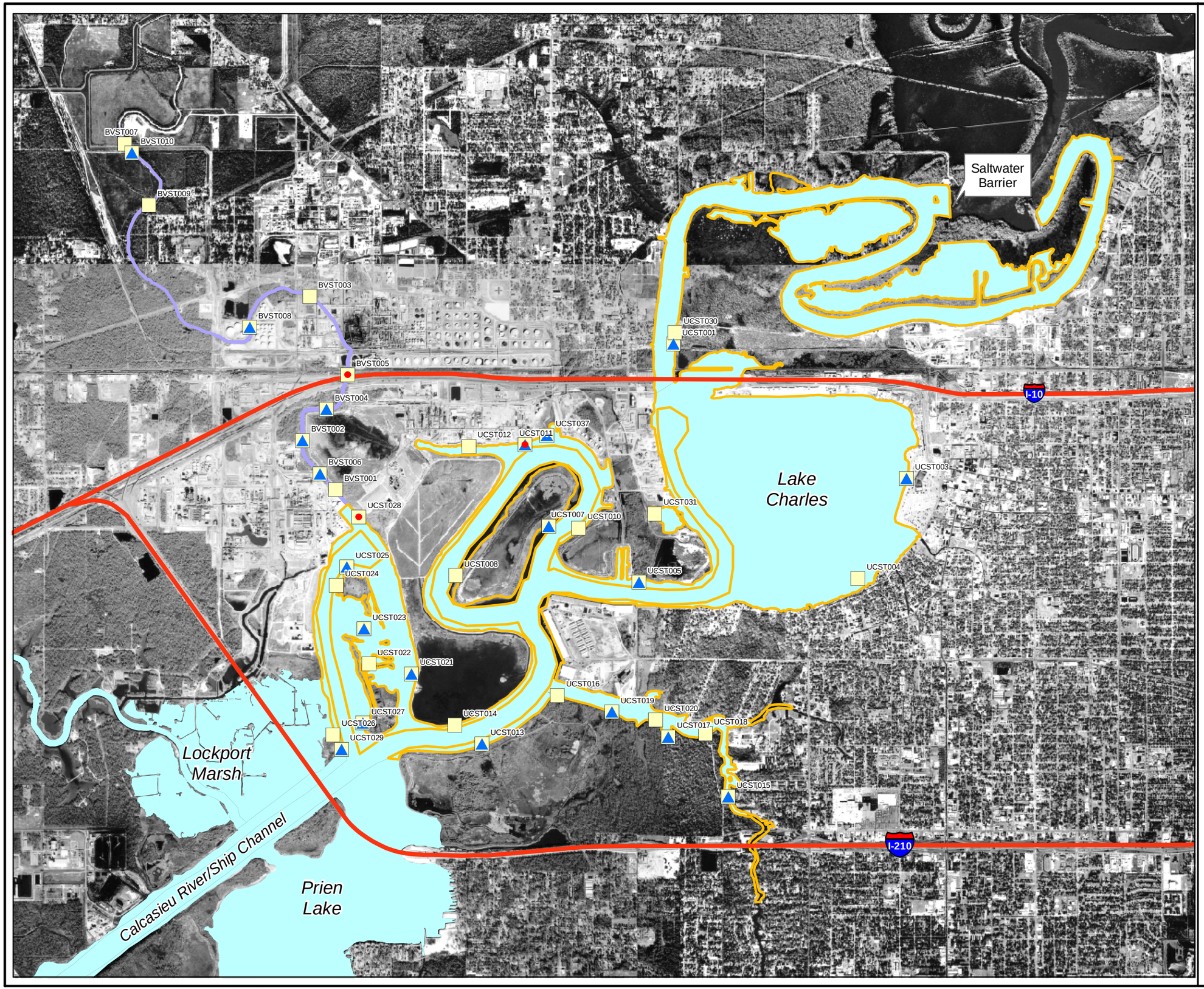
N
W E
S

Kilometers
0 0.25 0.5 1

CDM

Map Filename: P2BISQTandTissueLocations.mxd 07/15/2002

Figure 4-8
Phase II
Upper Calcasieu & Bayou Verdine
SQT Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Bioaccumulation Sample Location
- Porewater Sample Location
- SQT Sample Location
- Interstate
- Bayou Verdine
- Upper Calcasieu

SQT Sample Location - Location where a sediment quality triad samples was collected for sediment chemistry, sediment toxicity tests, and benthic community survey.

Porewater Sample Location - Location where sediment was collected to extract porewater for chemistry and toxicity tests.

Bioaccumulation Sample Location - Location where sediment was collected for bioaccumulation tests.

N
W E
S

Meters

0 250 500 1,000 1,500 2,000

CDM

Map Filename: figure4-8PIIUCandBVSQT.mxd 07/17/2002

Figure 4-9
Phase II
Lower Calcasieu SQT Sample Locations
Calcasieu Estuary remedial Investigation
Calcasieu Parish, Louisiana

Lockport Marsh

Calcasieu River/Ship Channel

Prien Lake

Moss Lake

LCST001
LCST002
LCST003
LCST004
LCST005
LCST006
LCST007
LCST008
LCST009
LCST010
LCST011
LCST012
LCST013
LCST014
LCST027

Legend

- Bioaccumulation Sample Location
- Porewater Sample Location
- SQT Sample Location
- Interstate
- Lower Calcasieu

SQT Sample Location - Location where a sediment quality triad samples was collected for sediment chemistry, sediment toxicity tests, and benthic community survey.

Porewater Sample Location - Location where sediment was collected to extract porewater for chemistry and toxicity tests.

Bioaccumulation Sample Location - Location where sediment was collected for bioaccumulation tests.

N
W E
S

Kilometers

0 0.5 1 2

CDM

Map Filename: figure4-9PIILCSQT.mxd 07/17/2002

Figure 4-10
Phase II
Fish Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Fish Sample Location
- Interstate
- Bayou Verdine AOC Boundary
- Bayou d'inde AOC Boundary
- Lower Calcasieu AOC Boundary
- Upper Calcasieu AOC Boundary

N
W E
S

Kilometers
0 0.45 0.9 1.8

CDM

Map Filename: fig4-10FishSampleLoc.mxd 07/17/2002

Figure 4-11
Phase II
Shellfish Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Shellfish Sample Location
- Interstate
- Bayou Verdine AOC Boundary
- Bayou d'Inde AOC Boundary
- Lower Calcasieu AOC Boundary
- Upper Calcasieu AOC Boundary

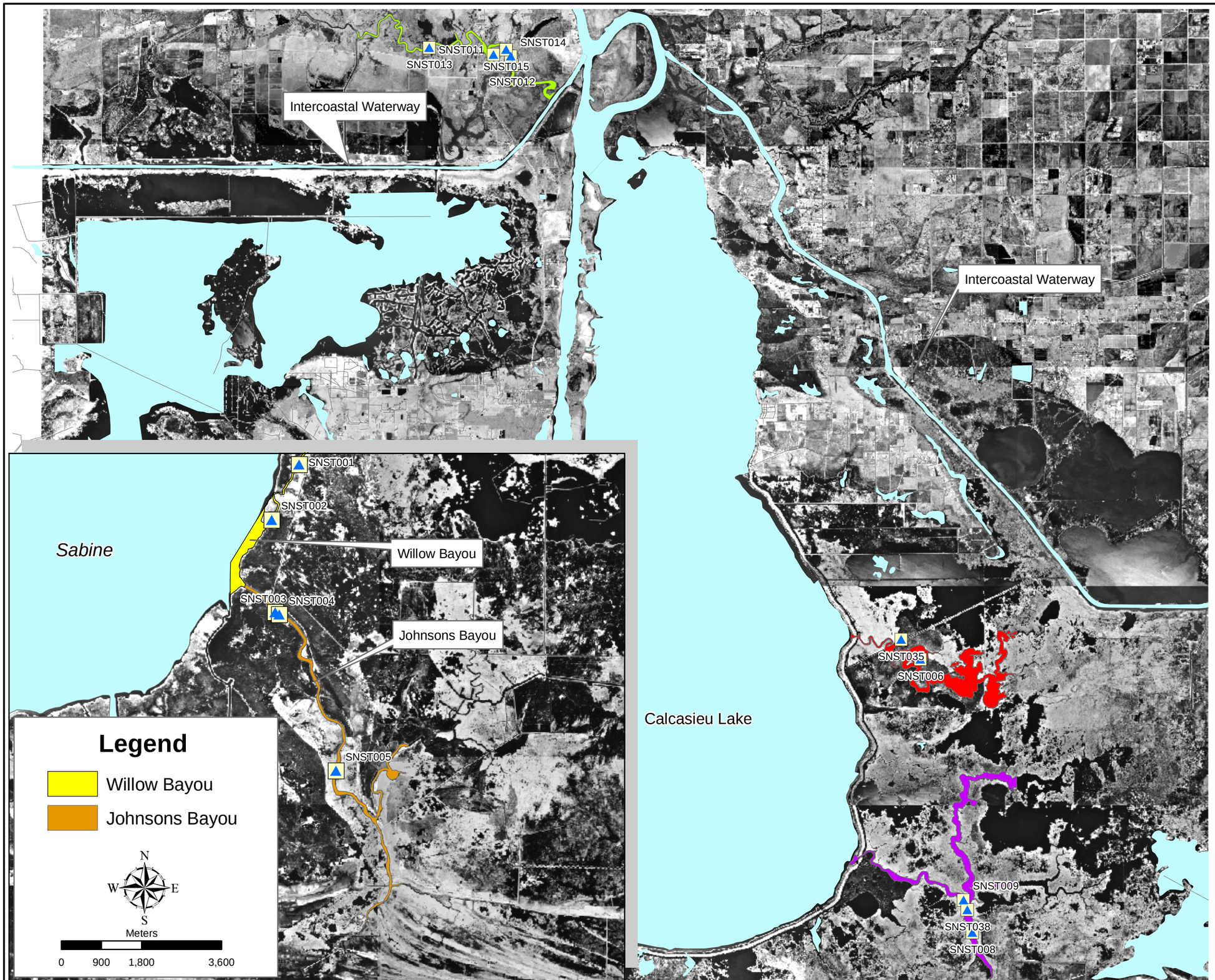
N
W E
S

Kilometers
0 0.4 0.8 1.6

CDM

Map Filename: fig4-11ShellFishSampleLoc.mxd 07/17/2002

Figure 4-12
Phase II
Reference Areas SQT Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Porewater Sample Location
- SQT Sample Location
- Bayou Bois Coninne
- Bayou Choupique
- Grand Bayou
- Water

N
W E
S

Kilometers
0 1.5 3 6

CDM

figure4-12PIIreferenceSQT.mxd 7/17/02

Figure 4-13
Phase II
Reference Areas Fish Tissue
Sample Locations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Fish Sample Location
- Bayou Bois Coninne
- Bayou Choupique
- Grand Bayou
- Water

N
W E
S

Kilometers

0 1.5 3 6

CDM

figure4-13referenceFishTissue.mxd 7/17/02

Table 4-1
Classification System for Calcasieu Estuary Fish and Invertebrates

Prey Group	Description of Group	Species	Size Class
Invertebrates			
1A	Small Sedentary Bivalves	*Rangia* clams, mussels, oysters	< 7.5 cm
1B	Small Sedentary Crustaceans	fidler crabs, hermit crabs, juvenile blue crabs	< 7.5 cm
2A	Small Migratory Crustaceans	shrimp	< 12.5 cm
2B	Large Migratory Crustaceans	blue crabs	> 12.5 cm
Fish			
1	Small Sedentary Species - Low Trophic Level (< 2.5)	killifish, sheepshead minnows, blennies, gobies, midshipman, mollies	< 15 cm
2A	Small Migratory Species - Low Trophic Level (< 2.5)	mullet, shad, anchovies, sunfish, spadefish, menhaden, herring, silverside	< 15 cm
2B	Small Migratory Species - High Trophic Level (>2.5)	puffer, spot, croaker, whiff, pinfish	< 15 cm
3A	Medium Migratory Species - Low Trophic Level (< 2.5)	mullet, shad, anchovies, spadefish, menhaden, herring, sunfish	15 - < 30 cm
3B	Medium Migratory Species - High Trophic Level (>2.5)	puffer, spot, croaker, whiff, pinfish, seatrout, black drum, redfish	15 - < 30 cm
4A	Large Migratory Species - Low Trophic Level (< 2.5)	mullet, shad	30 - 90 cm
4B	Large Migratory Species - High Trophic Level (>2.5)	croaker, redfish, black drum, flounder	30 - 90 cm

cm - centimeter

Table 4-2
COPCs Identified for the Calcasieu Estuary RI/FS

Contaminant Group	COPCs	Source
VOCS		
	1,2-dichloroethane	BERA Workshop
	trichloroethane	BERA Workshop
	acetone	BERA Workshop
SVOCs		
	bis(2-ethylhexyl)phthalate	HHRA, BERA Workshop
	hexachlorobenzene	HHRA
	hexachlorobutadiene	BERA Workshop
	3- & 4-Methylphenol	HHRA
	carbon disulfide	BERA Workshop
PAHs		
	acenaphthylene	HHRA, BERA Workshop
	benzo(a)anthracene	HHRA, BERA Workshop
	benzo(a)pyrene	HHRA, BERA Workshop
	benzo(b)fluoroanthene	HHRA
	benzo(g,h,I)perylene	HHRA
	benzo(k)fluoranthene	HHRA
	chrysene	HHRA, BERA Workshop
	dibenzo(a,h)anthracene	HHRA, BERA Workshop
	fluorene	HHRA, BERA Workshop
	phenanthrene	HHRA, BERA Workshop
	pyrene	BERA Workshop
	Total PAHs	BERA Workshop
	Low PAHs	BERA Workshop
	High PAHs	BERA Workshop
Pesticides/PCBs		
	aldrin	HHRA, BERA Workshop
	PCB Congeners	HHRA, BERA Workshop
	aroclor-1254	HHRA, BERA Workshop
	delta-bhc	HHRA
	dieldrin	HHRA, BERA Workshop
	endosulfan sulfate	HHRA
	endrin aldehyde	HHRA
	endrin ketone	HHRA
Dioxin/Furans		
	2,3,7,8-TCDD	HHRA
Metals		
	arsenic	HHRA
	barium	HHRA
	chromium (total)	HHRA, BERA Workshop
	copper	BERA Workshop
	lead	HHRA, BERA Workshop
	mercury	HHRA, BERA Workshop
	nickel	BERA Workshop
	zinc	BERA Workshop

HHRA - Human Health Risk Assessment

BERA Workshop - Baseline Environmental Risk Assessment Workshop (MacDonald et. al. 2000)

Table 4-3
Analytical Methods and Range of Detection Limits

Phase	Contaminant Group	Analytical Method	Detection Limits Minimum		Maximum	Units
Phase 1						
Sediment	Ancillary	SW9030	5.9	-	11.7	MG/KG
	Dioxin/Furans	SW8290	0.044	-	760	PG/G
	Herbicide	SW8151A	1.2	-	160000	ug/Kg
	Herbicide	SW8270C	780	-	8800	ug/Kg
	Metal	CLP-Metals	0.05	-	25900	MG/KG
	Metal	SW6010B	0	-	129	MG/KG
	Metal	SW6020	0.045	-	3.6	MG/KG
	Metal	SW7196	0.54	-	14	MG/KG
	Metal	SW7471A	0	-	0.27	MG/KG
	PAH	CLP-SVOC	180	-	280000	ug/Kg
	PAH	EPA Region 6 Laboratory	110	-	22720	ug/Kg
	PAH	SW8260B	1.5	-	7.7	ug/Kg
	PAH	SW8270C	28.5	-	10000	ug/Kg
	PAH	SW8310	6.8	-	67000	ug/Kg
	PCB	CLP-PPCB	23	-	7200	ug/Kg
	PCB	SW8082	3.8	-	280	ug/Kg
	Pesticide	CLP-PPCB	0.23	-	18000	ug/Kg
	Pesticide	SW8081A	0.12	-	570	ug/Kg
	Semivolatile	CLP-SVOC	63	-	690000	ug/Kg
	Semivolatile	CLP-VOC	10	-	27000	ug/Kg
	Semivolatile	EPA Region 6 Laboratory	110	-	119280	ug/Kg
	Semivolatile	SW8260B	0.5	-	26000	ug/Kg
	Semivolatile	SW8270C	32.5	-	54000	ug/Kg
	TPH	SW8015B MOD	12000	-	88000	ug/Kg
	Volatile	CLP-VOC	3	-	27000	ug/Kg
	Volatile	SW8260B	0.27	-	110000	ug/Kg
Soil	Herbicide	SW8151A	1.2	-	3700	ug/Kg
	Herbicide	SW8270C	1200	-	37000	ug/Kg
	Metal	SW6020	0.01	-	0.26	MG/KG
	Metal	SW6010B	0	-	228	MG/KG
	Metal	SW7196	0.85	-	2	MG/KG
	Metal	SW7471A	0	-	0.12	MG/KG
	PAH	SW8260B	1.5	-	1.5	ug/Kg
	PAH	SW8270C	33	-	37000	ug/Kg
	PCB	SW8082	3.8	-	90	ug/Kg
	Pesticide	SW8081A	0.12	-	560	ug/Kg
	Semivolatile	SW8260B	0.5	-	14	ug/Kg
	Semivolatile	SW8270C	33	-	190000	ug/Kg
	TPH	SW8015B	940	-	940	ug/Kg
	Volatile	SW8260B	0.395	-	650	ug/Kg
Tissue	Dioxin/Furans	AXYS METHOD DX-T-1613/Ver.3	0.1	-	1.97	PG/G
	Dioxin/Furans	SW8290	0.23	-	3.8	PG/G
	Metal	SW6010B	0.2	-	1730	MG/KG
	Metal	SW6020	0.0017	-	0.014	MG/KG
	Metal	SW7471A	0.00092	-	0.21	MG/KG
	PAH	8270C-SIM	1	-	4	ug/Kg
	PAH	SW8270C	250	-	20000	ug/Kg
	PCB	SW8082	2.5	-	100	ug/Kg
	Pesticide	SW8081A	0.13	-	430	ug/Kg
	Semivolatile	SW8270C	250	-	98000	ug/Kg
	Volatile	SW8260B	2	-	380	ug/Kg
Surface Water	Ancillary	E130.2	5	-	5	mg/L

Table 4-3
Analytical Methods and Range of Detection Limits

Phase	Contaminant Group	Analytical Method	Detection Limits Minimum		Maximum	Units
	Ancillary	E160.1	10	-	10	mg/L
	Ancillary	E160.2	4	-	4	mg/L
	Ancillary	E300	0.1	-	5	mg/L
	Ancillary	E310.1	5	-	5	mg/L
	Ancillary	E350.1	0.1	-	0.1	mg/L
	Ancillary	E351.2	0.5	-	1.4	mg/L
	Ancillary	E351.3	2.5	-	2.5	mg/L
	Ancillary	E353.2	0.1	-	0.1	mg/L
	Ancillary	E405.1	2	-	4	mg/L
	Ancillary	E410.4	20	-	42.5	mg/L
	Ancillary	EPA300.0A	0.2	-	20	mg/L
	Dioxin/Furans	AXYS METHOD DX-W-1613/Ver.1	1	-	40.1	PG/L
	Dioxin/Furans	SW8290	0.59	-	20	PG/L
	Herbicide	SW8151A	0.014	-	800	ug/L
	Herbicide	SW8270C	20	-	20	ug/L
	Metal	CLP-Metals	0.0001	-	2870	ug/L
	Metal	CVAFS	0.000011	-	0.000037	ug/L
	Metal	SW6010B	0	-	200	ug/L
	Metal	SW6020	0.000001	-	0.57	mg/L
	Metal	SW7196	0	-	0	mg/L
	Metal	SW7470A	0	-	0.2	ug/L
	Metal	SW7471A	0.02	-	0.02	umol/g
	Metal	SW9012	0.0035	-	0.01	mg/L
	PAH	8270C-SIM	0.01	-	0.011	ug/L
	PAH	CLP-SVOC	9	-	13	ug/L
	PAH	SW8260B	1.1	-	1.1	ug/L
	PAH	SW8270C	0.002	-	50	ug/L
	PAH	SW8310	0.1	-	2	ug/L
	PCB	CLP-PPCB	0.91	-	2.1	ug/L
	PCB	SW8082	0.02	-	1	ug/L
	Pesticide	CLP-PPCB	0.0071	-	5.3	ug/L
	Pesticide	SW8081A	0	-	2	ug/L
	Semivolatile	CLP-SVOC	7	-	31	ug/L
	Semivolatile	CLP-VOC	10	-	10	ug/L
	Semivolatile	SW8260B	1	-	2	ug/L
	Semivolatile	SW8270C	0.5	-	100	ug/L
	TPH	SW8015B	43	-	43	ug/L
	TPH	SW8015B MOD	100	-	360	ug/L
	Volatile	CLP-VOC	1	-	26	ug/L
	Volatile	SW8260B	0.5	-	100	ug/L
Phase II						
Porewater	Metal	TotalRecoverableMetals	0.000016	-	0.054	mg/L
	PAH	8270C-SIM	0.05	-	0.2	ug/L
	PAH	SW8270C	0.05	-	10	ug/L
	PCB	GCECD	0.04	-	1.52	ng/L
	PCB	SW8081A	0.1	-	0.1	ug/L
	PCB	SW8082	0.1	-	0.1	ug/L
	Pesticide	GCECD	0.03	-	0.862	ng/L
	Pesticide	SW8081A	0.005	-	0.5	ug/L
	Semivolatile	8270C-SIM	0.15	-	0.15	ug/L
	Semivolatile	GCECD	0.08	-	0.56	ng/L
	Semivolatile	SW8270C	0.15	-	0.2	ug/L
Sediment	Dioxin/Furans	SW8290	0.0927	-	71.2	PG/G

Table 4-3
Analytical Methods and Range of Detection Limits

Phase	Contaminant Group	Analytical Method	Detection Limits Minimum		Maximum	Units
	Metal	200.7	0.22	-	7.86	MG/KG
	Metal	200.9	0.33	-	3.1	MG/KG
	Metal	SW6010B	0.01	-	4860	MG/KG
	Metal	SW7470A	0.0099	-	0.0099	MG/KG
	Metal	SW7471A	0.02	-	0.5	MG/KG
	Metal	TotalRecoverableMetals	0.04	-	0.07	MG/KG
	Metal	MethylMercury USGS 005 Modified	0.00049	-	0.0012	MG/KG
	PAH	SW8270C	8	-	14150	ug/Kg
	PCB	SW1668	1.49	-	125	NG/KG
	PCB	SW8082	12	-	390	ug/Kg
	Pesticide	SW8081A	0.51	-	2000	ug/Kg
	Semivolatile	SW8270C	8	-	56600	ug/Kg
Tissue	Dioxin/Furans	AXYS METHOD DX-T-8290/Ver.2	0.1	-	0.1	PG/G
	Dioxin/Furans	SW8290	0.0166	-	13.9	PG/G
	Metal	M6020 ICPMS	0.002	-	0.003	MG/KG
	Metal	SW6010B	0.003	-	2200	MG/KG
	PAH	8270C-SIM	1.7	-	1.7	ug/Kg
	PAH	SW8270C	40	-	4000	ug/Kg
	PCB	AXYS METHOD CL-T-1668A/Ver.3	0.142	-	28.5	PG/G
	PCB	SW1668	1.97	-	238	ng/kg
	PCB	SW8081A	10	-	100	ug/Kg
	PCB	SW8082	7.8	-	830	ug/Kg
	Pesticide	SW8081A	1	-	1700	ug/Kg
	Semivolatile	SW8270C	40	-	330000	ug/Kg

Table 4-4
Sample Containers, Volume, and Preservation

Media	Contaminant Group	Containers/Volume	Preservation
Solid			
	VOCs	2 x 4 oz. Clear glass	4° C ± 2° C
	SVOCs	1 x 8 oz. Clear glass	4° C ± 2° C
	Pesticides/PCBs	1 x 8 oz. Clear glass	4° C ± 2° C
	PCB Congeners	1 x 8 oz. Clear glass	4° C ± 2° C
	Dioxin/Furans	1 x 4 oz. Clear glass	4° C ± 2° C
	TAL Metals	1 x 8 oz. Clear glass	4° C ± 2° C
	Methyl Mercury	1 x 4 oz. Clear glass	4° C ± 2° C
	TCLP Metals and SVOCs	2 x 4 oz. Clear glass	4° C ± 2° C
	AVS/SEM	1 x 4 oz. Clear glass	4° C ± 2° C
	TOC/Grain Size	1 x 4 oz. Clear glass	4° C ± 2° C
	10-day acute toxicity, *Hyalella azteca*		
	28-day acute toxicity, *Hyalella azteca*	1 - 128 oz. HPDE	4° C ± 2° C
	Bioluminescence tests with Microtox, *Vibrio fisheri*		
	10-day survival tests, *Ampelisca abdita*	2- 128 oz. HPDE	4° C ± 2° C
	28-day bioaccumulation tests, *Nereis Virens*	2 - 68 oz. HPDE	4° C ± 2° C
Surface Water			
	VOCs	2 x 40 ml Clear glass	4° C ± 2° C HCl to pH<2
	SVOCs	2 x 1 L Amber glass	4° C ± 2° C
	Pesticides/PCBs	2 x 1 L Amber glass	4° C ± 2° C
	Dioxin/Furans	2 x 1 L HPDE	4° C ± 2° C
	TAL Metals	2 x 1 L HPDE	4° C ± 2° C and HNO3 to pH<2 (Metals) NaOH to pH>12 (Cyanide)
Porewater	*Note: 6 - 128 oz HPDE of sediment were required to provide adequate volume for these analyses.*		
	SVOCs	2 x 500 ml Amber glass	4° C ± 2° C
	Pesticides/PCBs	2 x 500 ml Amber glass	4° C ± 2° C
	TAL Metals	2 x 60 ml HPDE	4° C ± 2° C and HNO3 to pH<2 (Metals)
	Embryo-larval assay, *Sciaenops ocellatus* Fertilization & development assays, *Arbacia punctulata* Germination assay, *Ulva spp.*	None Required	None Required
Tissue	VOCs	Aluminum Foil - 10 g	Frozen < 0°C
	SVOCs	Aluminum Foil - 20 g	Frozen < 0°C
	Pesticides/PCBs	Aluminum Foil - 10 g	Frozen < 0°C
	PCB Congeners	Aluminum Foil - 10 g	Frozen < 0°C
	Dioxin/Furans	Aluminum Foil - 10 g	Frozen < 0°C
	TAL Metals	Aluminum Foil - 10 g	Frozen < 0°C
	Methyl Mercury	Aluminum Foil - 5 g	Frozen < 0°C

Table 4-5
Phase I Data Validation and Evaluation Summary

Lab	Analytical Method	Samples/ Analytes Analyzed	Percent Validated	Percent Evaluated	Number of Samples Affected by Rejects
CLP	CLP-Metals	615/14682	100%	100%	337
CLP	CLP-PPCB	567/16138	100%	100%	24
CLP	CLP-SVOC	617/40168	100%	100%	1
CLP	CLP-VOC	663/31824	100%	100%	6
Conoco Contract Lab	8270C-SIM	85/1445	100%	0%	--
Conoco Contract Lab	Abiotic	16/16	100%	0%	--
Conoco Contract Lab	AVS/SEM	53/395	100%	0%	--
Conoco Contract Lab	AXYS METHOD DX-T-1613/Ver.3	28/700	100%	0%	21
Conoco Contract Lab	AXYS METHOD DX-W-1613/Ver.1	6/150	100%	0%	5
Conoco Contract Lab	CVAFS	70/70	100%	0%	--
Conoco Contract Lab	E130.2	13/13	100%	0%	--
Conoco Contract Lab	E160.3	74/74	100%	0%	--
Conoco Contract Lab	E300	13/13	100%	0%	--
Conoco Contract Lab	E310.1	13/13	100%	0%	--
Conoco Contract Lab	E350.1	13/13	100%	0%	--
Conoco Contract Lab	E351.2	13/13	100%	0%	--
Conoco Contract Lab	EPH	66/983	100%	0%	--
Conoco Contract Lab	Gravimetry	67/67	100%	0%	--
Conoco Contract Lab	SW6010B	134/1498	100%	0%	37
Conoco Contract Lab	SW6020	71/994	100%	0%	--
Conoco Contract Lab	SW7196	101/101	100%	0%	--
Conoco Contract Lab	SW7470A	23/23	100%	0%	--
Conoco Contract Lab	SW7471A	182/182	100%	0%	--
Conoco Contract Lab	SW8081A	151/2896	100%	0%	--
Conoco Contract Lab	SW8082	151/1091	100%	0%	--
Conoco Contract Lab	SW8260B	244/8887	100%	0%	24
Conoco Contract Lab	SW8270C	309/15025	100%	0%	--
Conoco Contract Lab	SW8310	71/1111	100%	0%	13
Conoco Contract Lab	SW9030	22/22	100%	0%	--
Conoco Contract Lab	Methyl Mercury	1/1	100%	0%	--
Conoco Contract Lab	VPH	73/519	100%	0%	--
Conoco Contract Lab	WBLACK	122/122	100%	0%	--
EPA R6	HOU-SVOC	6/396	100%	100%	--
Olin Contract Lab	E130.2	2/2	100%	0%	--
Olin Contract Lab	E160.1	2/2	100%	0%	--
Olin Contract Lab	E160.2	2/2	100%	0%	--
Olin Contract Lab	E300	2/14	100%	0%	--
Olin Contract Lab	E310.1	2/8	100%	0%	--
Olin Contract Lab	E350.3	2/2	100%	0%	--
Olin Contract Lab	E351.3	2/2	100%	0%	--
Olin Contract Lab	E405.1	2/2	100%	0%	--
Olin Contract Lab	E410.4	2/2	100%	0%	--
Olin Contract Lab	E6020	74/592	100%	0%	23
Olin Contract Lab	SW6010B	74/1414	100%	0%	--
Olin Contract Lab	SW7470A	9/9	100%	0%	--
Olin Contract Lab	SW7471A	65/65	100%	0%	--
Olin Contract Lab	SW8015B	12/12	100%	0%	--
Olin Contract Lab	SW8081A	74/1476	100%	0%	--
Olin Contract Lab	SW8082	74/518	100%	0%	--
Olin Contract Lab	SW8151A	74/740	100%	0%	--
Olin Contract Lab	SW8260B	85/4845	100%	0%	--

Table 4-5
Phase I Data Validation and Evaluation Summary

Lab	Analytical Method	Samples/ Analytes Analyzed	Percent Validated	Percent Evaluated	Number of Samples Affected by Rejects
Olin Contract Lab	SW8270C	74/4662	100%	0%	--
Olin Contract Lab	SW9045C	11/11	100%	0%	--
Olin Contract Lab	SW9060	13/13	100%	0%	--
Quanterra	%Lipid	71/71	100%	100%	--
Quanterra	E130.2	18/18	100%	100%	--
Quanterra	E160.1	17/17	100%	100%	--
Quanterra	E160.2	17/17	100%	100%	--
Quanterra	E310.1	17/65	100%	100%	--
Quanterra	E350.1	18/18	100%	100%	--
Quanterra	E351.2	18/18	100%	100%	--
Quanterra	E353.2	18/18	100%	100%	--
Quanterra	E405.1	16/16	100%	100%	--
Quanterra	E410.4	17/17	100%	100%	--
Quanterra	EPA300.0A	18/89	100%	100%	--
Quanterra	SW6010B	73/1576	100%	100%	1
Quanterra	SW6020	568/1076	100%	100%	--
Quanterra	SW7470A	66/67	100%	100%	1
Quanterra	SW7471A	68/68	100%	100%	--
Quanterra	SW8015B MOD	114/114	100%	100%	--
Quanterra	SW8081A	71/1491	100%	100%	30
Quanterra	SW8082	71/497	100%	100%	--
Quanterra	SW8151A	536/5542	100%	100%	25
Quanterra	SW8270C	85/5490	100%	100%	1
Quanterra	SW8290	116/2900	100%	100%	--
Quanterra	SW9012	87/87	100%	100%	--
Quanterra	SW9045C	94/94	100%	100%	--
Quanterra	SW9060	113/113	100%	100%	--
Quanterra	SW9081	82/82	100%	100%	--
Quanterra	VPH	2/10	100%	100%	--

Table 4-6
Phase II Data Validation and Evaluation Summary

Lab	Analytical Fraction	Samples/ Analytes Analyzed	Percent Validated	Percent Evaluation Only	Received	Number of Samples Affected by Rejects
AATS	Methyl Mercury	219/219	0%	0%	100%	--
AATS	Percent Lipids	663/663	0%	0%	100%	--
AATS	TAL Metals	737/8636	17%	100%	99%	83
AATS	TAL Pesticide/PCB	900/24969	18%	100%	99%	190
AATS	TAL SVOC	930/54219	22%	100%	100%	835
AATS	TCLP Metals	14/127	14%	100%	100%	--
AATS	TCLP Semivolatiles	13/215	23%	100%	85%	--
ACZ	Mercury ICP/MS	690/690	0%	12%	100%	--
ALTA	Dioxins and Furans	198/4950	14%	100%	100%	--
ALTA	PCBs (CONGENERS)	198/4354	13%	100%	100%	--
CERC	10-day Acute, Hyalella azteca	101/NA	0%	0%	0%	--
CERC	28-day Chronic, Hyalella aztec	101/NA	0%	0%	0%	--
CERC	AVS/SEM	109/970	100%*	100%*	100%	--
CERC	Dissolved Metals	52/336	100%*	100%*	100%	--
CERC	Grain Size	110/330	100%*	100%*	91%	--
CERC	Microtox	101/NA	100%*	100%*	0%	--
CERC	Total Dissolved Carbon	101/NA	100%*	100%*	99%	--
CERC	Total Metals	53/984	100%*	100%*	98%	--
CERC	Total Organic Carbon	110/110	100%*	100%*	90%	--
EPA R6	Toxicity Identification Evaluation	11/NA	100%	100%	0%	--
EPA R6	TAL Metals	7/159	100%	200%	100%	5
EPA R6	TAL Pesticide/PCB	8/132	100%	200%	100%	--
EPA R6	TAL SVOC	106/3280	100%	200%	100%	76
ES&E	10-day Survival, Ampelisca Abd	101/NA	0%	0%	0%	--
ES&E	Ammonia	101/100	0%	0%	99%	--
ES&E	Bioaccumulation	13/NA	0%	0%	0%	--
ES&E	Hardness	100/100	0%	0%	100%	--
ES&E	Salinity	100/100	0%	0%	100%	--
MERC	Embryo-larval assays, Sciaenop	50/NA	0%	0%	0%	--
MERC	Fertilization and development	50/NA	0%	0%	0%	--
MERC	Germination assay, Ulva. Spp	50/NA	0%	0%	0%	--
MERC	Hydrogen Sulfide	101/100	100%*	100%*	99%	--
UMISS	Benthic Community Survey	101/NA	0%	0%	0%	--

* Validated in accordance with USGS protocol but not in accordance with EPA protocol

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	--		0.099-110	PG/G	--		0.317-0.654	PG/G
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	--		0.044-7.7	PG/G	--		0.426-1.65	PG/G
Dioxin/Furans	1,2,3,4,7,8-HxCDD	--		0.13-79	PG/G	--		0.654-71.2	PG/G
Dioxin/Furans	1,2,3,4,7,8-HxCDF	--		0.18-45	PG/G	--		0.197-2.43	PG/G
Dioxin/Furans	1,2,3,6,7,8-HxCDD	--		0.4-9.9	PG/G	--		0.723-19.3	PG/G
Dioxin/Furans	1,2,3,6,7,8-HxCDF	--		0.049-12	PG/G	--		0.219-2.28	PG/G
Dioxin/Furans	1,2,3,7,8,9-HxCDD	--		0.59-63	PG/G	--		0.654-39.6	PG/G
Dioxin/Furans	1,2,3,7,8,9-HxCDF	--		0.051-8.8	PG/G	--		0.241-2.66	PG/G
Dioxin/Furans	1,2,3,7,8-PeCDD	--		0.22-67	PG/G	--		0.477-3.29	PG/G
Dioxin/Furans	1,2,3,7,8-PeCDF	--		0.27-13	PG/G	--		0.272-2.66	PG/G
Dioxin/Furans	2,3,4,6,7,8-HxCDF	--		0.044-11	PG/G	--		0.241-2.37	PG/G
Dioxin/Furans	2,3,4,7,8-PeCDF	--		0.21-8.8	PG/G	--		0.275-2.8	PG/G
Dioxin/Furans	2,3,7,8-TCDD	--		0.11-4	PG/G	2	PG/G	0.0927-0.951	PG/G
Dioxin/Furans	2,3,7,8-TCDF	--		0.23-3.9	PG/G	2	PG/G	0.182-0.944	PG/G
Dioxin/Furans	OCDF	--		0.21-760	PG/G	--		6.33-6.33	PG/G
Dioxin/Furans	Total HpCDD	--		360-360	PG/G	--		0.366-0.811	PG/G
Dioxin/Furans	Total HpCDF	--		0.099-7.4	PG/G	--		--	
Dioxin/Furans	Total HxCDD	--		2.7-3.2	PG/G	--		--	
Dioxin/Furans	Total HxCDF	--		0.19-9.2	PG/G	--		0.239-2.42	PG/G
Dioxin/Furans	Total PeCDD	--		0.5-93	PG/G	--		2.26-2.26	PG/G
Dioxin/Furans	Total PeCDF	--		0.27-10	PG/G	--		0.273-2.37	PG/G
Dioxin/Furans	Total TCDD	--		0.45-2.8	PG/G	--		0.246-0.394	PG/G
Dioxin/Furans	Total TCDF	--		0.3-1.6	PG/G	--		0.182-0.944	PG/G
Herbicide	2,2-Dichloropropionic Acid	--		48-810	ug/Kg	--		--	
Herbicide	2,4,5-T	--		24-410	ug/Kg	--		--	
Herbicide	2,4,5-TP (Silvex)	--		24-410	ug/Kg	--		--	
Herbicide	2,4-D	--		97-1600	ug/Kg	--		--	
Herbicide	2,4-DB	--		97-1600	ug/Kg	--		--	
Herbicide	Dicamba	--		48-810	ug/Kg	--		--	
Herbicide	Dichlorprop	--		97-1600	ug/Kg	--		--	
Herbicide	Dinitrobutyl Phenol	--		14-240	ug/Kg	--		--	

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Herbicide	MCPA (2-Methyl-4-Chlorophenoxyacetic Acid)	--		9700-160000	ug/Kg	--		--	
Herbicide	Mecoprop	--		9700-160000	ug/Kg	--		--	
Metal	Antimony	2	mg/kg	0.54-47.7	G	--		0.02-7.86	G
Metal	Arsenic	8.2	mg/kg	0.3-5.4	G	0.100	mg/kg	0.7-0.7	G
Metal	Beryllium	--		0.05-2.6	G	--		0.3-0.41	G
Metal	Cadmium	1.2	mg/kg	0.08-3.9	G	--		0.04-0.41	G
Metal	Calcium Metal	--		592-3700	G	--		--	
Metal	Chromium	81	mg/kg	1.4-13.6	G	0.100	mg/kg	--	
Metal	Cobalt	--		0.56-11.9	G	--		1.2-1.2	G
Metal	Copper	34	mg/kg	1.9-65.7	G	0.100	mg/kg	--	
Metal	Cyanide	--		0.05-3.1	G	--		--	
Metal	Iron	20000	mg/kg	1320-25900	G	--		3260-4860	G
Metal	Lead	46.7	mg/kg	3.8-74.9	G	0.100	mg/kg	--	
Metal	Magnesium	--		389-389	G	--		--	
Metal	Manganese	0.46	mg/kg	18.6-108	G	--		--	
Metal	Mercury	0.15	mg/kg	0.06-0.71	G	0.005	mg/kg	0.0099-0.5	G
Metal	Methyl Mercury	--		--		--		0.00049-0.0012	G
Metal	Nickel	20.9	mg/kg	1.4-38.7	G	--		1.2-1.2	G
Metal	Potassium	--		166-2690	G	--		--	
Metal	Selenium	--		0.16-5.9	G	--		0.05-0.7	G
Metal	Silver	1	mg/kg	0.1-5.1	G	--		0.001-1.31	G
Metal	Sodium	--		1990-19400	G	--		--	
Metal	Thallium	--		0.26-8.4	G	--		0.03-3.1	G
Metal	Vanadium (Fume Or Dust)	--		3.5-17.3	G	--		1.9-1.9	G
Metal	Zinc	150	mg/kg	8-347	G	0.500	mg/kg	11.4-13.2	G
PAH	1,1'-Biphenyl	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
PAH	1,2-Benzphenanthracene	384	ug/kg	180-190000	ug/Kg	--		0.016-6.9	mg/kg
PAH	2-Methylnaphthalene	70	ug/kg	110-190000	ug/Kg	0.01	mg/kg	0.009-6.9	mg/kg
PAH	Acenaphthene	16	ug/kg	110-280000	ug/Kg	--		0.008-6.9	mg/kg
PAH	Acenaphthylene	44	ug/kg	110-280000	ug/Kg	--		0.008-11	mg/kg
PAH	Anthracene	85.3	ug/kg	110-280000	ug/Kg	--		0.01-11	mg/kg

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
PAH	Benzo(a)anthracene	261	ug/kg	180-190000	ug/Kg	0.01	mg/kg	0.016-11	mg/kg
PAH	Benzo(a)pyrene	430	ug/kg	180-190000	ug/Kg	0.01	mg/kg	0.016-6.9	mg/kg
PAH	Benzo(b)fluoranthene	--		180-190000	ug/Kg	--		0.016-11	mg/kg
PAH	Benzo(g,h,i)perylene	--		180-190000	ug/Kg	--		0.016-11	mg/kg
PAH	Benzo(k)fluoranthene	--		180-280000	ug/Kg	--		0.016-11	mg/kg
PAH	Dibenzo(a,h)anthracene	63.4	ug/kg	180-280000	ug/Kg	0.01	mg/kg	0.016-11	mg/kg
PAH	Fluoranthene	600	ug/kg	110-190000	ug/Kg	--		0.016-11	mg/kg
PAH	Fluorene	19	ug/kg	110-280000	ug/Kg	--		0.008-6.9	mg/kg
PAH	Indeno(1,2,3-cd)pyrene	--		180-280000	ug/Kg	--		0.016-11	mg/kg
PAH	Naphthalene	160	ug/kg	110-280000	ug/Kg	--		0.009-6.9	mg/kg
PAH	Phenanthrene	240	ug/kg	110-27000	ug/Kg	0.01	mg/kg	0.016-6.9	mg/kg
PAH	Pyrene	665	ug/kg	110-190000	ug/Kg	--		0.016-6.9	mg/kg
PCB	Aroclor-1016	7	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1221	120	ug/kg	46-7200	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1232	600	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1242	170	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1248	30	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1254	60	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	Aroclor-1260	5	ug/kg	23-3600	ug/Kg	--		12-390	ug/Kg
PCB	PCB-105	--		--		--		46.4-46.4	ng/kg
PCB	PCB-108	--		--		--		46.4-46.4	ng/kg
PCB	PCB-114	--		--		--		2.24-48.4	ng/kg
PCB	PCB-118	--		--		--		46.4-46.4	ng/kg
PCB	PCB-126	--		--		--		4.97-49.5	ng/kg
PCB	PCB-127	--		--		--		4.56-50	ng/kg
PCB	PCB-15	--		--		--		4.99-4.99	ng/kg
PCB	PCB-156	--		--		--		46.4-46.4	ng/kg
PCB	PCB-157	--		--		--		4.97-48.4	ng/kg
PCB	PCB-162	--		--		--		46.4-46.4	ng/kg
PCB	PCB-167	--		--		--		46.4-46.4	ng/kg
PCB	PCB-169	--		--		--		4.77-49.8	ng/kg

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
PCB	PCB-189	--		--		--		4.97-46.4	ng/kg
PCB	PCB-37	--		--		--		13.8-73.9	ng/kg
PCB	PCB-58	--		--		--		4.98-49.5	ng/kg
PCB	PCB-60	--		--		--		10.3-56.4	ng/kg
PCB	PCB-61/70	--		--		--		25.3-125	ng/kg
PCB	PCB-66	--		--		--		21.9-75.1	ng/kg
PCB	PCB-77	--		--		--		6.07-46.4	ng/kg
PCB	PCB-79	--		--		--		4.97-48.4	ng/kg
PCB	PCB-80	--		--		--		1.49-49.8	ng/kg
PCB	PCB-81	--		--		--		4.97-48.4	ng/kg
PCB	TOTAL PCBs	22.7	ug/kg	--		0.010	mg/kg	--	
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	19	ug/kg	0.79-1800	ug/Kg	--		0.001-0.88	mg/kg
Pesticide	4,4'-DDD	2	ug/kg	2.3-360	ug/Kg	0.0005	mg/kg	0.001-0.94	mg/kg
Pesticide	4,4'-DDE	2.2	ug/kg	2.3-360	ug/Kg	0.0005	mg/kg	0.001-0.94	mg/kg
Pesticide	4,4'-DDT	1	ug/kg	2.3-360	ug/Kg	0.0005	mg/kg	0.001-0.26	mg/kg
Pesticide	Aldrin	2	ug/kg	0.74-180	ug/Kg	0.0005	mg/kg	0.00051-0.26	mg/kg
Pesticide	alpha-BHC	6	ug/kg	1.2-180	ug/Kg	--		0.00051-0.26	mg/kg
Pesticide	alpha-Chlordane	--		0.23-180	ug/Kg	--		0.00051-0.94	mg/kg
Pesticide	beta-BHC	5	ug/kg	1.2-390	ug/Kg	0.0005	mg/kg	0.00051-0.26	mg/kg
Pesticide	Camphechlor	--		120-18000	ug/Kg	--		0.015-2	mg/kg
Pesticide	delta-BHC	--		1.2-180	ug/Kg	--		0.00051-0.26	mg/kg
Pesticide	Dieldrin	0.02	ug/kg	2.3-360	ug/Kg	0.0005	mg/kg	0.001-0.26	mg/kg
Pesticide	Endosulfan I	5.5	ug/kg	1.2-180	ug/Kg	--		0.00051-0.94	mg/kg
Pesticide	Endosulfan II	--		2.3-360	ug/Kg	--		0.001-0.26	mg/kg
Pesticide	Endosulfan Sulfate	--		2.7-360	ug/Kg	--		0.001-0.26	mg/kg
Pesticide	Endrin	2.67	ug/kg	2.3-360	ug/Kg	--		0.0025-0.94	mg/kg
Pesticide	Endrin Aldehyde	--		2.3-360	ug/Kg	--		0.001-0.26	mg/kg
Pesticide	Endrin Ketone	--		2.3-360	ug/Kg	--		0.001-0.26	mg/kg
Pesticide	gamma-BHC (Lindane)	0.32	ug/kg	1.2-180	ug/Kg	--		0.00051-0.26	mg/kg
Pesticide	gamma-Chlordane	--		1.2-180	ug/Kg	--		0.00051-0.26	mg/kg
Pesticide	Heptachlor	68	ug/kg	1.2-180	ug/Kg	--		0.00051-0.26	mg/kg

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Pesticide	Heptachlor Epoxide	0.6	ug/kg	1.2-180	ug/Kg	--		0.00051-0.94	mg/kg
Pesticide	Technical Chlordane	--		--		--		0.01-0.269	mg/kg
Semivolatile	1,2,4-Trichlorobenzene	--		10-27000	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	1,2-Dichlorobenzene	--		10-27000	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	1,4-Dichlorobenzene	--		10-27000	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	2,2'-oxybis(1-Chloropropane)	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	2,4,5-Trichlorophenol	--		275-690000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2,4,6-Trichlorophenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2,4-Dichlorophenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2,4-Dimethylphenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2,4-Dinitrophenol	--		460-690000	ug/Kg	--		0.13-56.6	mg/kg
Semivolatile	2,4-Dinitrotoluene	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2,6-Dinitrotoluene	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2-Chloronaphthalene	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2-Chlorophenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2-Methylphenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	2-Nitroaniline	--		440-690000	ug/Kg	--		0.054-28	mg/kg
Semivolatile	2-Nitrophenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	3,3'-Dichlorobenzidine	--		180-280000	ug/Kg	--		0.053-14.15	mg/kg
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	3-Methylphenol & 4-Methylphenol	--		290-2300	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	3-Nitroaniline	--		440-690000	ug/Kg	--		0.13-28	mg/kg
Semivolatile	4,6-Dinitro-2-methylphenol	--		460-690000	ug/Kg	--		0.13-56.6	mg/kg
Semivolatile	4-Bromophenyl Phenyl Ether	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	4-Chloro-3-methylphenol	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	4-Chlorophenyl Phenyl Ether	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	4-Methylphenol	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	4-Nitrophenol	--		460-690000	ug/Kg	--		0.13-36.79	mg/kg
Semivolatile	Acetophenone	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	Atrazine	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	Benzaldehyde	--		330-280000	ug/Kg	--		0.051-14.15	mg/kg

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Semivolatile	Benzoic Acid	--		550-14200	ug/Kg	--		1.03-28.3	mg/kg
Semivolatile	Benzyl Alcohol	--		275-5680	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	Benzyl Butyl Phthalate	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	bis(2-Chloroethoxy)methane	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	bis(2-Chloroethyl)ether	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	bis(2-chloroisopropyl)ether	--		--		--		0.515-14.15	mg/kg
Semivolatile	bis(2-Ethylhexyl)phthalate	182	ug/kg	120-280000	ug/Kg	0.01	mg/kg	0.051-11	mg/kg
Semivolatile	Caprolactam			180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	Carbazole	--		180-280000	ug/Kg	--		0.009-14.15	mg/kg
Semivolatile	Di-n-butylphthalate	--		63-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	Di-n-octylphthalate	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	Dibenzofuran	--		180-280000	ug/Kg	--		0.008-11	mg/kg
Semivolatile	Diethyl Phthalate	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	Dimethyl Phthalate	--		180-280000	ug/Kg	--		0.051-11	mg/kg
Semivolatile	Hexachloro-1,3-butadiene	--		110-280000	ug/Kg	0.01	mg/kg	0.021-11	mg/kg
Semivolatile	Hexachlorobenzene	--		110-280000	ug/Kg	0.01	mg/kg	0.021-11	mg/kg
Semivolatile	Hexachlorocyclopentadiene	--		180-280000	ug/Kg	--		0.054-14.15	mg/kg
Semivolatile	Hexachloroethane	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	M-Dichlorobenzene	--		10-27000	ug/Kg	--		0.515-14.15	mg/kg
Semivolatile	N-Nitroso-di-n-propylamine	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	N-Nitrosodiphenylamine	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	Nitrobenzene	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	P-Chloroaniline	--		180-280000	ug/Kg	--		0.051-14.15	mg/kg
Semivolatile	P-Nitroaniline	--		440-690000	ug/Kg	--		0.13-28	mg/kg
Semivolatile	Pentachlorophenol	--		275-690000	ug/Kg	--		0.13-28	mg/kg
Semivolatile	Phenol	--		180-280000	ug/Kg	0.01	mg/kg	0.051-11	mg/kg
TPH	Diesel Range Organics	--		12000-88000	ug/Kg	--		--	
Volatile	1,1,1-Trichloroethane	--		10-210	ug/Kg	--		--	
Volatile	1,1,2,2-Tetrachloroethane	--		10-27000	ug/Kg	--		--	
Volatile	1,1,2-Trichloroethane	--		10-210	ug/Kg	--		--	
Volatile	1,1-Dichloroethane	--		10-210	ug/Kg	--		--	

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Volatile	1,1-Dichloroethylene	--		10-210	ug/Kg	--		--	
Volatile	1,2-Dibromo-3-chloropropane (DBCP)	--		10-27000	ug/Kg	--		--	
Volatile	1,2-Dibromoethane	--		10-27000	ug/Kg	--		--	
Volatile	1,2-Dichloroethane	--		10-210	ug/Kg	--		--	
Volatile	1,2-Dichloropropane	--		10-210	ug/Kg	--		--	
Volatile	2-Butanone	--		10-210	ug/Kg	--		--	
Volatile	4-Methyl-2-pentanone	--		10-27000	ug/Kg	--		--	
Volatile	Acetone	--		10-730	ug/Kg	--		--	
Volatile	Benzene	--		10-150	ug/Kg	--		--	
Volatile	Bromodichloromethane	--		10-210	ug/Kg	--		--	
Volatile	Bromomethane	--		10-210	ug/Kg	--		--	
Volatile	Carbon Disulfide	--		10-210	ug/Kg	--		--	
Volatile	Carbon Tetrachloride	--		10-210	ug/Kg	--		--	
Volatile	CFC-11	--		10-210	ug/Kg	--		--	
Volatile	CFC-12	--		10-210	ug/Kg	--		--	
Volatile	Chlorinated Fluorocarbon (Freon 113)	--		10-210	ug/Kg	--		--	
Volatile	Chlorobenzene	--		10-27000	ug/Kg	--		--	
Volatile	Chlorodibromomethane	--		10-210	ug/Kg	--		--	
Volatile	Chloroethane	--		10-210	ug/Kg	--		--	
Volatile	Chloroform	--		3-210	ug/Kg	--		--	
Volatile	Chloromethane	--		10-210	ug/Kg	--		--	
Volatile	cis-1,2-Dichloroethene	--		10-210	ug/Kg	--		--	
Volatile	cis-1,3-Dichloropropene	--		10-210	ug/Kg	--		--	
Volatile	Cyclohexane	--		10-150	ug/Kg	--		--	
Volatile	Dichloromethane	--		3-150	ug/Kg	--		--	
Volatile	Ethylbenzene	--		10-150	ug/Kg	--		--	
Volatile	Isopropylbenzene	--		10-27000	ug/Kg	--		--	
Volatile	Methyl Acetate	--		5-210	ug/Kg	--		--	
Volatile	Methyl N-Butyl Ketone	--		10-27000	ug/Kg	--		--	
Volatile	Methyl tert-Butyl Ether	--		10-27000	ug/Kg	--		--	
Volatile	Methylbenzene	--		10-150	ug/Kg	--		--	

[a] Calcasieu Estuary Phase I SAP (Table 5-3).

[b] Calcasieu Estuary Database.

[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-7
Sediment Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units	Target DL Phase II[c]	Units	DL Range Phase II[b]	Units
Volatile	Methylcyclohexane	--		10-210	ug/Kg	--		--	
Volatile	Styrene (monomer)	--		10-210	ug/Kg	--		--	
Volatile	Tetrachloroethene	--		10-27000	ug/Kg	--		--	
Volatile	trans-1,2-Dichloroethene	--		10-210	ug/Kg	--		--	
Volatile	trans-1,3-Dichloropropene	--		10-210	ug/Kg	--		--	
Volatile	Tribromomethane	--		10-210	ug/Kg	--		--	
Volatile	Trichloroethylene	--		10-210	ug/Kg	--		--	
Volatile	Vinyl Chloride	--		10-210	ug/Kg	--		--	
Volatile	Xylenes (total)	--		4-27000	ug/Kg	--		--	

[a] Calcasieu Estuary Phase I SAP (Table 5-3).
[b] Calcasieu Estuary Database.
[c] Calcasieu Estuary Phase II SAP (Table 5-2).

Table 4-8
Surface Water Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units
Ancillary	Biochemical Oxygen Demand	--		2-4	mg/L
Ancillary	Bromide	--		0.2-0.2	mg/L
Ancillary	Carbonate Alkalinity	--		5-5	mg/L
Ancillary	Chemical Oxygen Demand (COD)	--		20-42.5	mg/L
Ancillary	Fluoride	--		5-20	mg/L
Ancillary	Hardness, as CaCO3	--		5-5	mg/L
Ancillary	Hydroxide Alkalinity	--		5-5	mg/L
Ancillary	Nitrate-Nitrite	--		0.1-0.1	mg/L
Ancillary	Phosphate as P, Ortho	--		0.5-10	mg/L
Ancillary	Sulfate	--		5-5	mg/L
Ancillary	Total Kjeldahl Nitrogen	--		0.5-1.4	mg/L
Ancillary	Total Suspended Solids	--		4-4	mg/L
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	--		2.7-8.3	PG/L
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	--		1.8-6.1	PG/L
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	--		2.1-15	PG/L
Dioxin/Furans	1,2,3,4,7,8-HxCDD	--		0.6-6.2	PG/L
Dioxin/Furans	1,2,3,4,7,8-HxCDF	--		2.5-4.8	PG/L
Dioxin/Furans	1,2,3,6,7,8-HxCDD	--		0.63-5.8	PG/L
Dioxin/Furans	1,2,3,6,7,8-HxCDF	--		2-16	PG/L
Dioxin/Furans	1,2,3,7,8,9-HxCDD	--		0.59-5.9	PG/L
Dioxin/Furans	1,2,3,7,8,9-HxCDF	--		1.8-4.8	PG/L
Dioxin/Furans	1,2,3,7,8-PeCDD	--		1.2-4.8	PG/L
Dioxin/Furans	1,2,3,7,8-PeCDF	--		1.8-15	PG/L
Dioxin/Furans	2,3,4,6,7,8-HxCDF	--		1.6-3	PG/L
Dioxin/Furans	2,3,4,7,8-PeCDF	--		1.7-7.1	PG/L
Dioxin/Furans	2,3,7,8-TCDD	--		0.71-4.3	PG/L
Dioxin/Furans	2,3,7,8-TCDF	--		1.2-2.8	PG/L
Dioxin/Furans	OCDD	--		3.6-18	PG/L
Dioxin/Furans	OCDF	--		3-20	PG/L
Dioxin/Furans	Total HpCDD	--		4.2-8.3	PG/L
Dioxin/Furans	Total HpCDF	--		2.3-6.1	PG/L
Dioxin/Furans	Total HxCDD	--		3.2-12	PG/L
Dioxin/Furans	Total HxCDF	--		3.1-7	PG/L
Dioxin/Furans	Total PeCDD	--		1.8-4.8	PG/L
Dioxin/Furans	Total PeCDF	--		1.8-9.4	PG/L
Dioxin/Furans	Total TCDD	--		1.4-4.3	PG/L
Dioxin/Furans	Total TCDF	--		1.2-2.1	PG/L
Herbicide	2,2-Dichloropropionic Acid	--		2-4	ug/L
Herbicide	2,4,5-T	--		1-2	ug/L
Herbicide	2,4,5-TP (Silvex)	--		1-2	ug/L
Herbicide	2,4-D	--		4-8	ug/L
Herbicide	2,4-DB	--		4-8	ug/L
Herbicide	Dicamba	--		2-4	ug/L
Herbicide	Dichlorprop	--		4-8	ug/L
Herbicide	Dinitrobutyl Phenol	--		0.6-1.2	ug/L
Herbicide	MCPA (2-Methyl-4-Chlorophenoxyacetic Acid)	--		400-800	ug/L

[a] Calcasieu Estuary Phase I Sampling and Analysis Plan (Table 5-3).

[b] Calcasieu Estuary Database.

Table 4-8
Surface Water Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units
Herbicide	Mecoprop	--		400-800	ug/L
Metal	Aluminum (Fume Or Dust)	87	ug/L	0.05-1000	ug/L
Metal	Antimony	--		2-300	ug/L
Metal	Arsenic	36	ug/L	0.002-10	ug/L
Metal	Barium	--		0.1-200	ug/L
Metal	Beryllium	--		0.1-25	ug/L
Metal	Cadmium	9.3	ug/L	0.3-25	ug/L
Metal	Calcium Metal	--		35.9-310	ug/L
Metal	Chromium	103	ug/L	0.7-50	ug/L
Metal	Cobalt	--		1-250	ug/L
Metal	Copper	3.1	ug/L	0.6-31.1	ug/L
Metal	Cyanide	1	ug/L	3.5-10	ug/L
Metal	Iron	1000	ug/L	6.6-3470	ug/L
Metal	Lead	8.1	ug/L	0.17-9	ug/L
Metal	Magnesium	--		11.4-5000	ug/L
Metal	Manganese	--		0.2-130	ug/L
Metal	Mercury	0.025	ug/L	0.052-0.2	ug/L
Metal	Nickel	8.2	ug/L	0.002-200	ug/L
Metal	Potassium	--		36-5000	ug/L
Metal	Selenium	71	ug/L	0.002-22	ug/L
Metal	Silver	1.9	ug/L	0.001-6	ug/L
Metal	Sodium	--		115-5000	ug/L
Metal	Thallium	--		0.13-10	ug/L
Metal	Vanadium (Fume Or Dust)	--		1-250	ug/L
Metal	Zinc	81	ug/L	1.6-100	ug/L
PAH	1,1'-Biphenyl			9-13	ug/L
PAH	1,2-Benzphenanthracene	--		9-13	ug/L
PAH	2-Methylnaphthalene	--		9-13	ug/L
PAH	Acenaphthene	--		9-13	ug/L
PAH	Acenaphthylene	--		9-13	ug/L
PAH	Anthracene	--		9-13	ug/L
PAH	Benzo(a)anthracene	--		9-13	ug/L
PAH	Benzo(a)pyrene	--		9-13	ug/L
PAH	Benzo(b)fluoranthene	--		9-13	ug/L
PAH	Benzo(g,h,i)perylene	--		9-13	ug/L
PAH	Benzo(k)fluoranthene	--		9-13	ug/L
PAH	Dibenzo(a,h)anthracene	--		9-13	ug/L
PAH	Fluoranthene	--		9-13	ug/L
PAH	Fluorene	--		9-13	ug/L
PAH	Indeno(1,2,3-cd)pyrene	--		9-13	ug/L
PAH	Naphthalene	--		9-13	ug/L
PAH	Phenanthrene	--		9-13	ug/L
PAH	Pyrene	--		9-13	ug/L
PCB	Aroclor-1016	--		0.91-1	ug/L
PCB	Aroclor-1221	--		1.8-2.1	ug/L
PCB	Aroclor-1232	--		0.91-1	ug/L

[a] Calcasieu Estuary Phase I Sampling and Analysis Plan (Table 5-3).

[b] Calcasieu Estuary Database.

Table 4-8
Surface Water Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units
PCB	Aroclor-1242	--		0.91-1	ug/L
PCB	Aroclor-1248	--		0.91-1	ug/L
PCB	Aroclor-1254	--		0.91-1	ug/L
PCB	Aroclor-1260	--		0.91-1	ug/L
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	0.03	ug/L	0.015-0.53	ug/L
Pesticide	4,4'-DDD	0.25	ug/L	0.091-0.1	ug/L
Pesticide	4,4'-DDE	0.14	ug/L	0.091-0.1	ug/L
Pesticide	4,4'-DDT	0.001	ug/L	0.091-0.1	ug/L
Pesticide	Aldrin	1.3	ug/L	0.0079-0.053	ug/L
Pesticide	alpha-BHC	--		0.045-0.053	ug/L
Pesticide	alpha-Chlordane	--		0.045-0.053	ug/L
Pesticide	beta-BHC	--		0.031-0.11	ug/L
Pesticide	Camphechlor	0.0002	ug/L	4.5-5.3	ug/L
Pesticide	delta-BHC	--		0.0071-0.053	ug/L
Pesticide	Dieldrin	0.0019	ug/L	0.091-0.1	ug/L
Pesticide	Endosulfan I	0.0087	ug/L	0.045-0.053	ug/L
Pesticide	Endosulfan II	0.0087	ug/L	0.091-0.1	ug/L
Pesticide	Endosulfan Sulfate	--		0.091-0.1	ug/L
Pesticide	Endrin	0.0023	ug/L	0.091-0.1	ug/L
Pesticide	Endrin Aldehyde	--		0.091-0.1	ug/L
Pesticide	Endrin Ketone	--		0.091-0.1	ug/L
Pesticide	gamma-BHC (Lindane)	0.16	ug/L	0.045-0.053	ug/L
Pesticide	gamma-Chlordane	--		0.045-0.053	ug/L
Pesticide	Heptachlor	0.0036	ug/L	0.045-0.053	ug/L
Pesticide	Heptachlor Epoxide	0.0036	ug/L	0.045-0.053	ug/L
Semivolatile	1,2,4-Trichlorobenzene	--		10-10	ug/L
Semivolatile	1,2-Dichlorobenzene	--		10-10	ug/L
Semivolatile	1,4-Dichlorobenzene	--		10-10	ug/L
Semivolatile	2,2'-oxybis(1-Chloropropane)	--		9-13	ug/L
Semivolatile	2,4,5-Trichlorophenol	--		23-31	ug/L
Semivolatile	2,4,6-Trichlorophenol	--		9-13	ug/L
Semivolatile	2,4-Dichlorophenol	101	ug/L	9-13	ug/L
Semivolatile	2,4-Dimethylphenol	--		9-13	ug/L
Semivolatile	2,4-Dinitrophenol	--		23-31	ug/L
Semivolatile	2,4-Dinitrotoluene	--		9-13	ug/L
Semivolatile	2,6-Dinitrotoluene	--		9-13	ug/L
Semivolatile	2-Chloronaphthalene	--		9-13	ug/L
Semivolatile	2-Chlorophenol	129	ug/L	9-13	ug/L
Semivolatile	2-Methylphenol	--		9-13	ug/L
Semivolatile	2-Nitroaniline	--		23-31	ug/L
Semivolatile	2-Nitrophenol	--		9-13	ug/L
Semivolatile	3,3'-Dichlorobenzidine	--		9-13	ug/L
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--		9-13	ug/L
Semivolatile	3-Nitroaniline	--		23-31	ug/L
Semivolatile	4,6-Dinitro-2-methylphenol	--		23-31	ug/L
Semivolatile	4-Bromophenyl Phenyl Ether	--		9-13	ug/L

[a] Calcasieu Estuary Phase I Sampling and Analysis Plan (Table 5-3).

[b] Calcasieu Estuary Database.

Table 4-8
Surface Water Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units
Semivolatile	4-Chloro-3-methylphenol	--		9-13	ug/L
Semivolatile	4-Chlorophenyl Phenyl Ether	--		9-13	ug/L
Semivolatile	4-Methylphenol	--		9-13	ug/L
Semivolatile	4-Nitrophenol	--		23-31	ug/L
Semivolatile	Acetophenone	--		9-13	ug/L
Semivolatile	Atrazine	--		9-13	ug/L
Semivolatile	Benzaldehyde	--		9-13	ug/L
Semivolatile	Benzyl Butyl Phthalate	--		9-13	ug/L
Semivolatile	bis(2-Chloroethoxy)methane	--		9-13	ug/L
Semivolatile	bis(2-Chloroethyl)ether	--		9-13	ug/L
Semivolatile	bis(2-Ethylhexyl)phthalate	--		7-13	ug/L
Semivolatile	Caprolactam	--		9-13	ug/L
Semivolatile	Carbazole	--		9-13	ug/L
Semivolatile	Di-n-butylphthalate	--		9-13	ug/L
Semivolatile	Di-n-octylphthalate	--		9-13	ug/L
Semivolatile	Dibenzofuran	--		9-13	ug/L
Semivolatile	Diethyl Phthalate	--		9-13	ug/L
Semivolatile	Dimethyl Phthalate	--		9-13	ug/L
Semivolatile	Hexachloro-1,3-butadiene	0.32	ug/L	9-13	ug/L
Semivolatile	Hexachlorobenzene	--		9-13	ug/L
Semivolatile	Hexachlorocyclopentadiene	0.001	ug/L	9-13	ug/L
Semivolatile	Hexachloroethane	--		9-13	ug/L
Semivolatile	M-Dichlorobenzene	--		10-10	ug/L
Semivolatile	N-Nitroso-di-n-propylamine	--		9-13	ug/L
Semivolatile	N-Nitrosodiphenylamine	--		9-13	ug/L
Semivolatile	Nitrobenzene	--		9-13	ug/L
Semivolatile	P-Chloroaniline	--		9-13	ug/L
Semivolatile	P-Nitroaniline	--		23-31	ug/L
Semivolatile	Pentachlorophenol	7.9	ug/L	23-31	ug/L
Semivolatile	Phenol	290	ug/L	9-13	ug/L
TPH	C5-C8 Aliphatics	--		18000-18000	ug/L
TPH	C9-C10 Aromatics	--		10000-10000	ug/L
TPH	C9-C12 Aliphatics	--		5200-5200	ug/L
TPH	Diesel Range Organics	--		100-360	ug/L
TPH	Unadjusted C5-C8 Aliphatics	--		18000-18000	ug/L
TPH	Unadjusted C9-C12 Aliphatics	--		5200-5200	ug/L
Volatile	1,1,1-Trichloroethane	1560	ug/L	10-10	ug/L
Volatile	1,1,2,2-Tetrachloroethane	451	ug/L	10-10	ug/L
Volatile	1,1,2-Trichloroethane	900	ug/L	10-10	ug/L
Volatile	1,1-Dichloroethane	--		10-10	ug/L
Volatile	1,1-Dichloroethylene	11200	ug/L	10-10	ug/L
Volatile	1,2-Dibromo-3-chloropropane (DBCP)	--		10-10	ug/L
Volatile	1,2-Dibromoethane	--		10-10	ug/L
Volatile	1,2-Dichloroethane	5650	ug/L	10-10	ug/L
Volatile	1,2-Dichloropropane	--		10-10	ug/L
Volatile	2-Butanone	--		10-12	ug/L

[a] Calcasieu Estuary Phase I Sampling and Analysis Plan (Table 5-3).

[b] Calcasieu Estuary Database.

Table 4-8
Surface Water Target and Achieved Detection Limits

Method Group	Analyte	Target DL Phase I[a]	Units	DL Range Phase I[b]	Units
Volatile	4-Methyl-2-pentanone	--		10-10	ug/L
Volatile	Acetone	--		10-26	ug/L
Volatile	Benzene	1350	ug/L	10-10	ug/L
Volatile	Bromodichloromethane	--		10-10	ug/L
Volatile	Bromomethane	--		10-10	ug/L
Volatile	Carbon Disulfide	--		10-10	ug/L
Volatile	Carbon Tetrachloride	7500	ug/L	10-10	ug/L
Volatile	CFC-11	--		10-10	ug/L
Volatile	CFC-12	--		10-10	ug/L
Volatile	Chlorinated Fluorocarbon (Freon 113)	--		10-10	ug/L
Volatile	Chlorobenzene	--		10-10	ug/L
Volatile	Chlorodibromomethane	--		10-10	ug/L
Volatile	Chloroethane	--		10-10	ug/L
Volatile	Chloroform	4075	ug/L	1-10	ug/L
Volatile	Chloromethane	13500	ug/L	10-10	ug/L
Volatile	cis-1,2-Dichloroethene	--		10-10	ug/L
Volatile	cis-1,3-Dichloropropene	39.5	ug/L	10-10	ug/L
Volatile	Cyclohexane	--		10-10	ug/L
Volatile	Dichloromethane	12800	ug/L	1-19	ug/L
Volatile	Ethylbenzene	4380	ug/L	10-10	ug/L
Volatile	Isopropylbenzene	--		10-10	ug/L
Volatile	Methyl Acetate	--		10-10	ug/L
Volatile	Methyl N-Butyl Ketone	--		10-10	ug/L
Volatile	Methyl tert-Butyl Ether	--		10-10	ug/L
Volatile	Methylbenzene	475	ug/L	10-10	ug/L
Volatile	Methylcyclohexane	--		10-10	ug/L
Volatile	Styrene (monomer)	--		10-10	ug/L
Volatile	Tetrachloroethene	510	ug/L	10-10	ug/L
Volatile	trans-1,2-Dichloroethene	--		10-10	ug/L
Volatile	trans-1,3-Dichloropropene	--		10-10	ug/L
Volatile	Tribromomethane	895	ug/L	10-10	ug/L
Volatile	Trichloroethylene	100	ug/L	10-10	ug/L
Volatile	Vinyl Chloride	--		10-10	ug/L
Volatile	Xylenes (total)	--		10-10	ug/L

[a] Calcasieu Estuary Phase I Sampling and Analysis Plan (Table 5-3).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
%Lipid	Percent Lipids	--		--		0.1-0.1	%
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	0.63-1.8	PG/G	--		0.15-4.38	PG/G
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	0.23-1.9	PG/G	--		0.0758-1.23	PG/G
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	0.3-1.6	PG/G	--		0.0298-3.37	PG/G
Dioxin/Furans	1,2,3,4,7,8-HxCDD	0.9-1.8	PG/G	--		0.0447-2.04	PG/G
Dioxin/Furans	1,2,3,4,7,8-HxCDF	0.43-0.91	PG/G	--		0.0392-0.885	PG/G
Dioxin/Furans	1,2,3,6,7,8-HxCDD	0.76-1.7	PG/G	--		0.074-2.37	PG/G
Dioxin/Furans	1,2,3,6,7,8-HxCDF	0.38-2.3	PG/G	--		0.0405-0.946	PG/G
Dioxin/Furans	1,2,3,7,8,9-HxCDD	0.77-1.5	PG/G	--		0.0462-2.02	PG/G
Dioxin/Furans	1,2,3,7,8,9-HxCDF	0.5-1.2	PG/G	--		0.0255-4.72	PG/G
Dioxin/Furans	1,2,3,7,8-PeCDD	0.54-0.89	PG/G	--		0.0507-2.4	PG/G
Dioxin/Furans	1,2,3,7,8-PeCDF	0.28-1.9	PG/G	--		0.0623-1.11	PG/G
Dioxin/Furans	2,3,4,6,7,8-HxCDF	0.44-0.71	PG/G	--		0.0166-1.4	PG/G
Dioxin/Furans	2,3,4,7,8-PeCDF	0.28-1.8	PG/G	--		0.0474-1.45	PG/G
Dioxin/Furans	2,3,7,8-TCDD	0.25-0.44	PG/G	0.15	PG/G	0.026-0.882	PG/G
Dioxin/Furans	2,3,7,8-TCDF	0.31-1.7	PG/G	0.40	PG/G	0.0344-2.35	PG/G
Dioxin/Furans	OCDD	2.4-3.8	PG/G	--		0.508-12.6	PG/G
Dioxin/Furans	OCDF	0.57-1.3	PG/G	--		0.178-13.9	PG/G
Dioxin/Furans	Total HpCDD	0.68-1.8	PG/G	--		0.15-4.38	PG/G
Dioxin/Furans	Total HpCDF	0.3-1.9	PG/G	--		0.0811-1.81	PG/G
Dioxin/Furans	Total HxCDD	0.9-1.5	PG/G	--		0.0815-2.13	PG/G
Dioxin/Furans	Total HxCDF	0.5-1.6	PG/G	--		0.102-3.51	PG/G
Dioxin/Furans	Total PeCDD	0.54-2.8	PG/G	--		0.0507-2.4	PG/G
Dioxin/Furans	Total PeCDF	0.28-0.78	PG/G	--		0.13-1.37	PG/G
Dioxin/Furans	Total TCDD	0.25-0.5	PG/G	--		0.0228-0.882	PG/G
Dioxin/Furans	Total TCDF	0.44-0.48	PG/G	--		0.103-0.134	PG/G
Metal	Aluminum (Fume Or Dust)	4.4-28.6	MG/KG	--		21-47	MG/KG
Metal	Antimony	0.38-1	MG/KG	0.12	MG/KG	0.02-1	MG/KG
Metal	Arsenic	0.42-3.4	MG/KG	0.12	MG/KG	0.01-0.98	MG/KG
Metal	Barium	0.2-2.9	MG/KG	--		--	
Metal	Beryllium	0.5-0.5	MG/KG	--		0.054-0.1	MG/KG
Metal	Cadmium	0.5-0.5	MG/KG	--		0.003-0.3	MG/KG
Metal	Calcium Metal	--		--		250-330	MG/KG
Metal	Chromium	1-1	MG/KG	0.41	MG/KG	0.01-0.97	MG/KG

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
Metal	Cobalt	1-1	MG/KG	--		--	
Metal	Copper	0.33-1.3	MG/KG	19.40	MG/KG	0.01-4.2	MG/KG
Metal	Iron	3.1-26.6	MG/KG	--		0.11-3.6	MG/KG
Metal	Lead	0.8-0.8	MG/KG	0.47	MG/KG	0.02-0.49	MG/KG
Metal	Magnesium	251-280	MG/KG	--		110-160	MG/KG
Metal	Manganese	0.23-1.9	MG/KG	--		--	
Metal	Mercury	0.009-0.21	MG/KG	0.18	MG/KG	0.002-0.003	MG/KG
Metal	Nickel	4-4	MG/KG	--		0.03-0.33	MG/KG
Metal	Potassium	--		--		150-1500	MG/KG
Metal	Selenium	0.7-2	MG/KG	--		0.03-1	MG/KG
Metal	Silver	1-1	MG/KG	--		0.01-0.55	MG/KG
Metal	Sodium	351-1730	MG/KG	--		300-2200	MG/KG
Metal	Thallium	1.2-1.2	MG/KG	--		0.84-1	MG/KG
Metal	Vanadium (Fume Or Dust)	1-1	MG/KG	--		--	
Metal	Zinc	4.7-7.7	MG/KG	6.00	MG/KG	0.01-20	MG/KG
PAH	1,1'-Biphenyl			--		40-1000	ug/Kg
PAH	1,2-Benzphenanthracene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	1-Methylnaphthalene			--		1.7-1.7	ug/Kg
PAH	2-Methylnaphthalene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	Acenaphthene	1000-2000	ug/Kg	--		1.7-1000	ug/Kg
PAH	Acenaphthylene	1000-2000	ug/Kg	--		1.7-1000	ug/Kg
PAH	Anthracene	1000-2000	ug/Kg	--		1.7-1000	ug/Kg
PAH	Benzo(a)anthracene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	Benzo(a)pyrene	1000-2000	ug/Kg	990	ug/Kg	40-4000	ug/Kg
PAH	Benzo(b)fluoranthene	1000-2000	ug/Kg	--		40-4000	ug/Kg
PAH	Benzo(g,h,i)perylene	1000-2000	ug/Kg	--		40-4000	ug/Kg
PAH	Benzo(k)fluoranthene	1000-2000	ug/Kg	--		40-4000	ug/Kg
PAH	Dibenzo(a,h)anthracene	1000-2000	ug/Kg	--		1.7-4000	ug/Kg
PAH	Fluoranthene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	Fluorene	1000-2000	ug/Kg	--		1.7-1000	ug/Kg
PAH	Indeno(1,2,3-cd)pyrene	1000-2000	ug/Kg	--		40-4000	ug/Kg
PAH	Naphthalene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	Phenanthrene	1000-2000	ug/Kg	--		40-1000	ug/Kg
PAH	Pyrene	1000-2000	ug/Kg	--		40-1000	ug/Kg

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
PCB	Aroclor-1016	100-100	ug/Kg	--		10-830	ug/Kg
PCB	Aroclor-1221	100-100	ug/Kg	--		10-830	ug/Kg
PCB	Aroclor-1232	100-100	ug/Kg	--		10-830	ug/Kg
PCB	Aroclor-1242	100-100	ug/Kg	--		10-830	ug/Kg
PCB	Aroclor-1248	100-100	ug/Kg	--		10-830	ug/Kg
PCB	Aroclor-1254	100-100	ug/Kg	--		10-670	ug/Kg
PCB	Aroclor-1260	100-100	ug/Kg	--		7.8-830	ug/Kg
PCB	PCB-10	--		--		0.341-1.44	PG/G
PCB	PCB-105	--		--		36.4-89.9	PG/G
PCB	PCB-106	--		--		1.26-2.5	PG/G
PCB	PCB-112	--		--		0.28-0.604	PG/G
PCB	PCB-114	--		--		18.9-89.9	PG/G
PCB	PCB-126	--		--		2.01-89.9	PG/G
PCB	PCB-127	--		--		1.97-238	PG/G
PCB	PCB-14	--		--		0.325-0.336	PG/G
PCB	PCB-142	--		--		1.2-2.66	PG/G
PCB	PCB-15	--		--		1.99-238	PG/G
PCB	PCB-156	--		--		89.9-89.9	PG/G
PCB	PCB-157	--		--		18.9-89.9	PG/G
PCB	PCB-161	--		--		1.2-1.59	PG/G
PCB	PCB-162	--		--		1.97-1.97	PG/G
PCB	PCB-167	--		--		89.9-89.9	PG/G
PCB	PCB-169	--		--		1.99-238	PG/G
PCB	PCB-17	--		--		12-12.6	PG/G
PCB	PCB-186	--		--		0.27-0.27	PG/G
PCB	PCB-189	--		--		1.99-238	PG/G
PCB	PCB-21	--		--		14.1-14.6	PG/G
PCB	PCB-3	--		--		2.71-4.01	PG/G
PCB	PCB-36	--		--		0.159-0.159	PG/G
PCB	PCB-37	--		--		2-33.2	PG/G
PCB	PCB-38	--		--		0.142-0.231	PG/G
PCB	PCB-4	--		--		6.26-6.26	PG/G
PCB	PCB-5	--		--		0.341-1.48	PG/G
PCB	PCB-54	--		--		0.193-0.21	PG/G

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
PCB	PCB-55	--		--		0.513-1.17	PG/G
PCB	PCB-58	--		--		1.99-89.9	PG/G
PCB	PCB-60	--		--		2-33.2	PG/G
PCB	PCB-61/70	--		--		20.8-86.5	PG/G
PCB	PCB-66	--		--		20.9-66.1	PG/G
PCB	PCB-73	--		--		0.182-0.306	PG/G
PCB	PCB-77	--		--		33.2-89.9	PG/G
PCB	PCB-78	--		--		0.536-1.17	PG/G
PCB	PCB-79	--		--		89.9-89.9	PG/G
PCB	PCB-8/5	--		--		11-28.5	PG/G
PCB	PCB-80	--		--		0.529-238	PG/G
PCB	PCB-81	--		--		2.01-89.9	PG/G
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxpheny	11-44	ug/Kg	--		4.2-330	ug/Kg
Pesticide	4,4'-DDD	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	4,4'-DDE	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	4,4'-DDT	6-43	ug/Kg	1	ug/Kg	5-100	ug/Kg
Pesticide	Aldrin	6-43	ug/Kg	360	ug/Kg	2.5-100	ug/Kg
Pesticide	alpha-BHC	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	alpha-Chlordane	6-43	ug/Kg	--		2.5-100	ug/Kg
Pesticide	beta-BHC	0.64-43	ug/Kg	50	ug/Kg	2.5-100	ug/Kg
Pesticide	Camphechlor	60-430	ug/Kg	--		33-1700	ug/Kg
Pesticide	delta-BHC	1.6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	Dieldrin	6-43	ug/Kg	30	ug/Kg	1-100	ug/Kg
Pesticide	Endosulfan I	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	Endosulfan II	6-43	ug/Kg	--		5-100	ug/Kg
Pesticide	Endosulfan Sulfate	6-43	ug/Kg	--		5-100	ug/Kg
Pesticide	Endrin	6-24	ug/Kg	--		5-100	ug/Kg
Pesticide	Endrin Aldehyde	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	Endrin Ketone	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	gamma-BHC (Lindane)	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	gamma-Chlordane	6-43	ug/Kg	--		2.5-100	ug/Kg
Pesticide	Heptachlor	6-43	ug/Kg	--		1-100	ug/Kg
Pesticide	Heptachlor Epoxide	22-160	ug/Kg	--		1-100	ug/Kg
Semivolatile	1,2,4-Trichlorobenzene	1000-2000	ug/Kg	--		670-670	ug/Kg

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
Semivolatile	1,2-Dichlorobenzene	1000-2000	ug/Kg	--		670-670	ug/Kg
Semivolatile	1,4-Dichlorobenzene	1000-2000	ug/Kg	--		670-670	ug/Kg
Semivolatile	2,2'-oxybis(1-Chloropropane)	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2,4,5-Trichlorophenol	1000-2000	ug/Kg	--		40-1700	ug/Kg
Semivolatile	2,4,6-Trichlorophenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2,4-Dichlorophenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2,4-Dimethylphenol	1000-2000	ug/Kg	--		40-750	ug/Kg
Semivolatile	2,4-Dinitrophenol	5000-10000	ug/Kg	--		100-2500	ug/Kg
Semivolatile	2,4-Dinitrotoluene	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2,6-Dinitrotoluene	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2-Chloronaphthalene	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2-Chlorophenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2-Methylphenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	2-Nitroaniline	5000-10000	ug/Kg	--		50-2500	ug/Kg
Semivolatile	2-Nitrophenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	3,3'-Dichlorobenzidine	5000-10000	ug/Kg	--		40-800	ug/Kg
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	3-Methylphenol & 4-Methylphenol	1000-2000	ug/Kg	--		--	
Semivolatile	3-Nitroaniline	5000-10000	ug/Kg	--		100-2500	ug/Kg
Semivolatile	4,6-Dinitro-2-methylphenol	5000-10000	ug/Kg	--		100-2500	ug/Kg
Semivolatile	4-Bromophenyl Phenyl Ether	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	4-Chloro-3-methylphenol	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	4-Chlorophenyl Phenyl Ether	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	4-Methylphenol	--		--		40-1000	ug/Kg
Semivolatile	4-Nitrophenol	5000-10000	ug/Kg	--		100-2000	ug/Kg
Semivolatile	Acetophenone	--		--		40-1000	ug/Kg
Semivolatile	Atrazine	--		--		40-1000	ug/Kg
Semivolatile	Benzaldehyde	--		--		40-800	ug/Kg
Semivolatile	Benzyl Butyl Phthalate	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	bis(2-Chloroethoxy)methane	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	bis(2-Chloroethyl)ether	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	bis(2-Ethylhexyl)phthalate	1000-2000	ug/Kg	450	ug/Kg	40-330000	ug/Kg
Semivolatile	Caprolactam	--		--		40-1000	ug/Kg
Semivolatile	Carbazole	1000-2000	ug/Kg	--		670-670	ug/Kg

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-9
Tissue Target and Achieved Detection Limits

Method Group	Analyte	DL Range Phase I[b]	Units	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
Semivolatile	Di-n-butylphthalate	1000-2000	ug/Kg	--		40-9600	ug/Kg
Semivolatile	Di-n-octylphthalate	1000-2000	ug/Kg	--		40-4000	ug/Kg
Semivolatile	Dibenzofuran	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Diethyl Phthalate	2000-4000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Dimethyl Phthalate	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Hexachloro-1,3-butadiene	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Hexachlorobenzene	1000-2000	ug/Kg	200	ug/Kg	40-1000	ug/Kg
Semivolatile	Hexachlorocyclopentadiene	5000-10000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Hexachloroethane	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	M-Dichlorobenzene	1000-2000	ug/Kg	--		670-670	ug/Kg
Semivolatile	N-Nitroso-di-n-propylamine	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	N-Nitrosodiphenylamine	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	Nitrobenzene	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	P-Chloroaniline	1000-2000	ug/Kg	--		40-1000	ug/Kg
Semivolatile	P-Nitroaniline	5000-10000	ug/Kg	--		100-2500	ug/Kg
Semivolatile	Pentachlorophenol	5000-10000	ug/Kg	--		100-2000	ug/Kg
Semivolatile	Phenol	1000-2000	ug/Kg	--		40-1000	ug/Kg

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-10
Porewater Target Detection and Achieved Detection Limits

Method Group	Analyte	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
Metal	Cadmium	--		0.000016-0.00094	mg/L
Metal	Copper	0.001	mg/L	0.00484-0.0106	mg/L
Metal	Lead	0.0002	mg/L	0.000052-0.0022	mg/L
Metal	Nickel	--		0.0038-0.0051	mg/L
Metal	Silver	--		0.000025-0.0018	mg/L
Metal	Zinc	0.002	mg/L	0.0071-0.054	mg/L
PAH	1,2-Benzphenanthracene	--		0.00005-0.00005	mg/L
PAH	2-Methylnaphthalene	0.00001	mg/L	0.01-0.01	mg/L
PAH	Acenaphthene	--		0.00005-0.00005	mg/L
PAH	Acenaphthylene	--		0.00005-0.00005	mg/L
PAH	Anthracene	--		0.00005-0.00005	mg/L
PAH	Benzo(a)anthracene	0.00001	mg/L	0.00005-0.00005	mg/L
PAH	Benzo(a)pyrene	0.00001	mg/L	0.00005-0.00005	mg/L
PAH	Benzo(b)fluoranthene	--		0.00005-0.00005	mg/L
PAH	Benzo(g,h,i)perylene	--		0.00005-0.00005	mg/L
PAH	Benzo(k)fluoranthene	--		0.00005-0.00005	mg/L
PAH	Dibenzo(a,h)anthracene	0.00001	mg/L	0.00005-0.00005	mg/L
PAH	Fluoranthene	--		0.00005-0.00005	mg/L
PAH	Fluorene	--		0.00005-0.00005	mg/L
PAH	Indeno(1,2,3-cd)pyrene	--		0.00005-0.00005	mg/L
PAH	Naphthalene	--		0.00005-0.0004	mg/L
PAH	Phenanthrene	0.00001	mg/L	0.00005-0.00005	mg/L
PAH	Pyrene	--		0.00005-0.00005	mg/L
PCB	Aroclor-1016	--		0.1-0.1	ug/L
PCB	Aroclor-1221	--		0.1-0.1	ug/L
PCB	Aroclor-1232	--		0.1-0.1	ug/L
PCB	Aroclor-1242	--		0.1-0.1	ug/L
PCB	Aroclor-1248	--		0.1-0.1	ug/L
PCB	Aroclor-1254	--		0.1-0.1	ug/L
PCB	Aroclor-1260	--		0.1-0.1	ug/L
PCB	PCB-101/90	--		0.09-0.41	ng/L
PCB	PCB-105	--		0.06-0.31	ng/L

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-10
Porewater Target Detection and Achieved Detection Limits

Method Group	Analyte	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
PCB	PCB-110/77	--		0.07-0.27	ng/L
PCB	PCB-118	--		0.38-1.52	ng/L
PCB	PCB-128	--		0.07-0.976	ng/L
PCB	PCB-153/132	--		0.09-0.46	ng/L
PCB	PCB-170/190	--		0.11-0.54	ng/L
PCB	PCB-18/17	--		0.06-0.25	ng/L
PCB	PCB-180	--		0.08-0.32	ng/L
PCB	PCB-187	--		0.1-0.41	ng/L
PCB	PCB-195/208	--		0.07-0.35	ng/L
PCB	PCB-201/157/173	--		0.08-0.42	ng/L
PCB	PCB-206	--		0.08-0.39	ng/L
PCB	PCB-209	--		0.08-0.42	ng/L
PCB	PCB-28/20	--		0.06-0.31	ng/L
PCB	PCB-29/26	--		0.04-0.19	ng/L
PCB	PCB-44	--		0.11-0.42	ng/L
PCB	PCB-52	--		0.04-0.2	ng/L
PCB	PCB-66	--		0.07-0.34	ng/L
PCB	PCB-8/5	--		0.05-0.23	ng/L
PCB	PCB-87/115	--		0.06-0.31	ng/L
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--		0.05-0.05	ug/L
Pesticide	2,4' DDD	--		0.00005-0.00027	ug/L
Pesticide	2,4' DDE	--		0.00006-0.00031	ug/L
Pesticide	2,4' DDT	--		0.00007-0.00031	ug/L
Pesticide	4,4'-DDD	0.005	ug/L	0.00005-0.01	ug/L
Pesticide	4,4'-DDE	0.005	ug/L	0.00005-0.01	ug/L
Pesticide	4,4'-DDT	0.005	ug/L	0.00006-0.01	ug/L
Pesticide	Aldrin	0.007	ug/L	0.00003-0.005	ug/L
Pesticide	alpha-BHC	--		0.00008-0.005	ug/L
Pesticide	alpha-Chlordane	--		0.00006-0.005	ug/L
Pesticide	beta-BHC	0.005	ug/L	0.00005-0.025	ug/L
Pesticide	Camphechlor	--		0.0005-0.0005	ug/L
Pesticide	Chlorpyrifos	--		0.00015-0.00074	ug/L

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).

[b] Calcasieu Estuary Database.

Table 4-10
Porewater Target Detection and Achieved Detection Limits

Method Group	Analyte	Target DL Phase II[a]	Units	DL Range Phase II[b]	Units
Pesticide	Cis-Nonachlor	--		0.00006-0.00029	ug/L
Pesticide	delta-BHC	--		0.00006-0.005	ug/L
Pesticide	Dieldrin	0.012	ug/L	0.00005-0.01	ug/L
Pesticide	Endosulfan I	--		0.005-0.005	ug/L
Pesticide	Endosulfan II	--		0.00006-0.01	ug/L
Pesticide	Endosulfan Sulfate	--		0.01-0.01	ug/L
Pesticide	Endrin	--		0.00012-0.01	ug/L
Pesticide	Endrin Aldehyde	--		0.01-0.01	ug/L
Pesticide	Endrin Ketone	--		0.01-0.01	ug/L
Pesticide	gamma-BHC (Lindane)	--		0.00004-0.045	ug/L
Pesticide	gamma-Chlordane	--		0.00005-0.0073	ug/L
Pesticide	Heptachlor	--		0.00008-0.01	ug/L
Pesticide	Heptachlor Epoxide	--		0.00004-0.005	ug/L
Pesticide	Mirex	--		0.00009-0.0004	ug/L
Pesticide	Oxychlordane	--		0.00006-0.00028	ug/L
Pesticide	Pentachloroanisole	--		0.00006-0.00028	ug/L
Pesticide	Pentachlorobenzene	--		0.00012-0.0005	ug/L
Pesticide	Tetrachlorobenzene 1,2,3,4	--		0.00017-0.00057	ug/L
Pesticide	Trans-Nonachlor	--		0.00004-0.0002	ug/L
Semivolatile	1,2,4,5-Tetrachlorobenzene	--		0.00011-0.00056	ug/L
Semivolatile	Hexachloro-1,3-butadiene	0.01	ug/L	0.15-0.2	ug/L
Semivolatile	Hexachlorobenzene	0.01	ug/L	0.00008-0.2	ug/L

[a] Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-2).
[b] Calcasieu Estuary Database.

Table 4-11
Data Quality Assessment Summary

DQO Step	Project Objective Description	Assessment
1. State the Problem	The objective of the RI sampling and analysis program was to: (1) characterize the nature and spatial extent of organic and inorganic chemical contamination in sediment, and surface water, (2) support evaluation of human health and ecological risk assessments, and (3) support feasibility study data needs.	Sampling was performed to access the problem statement and the results will be discussed in future sections.
2. Identify the Decision	Were analytical requirements met?	Data was validated in accordance with National Functional Guidelines and evaluated (PARCC parameters) to make sure that project DQOs were met. Analytical requirements were met.
	Were the vertical and horizontal extent for all areas impacted delineated?	Surface sediment, cores and multi-level surface water samples were collected throughout the areas of concern to delineate extent of contamination. Impacted areas were delineated within the Calcasieu Estuary.
	Do highly impacted sediment areas exceed TCLP limits?	Samples were collected and analyzed for TCLP in areas of interest in support of remedial alternative analysis. Impacted areas did not exceed TCLP limits.
	Did surface water results yield definitive occurrence trends?	Surface water samples were collected to delineate extent, if any, of contamination.
3. Identify the Inputs to the Decision	Determine the vertical and lateral extent of COPCs present above screening levels in sediment.	Historical data was used to determine COPCs of interest and compared to screening levels to develop analytical program. Surface samples and cores (10 cm - 30cm) were collected vertically and horizontally to determine spatial distribution of contaminants. Vertical extent was delineated in areas above screening levels.
	Characterize the absence and or presence of contaminants in surface water.	Evaluation of the surface water data indicates that significant impact of the surface water has not occurred.
	Perform sediment chemical testing on a broad spatial and concentration distribution to support logistic regression modeling of sediment chemistry.	Sediment samples were collected from over 700 locations within the estuary. Although not performed, sampling would support logistic regression modeling.

Table 4-11 (cont.)
Data Quality Assessment Summary

DQO Step	Project Objective Description	Assessment
4. Define the Boundaries of the Study	The data populations needed for decision-making for this study include the chemical concentrations (including both detected and non-detected values) for all the media sampled and analyzed.	Samples were collected from within the boundaries of the study area.
5. Develop a Decision Rule	The parameters of interest are the concentrations and locations of constituents identified in the separate media that pose potential significant adverse risk. Measured concentrations are the true values of the constituents at a specific location and may be used on an individual or cumulative compound basis. The screening levels include sediment ERMs, wildlife benchmark criteria and human health. Table 5-2 in the Phase II SAP (CDM 2000) summarizes the screening values for human health fish and shellfish consumption, ecological sediment ERMs, and wildlife benchmark values. Analytical quantitation limits are provided on Table 5-2 in the Phase II SAP (CDM 2000) for comparison.	Benchmarks and comparison indices were used to determine most appropriate analytical protocols and detection limits for COPCs.
6. Specify Tolerable Limits on Decision Errors	The closer the reported concentration is to the action level, the higher the probability that an incorrect decision will be made and, therefore, there is a "gray region" surrounding the action level. Remediation goals should have a confidence and precision in fair agreement with chemical concentrations used in the risk assessment.	This "gray region" will be addressed in coordination with the risk managers and feasibility study engineers.
7. Optimize the Design for Obtaining Data	Identifies a resource-efficient data collection design for generating data that are expected to satisfy the DQOs. The data collection design or sampling program is described in detail in Section 3.0.	The SAP provided procedures for sampling and analysis to satisfy DQOs for the project and was provided by EPA. Deviations from the SAP discussed earlier did not affect the quality of the data.

Table 4-12
Deviations from SAPs

From CDM SAPs	Deviation	Impact
Surface samples will be collected at 0-10 for surface sediment samples and multi-depth samples will be collected at 0-10, 10-20, 20-30 cm intervals.	Surface samples were collected at 0-15 cm and multi-depth samples were collected at 0-15, 15-30, and 30-45 cm intervals for Bayou Verdine only.	Sediment samples were collected at intervals to correspond with the intervals Conoco had used for their nature and extent investigation of Bayou Verdine. This provided consistency between data sets.
Multi-depth sample locations were to be selected based on the maximum number and concentration of SVOCs measured in the surface sediment samples. The measured SVOC concentrations will be available approximately 72-hours after analytical laboratory receipt.	Due to high moisture content in the sediments, the 72-hour turnaround was difficult to achieve. Analysis turnaround time was set at 14 days.	The quantity of vertical profile samples in Bayou d'Inde and Lower and Upper Calcasieu AOCs. Vertical extent was not determined in Phase I with the understanding that additional vertical profile samples will be collected in Phase II.
Sediment samples were to be collected with a petite Ponar®, modified Eckman dredge, or stainless steel push tubes.	In areas where the sediment had high clay content, the dredge sampler was unable to penetrate the surface. In these areas, an auger was used to collect the samples.	The auger collected a lower volume of sample that required multiple penetrations to collect the required sediment volume, which impacted time slightly.
No samples were to be collected in Bayou Olsen in Lower Calcasieu AOC.	Additional locations were sampled in the Lower Calcasieu AOC in Bayou Olsen. Samples were chosen by dividing the bayou into equal areas and randomly generating locations with the use of FIELDS.	Sampling of Bayou Olsen provided a larger area to characterize the nature and extent of contamination at the site.
CDM is to collect sediment and surface water samples in the Upper Calcasieu AOC, including Coon and Clooney Island Loops.	Data collected from Coon Island Loop was collected in a cooperative arrangement between EPA\CDM and Olin Corporation. Samples were collected in accordance with the Phase I RI SAP (except dioxin/furans which CDM collected).	Samples collected by Olin Corporation did not go through CDM's validation process. Data collected by Olin was determined usable.
CDM is to collect sediment and surface water samples in Bayou Verdine.	Data collected from Bayou Verdine was collected in a cooperative arrangement between EPA\CDM and Conoco. Samples were collected in accordance with the Phase I SAP.	Samples collected by Conoco did not go through CDM's validation process. Data collected by Conoco was determined usable.
SVOCs to be analyzed at UCR2023.	SVOCs were not analyzed for at UCR2023 by the laboratory. The chain of custody stated to analyze for SVOCs and the sample had been disposed of before it was noticed that analysis was missing.	Limited analysis at that location does not affect the investigation of nature and extent of the estuary.
SVOCs to be analyzed at UCR2034.	SVOCs were not analyzed for at UCR2023 by the laboratory. The sample was not marked for analysis on the chain of custody.	Limited analysis at that location does not affect the investigation of nature and extent of the estuary.

Table 4-12 (continued)
Deviations from SAPs

From CDM SAPs	Deviation	Impact
Analysis of Pesticides and PCBs (Pest/PCBs) at alternating locations in Reach 2 (Lockport Marsh) beginning with location BIR2001.	Pest/PCBs were not analyzed at alternating locations.	It was determined that Pest/PCB analysis was not needed at alternating locations to determine the nature and extent of contamination in Reach 2. The reach has a high density of sampling locations and is adequate to characterize Pest/PCBs.
TOC to be analyzed at BIR3018.	TOC was not analyzed at BIR3018 by the laboratory. The chain of custody marked that location for TOC analysis.	Limited analysis at that location does not affect the investigation of nature and extent of the estuary.
99BV1-R1002-015 was to be analyzed for SVOCs, Pest/PCBs, and VOCs.	Analysis was for SVOCs only.	It was determined that SVOCs were the only constituents needed to be analyzed at this location due to Conoco's participation in the sampling event. This did not impact the nature and extent characterization.
Sediment and surface water samples were not going to be collected during the Site Wide Ecological Reconnaissance in the Calcasieu Estuary.	Sediment and surface water locations were collected in the Calcasieu Estuary.	Sediment and surface water samples were collected at locations where tissue samples were collected to determine if there was a relationship between sediment and surface water contamination and tissue concentrations. This did not impact the nature and extent characterization.
Herbicides were to be collected during the Site Wide Ecological Reconnaissance.	It was determined in field that based upon limited detection results from the Phase I investigation; analysis of herbicides was not necessary.	Based upon Phase I data, herbicides were not widely detected nor at a high concentration and therefore did not pose a threat to wildlife.
During Phase II, soil samples from confined disposal facilities (CDFs) were to be analyzed.	The CDFs were not sampled once it was determined that the dredged material had been collected in accordance with COE requirements. These requirements include volume-based sampling as the material is removed.	Additional characterization in Phase II would have provided limited value given the CDFs are not sources of contamination.
For Phase II, sediment samples were to be analyzed for TAL Metals by AATS.	Samples were not analyzed for TAL metals in SQT sediments. Metal analysis was conducted by USGS for total recoverable metals, with the exception of two SQT sediment samples. These two samples provided overlap for comparison purposes. Mercury analysis was included in total recoverable metal analysis.	Metals analysis was still performed and at lower detection limits. Mercury analysis was conducted with frozen samples stored at the USGS-Columbia facility and analyzed by AATS.
Phase II required the sampling of Group 5 fish for the human health risk assessment.	Group 5 fish were not sampled, as it was determined that they are not a significant prey species to ecologic receptors nor do they serve as a common choice for human consumption.	Human and wildlife prey species consume Group 4 fish. Group 4 fish will meet the HHRA and BERA data needs.

Table 4-12 (continued)
Deviations from SAPs

From CDM SAPs	Deviation	Impact
SVOC and Pest/PCBs analysis to be conducted by AATS for sediment and porewater.	SVOC and Pest/PCB analysis was conducted by AATS, but for verification, EPA R6-Houston Laboratory analyzed all SQT samples for PAHs and GERG analyzed porewater samples for PAHS and PCBs.	Additional analysis provided lower detection limits then achieved with AATS.
The Phase II tissue design strategy did not include the collection of hermit crabs.	Additional sampling was conducted to collect hermit crabs for analysis.	Analysis of hermit crab tissue provided additional information needed for the BERA.
The Phase II tissue design strategy outlined 5 groups to collect representative tissue samples.	During the sampling event, the groups described in the Phase II SAP were broken down to smaller groups based upon field conditions and tissues being collected.	Refinement of the groups will assist in developing the BERA.

Table 4-13
PAH Categories

CAS No.	PAH	Category
92-52-4	1,1'-Biphenyl	LPAH
218-01-9	1,2-benzphenanthracene	HPAH
91-57-6	2-methylnapthalene	LPAH
83-32-9	Acenaphthene	LPAH
208-96-8	Acenaphthylene	LPAH
120-12-7	Anthracene	LPAH
56-55-3	Benzo(a)anthracene	HPAH
50-32-8	Benzo(a)pyrene	HPAH
205-99-2	Benzo(b)fluoranthene	HPAH
191-24-2	Benzo(g,h,i)perylene	HPAH
207-08-9	Benzo(k)fluoranthene	HPAH
53-70-3	Dibenzo(a,h)anthracene	HPAH
206-44-0	Fluoranthene	HPAH
86-73-7	Fluorene	LPAH
193-39-5	Indeno(1,2,3-cd)pyrene	HPAH
91-20-3	Naphthalene	LPAH
85-01-8	Phenanthrene	LPAH
129-00-0	Pyrene	HPAH

Table 4-14
TEFs for Dioxin/Furans

CAS No.	ANALYTE	Toxicity Equivalent Factor (TEF)
1746-01-6	2,3,7,8-tetrachlorodibenzo-p-dioxin	1
19408-74-3	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	0.1
3268-87-9	octachlorodibenzo-p-dioxin	0.0001
35822-46-9	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxi	0.01
39001-02-0	Octachlorodibenzofuran	0.0001
39227-28-6	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	0.1
40321-76-4	1,2,3,7,8-pentachlorodibenzo-p-dioxin	1
51207-31-9	2,3,7,8-tetrachlorodibenzofuran	0.1
55673-89-7	1,2,3,4,7,8,9-heptachlorodibenzofuran	0.01
57117-31-4	2,3,4,7,8-pentachlorodibenzofuran	0.5
57117-41-6	1,2,3,7,8-pentachlorodibenzofuran	0.05
57117-44-9	1,2,3,6,7,8-hexachlorodibenzofuran	0.1
57653-85-7	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	0.1
60851-34-5	2,3,4,6,7,8-hexachlorodibenzofuran	0.1
67562-39-4	1,2,3,4,6,7,8-heptachlorodibenzofuran	0.01
70648-26-9	1,2,3,4,7,8-hexachlorodibenzofuran	0.1
72918-21-9	1,2,3,7,8,9-hexachlorodibenzofuran	0.1

Section 5
Chemical Fate and Transport

An understanding of the fate and transport processes acting on the COPCs in the Calcasieu Estuary is critical when predicting the distribution of the COPCs between different media in the environment (i.e. sediment, water, soil, and air) under various conditions (pH, salinity, etc.). As the conditions change in the environment, the distribution of the COPCs in the media and the form of the COPCs can change (i.e., the oxidation state, molecular configuration, ionic charge, aqueous species), which can affect the mobility and toxicity of the compounds. This section discusses the theoretical aspects of fate and transport processes in the environment, including equations that define and/or control these processes. Section 5.1 provides a general description of the fate and transport processes of concern. Section 5.2 elaborates on the estuarine environment and how conditions can change due to natural cycles (tides and spring run-off), weather patterns (storms), and acts of man (i.e., channel dredging, deforestation, etc.). Described throughout is form and behavior of each of the major types of COPC, including the most important fate and transport processes under various conditions within the estuarine environment.

The fate and transport processes discussed are provided as a basis for understanding the presence of contamination within the estuary. Table 5-1 provides detailed chemical property values (e.g., water solubility, vapor pressure, Henry's Law constant, K_{OC}, and bioaccumulation factor) for each COPC. These properties and processes will be referred to throughout the data interpretation sections for each AOC (Sections 7 [Bayou d'Inde], 8 [Bayou Verdine], and 9 [Upper Calcasieu] and 10 [Lower Calcasieu]) to describe the distribution of the COPCs between different media.

5.1 Fate and Transport Processes

Fate and transport processes determine the phase in which a COPC may exist, and, along with the dynamics of the environment, the mobility and bioavailability of the compound. The most important fate and transport processes depend on the environment (e.g., estuary, river, shallow lake, etc.) and on the chemical-specific properties of the COPC. The major fate and transport processes are:

- Adsorption/Desorption
- Volatilization/Condensation
- Precipitation and co-precipitation
- Degradation/Transformation

These processes will be described in the following sections, along with a summary of the important processes for the major classes of compounds (e.g., metals, PAHs, etc.) of interest in the Calcasieu Estuary.

5.1.1 Adsorption/Desorption

One of the key geochemical processes affecting the rate of migration of the COPCs is the adsorption to and desorption from sediments and suspended particulate matter. If the organic chemical is strongly adsorbed to the sediment, the chemical is relatively immobile and will not be leached or transported from the source. If the organic chemical is weakly adsorbed, the chemical can be more readily transported. The degree of adsorption also effects other transformation reactions such as volatilization, hydrolysis, and biodegradation. The rates of such reactions are directly dependent upon the degree of adsorption.

In the following discussions, the word adsorption is used because typically the most important processes causing retention of organic molecules are adsorption processes rather than absorption processes. Some texts have preferred to use the more generic term "sorption" to avoid any mechanistic connotations (Callahan et al. 1979). In selected cases, the word "partitioning" will also be used.

The distribution of chemicals between water and the sediment or suspended particles is often described by the soil/water distribution coefficient, K_d. The distribution coefficient is a constant, relating the thermodynamic activities of the two phases:

$$K_d = \frac{\alpha S}{\alpha W}$$

Where:

αS	=	Activity of the chemical in the sediment (or suspended particles)
αW	=	Activity of the chemical in the water (aqueous phase)

Because the activities are equal to the activity coefficients multiplied by the chemical concentrations and the activity coefficients approach unity for environmental concentrations, the distribution coefficient is usually defined as the ratio of concentrations in the solid and water phase (Freeze and Cherry 1979) or as:

$$K_d = \frac{Cs}{Cw} = \frac{\text{mass of solute on the solid phase per unit mass of solid phase}}{\text{concentration of solute in solution}}$$

Cs is usually expressed in terms of milligrams per kilogram (mg/kg) or parts per million (ppm in the solid), and Cw is expressed in terms of milligrams per liter (mg/L) or ppm in the water, if the density equals one. Therefore, the units on K_d are:

$$\frac{mg/kg}{mg/L} = \frac{L}{kg} \text{ or } \frac{mL}{g}$$

5.1.1.1 Organic Constituents

For organic compounds, the value of K_d increases with increasing organic carbon content of the sediment. Typically, K_d values are not available in the literature for all organic carbon contents possible in estuarine sediments. Therefore, K_d is usually normalized for the amount of organic carbon in the soil, resulting in a new parameter, K_{oc}, the organic-carbon partition coefficient.

$$K_{oc} = \frac{K_d}{f_{oc}}$$

Where:

f_{oc} = The fraction of natural organic carbon in the sediment
= % TOC/100
= (mg/kg TOC)10^6

This relation implies that adsorption is linearly related to the amount of organic carbon in the sediment. While K_d may vary greatly in different sediments, K_{oc} usually does not vary by more than a factor of two to three (Goring 1962). K_{oc} can also be defined as follows:

$$K_{oc} = \frac{\text{mg of adsorbed chemical/}k\text{ g of organic carbon}}{\text{mg of chemical in solution/L of solution}}$$

Historically, reported adsorption results were typically reported on the basis of soil organic matter (rather than soil organic carbon). The ratio of organic matter to organic carbon varies by soil type, but, in most cases, a value of 1.724 is used to convert organic matter to organic carbon. That is,

$$K_{oc} = 1.724\, K_{om}$$
$$\log K_{oc} = \log 1.724 + \log K_{om}$$

Studies have shown that the organic matter present in the sediment dominates the adsorption process. However, as the fraction of organic carbon becomes small, adsorption of organic chemicals to inorganic surfaces (mostly clays) also becomes important. The critical level of organic carbon (f_{oc}^*) is the concentration below which the inorganic fraction dominates the adsorption process. McCarty et al. (1981) developed the following equation to calculate f_{oc}^*:

$$f_{oc}^* = \frac{(SA)}{200}\,\frac{1}{K_{ow}^{0.84}}$$

Where:

SA = Surface area of soil square meters/gram (m^2/G)
K_{ow} = Octanol-water partition coefficient

When foc is higher than f_{oc} *, the K_{oc} value can be estimated from the solubility of the compound in water or the octanol/water partition coefficient (K_{ow}). High values of K_{ow} indicate the compound is hydrophobic and typically partitions out of the water and into the organic phase (in this case octanol). Therefore, by evaluating K_{ow} and solubility data, the relative importance of adsorption onto organic matter within the sediment for various classes of organic compounds can be determined. Exhibit 5-1 presents examples of typical solubility values and log octanol-water partitioning coefficients.

Exhibit 5-1 Example Log Octanol-Water Partitioning Coefficients

Compound Name	Group	Solubility (mg/L)	Log Octanol-Water Partitioning Coefficient (Log K_{ow})
Acetone	VOC	1×10^6	-2.40
Hexachlorobenzene	SVOC	0.006	5.23
Pyrene	PAH	0.132	4.88
Aroclor 1254	PCB	0.012	6.50
Aldrin	Pesticide	0.0180	5.30
2,3,7,8-TCDD	Dioxin	2.0×10^{-4}	6.84

In general, adsorption is most important for the dioxins, pesticides, PCBs, and SVOCs and less so for VOCs. However, other factors can affect the adsorption of organic compounds, including salinity and pH.

Salinity can have an impact on the adsorption of organic chemicals due to a process called salting out. Salting out occurs when water with a high concentration of dissolved ions (i.e., salts) has less water available for dissolving hydrophobic compounds or species. The ions being charged tend to attract the polar water molecules while leaving non-polar organic compounds with less water to dissolve into. Therefore, hydrophobic compounds will have even more tendency to partition to organic matter with the sediment. The process can occur not only with organic compounds, but also with non-charged species such as mercuric chloride ($HgCl_2$) and organically complexed or methyl mercury (Turner et al. 2001).

5.1.1.2 Inorganic Constituents

Inorganic constituents adsorb to mineral surfaces and the surfaces of chemical precipitates within sediment. Generally, inorganic adsorption is independent of the amount of organic carbon, with the exception of mercury, cyanide, and copper. Exhibit 5-2 lists the K_d values for several important inorganic species.

Exhibit 5-2 Example Partitioning Coefficients for Inorganic Constituents

Name	Species	Partitioning Coefficient (K_d) (for Silt)[1]
Arsenic (V)	$HAsO_4^{2-}$	1.9-18
Cadmium	Cd^{2+}	40.4
Cobalt	Co^{2+}	1339
Copper	Cu^{2+}	1.4-333
Chromium (III)	Cr^{3+}	470-150,000
Lead	Pb^{2+}	4.5-7640
Mercury (II)	Hg^{2+}	5012-1,000,000[2]
Nickel	Ni^{2+}	299
Zinc	Zn^{2+}	1339

1. Thibault et al. 1990 except where noted otherwise
2. Measured in estuaries (Turner et al. 2001).

The K_d values listed above have some wide ranges of values due to the large number of variables that can affect the measurements. The most important variables include the following:

- pH of the water
- Sediment grain size
- Concentrations of competing ions present
- Ionic strength of the water (salinity)
- Mineralogy and organic carbon content of the sediment

The pH of the water can have an effect on both the speciation of the metals/metalloids and the surface charge of the adsorbing media. At low pH values, the surfaces of most of the important minerals within sediment are positively charged and tend to repel positively charged ions such as metals and attract negatively charged ions such as arsenic. At high pH, the surfaces tend to be negative and attract metals to a greater extent. The speciation of the ions can work against this trend by changing the charge on the ion itself. For instance, at high pH, metals can combine with hydroxide ions in solution, forming an aqueous complex with a neutral or negative charge.

Because adsorption is a surface phenomenon, the smaller the grain size of the adsorbing media the greater the surface area per mass of media and the greater the adsorption. Grain size has been found to be the most important parameter for explaining adsorption in most estuaries (Borrego et al. 2002).

Ions of similar character can compete for adsorption sites on the sediment. For example, sulfate and phosphate can compete for the same sites on a solid and adsorb

to a lesser extent together (in the same solution) than they do when measured separately. Adsorbed ions can be desorbed from the surfaces of soils and sediment when introduced to a solution of different chemistry, especially when the salinity is high. The process is called ion exchange and is very important in estuaries where saltwater and contaminated sediment may combine.

The ionic strength of the water can decrease the concentration of ions actually seen by the surfaces of the adsorbing media, which has the effect of decreasing the K_d. The process is important in estuaries due to the high ionic strength of saltwater.

The mineralogy of the sediment can influence adsorption of COPC metals or inorganics. For instance, arsenic has a strong affinity for iron-containing minerals while mercury and cyanide are attracted to organic matter.

5.1.2 Volatilization/Condensation

Volatilization is the process by which a chemical is transferred from soil or water into the atmosphere. For the discussion of transport in the aquatic environment, COPCs are typically at low concentrations (below saturation) and exist dissolved in the water phase (i.e., no free non-aqueous phase liquids).

The relation between the concentrations in the air and water is described by the following equilibrium:

$$K_H = \frac{1}{H} = \frac{[\text{Conc. in water}]\,(\text{mg/L})}{[\text{Conc. in air}]\,(\text{mg/L})}$$

Where H is Henry's Law Constant and typically expressed in units of atmospheres-cubic meters per mole (atm-m^3/mol). From the above equations, Henry's Law Constant is the controlling parameter in determining the amount of volatilization. In turn, Henry's Law Constant is related to various factors, the most important of which is vapor pressure expressed in millimeters of mercury (mm Hg). Examples of Henry's Law Constant for selected compounds are provided in Exhibit 5-3. A general guide to evaluate the importance of volatilization is as follows:

	Vapor Pressure (mm Hg)	H (atm-m^3/mol)
Compound mostly in water	$< 10^{-7}$	$< 5 \times 10^{-5}$
Compound mostly in air	$> 10^{-2}$	$> 5 \times 10^{-3}$

The importance of volatilization as a transport mechanism will depend on the depth of the water layer containing the COPC, the degree of turbulence of the water, and the wind velocity just above the air/water interface.

Exhibit 5-3 Henry's Law Constant for Example Compounds

Compound	H (atm-m^3/mol)	Compound Group
Benzene	5.6×10^{-3}	VOC
Vinyl chloride	1.1×10^{-2}	VOC
Hexachlorobenzene	6.8×10^{-4}	SVOC
Naphthalene	4.60×10^{-4}	PAH
Aroclor 1242	1.98×10^{-3}	PCB
DDT	1.58×10^{-5}	Pesticide
TCDD	1.61×10^{-5}	Dioxin

Based on the criteria above, volatilization is only important for the VOCs and some of the SVOCs, PAHs, and PCBs. The molecules with a greater atomic mass tend to be less subject to volatilization than the lighter molecules.

5.1.3 Precipitation and Co-precipitation

5.1.3.1 Inorganics and Metals

Precipitation is the process where negatively and positively charged ions in solution combine to form a solid phase compound or mineral. Given the generalized reaction,

$$nA^{+m} + mB^{-n} = A_mB_n \text{ (solid)}$$

precipitation is governed by the following equation:

$$[A^{+m}]^n [B^{-n}]^m = K_{sp}$$

Where:

$[A^{+m}]$	=	The concentration of the positively charged ion (cation) in solution
$[B^{-n}]$	=	The concentration of the negatively charged ion (anion) in solution
n	=	The relative number of cations that form the solid phase
m	=	The relative number of anions that form the solid phase
K_{sp}	=	The solubility product constant

Ion A can represent positively charged ions (cations) such as zinc (Zn^{2+}), mercury (Hg^{2+}), or copper (Cu^{2+}). Ion B represents an anion such as hexavalent chromium (CrO_4^{2-}) or arsenic ($HAsO_4^{2-}$). The product of the concentrations of A^{+m} and B^{-n} in solution cannot exceed the value of K_{sp}. If either A^{+m} or B^{-n} is added to the solution to concentrations that would exceed the K_{sp}, a precipitate of A_mB_n will form until the solubility product reaches the value of K_{sp}. Solid phases or minerals, which are insoluble or have low solubility in water, have a low K_{sp} value while very soluble

phases have a high K_{sp}. Therefore, K_{sp} values of phases, which contain one or more COPCs, can be used to evaluate precipitation as a potential fate and transport process.

K_{sp} values for some example mineral phases are provided in Exhibit 5-4.

Exhibit 5-4 Example Log K_{sp} Values

Mineral	Formula	Log K_{sp}
Iron oxyhydroxide	FeOOH	10^{-37}
Birnessite	MnO_2	$10^{18.1}$
Pyrite	FeS_2	$10^{-18.5}$
Covellite	CuS	10^{-23}
Siderite	$FeAsO_4$	$10^{-10.6}$
Mercury(I) hydroxide	$Hg_2(OH)_2$	$10^{5.3}$
Lead chromate	$PbCrO_4$	$10^{-13.7}$

While many of the COPC-containing mineral phases listed above have relatively low K_{sp} values, they typically do not form precipitates due to the comparatively low concentrations of the COPCs present, even in waters that are considered contaminated. Typically, the levels of COPC required to trigger human health or environmental concerns is much less than is required to reach the solubility limit. Therefore, pure-phase minerals rarely control the dissolved concentrations of COPCs. However, precipitation of impure phases is often an important control on COPC concentrations. For example, iron oxyhydroxide, which in the pure phase does not control concentrations of any metals except for iron, can and usually is a very important control on metals such as copper, lead, and zinc when impure.

The process by which metals are precipitated along with iron oxyhydroxide is termed "co-precipitation." COPC metals can substitute for iron within the structure of the mineral during precipitation, which can be a very important control on the aqueous concentrations of metals in the environment. Precipitation of iron oxyhydroxides can occur as a result of the oxidation of iron, which can be initiated by the turbulent conditions present in the tidal influenced areas of estuaries. Similar effects may be noted in outfall areas if dissolved oxygen is increased by outfall turbulence.

The only pure phases that commonly precipitate metals are the sulfide phases as evidenced by the extremely low K_{sp} values noted in Exhibit 5-4. Metal sulfides can precipitate under reducing conditions such as exist in the organic mud present in the low energy areas of many estuaries.

5.1.4 Degradation/Transformation Processes

5.1.4.1 Abiotic Degradation/Transformation

5.1.4.1.1 Oxidation/Reduction

Organic Compounds

Oxidation is the loss of electrons during a chemical reaction. Typical abiotic oxidation reactions would include treatment processes using chlorine, ozone, or hydrogen peroxide. The result of complete reaction is conversion of the organic molecules to carbon dioxide and water. Such powerful abiotic oxidizing agents do not occur naturally in estuarine environments. Oxidation can occur through either of two major pathways: the polar reaction or free-radical reaction pathways. Typically, free-radical reactions are more common because less activation energy is required. Before an oxidation reaction can occur via the free-radical pathway, a free radical must be formed by the removal of a single electron from a molecule. This can occur through thermal energy, radiant energy, high-energy particles, and other mechanisms. Free-radical concentrations of the single oxygen in natural surface water are approximately 10^{-12} M and results from the photo-disassociation of the water molecule. Once the free radicals are formed, they will react with organic molecules present to form an intermediate organic free radical, which usually reacts further.

Reduction of organic compounds (i.e., the addition of electrons to a molecule) can also transform organic COPCs. For example, chlorinated organic compounds can be transformed into less chlorinated or un-chlorinated compounds by reduction reactions. Typically, the process is biologically mediated.

Inorganic Compounds and Metals

Unlike organic compounds, oxidation or reduction of inorganic compounds and metals cannot change the identity of the COPC. The aqueous species can change, which can have profound effects on the fate and transport properties of the COPC, but not the identity. The important metals and inorganics which undergo oxidation/reduction reactions include iron, manganese, sulfur, chromium, arsenic, and mercury. A roman numeral within parentheses following the name indicates the oxidation state of the metals.

Iron. While iron is not typically a COPC, the fate and transport of iron can strongly influence other metals and inorganics due to co-precipitation. The oxidation state of iron is an important parameter for predicting the precipitation of iron oxyhydroxide and the fate and transport of many metals. The formation of iron oxyhydroxide occurs by oxidation of iron (II) to iron (III) (usually by oxygen) followed by a precipitation or co-precipitation reaction as follows:

$$Fe^{2+} + \tfrac{1}{2}\, O_2 + 2H^+ = Fe^{3+} + H_2O$$

$$Fe^{3+}\,(aq) + 2H_2O = FeOOH\,(solid) + H^+\,(precipitation)$$

or

$$(1\text{-}x)Fe^{3+}\ (aq) + xCr^{3+}\ (aq) + 2H_2O = Fe_{1-x}Cr_xOOH\ (solid) + H^+\ (aq)\ (co\text{-}precipitation)$$

The example shown is for substitution of chromium into iron oxyhydroxide; however, many other metal substitutions can occur simultaneously. Arsenic, which is an anion, can substitute for hydroxide in the phase particularly when arsenic concentrations are high and the pH is low (Whiting 1992).

Manganese. Manganese, like iron, is mobile in the reduced phase (Mn^{2+}) and relatively immobile in the more oxidized phase (Mn^{4+}). The relevant reaction, which involves both oxidation of manganese and precipitation of manganese dioxide is as follows:

$$Mn^{2+} + 2O_2 = MnO_2\ (solid)$$

Manganese can also co-precipitate other metals, such as copper and cobalt as follows:

$$(1\text{-}x)Mn^{2+} + xCu^{2+} + 2O_2 = Mn_{1-x}Cu_xO_2\ (solid)$$

Sulfur. Sulfur is more mobile in the oxidized form (sulfate, SO_4^{2-}) than in the reduced form (sulfide, S^{2-}) due to precipitation of metal sulfide phases. The relevant reactions are as follows:

$$SO_4^{2-} + CH_2O\ (generic\ organic\ compound) + 3H^+ = S^{2-} + HCO_3^- + 2H_2O$$

$$S^{2-} + Cd^{2+} = CdS\ (solid)$$

Metals/Metalloids capable of forming sulfide phases include copper, cadmium, iron, lead, nickel, and to a lesser extent arsenic and zinc.

Chromium. Chromium exists in two different oxidation states, chromium (III) and chromium (VI). Chromium (III) is much less mobile than chromium (VI) (also called hexavalent chromium) and is the more stable form in nature. Chromium (VI) is typically only encountered when released in this form. Additionally, chromium (VI) is eventually reduced to chromium (III) by fulvic and humic acids within soils or sediments, which is either co-precipitated with iron oxyhydroxide (see equation above) or adsorbed to soil or sediment grains.

Arsenic. Arsenic is more mobile in the reduced form (arsenic (III), $H_3AsO_3^0$) than in the oxidized form (arsenic (V), $HAsO_4^{2-}$) because arsenic (III) is uncharged while arsenic (V) is negatively charged. As mentioned previously, arsenic (V) is removed from solution via adsorption and co-precipitation with iron oxyhydroxide to a greater extent than arsenic (III).

Mercury. Mercury exists as mercury (I), mercury (II), and metallic mercury. Metallic mercury is much less soluble than the oxidized versions, which are strongly complexed by organics and chloride present in estuaries.

Photolysis

Photochemical transformation may occur by one of several processes depending upon the chemical structure and substances in the environment. Direct photolysis occurs when the chemical absorbs light and is then transformed from an excited state by rearrangement, dissociation, oxidation, or other mechanisms. The rate of reaction depends upon the sunlight photo flux, the light absorption coefficients of the chemical, and the efficiency of conversion of the absorbed light in the chemical reaction.

Indirect photolysis occurs when substances present in the aquatic environment absorb light to form excited chemical species or free radicals that interact with the COPCs to produce a reaction. Single oxygen and oxy radicals are examples of intermediates that can result in transformations of chemicals. Since these intermediates result from photoreactions of naturally occurring substances and the COPC does not undergo photochemical reaction itself, the reaction should not be referred to as photolysis but rather photo-induced free-radical reactions. An example of a photolysis reaction of hazardous chemicals is the reaction of chlorinated dibenzodioxins with ultraviolet light (UV) to produce two toluene-like molecules that can then be biologically attacked.

5.1.4.2 Biotic Degradation/Transformation

Removal or transformation of organic chemicals from the subsurface environment can occur through the action of microorganisms that may be attached to the sediment or suspended particles.

Biodegradation of organic chemicals by microorganisms ultimately produces microbial cells, water, and carbon dioxide (i.e., complete "mineralization"). The enzymes produced by the microorganisms are essentially responsible for the degradation of the organic chemicals. Whether or not a chemical is transformed by enzymes depends basically upon the configuration or alignment of the enzyme with the organic chemical during reaction. If an ideal configuration of the enzyme and organic chemicals occur, the reaction will occur. Persistent chemicals have less favorable alignments, and non-reacting or recalcitrant chemicals fail to bond or produce favorable alignments.

Typically, biodegradation rates are found to be proportional to both the substrate, the organic compound providing the energy source, and microbial numbers. However, some organics, termed secondary substrates, do not provide sufficient energy to support growth of the microbial biomass. In this case, a primary substrate must be present. When enzymes, produced for degradation of the primary substrate, can also serve to degrade the secondary substrate, this is termed co-metabolism.

Microbes can facilitate either oxidation or reduction of organics under oxic (aerobic) or anoxic (anaerobic) conditions, respectively. During the oxidation reaction, electrons are donated to an electron acceptor, generally oxygen, which is reduced. Reduction of organics requires the presence of an appropriate electron donor, such as other organics, nitrate, hydrogen, or glucose. Biodegradation can occur when the combined oxidation and reduction half reactions are energetically favorable.

Biodegradation is predicted using degradation kinetics and rate equations that describe the reduction of contaminant with time. Three rate equations that have been developed are the power rate law, the Monod and the Michaelis-Menton equations.

The power rate law, the simplest method, is in the following form:

$$\frac{-dC}{dt} = kC^n$$

Where :

C	=	Substrate concentration
t	=	Time
k	=	The rate constant for chemical disappearance
n	=	0 for zero order reactions and 1 for first order reactions

Concentration and the natural log of the concentration vary linearly with time in zero and first order reactions, respectively. The rate constant is determined by fitting laboratory or field data to the equation. Published rate constants can be used to estimate the relative importance of biodegradation for a given compound or class of compounds in the estuarine environment. Often, the degradation rate is expressed as the half-life of the compound, which is defined as the time required for biotransformation of one half of the initial concentration.

While a discussion of the biotransformation of each of the thousands of organic compounds is beyond the scope of the current discussion, an evaluation of biodegradation trends for organic compounds and groups is appropriate. Dragun (1988) lists the following "rules of thumb" that relate the chemical structure of the organic compounds within a given group to the biodegradation rate:

- Hydroxyl and carboxyl functional groups on benzene rings usually increase biodegradation rates.
- Halogen, nitro, and sulfonate functional groups on benzene rings usually decrease biodegradation rates.
- As the number of chlorine atoms within the molecule increases, the biodegradation rate decreases.

- The presence of hydroxyl, aldehyde, carboxyl, ester, and amide functional groups on organic chemicals usually causes faster biodegradation rates.
- Water-soluble chemicals are usually degraded faster than less soluble chemicals.
- N-alkanes, n-alkylaromatics, and aromatic compounds in the C10 to C22 range are usually readily biodegradable.
- N-alkanes, n-alkylaromatics, and aromatic hydrocarbons in the C5 to C9 range are biodegradable, but in most environments volatilization competes very effectively with biodegradation as a fate process.
- Gaseous n-alkanes (C1-C4) are biodegradable but are usually utilized by a narrow range of specialized hydrocarbon degraders.
- The n-alkanes, n-alkylaromatics, and aromatic hydrocarbons above C22 have very low water solubilities that result in slow rates of microbial degradation.
- Condensed or fused aromatic and cycloparaffinic molecules with four or more rings have very low biodegradation rates.
- Rate of oxidation of straight chain aliphatic hydrocarbons is correlated to chain length; in general, short chains are not as quickly degraded as long chains.
- Unsaturated aliphatic organics have faster biodegradation rates than corresponding saturated aliphatic organics.

A list of half lives for representative compounds and groups is provided in Exhibit 5-5 below.

Exhibit 5-5 Biotransformation Half-Lives of Organic Compounds and Groups

Compound or Group	Laboratory Half-Life	Field Determined Half-Life
Benzene group (aromatic VOCs[1])	1 week	1-2 months
Naphthalene (a PAH[2])	1 week	1 month
Chlorinated aliphatics (VOCs and SVOCs[3])	1 month	1 year
Phenanthrene (a PAH)	1 month	Not Available
Benzofluoranthene (a PAH)	3 months	Not Available
Chlorinated pesticides	1 year	Decades
TCDD[4] (a dioxin)	2 years	Decades

1. VOC = volatile organic compound
2. PAH =polynuclear aromatic hydrocarbon
3. SVOC = semi-volatile organic compound
4. TCDD = tetrachlorodibenzo-*p*-dioxin

Under laboratory conditions where the bacteria responsible for biotransformation are carefully cultured and maintained under ideal conditions, the half life of a given compound is dramatically shorter (biotransformation rate is faster) than under field conditions. Note that the degradation of chlorinated pesticides, dioxins, and large molecule PAHs is much slower than for the VOCs, SVOCs, and smaller PAHs.

5.1.5 Summary

Exhibit 5-6 summarizes the fate and transport processes and the applicability to COPC groups in the Calcasieu Estuary.

Exhibit 5-6 Summary of Fate and Transport Process in Relation to COPC Groups

F & T Process	VOCs	SVOCs	Pesticides	PCBs	Dioxins/ Furans	Metals	Inorganics
Adsorption	Low - Int.[1]	Int.- High[1]	Int.-High[1]	High[1]	High[1]	High[2]	Usually at lower pH
Volatilization	High	Low -Int.	Low	Low-Int.	Low	Hg only	Low
Precipitation	Low[3]	Low[3]	Low[3]	Low[3]	High	Fe, Mn	High
Abiotic Transformation	Low	Low	Low	Low	Low	Oxidation/ Reduction	Oxidation/ Reduction
Biotransformation	High-Int.	High-Int.	Low	Low-High	Low	None	Low

1. Increased in estuaries by "salting-out" effect.
2. An important exception is chromium (VI).
3. Can form non-aqueous phase liquid (NAPL) when salted out.

5.2 Fate and Transport in the Estuarine Environment

Conditions in the estuarine environment change due to natural cycles, weather patterns and acts of man. The following sections provide a general description of two fate and transport processes, flushing/physical transport and chemical fate/transformation, in the estuarine environment.

5.2.1 Flushing/Physical Transport

Flushing is defined as the average amount of time that freshwater spends in an estuary (Alber and Sheldon 1999). In general, estuaries with a greater input of river flow and smaller volume have short flushing times while estuaries with lower freshwater inflows and greater volumes have long flushing times. Flushing time can be estimated from the salinity of the estuary compared to that of seawater and the total volume of each segment of the estuary as follows (Dyer 1973):

$$\iota = \text{Freshwater volume/freshwater input}$$

$$= \Sigma[(S_{sw}-S_i/S_{sw})V_i]/Q$$

Where:

ι = Flushing time

S_{sw} = Seawater salinity
S_i = Salinity of volume segment i
V_i = Volume of segment i
Q = Freshwater input

Flushing time can be a reliable predictor of the residence time of a compound in the estuary. In other words, the equation is valid if none of the fate and transport properties described previously are acting on the particular COPC under consideration. The concentration of the compound downstream from a point source (such as an outfall) can be predicted using the following:

$$C_x = (P/Q)\, f_x$$

Where:

C_x = Concentration of the COPC at a point x, downstream of the outfall
P = Rate of supply of the COPC (mass of COPC/time)
f_x = Fraction of freshwater at point x (calculated from salinity)

The concentration of the COPC downstream of the outfall is directly proportional to the fraction of freshwater (inversely proportional to the fraction of seawater). Upstream (up estuary) of the outfall, the concentration of the COPC does not decrease dramatically as is often the case for point sources discharging to river systems. In estuaries, tidal forces or onshore winds can transport COPCs landward, or upgradient of the outfall. The concentration of the COPC at a point y upgradient of the outfall is given by:

$$C_y = C_0\, (S_y/S_0)$$

Where:

C_y = Concentration of the COPC at point y upstream of the outfall
C_0 = Concentration of the COPC at the outfall
S_y = Salinity at point y
S_0 = Salinity at the outfall

Upgradient of the outfall, the COPC concentration is directly proportional to the salinity due to the landward flow of higher salinity water caused by tides and onshore winds.

The relationships presented above, while quite useful under the right conditions, are severely limited by the fact that they are only valid for conservative COPCs. For the purpose of this discussion, "conservative" refers to compounds with concentrations that are only affected by dilution processes. Very few COPCs can be considered conservative or are mobile enough to be approximated as a conservative compound.

Instead, most COPCs will be either transformed into another compound or transferred from the water phase to either the solid or gas phase to some extent within an estuary. The extent to which the fate and transport processes will act on a given COPC will depend on the chemical properties discussed above and on the conditions within the water column and sediment of the estuary.

5.2.2 Chemical Fate/Transformation

The fate and transport properties discussed above act on most COPCs, such that the flushing equations for conservative species (discussed above) are generally not valid. The degree to which fate and transport processes cause a deviation from the conservative flushing behavior depends on the properties of the COPC (as discussed previously) and on the environmental conditions and processes within the estuary. Numerous investigators have studied non-conservative behavior in estuaries and have identified the key conditions for many different potential contaminants. The most important conditions include:

- Salinity
- Grain size of the sediment
- TOC of the sediment
- Turbidity
- pH and ORP

5.2.2.1 Salinity

Salinity is perhaps the most important parameter affecting the fate and transport of both organic compounds and metals within estuaries. Increases in salinity from near zero within a bayou discharge to seawater levels can dramatically shift the equilibrium of the COPCs between the dissolved and particulate phases. In addition, salinity changes can control the sediment load within the water column, resulting in an even more pronounced effect.

5.2.2.1.1 Organics

The salting-out effect is the dominant process controlling hydrophobic organic compounds in the estuarine environment. Means (1995) performed an extensive study of the variation of PAH adsorption with salinity within Lafitte Bayou and Pass Fourchon/Lake Champagne, LA. They reported significant increases in K_d values with increasing salinity. For example, at a salinity of 9 ppt, they measured a K_d value of 5,146 liters per kilogram (L/kg) for pyrene while at a salinity of 32 ppt, a K_d of 9,578 L/kg was obtained. Brunk et al. (1997) found that the phenanthrene K_d value was 55 percent higher in saltwater than in freshwater. Salting-out affects most organic compounds to some degree but is less significant for charged or polar molecules such as low molecular weight phenols, alcohols, and carboxylic acids.

Brunk et al. (1997) found that salinity increases can result in the precipitation of organic coatings onto the surfaces of suspended particulate matter, increasing the available adsorption sites for hydrophobic organic compounds (thereby increasing effective K_d).

Bates et al. (1987) found that the concentrations of aromatic hydrocarbons within Puget Sound were controlled by a rapid vertical flux where contaminated sediments were removed from the water column. While Bates et al. (1987) did not attempt to determine the removal mechanism, it has since been attributed to removal of suspended particulate matter in response to salinity increases (Means 1995).

The combined processes of salting-out COPCs in the aqueous phase, precipitation of organic compounds onto suspended particles, and salinity induced flocculation of suspended particulate matter effectively removes hydrophobic COPCs from the water column.

5.2.2.1.2 Metals

Salinity can result in the removal of neutral metals species via salting-out (i.e., $HgCl_2^0$, Turner et al. 2001,) or ionic strength effects for metal ions. Increases in salinity result in an increase in ionic strength, which reduces activity of the species in solution. The result is increased solubility and decreased K_d values compared to the values obtained for freshwater. Turner et al. (2001) performed modeling to show that formation of $HgCl_4^{2-}$ would decrease the mercury K_d. Depending on the speciation, mobility either decreased (via salting-out of the neutral species) or increased (due to ionic strength effects on mercury ions), resulting from an increase in salinity. Similar trends would occur for other metals.

Seawater ions can also compete with metals for adsorption sites on sediments. Hanor and Chan (1979) (reported in Coffey et al., 1997) found that barium is mobilized within the mixing zone of the Hudson River Estuary due to ion exchange between magnesium from the seawater and adsorbed barium. Investigators have found similar trends for other metals.

Coagulation of suspended sediment has been shown to greatly reduce metals concentrations within the water column. The TSS load within the water column can be an effective means of transporting otherwise immobile compounds.

5.2.2.2 Grain Size

Grain size is an important parameter for adsorption of inorganic constituents due to the greatly increased surface area per mass of fine-grained sediment compared to coarse sediment. Menon et al. (1998) found that sediment cadmium, copper, lead, and zinc concentrations correlated with sediment surface area within the Hudson River Estuary. Borrego et al. (2002) performed cluster analyses on sediment results from the Odiel Estuary and found that aluminum, iron, phosphorous, copper, lead, and barium cluster together with high contents of silt and clay. The relationship was first

illustrated within estuaries by Gibbs (1977) and has since been used to normalize sediment samples for comparative purposes.

5.2.2.3 Sediment TOC

Sediment TOC, as discussed previously, is an important parameter for determining partitioning between organic compounds and sediments. Gunderson et al. (1997) found that within the York Estuary in Virginia, sediment TOC concentrations of only 0.1 percent are required before organic carbon adsorption of chlorinated methoxyphenols predominates (foc* = 0.00001). Brunk et al. (1997) found that adsorption of phenanthrene onto clay minerals is increased due to precipitation of organic coatings onto clay particles. Albanis et al. (1995) found that pesticides were adsorbed by sediments.

5.2.2.4 Oxidation/Reduction Potential and pH

Redox potential and pH can be very important within estuaries due to the mixing of seawater and river water and flooding and evaporation cycles within marsh areas. Turbulence, caused by tidal action, can increase the DO levels and, consequently, the redox state within the tidal influenced zones of the estuary.

5.2.2.4.1 Organics

The pH of an estuary is typically higher than that of the river input due to the high alkalinity of seawater. The increase in pH on an organic compound is usually minimal except for compounds with carboxyl or hydroxyl substituents. For example, pentachlorophenol is much more mobile at high pH than at low pH due to the hydroxyl group, which gives the molecule an acid/base character. Gunderson et al. (1997) found that chlorinated methoxyphenols are more soluble and have lower K_d values at high pH (when the molecule is negatively charged) than at lower pH (when the molecule is neutral and more hydrophobic).

Theoretically, organic compounds can be completely oxidized to carbon dioxide and water within estuaries. However, abiotic oxidation is relatively unimportant except perhaps in the surface water where photo-oxidation may occur. Of much greater importance is the biotransformation of organic compounds within the estuarine environment. The more available oxygen, higher redox conditions within the turbulent tidal areas can result in aerobic biotransformation. The process will be most important for the more soluble and easily degraded compounds such as the aromatic VOCs (i.e., benzene, toluene, phenols, etc.). Other, less mobile and less bioavailable compounds such as the dioxins/furans, SVOCs, pesticides, and large molecule PAH compounds will not biodegrade to any great extent.

Within consistently flooded marshes and other low energy environments, organic matter within fine-grained sediments can produce anoxic conditions, which favor anaerobic biotransformation. Chlorinated organic compounds such as tetrachloroethene can be reduced and sequentially dechlorinated to form cis-1,2 dichloroethene, vinyl chloride, ethene, and ethane.

5.2.2.4.2 Metals

The increased DO and redox can result in the oxidation of ferrous iron and manganese and the resultant removal of metals via co-precipitation. Turner (2000) found that sediments within estuaries have an iron to manganese ratio ranging from <10 to 100, suggesting that iron is removed to a greater extent than manganese within the estuaries. The oxidation kinetics of ferrous iron (iron (II)) are dependent on the dominant iron species in solution. King (1998) found that free ferrous iron (Fe^{2+}) has an oxidation half life of days to weeks while $Fe(OH)_2^0$ has a half life of a few seconds. Therefore, an increase in pH can increase the fraction of $Fe(OH)_2^0$ and can result in a much faster oxidation rate. The carbonate species $Fe(CO_3)_2^{2-}$ was found to control ferrous iron oxidation rates in seawater due to the high alkalinity and relatively fast oxidation rate of the species. Therefore, when ferrous iron from a river input is mixed with oxygenated, higher pH, higher alkalinity seawater within an estuary, conversion of iron (II) to the much less mobile iron (III) is predicted. Co-precipitation of metals would also likely be the result. Turner (2000) found that sediment concentrations of chromium, copper, lead, and zinc could be correlated with iron concentrations within the Clyde, Dee, Forth, Lohghor, Mersey, and Poole Harbour estuaries in the United Kingdom. Copper from sulfidic sources (i.e., mine drainage) was found to correlate more strongly with iron oxides while copper from industrial sources correlated with anthropogenic organics.

The pH and redox conditions are particularly important within stagnant marshes and salt flats where fine sediments are subjected to repeated flooding and evaporation cycles. When the marshes are flooded, the organics within the marsh sediments can create sulfate-reducing conditions, resulting in the production of sulfide and the precipitation of metal sulfide minerals such as pyrite. However, following evaporation of the stagnant water, the sulfides can become re-oxidized, resulting in acid production and remobilization of metals during heavy rains or spring tides when the areas become flooded. Anisfeld and Benoit (1997) compared two marshes in Connecticut, one with a tide gate, which prevented tidal inflow, and another without a gate. They found that in the more stagnant gated marsh the DO, metals, sulfate, acidity, ammonia, and nitrate levels were much higher than in the more consistently flooded, un-gated marsh. The high nitrate and ammonia levels were attributed to oxidation of nitrogen-containing organic matter within the fine-grained marsh sediments. Borrego et al. (2002) found jarosite ($HFeSO_4(OH)$) and other hydrated sulfide minerals within the tidal flats above the spring tide line at the Odiel and Tinto estuaries in southwestern Spain. The tidal flats were sterile and contained the highest sediment zinc concentrations anywhere within the estuarine systems. The mineralogy and chemical composition of the sediments in these isolated marsh areas can be very similar to the precipitates found on the surfaces of mine tailings dumps where sulfide minerals oxidize in response to wetting and drying cycles within the piles.

5.3 Summary of Fate and Transport Processes

In summary, important fate and transport processes acting on COPCs in Calcasieu Estuary and the environmental factors influencing these processes are as follows:

- Adsorption is one of the most important fate and transport processes in the estuarine environment. It is influenced by salinity, pH, and grain size of the adsorbing sediments. It is a significant process for dioxins, pesticides, PCBs, SVOCs, and some metals.

- Adsorption in the estuarine environment is controlled by processes that affect salinity and pH. Erosion and deposition patterns are related to the energy of the environment.

- Precipitation/co-precipitation is an important removal process for some metals (chromium, copper, lead, and zinc). Co-precipitation tends to be led by the oxidation of iron (II) to iron (III) and is influenced by the presence of iron oxyhydroxides.

- Precipitation is controlled in estuaries by pH, oxidation-reduction potential, and salinity (via salting out). Precipitation of oxides typically occurs in oxygenated, turbulent areas (flood tidal zones) while precipitation of sulfides occurs in anoxic low energy areas, such as marshes.

- Volatilization is important for VOCs. Volatilization is controlled by the turbulence of the water and the wind speed at the surface of the water. Volatilization is greatest in turbulent waters with high wind speeds. High turbulence areas within an estuary occur in the areas influenced by tidal energy while low turbulence areas are in marsh areas and embayments.

- Biotransformation is important for soluble organic compounds and compounds with easily broken bonds, such as aromatic compounds.

- Aerobic biotransformation is important in turbulent oxygenated waters, such as tidal zones, while anaerobic biotransformation is important in low energy marshes and embayments.

- The residence time of a COPC within an estuary depends on the flushing time of the estuary and on the degree of attenuation imparted on the COPC by fate and transport processes.

These processes will be referred to throughout the data interpretation sections for each AOC in Sections 7 through 10.

Table 5-1
Chemical Properties Affecting Fate

CHEMICAL	WATER SOLUBILITY (mg/L)	VAPOR PRESSURE (mm Hg)	HENRY'S LAW CONSTANT (atm-m3/mol)	K_{oc} (ml/g)	log K_{ow}	Fish BCF (l/kg)	Fate and Transport Driver	Reference
VOC								
1,1,1-Trichloroethane	1.50E+03	1.24E+02	8.00E-03	1.52E+02	2.49	9	Volatilization (VP) Leaching (WS)	Howard 1990
1,1,2-Trichloroethane	4.50E+03	3.00E+01	1.17E-03	5.60E+01	2.47	5	Volatilization (VP) Leaching (WS)	EPA 1987
1,2-Dichloroethane (EDC)	8.52E+03	6.40E+01	9.78E-04	1.40E+01	1.48	1	Volatilization (VP) Leaching (WS)	EPA 1987
Acetone	1.00E+06	2.70E+02	2.06E-05	2.20E+00	-2.40	ND	Volatilization (VP) Leaching (WS)	EPA 1987
Carbon disulfide	2.94E+03	3.60E+02	1.23E-02	5.40E+01	2.00	0	Volatilization (VP) Leaching (WS)	EPA 1987
SVOC								
SVOCs - PHTHALATES								
Bis(2-ethylhexyl)phthalate	2.85E-01	6.20E-08	1.10E-05	5.00E+00	4.50	3	Adsorb to soil (Koc)	Howard 1990
SVOCs - AROMATIC								
4-Chloro-3-methylphenol (para-chlorocresol)	3.85E+03				2.95	18	Leaching (WS)	Clement Associates 1985
Hexachlorobenzene (HCB)	6.00E-03	1.09E-05	6.81E-04	3.90E+03	5.23	8600	Bioaccumulation (WS, BCF)	EPA 1987
Hexachlorobutadiene (HCBD)	2 to 4	1.50E-01	1.02E-03 to 2.6E-02	4.68E+03 to 5.01E+04	4.78 - 4.90	435 to 1,700		ChemRisk 1994
N-nitrosodiphenylamine	4.00E+01	1.00E-01	6.60E-04	3.00E+00	3.00	ND	Volatilization (VP)	ATSDR 1992
SVOCs - PAHs								
Acenaphthylene	3.93E+00	2.90E-02	1.48E-03	2.50E+03	3.70	ND	Volatilization (VP) Bioaccumulation (WS, Koc)	EPA 1987
Benzo(a)anthracene	5.70E-03	2.20E-08	1.16E-06	1.38E+06	5.60	ND	Bioaccumulation (WS, Koc)	EPA 1987
Benzo(a)pyrene	1.20E-03	5.60E-09	1.55E-06	5.50E+06	6.06	ND	Bioaccumulation (WS, Koc)	EPA 1987
Benzo(b)fluoranthene	1.40E-02	5.00E-07	1.19E-05	5.50E+05	6.06	ND	Bioaccumulation (WS, Koc)	EPA 1987
Benzo(g,h,i)perylene	7.00E-04	1.03E-10	5.34E-08	1.60E+06	6.51	ND	Bioaccumulation (WS, Koc)	EPA 1987
Benzo(k)fluoranthene	4.30E-03	5.10E-07	3.94E-05	5.50E+05	6.06	ND	Bioaccumulation (WS, Koc)	EPA 1987
Chrysene	1.80E-03	6.30E-09	1.05E-06	2.00E+05	5.61	ND	Bioaccumulation (WS, Koc)	EPA 1987
Dibenz(a,h)anthracene	5.00E-04	1.00E-10	7.33E-08	3.30E+06	6.80	ND	Bioaccumulation (WS, Koc)	EPA 1987
Fluoranthene	2.06E-01	5.00E-06	6.46E-06	3.80E+04	4.90	1150	Bioaccumulation (BCF, Koc)	EPA 1987
Fluorene	1.69E+00	7.10E-04	6.42E-05	7.30E+03	4.20	1300	Bioaccumulation (BCF, Koc)	EPA 1987
Phenanthrene	1.00E+00	6.80R-04	1.59E-04	1.40E+04	4.46	2630	Bioaccumulation (BCF, Koc)	EPA 1987
Pyrene	1.32E-01	2.50E-06	5.04E-06	3.80E+04	4.88	ND	Bioaccumulation (BCF, Koc)	EPA 1987
PESTICIDES								
Aldrin	1.80E-01	6.00E-06	1.60E-05	9.60E-04	5.30	28	Bioaccumulation (WS, BCF)	EPA 1987
Chlordane	5.60E-01	1.00E-05	9.63E-06	1.40E+05	3.32	14000	Bioaccumulation (BCF, Koc)	EPA 1987
Chlordane (alpha)	ND	ND	ND	ND	ND	ND		
Chlordane (gamma)	ND	ND	ND	ND	ND	ND		
Dieldrin	1.95E-01	1.78E-07	4.58E-07	1.70E+03	3.50	4760	Bioaccumulation (WS, BCF)	EPA 1987
Endosulfan	1.55E-01	1.00E-05	1.00E-05	3.50E+00	3.60	600	Bioaccumulation (WS, BCF)	ATSDR 1991
Endosulfan II	5.30E-01	1.00E-05	1.00E-05	ND	3.52	600	Bioaccumulation (WS, BCF)	ATSDR 1991
Endosulfan Sulfate	1.17E-01	1.00E-05	2.60E-05	ND	3.66	600	Bioaccumulation (WS, BCF)	ATSDR 1991
Hexachlorocyclohexane (alpha)	1.63E+00	2.50E-05	5.87E-06	3.80E+03	3.90	130	Bioaccumulation (WS, BCF)	EPA 1987
Hexachlorocyclohexane (beta)	2.40E-01	2.80E-07	4.47E-07	3.80E+03	3.90	130	Bioaccumulation (WS, BCF)	EPA 1987
Hexachlorocyclohexane (delta)	3.14E+01	1.70E-05	2.07E-07	6.60E+03	4.10	130	Bioaccumulation (WS, BCF)	EPA 1987
Hexachlorocyclohexane (gamma)	7.80E+00	1.60E-04	7.85E-06	1.08E+03	3.90	130	Bioaccumulation (WS, BCF)	EPA 1987
Endrin aldehyde	2.60E-01	2.00E-07	3.86E-07	3.98E+05	4.43	ND	Bioaccumulation, Adsorb to soil	ChemRisk, 1994
Endrin ketone	3.10E-02	7.70E-05	1.07E-03	5.30E+05	1100000.00	25 to 200	Bioaccumulation (Kow, BCF)	ATSDR 1992

Table 5-1
Chemical Properties Affecting Fate

CHEMICAL	WATER SOLUBILITY (mg/L)	VAPOR PRESSURE (mm Hg)	HENRY'S LAW CONSTANT (atm-m3/mol)	K_{oc} (ml/g)	log K_{ow}	Fish BCF (l/kg)	Fate and Transport Driver	Reference
PCBs								
Aroclor 1254	1.20E-02	7.71E-05	2.00E-03	4.10E+05 to 1.07E+06	6.50	ND	Adsorb to soil, Bioaccumulation (WS, Kow)	ATSDR 1992
DIOXIN/FURANS								
2,3,7,8-TCDD	2.00E-04	1.00E-06	2.10E-03	3.98E+06	6.84	9333	Adsorb to soil, Bioaccumulation(BCF)	Mackay et al. 1992
METALS								
Arsenic	ND	NA	NA	NA	NA	0-350	Bioaccumulation (BCF)	ATSDR 1999
Barium		NA	NA	NA	NA			
Chromium (total)	ND	NA	NA	NA	NA	1-192	Bioaccumulation (BCF)	ATSDR 1992
Chromium (+6)	ND	NA	NA	NA	NA	1-192	Bioaccumulation (BCF)	ATSDR 1992
Copper	ND	NA	NA	NA	NA	10 to 100	Bioaccumulation (BCF)	ATSDR 1990
Lead	ND	NA	NA	NA	NA	0-92,000	Bioaccumulation (BCF)	ATSDR 1997
Mercury	3.00E-02	2.00E-03	1.10E-02	ND	3.4 to 6.0	10000 to 100000	Bioaccumulation (BCF)	ATSDR 1999
Nickel	ND	NA	NA	NA	NA	36	Bioaccumulation (BCF)	ATSDR 1997
Zinc	ND	NA	NA	NA	NA	4-24000	Bioaccumulation (BCF)	EPA 1987, ATSDR 1994

U.S. EPA 1987. *Superfund Public Health Evalutation Manual* . Office of Emergency and Remedial Response. EPA/540/1-86/060

Howard, P. H., 1990. *Handbood of Environmental Fate and Exposure Data for Organic Chemicals, Vol 1.* Lewis Publishers. Chelsea, Michigan

Ney, R. E., 1990. *Where did that Chemical Go? A practical guide to chemcial fate and transport in the environment.* Van Nostrand. NY, NY.

ATSDR - Toxicological Profiles

NIH - National Institutes of Health Hazardous Substance Database

ChemRisk 1994. *Environmental Fate and Transport Review for Preliminary Chemicals of Interest for the PPG - Lake Charles Facility*. November 14, 1994.

Mackay et al. 1992. *Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume 2. Polynuclear Aromatic Hydrocarbons, Polychlorinated dioxins, and Dibenzofurans.* Boca Raton, Florida: Lewis Publishers.

atm-m3/mol = (vapor pressure - cubic meters per mole)
BCF = bioconcentration factor
mg/L = milligrams per liter
MIBK = Methyl Isobutyl Ketone
ml/g = milliliters per gram
mm Hg = millimeters mercury
ND = no data
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
SVOC = semivolatile organic chemical
VOC = volatile organic chemical
VP = Vapor Pressure
WS=Water Solubilbity

Section 6
Reference Areas

6.1 Introduction

A total of five areas were selected to represent reference conditions within the Calcasieu Basin. These areas included Choupique Bayou, Grand Bayou, Bayou Bois Connine, Willow Bayou, and Johnsons Bayou (Figure 2-7). Within the five areas, 18 reference sites were selected using a stratified random sampling design, whereby each of the five reference sub-areas (strata) are sampled individually by simple random sampling. The reference areas were selected for minimal sediment contamination while having similar sediment characteristic as the Calcasieu Estuary study area as described in Section 2. Examination of these reference area sediments will enable the interpretation of the significance of elevated concentrations that were observed in the respective sediments from the study area.

6.2 Comparing Reference Sites Among the Reference Areas

Because the reference sites were stratified into five different reference sub-areas, of primary concern was comparing observations from the reference sites to determine whether all of the reference sites could be considered to come from the same population, i.e., to determine whether the distributions of chemical concentrations in each of the five reference sub-areas were the same. The nonparametric one-way Analysis of Variance (ANOVA) is a commonly used statistical method to compare two or more groups, in this case reference sites, collectively. The nonparametric ANOVA is also called the Kruskal-Wallis test. For comparative purposes, only chemical constituents in the sediments were examined, because surface water tends to be fairly variable both spatially and temporally.

6.3 Kruskal-Wallis Test

Comparisons between the five reference areas were conducted using the Kruskal-Wallis test on selected constituents (See Appendix C). The Kruskal-Wallis test evaluates whether three or more sample distributions are derived from the same population, or whether there is a statistically significant difference between any two of the three or more sample distributions. The null hypothesis (H_0) and the alternative hypothesis (H_A) can be formulated as follows:

- H_0: All five reference area sample distributions are from the same population against the alternative.
- H_A: At least one of the five reference area sample distributions are from a different population that at least one other reference area sample distribution at a significance level $\alpha = 0.05$.

The Kruskal-Wallis test is described in detail in Gilbert (1987) and EPA (1992). The test was conducted on reference area sediment samples using the computer software Systat® Version 10.

The Kruskal-Wallis test is an extension of the nonparametric Wilcoxon ranked sum test for comparing more than two groups simultaneously, just as the parametric one-way ANOVA is an extension of the parametric t-test. As with the Wilcoxon ranked sum test, the Kruskal-Wallis test does not require the assumption that the data are derived from a normal (or any other specific) population distribution. The only assumption is that the distributions have the same shape, although they need not be symmetric. The Kruskal-Wallis test was selected (over the parametric one-way ANOVA equivalent) because the population distributions were unknown and the sample sizes of the data were generally insufficient to distinguish the shape of the population distribution. In addition, the Kruskal-Wallis test is capable of handling the moderate number of nondetect values present in the sample data. Both parametric and nonparametric ANOVA are based on the idea that if the amount of variability between the sample distributions is large relative to the amount of variability within each distribution, thus providing an indication that the distributions are not derived from the same population.

6.4 The Selection of Chemical Constituents

To ensure consistency, the sediment sample data used for the Kruskal-Wallis test were obtained using the same protocols employed in the PCA and the Wilcoxon ranked sum tests. The data groups consisted of the reference sample sites distributed among the five reference areas as displayed in Exhibit 6-1.

Exhibit 6-1 Distribution of Reference Sites Among the Reference Area.

Reference Area	Reference Sites			Energy Area
Bayou Bois Connine	SNST006	SNST035		Bayou
Bayou Choupique	SNSTO11	SNST012	SNST013	Bayou
	SNST014	SNST015		
Grand Bayou	SNST008	SNST009	SNST038	Bayou
Johnsons Bayou	ECOSN001	ECOSN002	ECOSN003	Bayou
	SNST003	SNST004	SNST005	
Willow Bayou	SNST001	SNST002		Bayou

The chemical constituents selected for the Kruskal-Wallis testing were determined from the PCA results and were the same as those selected for the Wilcoxon ranked sum testing. These chemical constituents are depicted in Exhibit 6-2. All but the last of the constituents were selected directly from the PCA results. The last chemical

constituent, 2,3,7,8-TCDD toxicity equivalent, was selected based on the prevalence of dioxin/furan isomers in the PCA results. The dioxin/furan isomers were converted to 2,3,7,8-TCDD toxicity equivalents (TEQ) as described in Section 4, then summed to obtain the total 2,3,7,8-TCDD toxicity equivalents.

Exhibit 6-2 Selected chemical constituents.

Chemical Constituent	Frequency of Detect	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation	Coefficient of Variation
2,3,7,8-TCDD Equivalent (pg/g)	5/5	3.39	7.08	4.3	2.1	0.5
Aroclor 1254 (μg/Kg)	3/18	100	1000	---	---	---
Arsenic (mg/Kg)	3/3	4.8	9.5	8	3	0.4
Barium (mg/Kg)	3/3	28.7	40.1	35	7	0.2
bis(2-Ethylhexyl)phthalate (μg/Kg)	5/18	55	110	71	16	0.2
Chromium (mg/Kg)	3/3	7.9	10.5	9	1	0.2
Copper (mg/Kg)	18/18	4.9	18.1	13	3	0.3
Lead (mg/Kg)	18/18	8.6	29.1	19	6	0.3
Mercury (mg/Kg)	15/18	0.020	0.093	0.06	0.02	0.37
Nickel (mg/Kg)	18/18	8.5	21.5	16	5	0.3
Zinc (mg/Kg)	18/18	36	86	60	15	0.3
Pyrene (μg/Kg)	3/6	25	80	42	29	0.7

6.5 Kruskal-Wallis Results

The Kruskal-Wallis tests were conducted to compare each chemical constituent in each reference area to that chemical constituent in all other reference areas. Since there were six constituents, a total of six tests were conducted. The results are provided in Exhibit 6-3.

Exhibit 6-3 provides the probability (or p-value) results of the Kruskal-Wallis comparison test. The p-values must be compared with a critical value (alpha, α) in order to determine whether there is a statistical discernable difference between the five reference area groups tested. For the purpose of interpreting the p-values, three levels of significance were established:

- p-value > α accept H_0: All five reference areas are derived from the same population.
- p-value < α reject H_0: At least one of the five reference areas may be derived from a different population than at least one other reference area.
- adjusted p-value < α reject H_0: At least one of the five reference areas is derived from a different population than at least one other reference area.

For the first two levels of significance (all five reference areas are derived from the same population and at least one of the five reference areas may be derived from a different population than at least one other reference area), the p-values were compared directly with α = 0.05. For the third level of significance (at least one of the

five reference areas is derived from a different population than at least one other reference area), an adjusted p-value was used based on the total number of comparison tests conducted. The adjusted p-value was calculated using the Bonferroni adjustment method:

- adjusted p-value = n(p-value) where n is the number of comparison tests conducted.

In Exhibit 6-3, adjusted p-values that were less than alpha (α) are shown in parentheses; these are considered cases where the Kruskal-Wallis test definitely indicates that at least one of the five reference areas is derived from a different population than at least one other reference area.

Exhibit 6-3 Kruskal-Wallis Test Results – Comparison Among Reference Areas.

Chemical Constituents	p-Value [1]
Arochlor 1254 (μg/Kg)	0.074
Bis(2-Ethylhexyl)phthalate (μg/Kg)	0.113
Pyrene (μg/Kg)	---[2]
2,3,7,8-TCDD TEQ (pg/g)	0.202
Lead (mg/Kg)	**0.013**
Mercury (mg/Kg)	**0.042**
Nickel (mg/Kg)	**0.009** (0.045)
Arsenic (mg/Kg)	---[2]
Barium (mg/Kg)	---[2]
Chromium (mg/Kg)	---[2]
Copper (mg/Kg)	0.298
Zinc (mg/Kg)	**0.007** (0.035)

[1] If p-value < critical value (α = 0.05) then there is a statistically significant difference between the reference areas. Bold = significant difference. Values in parentheses are Bonferroni adjusted p-values (shown only if < 0.05).
[2] Insufficient data for analysis.

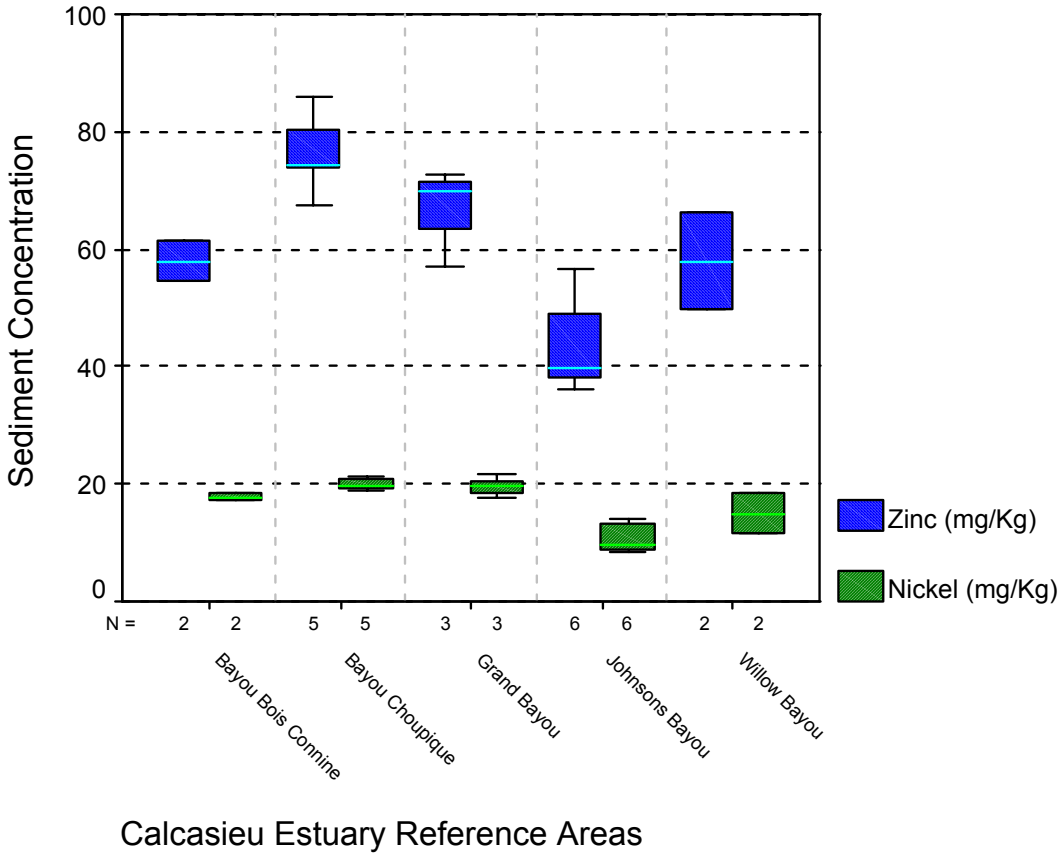
6.6 Conclusions

As illustrated in Exhibit 6-3, only nickel and zinc produced adjusted p-values less than 0.05, indicating at least one reference area is derived from a different population than at least one other reference area. Although lead and mercury yielded p-values of 0.013 and 0.042 respectfully, the adjusted p-values indicated that there was no statistically significant difference between the reference areas for the two chemical constituents.

Whereas shown in Exhibit 6-4, the low p-value attributed to zinc is due to a significantly higher zinc distribution in Choupique Bayou compared with Johnsons Bayou. This could be indicative of low-level zinc contamination in Choupique Bayou (specifically around reference site SNST011); however, the concentrations are low and could represent elevated natural background zinc levels in Choupique Bayou relative to Johnsons Bayou. Likewise, the adjusted p-value attributed to nickel is probably due to a significantly higher nickel distribution in all of the reference areas when compared to Johnsons Bayou. Since the concentrations for nickel were low, less than

22 mg/Kg for all locations and with a range of about 12 to 22 mg/Kg for four reference areas, this could also represent natural background levels in all of the reference areas relative to Johnsons Bayou. Additionally, Johnsons Bayou tended to exhibit lower constituent concentrations compared to other areas.

Exhibit 6-4 Comparison Among Reference Areas for Nickel and Zinc.



Furthermore, as pointed out in Exhibit 6-4, the other three reference areas had consistent zinc concentrations ranging between about 50 and 72 mg/Kg. Given that this range likely represents variation in natural background, and since no significant differences exist for other chemical constituents, the results of the Kruskal-Wallis test indicate that the five reference areas are similar and can be combined for the purpose of comparison with the other Calcasieu Estuary study areas/energy areas.

Calcasieu Estuary Remedial Investigation
Lake Charles, Louisiana

Draft Remedial Investigation Report

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Sections 7 – 16 with
Associated Tables and Figures
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DISCLOSURE

This disc contains Sections seven through sixteen with associated tables and figures of the Calcasieu Estuary Draft Final RI Report. The links in the table of contents are accessible only to the sections included on the disc. Sections one through six with associated tables and figures are on Disc One. Appendices A through I are on Disc Three. As with Disc One, Discs Two and Three links are only accessible to the sections included on that disc.

Section 7
Bayou d'Inde – Nature and Extent

This section describes the nature and extent investigation of the Bayou d'Inde AOC. Section 7.1 reviews the reaches and energy areas within Bayou d'Inde. Historical activities, including industrial development, permitted discharges; accidental spills and releases are discussed in Section 7.2. An overview of the data analysis and interpretation is provided in Section 7.3. Physical characteristics of the bayou are presented in Section 7.4. Presentation of the data from Bayou d'Inde RI is provided in Section 7.5 (bayou energy system) and 7.6 (marsh energy system), including the results of the PCA as well as the summary statistics of the COPCs. Section 7. 7 presents the summary and conclusions for Bayou d'Inde.

7.1 Introduction

Bayou d'Inde is approximately 15 km long. It is located in the northern portion of the Calcasieu Estuary, west of the city of Lake Charles, Louisiana (Figure 2-2). Bayou d'Inde's headwaters originate in the western part of Sulfur, Louisiana and flow primarily east-southeast through heavy commercial and industrialized areas before emptying into the ship channel southwest of Coon Island.

Bayou d'Inde flows through the low-lying marsh area called Lockport Marsh, located at the confluence of Bayou d'Inde and the Calcasieu River Ship Channel. Lockport Marsh covers an area of approximately 1.2 km^2. The middle section of Bayou d'Inde; between the PPG Canal and state highway LA-108, also contains several small, interconnected, low-lying marsh areas.

7.1.1 Physical Setting

Bayou d'Inde is a major tributary of the Calcasieu River (Curry et al et al 1997). The bayou, which originates near the I-10 Bridge in Sulphur, has a drainage area of over 4 km^2 (PRC 1993). Several smaller tributaries, the largest of which is Maple Fork Bayou, located between the PPG Canal and LA-108, join Bayou d'Inde. The second identifiable fork is the Little Bayou d'Inde, located to the west of LA-108 (Figure 7-1).

The surface elevation in the area of the bayou averages about 3.1 m above MSL. The area surrounding Bayou d'Inde is located within the 100-year flood plain of the Calcasieu River Basin (Figure 2-6).

According to the USFWS National Wetland Inventory Map, Bayou d'Inde is a perennial riverine system. The upper portion of Bayou d'Inde from the headwaters to the confluence of Little Bayou d'Inde has water depths ranging from 1.2 to 2.1 m. From Little Bayou d'Inde to LA-108, the bayou has water depths ranging from 2 to 4 m. The geometry of lower Bayou d'Inde is wide and deep, ranging from 24 to 46 m wide and 2.5 to 5 m deep. Depth is greatest from the ship channel to LA-108 where the bayou has historically been dredged to accommodate barge traffic. Dredging of

the lower portions of the bayou has removed natural subsurface barriers that dampen tidal influence, increasing upstream salinity encroachment.

Lockport Marsh is a low-lying, intermediate to brackish marsh area with water depths generally less than 1 m. Lockport Marsh is inundated with overbank flow [during periods of high water] from PPG Canal to the west, Bayou d'Inde from the south, and the ship channel to the east.

Bayou d'Inde headwaters are typically fresh. These waters mix with intermediate to saline water from the ship channel in lower sections (Reaches 1, 2, and 3) of the bayou. The majority of the bayou is subjected to tidal surge, storm surge, salinity effects and turbulence due to barge traffic. Significant bottom scouring (flood tide currents) during periods of salt-wedge salinity stratification have been noted in the deeper portions of the estuary and is assumed to be similar in Bayou d'Inde. Salinity can vary significantly and is dependant upon season, rainfall, tide, recent storm surge, winds, and other conditions.

7.1.2 Energy Systems and Reaches

Bayou d'Inde contains two energy systems; bayou and marsh (Figure 7-1). Distinguishing physical and chemical features of the energy systems are described in detail in Section 3.3.

The energy systems are further subdivided into reaches; numbered reaches for the bayou and unnumbered for the marsh, as described below. The reaches are created based on recognizable features such as similarity of geometry, location of outfalls, major abutments (bridges) that can affect flow or salinity, and changes in land use. Each reach is distinct and will be discussed in terms of flow, salinity, sediment characteristics, and contaminants.

The bayou system is divided into four reaches (Figure 7-1):

- **Reach 1:** the dredged bayou segment from the PPG Canal to the ship channel;
- **Reach 2:** the segment from LA-108 to the PPG Canal;
- **Reach 3:** the segment of Bayou d'Inde from the confluence of Little Bayou d'Inde and the highway LA-108 bridge; and
- **Reach 4:** the upper rural residential area from the headwaters to the confluence with Little Bayou d'Inde.

The marsh system consists of two primary marsh areas;

- a series of small intermediate marshes along the banks of middle Bayou d'Inde near the confluence of Maple Fork Bayou; and

- the more saline Lockport Marsh located at the confluence of Bayou d'Inde and the ship channel.

In summary, Bayou d'Inde in Reaches 2 through 4 is a net sediment exporter. The marsh areas tend to be sediment sinks, however it appears that not all sediments deposit in the marshes. Dredging of the bayou from the ship channel up to Westlake Polymers dock located at LA-108 has altered the flow and salinity regime in Bayou d'Inde. Surface water and sediment characteristics indicate significant suspended material that appears to mobilize sediments. Several conditions may affect the degree of turbulence and the conditions specific to each area of Bayou d'Inde will be discussed in Section 7.4.

7.2 Industrial Setting and Historical Contamination

This section describes the industrial setting along Bayou d'Inde, including facilities descriptions for those industries that historically or currently discharge to the bayou. In addition, results from previous investigations conducted in Bayou d'Inde are discussed to evaluate if contaminant suites or concentrations have varied over time. This temporal information will be used to support chemical fate and transport discussions.

7.2.1 Industrial Setting

Land use within the Bayou d'Inde drainage generally consists of industrial manufacturing facilities and commercial shipping. Reaches 1 through 3 are entirely industrial. Reach 4 and areas upstream are rural residential and agricultural. Much of this upper portion of the bayou is vegetated and has not been dredged.

Historical/Current Permitted Dischargers to Bayou d'Inde:
PPG
Citgo
Equistar (formerly OxyChem)
Firestone
Westlake Polymers
CertainTeed Products
Big Three Industries
Jupiter Chemicals

Industries with permitted disposal into Bayou d'Inde under NPDES permits include PPG, Citgo, OxyChem, Firestone, and Westlake Polymers.

Figure 7-2 identifies documented current and historical outfall locations. Spills or permit exceedances that have entered Bayou d'Inde through these outfalls are discussed in Sections 7.2.1.1 through 7.2.1.5. Other documented spills and releases are discussed to complete the contaminant extent and chemical fate discussions in Sections 7.4 and 7.6.

7.2.1.1 PPG

PPG is located along the northern side of Bayou d'Inde and Lockport Marsh, bounded by I-10 to the north, undeveloped land and Bayou D'Inde to the west, Coon Island Loop to the east and Lockport Marsh to the south (Figure 7-2).

Chemical manufacturing activities were initiated at the PPG site in the early 1940s. Magnesium was manufactured at the site until 1947, initially by the U.S. government and subsequently by Matheson Alkali Works. Between 1947 and 1969, chlorine and caustic soda were produced at the site by Alkali Corporation. PPG acquired full ownership of the site in 1968 and has manufactured a wide variety of chlorinated hydrocarbons and precipitated silica since the late 1960s.

PPG Products:
Chlorine
Sodium hydroxide
Hydrochloric acid
1,2- Dichloroethane (syn. EDC)
Vinyl chloride monomer
1,1-Dichloroethene
Ethyl chloride
1,1,1- Trichloroethane
1,1,2-Trichloroethane
Tetrachloroethene
Trichloroethene
Trans-1,2-Dichloroethene

PPG (NPDES Permit No. LA0000761) is authorized to discharge process wastewater through several designated outfalls. PPG discharges to Bayou d'Inde through outfall 001 and to the Calcasieu River (outfalls 002, 003 and 004; not shown). Outfall 001 discharges to the PPG Canal and is the primary effluent route. The PPG Canal originates in the southeast corner of the PPG facility and flows to the southwest to Bayou d'Inde. In 1994, PPG re-routed the most contaminated segment of the canal, and that area was designated RCRA solid waste management unit (SWMU) No. 15. Several of the SWMUs are present in the South Terminal Area. Potential contaminant sources include the former South Terminal Organic Earthen Pond, used from approximately 1962 through 1970; the Organic Pit, used from 1970 through 1974; the System E-Pond used from 1975 through 1982; and the Lead/Mercury Settling Pond, initiated in 1969 and closed in 1983. Release from each of these units is being addressed under RCRA and groundwater recovery systems were initiated in 1984. The PPG Canal received drainage from these units prior to their closure.

The PPG Canal also receives minor permitted flow from CertainTeed Products, Big Three Industries, Inc. and Jupiter Chemicals. Permitted flows are 0.733 million gallons per day (mgpd), 0.025 mgpd, and 0.160 mgpd, respectively. PPG Canal has a design flow capacity of 223 mgpd, although the average PPG discharge to outfall 001 (in 1997) was approximately 160,000 gpm (Curry et al et al 1997). These three permitted dischargers are small generators with minor compliance exceedances, in terms of Bayou d'Inde contaminants of concern. Based upon potential for impact, they are not considered significant and are not discussed further.

The PPG facility is divided into three primary operating areas that drain to Bayou d'Inde: the Chlor-Alkali plant (Plant A), the Derivatives area (Plant B) and the Chlor-Alkali/Silicas area (Plant C). Two material storage and transfer areas are located onsite: the South Terminal area and the North Dock area. Surface flow and process water from all but the North Dock area flow to the PPG Canal. Several internal sewers and associated outfalls are noted in Table 7-1, outfall 001 is the only outfall that discharges directly to Bayou d'Inde.

Waste was delivered to outfall 001 by PPG's 201 sewer up until 1994. The line originated in Plant C, the Chlor-Alkali/Silicas area, and flowed through Plant B (the Derivatives area) and emptied into a neutralization basin, and then discharged into

the PPG Canal. In 1986 PPG reportedly modified Incinerator 3 to destroy incidentally generated PCBs. It appears that operations transferred to Incinerator 5 in approximately 1988. A TSCA permit for PCB incineration was approved in 1989.

In approximately 1993, the 201 sewer was designated a RCRA SWMU and it was replaced by an above ground piping system. The PPG 101 sewer discharged to outfall 001, contributing chlor-alkali, mercury cell and caustic wastewater from Plant A (Chlor-Alkali). The 101 and 201 sewers discharge are mixed in the neutralization basin before entering the PPG Canal. Available data indicates that the basin was unlined.

The average combined discharge of outfall 001 is approximately 160,000 gpm. This is made up of approximately 7,000 gpm from the 201 sewer; 23,100 gpm from Plant A and the 101 sewer; and an additional 129,000 gpm of once-through cooling water from the Plant A powerhouses. Effluent from the Silicas Ditch enters the PPG Canal further downstream, adding approximately 720 gpm. Each of these sewers and outfalls has been active since 1988 (Curry et al 1997). The outfalls are monitored for TSS, BOD, pH, TOC, total residual chlorine (TRC), total chlorinated hydrocarbons, mercury, copper, and lead and several volatile and semivolatile organic compounds (Curry et al et al 1997).

Compliance records available for active units from January 1979 through October 1998 indicate that several permit violations were reported for PPG. Significant releases include chlorinated hydrocarbons, lead, copper, and mercury. Several documented releases to the PPG Canal (outfall 001) and internal areas draining to the canal were noted in 1985, 1988, 1992, and 1993, however, numerous indeterminate spills (unknown spill amount or undocumented drainage or outfall) were noted from 1979 through 1997. Exhibit 7-1 summarizes the approved discharges to Bayou d'Inde. Enforcement histories for the PPG outfalls are provided in Table 7-1.

Exhibit 7-1 Approved PPG Discharges into Bayou d'Inde (Curry et al et al 1997)

Outfall /Sewer	Discharge Area	Approved Discharges
Outfall 001	Bayou d'Inde at the PPG Canal	Surface runoff from the Chlor-Alkali plant (Plant A), the Derivatives area (Plant B) and the Chlor-Alkali/Silicas area (Plant C). The canal also receives surface runoff from the South Terminal area that consists of a landfill, barge dock, and several former unlined hazwaste impoundments.
Outfall 101	PPG Canal	Discharge point for the 101 sewer that receives plant runoff, catch basin effluent, washdown, storage tank overflow, and primary discharge from Plant A (Chlor-Alkali plant) and once-through cooling water from the Plant A Powerhouses.
Outfall 201	PPG Canal	Discharge point for 201 sewer that receives discharge waters from the organic chemical production area in Plant B (the Derivatives area) including the Nos. 1, 2, and 4 incinerator primary scrubbers, the waste treatment unit, the No. 3 primary scrubber unit when an upset condition exists in the acid recovery process, Plant C (Chlor-Alkali facility) and silica Products Plant effluent streams.
Outfall 501	PPG Canal	Discharge point for above ground piping system used as replacement for closed 201 sewer.

The soil and groundwater in the South Terminal and North Dock areas have been impacted from disposal areas, impoundments, accidental spills, and leaking underground transfer pipes (Curry et al et al 1997). Contamination has been found in all water bearing units down to the Chicot Aquifer. The upper three units (10, 20, and 30-foot units) have had a direct hydrologic connection with Bayou d'Inde and may possibly discharge to either the bayou or to the PPG Canal. Significant groundwater recovery systems were operating by 1986 and appear to have locally affected groundwater flow. It should be noted that groundwater contamination is addressed under other State and Federal programs, and therefore are not directly addressed by this RI. However, known contamination is noted because of its historic affect on the sediment and potential impact on surface water in Bayou d'Inde.

7.2.1.2 Citgo

Citgo currently owns and operates the Lake Charles manufacturing complex. The complex is the eighth largest petroleum refinery in the nation and currently covers 1,600 acres. The facility is located roughly six miles southwest of Lake Charles on the west bank of the ship channel and the south bank of Bayou d'Inde (Figure 7-2). In the early 1940s, the petroleum refinery was constructed by Cities Service Company to produce aviation fuel. The Citgo complex is comprised of three manufacturing operations: a refinery, lubricating oil plant, and propylene fractionation unit (PFU). Citgo and Conoco own the Lube Plant jointly. The PFU is located in the OxyChem

Citgo products:
Crude oil
Fuel oils
Naptha
Petroleum coke
Gasolines
Benzene
Methyl-tertiary butyl ethyl
Sulfuric acid
Ethane
Lubrication oils
Natural waxes
Propylene
Butyl rubber

petrochemical plant, but is operated by Citgo. The Citgo petroleum refinery is wholly owned and operated by Citgo and has the capacity to process 320,000 barrels of crude oil per day, supporting the production of a variety of refined petroleum products. Various compounds are managed on-site including the LPAHs 2-methylnapthalene, naphthalene and phenanthrene.

Citgo holds NPDES permit LA0005941 that authorizes discharge to Bayou d'Inde. Exhibit 7-2 summarizes the permitted Citgo outfalls. Enforcement histories for the Citgo outfalls are provided in Table 7-2.

Exhibit 7-2 Approved Citgo Discharges into Bayou d'Inde (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
Outfall 001	Bayou d'Inde	Treated process wastewater from the Lube Plant, average flow of 2,250 gpm. Discharge is monitored for phenolic compounds, Cr^{+6}, sulfide, total chromium, total zinc, ammonia, pH, BOD, TOC, TSS, and O&G.
Outfall 002	Bayou d'Inde	Storm water runoff from the PFU. Discharge is monitored for pH, TOC, total zinc, and O&G. Flow rates are not available.

There are 71 SWMUs within the Citgo refinery area, most of which are associated with wastewater processes and/or stormwater runoff. The only refinery area unit known to discharge to Bayou d'Inde is the West Impoundment. The Lube Plant contains 34 SWMUs, five of which are RCRA units. Four of these SWMUs are of interest as possible sources to Bayou d'Inde (Curry et al 1997).

West Impoundment

This unit is a 670,000 gallon unlined surface impoundment that was active from the late 1960s until 1980. The unit underwent closure-in-place in 1994. The unit was used to manage phenolics and metals contaminated oily wastes, tank bottom sludges, and slop oil residues. Contaminated soils and groundwater are associated with this unit (Curry et al 1997). It appears that the impoundment discharged to the West Ditch.

Interconnecting Channel and Holding Basins 1 and 2

Holding Basins 1 and 2 and the Interconnecting Channel are unlined surface units with capacities ranging from 4 to 13 million gallons. Wastes managed were primarily refinery sludges, tank farm runoff and steam condensate. Holding Basin 1 and the Interconnecting Channel have been active since 1949 and Holding Basin 2 since 1971. The units were active into 1994. These units discharge to Bayou d'Inde through Citgo outfall 001 and information about ground water near these units is not available (Curry et al 1997).

Neutralization and Retention Basins

The Neutralization Basin and Retention Basin were active from 1972 to 1988, with capacities of 50,000 and 2 million gallons, respectively. Both units were closed in 1992. When active, the Neutralization Basin received wastewater from the Lube Plant's Process Water Runoff Sewer System and discharged to the Retention Basin prior to discharging to Bayou d'Inde, outfall 001 [assumed] (Curry et al 1997).

7.2.1.3 Equistar (formerly OxyChem)

Occidental Petroleum Corporation (Occidental) purchased the Cities Service petrochemical manufacturing facility on Bayou d'Inde from Cities Service Company in 1985. The facility is located along the south side of Bayou d'Inde, west of the ship channel (Figure 7-2). The facility is bound on the north by Bayou d'Inde, Westlake Polymers on the east, Firestone on the south, and Citgo on the west.

At the time of the purchase, the facility encompassed about 300 acres and consisted of two ethylene/propylene units, which were later expanded. In 1987, Occidental sold two polyethylene production units to Westlake Polymers. Occidental also leased one of the ethylene/propylene units to Citgo, who subsequently modified the facility into a propylene fraction unit. Occidental currently operates one ethylene/propylene unit through OxyChem Petrochemicals (OxyChem). The plant has the capacity to produce 500 million pounds of ethylene and 125 million pounds of propylene annually. Finished product is stored onsite or in a near-by salt dome prior to shipping by rail, truck, pipeline or barge (Curry et al 1997). Records indicate that ownership remained the same but the name was changed from OxyChem to Equistar in 1998, both names are used interchangeably throughout this document.

OxyChem Products:
Ethylene
Propylene

OxyChem holds NPDES permit LA0069850, which authorizes discharge to Bayou d'Inde through outfalls 001, 002, and 003. Records indicate that OxyChem also discharged to outfall 002B (not shown on Figure 7-2) until 1987, when the discharge route was transferred to Westlake Polymers as part of the polyethylene facility sale.

OxyChem operated unlined basins called the East and West Impoundments (The East Impoundment was approximately 4.8 acres, up to 6 feet deep, the West Impoundment was slightly smaller) [Curry et al 1997]. The impoundments contained PCB waste sludge. The impoundments contents were removed in 1992 (CRA Services, 1999).

OxyChem outfall 001 is the facility's main outfall, receiving treated waste from boiler and saturator blowdown, maintenance washdown, spent caustic, and decoking sump water. The primary waste source is the OxyChem Olefins Plant #1. Prior to 1991, outfall 001 was known as outfall 002E. Outfall 001 is monitored for benzene, ethylbenzene, toluene, BOD, TSS, and pH. Prior to 1991, outfall 002 was called outfall 002A, and outfall 102 was 002C. Outfall 003 (prior name 002F) discharges storm water runoff from the northwest portion of the facility. The outfall's flow is intermittent.

Exhibit 7-3 summarizes the permitted OxyChem outfalls. Enforcement histories for the OxyChem outfalls are provided in Table 7-3.

Exhibit 7-3 Approved OxyChem Discharges into Bayou d'Inde (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
Outfall 001	Bayou d'Inde	Treated waste from boiler and saturator blowdown, maintenance washdown, spent caustic and decoking sump water. The primary waste source is the OxyChem Olefins Plant #1. Outfall 001 is monitored for benzene, ethylbenzene, toluene, BOD, TSS and pH.
Outfall 002	Bayou d'Inde	Stormwater discharge from the south portion of the facility and sanitary waste from internal outfall 102. Outfall 002 is monitored for pH, TOC, O&G, BOD, TSS, and fecal coliform.
Outfall 003	Bayou d'Inde	Storm water runoff from the northwest portion of the facility.

7.2.1.4 Firestone Synthetic Rubber and Latex Company

Firestone owns and operates a rubber and latex facility on the south side of Bayou d'Inde (Figure 7-2). The facility began operations in 1943 and currently occupies an area of 80 acres on the south side of Bayou d'Inde. The facility produces synthetic rubber and latex, which are used in the production of tires and other rubber-based products. The plant currently has an annual production capacity of 165,000 tons. Although an emulsion synthetic rubber production unit had historically been operated at the site, this facility was shut down in 1981. The plant is bounded on the west by Citgo and to the north and east by OxyChem.

Firestone products:
Synthetic rubber and latex
(Butadiene, Styrene, Hexane are used in the process)

Firestone holds NPDES permit LA0003824, which authorizes the plant to discharge process wastewater and stormwater runoff to Bayou d'Inde via outfalls 001, 003, and 004. The main discharge point is outfall 001. Flow through outfall 001 is approximately one million gallons per day. Outfall 001 is monitored for BOD, COD, TSS, O&G, ammonium nitride and chromium. Coordinates for Firestone outfalls were not available and as such, the outfall locations are estimated on Figure 7-2.

Outfalls 003 and 004 discharge non-process storm water runoff collected by earthen ditches along the east and west plant boundaries. Flow is intermittent and they are monitored for TOC, oil and gas (O&G), and pH. Exhibit 7-4 summarizes the permitted Firestone outfalls. Enforcement histories for the Firestone outfalls are provided in Table 7-4.

Exhibit 7-4 Approved Firestone Discharges into Bayou d'Inde (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
Outfall 001	Bayou d'Inde	Outfall 001 discharges process wastewater, sanitary wastewater, cooling tower blowdown and process area storm water.
Outfall 003	Bayou d'Inde	Discharge of non-process storm water runoff collected by earthen ditches along the east and west plant boundaries.
Outfall 004	Bayou d'Inde	Discharge of non-process storm water runoff collected by earthen ditches along the east and west plant boundaries.

7.2.1.5 Westlake Polymers

Westlake Polymers produces:
Polyethylene
Ethylene Vinyl Acetate

Westlake Polymers owns and operates a polyethylene manufacturing facility just south of Bayou d'Inde (Figure 7-2). The facility is located on the south side of Bayou d'Inde, west of the ship channel, and is comprised of two polyethylene production plants that were acquired from Occidental in 1987. The two plants have a combined production capacity of 700 million pounds of polyethylene annually. An ethylene vinyl acetate copolymer product is also manufactured at the Westlake facility. The facility is bordered by OxyChem on the south and west, and by Bayou d'Inde on the north.

Westlake holds NPDES permit LA0071382, which authorizes the plant to discharge process wastewater and storm water runoff to Bayou d'Inde via five outfalls. Westlake's main industrial discharge point is outfall 010, which receives treated process water utility water and potentially contaminated storm water from the polyethylene plants to Bayou d'Inde via the East Ditch. Westlake Polymers flow enters Bayou d'Inde at the Outfall 002B location shown on Figure 7-2. The remaining primary active outfall (011) discharges uncontaminated storm water to Bayou d'Inde.

Exhibit 7-5 summarizes the primary permitted Westlake Polymers outfalls. Enforcement histories for the Westlake Polymers outfalls are provided in Table 7-5.

Exhibit 7-5 Approved Westlake Discharges into Bayou d'Inde (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
Outfall 010	Bayou d'Inde	Outfall 010 discharges treated process water, utility water and potentially contaminated storm water from the polyethylene plants. Water is discharged to Bayou d'Inde via the East Ditch.
Outfall 011	Bayou d'Inde	Outfall discharges uncontaminated storm water received from collection systems from across the plant. Water is discharged to Bayou d'Inde via the East and West Ditches.

7.2.1.6 Montell USA

Montell USA is located to the south of Highway LA-108 and has two permitted outfalls that discharge to Lower Calcasieu River. A brief discussion of Montell releases is included here as an accidental release occurred in 1990 that reportedly flowed into Bayou d'Inde. A release of several thousand pounds of polypropylene pellets reportedly overflowed a retaining wall on the west side of the facility and entered a ditch that flows to Bayou d'Inde, transporting the spill to Bayou d'Inde. No other direct discharges to Bayou d'Inde are noted and a summary of the Montell USA enforcement history is provided in Table 7-6.

7.2.2 Historical Contamination

Five previous studies were identified where multi-media samples were collected within the Bayou d'Inde AOC. These studies include:

- Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report, Prepared by McNeese State University for the Louisiana Department of Wildlife and Fisheries, June 1987. (Conducted in 1983-1985, see Appendix A).

- Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency-Region VI, Louisiana Department of Environmental Quality and the U.S. Geological Survey, March 1990. (Conducted in 1988-1989, see Appendix A).

- Bayou d'Inde Expanded Site Inspection – Final Report, Prepared by PRC Environmental Management, Inc. for the U.S. Environmental Protection Agency-Region VI, September 1993. (Conducted in 1992, See Appendix A).

- Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report, Prepared by McLaren/Hart Environmental Engineering – ChemRisk Division for PPG Industries, Inc., June 1995. (Conducted in 1994, See Appendix A).

- Findings Report for the Focused Site Assessment – Bayou d'Inde, Prepared by Fluor Daniel, Inc. for the U.S. Environmental Protection Agency – Region VI, August 1997. (Conducted in 1996, See Appendix A).

The occurrences of COPCs identified in Section 4 (Table 4-2) in sediment are discussed in this section. Only those data collected within the Bayou d'Inde AOC boundaries are used for historical comparison. The Bayou d'Inde AOC boundary was partitioned into two systems, a bayou energy system and a marsh energy system, to reflect the differing physical and geochemical dynamics of each area. The samples discussed in the following sections were not part of the Calcasieu Estuary RI/FS with the intent to compare historical contamination with current conditions. Historical surface water samples are not discussed since they are more variable with time, sources, and season.

7.2.2.1 Historical Contamination Bayou System

7.2.2.1.1 Volatile Organic Compounds

1,1,1-trichloroethane was detected in samples from the *1995 PPG Bayou d'Inde*, *Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, *1993 Bayou d'Inde Expanded Site Inspection*, and *1990 EPA Toxic Study of the Lower Calcasieu River* investigations. 1,1,1-trichloroethane was detected at concentrations ranging from 430 to 8,100,000 µg/Kg. The maximum concentration was detected at location 6100-04-BDI39, approximately 800 meters upstream from PPG's outfall 001 during the *1993 EPA Bayou d'Inde Expanded Site Inspection*.

1,2-dichloroethene was detected in only one investigation, the *1993 EPA Bayou d'Inde Expanded Site Inspection*, where it was detected in sediment samples at concentrations ranging from 47,000 to 49,000 µg/Kg. The maximum concentration was detected at location 6100-04-BDI29, approximately 7,430 meters upstream from the mouth of Bayou d'Inde and 768 meters downstream from Citgo outfall 001. In addition, at this same location and during the same investigation, the maximum detected concentration of acetone was observed. Acetone was also detected in sediment samples from the *1993 EPA Bayou d'Inde Expanded Site Inspection*, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, and *1997 EPA Focused Site Assessment-Bayou d'Inde* investigations. Acetone sediment concentrations ranged from 6 to 650 µg/Kg in the bayou portion of Bayou d'Inde.

Carbon disulfide was detected in sediment samples from *1993 EPA Bayou d'Inde Expanded Site Inspection*, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, and *1997 EPA Focused Site Assessment-Bayou d'Inde* investigations. Carbon disulfide was detected at concentrations ranging from 3 to 42 µg/Kg. The maximum concentration was detected at location 6100-03-BI14-A, approximately 1,049 meters upstream from the mouth of Bayou d'Inde during the *Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation.

7.2.2.1.2 Semivolatile Organic Compounds

Bis(2-ethylhexyl)phthalate (BEHP) and HCB were detected in sediment sample during the *1990 EPA Toxics Study of the Lower Calcasieu River*, *1993 EPA Bayou d'Inde Expanded Site Inspection*, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, and *1997 EPA Focused Site Assessment-Bayou d'Inde* investigations.

BEHP was detected in sediment samples at concentrations ranging from 39 to 5,700 µg/Kg with the highest detected concentration at location 6100-06-03U1 approximately 1,810 meters upstream from the mouth of Bayou d'Inde near the mouth of the PPG Canal, during the *1990 EPA Toxics Study of the Lower Calcasieu River* survey. HCB was detected at concentrations ranging from 100 to 380,000 µg/Kg. In the *1993 EPA Bayou d'Inde Expanded Site Inspection*, location 6100-04-BDI38, about 70 meters downstream from Citgo outfall 001.

7.2.2.1.3 Polycyclic Aromatic Hydrocarbons

PAH concentrations in sediment samples were reported in *1993 EPA Bayou d'Inde Expanded Site Inspection*, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, and *1997 EPA Focused Site Assessment-Bayou d'Inde* investigations. Total PAH (the summation of 18 PAH compounds) were detected in concentrations ranging from 165 to 338,000 µg/Kg. The maximum concentration was detected during the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation located at 6100-03-LPC01-A, approximately 701 meters upstream from Citgo outfall 001.

7.2.2.1.4 PCBs

PCBs were only detected in sediment samples during one study, the *1993 EPA Bayou d'Inde Expanded Site Inspection*, which total PCB concentrations ranged from 160 to 22,200 µg/Kg. The maximum concentration occurred at location 6100-04-BDI29, nearly 7430 meters upstream from the mouth of Bayou d'Inde and about 768 meters upstream from Citgo outfall 001.

7.2.2.1.5 Pesticides

Aldrin and dieldrin were detected in sediment samples during the *1990 EPA Toxics Study of the Lower Calcasieu River* and *1993 EPA Bayou d'Inde Expanded Site Inspection* studies. The maximum concentration for both compounds was measured during the *1993 EPA Bayou d'Inde Expanded Site Inspection* at location 6100-04-BDI39, roughly 800 meters upstream from PPG's outfall 001. Concentrations for aldrin ranged from 2 to 3,500 µg/Kg and 7 to 8,000 µg/Kg for dieldrin.

7.2.2.1.6 Metals

Arsenic, copper, lead, mercury, and zinc were analyzed in sediment samples during the *1987 LDWF Ecosystem Analysis of the Calcasieu River*, *1990 EPA Toxics Study of the Lower Calcasieu River*, *1993 EPA Bayou d'Inde Expanded Site Inspection*, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*, and *1997 EPA Focused Site Assessment-Bayou d'Inde* investigations.

Barium was analyzed in sediment samples during the *1990 EPA Toxics Study of the Lower Calcasieu River* and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations. Chromium was analyzed in the *1993 EPA Bayou d'Inde Expanded Site Inspection* and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations. Nickel was analyzed in all but one study, *1987 LDWF Ecosystem Analysis of the Calcasieu River*.

Arsenic was detected in sediment samples from all five investigations. Concentrations ranged from 0.21 to 9.10 mg/Kg. The maximum concentration value occurred in the *1997 EPA Focused Site Assessment-Bayou d'Inde investigation* at location 6100-01-000S1, at the mouth of Bayou d'Inde.

Sediment samples from the five investigations also contained copper at concentrations ranging from 0.7 to 713.0 mg/Kg. The maximum concentration value occurred in the

1993 EPA Bayou d'Inde Expanded Site Inspection at location 6100-04-BDI40, approximately 1,663 meters downstream from PPG's outfall 001.

Lead was detected in sediment samples from all five investigations with concentrations ranging from 5.3 to 900.0 mg/Kg. The maximum concentration value occurred in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation at location 6100-03-LPC05-A, about 328 meters downstream from PPG outfall 001.

Mercury was detected in sediment samples from all five investigations with concentrations ranging from 0.01 to 58.00 mg/Kg. The maximum concentration occurred in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation at location 6100-03-BI14-A, approximately 1,049 meters upstream from the mouth of Bayou d'Inde.

Zinc was detected in sediment samples from all five investigations with concentrations ranging from 1.0 to 771.0 mg/Kg. The maximum concentration value occurred in the *1993 EPA Bayou d'Inde Expanded Site Inspection* at location 6100-04-BDI29, approximately 7,430 meters upstream from the mouth of Bayou d'Inde and nearly 768 meters downstream from Citgo outfall 001.

Barium, detected in sediment samples from two investigations, had concentrations ranging from 41 to 970 mg/Kg. The highest detected value was in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation at location 6100-03-LPC03-A, about 203 meters downstream from PPG's outfall 001.

Chromium, detected in sediment samples from two investigations, had concentrations ranging from 6 to 2,610 mg/Kg. The highest detected value was in the *1993 EPA Bayou d'Inde Expanded Site Inspection* at location 6100-04-BDI29, approximately 7,430 meters upstream from the mouth of Bayou d'Inde and about 768 meters downstream from Citgo outfall 001.

Nickel, detected in sediment samples from four investigations, had concentrations ranging from 4 to 69 mg/Kg. The highest detected value was in the *1993 EPA Bayou d'Inde Expanded Site Inspection* at location 6100-04-BDI40, approximately 1663 meters downstream from the PPG's outfall 001.

7.2.2.2 Historical Contamination Marsh system

7.2.2.2.1 Volatile Organic Compounds

1,1,1-trichloroethane was only detected in marsh sediment samples collected during the *1990 EPA Toxic Study of the Lower Calcasieu River* investigation. 1,1,1-trichloroethane was detected at concentrations ranging from 510 to 4,500 µg/Kg. The maximum concentration was detected at location 6100-06-02U0, 304 meters west-southwest of PPG's outfall 001. Acetone was detected in marsh sediment samples from the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and*

Sediment Sampling investigations. Acetone was detected at concentrations ranging from 27 to 164 µg/Kg. The maximum detected concentration was at location 6100-03-BI10-A, approximately 1491 meters east-southeast of PPG outfall 001, in Lockport Marsh.

Carbon disulfide was detected in only one marsh sediment sample. This sample was from the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation where carbon disulfide was detected at a concentration of 17 µg/Kg at location 6100-03-BI12-A, approximately 600 meters east-southeast of PPG's outfall 001.

7.2.2.2.2 Semivolatile Organic Compounds

BEHP and HCB were detected in marsh sediment samples collected during the *1990 EPA Toxics Study of the Lower Calcasieu River* and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

BEHP was detected at concentrations ranging from 135 to 2800 µg/Kg with the highest detected concentration at location 6100-06-02U0 304 meters west-southwest of PPG outfall 001, during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation. In addition, HCB was detected at concentrations ranging from 690 to 630,000 µg/Kg during the same investigation, where location 6100-06-01U0, 46 meters south of the same outfall was the most impacted location.

7.2.2.2.3 Metals

Arsenic, copper, and zinc were analyzed in marsh sediment samples collected during the *1987 LDWF Ecosystem Analysis of the Calcasieu River*, *1993 EPA Bayou d'Inde Expanded Site Inspection*, and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Barium, chromium, and nickel were analyzed in marsh sediment samples collected during the *1993 EPA Bayou d'Inde Expanded Site Inspection* and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Lead and mercury were analyzed in marsh sediment samples collected during the *1987 LDWF Ecosystem Analysis of the Calcasieu River*, *1990 EPA Toxics Study of the Lower Calcasieu River*, *1993 EPA Bayou d'Inde Expanded Site Inspection* and *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Arsenic, copper, and zinc were detected in all three investigations. The concentrations ranged from 0.31 to 13.00 mg/Kg for arsenic, 5 to 613 mg/Kg for copper, and 13 to 246 mg/Kg for zinc. The highest concentrations were identified in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation. The highest detected concentrations for both copper and zinc were located at 6100-03-BI12-A, roughly 600 meters west-southwest of PPG outfall 001. Likewise for arsenic, the highest detected value was located at 6100-03-LPC08-A, around 406 meters southwest of the same outfall.

Barium, detected in both investigations, had concentrations ranging from 29 to 12,478 mg/Kg. The highest detected value was in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation at location 6100-03-BI12-A, nearly 300 meters east-southeast of PPG outfall 001. At the same location and during the same investigation, the highest concentration value for nickel was observed. Regarding both investigations, nickel had concentrations ranging from 11 to 62 mg/Kg.

Chromium, detected in both investigations, had concentrations ranging from 21 to 35 mg/Kg. The highest detected value was in the *1993 EPA Bayou d'Inde Expanded Site Inspection* investigation at location 6100-04-BDI30, about 100 meters upstream from the mouth of the PPG Canal.

Lead was detected in all four investigations with concentrations ranging from 5 to 190 mg/Kg. The maximum concentration value occurred in the *1990 EPA Toxic Study of the Lower Calcasieu River* investigation at location 6100-06-01U0, approximately 460 meters south of PPG outfall 001.

Mercury was detected in all four investigations with concentrations ranging from 0.1 to 8.0 mg/Kg. The maximum concentration values occurred in the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation at locations 6100-03-BI12-A, approximately 300 meters east-southeast of PPG outfall 001 and 6100-03-LPC08-A, about 406 meters southwest of the same outfall.

7.2.2.2.4 Pesticides, PCBs, and PAHs

All five previous investigations examined marsh sediment sample for total PCBs and pesticides and only the *1987 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex* study examined marsh sediment samples for PAHs. None of the aforementioned compounds were detected in sediment samples of the marsh energy system.

7.2.2.3 Summary of Historical Data

Historical data from the five previous studies indicate that the occurrence of the primary COPCs is consistent with the findings of the RI. The distribution of the COPCs between the bayou and marsh areas throughout Reaches 1 through 3 are limited by the number and location of samples collected, but where detected, concentration trends correlate with the RI data. Tables 7-7 through 7-10 summarize the range of results for Reaches 1 through 4 (bayou energy system). In general, the data indicate that concentrations remained fairly constant from 1984 through 1996 in Reaches 3 and 4. Reach 3 data are limited to BEHP, lead and mercury for temporal comparison. Reach 2 data show a decrease in BEHP readings, and an increase in concentrations for lead and mercury. Reach 1 data indicate that concentrations for HCB and HCBD were constant from 1984 through 1994, but decreased from 1994 to 1996. Data for the remaining COPCs were fairly constant from 1984 through 1996. Historical data results are compared to RI findings in Sections 7.5 and 7.6.

7.3 Data Analysis and Interpretation Overview

The following discussions focus on data collected during Phase I and Phase II of the RI. The analytical program and the results of the data validation and interpretation are presented in Sections 4.6.1 and 4.8. Section 7.3.1 provides a summary of the samples collected and parameters analyzed. An overview of the data interpretation presented in Section 7.3.2 will describe the objectives of the principal component analysis (PCA), which will be used through the remainder of this section to describe the nature and extent of the contamination as well as the fate and transport of COPCs.

7.3.1 Analytical Program

Samples from Phase I and Phase II were collected within the Bayou d'Inde AOC, which is from where it flows into the Calcasieu River Ship Channel to I-10. Sampling was conducted in both the bayou, marshes adjoining the bayou, and Maple Fork Bayou, which is the largest tributary to the bayou.

The RI for Bayou d'Inde included collecting and analyzing sediment, surface water, and porewater samples (Figures 4-1, 4-4, 4-6, and 4-7) for a combination of compounds in accordance with EPA SW-846, EPA CLP, and ASTM standard methods. The compounds of interest included VOCs, SVOCs, pesticides, herbicides, PCBs, PCB congeners, dioxin/furans, metals (filtered and non-filtered for surface water), and TPHs. Surface sediment samples were collected from the 0 to 10 cm depth interval in Phases I and II. Multi-depth samples were typically collected in Phases I and II at: 0 to 10, 10 to 20, and 20 to 30-cm depth intervals. Other sampling intervals included 0 to 15, 15 to 30, and 30 to 45-cm, as well as 0 to 30 and 0 to 60-cm depth intervals. Surface water samples were collected at mid-depth of the water column in the middle of the bayou. Porewater samples were collected with sediment samples and extracted at the laboratory.

Sample Locations in Bayou d'Inde For Chemistry Only (Phases I and II)

- 261 Surface sediment
- 15 Multi-depth sediment
- 22 Surface water
- 15 Porewater

In addition to the chemical parameters discussed above, selected samples were analyzed for chemical/physical properties, which included grain size analysis, TOC for sediment only, DOC for porewater only, and pH. Field parameters for sediment were limited to penetrometer measurements and VOC screening. Ancillary properties for surface water samples included alkalinity, ammonia, hardness, and TKN. Field parameters for surface water included temperature, pH, DO, ORP, conductivity, and salinity.

7.3.2 Data Interpretation Overview

Data were interpreted by use of statistical tests such as Wilcoxon Rank Sum (WRS) and the PCA to determine primary COPCs and their fate and transport in the estuary. In this section, an overview of the WRS test is provided in Section 7.3.2.1 to describe

how it was used in the data interpretation. In Section 7.3.2.2, a brief overview of the PCA is provided explaining the objectives of this analysis. The development of energy system specific COPCs is described in Section 7.3.2.3 and the general fate and transport mechanisms that will explain the nature and extent of contamination of these COPCs in each of the energy systems is provided in Section 7.3.2.4.

7.3.2.1 WRS Test

This section describes the results of the WRS test to determine if there is a statistically significantly difference between the energy areas in Bayou d'Inde and reference area conditions. COPCs that were not detected in the reference area were not compared using the WRS test; however, these non-detected COPCs are retained for evaluation. Use of the WRS Test is discussed in Section 4.8.2.3. Results are presented in Table 7-11.

The WRS test compares the probabilities (p-values) with a critical value (alpha) in order to determine whether there is a statistically discernable difference in the median concentrations between the two groups tested (energy area in the AOC versus the reference area). For purposes of interpreting the p-values, two levels of significance were established and presented in Exhibit 7-6.

Exhibit 7-6 Levels of Significance

Level of Significance	Interpretation of Difference
p-value < alpha	Medians may be different
Adjusted p-value < alpha	Medians are different

For the first level of significance (medians may be different), the p-values were compared directly with an alpha value of 0.05 or 95 percent upper confidence limit (UCL) of the median of the COPCs. For the second level of significance (medians are different), an adjusted p-value was calculated using the Bonferroni adjustment method:

adjusted p-value = n(p-value),

where, n is the number of comparison tests conducted.

The test does not indicate whether higher concentrations were observed in the energy area or the reference area, only that there was significant statistical difference between the two areas. To determine which area had higher concentrations, box plots comparing the two systems were examined and are presented in Appendix D.

7.3.2.2 PCA

As discussed in Section 4, PCA was used to accomplish the following objectives:

- Objective 1: Study the correlations of multivariate data sets by grouping variables (analytical constituents or parameters) in principal components (also known as factors or groups). Variables within each factor are more highly correlated with each other than with variables in other factors.

- Objective 2: Summarize many variables by a few factors or groups. Essentially, this is a data reduction technique whereby several original variables may be represented by one or a few "indicator" variables or by the factor itself.

- Objective 3: Interpret each factor according to the "meaning" of the variables. Such interpretation may provide useful information regarding geochemical fate and transport.

Sediment composition is heterogeneous, which means that chemicals found in sediment will vary from one location to the next. The PCA groups the measured parameters into factors, which are parameters that tend to correlate with one another. By identifying parameters that correlate, sediment conditions can be better understood and explain why one location varies from another. Understanding the variability in the surface sediment, conclusions can be made in regard to sources and the fate and transport of contaminants.

Factors from the PCA will be discussed in Section 7.4.3 if one or more COPCs are grouped within that factor.

7.3.2.3 COPC Selection

The COPC list provided in Table 4-2 presents all of the COPCs in the Calcasieu Estuary; however, not all of these COPCs are present in each AOC or energy system. To limit discussion, energy system specific COPCs for each AOC were determined. COPCs that may not be present in a specific energy system, are not risk drivers, or there was not a statistically significantly difference from reference area conditions are not discussed.

The HHRA and BERA state which COPCs are the primary risk drivers for each AOC (Section 7.1 in the HHRA and in Appendix D2 of the BERA). An energy system specific COPC was determined if the following two conditions exist:

- The COPC was identified as a risk driver in the HHRA or the BERA

- The concentration of the COPC was determined to be statistically significantly different from reference area conditions

If either of these criteria failed, the COPC was determined not to be a COPC for a particular energy system. In some cases, there was insufficient data to compare a COPC with reference area conditions (i.e., low frequency of detects in a particular energy system). In these instances, the ranges of concentrations of a particular energy system are compared to reference area conditions by examining mean and median values by the use of box plots (Appendix D). If the range is comparable then they are not discussed in the following subsections. Additional information regarding these COPCs is presented in the HHRA or the BERA.

7.3.2.4 Fate and Transport Mechanisms

The major mechanisms that tend to guide chemical fate and transport in estuarine systems are:

- Adsorption
- Precipitation/Co-precipitation
- Salting out
- Complexation
- Biotransformation
- Hydrolysis
- Photolysis

Contaminant occurrence and extent in Bayou d'Inde is dependent upon physical conditions, the contaminants, their concentrations and the dominant processes given these conditions. Details on these fate and transport processes are provided in Section 5.0.

7.4 General Physical and Chemical Parameters for the Bayou d'Inde Bayou Energy System

This section presents the results of the sediment and surface water characteristics of Bayou d'Inde.

7.4.1.1 Sediment Characteristics

7.4.1.1.1 Particle size

Particle size analysis was conducted at predetermined locations in Phase I and on all sediment quality triad (SQT) samples in Phase II (Figure 7-3). Clay and silt percentages were the highest in Reach 3, with the percentages of clay and silt decreasing up and downstream of this area. Reaches 1 and 4, the lower and upper reach respectively, contained a higher percentage of sandy particles. The higher percentage of sand particles in Reach 1 may be the result of tidal surges and the high flow from the upper reaches of Bayou d'Inde and the PPG Canal. Reaches 1 and 2 support barge traffic and are occasionally dredged that may disturb finer grained particles into suspension, which are then transported into the Calcasieu River Ship Channel. In Reach 2, the coefficient of variance was high (greater than 1) indicating that sand percentages are highly variable within this reach. Silt concentrations were consistent throughout the bayou energy system. Exhibit 7-7 summarizes the average particle size in each of the reaches.

Exhibit 7-7 Mean[1] (Standard Deviation) of Particle Size Analysis in Bayou d'Inde

Area	Percent Clay	Percent Silt	Percent Sand
Bayou - Reach 1	25.11 (13.17)	33.63 (9.75)	41.26 (21.42)
Bayou - Reach 2	33.98 (15.96)	37.85 (9.64)	28.6 (19.76)
Bayou - Reach 3	52.27 (20.68)	32.7 (10.69)	15.03 (30.71)
Bayou - Reach 4	30.91 (10.81)	32.9 (9.31)	36.63 (15.42)
Marsh	24.17 (13.05)	43.81 (14.4)	34.24 (16.34)
Reference Area	23.94 (11.70)	40.2 (11.02)	35.86 (16.34)

1 – Values based on regression on ordered statistics (ROS). See Appendix D.

The bayou energy system within Bayou d'Inde was observed to have a higher clay percentage than the marsh energy system, although the percentage of silt was higher in the marsh system. The mixed sediment in the marsh energy area (sediment between sand clays) may be the result of alternating high and low-energy events, which produces inter-layered sediments.

Bayou d'Inde sediment tended to have higher percentage of clay particles than the reference area. The percentage of sand was similar to that of the reference areas with the exception of Reach 3. The variance in sediment particle size may be the result of sampling location, affects of dredging, and flow velocities. In Reaches 1 and 2, the majority of the samples were collected along the banks of the dredged bayou, with the exception being in Maple Fork Bayou. In Reaches 3 and 4, which are not dredged, samples were collected closer to the middle of the bayou as well as along the banks.

7.4.1.1.2 Total Organic Carbon

TOC provides an indication of the total organic material present in sediment and includes the carbon both from naturally occurring organic material and from organic chemical contaminants. TOC in sediment was measured in both Phase I and Phase II. The mean TOC concentration for the entire bayou was approximately 49,082 mg/Kg with a standard deviation of 58,021 mg/Kg. The coefficient of variance of 1.2 indicates the concentrations were variable within the bayou. Highest mean values were within Reach 3 that had a range of TOC values from 5,510 mg/Kg to 287,500 mg/Kg. The coefficient of variance was approximately 2, indicating that TOC concentrations are highly variable within Reach 3. Concentrations decreased downstream slightly and were more than twice the TOC measured in the upper reach. TOC was less variable in Reaches 1, 2 and 4. Exhibit 7-8 lists the mean concentrations by reach and compares them to reference area conditions.

Exhibit 7-8 Mean[1] (Standard Deviation) of TOC in Bayou d'Inde

Reach of Bayou d'Inde	TOC (mg/Kg)
Bayou - Reach 1	43,877 (16,958)
Bayou - Reach 2	55,612 (39,053)
Bayou - Reach 3	64,001 (129,339)
Bayou - Reach 4	28,364 (22,868)
Marsh	108,684 (73,348)
Reference Area	43,356 (24,874)

1 – Values based on ROS. See Appendix D

In comparison to the reference area, only Reach 1 had similar values. Both Reach 2 and 3 were higher and Reach 4 was slightly lower. The higher TOC concentrations may be the result of the types of vegetation along Bayou d'Inde as well as industrial input sources. The marsh was observed to have the highest observed values, which may be attributed to organic chemical contamination.

7.4.2.1 Surface Water Characteristics

Surface water characteristics observed in Bayou d'Inde are presented in this section and are compared to reference area conditions.

7.4.2.1.1 Total Dissolved Solids

Dissolved solids refer to any minerals, salts, metals, cations, or anions that may be dissolved in the estuarine water. Sources of dissolved solids may be from saltwater intrusion, soil erosion, waste discharge, urban runoff, eroding stream banks, and re-suspended bottom sediments from activities such as ship traffic or storm scour. In addition to total dissolved solids, salinity and conductivity were measured to describe the conditions within the bayou. Total dissolved solids is proportional to salinity and conductivity.

Salinity is the measure of the amount of dissolved salts (solids) in the estuary. Salinity levels control to some degree the types of animals and plants that may live in a particular area of the estuary. Salinity measurement is also important in determining if dissolved organic carbons will precipitate out of solution or "salt out".

Conductivity estimates the amount of total dissolved ions (solids) in water. Conductivity is controlled by geology, size of the watershed, evaporation of water, and other sources of ions to the bayou or estuary such as saltwater intrusion, wastewater, and urban and agricultural runoff. An increase in conductivity from what is normally observed could signal the introduction of a wastewater or runoff source or saltwater influence.

Mean values for TDS (Exhibit 7-9) were similar for the bayou energy system and the reference area although the maximum concentration was higher in the reference area. In Phases I and II, TDS values decreased moving upstream with little variation in values in the bayou as a whole. Reach 3, however, had TDS values that decreased significantly in both phases (by 83% and 86% for Phases I and II, respectively) before increasing in concentration in Reach 4. TDS results and comparison is presented in Exhibit 7-9. TDS was measured in the reference area in Phase II only.

Exhibit 7-9 Total Dissolved Solids (mg/L) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou – Phase I	3,000	24,000	15,598	4,924
Bayou – Phase II	800	24,500	12,724	7,256
Marsh – Phase I	9,150	43,000	18,998	3,977
Marsh – Phase II	8,000	25,000	18,316	6,204
Reference Area Phase II	6,000	32,000	13,467	10,245

1 – Values based on ROS. See Appendix D.

Within the marsh energy system, TDS values were slightly higher in Phase I than in Phase II and overall conditions in both phases were higher than reference area conditions. The higher TDS values in the marsh area may be the result of re-suspension of the silt and clay particles in the shallow marsh area and/or the influence of saltwater.

Salinity values were recorded in both Phase I and Phase II of the RI. Exhibit 7-10 presents summary statistics of the salinity for Bayou d'Inde and the reference area. Salinity in the reference area was measured in Phase II only.

Exhibit 7-10 Salinity (ppt) Levels in Bayou d'Inde and Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou – Phase I	3	26	16	6
Bayou – Phase II	1	27	13	8
Marsh – Phase I	2	25	19.1	3.6
Marsh – Phase II	7	27	19	7.1
Reference Area Phase II	6	36	14	12

1 – Values based on ROS. See Appendix D.

Salinity values decreased in the bayou moving upstream from the Calcasieu River Ship Channel to Reach 4. Based upon the USFWS salinity classification system and mean salinity values, there are two types of salinity regimes in Bayou d'Inde. Reach 1 and 2 would be classified as polyhaline (18 to 30 ppt) and changing to mesohaline (5 to 18 ppt) in Reaches 3 and 4. Salinity was higher in the reference area most likely due to its closer proximity to the Gulf of Mexico and their lack of freshwater sources.

Within the marsh area, salinity values decreased moving into the marsh regions, with the exception of the interior of Lockport Marsh and adjacent to PPG Canal. Elevated roads in Lockport Marsh may limit saltwater intrusion from the bayou or from Calcasieu River Ship Channel. However, more saline water may enter Lockport Marsh from PPG Canal. Salinity values were slightly higher than what was observed in the reference area.

Exhibit 7-11 presents the conductivity levels for both the bayou and marsh energy system in Bayou d'Inde. Conductivity in the reference area was measured in Phase II only.

Exhibit 7-11 Conductivity (µs/cm) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou – Phase I	1,500	36,600	12,719	11,938
Bayou – Phase II	242	135,000	17,781	34,299
Marsh – Phase I	1,000	39,200	21,235	14,052
Marsh – Phase II	1,660	41,250	20,129	16,699
Reference Area Phase II	1,350	53,800	21,363	18,967

1 – Values based on ROS. See Appendix D.

Mean conductivity levels in both Phase I and Phase II were slightly lower in the bayou energy system than reference area conditions, however, in Phase II, the max detection in the bayou was significantly higher than what was observed in the bayou. Station BIR4018 in Reach 3 had a result of 135,000 µs/cm, which indicates a source of dissolved ions in the vicinity (Exhibit 7-11).

Conductivity levels were similar to reference area conditions in the marsh energy system.

7.4.2.1.2 Hardness

Hardness is the measure of multivalent cations and is proportionate or equivalent to the concentration of calcium and magnesium in the surface water. Generally, as hardness increases, toxicity decreases. Surface water in Bayou d'Inde is considered very hard based on U.S Department of Interior and Water Quality Association standards (> 180 mg/L). The average fresh water value for the area is 140 mg/L (USACE 1998). Within the bayou energy system, hardness values decreased from Reach 1 to Reach 4. Hardness values in the marsh were more than double than what was observed in the reference area. Hardness was measured in Phase I and presented in Exhibit 7-12.

Exhibit 7-12 Hardness (mg/L as $CaCO_3$) in Bayou d'Inde and Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	2,250	3,085	2,857	436
Marsh	3,080	3,480	-	-
Hardness in Reference Area	1,295	1,295	-	-

1 – Values based on ROS. See Appendix D.

Hardness is typically a function of the geology of the area and/or influenced by point sources such as industries that discharge dissolved cations in effluent waters (EPA 1986). In comparison, wastewater from chemical industries has max concentrations of 1,000 mg/L, as $CaCO_3$, and electric utilities have a max concentration of 5,000 mg/L, as $CaCO_3$ (EPA 1986).

7.4.2.1.3 Alkalinity and pH

Increases or decreases of pH may be an indication of anthropogenic affects such as wastewater discharge or contamination from urban or agricultural runoff. Measurement of pH may isolate a particular area that might be receiving discharges from these or other sources. Alkalinity is the measure of a solution's resistance to changes in pH. Typically, water with a high alkalinity will resist the adverse affects of acidic contamination. The higher the alkalinity, the less likely a natural or man-made contaminant will cause a significant change in pH.

Exhibits 7-13 and 7-14 summarize the pH and alkalinity conditions present in the bayou and marsh energy system in Bayou d'Inde and the reference area. The pH was measured in Phase II only.

Exhibit 7-13 pH (standard units) Levels in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Median[1]
Bayou – Phase I	6.58	9.42	7.95
Bayou – Phase II	6.56	7.83	7.19
Marsh – Phase I	6.59	9.25	7.75
Marsh – Phase II	6.35	8.13	7.59
Reference Area	6.67	8.135	7.27

1 – Values based on ROS. See Appendix D.

Estuarine waters typically have pH values ranging from 7 to 7.5 (EPA 1993). Values for pH are slightly higher than what was observed in the reference area with the exception of the marsh energy system in Phase II. The difference in values may be due to chemical constituents entering the surface water from runoff or point sources in Bayou d'Inde.

Exhibit 7-14 Total Alkalinity (mg/L as $CaCO_3$) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	95.9	109	103	6
Marsh	76.4	101	-	-
Reference Area	42.1	42.1	-	-

1 – Values based on ROS. See Appendix D.

Estuaries typically have alkalinity values ranging from 30 to 160 mg/L as $CaCO_3$ (EPA 1993). Conditions in the reference area and in Bayou d'Inde (Phase I only) are not out of this range. The higher values in Bayou d'Inde may be due to the different geologic conditions (rocks or soils) in the area and/or industrial wastewater discharges.

7.4.2.1.4 Nitrogen

Nitrogen was measured as nitrate-nitrite, TKN, and ammonia. Nitrate and nitrite are inorganic ions occurring naturally as part of the nitrogen cycle (Smith 1990). TKN is the organic form of nitrogen and includes both the dissolved and particulate form,

whereas ammonia is the dissolved form of nitrogen. Ammonia, at low levels, is an important nutrient for estuarine organisms, whereas it becomes toxic at high concentrations. In contrast to freshwater systems where phosphorous is the limiting nutrient factor, nitrogen is the primary limiting nutrient in the seaward portions of most estuarine environments (Paerl 1993). If high levels of nitrogen are introduced into the estuary, a significant increase of algae or large aquatic plants may occur; NOAA/EPA (1988) suggests that nitrogen levels between 0.1 and 1 mg/L to avoid algae blooms. Exhibit 7-15 summarizes Nitrate/Nitrite measurements for Phase I.

American Water Works Association (AWWA) recommends that for maximum diversity in estuarine environments, the nitrate-nitrite should not exceed 0.1 mg/L for maximum diversity and 1.0 mg/L for moderate diversity (Exhibit 7-15). Based on Phase I nitrate-nitrite levels, the reference areas would support a more diverse environment whereas Bayou d'Inde would only support a moderate diversity.

Exhibit 7-15 Nitrate-Nitrite (mg/L) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	0.083	0.37	0.23	0.13
Marsh	0.064	0.34	0.18	0.17
Reference Area	0.06	0.06	-	-

1 – Values based on ROS. See Appendix D.

Higher TKN and ammonia values were found in the bayou in comparison with reference area conditions (Exhibits 7-16 and 7-17).

Exhibit 7-16 TKN (mg/L) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	1.7	2.9	2.4	0.5
Marsh	1.2	3.9		
Reference Area	0.95	0.95	-	-

1 – Values based on ROS. See Appendix D.

Exhibit 7-17 Ammonia, as N, (mg/L) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	0.96	2.5	1.7	0.7
Marsh	1.3	3.8	-	-
Reference Area	0.0064	0.0064	-	-

1 – Values based on ROS. See Appendix D.

TKN is the summation of ammonia and organic nitrogen. For Bayou d'Inde, ammonia makes up more than 50 percent of TKN values, which is very different from the reference area. However, with the marsh energy system, TKN is mostly comprised of ammonia with very little organic nitrogen. Sources of TKN are typically the decay of organic material and urban and industrial sewage discharge. According to EPA (1989b), the criteria maximum concentrations (CMC) for total ammonia for pH,

temperatures and salinity found in Bayou d'Inde range from 44 to 50 mg/L. The criteria continuous concentrations (CCC), according to EPA (1989b), range from 6.6 to 12 mg/L. Ammonia levels were below the CMC and CCC values for Bayou d'Inde.

7.4.2.1.5 Dissolved Oxygen

Dissolved oxygen is typically an indicator of high quality for aquatic life and helps determining the ability of aerobic organisms to survive. The concentration is dependent upon temperature, salinity, wind, water turbulence, atmospheric pressure, and presence of oxygen demanding compounds and organisms, and photosynthesis. The percent saturation is the measured dissolved oxygen level divided by the greatest amount of oxygen that the water can hold at that temperature and atmospheric conditions. Low dissolved oxygen levels typically indicate an excessive demand on the system from organic material deposited from pollution sources or from natural sources such as leaves and grass. Exhibit 7-18 presents dissolved oxygen data for Bayou d'Inde.

Exhibit 7-18 Dissolved Oxygen, in Percent Saturation, in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou – Phase I	5	19.5	11	3
Bayou – Phase II	3.02	11.75	6.84	2.60
Marsh – Phase I	3.29	19.9	9.9	3.4
Marsh – Phase II	6.07	12.05	9.06	2.05
Reference Area	7.50	12.76	10.36	1.55

1 – Values based on ROS. See Appendix D.

Typically, values over 80 percent represent water of high quality, which will support various flora and fauna, whereas values less than 80 percent indicate poor water quality conditions. If oxygen-requiring organisms perish, the remaining organisms will be air-breathing insects and anaerobic bacteria (Gower 1980).

7.4.2.1.6 Biochemical and Chemical Oxygen Demand

Biochemical oxygen demand (BOD_5) is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions in five days. Chemical oxygen demand (COD), however, does not differentiate between biologically available and inert organic matter and is a better indicator of medium to long-term demand. COD is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. COD values will always be greater than or equal to BOD_5 values and these data are typically measured when there are nearby industrial sources. High BOD_5 /COD values may deplete the water system of oxygen needed to support fish and other aquatic life. In an estuary, the rate of oxygen consumption is dependent upon temperature, presence of certain kind of microorganisms, and the type of organic and inorganic material in the water (EPA 1993). BOD_5 values between 1 and 2 mg/L represent clean water. BOD_5 values between 2 and 5 mg/L are considered moderately clean. BOD_5 values exceeding 5 mg/L indicate a nearby pollution source. The various sources of organic enrichment

include urban and agricultural runoff, sanitary sewer overflows, landfills and septic systems.

Exhibit 7-19 presents the chemical oxygen demand and COD values observed in Phase I. BOD_5 and COD were not analyzed in the reference areas.

Exhibit 7-19 BOD_5 and COD (mg/L) in Bayou d'Inde

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
BOD_5 in Bayou	2.85	10.4	6.4	3.6
COD in Bayou	71	83.2	76	5.9
BOD_5 in Marsh	3.5	7.3	-	-
COD in Marsh	55.4	196	-	-

1 – Values based on ROS. See Appendix D.

BOD_5 levels increased from Reach 1 to Reach 4 with the maximum located at station BIR5004. The high BOD_5 values may be due to urban and agricultural runoff in the upper segments of the bayou. Within the marsh energy area, BOD_5 levels did not vary greatly. There is little variation in COD values throughout Bayou d'Inde indicating that industrial discharges do not significantly affect the oxygen demand in the system.

7.4.3.1 Porewater

Porewater is the water occupying space between sediment particles. DOC, salinity, conductivity, hardness, total alkalinity, ammonia as N, unionized ammonia, and pH were measured at ten sample locations in Bayou d'Inde. DOC and salinity are presented in this section whereas discussion of the other parameters is presented in the BERA.

7.4.3.1.1 Porewater Dissolved Organic Carbon

Porewater DOC is the organic fraction of carbon in water that is filterable. DOC plays a role in the fate and transport of trace elements in the subsurface as well as influences the bioavailability of hydrophobic compounds. In saline environments, dissolved organic matter is removed from the water to the sediment phase, which can effectively sorb hydrophobic chemicals (Chapman et al 2001). Porewater DOC was measured in Phase II only and presented in Exhibit 7-20.

Exhibit 7-20 Porewater DOC (mg/L) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	2.52	23.09	14.31	6.01
Marsh	8.43	16.6	11.1	2.7
Reference Area	2.29	13.52	4.78	3.41

1 – Values based on ROS. See Appendix D.

7.4.3.1.2 Porewater Salinity

As discussed previously, salinity is a measure of TDS in water. Porewater salinity was measured in Phase II only and is presented in Exhibit 7-21.

Exhibit 7-21 Porewater Salinity (ppt) in Bayou d'Inde and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	11	22	19.2	3.1
Marsh	15	23	20.6	2.2
Reference Area	12	24	17.1	3.8

1 – Values based on ROS. See Appendix D.
2 – Results from Phase II only

The difference between salinity measurements in surface water and porewater are most likely related to sediment type and duration of sediment exposure to surface water salinity conditions (Chapman et al 2001). Equilibrium between surface water and porewater is slow in sediments containing higher percentages of fine particles such as clay and silt (Chapman et al 2001).

7.5 Nature and Extent for the Bayou Energy System

The results and discussion section is organized into four sections: COPCs identified for the bayou energy system (Section 7.5.1), the results of the PCA (Section 7.5.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 7.5.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix D provides details of the PCA and complete summary statistics for all compounds detected in the bayou energy system in Bayou d'Inde.

7.5.1 COPCs for the Bayou Energy System in Bayou d'Inde

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 7.5.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 7.5.1.2 presents the bayou energy system COPCs identified.

7.5.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 7-11. Contaminant concentrations that were determined to have a statistically significantly difference when compared to the reference area are:

- SVOCs (BEHP, HCB, and HCBD)
- PAHs (as pyrene)
- Total PCBs (as Aroclor 1254)
- Pesticides (aldrin and dieldrin)
- Dioxin/Furans (as 2,3,7,8 TCDD TEQ)
- Inorganics (arsenic, barium, chromium, copper, lead, mercury, and zinc)

7.5.1.2 COPCs Selection

Energy system specific COPCs for Bayou d'Inde were selected by determining if the COPC is a risk driver in the HHRA or the BERA and the concentration was determined to have a statistically significant difference when compared to the reference area conditions (Table 7-12). The following COPCs were selected for the bayou energy system in Bayou d'Inde:

- SVOCs (BEHP, HCB, HCBD)
- PAHs (as Low and High Molecular Weight)
- PCBs
- Pesticides (aldrin)
- Dioxin/Furans
- Inorganics (chromium, copper, lead, mercury, and zinc)

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 7.5.2 (PCA) and 7.5.3 (Isolated Chemistry).

7.5.2 PCA

The PCA revealed four dominant factors that accounted for most of the variability (63%) in surface sediment within Bayou d'Inde. These factors are:

- Medium to high-level concentrations of major cations, metals and PAHs (Major Cations/Metal/PAH Factor) that accounts for 18 percent of the variability.
- Medium to high-level concentrations of furans/dioxins and metals (Furan/Dioxin/Metal Factor) that accounts for 18 percent of the variability.
- Medium to high-level concentrations of dioxins, PAHs, PCBs, and metals (Dioxin/PAH/PCB/Metal Factor) that accounts for 16 percent of the variability.

- Medium to high-level of concentrations of pesticides (Pesticide Factor) that accounts for 12 percent of the variability.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

7.5.2.1 Major Cations/Metals/PAH Factor

This section presents the extent of the Major Cations/Metals/PAH Factor and discussion as to the fate and transport of contaminants in this factor.

7.5.2.1.1 Results

Various metals and cations as well as two PAHs and a pesticide were grouped in this factor. The metals grouped in the factor are at low level concentrations are similar to reference area conditions. However, the PAHs and the pesticide represent contamination to the bayou. The cations help to explain compound fate and transport in the system. In addition to major cations, clay and sand were grouped within this factor. Sand was negatively correlated to the contaminants, signifying that areas within the bayou with a low percentage of sand (or high percentage of clay) would be more likely to have higher concentrations of contaminants grouped within this factor. Summary statistics are presented in Exhibits 7-22 through 7-24.

Exhibit 7-22 Summary Statistics of Inorganics (mg/Kg) in Major Cations/Metals/PAH Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Beryllium	83/87	0.27	1.2	0.8	0.2	0.3
Iron	87/87	5,610	25,900	13,718	4,398	0.3
Magnesium	87/87	1,520	11,100	3,926	1,327	0.3
Potassium	87/87	886	4,150	2,183	688	0.3
Vanadium	87/87	9.3	59.2	24.1	9.1	0.4
Aluminum	87/87	4,390	28,100	13,399	5,003	0.4
Arsenic	87/87	1.3	8.4	4.0	1.3	0.3
Cobalt	87/87	2.6	16.1	6.0	1.9	0.3
Manganese	87/87	59.4	1,020	211	127	0.6
Sodium	87/87	3,380	21,100	9,389	3,903	0.4

1 – Values based on ROS. See Appendix D.

Exhibit 7-23 Summary Statistics of PAHs (µg/Kg) in Major Cations/Metals/PAH Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Benzo(a)anthracene	21/97	33.7	1,950	127.9	244	1.91
Benzo(b)fluoranthene	21/98	54.1	1,990	169	255	1.50

1 – Values based on ROS. See Appendix D.

Exhibit 7-24 Summary Statistics of Pesticides (µg/Kg) in Major Cations/Metals/PAH Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detect	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Endrin Aldehyde	25/99	0.86	77	5.32	11.92	2.24

1 – Values based on ROS. See Appendix D.

Benzo(a)anthracene was used as the indicator variable for this factor.

Surface Sediment

Elevated concentrations of contaminants grouped within this factor were located in 4 areas within the bayou energy system (Figure 7-4). The first area is located in Reach 4 approximately 120 to 250-m downstream of I-10. This area showed lower concentrations in comparison with the other areas in Bayou d'Inde and concentrations were consistent among Reach 4 sample locations.

The second area is located 52 m upstream to 250 m downstream of LA-108. Elevated concentrations were primarily between LA-108 and the railroad crossing. Concentrations of HPAHs are the highest in Bayou d'Inde at this location (BIR4015) measured at 23,000 µg/Kg. Concentrations decreased downstream. In Reach 1 the second highest concentration was recorded at 5,820 µg/Kg.

In Maple Fork Bayou at station BIR3024, an area from about 250 to 650-m from the mouth of Maple Fork Bayou reported elevated concentrations at 4,000 µg/Kg. Contaminant concentrations are more varied within Maple Fork Bayou with high detections located at both ends of this segment.

The Reach 1 HPAH impacted area encompasses the region approximately 1,125 to 375-m from where Bayou d'Inde flows into the Calcasieu River Ship Channel. Concentrations are varied within this area as well.

Subsurface Sediment

Benzo(b)fluoranthene and benzo(b)anthracene concentrations in subsurface sediment decrease with depth, similar to HPAHs in the bayou energy system (Figure 7-4). Within Reach 1, HPAH concentrations increase at station BIR1003 (near the confluence of PPG Canal and Bayou d'Inde) from 220 to 2,420 µg/Kg whereas stations BIR1010 and 1012 (within the lower one-third of Bayou d'Inde Reach 1) decrease with depth. BIR1014 (near the mouth of Bayou d'Inde) increases from 260 µg/Kg in surface sediment to 900 µg/Kg in the 10 to 20-cm interval before decreasing in the 20 to 30-cm interval (280 µg/Kg).

In Reach 2, at station BIR3024, HPAH concentrations decrease with depth from 619 to 195 µg/Kg. Station BIR4015, in Reach 3, concentrations increase sharply from 398 to 1,430 µg/Kg in the 10 to 20-cm interval. HPAHs were not detected in the 20 to 30-cm interval at station BIR4015.

Surface Water

PAHs were not detected in surface water samples within the bayou energy system in Bayou d'Inde.

7.5.2.1.2 Discussion

Distribution of the compounds detected in the Major Cations/Metals/PAHs factor for the bayou energy system are found at concentrations of potential concern in Reaches 1 and 3, and in Maple Fork Bayou. The primary COPCs in this correlated group of detections are HPAHs. The HPAHs correlate with a broad group of major cations and associated metals. This group of cations and metals appear to represent clay local mineralogy and the association with sediment sodium may indicate sediment deposition under saline conditions.

The maximum HPAH concentrations were found in Reach 3, at 23,000 µg/Kg. The lateral extent in Reach 3 is limited, it appears that the release was localized, possibly entering Bayou d'Inde near BIR4015 (near Citgo Outfall 001) and that the PAHs salted-out of solution, binding with sediments and have remained in the immediate local area. The core data suggests that this release has been relatively recent as the concentrations of HPAHs in BIR4015 decrease in the 10 to 20-cm and 20 to 30-cm samples. The concentrations in these lower horizons are 1,400 µg/Kg and non-detect, respectively. Conversely, historic data from 1992 studies found that HPAH

concentrations ranged from 239 to 24,900 µg/Kg throughout Reach 3. Compared to core data from BIR 4015, this would indicate that surface material has moved within Reach 3. Current conditions are similar to those of 1992 and it appears that the potential for sediment mobility in Reach 3 exists currently.

The second highest occurrence of HPAHs is in Reach 1 of Bayou d'Inde. The surface sediment concentrations range from 260 to 5,820 µg/Kg. The distribution is not linear, but scattered from the confluence of the PPG Canal to the mouth of Bayou d'Inde. The surface sediment distribution may be attributed to two things, the generally lower percentage of clay in the Reach 1 sediments lead to the more isolated concentrations of HPAHs, and sediment mobility, or localized sources related to oil and gas production activities. The subsurface data from Reach 1 indicates a similar variability in the lateral distribution and concentration gradients. An example of the total HPAH concentration variability in Reach 1 is the variability noted in the following vertical profiles:

Reach 1

- BIR1003: 290 µg/Kg, 1,000 µg/Kg, 2,420 µg/Kg (maximum is in the 20 to 30-cm interval)
- BIR1010: 3,010 µg/Kg, 1,880 µg/Kg, 2,200 µg/Kg (maximum is in the 0 to 10-cm interval)
- BIR1012: 5,820 µg/Kg, 24 µg/Kg, 413 µg/Kg (maximum is in the 0 to –10-cm interval)
- BIR1014: 260 µg/Kg, 900 µg/Kg, 280 µg/Kg (maximum is in the 10 to 20-cm interval)

Previous studies found that HPAH concentrations were higher in surface sediments than detected in the RI. The data from 1992 ranged from 7,920 to 17,870 µg/Kg, which was also higher than that observed in any of the cores collected during the RI. This suggests that surface sediment may have been removed from the area. The variability in the RI core data supports this interpretation.

The third area of elevated HPAHs is in Maple Fork Bayou. The elevated concentrations are detected in the middle portion of the bayou. No known sources are present in this area. Potential sources are pipeline and railroad crossings located within 150 m of the detected maximum as well as runoff from I-10 approximately 300 to 500 m to the upstream. The vertical distribution of contaminant concentrations in BIR 3024 in Maple Fork Bayou shows a marked decrease with depth (4,200 µg/Kg, 630 µg/Kg, and 195 µg/Kg [0 to 10, 10 to 20, and 20 to 30-cm, respectively]). Elevated surface concentrations are noted in several of the adjacent sample locations in Maple Fork Bayou. Maple Fork Bayou was not sampled in previous studies, therefore no temporal evaluation beyond the subsurface core data is available.

7.5.2.2 Furan/Dioxin/Metal Factor

This section presents the extent of the Furan/Dioxin/Metal Factor and discussion of the fate and transport of contaminants in this factor.

7.5.2.2.1 Results

The Furan/Dioxin/Metal Factor is comprised of five furan congener groups and one dioxin congener group. In addition, the beta-BHC, hexachloro-1,3-butadiene, phenol, copper, lead mercury, and nickel are grouped in this factor. Controlling 18% of the variance, the Furan/Dioxin/Metal Factor is the result of contamination introduction to the bayou. Summary statistics for the parameters that group within this factor are presented in Exhibits 7-25 through 7-27.

Exhibit 7-25 Summary Statistics of Furans and Dioxins (ρg/g) in Furan/Dioxin/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Total HxCDF	27/27	21	36,000	2,354	8,639	3.67
OCDF	27/27	39	290,000	17,547	69,755	3.98
Total TCDF	27/27	12	11,000	806	2,609	3.24
Total PeCDF	26/27	12	25,000	1,576	6,019	3.82
Total HpCDF	27/27	46	54,000	3,637	12,892	3.54
Total TCDD	25/27	1.29	120	17.6	27.7	1.57

1 – Values based on ROS. See Appendix D.

Exhibit 7-26 Summary Statistics of Organic Parameters (µg/Kg) in Furan/Dioxin/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Beta-BHC	28/98	5.2	300	28.0	69.6	2.48
Hexachloro-1,3-butadiene	8/98	100	1,600	(-)	(-)	(-)
Phenol	9/98	49	400	(-)	(-)	(-)

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 7-27 Summary Statistics of Inorganic Parameters (mg/Kg) in Furan/Dioxin/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Mercury	73/99	0.0698	3	0.65	0.76	1.17
Copper	98/99	8.27	280	60.2	46.6	0.77
Nickel	99/99	4.64	53.8	19.5	9.4	0.48
Lead	94/99	7.45	218	38.1	25.4	0.67

1 – Values based on ROS. See Appendix D.

Nickel was used as the indicator variable to discuss the contamination present in the bayou energy system of Bayou d'Inde.

A brief discussion of the nature and extent of the COPCs grouped in this factor is presented below.

Surface Sediment

As shown in Figure 7-5, elevated concentrations are located in Reach 3 and downstream of Maple Fork Bayou to the Calcasieu River Ship Channel. Reach 3 had variable concentrations throughout the area with elevated concentrations observed at the following: the entry of Little Bayou d'Inde into Bayou d'Inde; 525 m downstream of Little Bayou d'Inde; 215 m downstream of Citgo outfall 001 approximately where a Firestone outfall empties into Bayou d'Inde; and near the railroad crossing at LA-108 outfall area of Westlake Polymers and OxyChem.

The concentrations in Maple Fork Bayou are elevated with concentrations increasing from I-10 the confluence of Maple Fork Bayou and Bayou d'Inde (approximately 275 m upstream of the confluence in Maple Fork Bayou). Once in Bayou d'Inde, concentrations remain constant until Reach 1 where they increase. Reach 1 was observed to have the highest detects, specifically from 190 m upstream of the mouth of PPG Canal to 1,000 m downstream of PPG Canal in Bayou d'Inde.

Subsurface Sediment

At stations BIR1003 and BIR1010, HCBD concentrations increased in the subsurface (Figure 7-5). At station BIR1012, HCBD was detected in the surface sediment sample and at the 20 to 30-cm interval, but was not detected in the middle interval. At station BIR1014, HCBD was not detected in the surface sediment (most likely due to high detection limits), but it was detected in the subsurface at decreasing concentrations.

Mercury concentrations tended to decrease with depth in Reach 1 (Stations BIR1003, BIR1010, and BIR1012) with the exception of station BIR1014 (Figure 7-5). At station BIR1014, mercury concentrations decreased in the 10 to 20-cm layer and increasing in the 20 to 30-cm layer. In the upper reaches at station BIR3024 and BIR4015, mercury concentrations were higher in the 10 to 20-cm interval. BIR3024 exhibited the highest concentration of mercury of all subsurface samples with a result of 4.8 mg/Kg in the 20 to 30-cm layer. Mercury was not detected in the subsurface at station BIR4017.

With the exception of stations BIR1010 and BIR1012 (Reach 1), copper concentrations decreased with depth (Figure 7-5). At station BIR1010, concentrations decreased from the surface sample to the 10 to 20-cm interval sample. Concentrations in the 20 to 30-cm interval, however, had the highest concentration for copper for subsurface samples with an observed value of 195 mg/Kg. Copper behaved similarly at station BIR1012.

In Reach 1, lead concentrations increased in the 20 to 30-cm interval at station BIR1003 and BIR1014 and decreased in the 20 to 30-cm interval (Figure 7-5). Highest concentration for lead in the subsurface for lead was observed at station BIR1014 with

a value of 83 mg/Kg. In Reaches 2 and 3, lead concentrations decreased in the subsurface.

Dioxin/furans in the subsurface will be discussed as a whole as 2,3,7,8-TCDD TEQ in Section 7.5.3.5.

Surface Water

Copper, lead, mercury, and nickel were detected in surface water samples collected in the bayou energy system in Bayou d'Inde. Exhibit 7-28 presents the total and dissolved (if detected) concentrations of these contaminants and compares them to EPA Ambient Water Quality Regulations (AWQC; as reported in the Federal Register 1995) criteria continuous concentration (CCC; chronic) and criteria maximum concentration (CMC; acute) values and/or LDEQ Water Quality Regulation (LDEQ 2000) for both freshwater and marine environments. For systems with salinity between 1 and 10 ppt, the more stringent of either fresh or marine values should be used to compare with mean dissolved concentrations. In cases where the dissolved phase was not detected, the surface water criteria for that contaminant were converted to an unfiltered criterion using a conversion factor provided in LDEQ 2000.

Exhibit 7-28 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Furan/Dioxin/Metal Factor in Surface Water, Bayou Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Copper	0.0082 (0.0032)	0.0082 (0.0071)	0.035[3]	0.022[3]	**0.00363**	**0.00363**
Lead	0.0022 (0.0005)	0.00195 (0.0002)	0.138[3]	0.00531[3]	0.209	0.00808
Mercury	0.0001 (0.00005)	0.0001[2]	0.0017[3]	0.00001[3]	0.0017	**0.000021**
Nickel	0.0112 (0.0123)	0.0103 (0.0118)	2.49[3]	0.279[3]	0.074	**0.0082**

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected in one sample.
3 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.

Dissolved copper concentrations exceed both the acute and chronic criterion for marine surface water. The highest dissolved concentration of copper observed was at station BIR4004 in Reach 3 with a value of 0.0231 mg/L. This maximum concentration also exceeds the chronic criteria for freshwater. Dissolved mercury and nickel concentrations exceeded the chronic criteria for marine surface water. Dissolved mercury was only detected at one location, ECOBI014. The highest concentration of dissolved nickel was observed at BIR1004 with a concentration of 0.0348 mg/L.

7.5.2.2.2 Discussion

The Furan/Dioxin/Metal Factor is comprised of five furan congener groups and the COPCs HCBD, copper, mercury, lead, and nickel. As noted above, the extent of the dioxin/furans and metals compounds is represented by the distribution of nickel. Elevated concentrations of this group of compounds are noted from 650 m upstream of the Maple Fork Bayou confluence with Bayou d'Inde through to the ship channel. Concentrations are greatest around the PPG Canal and Citgo outfall 001.

Mercury is found to occur in the middle reaches of Maple Fork Bayou at elevated levels, albeit lower than those in Reach 1. It appears that mercury is entering Bayou d'Inde from various sources. Potential sources in Lockport Marsh include oil field (gas metering) equipment. Available data do not indicate known discharge to Maple Fork Bayou. Mercury is managed on-site at a number of facilities throughout Bayou d'Inde (OxyChem, Firestone and PPG) and each has had reported releases or NPDES exceedances. Comparison of some metals total versus dissolved concentrations in surface water illustrates the degree of suspended or colloidal phase material in Bayou d'Inde. An example is dissolved phase copper. Dissolved copper was less than total copper, indicating adsorption to suspended phase material. This finding is significant as suspended phase transport may be a major process for some PAHs, PCBs, metals, and dioxins.

Copper tends to have similar distribution, with the exception that elevated concentrations of copper are noted in two places: downstream of Maple Fork Bayou in Bayou d'Inde and downstream of Citgo outfall 001. Copper tends to become more soluble in saline waters due to chlorine complexing and this may account for the greater downstream extent of copper.

The occurrence of lead is fairly consistent throughout Bayou d'Inde. Levels are generally greater than the reference areas and less than values measured in previous studies. The distribution of elevated lead noted during the RI is primarily in and at the confluence of Maple Fork Bayou, upstream of LA-108 and in Reach 1. This distribution is consistent with previous studies.

Historical concentrations of lead were generally higher than those observed in the RI. Concentrations as high as 900 mg/Kg in Reach 2 downstream of Maple Fork Bayou were noted. Concentrations, however, remained near 200 mg/Kg throughout middle Reach 2, decreasing to less than 100 mg/Kg in lower Reach 2. Concentrations increase at PPG Canal and remain elevated (200-400 mg/Kg levels) into the ship channel.

Sources of the dioxin/furan/metal compounds in this factor appear to be Citgo, OxyChem and Westlake Polymers outfall areas and PPG Canal. Lead compounds, formed in the environment due to precipitation processes, are generally stable in the environment, with the exception of chloride complexes, which tend to form more soluble lead and copper compounds. However, the data suggests that the metals observed in sediment are not expected to become mobile or soluble in Bayou d'Inde. Transport of the precipitated compounds adsorbed to sediments, however, is possible and is apparent where sediments are disturbed. The condition is apparent from historical data in lower Reach 1 where sediments with elevated lead concentrations are noted in both Reach 1 and the confluence of Bayou d'Inde and the ship channel. Increased concentrations in Reach 1 may be due to water velocity drops and sediment accumulation.

HCBD distribution is an exception to the group, its occurrence is isolated to Reach 1 below the PPG Canal; however, and no discernable concentration gradients are noted.

The primary source of HCBD is the PPG Canal; however, compound distribution is controlled by the mobility of the sediments to which the compound binds.

7.5.2.3 Dioxin/PAH/PCB/Metal Factor

This section presents the extent of the Dioxin/PAH/PCB/Metal Factor and discussion as to the fate and transport of contaminants in this factor.

7.5.2.3.1 Results

This factor groups various dioxins, PAHs, PCBs, and metals as well as TOC, which may explain the mobility of these contaminants within the bayou energy system. Summary statistics for these contaminants are presented in Exhibits 7-29 through 7-33.

Exhibit 7-29 Summary Statistics of Dioxins (ρg/g) in Dioxin/PAH/PCB/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Total HxCDD	27/27	25.5	1,200	199	259	1.30
Total HpCDD	27/27	92.4	4,700	820	1,001	1.22
OCDD	27/27	593	23,000	5,406	4,732	0.88

1 – Values based on ROS. See Appendix D.

Exhibit 7-30 Summary Statistics of PAH (µg/Kg) in Dioxin/PAH/PCB/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Fluoranthene	28/98	76	3,560	236	453	1.92
Pyrene	38/98	85	2,550	248	346	1.40

1 – Values based on ROS. See Appendix D.

Exhibit 7-31 Summary Statistics of SVOCs (µg/Kg) in Dioxin/PAH/PCB/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Benzaldehyde	6/97	41	290	-	-	-

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 7-32 Summary Statistics of PCBs (µg/Kg) in Dioxin/PAH/PCB/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Aroclor 1260	4/98	59	190	-	-	-

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 7-33 Summary Statistics of Inorganics (mg/Kg) in Dioxin/PAH/PCB/Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Chromium	87/87	7.1	231	46.5	33.9	0.73
Silver	39/99	3,380	21,100	9,389	3,903	0.42

1 – Values based on ROS. See Appendix D.

Pyrene was used as the indicator variable to describe the distribution of contaminants grouped in this factor. Dioxin/furans distribution and fate and transport are discussed as a whole as 2,3,7,8-TCDD TEQ. The detail is provided in Section 7.5.3.5.

Surface Sediment

Contamination from this factor is present in all four reaches of the bayou energy system (Figure 7-6). With the exception of metals, the dioxins, PAHs, and PCBs are variable in the bayou with three areas of elevated concentration noted.

In Reach 3, elevated concentrations were observed from the area downstream of the CitCon outfall to approximately 200 m downstream of LA-108. Highest concentrations were observed near the Citgo outfall 001 and where the railroad crosses the bayou at LA-108.

Maple Fork Bayou was also observed to have elevated concentrations of dioxins, PAHs, and metals from approximately 260 m to 675 m downstream of I-10. Aroclor 1260 was not detected in the Maple Fork Bayou.

In Reach 1, station BIR1010 was reported to having high concentrations. Concentrations decreased both upstream and downstream from this location.

Subsurface Sediment

Pyrene and fluoranthene decreased in concentration in the subsurface or concentrations remained similar (Figure 7-6). Station BIR1003 did exhibit increasing concentrations from surface to the deeper interval with values increasing from 220 to 2,420 µg/Kg. See discussion in Section 7.5.2.1.1.

Chromium had similar concentrations with depth for samples in Reach 1 (Figure 7-6). Stations BIR3024, BIR4015, and BIR4017 had increasing chromium concentrations

from the surface sediment layer to the 10 to 20-cm interval and then decreasing in the 20 to 30-cm interval. Station BIR3024 exhibited the highest chromium concentration at the middle depth interval (20 to 30 cm) with a measured value of 357 mg/Kg. Aroclor 1260 was not detected in the subsurface sediments.

Dioxin/furans in the subsurface will be discussed in Section 7.5.3.5.

Surface Water

Neither PAHs nor PCBs were detected in surface water in the bayou energy system in Bayou d'Inde.

Mean total and dissolved chromium (total) concentrations are presented in Exhibit 7-34 and compared to fresh and marine acute/chronic criterion.

Exhibit 7-34 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Dioxin/Furan/Metal Factor in Surface Water, Bayou Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Chromium (total)	0.0057 (0.0163)	0.0034 (0.0047)	NA	NA	NA	NA

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
NA – Not available. LDEQ provides criteria for Cr^{3+} and Cr^{6+}.

7.5.2.3.2 Discussion

Reach 1 tends to have the highest concentrations of HPAHs, although the HPAH compounds are found throughout Bayou d'Inde. The occurrence of these compounds is concentrated in three areas: near the Citgo outfall 001; near the highway LA-108 bridge downstream of the Westlake Polymers dock and outfall 002B; and below the PPG Canal. Slightly elevated concentrations of the PAH Factor compounds are noted in the lower to middle portions of Maple Fork Bayou. No documented discharge to Maple Fork Bayou was found, however unidentified sources in the area near the PAH detections may be present.

Sources of PAHs to Bayou d'Inde appear to be Citgo outfall 001, Westlake Polymers outfall 002B and the PPG Canal. PAHs are hydrophobic, with strong tendencies to bind to suspended or dissolved organics. The presence of suspended organic material and detritus which is elevated in Reach 1 and Lockport Marsh combined with velocity drops due to bayou geometry appear to make Reach 1 a contaminant sink.

The extent of elevated chromium in Bayou d'Inde is primarily in Reach 2 and Reach 3. The bayou energy system concentrations are highest in Maple Fork Bayou and in Bayou d'Inde downstream of the confluence with Maple Fork Bayou. The concentrations are higher than the reference area, both for mean and maximum values. The distribution of sediment concentrations indicates decreasing concentrations downstream of apparent sources. Concentrations noted in the RI are generally lower than those observed during previous studies.

Historically, the highest concentrations of chromium were found in Reach 3, near the Citgo outfall 001 (2,610 mg/Kg). Concentrations were also elevated downstream of the Westlake Polymers outfall 002B area near Reach 2.

Potential sources are numerous, as many of the facilities handle chromium and many of them have had releases to Bayou d'Inde. However, it appears that the Citgo outfall 001 and Westlake Polymers outfall 002B area are primary contributors in Reach 3, as is the PPG Canal in Reach 1.

Chromium will generally precipitate out in the environment as chromium hydroxide. The hydroxide compound consists of trivalent chromium, which is generally stable in the environment. Chromium is not expected to become more soluble under the conditions present in Bayou d'Inde. Particle transport of the adsorbed chromium, however, is possible.

As noted earlier, the correlation of several different dioxin/furans in more than one PCA factor resulted in a standalone discussion of 2,3,7,8 TCDD TEQ occurrence. This is considered the most comprehensive approach to presenting dioxin/furan data. The grouping of hepta-, hexa- and octa-dioxins with the dioxin/PAH/PCB/Metal factor here appears to be related to the spatial distribution. The common thread may be the distribution noted in Reaches 2 and 3, possibly associated with the railroad line.

7.5.2.4 Pesticides Factor

This section presents the extent of the Pesticides Factor and discussion as to the fate and transport of contaminants in this factor.

7.5.2.4.1 Results

The Pesticide Factor is comprised of several pesticides. Summary statistics for the parameters that group within this factor are presented in Exhibits 7-35.

Exhibit 7-35 Summary Statistics of Pesticides (µg/Kg) in Pesticide Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Aldrin	20/99	0.65	370	9.67	48.2	4.98
Gamma-BHC	9/98	1.9	23	-	-	-
4,4'-DDE	26/99	0.63	120	4.85	15.2	3.14
Endosulfan Sulfate	32/99	0.93	110	6.19	15.7	2.53
Heptachlor	5/98	50	240	-	-	-
Hexachlorobenzene	11/98	630	24,000	-	-	-

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Hexachlorobenzene (HCB) was used as the indicator variable for this factor.

Surface Sediment

Elevated pesticide and HCB concentrations are located in Reach 1, from PPG Canal to where Bayou d'Inde flows into the Calcasieu River Ship Channel (Figure 7-7). Concentrations decrease from PPG Canal to approximately 780 m downstream (BIR1008), where they become elevated again. Pesticide concentrations become variable from BIR1008 to the ship channel.

Subsurface Sediment

Aldrin was the only pesticide COPC detected in the subsurface. At station BIR1010, the aldrin concentration decreased from 370 µg/Kg in the surface sediment to 300 µg/Kg in the 10 to 20-cm interval. It was not detected in the 20 to 30-cm interval.

HCB at stations BIR1003 and BIR1010 exhibited higher concentrations in the 20 to 30-cm interval than in the upper layers of the sediment (Figure 7-7). Concentrations decreased from the surface to the 10 to 20-cm interval before increasing significantly in the 20 to 30-cm interval. At station BIR1014, HCB concentrations were higher in the middle depths (10 to 20-m interval), with similar concentrations in the surface and 20 to 30-cm interval.

Surface Water

Contaminants within the Pesticide Factor were not detected in surface water in the bayou energy system in Bayou d'Inde.

7.5.2.4.2 Discussion

A significant portion of Bayou d'Inde data variability is explained by the data referred to as the Pesticide Factor. The factor is comprised of several pesticides including aldrin and HCB. These two compounds are COPCs in terms potential human risk and/or ecological risk. They are the focus of the following fate and transport discussion.

Pesticides were not detected extensively throughout Bayou d'Inde; they are limited to Reach 1. Further, they were each detected in less than 20% of the samples collected in Bayou d'Inde. Sources of pesticides are likely anthropogenic.

The historic occurrence of pesticides tends to correlate with the RI findings. The highest concentration measured in previous studies was at location 6100-04-BDI39 in the PPG Canal. This location had levels of 3,500 and 8,800 µg/Kg aldrin and dieldrin, respectively. Elevated PAHs and BEHP values were also reported at this location.

The behavior of pesticides in Reach 1 appears to be affected by suspended particulate material. The compounds are hydrophobic with generally high log K_{ow} values leading to sorption to organics. However, Reach 1 of the bayou system generally contains less TOC than Reaches 2 or 3. Pesticides have an affinity for organic-rich, fine-grained materials; however the Reach 1 matrix is 55% silts and clay, and 45%

sand, which has a lower silt and clay content than either Reaches 2 or 3 (Figure 7-3). One explanation may be the mobilization and re-suspension of pesticide-sorbed colloidal phase material and collection/deposition in Reach 1. Anthropogenic use of detected pesticides is common throughout the region to control a variety of pests. The accumulation of these compounds in the Reach 1 sediments appears not to be an issue of release or source, but one of deposition.

Dissolved organics and TSS content are locally higher due to input from PPG Canal and Lockport Marsh and this may control the deposition or coagulation of these fine-grained particles in Reach 1. Reach 1 appears to act as a sediment trap for Bayou d'Inde. It is the broad, deep and an intermediate step to the ship channel, and it is the largest overall geometry in Bayou d'Inde. Significant velocity decreases appear to occur just upstream of the PPG Canal confluence with Reach 1. The organic rich waters of Lockport Marsh and Reach 1 appear to provide a source of algal drift that helps create organic flocculants that bind and precipitate many contaminants (PCBs, PAHs, dioxins, pesticides and metals).

7.5.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the major PCA factor groups previously discussed. These include:

- SVOCs (bis[2-ethylhexyl]phthalate)
- LPAHs
- PCBs (Aroclor 1254)
- Inorganics (zinc)
- 2,3,7,8-TCDD TEQ

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection was typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections. In addition, the nature and extent of dioxin/furans presented as 2,3,7,8-TCDD TEQ is discussed.

7.5.3.1 Bis(2-ethylhexyl)phthalate

This section presents the nature and extent of bis(2-ethylhexyl)phthalate (BEHP) in the bayou energy system in Bayou d'Inde and describes its fate and transport in the environment.

7.5.3.1.1 Results

Surface Sediment

Bis(2-ethylhexyl)phthalate is located throughout the bayou energy system in Bayou d'Inde (Figure 7-8). Concentrations are highly variable as evident by the high correlation coefficient (Exhibit 7-36).

Exhibit 7-36 Summary Statistics of BEHP (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
BEHP	64/98	66	80,000	1,573	10,314	6.6

1 – Values based on ROS. See Appendix D.

Station BIR1003 had the highest concentration at 80,000 µg/Kg, which is located near the mouth of the PPG Canal in Reach 1. Highest mean concentrations are in Reach 1 and Reach 3 at 6,447 (±22,747) µg/Kg and 560 (±1,414) µg/Kg, respectively. Reach 4 had comparable mean concentrations 458 (±376) µg/Kg as Reach 3, but had a lower coefficient of variance. This indicates that sediment concentrations are more consistent.

Subsurface Sediment

BEHP values in the subsurface varied, some locations were found to decrease with depth while others were found to increase. There was not a consistent depositional pattern (Figure 7-8). This may indicate fine-particle deposition and re-mobilization, indicating lower sediment stability.

Surface Water

BEHP was not detected in surface water in the bayou energy system in Bayou d'Inde.

7.5.3.1.2 Discussion

BEHP is present throughout Bayou d'Inde and its range of concentrations is variable. The highest individual and mean concentration is located near the mouth of PPG Canal in Reach 1. However the second highest mean concentration is found in Reach 3, due primarily to elevated levels near Reach 3 industrial outfalls. It appears that BEHP is binding to the suspended particle material and being transported by tidal activity and storm surge throughout the bayou.

Historically, BEHP has been found throughout Bayou d'Inde, and the maximum of 5,700 µg/Kg was detected in lower Reach 1 during the EPA Toxics study in June of 1988. However, levels one-half of that maximum were detected throughout Reaches 2 and 3. BEHP was detected at several locations above 1,000 µg/Kg in Reach 4, hundreds of meters upstream of Little Bayou d'Inde.

Potential sources of BEHP to Bayou d'Inde appear to be the areas near Citgo outfall 001, Westlake Polymers outfall 002B, and PPG Canal. The distribution of BEHP through Bayou d'Inde appears to be the result of significant small particle or colloidal size particle mobilization/transport. The upstream extent of BEHP supports this interpretation, e.g., the increasing TOC levels in Reaches 3 and 4 provide sorption sites for BEHP released into the system near LA-108. Results from the marshes in Reach 2 further support this interpretation. The increase in sediment concentration in Reach 1 downstream of PPG Canal, however, may indicate the addition of BEHP to the system.

7.5.3.2 LPAHs

This section presents the nature and extent of LPAHs in the bayou energy system in Bayou d'Inde and describes its fate and transport in the environment. LPAHs were calculated by summing the corresponding low molecular weight PAHs that were detected. Non-detects were not included in the summation due to elevated detection limits.

7.5.3.2.1 Results

LPAH contamination was located at 24 stations and was highly variable throughout the energy system (Exhibit 7-37).

Surface Sediment

LPAHs tend to concentrate in four areas in the bayou energy system: downstream of PPG Canal in Reach 1; in Maple Fork Bayou; downstream of LA-108; and downstream of I-10 (Figure 7-9).

Exhibit 7-37 Summary Statistics of LPAHs (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detect	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
LPAHs	24/98	5	3,737.8	427.7	901.3	2.1

1 – Values based on ROS. See Appendix D.

The highest LPAH concentration was observed at station BIST008 in Maple Fork Bayou.

Subsurface Sediments

LPAH concentrations varied in the subsurface with stations exhibiting different profiles (Figure 7-9). At stations BIR1003 and BIR1010 concentrations decrease from the surface sediment layer to the 10 to 20-cm layer and then increase in the 20 to 30-cm layer. The deeper interval had the highest observed concentrations ranging from 770 to 1,130 µg/Kg. BIR1012 and BIR3024 had similar gradients showing decreasing concentrations with depth. LPAH concentrations at station BIR1014 and BIR4015 increase in the 10 to 20-cm interval and then decrease in the 20 to 30-cm interval. At station BIR4015, LPAHs were not detected in the surface sediment.

Surface Water

LPAHs were not detected in the surface water in the bayou energy system of Bayou d'Inde.

7.5.3.2.2 Discussion

LPAHs in the bayou energy system of Bayou d'Inde were detected at 24 locations. Analytical results were highly variable, however, the LPAHs tend to concentrate in four areas: downstream of the PPG Canal in Reach 1, in Maple Fork Bayou, downstream of highway LA-108 and downstream of I-10. The highest concentration of LPAHs was in Maple Fork Bayou.

LPAHs in Reach 1 were found to have the highest concentrations at depth, generally the 20 to 30-cm horizon. In Reach 3 the concentrations tend to decrease with depth. One exception was sample location BIR4015, which did not contain LPAHs in the surface sediment (0-10 cm) interval, only at depth (in the 10 to 20-cm and 20 to 30-cm intervals) (Figure 7-9).

LPAH sources appear to be the Citgo outfall 001 area, Westlake Polymers outfall 001, area and the PPG Canal. LPAHs tend to be more soluble than many other PAHs and the relatively broad distribution, particularly notable in upper Reach 3 and lower Reach 4, may be an indicator of LPAH adsorption to suspended or particulate matter.

7.5.3.3 PCBs

This section presents the nature and extent of Aroclor 1254 and PCB congeners in the bayou energy system in Bayou d'Inde and describes its fate and transport in the environment.

7.5.3.3.1 Results

Surface Sediment

Aroclor 1254 did not correlate with other PCBs or contaminants in the bayou energy system in Bayou d'Inde. Exhibit 7-38 presents the summary statistics for Total PCBs. Appendix D includes the statistics for individual Aroclors.

Exhibit 7-38 Summary Statistics of Total PCBs (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detect	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Aroclor 1254	52/99	33	590	80.0	91.9	1.15

1 – Values based on ROS. See Appendix D.

Aroclor was frequently detected in Reach 3. Concentrations in this area range from 37 to 550 µg/Kg and had a higher mean concentration in comparison with the other reaches.

In Maple Fork Bayou, elevated concentrations were detected at station BIR3024 (Reach 2) and generally decreased in concentration moving downstream toward Bayou d'Inde. Concentrations range from 55 to 310 µg/Kg.

Aroclor 1254 was detected at high concentrations in Reach 1 downstream of PPG Canal to the Calcasieu River Ship Channel. Concentrations range from 33 to 260 µg/Kg.

Two dominant PCB congeners were observed in the bayou energy system in Bayou d'Inde. PCB-118, which tends to have elevated concentrations upstream of Reach 1, and PCB-15, which is more dominant in Reach 1. Figure 7-11 presents the PCB congener data for Bayou d'Inde.

Subsurface Sediment

Aroclor 1254 was detected in the subsurface at BIR3024 in Maple Fork Bayou. Concentrations range from 310 µg/Kg at the 0 to 10-cm, increases to 1,700 µg/Kg and then decreases to 460 µg/Kg.

In addition, at station BIR4015, Aroclor 1254 was detected in all three horizons. It was measured in the three intervals at 52, 4 and 280 µg/Kg, respectively. The maximum was noted in the 20 to 30-cm interval.

At station BIR1003, PCB-15 is the dominant congener in the surface layer and decreases with depth (Figure 7-11). At station BIR1010, PCB-118, PCB-15, PCB-61/70 and PCB-66 are the dominant congeners in the surface sediment. Values tended to decrease slightly in the 10 to 20-cm layer. In the 20 to 30-cm interval, some PCB congeners increase slightly with PCB-15 the dominant PCB congener at that interval (Figure 7-11).

The dominant congeners at station BIR1014 were the same as BIR1010 and decreased slightly in the 10 to 20-cm interval. However, the observed concentrations in the 20 to 30-cm interval were greater than found in BIR1010 at the same interval (Figure 7-11).

Dominant congeners at station BIR3024 include PCB-105, PCB-118, PCB-162, PCB-61/70 and PCB-66. The congeners are similar to that of Reach 1 with one exception; in BIR3024 PCB-15 was not a dominant congener. In addition, PCB congener concentrations increased in the 10 to 20-cm interval and decreased in the deeper layer.

Surface Water

Aroclor 1254 was not detected in the surface water in the bayou energy system in Bayou d'Inde. PCB congeners were not analyzed in surface water.

7.5.3.3.2 Discussion

Aroclor 1254 was detected in sediment downstream of Little Bayou d'Inde. Reach 3 had the greatest number of locations where it was detected, however, Reach 1 exhibited the highest concentration.

Occurrence with depth was variable at station BIR4015, with concentrations decreasing in the middle horizon and then increasing in the deeper interval. This may indicate scouring or movement of material due to flow entering Bayou d'Inde.

PCB congener profiles vary by reach in Bayou d'Inde. In Reach 1, the dominant congeners in surface sediment are PCB-15, PCB-61/70, PCB-66 and PCB-118. At depth in Reach 1, the dominant congener is PCB-15. Upstream at station BIR3024 the dominant congeners differ; where PCB-118 in surface sediment and PCB-105 in subsurface sediment were present and PCB-15 concentrations were insignificant. It appears that deposition of PCBs is ongoing, particularly in Reach 1, and the result of two different sources. The primary potential source of PCBs in Reach 3 appears to be the East and West Impoundments operated by OxyChem. The impoundments operated for several years and were closed in 1999 (CRA Services, 1999). The source of PCBs in Reach 1 may be the result of air deposition and/or storm runoff/surface water transport from the PPG TSCA incinerator.

Aroclor 1254 is not likely to desorb from sediments; the high sorption capability leads Aroclor 1254 to bind strongly to sediments. Aroclors are typically transported only through physical transport of the sediments to which they adsorb.

Historical Total PCB data indicates that concentrations have ranged from 160 to 22,200 µg/Kg. The maximum detection was in Reach 3 downgradient of the Citgo outfall 001 area, however positive detections were found throughout Reaches 1 through 3. Elevated concentrations tended to be most consistent in the PPG Canal. Aroclor or congener data is not available for historic data.

7.5.3.4 Zinc

This section presents the nature and extent of zinc in the bayou energy system in Bayou d'Inde and describes its fate and transport in the environment.

7.5.3.4.1 Results

Surface Sediment

Elevated zinc concentrations are located primarily in and downstream of Maple Fork Bayou and in Reach 3, upstream of LA-108 (Figure 7-12). Exhibit 7-39 presents the summary statistics and shows that concentrations are fairly consistent with a coefficient of variance of 0.6.

Exhibit 7-39 Summary Statistics of Zinc (mg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Zinc	87/99	39.7	700	177	107	0.6

1 – Values based on ROS. See Appendix D.

Reach 2 had the highest mean concentration (221 ±164 mg/Kg) and had the highest variability in concentration. Two areas that have the highest concentrations are in Maple Fork Bayou and an area 854 to 1,400 m downstream of the confluence of Maple Fork and Bayou d'Inde.

Subsurface Sediment

Zinc was detected at all the multi-depth locations with the exception of station BIR1014 (Figure 7-12). Zinc concentrations decreased in the subsurface with the highest concentration observed (209 mg/Kg) at station BIR3024 in the 20 to 30-cm interval.

Surface Water

Zinc was detected in surface waters samples in the bayou energy system in Bayou d'Inde. Exhibit 7-40 presents the mean total and dissolved concentrations and compares the values to LDEQ acute and chronic criterion.

Exhibit 7-40 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Metal Factor in Surface Water, Bayou Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Zinc	0.009 (0.003)	0.0134 (0.003)	0.205[2]	0.187[2]	0.090	0.081

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.

Mean zinc concentrations did not exceed LDEQ criterion.

7.5.3.4.2 Discussion

Distribution of zinc in Bayou d'Inde is consistent with the occurrence of lead. Zinc is found at the confluence of Maple Fork Bayou, and upstream of LA-108. Mean and maximum concentrations for zinc are greater in comparison to concentration data from the reference area.

Zinc was found in previous studies in the same general areas as the RI. Historically, the highest concentration (771 mg/kg) was detected approximately 700 m downstream of Citgo outfall 001. Moderate concentrations (200 to 400 mg/Kg) were noted in Reach 2 downstream of the Maple Fork Bayou confluence and throughout Reach 1.

Sources appear to be the Citgo and Westlake Polymers outfall areas and PPG Canal. Zinc precipitates as hydroxides or carbonates and adsorbs to suspended and colloidal phase organic materials and transport via suspended bed load is common. The low coefficient of variability for zinc and its widespread distribution in Bayou d'Inde indicates that this may be occurring. Transport of these smaller particles increases where sediments are disturbed, as is common in Bayou d'Inde due to barge traffic.

7.5.3.5 2,3,7,8-TCDD TEQ

This section presents the nature and extent of 2,3,7,8-TCDD TEQ in the bayou energy system in Bayou d'Inde and describes its fate and transport in the environment. Dioxin/furans were evaluated as 2,3,7,8-TCDD TEQ solely, since various dioxins/furans are grouped with different factors.

7.5.3.5.1 Results

Surface Sediment

Elevated concentrations of 2,3,7,8-TCDD were located primarily in the lower reaches of Bayou d'Inde. The distribution of contamination is presented in Figure 7-13 with elevated concentrations found at BIR1004 (2,314 ρg/g) and BIR1010 (969 ρg/g); summary statistics are presented in Exhibit 7-41.

Exhibit 7-41 Summary Statistics of 2,3,7,8-TCDD TEQ (ρg/g) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
2,3,7,8-TCDD TEQ	25/25	1.78	2,314	184	568	3.1

1 – Values based on ROS. See Appendix D.

Mean concentrations decrease from Reach 1 (651 ±1,014 pg/g) to Reach 4 (19 ±27 pg/g). Coefficient of variance ranges from between 1 and 1.5 for each of the reaches indicating there is limited variability in concentration in the reaches.

Subsurface Sediment

Concentrations of dioxin/furans expressed as 2,3,7,8-TCDD TEQ were typically lower in the subsurface samples (Figure 7-13). Station BIR1012 had concentrations that increased slightly from the 10 to 20-cm interval to the 20 to 30-cm interval. The next highest TEQ concentration was observed in BIR1012 just downstream of BIR1010 with a detection of 251 pg/g. At station BIR3024, concentrations increased from the surface to the 10 to 20-cm interval and then decreased. Highest observed subsurface

concentration was at the 10 to 20-cm interval at station BIR3024 with a result of 119 pg/g.

Surface Water

Dioxin/furans were not analyzed in surface water.

7.5.3.5.2 Discussion
Dioxin/furans expressed as 2,3,7,8-TCDD TEQ provide a unified picture of the area that may exhibit elevated concentrations in comparison to background values observed in the reference area.

Elevated concentrations were noted in the lower reaches of Bayou d'Inde (from 969 to 2,314 pg/g), however dioxin/furan TEQ were also noted in Reach 3. Distribution indicates that the most elevated concentrations are located in Reach 1. Concentrations decreased with depth in Reach 1. Concentrations were highest in Reach 3 in the 10 to 20-cm interval (119 pg/g).

Dioxin/Furans were not analyzed in previous studies, limiting temporal variability discussions. As noted previously, dioxin/furans bind to sediments and are transported only through physical transport of the sediments to which they adsorb.

7.6 Nature and Extent of the Marsh Energy System

The results and discussion section is organized into four sections: COPCs identified for the marsh energy system (Section 7.6.1), the results of the PCA (Section 7.6.2), and isolated contaminants that showed little or no correlation to other contaminants or parameters (Section 7.6.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix D provides details of the PCA and complete summary statistics for all compounds detected in the marsh energy system in Bayou d'Inde.

7.6.1 COPCs for the Marsh Energy System in Bayou d'Inde

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 7.6.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 7.6.1.2 presents the marsh energy system COPCs identified.

7.6.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 7-11. Contaminant concentrations that were determined to have a statistically significant difference when compared to reference area concentrations are:

- SVOCs (BEHP, HCB, and HCBD)
- PAHs (as pyrene)
- PCBs (as Aroclor 1254)
- Pesticides (aldrin and dieldrin)
- Dioxin/Furans (as 2,3,7,8 TCDD TEQ)
- Inorganics (arsenic, barium, chromium, copper, lead, mercury and zinc)

7.6.1.2 COPCs Selection

Energy system specific COPCs for Bayou d'Inde were selected by determining if the COPC is a risk driver in the HHRA or the BERA and the concentration was determined to have a statistically significantly difference when compared to reference area conditions (Table 7-13). The follow COPCs were selected for the marsh energy system in Bayou d'Inde:

- SVOCs (BEHP, HCB, HCBD)
- PAHs (as LPAH and HPAHs)
- Pesticides (aldrin and dieldrin)
- PCBs
- Dioxin/Furans
- Inorganics (arsenic, chromium, copper, lead, mercury, and zinc)

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 7.6.2 (PCA) and 7.6.3 (Isolated Chemistry).

7.6.2 PCA

The PCA revealed two dominant factors that accounted for most of the variability (59%) in marsh area surface sediment within Bayou d'Inde. These factors are:

- Medium to high-level concentrations of furans, dioxins and metals (Furan/Dioxin/Pesticide/Metal Factor) that accounts for 25 percent of the variability.

- Medium to high-level concentrations of metals and dioxins (Metal/Dioxin Factor) that accounts for 21 percent of the variability.

- Background physical or major cations (Background Factor) that accounted for 13percent of the variability, but does not group any COPCs.

The Furan/Dioxin/Metal and Pesticide Factors are discussed below. The Background Factor is not be discussed since they do not describe the nature or extent of COPCs in the marsh energy system.

7.6.2.1 Furan/Dioxin/Metal Factor

This section presents the extent of the Furan/Dioxin/Metal factor and discussion as to the fate and transport of contaminants in this factor.

7.6.2.1.1 Results and Extent

The Furan/Dioxin/Metal Factor is comprised of several dioxin/furans, metals, and a SVOC. This represents medium to high concentrations and controls 25 percent of the variance in the marsh energy system in Bayou d'Inde. Summary statistics for the parameters that group within this factor are presented in Exhibits 7-42 through 7-45.

Exhibit 7-42 Summary Statistics of Dioxin/Furans (ρg/g) in Furan/Dioxin/Pesticide/Metal Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Total PeCDF	23/23	40	14,100	1,487	3,513	2.36
Total HxCDF	23/23	34	18,600	2,089	4,606	2.20
Total TCDF	23/23	77	8,150	1,372	1,931	1.41
Total HpCDF	23/23	98	14,900	2,518	4,121	1.64
Total TCDD	22/23	4	163	34.5	45.3	1.31
OCDF	22/23	310	41,700	7,362	12,293	1.67

1 – Values based on ROS. See Appendix D.

Exhibit 7-43 Summary Statistics of Pesticides (µg/Kg) in Furan/Dioxin/Pesticide/Metal Factor Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Endosulfan Sulfate	45/110	0.86	150	5.04	18.8	3.72
Aldrin	25/109	0.35	320	5.8	41.0	7.07
Beta-BHC	40/109	1.5	480	13.7	58.0	4.23
4,4'-DDE	26/110	0.67	120	3.5	15.9	4.6
Gamma-BHC	4/109	8	30	-	-	-
4,4'-DDD	22/109	0.61	120	4.8	14.5	3.0

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 7-44 Summary Statistics of Metals (mg/Kg) in Furan/Dioxin/Pesticide/Metal Factor Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Copper	161/162	7.1	943	126	155	1.23
Nickel	150/162	5.1	110	22	16	0.74

1 – Values based on ROS. See Appendix D.

Exhibit 7-45 Summary Statistics of PAHs (µg/Kg) in Furan/Dioxin/Pesticide/Metal Factor Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
1,2-benzphenanthracene	28/160	110	10,400	-	-	-

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Nickel was used as the indicator variable for the constituents in this factor.

Surface Sediment

Contamination by dioxins, furans, pesticides, metals and the PAH, 1,2-benzphenanthracene (1,2-BPA) was observed at sampling locations in the marsh areas of Bayou d'Inde (Figure 7-4). Areas with the highest concentrations include the surrounding area near the mouth of PPG Canal and the interior portions of Lockport Marsh. Elevated concentrations tend to be located near PPG Canal and decrease moving towards the Calcasieu River Ship Channel within Lockport Marsh. Maximum concentrations are typically located at BIST011, which is located in Lockport Marsh near the mouth of PPG Canal. The western half of Lockport Marsh (across Bayou d'Inde) was observed to have elevated concentrations in the northwest corner and decreases toward Bayou d'Inde and the Calcasieu River Ship Channel.

The fringe marshes along the bayou have variable concentrations, but in general tend to decrease upstream from PPG Canal.

Subsurface Sediment

Copper concentrations decreased in the subsurface with the exception of station BIR3046. Concentrations increased from the 10 to 20-cm to the 20 to 30-cm interval. Highest observed subsurface copper concentration was at the 20 to 30-cm interval at station BIR3046 with a result of 692 mg/Kg (Figure 7-5).

Dioxin/furans in the subsurface are discussed as 2,3,7,8-TCDD TEQ in Section 7.5.4.8.

Surface Water

Copper and nickel were detected in both the total and dissolved phase in the marsh energy system. Exhibit 7-46 Presents the mean and standard deviation and compares the concentrations to LDEQ's acute and chronic criterion.

Exhibit 7-46 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Furan/Dioxin/Pesticide/Metal Factor in Surface Water, Marsh Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Copper	0.0159 (0.0138)	0.0056 (0.0013)	0.035[2]	0.022[2]	**0.00363**	**0.00363**
Nickel	0.0074 (0.0011)	0.0064 (0.0011)	2.49[2]	0.279[2]	0.074	0.0082

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.

Dissolved copper concentrations exceeded both the marine acute and chronic criteria in the marsh energy system. The maximum concentration of copper detected was 0.0079 mg/L at station BIR2068.

Dioxin/furans were not analyzed and pesticides/PAHs were not detected in surface water within the marsh energy system in Bayou d'Inde.

7.6.2.1.2 Discussion

Primary occurrence of dioxin/furans in Bayou d'Inde marshes is in Lockport Marsh, however, dioxin/furan were detected in marshes adjacent to Maple Fork Bayou. The highest concentrations were noted at the confluence of PPG Canal, Bayou d'Inde and Lockport Marsh and included total HpCDF, total HxCDF, total PeCDF, total TCDD, OCDF, and nickel. The marsh adjacent to Maple Fork Bayou (station BIR3018) contained the second highest concentrations. The remaining marsh areas were generally an order of magnitude less in concentration.

Copper and nickel concentrations correlated with the dioxin/furans, highest detections were in Lockport Marsh and the Maple Fork Bayou Marsh, as well. Nickel and copper values were higher in the marshes than those measured in the bayou (maximum of 943 mg/Kg in the marsh versus 280 mg/Kg measured in the in the bayou). Dioxin/furans were not sampled at depth in the marshes.

Metals tend to decrease with depth in the Bayou d'Inde marshes. There was one exception, the marsh in middle Reach 2 at BIR3046, located between Maple Fork Bayou and PPG Canal. The highest copper concentration noted was in the 20 to 30-cm interval in this Reach 2 marsh.

Various pesticides correlated with dioxins and metals and their distribution is generally slightly higher in the marshes than the bayou. Vertical distribution of pesticides was not observed.

Dioxin/furans were not analyzed in previous studies. Maximum copper concentrations have been comparable to that observed in the RI (613 compared to 692

mg/Kg in the RI), whereas nickel was higher in concentration in comparison to previous studies (a maximum of 62 mg/Kg in previous studies compared to 110 mg/Kg in the RI).

Overall, the copper and nickel concentrations appear to be highest in the vicinity of BIR3046 (Reach 2) marsh and Lockport Marsh. This would indicate that these two marshes are contaminant sinks for Reach 3 and Reach 1 dioxin/furan, copper and nickel releases.

Concentrations of 1,2-BPA, which were measured at a maximum of 10,400 µg/Kg in Lockport Marsh and at 4,600 µg/Kg in Reach 1 of Bayou d'Inde indicate that Lockport Marsh is a sink for 1,2-BPA. It is noteworthy that the compound is also largely absent from the remaining marshes, although it is present in Reaches 1 through 3. Lockport Marsh tends to have the highest concentration of TOC and detritus, which may be influential in adsorbing HPAHs.

1,2-BPA is not expected to desorb from the organic rich sediments in Lockport Marsh. It appears to be most concentrated in the 10 to 20-cm interval, and it is expected, along with the majority of PAHs, to remain at these concentrations. Major storm surge may be capable of disturbing and mobilizing the upper 10 cm of sediment in Lockport Marsh, given its proximity to the ship channel and limited seclusion in the lower portion of the area.

7.6.2.2 Metal/Dioxin Factor

This section presents the extent of the Metal/Dioxin Factor and discussion as to the fate and transport of contaminants in this factor. Dioxin/furans in the subsurface are discussed as 2,3,7,8-TCDD TEQ in Section 7.6.4.7.

7.6.2.2.1 Results

The Metal/Dioxin Factor is comprised primarily of metals and includes total HpCDD and total HxCDD. This factor represents 21 percent of the variability in the marsh energy system. Summary statistics for the parameters that group within this factor are presented in Exhibit 7-47 through 7-48.

Exhibit 7-47 Summary Statistics of Metals (mg/Kg) in Metal/Dioxin Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Iron	148/149	772	28,300	11,626	4,960	0.43
Beryllium	126/149	0.24	2.4	0.76	0.27	0.35
Cobalt	123/149	1.6	10.2	5.5	1.8	0.33
Zinc	151/162	9.9	468	148	99	0.67
Aluminum	149/149	956	25,200	11,159	4,900	0.44
Vanadium	149/149	1.8	34.1	18.1	5.9	0.33
Potassium	142/149	818	3,680	2,201	612	0.28
Cadmium	23/162	0.074	3.8	-	-	-

Chromium	149/149	2.8	774	102	129	1.26

1 – Values based on ROS. See Appendix D.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 7-48 Summary Statistics of Dioxins (ρg/g) in Metal/Dioxin Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Total HpCDD	23/23	110	2,700	850	725	0.85
Total HxCDD	23/23	17	1,500	306	357	1.17

1 – Values based on ROS. See Appendix D.

Zinc was used as the indicator variable for this factor.

Surface Sediment

Elevated concentrations of contaminants grouped within the Metal/Dioxin Factor were observed in both Lockport Marsh and the fringe marshes located along the bayou (Figure 7-14). Three areas that exhibited high concentrations include the Lockport Marsh area surrounding the mouth of PPG Canal, the interior of Lockport Marsh, and the fringe marshes located adjacent to and across from Maple Fork Bayou.

Highest concentrations were observed in the fringe marshes near Maple Fork Bayou although elevated concentrations were observed in all fringe marshes. Within Lockport Marsh, concentrations decrease sharply moving towards the Calcasieu River Ship Channel.

Subsurface Sediment

Zinc concentrations decreased in the subsurface in the marshes of Bayou d'Inde as shown in Figure 7-14. Zinc at station BIR3018 did increase in concentration from the 10 to 20-cm to the 20 to 30-cm interval (from 64 to 92 mg/Kg). The highest zinc concentration observed in the subsurface was at BIR3046 with a result of 145 mg/Kg.

Chromium concentrations tend to decrease in the subsurface in the marsh energy system in Bayou d'Inde. At station BIR3018, however, concentrations increase from the 10 to 20-cm interval to the 20 to 30-cm interval. Concentration for this interval at station BIR3018 was 290 mg/Kg.

Surface Water

Zinc and chromium were detected in the surface water in the marsh energy system in Bayou d'Inde. Exhibit 7-49 provides the mean concentrations for total and dissolved chromium (total) and zinc.

Exhibit 7-49 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Metal/Dioxin Factor in Surface Water, Marsh Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Chromium (total)	0.0036 (0.0114)	ND	NA	NA	NA	NA
Zinc	ND	0.01[2]	0.205[3]	0.187[3]	0.090	0.081

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected at one location.
3 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.
NA – Not available. LDEQ provides criteria for Cr^{3+} and Cr^{6+}.

Chromium (total) and zinc did not exceed criteria listed in LDEQ 2000.

7.6.2.2.2 Discussion

As noted earlier, dioxin/furans are discussed as a group for the marsh area as 2,3,7,8-TCDD TEQ concentrations. The following discussion will focus on chromium and zinc.

The distribution of metals (specifically chromium and zinc) is fairly widespread throughout the marshes. Chromium is found to be highest in the fringe marshes near Maple Fork Bayou. Chromium concentrations tend to decrease with depth, being highest in the surface sediments. Zinc concentrations tend to be lower overall than chromium, however the number of positive detections of zinc is slightly higher.

7.6.3 Isolated Chemistry

Several COPCs were detected in 5 percent or greater of the samples did not group with the three major PCA factor groups previously discussed. These include:

- SVOCs (bis[2-ethylhexyl]phthalate, hexachlorobenzene)
- HPAHs and LPAHs
- PCBs
- Inorganics (lead and mercury)

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection is typically low
- The distribution of contamination was different than observed for the compounds for the four major factors

Each of these COPCs is discussed in the following sections. In addition, the nature and extent of dioxin/furans presented as 2,3,7,8-TCDD TEQ is discussed.

7.6.3.1 Bis(2-ethylhexyl)phthalate

This section presents the results of BEHP in the marsh energy system of Bayou d'Inde and discusses the fate and transport of this compound.

7.6.3.1.1 Results

BEHP summary statistics for surface sediment are provided in Exhibit 7-50.

Exhibit 7-50 Summary Statistics of BEHP (µg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
BEHP	83/162	58	8,000	393	865	2.20

1 – Values based on ROS. See Appendix D.

Highest concentration was observed at station BIR2042, which is located in Lockport Marsh (Figure 7-8). Elevated concentrations are also located in the marsh areas between PPG Canal and Maple Fork Bayou.

Subsurface Sediment

BEHP was only detected in the subsurface at only one location, station BIR2072. Concentrations decreased from the surface to the 10 to 20-cm interval (1,100 µg/Kg to non-detect). However, concentrations increased dramatically to 150,000 µg/Kg in the 20 to 30-cm interval.

Surface Water

BEHP was not detected in the surface water in the marsh energy system of Bayou d'Inde.

7.6.3.1.2 Discussion

BEHP was detected in the marsh at a maximum of 8,000 µg/Kg. The maximum was located in Lockport Marsh. The distribution in Lockport Marsh is scattered, no significant trends are apparent. Remaining detections appear to show a trend, the southern most Reach 2 marsh containing stations BIR3054 through BIR3062 contained the greatest number of detections and the second highest concentration. The marsh across Bayou d'Inde (locations BIR3045 through BIR3050) contained the third highest marsh concentration in Bayou d'Inde. This meander in Reach 2 is the main collection point of BEHP that originates upstream. It should be noted however, that the concentrations within the bayou energy system were an order of magnitude higher than those measured in the marshes (80,000 in the bayou, Reach 1 near the mouth of PPG Canal and 8,000 µg/Kg measured in the center of Lockport Marsh, versus 3,900 µg/Kg measured in Reach 2 Marsh).

Limited historic data was collected specifically in the marsh areas. The two available marsh samples collected from the Reach 2 southern marsh area both were non-detect with elevated (1,800U and 2,000U µg/Kg) detection limits.

Potential sources appear to be the Citgo outfall 001 area, and PPG Canal. The concentrations within the bayou portion of d'Inde with the exception of Reach 1 were less than that measured in the Reach 2 marshes. The distribution of BEHP in Lockport Marsh and Reach 1 appear unrelated. The BEHP appears to be adsorbing to bayou sediments versus settling out into Lockport Marsh. This indicates that sufficient quantity of organic material is present within Reach 1 of the bayou to bind available BEHP. Surface water data indicates that the sorption capacity is sufficient to bind BEHP to sediment.

7.6.3.2 Hexachlorobenzene

This section presents the results of hexachlorobenzene (HCB) in the marsh energy system of Bayou d'Inde and discusses the fate and transport of this compound.

7.6.3.2.1 Results

HCB summary statistics for surface sediment are provided in Exhibit 7-51.

Exhibit 7-51 Summary Statistics of HCB (µg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
HCB	10/162	130	790	-	-	-

1 – Values based on ROS. See Appendix D.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

HCB was observed at isolated in Lockport Marsh and the marsh area to the north of PPG Canal. However, there is uncertainty in the extent of HCB in the marsh areas resulting from elevated analytical detection limits (Figure 7-15). Elevated detection limits and non-detectable concentrations in many locations exceed maximum detected concentrations. Highest concentration observed was at station BIR2088, which is located in the northwest corner of Lockport Marsh.

Subsurface Sediment

HCB was not detected in subsurface samples in the marsh energy system in Bayou d'Inde.

Surface Water

HCB was not detected in surface water in the marsh energy system in Bayou d'Inde.

7.6.3.2.2 Discussion

The occurrence of HCB in marsh sediment is limited to Lockport Marsh. The range of concentrations of 130 to 790 µg/Kg is an order of magnitude less than the bayou energy system, indicating that Lockport Marsh may receive flow from Reach 1 but is not a sediment sink for HCB. The distribution within Lockport Marsh indicates that there may be two sources of HCB to Lockport Marsh. It appears that the maximum may be influenced by flow from Bayou d'Inde, communication between the marsh

and bayou is apparent in this area. The remaining low level detections (130 to 240 µg/Kg) are more isolated from the bayou and may have been sourced by overflow of PPG Canal, as they are in the northeastern portion of the marsh, isolated from Reach 1.

The sediments in the isolated portions of Lockport Marsh are less likely to be disturbed by minor storm surge or high spring tides than are the sediments adjacent to the bayou. The HCB sorbs readily to sediment, as was noted by the lack of HCB in marsh surface water, however, disturbance of those sediments could result in mobilization of the HCB.

Historically, HCB was found to be in the same areas of Reach 1 and Lockport Marsh, however the concentrations were higher from 1984 through 1994. Surface sediment concentrations were found to decrease in 1996 and those concentrations are comparable to measurements from the RI.

7.6.3.3 PAHs

This section presents the results of PAHs in the marsh energy system of Bayou d'Inde and discusses the fate and transport of this compound. PAHs were calculated by summing the corresponding low or high molecular weight PAHs that were detected. Non-detects were not included in the summation due to elevated detection limits.

7.6.3.3.1 Results

HPAHs and LPAHs were summed for the marsh energy system in Bayou d'Inde as described in Section 4. PAHs summary statistics for surface sediment are provided in Exhibit 7-52.

Exhibit 7-52 Summary Statistics of PAHs (µg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
HPAH	50/160	61	66,884	2,917.7	12,089.7	4.1
LPAH	21/160	26	73,800	6,511.3	2,0106.5	3.1
TPAH	53/160	26	73,800	5332.5	15,699.9	2.9

1 – Values based on ROS. See Appendix D.

Elevated HPAH concentrations were located throughout the marsh areas in Bayou d'Inde (Figure 7-16). Highest HPAH concentration was observed at station BIR2020 in the northern portion of Lockport Marsh.

Similar to HPAH, highest LPAH concentration was observed at station BIR2020 (Figure 7-17). Elevated concentrations were not as widespread as HPAHs, but were at greater concentrations and were less variable.

Subsurface Sediment

HPAHs were detected in the subsurface at stations BIR3018 and BIR3046 (Figure 7-16). At station BIR3018, concentrations were similar ranging from 53 to 82 µg/Kg. At station BIR3046, HPAHs were not detected in the surface layer, but were detected at the 10 to 20-cm interval with a concentration of 1,180 µg/Kg.

Surface Water

PAHs were not detected in the surface water in the marsh energy system of Bayou d'Inde.

7.6.3.3.2 Discussion

PAH distribution in the Bayou d'Inde marshes consists primarily of HPAH compounds, as noted in the bayou. The primary PAH compound in the marshes is pyrene. The concentrations are most notable in the Maple Fork Bayou and downstream Reach 2 marshes (stations BIR3018, BIR3036 and BIR3067). Marsh concentrations of TPAHs are higher in the marshes than those measured in the bayou portion Bayou d'Inde (73,800 µg/Kg marsh maximum versus 3,737 µg/Kg maximum in the bayou). Concentrations tend to be highest within the interior of Lockport Marsh, indicating possible flow from the PPG Canal. This is noted for LPAH and HPAH groups. Concentrations within the Maple Fork Bayou and downstream Reach 2 marshes are elevated, however, lower than measurements in Lockport Marsh. Potential sources of low and high molecular weight PAHs to Bayou d'Inde include Citgo (LPAHs), Equistar (LPAHs), and Westlake Polymers (LPAHs and HPAHs). Further, oil and gas production activities in Lockport Marsh may be localized sources of PAHs.

Historically, the distribution and contaminant suites were similar, although concentrations were generally higher. Vertically, PAH distribution varies from the marsh at Maple Fork Bayou to the marsh at station BIR3046 in Reach 2. At Maple Fork Bayou the concentrations are generally consistent with depth, however downgradient at station BIR3046 the concentration increase from non-detect at the surface to a maximum of 1,180 µg/Kg in the 10 to 20-cm interval. This may indicate that there are more sources that are recent closer to this upstream location. Vertical extent was not sampled in Lockport Marsh.

Potential sources of PAHs to Bayou d'Inde marshes appear to be the Citgo outfall 001 area, Westlake Polymers outfall 001 area and the PPG Canal.

7.6.3.4 PCBs

This section presents the results of PCBs in the marsh energy system of Bayou d'Inde and discusses the fate and transport of this compound.

7.6.3.4.1 Results

Surface Sediment

Aroclor 1254 and Aroclor 1260 were detected in the marsh energy system in Bayou d'Inde. Aroclor 1260, however, was only detected at two locations with concentrations ranging from 120 to 140 µg/Kg. Aroclor 1254 had a higher detection frequency and the summary statistics are presented in Exhibit 7-53.

Exhibit 7-53 Summary Statistics of Aroclor 1254 (µg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Aroclor 1254	49/111	4.9	1,300	116	235	2.04

1 – Values based on ROS. See Appendix D.

Elevated concentrations of Aroclor 1254 were predominantly located in the fringe marshes in Reach 2 (Figure 7-10). Concentrations tend to decrease in the marshes moving downstream towards the Calcasieu River Ship Channel and into Lockport Marsh. Aroclor 1254 was only detected at 13 locations within Lockport Marsh with concentrations less than what was observed in the upper reaches of Bayou d'Inde. Station BIR3018 was observed to have the maximum concentration and is located in a fringe marsh adjacent to Maple Fork Bayou. Stations BIR3007 and BIR3041 were observed to have similar concentrations.

PCB-105, 118, 15, 61/70, and 66 accounted for more than 70 percent of total PCB concentration at stations in the marsh energy area where congeners were measured (Figure 7-11). PCB-118 and PCB-15 tended to be the more dominant congeners. Distribution in the surface sediment tends to show a prevalence of either PCB-118 or PCB-15. In the upper marshes (e.g., BIR3018) PCB-118 accounts for 37% of the PCBs detected. At location BIST011, PCB-15 accounted for 35%. This trend tends to reverse near BIR3046.

Subsurface Sediment

Aroclor 1254 was measured in the subsurface at stations BIR3018 and BIR3046 (Figure 7-10). At station BIR3018, concentrations decreased with depth from 1,300 µg/Kg in surface sediment to 910 µg/Kg in the 10-20 cm interval and finally to 650 µg/Kg in the 20 to30-cm interval. At station BIR3046, concentrations decreased from 810 µg/Kg in surface sediment to 620 in the 10 to –20-cm interval and finally to 310 in the 20 to 30-cm interval.

Elevated PCB congener concentrations were observed at stations BIR3018 and BIR3046 (Figure 7-11). The dominant congeners were PCB-105, PCB-118, PCB-61/70, and PCB-66 at both locations. PCB-15 was also a dominant congener at station BIR3046, but detected at low concentrations at station BIR3018.

At station BIR3018, PCB congener concentrations increased from the surface sediment interval to the 10 to 20-cm interval. Concentrations then decreased to near surface sediment levels. PCB-118 was the dominant congener in all three depths with a maximum concentration of 125,000 ng/Kg at the 10 to 20-cm interval.

At station BIR3046, PCB congener concentrations tended to decrease with depth for the dominant congeners. The dominant congener in surface sediment was PCB-15 with a concentration of 69,100 ng/Kg.

Surface Water

Aroclor 1254 was detected at station BIR3013, which is located in the Maple Fork Bayou marsh, upstream of Maple Fork Bayou. Surface water concentrations are compared to established criteria in Exhibit 7-54.

Exhibit 7-54 Aroclor 1254 in Surface Water, Marsh Energy System

Analyte	Mean[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Aroclor 1254	0.21[2]	2.00	**0.0140**	10.0	**0.03**

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected at one location.
3 – Criteria for Total PCBs

The reported result exceeded the fresh and marine chronic criterion established by LDEQ.

7.6.3.4.2 Discussion

Aroclor 1254 detected within the fringe marshes of Bayou d'Inde was widespread. The highest concentration noted was found upstream of Maple Fork Bayou and continued to downstream marshes in Reach 2 (primarily on the south side of Bayou d'Inde). The concentrations decreased downstream. The concentrations are higher than what was measured in the bayou energy system. This may indicate that material is moved from the bayou to the marshes by surge or storm events and that there are not considerable ongoing releases adding PCBs to the system in Reach 2. This is consistent with release history information. The concentrations vary in Lockport Marsh and there appears to be downstream movement in Reach 1 of the bayou.

Historically, the distribution of total PCBs was similar to previous sampling events. Aroclor 1254 decreased with depth at both core locations in the fringe marshes. Core locations were not collected in Lockport Marsh. Congener analysis indicates that near Maple Fork bayou the dominant congener is PCB-118 (maximum value of 125,000 ng/g), whereas at station BIR3046 downstream, the dominant congener is PCB-15 (maximum value of 69,100 ng/g). This may indicate that the PCB-118 source was nearer to station BIR3018 and material has moved downstream, collecting in the Reach 2 marshes. Cores were not sampled in Lockport Marsh.

Aroclor 1254 was detected at 0.21 µg/L at station BIR3013, at the Maple Fork Bayou marsh. It is unlikely, due to the nature of Aroclor 1254 that this aqueous detection is

the result of desorption from impacted sediments and may be the result of an unknown localized release.

The former OxyChem impoundments Reach 3 industrial area and the PPG Canal may be potential sources of PCBs in Bayou d'Inde.

7.6.3.5 Lead

This section presents the nature and extent of lead in the marsh energy system in Bayou d'Inde and describes its fate and transport in the environment.

7.6.3.5.1 Results

Surface Sediment

Lead, although present throughout the marshes, was found in the highest concentrations in Lockport Marsh (Figure 7-18). Summary statistics for lead is presented in Exhibit 7-55.

Exhibit 7-55 Summary Statistics of Lead (mg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Lead	153/162	4.6	902	87	117	1.3

1 – Values based on ROS. See Appendix D.

Within Lockport Marsh, elevated lead concentrations were typically found near the mouth of PPG Canal and near the center of the marsh. The highest concentration was located at station BIR2044, which is located between the roads in the marsh and the Calcasieu River Ship Channel.

Subsurface Sediment

In the subsurface, lead tended to decrease with depth (Figure 7-18). Station BIR3046 exhibited the highest subsurface concentration (64.5 mg/Kg) in the 10 to 20-cm interval.

Surface Water

Total lead was detected at 7 of 8 locations whereas dissolved lead was detected at 3 of 8 locations. Exhibit 7-56 presents the mean concentrations for total and dissolved lead and compare to LDEQ criterion.

Exhibit 7-56 Mean & Standard Deviation of Total and Dissolved Concentrations Lead (mg/L) in Surface Water, Marsh Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Lead	0.0030 (0.0011)	0.0015 (0.0011)	0.138[3]	0.00531[3]	0.209	0.00808

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected in one sample.

3 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.

Dissolved concentrations of lead in surface water did not exceed criterion established by LDEQ.

7.6.3.5.2 Discussion

Lead distribution tends to be highest in Lockport Marsh followed by the middle Reach 2 marshes (station BIR3060). Lockport Marsh detections tend to be concentrated near the mouth of PPG Canal or in the center of the marsh. The maximum location within Lockport Marsh is isolated somewhat away from the PPG Canal and the bayou. The location likely receives flow from the Calcasieu River Ship Channel. Concentrations tend to exceed the reference area lead results.

Lead concentrations decrease with depth in all multi-depth samples. Surface water samples do not exceed CCC or CMC adjusted limits.

7.6.3.6 Mercury

This section presents the nature and extent of mercury in the marsh energy system in Bayou d'Inde and describes its fate and transport in the environment.

7.6.3.6.1 Results

Elevated mercury concentrations were primarily in Lockport Marsh (Figure 7-19). The high variability of mercury in sediment may be possibly due to the maximum detected value (Exhibit 7-57).

Exhibit 7-57 Summary Statistics of Mercury (mg/Kg) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
Mercury	145/162	0.11	93.9	2.7	9.3	3.5

1 – Values based on ROS. See Appendix D.

Station BIR2013 in Lockport Marsh had a detected value of 94 mg/Kg. This station is located near the mouth of PPG Canal where it enters into Bayou d'Inde. The next highest concentration of mercury is at station BIR2023 with a detected value of 13 mg/Kg.

Subsurface Sediment

Mercury concentrations decreased with depth as shown in Figure 7-19. Station BIR3046 had the highest detected concentration (1.4 mg/Kg) in the 10 to 20-cm interval.

Surface Water

Total mercury was detected at 8 of 8 locations within the marsh energy system whereas dissolved mercury was only detected at one location. Mean concentrations are presented in Exhibit 7-58.

Exhibit 7-58 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Metal Factor in Surface Water, Marsh Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Mercury	0.00017 (0.0009)	0.000078[2]	0.0017[3]	0.00001[3]	0.0017	**0.000021**

1 – Based on ROS. See Appendix D. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected in one sample.
3 – LDEQ Water Quality Regulations (LDEQ 2000) based on 200 mg/L hardness for dissolved concentrations.

Dissolved concentrations of mercury did not exceed LDEQ established criterion.

7.6.3.6.2 Discussion

Mercury concentrations within the marshes are elevated in Lockport Marsh and Maple Fork Marsh. The most significant detection was noted near the mouth of PPG Canal and measured 93 mg/Kg. The remaining values were not significantly elevated. The second highest marsh detection was noted in Maple Fork Bayou at 12 mg/Kg. The remaining values were fairly consistent, with concentrations ranging from 1 to 3 mg/Kg. Historical results are similar, including a maximum of 58 mg/Kg. The maximum measured concentrations at station BIR2013 and the isolated nature of the area in Lockport Marsh suggest a source other than the PPG Canal or Bayou. Local oil field operations (i.e., gas well monometers) may have contributed to localized elevated mercury detections.

Mercury tends to accumulate in the marsh areas; in general the concentrations are higher in the marshes than those noted for the bayou energy system. Also, elevated concentrations are typically surficial occurrences.

7.6.3.7 2,3,7,8-TCDD TEQ

This section presents the nature and extent of 2,3,7,8-TCDD TEQ in the marsh energy system in Bayou d'Inde and describes its fate and transport in the environment. Dioxin/furans were evaluated as 2,3,7,8-TCDD TEQ since various dioxins/furans are grouped with different factors. In addition, some dioxin/furans may be at background concentrations and this will provide an overall picture of areas that may exhibit elevated concentrations of dioxin/furans.

7.6.3.7.1 Results

Surface Sediment

The concentrations of 2,3,7,8-TCDD TEQ are variable in the marsh areas of Bayou d'Inde (Exhibit 7-59). Elevated concentrations were found in the marshes adjoining the bayou and in Lockport Marsh (Figure 7-14). The maximum concentration was

detected at station BIST011, which is at the mouth of PPG Canal prior to it entering into Bayou d'Inde.

Exhibit 7-59 Summary Statistics of 2,3,7,8-TCDD TEQ (ρg/g) in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of variance
2,3,7,8-TCDD TEQ	24/25	1.16	1,645.65	201.85	397.17	1.97

1 – Values based on ROS. See Appendix D.

Subsurface Sediment

Dioxin/furans as expressed as 2,3,7,8-TCDD TEQ typically decreased with depth with the exception of station BIR3018 (Figure 7-14). At station BIR3018, concentrations slightly increased with depth from 33 to 57 ρg/g. Station BIR3046 had the highest subsurface detection at the 10 to 20-cm interval with a value of 201 ρg/g.

Surface Water

Dioxin/furans were not analyzed in surface water.

7.6.3.7.2 Discussion

2,3,7,8-TCDD TEQ values are variable in Bayou d'Inde, however, they tend to be highest at the mouth of PPG Canal. Concentrations in core samples tend to decrease with depth. One exception is Maple Fork Bayou where concentrations increased slightly. Concentrations at depth generally approximate the surface sample mean. Concentrations are slightly higher in the marshes than values measured for the bayou. Dioxin concentrations in general are elevated in Lockport Marsh and may be attributed to the local operation of industrial incinerators. Localized surface deposition of air emissions impacting surface run-off into the PPG Canal and subsequently Lockport Marsh.

Historically, dioxin/furans data was not collected. No temporal comparison is available for 2,3,7,8-TCDD TEQ.

7.7 Summary and Conclusions

This section summarizes the COPCs found in Bayou d'Inde and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability and chemical fate and transport.

7.7.1 Summary

Bayou d'Inde is divided into five geographic areas; four reaches in the bayou energy system and the marsh areas. Marshes are present in Reaches 1 and 2. The reaches are defined in Section 7.1.2 and Figure 7-1. Lower Bayou d'Inde below highway LA-108 can be characterized as a

Potential Sources to Bayou d'Inde:

Citgo, Equistar, Firestone, Westlake Polymers, Montell USA, and PPG

moderately-saline to saline, broad channelized ship channel with significant industrial development. The upper reach of Bayou d'Inde (Reach 4) is a less saline, steep-sided, narrow and vegetated low-flow system. The drainage area for the upper reach (Reach 4) is generally rural residential. The majority of Bayou d'Inde from Reaches 1 through 3 receives surface runoff and wastewater discharge from several industrial facilities (PPG, Westlake Polymers, Firestone, Citgo and Equistar [formerly OxyChem]), (Figure 7-2). Point and non-point sources are present in Reaches 1 through 3. Introduction of contaminants to the system appears to occur due to industrial release primarily between Little Bayou d'Inde and Highway LA-108 and near the LA-108 Bridge; through unidentified release to Maple Fork Bayou; and from industrial release to the PPG Canal.

Contaminants of primary interest in Bayou d'Inde are those contaminants that increase human health or ecological risk. The occurrence of COPCs varies across Bayou d'Inde; the following is an overview of the condition of each of the four reaches and associated marshes, within Bayou d'Inde.

Contaminants of Potential Concern in Bayou d'Inde:

Dioxin/Furans, PCBs, Mercury, HPAHs, LPAHs, BEHP, HCB, and HCBD

The largest set of contaminants and generally the greatest concentrations are found in Reach 1 of Bayou d'Inde and Lockport Marsh. PPG operates three major process areas in the immediate vicinity: the Chlor-Alkali plant; the Derivatives plant and the Chlor-Alkali/Silicas area. All process areas drain to the PPG Canal. Further three offsite facilities, CetainTeed Products, Jupiter Chemicals and Big Three Industries also discharge to the PPG Canal. The non-PPG permitted design flows account for 1 MGPD of a 233 MGPD design flow capacity for the PPG Canal.

Dioxin/furans are predominant in Reaches 1 through 3, Lockport Marsh and Maple Fork Bayou Marsh (the location of sample BIR3018). Dioxin/furan concentrations are comparable where bayou and marsh locations are present. Dioxin/furan contamination is widespread throughout Bayou d'Inde. Primary impacted areas are lower Reach 3 and Reach 1. The highest 2,3,7,8-TCDD TEQ (or most toxic) concentrations are found in Reach 1 and in Lockport Marsh (see Figure 7-13). No documented sources of dioxin/furans were noted in the regulatory record, however, it is noted that incomplete or uncontrolled combustion of PCBs may result in the production of dioxin or furan compounds and industrial incinerators in the area used to burn chlorinated wastes.

PCBs tend to occur in two areas in two primary groupings, those grouped with PCB-118 and those with PCB-15. The PCB-118 group appears to originate in lower Reach 3 and extends through to the middle Reach 2 marsh area (BIR3046). The apparent source of this is the former OxyChem impoundments. The PCB-15 impacted areas begin at PPG Canal and are prevalent up to BIR3046 in middle Reach 2 marsh and extend downstream through Reach 1 to the ship channel. Lockport Marsh contains the highest detection of PCBs at location BIR2018, near the mouth of PPG Canal. The

occurrence of PCBs in Lockport Marsh is within the bermed area. No documented PCB releases were noted in the regulatory record, however PCBs are handled and disposed of through incineration at PPG and localized air deposition is likely. Surface transport of impacted soils to the estuary may be occurring.

Mercury tends to be found from Maple Fork Bayou through Reach 1 to the ship channel. The concentrations, however lower, extend into upper Reach 2. Mercury concentration is highest in the marshes. Potential sources to Lockport Marsh include the former PPG mercury-cell settling pond that was operated in the late 1960's. The pond was an unlined impoundment within the PPG Canal drainage area. In addition, enforcement history data indicates numerous NPDES exceedances. It should be noted that elevated, localized detections within Lockport Marsh may be due to the use of mercury manometers by the oil and gas industry. These manometers contain elemental mercury and are sometimes damaged or broken on-site, causing localized mercury release.

HPAHs are found in the highest concentration in Reach 1, Lockport Marsh, Maple Fork Bayou marsh (BIR3018) and the eastern Reach 2 marsh (BIR3036). PPG Canal, Maple Fork Bayou, lower Reach 3 and LA-108 appear to be the sources of these PAHs. Elevated concentrations are noted in the marshes upstream of PPG Canal and may indicate overflow conditions to this area. HPAHs tend to be slightly higher in concentration in the marshes than in the bayou sediments, overall. No known sources exist on Maple Fork Bayou, although numerous industrial pipelines, a highway and a railroad spur cross Maple Fork near the highest detections, release from these operations are unknown. Urban runoff from the nearby highways may be a source of PAHs, as well.

LPAH distribution is not as widespread in Bayou d'Inde as HPAHs. The LPAHs tend to be found in Lockport Marsh and concentrations are generally higher than HPAHs. The second highest concentration of LPAHs is in Maple Fork Bayou, in lower Reach 3 and near LA-108 in Reach 2. In general, LPAHs tend to increase with depth. Potential LPAH sources include PPG, Citgo, Westlake Polymers and Equistar.

BEHP is found throughout Bayou d'Inde and in Reaches 2 and 3. Potential sources of BEHP include Westlake Polymers, and Equistar. BEHP appears to accumulate in the Reach 2 marshes (predominantly the Middle and Lower Reach 2 marshes, areas identified by BIR3054 and BIR3062, respectively) in this area. However, in Reach 1 where significant levels of BEHP as found, the bayou contains the majority of the contaminant, not the marsh. The concentrations in the bayou are greater than the Lockport Marsh by an order of magnitude in Reach 1. The overall distribution of BEHP suggests that the compound is greatly influenced by the presence of suspended or colloidal phase material in the water column. The distribution of BEHP indicates the greatest degree of transport of any COPC in Bayou d'Inde and suggests that its concentration in sediment is an indicator of low surface water flow velocity (high settling rate) and high organic or detritus material, either particulate or suspended. Flow appears to control BEHP distribution, as noted in Reach 1 where the

configuration of the channel has been modified creating a broader, slower flow regime.

7.7.2 Conclusions

The general distribution of COPCs in Bayou d'Inde is complex, given the multiple sources and flow dynamics. Industrial releases to Reaches 1 and 3 are a significant component of surface water flow volume in Bayou d'Inde. Permitted and unpermitted discharges mix with surface water in the bayou that migrate up and downstream via, natural pathways, wind and tidal fluctuation. Large storms may push water and sediment upstream in Bayou d'Inde perhaps explaining the isolated occurrences of COPCs in Reach 4.

In the upstream region, Reach 4, the level of contamination is minimal; the primary contaminants noted are LPAHs, mercury, copper, BEHP, and PCBs. The detections were noted downstream of I-10 and in the lower portion of Reach 4 near Little Bayou d'Inde.

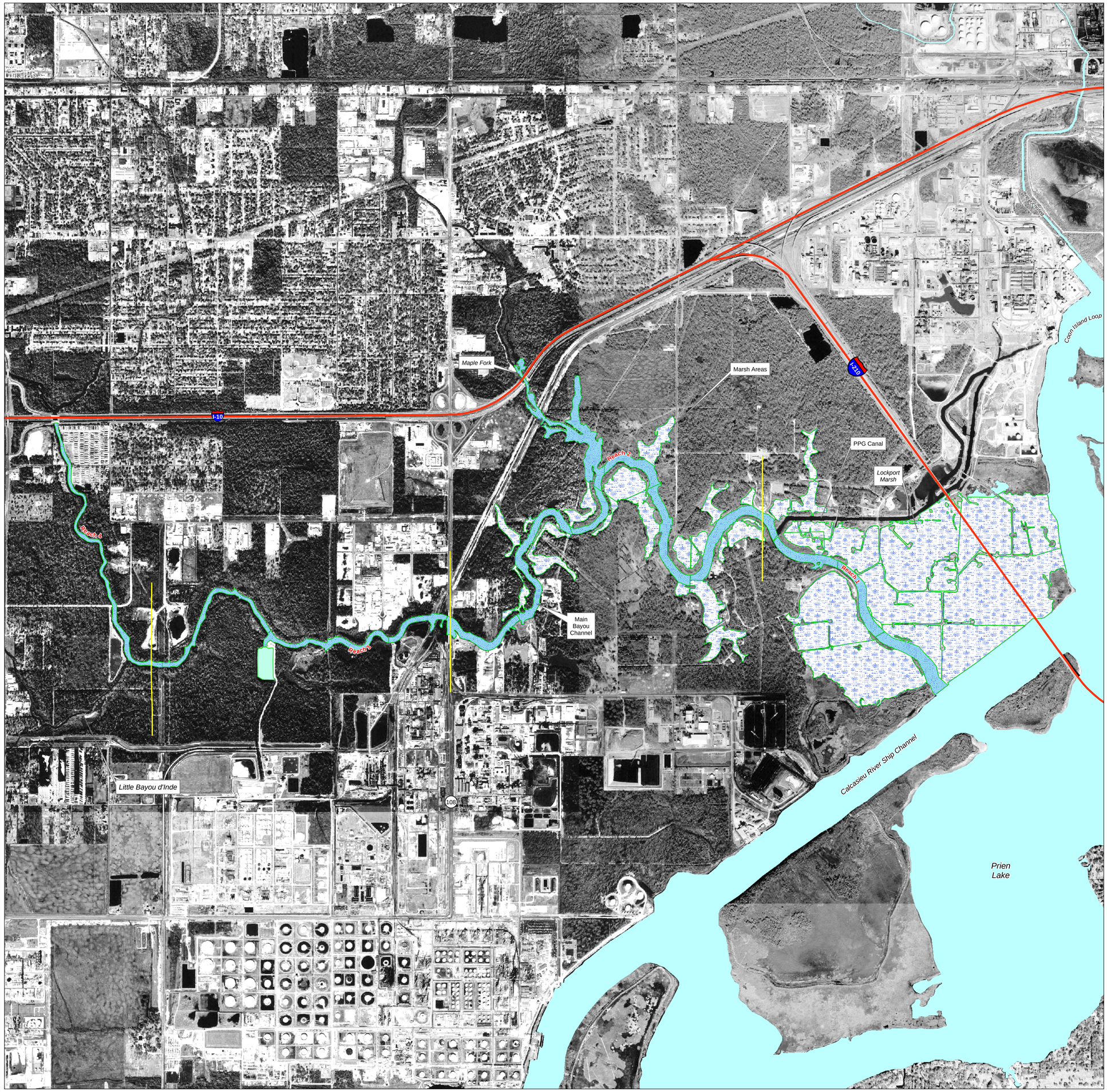
Reach 3 contained a number of COPCs and concentrations in the area tend to be the second highest observed in all of Bayou d'Inde. Two areas of possible sources were noted, the area near Citgo outfall 001 and upstream of the LA-108 bridge near the Equistar and Westlake Polymers outfalls. Primary COPCs in Reach 3 are dioxin/furans, PCBs, BEHP, HPAHs, LPAHs, and mercury.

Reach 2 COPCs are essentially the same as Reach 3, however, PCBs mercury, HPAHs, and BEHP tend to dominate. Reach 2 marshes tend to show the highest concentrations for metals, dioxin/furans and most HPAHs. Concentrations tend to be about the same in the marshes and the bayou for PCBs and tend to be lower in the marshes in Reach 2 for LPAHs. Reach 1 was the area with the greatest number of compounds detected and the highest COPC concentrations. Reach 1 COPCs are dioxin/furans, PCBs, BEHP, mercury, HPAHs, LPAHs, HCB, and HCBD.

Overall, contaminants appear to be highest in Reach 3, Maple Fork Bayou, Reach 1, and Lockport Marsh. The contaminant suite in each of these areas is similar, and may represent some source and transported sediment overlap. The data suggests that fine or suspended particle transport is active in Bayou d'Inde. Flocculation and suspended particle binding may be prevalent for some compounds (LPAHs, BEHP, and some metals). Distribution and concentration gradients of many of the COPCs indicate sediment movement into the marshes, however this is not the case for all compounds. Overall, sediment stability tends to be moderate to poor. Open areas of Lockport Marsh are susceptible to sediment mobilization. Reaches 2 and 3 tend to be net sediment exporters. Sediment stability within the fringe marshes in Reach 2 is typically good. Potential for mobilization from the marshes immediately upstream of PPG Canal is moderate given the increased flow potential in Reach 1. It appears that re-suspension of fine grained material (organic or inorganic) facilitates physical transport throughout Bayou d'Inde.

Figure 7-1
Bayou d'Inde Energy Areas and Reaches

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Interstate
- Reach Extents
- Bayou d'Inde AOC Boundary
- Water

Energy Area

- Bayou
- Marsh
- Shallow Lake

N
W E
S

Kilometers
0 0.25 0.5 1

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Region 6

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Map Filename: Figure7-8BIEnergyAreasReaches-Esize.mxd 09/04/2002

Figure 7-2
Bayou d'Inde Industries
and
Current and Historical NPDES Outfall Locations

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

NPDES Outfall Status

- Unknown
- Active
- Inactive
- Interstate
- Reach Extent
- Bayou d'Inde AOC Boundary
- Water

Energy Systems

- Bayou
- Marsh
- Shallow Lake

Industrial Property

- Firestone
- Certainteed
- CitCon
- Citgo
- Conoco/Citgo
- Entergy
- Himont
- LA Pigment
- Lower Calcasieu Harbor/terminal
- Occidental (OxyChem)/Equistar
- PPG
- Westlake Polymer Corp
- Jupiter

Note: NPDES outfall locations are based on information provided as of 1998. Outfalls may be currently inactive or relocated.

Locations shown are based on coordinates supplied in the permits or information provided by the respective companies. The location represent sampling locations and may not be the point of entry into the surface water body (e.g. Bayou d'Inde, Bayou Verdine, Upper or Lower Calcasieu).

N
W E
S

Kilometers
0 0.25 0.5 1

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Map Filename: Figure7-8BIHistoricalNPDES-Esize.mxd 09/05/2002

Figure 7-3
Bayou d'Inde Grain Size Distribution
in Surface Sediment
Bayou and Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary

Energy Area

- Bayou
- Marsh
- Shallow Lake
- Water

- Percent Clay
- Percent Sand
- Percent Silt

N
W E
S

Kilometers
0 0.25 0.5 1

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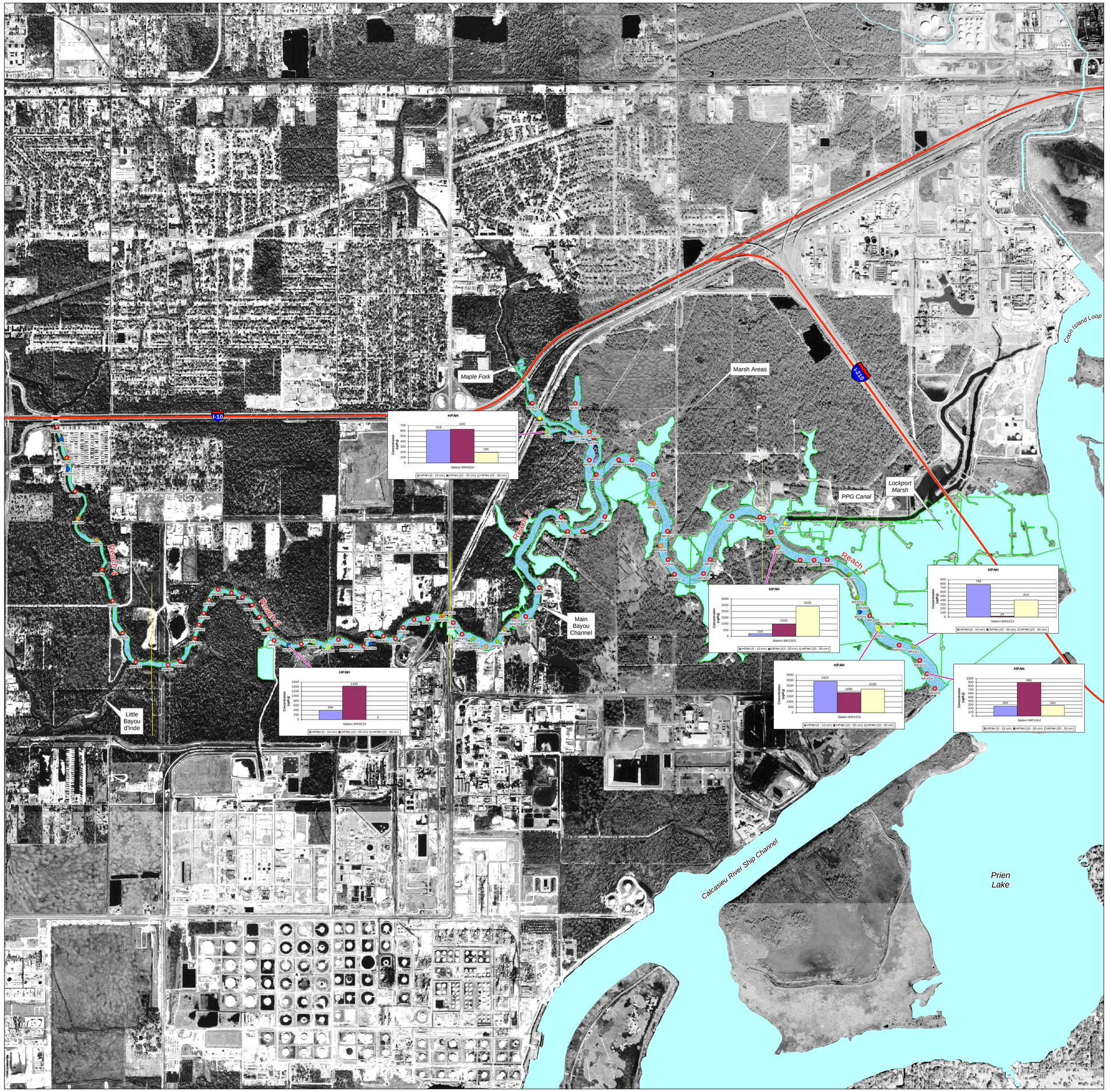
Prepared by CDM

Map Filename: Figure7-13BIParticleSizeAnalysisBayou-Esize.mxd 09/04/2002

Figure 7-4
Major Cations/PAH Factor
Bayou d'Inde AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area

Benzo(a)anthracene (ug/kg)

- 34 - 62
- 63 - 160
- 161 - 270
- 271 - 636
- 637 - 4900

Benzo(a)anthracene Non-Detects (ug/kg)

- 63 - 160
- 161 - 270
- 271 - 636
- 637 - 4900

Benzo(a)anthracene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Iron
Potassium
Beryllium
Arsenic
Aluminum
Magnesium
Vanadium
Cobalt
Manganese
Benzo(b)fluoranthene
Benzo(a)anthracene
Endrin Aldehyde
Sodium

N
W E
S

Kilometers
0 0.25 0.5 1

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Region 6

Prepared by CDM

Map Filename: Figure7-4BIMajorCationsPAHFactor-Esize.mxd 10/16/2002

Figure 7-5
Furan/Dioxin/Metal Factor
Bayou d'Inde AOC
Bayou and Marsh Energy Systems

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water

Nickel Bayou (mg/kg)

- 1 - 12
- 13 - 21
- 22 - 31
- 32 - 54
- 55 - 110

Bayou Metals Concentration Grid (based on Nickel) mg/kg

- High : 110 mg/kg
- Low : 1 mg/kg

Nickel Marsh (mg/kg)

- 1 - 12
- 13 - 21
- 22 - 31
- 32 - 54
- 55 - 110

Nickel Marsh Non-Detects (mg/kg)

- 1 - 12
- 13 - 21
- 22 - 31

Marsh Metals Concentration Grid (based on Nickel) mg/kg

- High : 110 mg/kg
- Low : 1 mg/kg

Nickel is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was
ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration
values or cleanup levels.

Contaminants grouped in this factor for the bayou are:
Total TCDF
Total PeCDF
Total HxCDF
OCDF
Total HpCDF
Total TCDD
Hexachloro-1,3-butadiene
Beta-BHC
Phenol
Copper
Lead
Mercury
Nickel

Contaminants grouped in this factor for the marsh are:
Endosulfan Sulfate
Total PeCDF
Total HxCDF
Aldrin
Total TCDF
Beta-BHC
4,4'-DDE
Total HpCDF
OCDF
Total TCDD
Gamma-BHC
Nickel
1,2-Benzphenanthracene
Copper
4,4'-DDD

N
W E
S

Kilometers
0 0.25 0.5 1

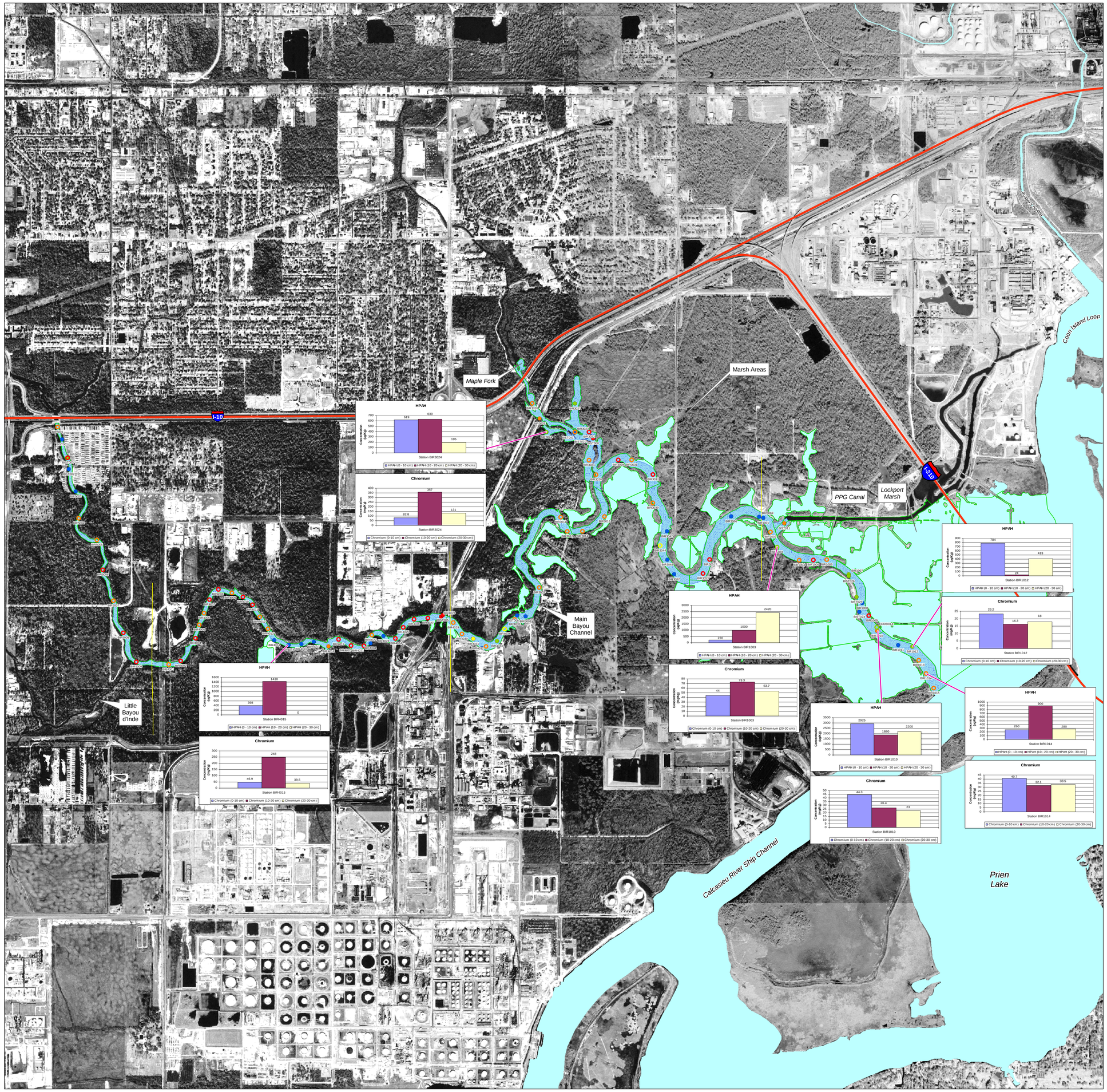
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-5BIDioxinFuranFactor-EsizewithGraphs 09/11/2002

Figure 7-6
Dioxin/PAH/Pesticide/Metal Factor
Bayou d'Inde AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area

Pyrene (ug/kg)

- 85 - 178
- 179 - 321
- 322 - 530
- 531 - 985
- 986 - 4900

Pyrene Non-Detects (ug/kg)

- 179 - 321
- 322 - 530
- 531 - 985
- 986 - 4900

Pyrene is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total HxCDD
Total HpCDD
OCDD
Fluoranthene
Pyrene
Benzaldehyde
Aroclor 1260
Chromium
Silver

N
W E
S

Kilometers
0 0.25 0.5 1

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Region 6

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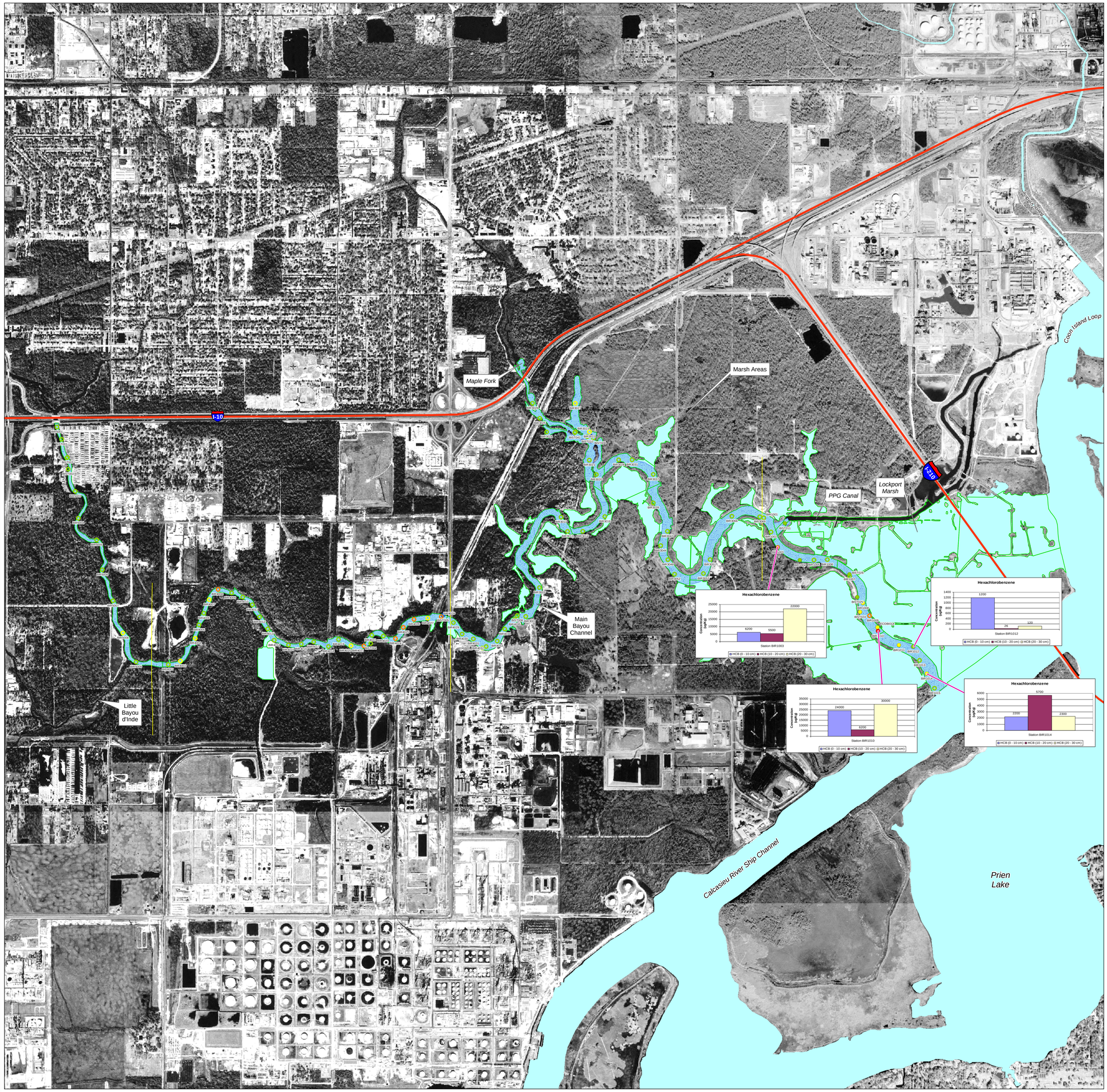
Map Filename: Figure7-6BIPyrenePAHFactor-Esize.mxd 09/18/2002

Figure 7-7
Pesticide Factor
Bayou d'Inde AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area

Hexachlorobenzene (ug/kg)

- 20
- 21 - 1200
- 1201 - 2600
- 2601 - 6200
- 6201 - 24000

Hexachlorobenzene Non-Detects (ug/kg)

- 21 - 1200
- 1201 - 2600
- 2601 - 6200

Hexachlorobenzene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Aldrin
Gamma-BHC
4,4'-DDE
Endosulfan Sulfate
Heptachlor
Hexachlorobenzene

N
W E
S

Kilometers
0 0.25 0.5 1

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Region 6

Prepared by CDM

Map Filename: Figure7-7BIPesticideFactor-Esize.mxd 10/16/2002

Figure 7-8
Bis(2-ethylhexyl)phthalate
Bayou d'Inde AOC
Bayou and Marsh Energy Systems

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Bis(2-ethylhexyl)phthalate Bayou (ug/kg)

- 58 - 250
- 251 - 560
- 561 - 2500
- 2501 - 36000
- 36001 - 80000

Bis(2-ethylhexyl)phthalate Bayou Non-Detects (ug/kg)

- 58 - 250
- 251 - 560
- 561 - 2500
- 2501 - 36000

Bis(2-ethylhexyl)phthalate Marsh (ug/kg)

- 58 - 250
- 251 - 560
- 561 - 2500
- 2501 - 36000

Bis(2-ethylhexyl)phthalate Marsh Non-Detects (ug/kg)

- 58 - 250
- 251 - 560
- 561 - 2500
- 2501 - 36000

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-8BIBis2EthylHexBayouMarsh-Esize 09/24/2002

Figure 7-9
Low Molecular Weight PAHs
Bayou d'Inde AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area

LPAH (ug/kg)

- 25 - 2000
- 2001 - 6640

LPAH Non-Detects (ug/kg)

- 25 - 2000
- 2001 - 6640
- 6641 - 9600
- 9601 - 15200
- 15201 - 39200

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

LPAHs consist of the following:
1Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

N
W E
S

Kilometers
0 0.25 0.5 1

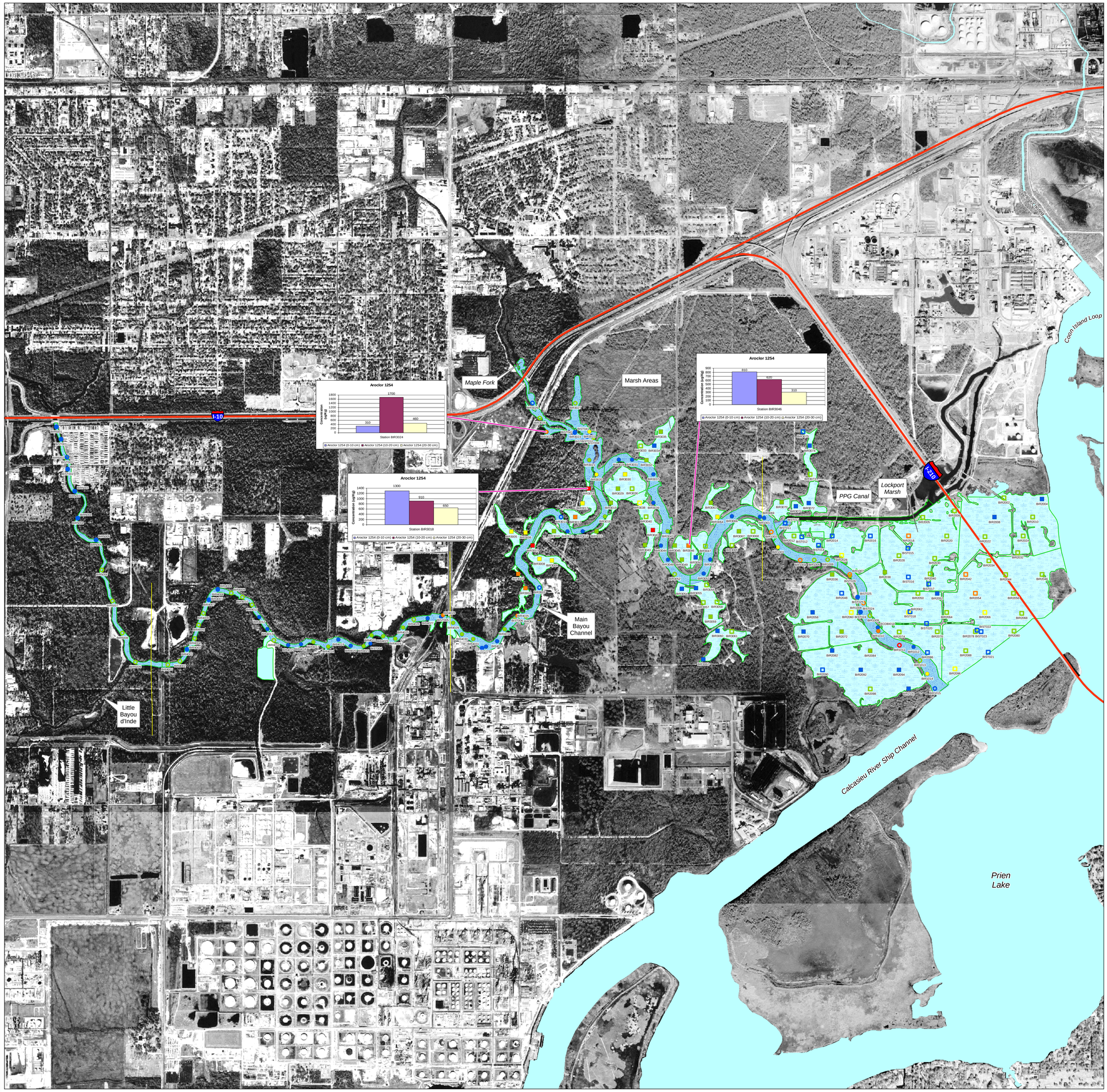
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-9BILPAHinBayou-Esize 09/24/2002

Figure 7-10
Aroclor 1254
Bayou d'Inde AOC
Bayou and Marsh Energy Systems

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Aroclor 1254 Bayou (ug/kg)

- 5 - 72
- 73 - 170
- 171 - 260
- 261 - 860

Aroclor 1254 Non-Detects Bayou (ug/kg)

- 5 - 72
- 73 - 170
- 171 - 260
- 261 - 860
- 861 - 1300

Aroclor 1254 Marsh (ug/kg)

- 5 - 72
- 73 - 170
- 171 - 260
- 261 - 860
- 861 - 1300

Aroclor 1254 Non-Detects Marsh (ug/kg)

- 5 - 72
- 73 - 170
- 171 - 260
- 261 - 860

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-10BIAroclor1254BayouMarsh-Esize 09/24/2002

Figure 7-11
PCB Congeners
in Surface Sediment
Bayou and Marsh Energy Systems
Bayou d'Inde AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy System

Total PCB Congeners

- PCB Total

- PCB 105
- PCB 108
- PCB 114
- PCB 118
- PCB 126
- PCB 127
- PCB 15
- PCB 156
- PCB 157
- PCB 162
- PCB 167
- PCB 169
- PCB 189
- PCB 37
- PCB 58
- PCB 60
- PCB 61/70
- PCB 66
- PCB 77
- PCB 79
- PCB 80
- PCB 81

N W E S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-11BIPCBCongenerResultsCOMBO-Esize.mxd 09/24/2002

Figure 7-12
Zinc
Bayou d'Inde AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water

Zinc (mg/kg)

- 26 - 95
- 96 - 168
- 169 - 288
- 289 - 470
- 471 - 700

Zinc Non-Detects (mg/kg)

- 26 - 95
- 96 - 168
- 169 - 288
- 289 - 470

Zinc Concentration Grid (mg/kg)

- High : 700
- Low : 26

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-12BIZincBayou-Esize.mxd 09/24/2002

Figure 7-13
2,3,7,8-TCDD TEQ
Bayou d'Inde AOC
Bayou and Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

2,3,7,8,-TCDD TEQ Marsh (pg/g)

- 4 - 27
- 28 - 71
- 72 - 250
- 251 - 1657

2,3,7,8-TCDD TEQ Bayou (pg/g)

- 4 - 27
- 28 - 71
- 72 - 250
- 251 - 1657
- 1658 - 2395

Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin/furan compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin/furan compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD. The concentration of dioxin/furans are multiplied by the TEF and then summed to provide the 2,3,7,8-TCDD TEQ result.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

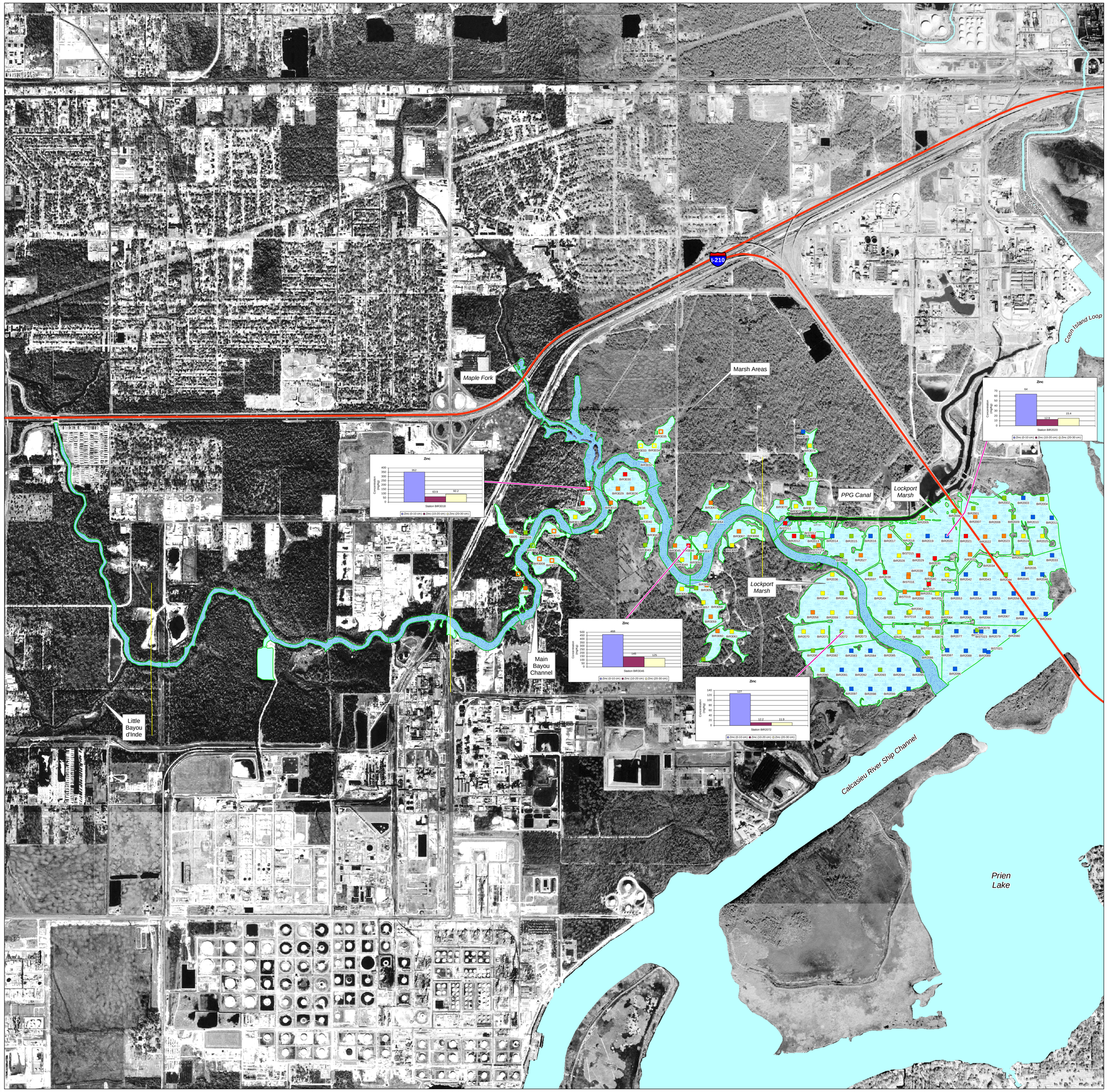
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-13BITCDDBayouandMarsh-Esize.mxd 09/24/2002

Figure 7-14
Metal/Dioxin Factor
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Zinc (mg/kg)

- 10 - 73
- 74 - 135
- 136 - 201
- 202 - 304
- 305 - 468

Zinc Non-Detects (mg/kg)

- 74 - 135
- 136 - 201
- 202 - 304

Zinc is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Iron
Total HpCDD
OCDD
Beryllium
Cobalt
Total HxCDD
Zinc
Aluminum
Vanadium
Potassium
Cadmium
Chromium

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-14BIMetalDioxinFactor-Esize.mxd 10/16/2002

Figure 7-15
Hexachlorobenzene
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Hexachlorobenzene (ug/kg)

- 91 - 150
- 151 - 260
- 261 - 320
- 321 - 600
- 601 - 15000

Hexachlorobenzene Non-Detects (ug/kg)

- 91 - 150
- 151 - 260
- 261 - 320
- 321 - 600
- 601 - 15000

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

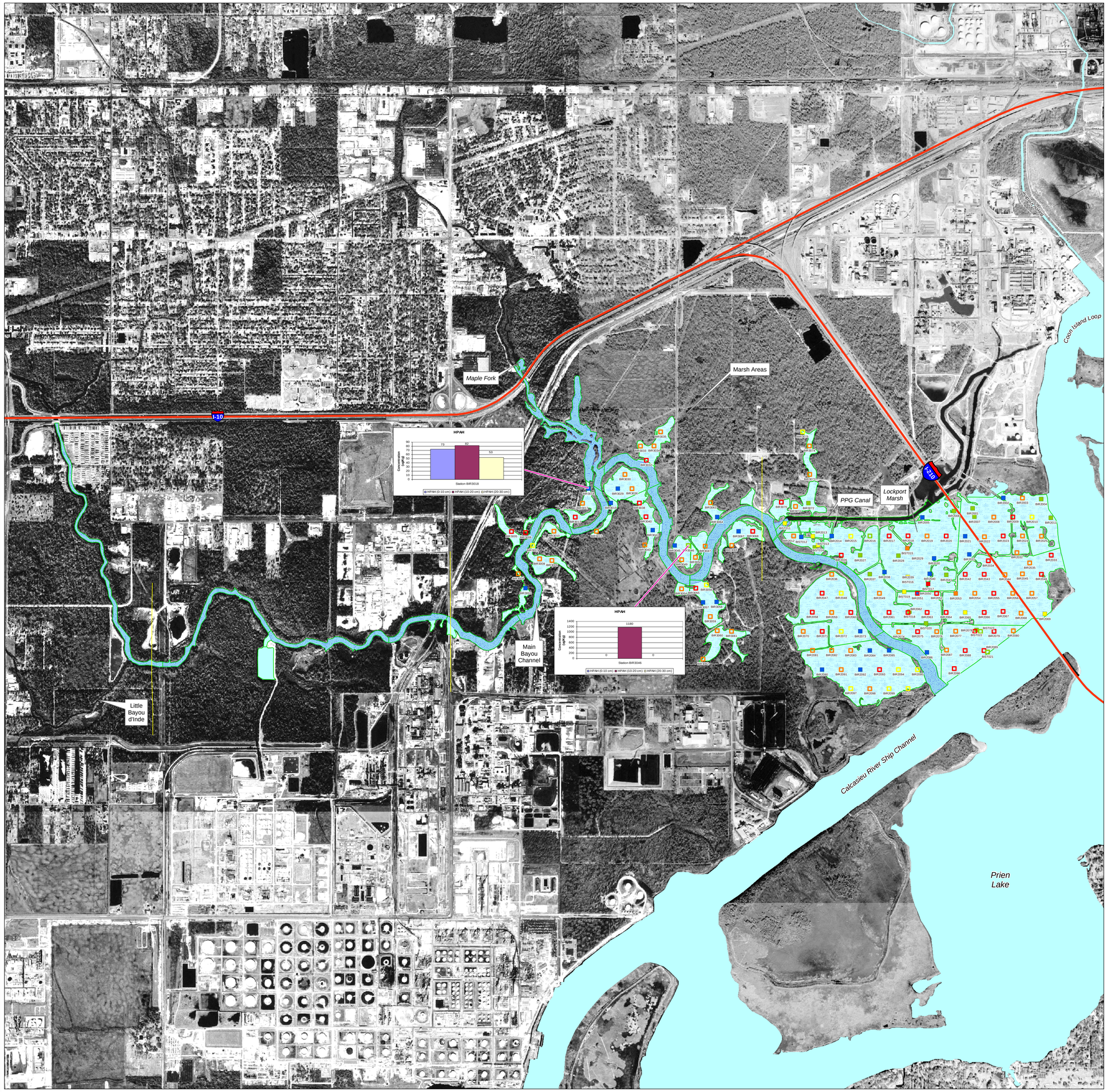
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-15BIHCBMarsh-Esize.mxd 09/18/2002

Figure 7-16
High Molecular Weight PAHs
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

HPAHs (ug/kg)

- 61 - 640
- 641 - 2038
- 2039 - 7470
- 7471 - 12130
- 12131 - 66884

HPAH Non-Detects (ug/kg)

- 641 - 2038
- 2039 - 7470
- 7471 - 12130
- 12131 - 66884

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

HPAHs consist of the following:
1,2-Benzphenanthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Dibenzo(a,h)anthracene
Fluoranthene
Indeno(1,2,3-cd)pyrene
Pyrene

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-16BIHPAHsMarsh-Esize.mxd 10/17/2002

Figure 7-17
Low Molecular Weight PAHs
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

LPAHs (ug/kg)

- 70 - 5600
- 5601 - 9600
- 9601 - 15200
- 15201 - 34400
- 34401 - 120000

LPAH Non-Detects (ug/kg)

- 70 - 5600
- 5601 - 9600
- 9601 - 15200
- 15201 - 34400
- 34401 - 120000

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

LPAHs consist of the following:
1Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

N
W E
S

Kilometers
0 0.25 0.5 1

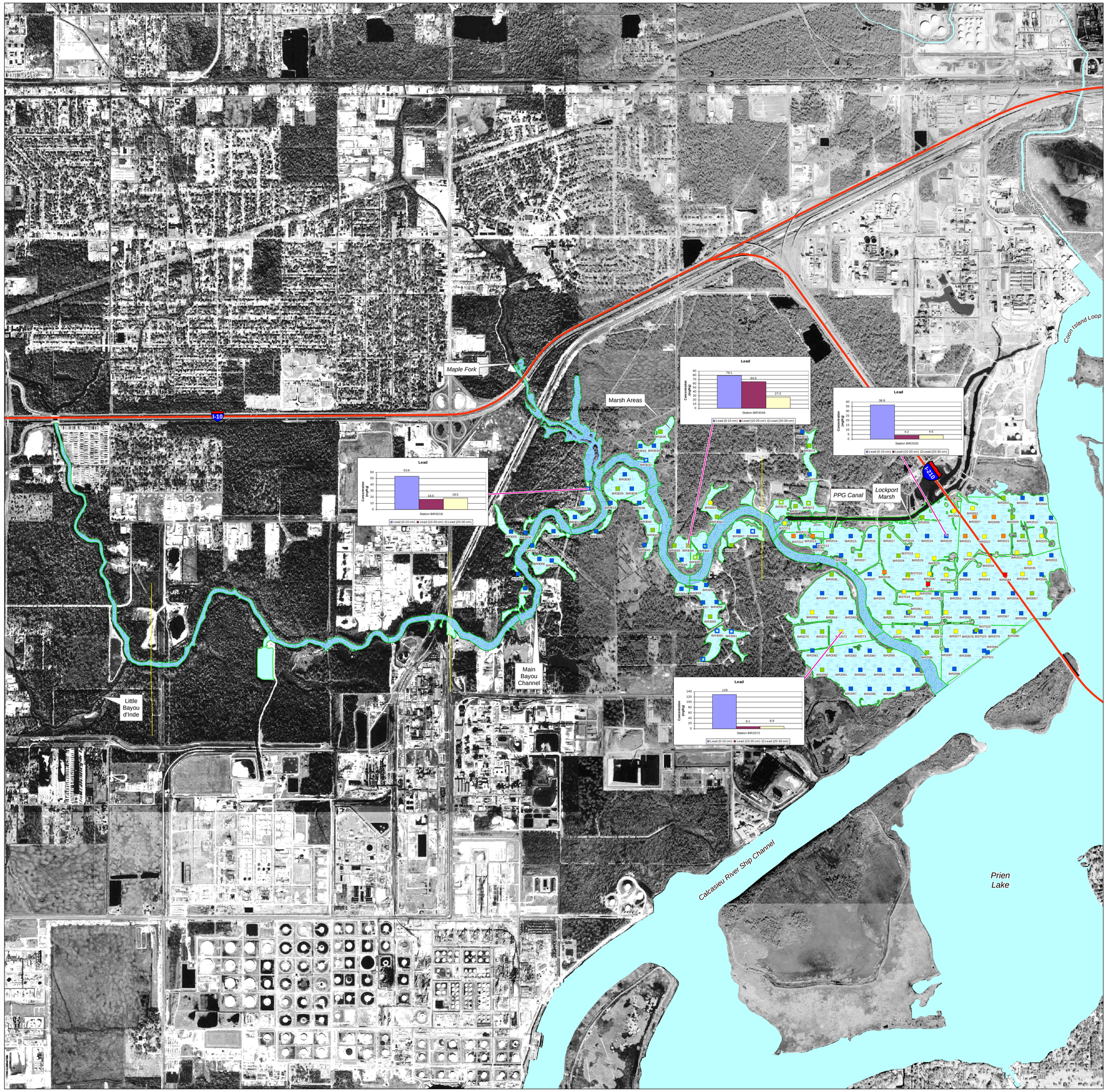
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-1BILPAHsMarsh-Esize.mxd 10/17/2002

Figure 7-18
Lead
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Lead Marsh (mg/kg)

- 5 - 55
- 56 - 111
- 112 - 228
- 229 - 494
- 495 - 902

Lead Non-Detects Marsh (mg/kg)

- 29 - 55
- 56 - 111
- 112 - 228
- 229 - 494
- 495 - 902

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

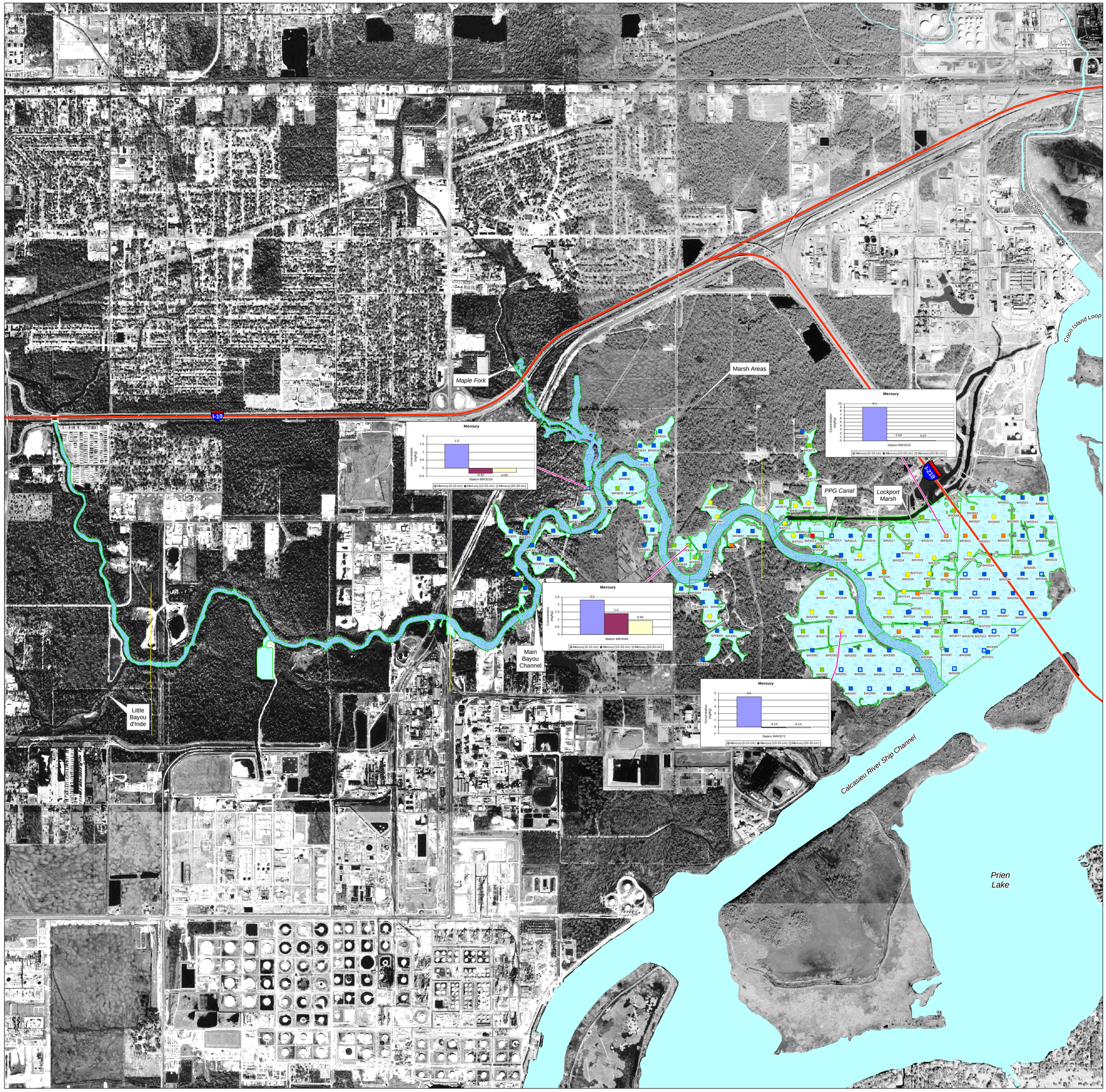
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-18BILeadMarsh-Esize 09/18/2002

Figure 7-19
Mercury
Bayou d'Inde AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extents
- Interstate
- Bayou d'Inde AOC Boundary
- Water
- Bayou Energy Area
- Marsh Energy Area

Mercury (mg/kg)

- 0.07 - 1.6
- 1.7 - 3.8
- 3.9 - 7.3
- 7.4 - 12.6
- 12.7 - 93.9

Mercury Non-Detects (mg/kg)

- 0.07 - 1.6
- 1.7 - 3.8
- 3.9 - 7.3
- 7.4 - 12.6
- 12.7 - 93.9

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: Figure7-19BIMercuryMarsh-Esize.mxd 09/18/2002

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
1,2-Dichloroethylene	4/7/1987	Chlorinated organics containing 1.6 lbs of 1,2-Dichloroethylene were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Bromoform	7/30/1996	Reported deviation value of +5.4 #/day was in violation of the daily maximum permit limit of 81 #/day.	BAC1
Bromoform	7/30/1996	Reported deviation value of +5.4 #/day was in violation of the daily maximum permit limit of 81 #/day.	BAC1
Bromoform	7/30/1996	Reported deviation value of +5.4 #/day was in violation of the daily maximum permit limit of 81 #/day.	BAC1
CCL4	4/7/1987	Chlorinated organics containing 23.4 lbs of Carbon Tetrachloride were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
CCL4	4/7/1987	Chlorinated organics containing 24.7 lbs of (cis) 1,2-Dichloroethylene were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
CCL4	5/29/1988	There was an unauthorized discharge of 25.83506 lbs. of Carbon Tetrachloride at the #2 VC tank.	NOI
Chloroform	1/25/1981	Reported deviation value of +67 lbs/day was in violation of the permit limit of 1368 lbs/day from a sum of outfalls 010 and 018.	SUM
Chloroform	1/23/1993	A discharge of 0.11 lbs. from the Waste Treatment Unit on the Columbia Southern Road spilled to the ground.	NOI
Chlorinated Hydrocarbons	5/13/1982	Reported value of 1,884 lbs. per day was in violation of the daily maximum permit limit of 1,368 lbs. per day from a sum of outfalls 010, 018, and 118.	SUM
Chlorinated Hydrocarbons	4/4/1983	Reported value of an unspecified amount was in violation of the permit limit of 1,368 lbs. per day from a sum of outfalls 010, 018, and 118.	SUM
Chlorinated Hydrocarbons	6/5/1983	Reported value of an unspecified amount was in violation of the permit limit of 1,368 lbs..	10
Chlorinated Hydrocarbons	3/10/1986	Approximately 190 lbs of TCE, 274 lbs of PER, 2.4 lbs of EC, and 464.5 lbs of "other chlorinated hydrocarbons" spilled to the at the Bottoms Plant. Duration of violation: 1 min.	NOI
Chlorinated Hydrocarbons	10/8/1986	Approximately 300 lbs total leaked to the ground from the Waste Treatment Unit. Duration of violation: 5 min.	NOI
Chlorinated Hydrocarbons	11/3/1986	Approximately 30 lbs. were discharged from the Waste Treatment Unit to the ground.	NOI
Chlorinated Hydrocarbons	4/9/1987	Approximately 25 lbs (visually estimated) were leaked to the ground from the South Terminal Tank. Duration of violation: 4-8 hours.	NOI
Chlorinated Hydrocarbons	12/8/1987	Approximately 11 lbs of material were spilled at the Caribe Tank (South Terminal).	NOI
Chlorinated Hydrocarbons	2/3/1988	Over a period of 1-3 minutes, 10 lbs of a chlorinated hydrocarbon mixture leaked to the ground at the Hammer Union Connection on the loading line.	NOI
Chlorinated Hydrocarbons	2/10/1988	Reported value of 1,234 lbs. was in violation of the permit limit of 500 lbs.	201

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Chlorinated Hydrocarbons	2/10/1988	Reported deviation value of +734 lbs/day was in violation of the permit limit of 500 lbs/day.	201
Chlorinated Hydrocarbons	2/10/1988	Reported value of 1234 lbs/day was in violation of the daily maximum permit limit of 500 lbs/day.	201
Chlorinated Hydrocarbons	2/10/1988	Reported value of 1,234 lbs. was in violation of the permit limit of 500 lbs.	BAC1
Chlorinated Hydrocarbons	2/11/1988	Reported value of 610 lbs. was in violation of the permit limit of 500 lbs.	201
Chlorinated Hydrocarbons	2/11/1988	Reported deviation value of +110 lbs/day was in violation of the permit limit of 500 lbs/day.	201
Chlorinated Hydrocarbons	2/11/1988	Reported value of 610 lbs/day was in violation of the daily maximum permit limit of 500 lbs/day.	201
Chlorinated Hydrocarbons	2/11/1988	Reported value of 610 lbs. was in violation of the permit limit of 500 lbs.	BAC1
Chlorinated Hydrocarbons	2/26/1988	Approximately 110 lbs of FO24 (waste and residues from chlorinated hydrocarbon production) were discharged to the ground. Duration: 5 minutes.	NOI
Chlorinated Hydrocarbons	3/25/1988	Approximately 25-30 lbs of chlorinated hydrocarbons materials were spilled to the ground.	NOI
Chlorinated Hydrocarbons	9/4/1988	Reported value of 4245 lbs. spilled to the ground and no permit limit was provided.	NOI
Chlorinated Hydrocarbons	9/24/1988	Discharge of 5400 lbs. to the ground at the vinyl chloride II unit.	NOI
Chlorinated Hydrocarbons	9/24/1988	Approximately 5400 lbs. spilled to the ground near the Vinyl Chloride II Unit.	NOI
Chlorinated Hydrocarbons	9/26/1988	Approximately 5400 lbs. of a chlorinated hydrocarbon mixture (F024) discharged to the ground surrounding a new concrete sump in the VCII unit, over a 2-day period.	NOI
Chlorinated Hydrocarbons	11/17/1988	2485 lbs of wastewater contaminated with chlorinated hydrocarbon mixture were released from South Terminal Withdrawal Well No. DW 3 to the ground and, of that, 1660 lbs. entered the Calcasieu River. Total FO24 in wastewater was <0.1 lbs. Duration of excursion: 45 min.	NOI
Chlorinated Hydrocarbons	12/23/1988	Approximately 11,950 lbs. of wastewater containing a chlorinated hydrocarbon mixture (F024) spilled to the ground and to the water (pond internal to facility).	NOI
Chlorinated Hydrocarbons	5/17/1989	Reported value of 370 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	6/26/1989	Reported value of 1,973 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	9/12/1989	There was a discharge of 2465 lbs, which constituted a deviation of +2267 lbs/day from the permit limit of a maximum discharge of 198 lbs/day.	201
Chlorinated Hydrocarbons	9/12/1989	Reported value of 2,466 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	9/12/1989	Reported value of 2,465 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	9/12/1989	Approximately 2,465 lbs. were released to Bayou D' Inde.	NOI

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Chlorinated Hydrocarbons	10/10/1989	Reported value of 424 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	10/16/1989	Reported value of 203 lbs. was in violation of the permit limit of 58 lbs.	201
Chlorinated Hydrocarbons	10/16/1989	Reported value of 2,465 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	10/30/1989	Reported deviation value was +53 lbs/day was in violation of the maximum discharge limit of 198 lbs/day.	201
Chlorinated Hydrocarbons	10/30/1989	Reported value of 251 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	10/30/1989	Reported value of 215 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	10/31/1989	Reported deviation value of +17 lbs. was in violation of the permit limit of 198 lbs/day.	201
Chlorinated Hydrocarbons	1/23/1991	Reported value of 1,634 lbs/day was in violation of the permit limit of 198 lbs/day.	201
Chlorinated Hydrocarbons	1/23/1991	Reported value of 1,634 lbs. was in violation of the permit limit of 198 lbs..	201
Chlorinated Hydrocarbons	1/23/1991	Approximately 1634 lbs. per day were discharged in violation of the permit limit of 198 lbs. per day. Two violations of 1634 lbs. per day occurred on 01/23/91.	201
Chlorinated Hydrocarbons	1/23/1991	Approximately 1634 lbs. per day were discharged in violation of the permit limit of 198 lbs. per day. Two violations of 1634 lbs. per day occurred on 01/23/91.	201
Chlorinated Hydrocarbons	1/23/1991	Reported value of 135 lbs. was in violation of the permit limit of 58 lbs..	201
Chlorinated Hydrocarbons	1/23/1991	Reported value of 1634 lbs. was in violation of the permit limit of 198 lbs..	201
Chlorinated Hydrocarbons	1/23/1997	Reported value of 1,634 lbs/day was in violation of the permit limit of 198 lbs/day.	201
Chlorinated Hydrocarbons	01/00/1991	Reported value of 135 lbs/day was in violation of the permit limit of 58 lbs..	201
Chlorinated Hydrocarbons	01/00/1991	Approximately 135 lbs. per day were discharged in violation of the permit limit 58 lbs. per day.	201
Chlorinated Hydrocarbons	01/00/1991	Reported deviation value of +77 lbs/day was in violation of the permit limit of 58 lb/day.	201
Chlorinated Hydrocarbons	01/00/1991	Reported value of 135 lbs. was in violation of the permit limit of 58 lbs..	201
Chlorinated Hydrocarbons	02/00/1988	Reported value of 1,234 lbs. was in violation of the permit limit of 500 lbs.	201
Chlorinated Hydrocarbons	02/00/1988	Reported value of 1234 lbs/day was in violation of the daily permit limit of 198 lbs/day. Number of exceedances: 2.	201
Chlorinated Hydrocarbons	04/00/1991	Reported value of 135 lbs. was in violation of the permit limit of 58 lbs..	3
Chlorinated Hydrocarbons	04/00/1991	Reported value of 1634 lbs. was in violation of the permit limit of 198 lbs..	3
Chlorinated Hydrocarbons	05/00/1989	Reported value of 370 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	05/00/1989	Reported value of 370 lbs/day was in violation of the permit limit of 198 lbs/day. Number of exceedances: 1.	201

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Chlorinated Hydrocarbons	06/00/1989	Reported value of 182 lbs. was in violation of the permit limit of 58 lbs.	201
Chlorinated Hydrocarbons	06/00/1989	Reported value of 182 lbs/day was in violation of the permit limit of 48 lbs/day.	201
Chlorinated Hydrocarbons	06/00/1989	Reported value of 1,972 lbs. was in violation of the permit limit of 198 lbs.	201
Chlorinated Hydrocarbons	06/00/1989	Reported value of 1,972 lbs/day was in violation of the permit limit of 198 lbs/day. Number of exceedances: 2.	201
Chlorinated Hydrocarbons	06/00/1989	Reported value of 182 lbs. was in violation of the permit limit of 58 lbs.	201
Chlorinated Hydrocarbons	09/00/1989	Reported value of 203 lbs. was in violation of the permit limit of 58 lbs.	201
Chlorinated Hydrocarbons	09/00/1989	Reported value of 203 lbs/day was in violation of the daily average permit limit of 48 lbs/day.	201
Chlorinated Hydrocarbons	09/00/1989	Reported value of 2,465 lbs/day was in violation of the permit limit of 198 lbs/day. Number of exceedances: 1.	201
Chlorinated Hydrocarbons	11/00/1989	Reported value of 63 lbs. was in violation of the permit limit of 58 lbs.	201
Chloroform	5/29/1988	There was an unauthorized discharge of 51.67012 lbs. of chloroform at the #2 VC tank.	NOI
Chloroform	9/14/1993	Approximately 7.5 lbs. spilled to the ground at the Waste Treatment Unit.	NOI
Chloroform	9/14/1993	A chlorinated hydrocarbon mixture containing 7.5 # of chloroform (CHC13) spilled to the ground at the Waste Treatment Unit.	NOI
Chloroform	5/7/1996	A reported value of 41 lbs spilled to the ground from the Vinyl Transfer Unit.	NOI
Chloroform	2/26/1997	18 lbs were spilled to the ground over a period of 3 minutes at the Waste Treatment Unit.	NOI
CLH Average	6/26/1989	Reported value of 182 lbs. per day was in violation of the permit limit of 58 lbs. per day.	201A
CLH Average	9/12/1989	At least one excursion of 203 lbs. per day was in violation of the permit limit of 58 lbs. per day.	201A
CLH Average	11/00/1989	Reported value of 63 lbs. per day was in violation of the permit limit 58 lbs. per day.	201A
CLH Maximum	2/10/1988	At least one excursion of 1,234 lbs. per day in violation of the permit limit of 500 lbs. per day.	201A
CLH Maximum	2/11/1988	At least one excursion of 610 lbs. per day was in violation of the permit limit of 500 lbs. per day.	201A
CLH Maximum	5/17/1989	Reported value of 370 lbs. per day was in violation of the permit limit of 198 lbs. per day.	201A
CLH Maximum	6/26/1989	Reported value of 1,972 lbs. per day was in violation of the permit limit of 198 lbs. per day.	201A
CLH Maximum	9/12/1989	Reported value of 2,465 lbs per day was in violation of the permit limit of 198 lbs. per day.	201A
CLH Maximum	10/30/1989	Reported value of 251 lbs. per day was in violation of the permit limit of 198 lbs. per day.	201A
CLH Maximum	10/31/1989	Reported value of 215 lbs. per day was in violation of the permit limit of 198 lbs. per day.	201A
CLH Maximum	11/9/1989	Reported value of 424 lbs. per day was in violation of the permit limit of 198 lbs. per day.	201A

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
CLHC	1/20/1981	Reported deviation value of +9187 lbs/day was in violation of the permit limit of 1368 lbs/day.	10
CLHC	1/21/1981	Reported value of +3124 lbs/day was in violation of the permit limit of 1368 lbs/day.	10
CLHC	1/22/1981	Reported deviation value of +881 lbs/day was in violation of the permit limit of 1368 lbs/day .	10
ClHC, avg.	8/31/1979	From 01/01/79 to 08/31/79 the reported value of 931 lbs/day from Outfall Sum (018/019) was in violation of the daily average permit limit of 420 lbs/day. Number of violations: 2.	SUM
ClHC, avg.	8/31/1979	From 01/01/79 to 08/31/79 the reported value of 2,671 lbs/day was in violation of the daily maximum permit limit of 840 lbs/day from Outfall Sum (018/019). Number of violations: 20.	SUM
ClHC, avg.	8/25/1983	Reported value of 1,764 lbs. per day was in violation of the permit limit of 1,368 lbs. per day from the sum of Outfalls 010 and 018.	SUM
Cobalt	10/8/1986	Approximately 120 lbs of a chlorinated hydrocarbon mixture containing 30 lbs of 1,2-dichloroethane were discharged to the ground at the Waste Treatment Unit over a period of 5 minutes.	NOI
Cobalt	5/29/1988	There was an unauthorized discharge of 558.0373 lbs. of 1,2-Dichloroethane at the #2 VC tank.	NOI
Copper	1/3/1989	Reported value of 143.3 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	1/5/1989	Reported value of 65.4 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	1/6/1989	Reported value of 65.3 lbs. was in violation of the permit limit of 49.13 lbs.	201
Copper	1/9/1989	Reported value of 67.6 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	1/17/1989	Reported value of 85 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	1/22/1989	Reported value of 51.8 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	2/1/1989	Reported value of 66.1 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper	2/2/1989	Reported value of 51.1 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper	02/00/1989	Reported value of 30.3 lbs/day was in violation of the permit average of 26.8 lbs/day.	201A
Copper	04/00/1989	Reported value of 33 lbs/day was in violation of the permit average of 18.2 lbs/day.	201A
Copper, Average	3/8/1989	Reported value of 50 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	02/00/1989	Reported value of 30 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	02/00/1989	Reported value of 30 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	02/00/1989	At least one excursion of 30.3 lbs. per day was in violation of the permit limit of 26.8 lbs. per day.	201A

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Copper, Average	04/00/1989	Reported value of 33 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	04/00/1989	Reported value of 33 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	04/00/1989	At least one excursion of 33 lbs. per day was in violation of the permit limit of 18.2 lbs. per day.	201A
Copper, Average	05/00/1989	Reported value of 30 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	05/00/1989	Reported value of 30.3 lbs. was in violation of the permit limit of 18.2 lbs.	201
Copper, Average	05/00/1989	Reported value of 30 lbs. per day was in violation of the permit limit of 18.2 lbs. per day.	201A
Copper, Average	05/00/1989	Reported value of 30 lbs/day was in violation of the permit average of 18.2 lbs/day.	201A
Copper, Daily Avg.	01/00/1989	Reported value of 50 lbs/day was in violation of the daily average permit limit of 18.2 lbs/day.	201
Copper, Daily Avg.	02/00/1989	Reported value of 30 lbs/day was in violation of the daily average permit limit of 18.2 lbs/day.	201
Copper, Daily Max.	01/00/1989	Reported value of 143 lbs/day was in violation of the daily maximum permit limit of 49.3 lbs/day. Number of exceedances: 5.	201
Copper, Daily Max.	02/00/1989	Reported value of 66 lbs/day was in violation of the daily maximum permit limit of 49.3 lbs/day. Number of exceedances: 2.	201
Copper, Maximum	4/17/1984	Reported value of 53 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/11/1987	Reported value of 64.7 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	12/28/1988	Reported value of 49.6 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	1/3/1989	At least one excursion of 143.3 lbs. was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	1/5/1989	At least one excursion of 65.4 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	1/6/1989	Reported value of 65 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	1/9/1989	Reported value of 67.6 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	1/9/1989	At least one excursion of 67.6 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	1/17/1989	Reported value of 85 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	1/17/1989	At least one excursion of 85 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	1/22/1989	Reported value of 51.8 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	1/22/1989	At least one excursion of 51.8 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	2/1/1989	Reported value of 66.1 lbs. was in violation of the permit limit of 49.3 lbs.	201

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CHEMICAL	DATE	VIOLATION	OUTFALL
Copper, Maximum	2/1/1989	At least one excursion of 66.1 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	2/2/1989	Reported value of 51.2 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	2/2/1989	Reported value of 51.2 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	2/12/1989	Reported value of 50.8 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	2/12/1989	Reported value of 66 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	2/12/1989	Reported value of 66 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	3/8/1989	Reported value of 143 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/11/1989	Reported value of 64.7 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/11/1989	Reported value of 64.7 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/11/1989	Reported value of 64.7 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	4/11/1989	Reported value of 64.7 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	4/12/1989	Reported value of 62.4 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/12/1989	Reported value of 62.4 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/12/1989	Reported value of 62.4 was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	4/12/1989	Reported value of 62.4 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	4/17/1989	Reported value of 53.1 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/17/1989	Reported value of 53.1 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/17/1989	Reported value of 53.1 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	4/17/1989	Reported value of 53.1 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	4/18/1989	Reported value of 67.5 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/18/1989	Reported value of 67.5 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	4/18/1989	Reported value of 67.5 lbs/day was in violation of the permit maximum of 49.3 lbs/day.	201A
Copper, Maximum	4/18/1989	Reported value of 67.5 lbs. per day was in violation of the permit limit 49.3 lbs. per day.	201A
Copper, Maximum	10/5/1989	Reported value of 66.7 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	10/5/1989	Reported value of 66.7 lbs. was in violation of the permit limit of 49.3 lbs.	201

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CHEMICAL	DATE	VIOLATION	OUTFALL
Copper, Maximum	10/29/1990	Reported value of 72.2 lbs. was in violation of the daily maximum permit limit of 49.3 lbs..	201
Copper, Maximum	10/29/1990	Reported value of 72 lbs. was in violation of the permit limit of 49.3 lbs..	201
Copper, Maximum	10/29/1990	Reported value of 72.2 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Maximum	02/00/1989	Reported value of 66 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	04/00/1989	Reported value of 67 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	10/00/1989	Reported value of 67 lbs. was in violation of the permit limit of 49.3 lbs.	201
Copper, Maximum	10/00/1989	Reported value of 69 lbs. per day was in violation of the permit limit of 49.3 lbs. per day.	201A
Copper, Total Avg	04/00/1989	Reported value of 33 lbs/day was in violation of the permit limit of 18.2 lbs/day.	201
Copper, Total Avg	05/00/1989	Reported value of 30 lbs/day was in violation of the permit limit of 18.2 lbs/day.	201
Copper, Total Max	04/00/1989	Reported value of 67 lbs/day was in violation of the permit limit of 49.3 lbs/day. Number of exceedances: 4.	201
Copper, Total Max	10/00/1989	Reported value of 66.7 lbs/day was in violation of the daily maximum permit limit of 49.3 lbs/day. Number of exceedances: 1.	201
Crude EDC/TCE Blend	4/23/1987	Approximately 3,200 lbs. spilled into the Calcasieu River near the loading dock.	NOI
DCE	5/3/1990	At least 325.8 lbs. of DCE Tar Buggy Waste (K028) was spilled to the ground.	NOI
DCE	1/23/1993	A discharge of 0.33 lbs. from the Waste Treatment Unit on Columbia Southern Road spilled to the ground.	NOI
Dichloroethane (EDC)	1/23/1993	A discharge of 4.40 lbs. from the Waste Treatment Unit on Columbia Southern Road spilled to the ground.	NOI
EC	1/23/1993	A discharge of 0.43 lbs. from the Waste Treatment Unit on Columbia Southern Road spilled to the ground.	NOI
1,2-dichloroethane	4/22/1987	3198 lbs of material (Crude 1, 2, dichloroethane) leaked from the South Terminal Block. Duration of violation: Approximately 1 hour.	NOI
1,2-dichloroethane	6/18/1988	There was an unauthorized discharge of 54 lbs. of a chlorinated hydrocarbon mixture containing 7% EDC. A total of 4 lbs. of EDC were discharged to the ground.	NOI
1,2-dichloroethane	2/27/1993	Approximately 250 gallons of EDC escaped beyond the diked area (EDC Filter Unit).	NOI
1,2-dichloroethane	2/21/1988	Approximately 40 gallons spilled to the ground at the EDC storage area inside the facility "dike."	NOI
1,2-dichloroethane	9/14/1993	A chlorinated hydrocarbon mixture containing 15.7 # of EDC (1,2-dichloroethane) spilled to the ground at the Waste Treatment Unit.	NOI
Ethylene Dichloride	4/26/1988	There was an unauthorized discharge to the ground of 4.6 lbs. of etholene Dichloride.	NOI

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Ethylene Chloride	12/31/1990	Over a period of thirty minutes, 346 lbs. were discharged to the air and ground from the Ethyl Chloride unit. Other chemicals were also released, but in amounts that were less than their respective reportable quantities.	NOI
Ethylene Chloride	12/31/1990	A discharge of 346 lbs. occurred to the air and ground from the Ethyl Chloride Unit.	NOI
Ethylene Dichloride	2/25/1987	Approximately 60 lbs of a chlorinated hydrocarbon mixture containing 28.7 lbs of Ethylene Dichloride were discharged to the ground at the Waste Treatment Unit over a period of approximately 1 minute.	NOI
Ethylene Dichloride	6/9/1994	Approximately 55,716 lbs were discharged to the ground over a period of 25 minutes.	NOI
Ethylene Dichloride	8/7/1995	A spill of 473 lbs occurred from a VCM furnace feed pump.	NOI
Ethylene Dichloride (EDC)	8/1/1984	There was a spill of 23,000 lbs of Ethylene Dichloride (EDC) (previously incorrectly reported as 29,000 lbs). The spilled EDC entered a stormwater runoff sewer (Outfall 010). The permitted limit was 1368 lbs/day.	10
Ethylene Dichloride (EDC)	4/13/1994	There was a spill to the ground of an unspecified amount in excess of the minimum reportable quantity.	NOI
Ethylene Dichloride (EDC)	4/13/1994	Approximately 100 lbs were discharged to the ground over a period of approximately 30 minutes.	NOI
HCB, Daily Average	01/00/1994	Reported value of 0.00603 lbs/day was in violation of the daily average permit limit of 0.00010 lbs/day.	501
HCB, Daily Average	01/00/1994	Reported value of 0.00603 lbs. per day was in violation of the permit limit of 0.00010 lbs. per day.	501
HCB, Daily Average	07/00/1994	Reported value of 0.04 ug/l was in violation of the daily average permit limit of 0.006 ug/l.	501
HCB, Daily Average	07/00/1994	Reported value of 0.04 ug/l was in violation of the permit limit of 0.006 ug/l.	501
HCB, Daily Max.	7/4/1995	Reported value of .0266 ug/l was in violation of the permit limit of 0.022 ug/l.	501A
HCB, Daily Maximum	01/00/1994	Reported value of 0.4300 lbs/day was in violation of the daily maximum permit limit of 0.20256 lbs/day.	501
HCB, Daily Maximum	01/00/1994	Reported value of 0.08435 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day.	501
HCB, Daily Maximum	01/00/1994	Reported value of 1.836 ug/l was in violation of the daily maximum permit limit of 0.022 ug/l.	501
HCB, Daily Maximum	01/00/1994	Reported value of 0.08435 lbs. per day was in violation of the permit limit of 0.00034 lbs. per day.	501
HCB, Daily Maximum	01/00/1994	Reported value of 1.836 ug/l was in violation of the permit limit of 0.022 ug/l.	501
HCB, Daily Maximum	01/00/1994	Reported value of 0.4300 lbs. per day was in violation of the permit limit of 0.20256 lbs. per day.	501
HCB, Daily Maximum	07/00/1994	Reported value of 0.00051 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day.	501
HCB, Daily Maximum	07/00/1994	Reported value of 0.053 ug/l was in violation of the daily maximum permit limit of 0.022 ug/l.	501
HCB, Daily Maximum	07/00/1994	Reported value of 0.00051 lbs. per day was in violation of the permit limit of 0.00034 lbs. per day.	501

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CHEMICAL	DATE	VIOLATION	OUTFALL
HCB, Daily Maximum	07/00/1994	Reported value of 0.053 ug/l was in violation of the permit limit of 0.022 ug/l.	501
Hexachlorobenzene	3/7/1989	LDEQ issued a compliance order to PPG citing them for the discharge an amount sufficient to contaminate sediments and certain fish species. An emergency condition was declared. No specific values were indicated in the source document.	NOI
Hexachlorobenzene	7/19/1993	Reported deviation value of +0.00025 lbs/day (+0.009 ug/L) was in violation of the permit limit of 0.00034 lbs/day (0.050 ug/L [MDL]).	501
Hexachlorobenzene	7/19/1993	Reported deviation value of +0.00025 lbs/day (+0.009 ug/l) was in violation of the permit limit of 0.00034 lbs/day (0.050 ug/l [MDL]).	501
Hexachlorobenzene	7/19/1993	Reported deviation value of +0.00025 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day. Reported deviation value of +0.009 ug/l was also in violation of the daily maximum permit limit of 0.050 ug/l.	501
Hexachlorobenzene	8/23/1993	Reported deviation value of +0.002 ug/l/day was in violation of the permit limit of 0.006 ug/l/day.	501
Hexachlorobenzene	8/23/1993	Reported deviation value of +0.0004 lbs/day (+0.053 ug/l) was in violation of the permit limit of 0.00034 lbs/day (0.050 ug/l [MDL]).	501
Hexachlorobenzene	12/12/1993	Reported value of 0.00128 lbs/day was in violation of the permit limit of 0.00034 lbs/day.	501
Hexachlorobenzene	12/12/1993	Reported value (24-hour composite) of .00128 lb/day was in violation of the permit limit of 0.00034 lb/day.	501
Hexachlorobenzene	12/12/1993	Reported deviation value of +0.00094 lbs/day (+0.061 ug/l) was in violation of the permit limit of 0.00034 lbs/day.	SUM
Hexachlorobenzene	1/27/1994	Reported deviation value of +0.08401 lbs. per day was in violation of the permit limit of 0.00034 lbs. per day.	501
Hexachlorobenzene	1/27/1994	Reported deviation value of +0.08401 lbs. per day was in violation of the permit limit of 0.00034 lbs. per day.	501
Hexachlorobenzene	10/23/1995	Reported value reflected a limit deviation of +0.170 #/d (+0.140 ug/L) from the daily maximum discharge limit of 0.00034 #/d (0.00026 ug/L).	BAC1
Hexachlorobenzene	10/24/1995	Reported value reflected a limit deviation of +0.076 #/d (+0.064 ug/L) from the daily maximum discharge limit of 0.00034 #/d (0.00026 ug/L).	BAC1
Hexachlorobenzene	10/25/1995	Reported value reflected a limit deviation of +0.077 #/d (+0.067 ug/L) from the daily maximum discharge limit of 0.00034 #/d (0.00026 ug/L).	BAC1
Hexachlorobenzene	4/22/1997	Reported deviation value of +0.00001 #/d was in violation of the daily maximum permit limit of 0.00034 #/d. Also reported deviation value of +0.005 ppb in violation of the daily maximum permit limit of 0.022 ppb.	501
Hexachlorobenzene	01/00/1994	Reported value of 0.08435 lbs/day was in violation of the daily maximum of 0.00034 lbs/day.	501A
Hexachlorobenzene	01/00/1994	Reported value of 0.00603 lbs/day was in violation of the daily average of 0.00010 lbs/day.	501A

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CHEMICAL	DATE	VIOLATION	OUTFALL
Hexachlorobenzene	01/00/1996	Reported value of 0.092 lbs/day (0.070 ug/l) was in violation of the daily maximum of 0.00034 lbs/day (0.00026 ug/l).	1
Hexachlorobenzene	01/00/1996	Reported value of .006 lbs/day (0.005 ug/l) was in violation of the daily average of 0.00010 lbs/day (0.00006 ug/l).	1
Hexachlorobenzene	04/00/1997	Reported value of 0.027 ug/l was in violation of the daily maximum permit limit of 0.022 ug/l.	501A
Hexachlorobenzene	06/00/1996	Reported value of 0.00075 lbs/day was in violation of the daily maximum of 0.00034 lbs/day.	501
Hexachlorobenzene	07/00/1994	Reported value of 0.00051 lbs/day was in violation of the daily maximum of 0.00034 lbs/day.	501A
Hexachlorobenzene	07/00/1994	Reported value of 0.053 ug/l was in violation of the daily maximum of 0.022 ug/l.	501A
Hexachlorobenzene	10/00/95	Reported October 1995 value reflected a limit deviation of +0.021 #/d (+0.018 ug/L) from the daily average permit limit of 0.00010 #/d (0.00006 ug/L).	BAC1
Hexachlorobenzene (HCB)	8/23/1993	Reported deviation value of +0.0004 was in violation of the permit limit of 0.00034 lb/day.	501
Hexachlorobenzene (HCB)	8/23/1993	Reported deviation value of +0.053 ug/l was in violation of the permit limit of 0.0050 ug/l.	501
Hexachlorobenzene (HCB)	7/4/1995	Limit deviation of +0.005 ug/L was in violation of the permit limit of 0.022 ug/L.	501
Hexachlorobenzene (HCB)	7/4/1995	Limit deviation of +0.005 ug/L was in violation of the permit limit of 0.022 ug/L.	501
Hexachlorobenzene (HCB)	9/14/1995	Limit deviation was +0.01591 #/d (+1.373 ug/L) was in violation of the daily maximum of 0.00034 #/d (0.022 ug/L).	501
Hexachlorobenzene (HCB)	9/14/1995	Limit deviation of +0.01591 #/d (+1.373 ug/L) was in violation of the permit limit of 0.00034 #/d (0.022 ug/L).	501
Hexachlorobenzene (HCB)	9/19/1995	Limit deviation was +0.00212 #/d (+0.223 ug/L) in violation of the daily maximum of 0.00034 #/d (0.022 ug/L).	501
Hexachlorobenzene (HCB)	9/19/1995	Limit deviation of +0.00212 #/d (+0.223 ug/L) was in violation of the permit limit of 0.00034 #/d (0.022 ug/L).	501
Hexachlorobenzene (HCB)	9/20/1995	Limit deviation of +0.01466 #/d (+1.437 ug/L) was in violation of the daily maximum of 0.00034 #/d (0.22 ug/L).	501
Hexachlorobenzene (HCB)	9/20/1995	Limit deviation of +0.01466 #/d (+1.437 ug/L) was in violation of the permit limit of 0.00034 #/d (0.022 ug/L).	501
Hexachlorobenzene (HCB)	10/23/1995	Limit deviation of +0.170 #/d (+0.140 ug/L) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/L).	BAC1
Hexachlorobenzene (HCB)	10/24/1995	Limit deviation of +0.076 #/d (+0.064 ug/L) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/L).	BAC1
Hexachlorobenzene (HCB)	10/25/1995	Limit deviation of +0.077 #/d (+0.067 ug/L) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/L).	BAC1

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CHEMICAL	DATE	VIOLATION	OUTFALL
Hexachlorobenzene (HCB)	1/7/1996	Limit deviation of +0.09166 #/d (+0.06974 ug/l) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/l).	BAC1
Hexachlorobenzene (HCB)	1/7/1996	Limit deviation of +0.09166 #/d (+0.06974 ug/l) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/l).	BAC1
Hexachlorobenzene (HCB)	3/21/1996	Limit deviation of +0.10574 #/d (+0.08 ug/l) was in violation of the daily maximum of 0.00034 #/d (0.00026 ug/l).	BAC1
Hexachlorobenzene (HCB)	6/23/1996	Reported deviation value of +0.00041 #/day was in violation of the daily maximum permit limit of 0.00034 #/day.	501
Hexachlorobenzene (HCB)	6/23/1996	Reported deviation value of +0.00041 #/day was in violation of the maximum discharge permit limit of 0.00034 #/day.	501
Hexachlorobenzene (HCB)	8/12/1996	Reported deviation value of +0.00264 #/day was in violation of the daily maximum discharge limit of 0.00034 #/day.	501
Hexachlorobenzene (HCB)	8/12/1996	Reported deviation value of +0.00264 #/day was in violation of the daily maximum permit limit of 0.00034 #/day.	501
Hexachlorobenzene (HCB)	09/00/1995	Limit deviation of +0.00272 #/d was in violation of the daily average of 0.00010 #/d (0.006 ug/L).	501
Hexachlorobenzene (HCB)	10/00/1995	Limit deviation of +0.017 #/d (+0.018 ug/L) was in violation of the daily average of 0.00010 #/d (0.00006 ug/L).	BAC1
Hexachlorobenzene Composite	7/31/1994	Reported value of 0.00051 lb/day was in violation of maximum discharge limit of 0.00034 lb/day.	501
Hexachlorobenzene, Avg	01/00/1996	Reported value of 0.006 lbs/day was in violation of the daily average permit limit of 0.00010 lbs/day.	1
Hexachlorobenzene, Avg	01/00/1996	Reported value of 0.005 ug/l was in violation of the daily average permit limit of 0.00006 ug/l.	1
Hexachlorobenzene, Avg	03/00/1996	Reported value of 0.00846 lbs/day was in violation of the daily average permit limit of 0.00010 lbs/day.	1
Hexachlorobenzene, Avg	03/00/1996	Reported value of 0.00615 ug/l was in violation of the daily average permit limit of 0.00006 ug/l.	1
Hexachlorobenzene, Avg	10/00/1995	Reported value of 0.0213 lbs/day was in violation of the daily average permit limit of 0.00010 lbs/day.	1
Hexachlorobenzene, Avg	10/00/1995	Reported value of 0.018 ug/l was in violation of the daily average permit limit of 0.00006 ug/l.	1
Hexachlorobenzene, Max	01/00/1996	Reported value of 0.092 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day.	1
Hexachlorobenzene, Max	01/00/1996	Reported value of 0.070 ug/l was in violation of the daily maximum permit limit of 0.00026 ug/l.	1
Hexachlorobenzene, Max	03/00/1996	Reported value of 0.1100 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day.	1
Hexachlorobenzene, Max	03/00/1996	Reported value of 0.07769 ug/l was in violation of the daily maximum permit limit of 0.00026 ug/l.	1
Hexachlorobenzene, Max	06/00/1996	Reported value of 0.045 ug/l was in violation of the daily maximum permit limit of 0.022 ug/l.	501A

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CHEMICAL	DATE	VIOLATION	OUTFALL
Hexachlorobenzene, Max	10/00/1995	Reported value of 0.17 lbs/day was in violation of the daily maximum permit limit of 0.00034 lbs/day.	1
Hexachlorobenzene, Max	10/00/1995	Reported value of 0.140 ug/l was in violation of the daily maximum permit limit of 0.00026 ug/l.	1
Hexachlorobutadiene	4/7/1987	Chlorinated organics containing 0.2 lbs of Hexachlorobutadiene were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Hexachlorobutadiene	7/13/1988	Reported value of 3.2 lbs. was spilled to the ground from the Waste Treatment Unit.	NOI
Hexachlorobutadiene	3/7/1989	LDEQ issued a compliance order to PPG citing them for the discharge of an amount sufficient to contaminate sediments and certain fish species. An emergency condition was declared. No specific amounts are indicated on the source document.	NOI
Hexachlorobutadiene	1/27/1994	Reported deviation value of +0.227 lbs. per day was in violation of the permit limit of 0.203 lbs. per day.	501
Hexachlorobutadiene	1/27/1994	Reported deviation value of +0.227 lbs. per day was in violation of the permit limit of 0.203 lbs. per day.	501
Hexachlorobutadiene	01/00/1994	Reported value of .43000 lbs/day was in violation of the daily maximum of 0.20256 lbs/day.	501A
Hexachlorobutadiene	01/00/1996	Reported value of 1.445 lbs/day (1.100 ug/l) was in violation of the daily maximum of .20256 lbs/day (0.12 ug/l).	1
Hexachlorobutadiene	01/00/1996	Reported value of 0.093 lbs/day (0.073 ug/l) was in violation of the daily average of 0.06752 lbs/day (0.04 ug/l).	1
Hexachlorobutadiene (HCBD)	2/22/1995	Limit deviation of +0.49744 lb/day (+0.23 ug/l) was in violation of the daily maximum of 0.20256 lb/day (0.12 ug/l).	BAC1
Hexachlorobutadiene (HCBD)	1/7/1996	Limit deviation of +1.242 #/d (+0.98 ug/l) was in violation of the daily maximum of 0.20256 #/d (0.12 ug/l).	BAC1
Hexachlorobutadiene (HCBD)	1/7/1996	Limit deviation of +1.242 #/d (+0.98 ug/l) was in violation of the daily maximum of 0.20256 #/d (0.12 ug/l).	BAC1
Hexachlorobutadiene (HCBD)	3/19/1996	Limit deviation of +0.2424 #/d (+0.24 ug/l) was in violation of the daily maximum of 0.20256 #/d (0.12 ug/l).	BAC1
Hexachlorobutadiene (HCBD)	3/19/1996	Limit deviation of +0.2424 #/d (+0.24 ug/l) was in violation of the daily maximum of 0.20256 #/d (0.12 ug/l).	BAC1
Hexachlorobutadiene (HCBD)	3/21/1996	Limit deviation of +0.65934 #/d (+0.53 ug/l) was in violation of the daily maximum of 0.20256 #/d (0.12 ug/l).	BAC1
Hexachlorobutadiene, Avg.	01/00/1996	Reported value of 0.093 lbs/day was in violation of the daily average permit limit of 0.06752 lbs/day.	1
Hexachlorobutadiene, Avg.	01/00/1996	Reported value of 0.073 ug/l was in violation of the daily average permit limit of 0.04 ug/l.	1
Hexachlorobutadiene, Avg.	03/00/1996	Reported value of 0.078 ug/l was in violation of the daily average permit limit of 0.04 ug/l.	1
Hexachlorobutadiene, Avg.	03/00/1996	Reported value of 0.10 lbs/day was in violation of the daily average permit limit of 0.06752 lbs/day.	1

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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Hexachlorobutadiene, Max.	01/00/1996	Reported value of 1.445 lbs/day was in violation of the daily maximum permit limit of 0.20256 lbs/day.	1
Hexachlorobutadiene, Max.	01/00/1996	Reported value of 1.100 ug/l was in violation of the daily maximum permit limit of 0.12 ug/l.	1
Hexachlorobutadiene, Max.	03/00/1996	Reported value of 0.90 lbs/day was in violation of the daily maximum permit limit of 0.20256 lbs/day.	1
Hexachlorobutadiene, Max.	03/00/1996	Reported value of 0.65 ug/l was in violation of the daily maximum permit limit of 0.12 ug/l.	1
Hexachloroethane	2/25/1987	Approximately 60 lbs of a chlorinated hydrocarbon mixture containing 6.5 lbs of Hexachloroethane were discharged to the ground at the Waste Treatment Unit over a period of approximately 1 minute.	NOI
Hexachloroethane	4/7/1987	Chlorinated organics containing 0.25 lbs of Hexachloroethane were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Lead	10/20/1981	There was a discharge of 450 lbs. from an underground waste pipeline. This discharge was not authorized by the NPDES permit issued to the facility.	14
Lead, Maximum	5/18/1982	Reported value of 25.3 lbs. per day was in violation of the daily maximum permit limit of 10.1 lbs. per day.	17
Lead, Maximum	5/18/1982	Reported value of 25.6 lbs. per day was in violation of the daily maximum permit limit of 10.1 lbs. per day.	17
Lead, Maximum	6/25/1982	Reported value of .67 ppm was in violation of the daily maximum permit limit of .5 ppm.	14
Mercury	1/19/1981	Reported deviation value of +0.15 lbs/day was in violation of the permit limit of 0.42 lbs/day .	11
Mercury	1/29/1981	Reported deviation value of +0.02 lbs/day was in violation of the permit limit of 0.42 lbs/day from a sum of Outfalls 011 and 111.	SUM
Mercury	7/14/1983	The maximum limit of 0.42 lbs/day was exceeded.	11
Mercury	7/14/1983	Reported value of 2.9 lbs. was in violation of the daily maximum permit limit of 0.42 lbs. from a sum of outfalls 011 and 111.	SUM
Mercury	9/15/1983	The maximum limit of 0.42 lbs/day was exceeded.	11
Mercury	11/15/1987	Reported value of .33 lbs/day was in violation of the permit value of .30 lbs/day.	101A
Mercury	11/20/1987	Reported value of 12 lbs. spilled to the ground and water at the Starks Brine Field.	NOI
Mercury	5/18/1988	There was an unauthorized discharge of 3 lbs. to the ground from the Mercury Cell Unit.	NOI
Mercury	7/6/1988	Reported value of .33 lbs/day was in violation of the permit maximum of .30 lbs/day.	101A
Mercury	12/28/1988	Reported value of 0.33 lbs. was in violation of the permit limit of 0.3 lbs.	201
Mercury	1/9/1989	Reported value of .51 lbs/day was in violation of the permit value of .30 lbs/day.	101A

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Mercury	2/3/1996	An overflow of wastewater from the Mercury Recovery Unit Collection Sump occurred onto the Mercury Recovery Unit pad, onto the ground, and into the 72" sewer. Two samples caught for analysis indicated 86 parts per billion (ppb) of Mercury (Hg).	NOI
Mercury	5/2/1996	Limit deviation of +0.21 #/d was in violation of the daily maximum of 0.30 #/d.	103Q
Mercury	5/2/1996	Reported deviation value of +0.21 #/d was in violation of the permit limit of 0.30 #/d.	103Q
Mercury	04/00/1992	Reported value of 0.27 was in violation of the permit average of 0.13 lbs.	101
Mercury	07/00/1981	Reported value of 1.10 lbs/day was in violation of the permit limit of .42 lbs/day.	11
Mercury	07/00/1988	Reported value of 0.327 lbs. was in violation of the permit limit of 0.3 lbs.	101
Mercury (Hg), Total, Max	03/00/1996	Reported value of 0.58 lbs/day was in violation of the daily maximum permit limit of 0.30 lbs/day.	201A
Mercury (Hg), Total, Max	05/00/1996	Reported value of 0.51 lbs/day was in violation of the daily maximum permit limit of 0.30 lbs/day.	101A
Mercury, Average	2/25/1990	Reported value of .158 lbs. per day was in violation of the permit limit of .13 lbs. per day.	101A
Mercury, Average	04/00/1992	Reported value of 0.27 lbs. was in violation of the permit limit of 0.13 lbs..	101
Mercury, Average	04/00/1992	Reported value of 0.27 lbs. was in violation of the daily average permit limit of 0.13 lbs..	103Q
Mercury, Average	07/00/1983	Reported value of 0.26 lbs. per day was in violation of the permit limit of 0.21 lbs. per day.	11
Mercury, Average	11/00/1991	Reported value of 0.18 lbs. was in violation of the permit limit of 0.13 lbs..	101
Mercury, Average	11/00/1991	Reported value of 0.18 lbs. was in violation of the daily average permit limit of 0.13 lbs...	103Q
Mercury, Average	11/00/1991	Reported value of 0.18 lbs/day was in violation of the permit limit of 0.13 lbs/day.	103Q
Mercury, Avg.	00/00/1979	From 01/01/79 to 08/31/79 the reported value of .72 lbs/day was in violation of the daily maximum permit limit of .21 lbs/day. Number of violations: 4.	11
Mercury, Daily Max.	01/00/1989	Reported value of 0.514 lbs/day was in violation of the daily maximum permit limit of 0.3 lbs/day.	101
Mercury, Daily Max.	07/00/1988	Reported value of 0.327 lbs/day was in violation of the daily maximum permit limit of 0.3 lbs/day.	101
Mercury, Daily Max.	12/00/1988	Reported value of 0.33 lbs/day was in violation of the daily maximum permit limit of 0.13 lbs/day.	101
Mercury, Max.	00/00/1979	From 01/01/79 to 08/31/79 the reported value of 3.58 lbs/day was in violation of the permit limit of .42 lbs/day. Number of violations: 17.	11
Mercury, Maximum	7/14/1983	Reported value of 2.91 lbs. per day was in violation of the permit limit of 0.42 lbs. per day from a sum of outfalls 011 and 111.	SUM
Mercury, Maximum	9/15/1983	Reported value of 0.98 lbs. per day was in violation of the permit limit of 0.42 lbs. per day.	11

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Mercury, Maximum	11/8/1987	Reported value of .33 lbs/day was in violation of the permit maximum of .3 lbs/day.	101A
Mercury, Maximum	11/8/1987	At least one excursion of .33 lbs. per day was in violation of the permit limit of .3 lbs. per day.	101A
Mercury, Maximum	11/15/1987	At least one excursion of .33 lbs. per day was in violation of the permit limit of .30 lbs. per day.	103Q
Mercury, Maximum	7/6/1988	Reported value of 0.3 lbs. was in violation of the permit limit of 0.03 lbs.	101
Mercury, Maximum	7/6/1988	At least one excursion of .33 lbs. per day was in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	12/28/1988	Reported value of 0.33 lbs. was in violation of the permit limit of 0.3 lbs.	101
Mercury, Maximum	12/28/1988	Reported value of .33 lbs/day was in violation of the permit maximum of .30 lbs/day.	101A
Mercury, Maximum	12/28/1988	Reported value of .33 lbs. per day was in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	1/9/1989	At least one excursion of .51 lbs. per day was in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	12/27/1989	Reported value of .51 lbs. was in violation of the permit limit of .30 lbs.	101
Mercury, Maximum	12/27/1989	Reported value of .72 lbs was in violation of an unspecified permit limit.	101
Mercury, Maximum	12/27/1989	Reported value of .508 lbs. per day was in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	2/25/1990	Reported value of 1.78 lbs. was in violation of the permit limit of 0.30 lbs.	101
Mercury, Maximum	2/25/1990	Reported value of 1.781 lbs. per day was in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	2/25/1990	Reported value of 1.78 lbs. was in violation of the permit limit of 0.3 lbs.	103Q
Mercury, Maximum	1/2/1991	Reported value of 4.5 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	1/2/1991	Reported value of 4.5 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	1/2/1991	Reported value of 4.5 lbs. per day was in violation of the permit limit of 0.3 lbs. per day.	201A
Mercury, Maximum	11/3/1991	Reported value of 0.62 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	11/3/1991	Reported value of 0.62 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	11/3/1991	Reported value of 0.62 lbs/day was in violation of the permit limit of 0.30 lbs/day.	103Q
Mercury, Maximum	11/5/1991	Reported value of 0.85 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	11/5/1991	Reported value of 0.85 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	11/15/1991	Reported value of 0.85 lbs/day was in violation of the permit limit of 0.30 lbs/day.	103Q
Mercury, Maximum	11/25/1991	Reported value of 0.315 lbs. was in violation of the permit limit of 0.3 lbs..	101

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Mercury, Maximum	11/25/1991	Reported value of 0.315 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	11/25/1991	Reported value of 0.315 lbs/day was in violation of the permit limit of 0.30 lbs/day.	103Q
Mercury, Maximum	4/29/1992	Reported value of 3.61 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	4/29/1992	Reported value of 3.61 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	7/1/1992	Reported value of 0.738 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	7/1/1992	Reported value of 0.738 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	00/00/0000	Reported value of .514 lbs. was in violation of the permit limit of 0.3 lbs.	101
Mercury, Maximum	02/00/1990	Reported value of 1.781 lbs. was in violation of the permit limit of 0.3 lbs.	103Q
Mercury, Maximum	04/00/1992	Reported value of 3.61 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	07/00/1992	Reported value of 0.74 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	07/00/1992	Reported value of 0.74 lbs. was in violation of the daily maximum permit limit of 0.3 lbs..	103Q
Mercury, Maximum	11/00/1987	Reported value of .314 lbs/day was in violation of the permit maximum of .30 lbs/day.	101A
Mercury, Maximum	11/00/1987	Two excursions of .314 lbs. per day were in violation of the permit limit of .30 lbs. per day.	101A
Mercury, Maximum	11/00/1991	Reported value of 0.85 lbs. was in violation of the permit limit of 0.3 lbs..	101
Mercury, Maximum	11/00/1991	Reported value of 0.85 lbs. was in violation of the daily maximum permit limit was 0.3 lbs..	103Q
Mercury, Maximum	12/00/1989	Reported value of .508 lbs was in violation of the permit limit of .30 lbs.	101
Mercury, Total	7/1/1992	Reported deviation value of +0.438 lbs/day was in violation of the maximum discharge limit of 0.30 lbs/day.	103Q
Mercury, Total	3/11/1996	Limit deviation of +0.277 #/d was in violation of the daily maximum permit limit of 0.30 #/d.	101
Mercury, Total	3/11/1996	Limit deviation of +0.277 #/d was in violation of the daily maximum of 0.30 #/d.	101
Mercury, Total (as HG)	8/20/1989	Discharge of 2 lbs. (visual estimate) to ground at the mercury cell chlorine area. Spill vacuumed and soil excavated and remediated.	NOI
Mercury, Total (as HG)	03/00/1996	Reported value of 0.58 lbs/day was in violation of the daily maximum of 0.30 lbs/day.	101A
Mercury, Total (as HG)	05/00/1996	Reported value of 0.51 lbs/day was in violation of the daily maximum of 0.30 lbs/day.	101A
Mercury, Total (as HG)	09/00/1997	Reported value of 0.54 lbs/dy was in violation of the daily maximum permit limit of 0.30 lbs/dy.	101A
Mixed Chlorinated Hydrocarbons	2/23/1991	Reported value of perchloroethylene, 1,1,2-Trichloroethane and other mixed chlorinated hydrocarbons was approximately 20 lbs. and no permit limits were provided in the source document.	NOI

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Mixed Chlorinated Hydrocarbons	4/5/1991	Reported value of perchloroethylene, hexachloroethane, and other mixed chlorinated hydrocarbons was approximately 40 lbs. and no permit limit was provided.	NOI
Nickel	2/2/1989	Reported value of 46.4 lbs. was in violation of the permit limit of 26.8 lbs.	201
Nickel	2/2/1989	Reported value of 46.4 lbs/day was in violation of the permit maximum of 19.3 lbs/day.	201A
Nickel (Ni), Total, Avg	02/00/1996	Reported value of 15.0 lbs/day was in violation of the daily average permit limit of 10.2 lbs/day.	201A
Nickel (Ni), Total, Max	02/00/1996	Reported value of 80.0 lbs/day was in violation of the daily maximum permit limit of 26.8 lbs/day.	201A
Nickel Maximum	2/2/1989	Reported value of 46.4 lbs. per day was in violation of the permit limit of 19.3 lbs. per day.	201A
Nickel Maximum	1/16/1990	Reported value of 29.9 lbs. was in violation of the permit limit of 26.8 lbs.	201
Nickel Maximum	1/22/1990	Reported value of 30 lbs. per day was in violation of the permit limit of 26.8 lbs. per day.	201A
Nickel Maximum	4/8/1992	Reported value of 34.6 lbs. was in violation of the daily maximum permit limit of 26.8 lbs..	201
Nickel Maximum	4/8/1992	Reported value of 34.6 lbs. was in violation of the permit limit of 26.8 lbs..	201
Nickel Maximum	01/00/1990	Reported value of 30.0 lbs. was in violation of the permit limit of 26.8 lbs.	201
Nickel Maximum	02/00/1989	Reported value of 46 lbs. was in violation of the permit limit of 19.3 lbs.	201
Nickel Maximum	04/00/1992	Reported value of 34.6 lbs. was in violation of the permit limit of 26.8 lbs..	201
Nickel, Average	05/00/1991	Reported value of 15.2 lbs. was in violation of the daily average permit limit of 10.2 lbs..	201
Nickel, Average	05/00/1991	Reported value of 15.2 lbs. was in violation of the permit limit of 10.2 lbs..	201
Nickel, Daily Max.	02/00/1989	Reported value of 46 lbs/day was in violation of the daily maximum permit limit of 26.8 lbs/day.	201
Nickel, Total	2/5/1996	Limit deviation of +1.4 #/d was in violation of the daily maximum of 26.8 #/d.	201
Nickel, Total	2/5/1996	Limit deviation of +1.4 #/d was in violation of the daily maximum of 26.8 #/d.	201
Nickel, Total	2/6/1996	Limit deviation of +53.2 #/d was in violation of the daily maximum of 26.8 #/d.	201
Nickel, Total	2/6/1996	Limit deviation of +53.2 #/d was in violation of the daily maximum of 26.8 #/d.	201
Nickel, Total	02/00/1996	Limit deviation of +4.8 #/d was in violation of the daily average of 10.2 #/d.	201
Pb, Avg.	8/31/1979	From 01/01/79 to 08/31/79 the reported value of 6.9 lbs/day was in violation of the daily average permit limit of 5.1 lbs/day. Number of violations: 2.	17
Pb, Max.	8/31/1979	From 01/01/79 to 08/31/79 the reported value of 44.72 lbs/day was in violation of the daily maximum permit limit of 10.1 lbs/day. Number of violations: 10.	17
PCB	10/14/1985	PCBs at a concentration of 140 parts per million were incinerated in violation of C.F.R. Section 761.70(d).	NOI

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
PCB	1/22/1987	PCBs at a concentration of 126 parts per million were incinerated in violation of 40 C.F.R. Section 761.70(d).	NOI
PCB	6/25/1991	A transformer was found to have a PCB concentration of 187 parts per million and was leaking PCBs at a concentration greater than 50 parts per million in violation of 40 C.F.R. Section 761.60(a).	NOI
PCB	6/25/1991	A transformer had a PCB concentration of 127 parts per million, and was leaking PCBs at a concentration greater than 50 parts per million in violation of 40 C.F.R. Section 761.60(a).	NOI
PCB	6/25/1991	A transformer had a PCB concentration greater than 160 parts per million, and was found to be leaking PCBs at a concentration greater than 50 parts per million in violation of 40 C.F.R. Section 761.60(a).	NOI
PCE	12/16/1988	Approximately 3.4 lbs. spilled to the ground.	NOI
PENTA	6/18/1988	There was an unauthorized discharge of 54 lbs. of a chlorinated hydrocarbon mixture containing 6% PENTA. A total of 3 lbs. of PENTA were discharged to the ground.	NOI
Perchloroethylene	10/24/1986	Approximately 13 lbs. spilled from the Per/Tri Unit onto the ground.	NOI
Perchloroethylene	10/24/1986	A discharge of 13 lbs. from the Per/Tri Unit spilled to the ground.	NOI
Perchloroethylene	2/25/1987	Approximately 60 lbs of a chlorinated hydrocarbon mixture containing 2.4 lbs of Perchloroethylene were discharged to the ground at the Waste Treatment Unit over a period of approximately 1 minute.	NOI
Perchloroethylene	4/7/1987	Chlorinated organics containing 375.7 lbs of Perchloroethylene were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Perchloroethylene	4/13/1987	Approximately 14 lbs (visual estimate) were discharged to the ground at the South Liquefaction Unit. Duration of violation: approximately 5.5 hrs.	NOI
Perchloroethylene	10/14/1987	A reported value of 260 lbs of material spilled to the ground from a transfer line west of the Chlorine Cylinder Building. Duration of violation: 20 minutes.	NOI
Perchloroethylene	10/28/1987	479 lbs. of Perchloroethylene were discharged to the ground at the Waste Treatment Unit.	NOI
Perchloroethylene	12/26/1987	Over a period of 15 minutes, 12 lbs. of perchloroethylene were discharged to the ground at the Waste Treatment Unit.	NOI
Perchloroethylene	1/15/1988	Approximately 17 lbs. from the Waste Treatment Plant was spilled to the ground.	NOI
Perchloroethylene	5/29/1988	There was an unauthorized discharge of 87.83919 lbs. of Perchloroethylene at the #2 VC tank.	NOI
Perchloroethylene	7/13/1988	Reported value of 5.6 lbs. was spilled to the ground from the Waste Treatment Unit.	NOI
Perchloroethylene	8/11/1988	Reported value of 27 lbs. spilled to the ground under the tanks.	NOI
Perchloroethylene	11/11/1988	Reported value of 16 lbs spilled to the ground.	NOI

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Perchloroethylene	12/16/1988	Reported value of 3.4 lbs. spilled to the ground near the Perchlor Pump at the per/tri unit.	NOI
Perchloroethylene	6/18/1990	Reported value of 12 lbs. (visual estimate) spilled to the ground at South Liquefaction Unit.	NOI
Perchloroethylene	12/22/1990	Approximately 3 lbs. spilled into the water at the "A" dock.	NOI
Perchloroethylene	2/23/1991	Reported value was 120 lbs. and no permit limit was provided.	NOI
Perchloroethylene	11/20/1991	Reported value of 3 lbs. spilled to the ground.	NOI
Perchloroethylene	9/14/1993	Approximately 2.8 lbs. spilled to the ground at the Waste Treatment Unit.	NOI
Perchloroethylene	5/7/1996	A reported value of 17 lbs spilled to the ground from the Vinyl Transfer Unit.	NOI
Perchloroethylene & 1,1,2-trichloroethane	1/15/1988	66 lbs were discharged to the ground at the Waste Treatment Unit. Duration of spill: 5 min.	NOI
Percholoethlyne	4/26/1988	There was an unauthorized discharge to the ground of 1.8 lbs of Percholoethylene.	NOI
Sodium Chromate	8/3/1991	Reported value of 24.8 lbs. spilled from the "A" Chlorine Electrolyzers storage room into the area sewer which empties into Bayou D'Inde.	NOI
Sodium Dichromate	7/1/1991	A reported value of 11.21 lbs spilled from the South Liquefaction Unit to the process sewer and through the outfall.	BAC1
Sodium Dichromate	7/1/1991	A spill of 11.21 lbs occurred.	BAC1
SYM	6/18/1988	There was an unauthorized discharge of 54 lbs. of a chlorinated hydrocarbon mixture containing 6% SYM. A total of 3 lbs. of SYM were discharged to the ground.	NOI
sym-Tetrachloroethane	9/14/1993	A chlorinated hydrocarbon mixture containing 0.8 # of sym-Tetrachloroethane spilled to the ground at the Waste Treatment Unit.	NOI
sym-Tetrachloroethane	9/14/1993	Approximately 0.8 lbs. spilled to the ground at the Waste Treatment Unit.	NOI
Sy-Tetrachloroethane	5/29/1988	There was an unauthorized discharge of 28.41856 lbs. of Sy-Tetrachloroethane at the #2 VC tank.	NOI
TCE	1/15/1988	Approximately 49 lbs. from the Waste Treatment Plant spilled to the ground.	NOI
TCE	6/18/1988	There was an unauthorized discharge of 54 lbs. of a chlorinated hydrocarbon mixture containing 15% TCE. A total of 8 lbs. of TCE were discharged to the ground.	NOI
TCE	1/23/1993	A discharge of 0.69 lbs. from the Waste Treatment Unit on Columbia Southern Road spilled to the ground.	NOI
TCE (1,1,2-trichloroethane)	9/14/1993	A chlorinated hydrocarbon mixture containing 3.5 # of TCE (1,1,2-trichloroethane) spilled to the ground at the Waste Treatment Unit.	NOI
TCH	4/4/1983	Reported value of 2,582 lbs. was in violation of the permit limit of 1,368 lbs from the sum of outfalls 010 and 018.	SUM
TCH	6/5/1983	Reported value of 1,518 lbs. was in violation of the permit limit of 1,368 lbs. from the sum of outfalls 010 and 018.	SUM

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
TCH	8/25/1983	Reported value of 1764 lbs. was in violation of the daily maximum permit limit of 1368 lbs. from a sum from outfalls 010 and 018.	SUM
Tetrachloroethane	10/28/1987	122 lbs. of tetracloroethane were discharged to the ground at the Waste Treatment Unit.	NOI
Tetrachloroethene	10/8/1986	Approximately 120 lbs of a chlorinated hydrocarbon mixture containing 24 lbs of Tetrachloroethene were discharged to the ground at the Waste Treatment Unit over a period of 5 minutes.	NOI
Tetrachloroethene	6/16/1988	A line used to transfer perchloroethylene to a stabilizer tank developed a leak and caused an unauthorized discharge to the ground of 92 lbs. over a period of 10 minutes.	NOI
Tetrachloroethene	9/14/1993	A chlorinated hydrocarbon mixture containing 2.8 # of Perchloroethylene (Tetrachloroethene) spilled to the ground at the Waste Treatment Unit.	NOI
Tetrachloroethylene	3/15/1992	A discharge of 23 lbs. spilled to the ground at the Per/Tri Unit on Columbia Southern Road.	NOI
Trichloroethane	10/28/1987	209 lbs. of Trichloroethane were discharged to the ground at the Waste Treatment Unit.	NOI
Trichloroethene	10/13/1986	Approximately 120 lbs of a chlorinated hydrocarbon mixture containing 15 lbs of Trichloroethene were discharged to the ground at the Waste Treatment Unit over a period of 5 minutes.	NOI
Trichloroethylene	1/22/1985	Approximately 4,300 lbs. spilled from the production unit and flowed into outfalls 013 and 001 leading to Bayou D'Inde.	SUM
Trichloroethylene	11/27/1986	Approximately 300 lbs spilled through the outfall and approximately 320 gallons discharged to the soil.	10
Trichloroethylene	4/7/1987	Chlorinated organics containing 162.5 lbs of Trichloroethylene were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Trichloroethylene	5/29/1988	There was an unauthorized discharge of 20.66804 lbs. of Trichloroethylene at the #2 VC tank.	NOI
Trichloroethylene	9/14/1993	Approximately 1.1 lbs. spilled to the ground at the Waste Treatment Unit.	NOI
Trichloroethylene	5/7/1996	A reported value of 5 lbs spilled to the ground from the Vinyl Transfer Unit.	NOI
Trichloroethylene (Trichloroethene)	9/14/1993	A chlorinated hydrocarbon mixture containing 1.1 # of Trichloroethylene (Trichloroethene) spilled to the ground at the Waste Treatment Unit.	NOI
Un-Tetrachloroethane	5/29/1988	There was an unauthorized discharge of 46.5031 lbs. of Un-Tetrachloroethane at the #2 VC tank.	NOI
Vanadium, Total	1/15/1988	Approximately 42 lbs. from the Waste Treatment Plant spilled to the ground.	NOI
Vanadium, Total	2/21/1988	The initial notification reported that 30,000 lbs. (3,000 gallons) spilled to the ground. This estimate was revised to 40 gallons on 02/22/88 by PPG.	NOI

Table 7-1
PPG Industries, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
VDCM (Vinylidine Chloride)(1,1-Dichloroethylene)	1/23/1993	A discharge of 0.04 lbs. from the Waste Treatment Unit on Columbia Southern Road spilled to the ground.	NOI
VDCM (Vinylidine Chloride)(1,1-Dichloroethylene)	1/31/1995	Reported value was approximately 16,000 lbs or 1600 gal and no permit limit was provided.	NOI
VDCM (Vinylidine Chloride)(1,1-Dichloroethylene)	9/23/1997	A release of an unknown quantity occurred over a duration of 2 minutes.	NS
Vinyl Chloride	2/9/1984	Approximately 1100 pounds spilled through a safety relief valve on a storage sphere.	NOI
Vinyl Chloride	5/18/1984	Approximately 3000 pounds spilled through a safety relief valve on a storage sphere.	NOI
Vinyl Chloride	2/15/1992	Facility released an unknown quantity of vinyl chloride into the atmosphere between 21:20 and 21:25 hours.	NS
Vinylidene Chloride	4/7/1987	Chlorinated organics containing 9.8 lbs of Vinylidene Chloride were discharged from the acid pit pumps to the shelled area around the pumps. The discharge was approximately 5 minutes in duration.	NOI
Vinylidene Chloride	1/24/1994	Reported value was 16,514 lbs and no permit limit was provided.	NOI
Vinylidene Chloride	1/24/1995	A spill of approximately 16,514 lbs. occurred.	NOI
Vinylidene Chloride	1/24/1995	A reported value 16,514 lbs. discharged to the air and the ground.	NOI
Vinylidene Chloride	5/7/1996	A reported value of 1 lb. was spilled to the ground from the Vinyl Transfer Unit.	NOI
Zirconium, Total	2/27/1993	Approximately 2480 pounds were discharged to the ground at the South Terminal Area for a period of 120 minutes.	NOI

NOI - No Outfall Identified
SUM - Combination of outfalls
Information obtained from permit files.

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Benzene	4/21/1990	A spill of 45 gallons occurred at the plant dock facility into the ship channel.	NOI
Benzene	2/18/1991	Inspection reported presence of 15.7 ppb in sampling.	NOI
Chlorobenzene	2/18/1991	Inspection reported presence of 775.9 ppb in sampling.	NOI
Chlorobenzene	10/21/1991	Inspection reported presence of 306 ppb in sampling.	NOI
Chlorobenzene	4/22/1987	A spill of 4-5 bbls occurred.	NOI
Chromium	12/9/1985	A discharge of 300-400 gallons of water contaminated with 3 mg/l occurred.	6
Chromium	12/9/1985	A spill of 300-400 gallons of water with 3 mg/l of chromium occurred from the rainwater discharge into the Calcasieu River.	6
Chromium	5/13/1986	Approximately .0076 lbs leaked into a sewer at the Citgo Refinery and into the Calcasieu River.	NOI
Chromium, Total	11/19/1981	Permittee was authorized to discharge "after Sabine river water" an average of 38 lbs/day and a maximum of 64 lbs/day.	3
Chromium, Total	11/19/1981	Permittee was authorized to discharge a daily average of 9 lbs/day and a daily maximum of 15 lbs/day.	BAC1
Chromium, Total	11/19/1981	Permittee was authorized to discharge from outfalls 002A and 002B a daily average of 11 lbs/day and a daily maximum of 28 lbs/day.	SUM
Cresol	12/11/1985	Wastewater was received by three impoundments.	NOI
Dichlorobenzene,1,3-	2/18/1991	Inspection reported presence of 24.9 ppb in sampling.	NOI
Dichlorobenzene,1,4-	2/18/1991	Inspection reported presence of 120.7 ppb in sampling.	NOI
Methyl Ethyl Ketone	12/11/1985	Wastewater was received by three impoundments.	NOI
Mysidopsis Bahia	04/00/1997	Failed bioassay test 3 times during the monitoring period of 04/28/97 - 10/27/97.	TX1S
Naphthalene	06/00/1987	Naphthalene was detected in wells 32 and 51.	NOI
Naphthalene	10/00/1987	Naphthalene was detected in well 36.	NOI
Naphthalene	10/00/1989	Sampling of Surge Pond wells detected naphthalene.	NOI
Phenol	4/16/1981	Reported value of 691 lbs/day was in violation of the permit value of 650 lbs/day.	3
Phenol	4/26/1981	Reported value of 10.3 lbs/day was in violation of the permit maximum of 7.0 lbs/day.	BAC1
Phenol	6/23/1981	Reported value of 1,048 lbs/day was in violation of the permit maximum of 650 lbs/day.	3
Phenol	8/4/1981	Recorded value was 345 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	8/4/1981	Reported value of 345 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/4/1981	Reported value of 345 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	8/6/1981	Reported value of 419 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/6/1981	Reported value of 419 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	8/11/1981	Reported value of 331 lbs/day was in violation of the permit value of 32 lbs/day.	3

Table 7-2
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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	8/11/1981	Reported value of 331 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	8/13/1981	Reported value of 743 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/13/1981	Reported value of 743 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/18/1981	Recorded value was 470 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	8/18/1981	Reported value of 470 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/18/1981	Reported value of 470 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	8/20/1981	Recorded value was 2,239 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	8/20/1981	Reported value of 2,239 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/20/1981	Reported value of 2,239 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/25/1981	Recorded value was 665 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	8/25/1981	Reported value of 665 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/25/1981	Reported value of 665 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/27/1981	Recorded value was 237 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	8/27/1981	Reported value of 237 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	8/27/1981	Reported value of 237 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	9/1/1981	Recorded value was 325 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/1/1981	Reported value of 325 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/1/1981	Reported value of 325 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	9/3/1981	Recorded value was 199 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/3/1981	Reported value of 199 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/3/1981	Reported value of 199 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/8/1981	Recorded value was 147 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/8/1981	Reported value of 147 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/8/1981	Reported value of 147 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	9/10/1981	Recorded value was 139 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	9/10/1981	Reported value of 139 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/10/1981	Reported value of 139 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/15/1981	Recorded value was 37 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/15/1981	Reported value of 37 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/15/1981	Reported value of 37 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/22/1981	Recorded value was 174 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/22/1981	Reported value of 174 lbs/day was in violation of the permit value of 32.	3
Phenol	9/22/1981	Reported value of 131 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/22/1981	Reported value of 174 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/24/1981	Recorded value was 131 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/24/1981	Reported value of 131 lbs/day was in violation of the permit maximum of 32 lbs/day.	3
Phenol	9/29/1981	Recorded value was 37 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	9/29/1981	Reported value of 37 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/29/1981	Reported value of 37 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/1/1981	Reported value of 94 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/6/1981	Reported value of 93 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/8/1981	Reported value of 80 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/13/1981	Reported value of 120 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/15/1981	Reported value of 112 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/20/1981	Reported value of 289 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	10/22/1981	Reported value of 699 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	11/5/1981	Reported value of 52.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	11/10/1981	Reported value of 90.8 lbs/day was in violation of the permit limit of 32 lbs/day.	3
Phenol	11/12/1981	Reported value of 61.4 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	11/17/1981	Reported value of 104.0 lbs/day was in violation of the permit value of 32 lbs/day.	3

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	11/24/1981	Reported value of 163.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	11/26/1981	Reported value of 372.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/1/1981	Reported value of 350 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/2/1981	Reported value of 45.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/5/1981	Reported value of 46.4 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/6/1981	Reported value of 41.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/7/1981	Reported value of 119.0 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/8/1981	Reported value of 128.6 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/10/1981	Reported value of 52.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/11/1981	Reported value of 108 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/12/1981	Reported value of 60.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/13/1981	Reported value of 626 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/14/1981	Reported value of 2,189 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/15/1981	Reported value of 2,637 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/16/1981	Reported value of 2,533 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/17/1981	Reported value of 2,467 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/18/1981	Reported value of 2,286 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/19/1981	Reported value of 2,110 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/20/1981	Reported value of 2,538 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/21/1981	Reported value of 1,356 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/22/1981	Reported value of 453 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/23/1981	Reported value of 311 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/24/1981	Reported value of 205 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/25/1981	Reported value of 166 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/26/1981	Reported value of 136 lbs/day was in violation of the permit value of 32 lbs/day.	3

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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	12/27/1981	Reported value of 120 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/28/1981	Reported value of 106.8 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/29/1981	Reported value of 78.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/30/1981	Reported value of 95 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	12/31/1981	Reported value of 464 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/1/1982	Reported value of 68 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/2/1982	Reported value of 48 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/3/1982	Reported value of 84.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/4/1982	Reported value of 69.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/5/1982	Reported value of 47.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/6/1982	Reported value of 46.1 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/7/1982	Reported value of 50 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/8/1982	Reported value of 42.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/9/1982	Reported value of 65.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/11/1982	Reported value of 46.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/12/1982	Reported value of 182.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/13/1982	Reported value of 102.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/14/1982	Reported value of 93.1 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/15/1982	Reported value of 76.1 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/16/1982	Reported value of 76.6 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	1/17/1982	Reported value of 64.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/9/1982	Reported value of 45.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/12/1982	Reported value of 47.6 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/13/1982	Reported value of 64.8 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/14/1982	Reported value of 127.8 lbs/day was in violation of the permit value of 32 lbs/day.	3

Table 7-2
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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	2/15/1982	Reported value of 159.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/16/1982	Reported value of 139.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/17/1982	Reported value of 83.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/18/1982	Reported value of 39.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/19/1982	Reported value of 46.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/20/1982	Reported value of 47.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/21/1982	Reported value of 41.1 lbs/day was in violation of the permit value e of 32 lbs/day.	3
Phenol	2/22/1982	Reported value of 46.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/23/1982	Reported value of 64.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/24/1982	Reported value of 74.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/25/1982	Reported value of 87.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/26/1982	Reported value of 72.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/27/1982	Reported value of 67.4 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	2/28/1982	Reported value of 57.4 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol	9/19/1983	Recorded value was 551.6 lbs/day. Permit values were a daily maximum of 230 lbs/day, and a daily average of 115 lbs/day.	3
Phenol	9/19/1983	Recorded value was 551.6 lbs/day. Permit values were a daily maximum of 230 lbs/day, and a daily average of 115 lbs/day.	3
Phenol	9/21/1983	Recorded value was 427.9 lbs/day. Permit values were a daily maximum of 230 lbs/day, and a daily average of 115 lbs/day.	3
Phenol	9/21/1983	Recorded value was 427.9 lbs/day. Permit values were a daily maximum of 230.0 lbs/day, and a daily average of 115.0 lbs/day.	3
Phenol	12/29/1983	A value of 66 was recorded at Plywood Dam, near Gate No. 25. Permit limits were not provided.	NOI
Phenol	12/29/1983	A value of 0.11 was recorded at Final Culvert Before Bayou D'Inde. Permit limits were not provided.	NOI
Phenol	1/5/1984	A value of 0.05 was recorded at Plywood Dam Near Gate No. 25. Permit limits were not provided.	NOI
Phenol	1/5/1984	A value of 0.07 was recorded at Bayou D'Inde Bridge. Permit limits were not provided.	NOI

Table 7-2
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CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	5/10/1984	Recorded value was 216.7 lbs/day. Permit values were a daily maximum of 7.0 lbs/day and a daily average of 3.0 lbs/day.	BAC1
Phenol	5/10/1984	Reported value of 216.7 lbs/day was in violation of the daily maximum of 7.0 lbs/day and the daily average of 3.0 lbs/day.	BAC1
Phenol	5/11/1984	Recorded value was 1,156.0 lbs/day. Permit values were a daily maximum of 7.0 lbs/day and a daily average of 3.0 lbs/day.	BAC1
Phenol	5/11/1984	Reported value of 1,156.0 lbs/day was in violation of the daily maximum of 7.0 lbs/day and the daily average of 3.0 lbs/day.	BAC1
Phenol	5/12/1984	Recorded value was 372.9 lbs/day. Permit values were a daily maximum of 7.0 lbs/day and a daily average of 3.0 lbs/day.	BAC1
Phenol	5/12/1984	Reported value of 372.9 lbs/day was in violation of the daily maximum of 7.0 lbs/day and the daily average of 3.0 lbs/day.	BAC1
Phenol	5/13/1984	Recorded value was 293.4 lbs/day. Permit values were a daily maximum of 7.0 lbs/day and a daily average of 3.0 lbs/day.	BAC1
Phenol	5/13/1984	Reported value of 293.4 lbs/day was in violation of the daily maximum of 7.0 lbs/day and the daily average of 3.0 lbs/day.	BAC1
Phenol	5/14/1984	Recorded value was 8.1 lbs/day. Permit values were a daily maximum of 7.0 lbs/day and a daily average of 3.0 lbs/day.	BAC1
Phenol	5/14/1984	Reported value of 8.1 was in violation of the daily maximum of 7.0 lbs/day and the daily average of 3.0.	BAC1
Phenol	9/16/1985	Recorded value was 45.9 lbs/day. Permit values were a daily maximum of 32 lbs/day, and a daily average of 15 lbs/day.	3
Phenol	10/27/1985	Recorded value was 1,317.3 lbs/day. Permit values were a daily maximum of 32.0 lbs/day, and a daily average of 15.0 lbs/day.	3
Phenol	10/28/1985	Recorded value was 3,947 lbs/day. Permit values were a daily maximum of 32 lbs/day, and a daily average of 15 lbs/day.	3
Phenol	10/29/1985	Reported value of 1,794.1 was in violation of the limit of 32.	NOI
Phenol	10/30/1985	Recorded value was 1,022.6 lbs/day. Permit values were a daily maximum of 32 lbs/day, and a daily average of 15 lbs/day.	3
Phenol	10/31/1985	Recorded value was 371.6 lbs/day. Permit values were a daily maximum of 32.0 lbs/day, and a daily average of 15.0 lbs/day.	3

Table 7-2
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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	5/20/1986	Approximately 16,400 gallons of untreated refinery effluent spilled into the Indian Marais. Analysis of the effluent spill indicated that 1.9 lbs of Phenol at a concentration of 14 ppm were discharged. The NPDES permit limit for this contaminant was 32 lbs/day.	NOI
Phenol	6/8/1986	Permittee discharged 210 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenol	6/11/1986	Reported value of 172 lbs/day was in violation of the permitted daily maximum of 32 lbs/day.	3
Phenol	11/24/1986	Permittee discharged 228 lbs/day. Permit values were a daily maximum of 15.6 lbs/day, and a daily average of 60.1 lbs/day. (Source documents appear to have reversed the daily average and daily maximum permit values.)	3
Phenol	5/18/1989	Recorded value was 1,243 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenol	6/28/1989	An exceedance occurred.	3
Phenol	6/28/1989	Recorded value was 83.8 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenol	6/28/1989	Permittee discharged 83.8 lbs/day in violation of the daily maximum permit limit of 60.1 lbs/day from a sum of outfalls 003A and 003B.	SUM
Phenol	6/28/1989	Recorded value for outfalls 003A and 003B was 83.8 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenol	6/29/1989	An exceedance occurred.	3
Phenol	6/29/1989	Recorded value was 136.4 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenol	6/29/1989	Recorded value was 0.002 mg/l. Closure permit testing value was 0.002 mg/l.	NOI
Phenol	6/29/1989	Permittee discharged 1,364 lbs/day in violation of the daily maximum permit limit of 60.1 lbs/day from a sum of outfalls 003A and 003B.	SUM
Phenol	6/29/1989	Recorded value for outfalls 003a and 003b was 1,364 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenol	6/30/1989	An exceedance occurred.	3
Phenol	6/30/1989	Recorded value was 92 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenol	6/30/1989	Permittee discharged 92 lbs/day in violation of the daily maximum permit limit of 60.1 lbs/day from a sum of outfalls 003A and 003B.	SUM
Phenol	6/30/1989	Recorded value for outfalls 003a and 003b was 92 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenol	7/1/1989	An exceedance occurred.	3

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol	7/1/1989	Recorded value was 129 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenol	7/1/1989	Permittee discharged 129 lbs/day in violation of the daily maximum permit limit of 60.1 lbs/day from a sum of outfalls 003A and 003B.	SUM
Phenol	7/1/1989	Recorded value for outfalls 003a and 003b was 129 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenol	11/23/1989	Total phenol compounds discharged was 18,530 pounds. The discharge triggered a series of events which resulted in 9 daily exceedances and 2 monthly exceedances. The fish kill was estimated at 400 pounds, and dead crabs were nearby the outfall.	NOI
Phenol	11/26/1989	Reported value was 5,124 lbs/day, and no permit value was provided.	BAC1
Phenol	12/28/1989	Recorded value was 249 lbs/day. Permit values were a daily average of 15.6 lbs/day, and a daily maximum of 60.1 lbs/day.	3
Phenol	7/15/1997	Reported value of 86.07 lbs/day was in violation of the daily maximum permit limit of 3.1 lbs/day.	BAC1
Phenol	01/00/1981	Reported value of 230 lbs/day was in violation of the permit value of 130 lbs/day.	3
Phenol	03/00/1981	Reported value of 170 lbs/day was in violation of the permit average of 130 lbs/day.	3
Phenol	04/00/1981	Reported value of 215 lbs/day was in violation of the permit average of 130 lbs/day.	3
Phenol	06/00/1981	Reported value of 357 lbs/day was in violation of the permit average of 130 lbs/day.	3
Phenol	08/00/1981	Reported value of 681 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol	08/00/1981	Reported value of 681 lbs/day was in violation of the permit average of 15 lbs/day.	3
Phenol	09/00/1981	Reported average of 135 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol	09/00/1981	Reported value of 135 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol	10/00/1981	Reported average of 166 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol	11/00/1981	Reported average of 112 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol	11/00/1985	Permittee discharged an average of 6.1 lbs/day. Daily average permit value was 3.0 lbs/day.	BAC1
Phenol	11/00/1985	Permittee discharged 47.3 lbs/day. Daily maximum permit value was 7.0 lbs/day.	BAC1
Phenol	12/00/1981	Reported average of 705 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol, Avg	01/00/1982	Reported value of 66 lbs/day was in violation of the permit value of 15 lbs/day.	3
Phenol, Avg	02/00/1981	Reported value of 3.2 lbs/day was in violation of the permit average of 3.0 lbs/day.	BAC1

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenol, Avg	05/00/1984	Permittee discharged 137 lbs/day. Permit value was 3 lbs/day.	BAC1
Phenol, Max	1/18/1982	Reported value of 83.6 lbs/day was in violation of permit limit of 32 lbs/day.	3
Phenol, Max	1/19/1982	Reported value of 89 lbs/day was in violation of permit limit of 32 lbs/day.	3
Phenol, Max	1/21/1982	Reported value of 100 lbs/day was in violation of permit limit of 32 lbs/day.	3
Phenol, Max	1/22/1982	Reported value of 69.2 lbs/day was in violation of permit limit of 32 lbs/day.	3
Phenol, Max	1/23/1982	Reported value of 66.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/24/1982	Reported value of 58 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/26/1982	Reported value of 44.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/27/1982	Reported value of 38.8 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/28/1982	Reported value of 72.7 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/29/1982	Reported value of 73.8 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	1/30/1982	Reported value of 90.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	2/1/1982	Reported value of 64.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	2/2/1982	Reported value of 49.9 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	2/3/1982	Reported value of 72.5 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	2/4/1982	Reported value of 56.3 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	2/6/1982	Reported value of 50.2 lbs/day was in violation of the permit value of 32 lbs/day.	3
Phenol, Max	5/10/1984	Permittee discharged 217 lbs/day. Permit value was 7 lbs/day.	BAC1
Phenol, Max	5/11/1984	Permittee discharged 1,156 lbs/day. Permit value was 7 lbs/day.	BAC1
Phenol, Max	5/12/1984	Permittee discharged 373 lbs/day. Permit value was 7 lbs/day.	BAC1
Phenol, Max	5/13/1984	Permittee discharged 293 lbs/day. Permit value was 7 lbs/day.	BAC1
Phenol, Max	5/14/1984	Permittee discharged 8.1 lbs/day. Permit value was 7 lbs/day.	BAC1
Phenolics	4/16/1981	Recorded value was 691 lbs/day. Permit value was a daily maximum of 650 lbs/day.	3
Phenolics	6/11/1981	Recorded value was 1,857 lbs/day. Permit value was a daily maximum of 7.0 lbs/day.	BAC1
Phenolics	6/11/1981	Reported value of 1,857 lbs/day was in violation of the permit maximum of 7.0 lbs/day.	BAC1

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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	6/16/1981	Recorded value was 49 lbs/day. Permit value was a daily maximum of 7.0 lbs/day.	BAC1
Phenolics	6/16/1981	Reported value of 49 lbs/day was in violation of the permit maximum of 7.0 lbs/day.	BAC1
Phenolics	6/18/1981	Recorded value was 16 lbs/day. Permit value was a daily maximum of 7.0 lbs/day.	BAC1
Phenolics	6/18/1981	Reported value of 16 lbs/day was in violation of the permit maximum of 7.0 lbs/day.	BAC1
Phenolics	6/23/1981	Recorded value was 1,048 lbs/day. Permit value was a daily maximum of 650 lbs/day.	3
Phenolics	6/25/1981	Recorded value was 1,905 lbs/day. Permit value was a daily maximum of 650 lbs/day.	3
Phenolics	6/25/1981	Reported value of 1,905 lbs/day was in violation of the permit maximum of 650 lbs/day.	3
Phenolics	8/13/1981	Recorded value was 743 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenolics	11/19/1981	Permittee was authorized to discharge a daily average of 3 lbs/day and a daily maximum of 7 lbs/day.	BAC1
Phenolics	9/14/1984	Permittee discharged 175.1 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	9/14/1985	Reported value of 175.1 was in violation of the limit of 32.	NOI
Phenolics	9/15/1985	Reported value of 114 was in violation of the limit of 32.	NOI
Phenolics	9/15/1985	Permittee discharged 114 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	9/16/1985	Reported value of 45.9 was in violation of the limit of 32.	NOI
Phenolics	9/16/1985	Permittee discharged 45.9 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	10/27/1985	Reported value of 1,317.3 was in violation of the limit of 32.	NOI
Phenolics	10/27/1985	Permittee discharged 1,317.3 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	10/28/1985	Reported value of 3,947.0 was in violation of the limit of 32.	NOI
Phenolics	10/28/1985	Permittee discharged 3,947.0 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	10/29/1985	Recorded value was 1,794.1 lbs/day. Permit value was a daily maximum of 32 lbs/day, and a daily average of 15 lbs/day.	3
Phenolics	10/29/1985	Permittee discharged 1,794.1 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	10/30/1985	Reported value of 1,022.6 was in violation of the limit of 32.	NOI
Phenolics	10/30/1985	Permittee discharged 1,022.6 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	10/31/1985	Reported value of 371.6 was in violation of the limit of 32.	NOI

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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	10/31/1985	Permittee discharged 371.6 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	11/5/1985	Recorded value was 47 lbs/day. Permit values were a daily maximum of 7 lbs/day, and a daily average of 3.2 lbs/day.	BAC1
Phenolics	12/11/1985	Wastewater was received by clay impoundments.	NOI
Phenolics	6/8/1986	Reported value of 210 was in violation of the limit of 32.	NOI
Phenolics	6/8/1986	Permittee discharged 210 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	6/8/1986	Permittee discharged 210 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	6/11/1986	Permittee discharged 172 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenolics	6/11/1986	Reported value of 172 was in violation of the limit of 32.	NOI
Phenolics	6/11/1986	Permittee discharged 172 lbs/day. Permit value was 32 lbs/day.	NOI
Phenolics	5/18/1989	Recorded value for outfalls 003a and 003b was 1,243 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	5/18/1989	Permittee discharged 1,243 lbs/day in violation of the daily maximum permit limit of 60.1 lbs/day from a sum of outfalls 003A and 003B.	SUM
Phenolics	5/18/1989	Recorded value for outfalls 003a and 003b was 1,243 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	6/28/1989	Recorded value for outfalls 003a and 003b was 83.8 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	6/29/1989	Recorded value for outfalls 003a and 003b was 1,364 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	6/30/1989	Recorded value for outfalls 003a and 003b was 92 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	7/1/1989	Recorded value for outfalls 003a and 003b was 129 lbs/day. Permit value was 60.1 lbs/day.	SUM
Phenolics	11/24/1989	Reported discharge was 5124 lbs/day. No other parameters given.	NOI
Phenolics	11/25/1989	Reported a high level of phenolic compounds which resulted in a fishkill of less than 100 fish and crabs. The bacteriological treatment unit experienced a complete bug kill.	BAC1
Phenolics	11/25/1989	Citgo's facility inspection report revealed a discharge of high levels of phenolic compounds, less than 100 fish and crabs observed dead and there was a complete bug kill.	BAC1
Phenolics	11/25/1989	Reported value was 119 ppm or 5,124 per day, and no permit value was provided.	BAC1
Phenolics	11/26/1989	Reported value of 5,124 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	11/26/1989	A massive discharge of over 18,000 lbs. of phenolic compounds to Bayou D'Inde resulted in a fish and crab kill. A complete "bug kill" was also noted. Dead fish were recovered from an area approximately one-half mile upstream and up to one mile downstream from the outfall.	BAC1
Phenolics	11/26/1989	Recorded value was 5,124 lbs/day, and no permit value was provided.	BAC1
Phenolics	11/26/1989	Reported value was 5,124 lb/day, and no permit value was provided.	BAC1
Phenolics	11/26/1989	Reported value of 5124 lb/day discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	11/26/1989	A discharge of 5,124 lbs/day occurred.	BAC1
Phenolics	11/26/1989	Permittee discharged 5,124 lbs/day. Permit value was 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	11/26/1989	Recorded value was 5,124 lbs/day.	BAC1
Phenolics	11/26/1989	Recorded value was 5,124 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/26/1989	Recorded value was 5,124 lbs/day. Permit values were a daily maximum of 10.6 lbs/day and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/26/1989	Reported value was 119 ppm or 5,124 per day discharge, and no permit limit was provided.	BAC1
Phenolics	11/26/1989	A release of 5,124 lbs/day or 119 ppm occurred.	BAC1
Phenolics	11/26/1989	A discharge of 5,124 lbs/day occurred.	NOI
Phenolics	11/27/1989	Reported value of 2,520 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	11/27/1989	Recorded value was 2,520 lbs/day.	BAC1
Phenolics	11/27/1989	Reported value of 2,520 lb/day, and no permit value was provided.	BAC1
Phenolics	11/27/1989	Reported value of 2520 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	11/27/1989	A discharge of 2,520 lbs/day occurred.	BAC1
Phenolics	11/27/1989	Permittee discharged 2,520 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	11/27/1989	Recorded value was 2,520 lbs/day.	BAC1
Phenolics	11/27/1989	Recorded value was 2,520 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/27/1989	Recorded value was 2,520 lbs/day. Permit values were a daily maximum of 10.6 lbs/day and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/27/1989	Reported discharge of 2520 lbs/day. No other parameters given.	NOI
Phenolics	11/27/1989	A discharge of 2,520 lbs/day occurred.	NOI

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Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	11/28/1989	Reported value of 3,692 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	11/28/1989	Recorded value was 3,692 lbs/day.	BAC1
Phenolics	11/28/1989	Reported value was 3,692 lb/day, and no permit value was provided.	BAC1
Phenolics	11/28/1989	Reported value of 3692 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	11/28/1989	A discharge of 3,692 lbs/day occurred.	BAC1
Phenolics	11/28/1989	Permittee discharged 3,692 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 monthly average.	BAC1
Phenolics	11/28/1989	Recorded value was 3,692 lbs/day.	BAC1
Phenolics	11/28/1989	Recorded value was 3,692 lbs/day. Permit value was a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/28/1989	Recorded value was 3,692 lbs/day. Permit values were a daily maximum of 10.6 lbs/day and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/28/1989	Reported discharge of 3692 lbs/day. No other parameters given.	NOI
Phenolics	11/28/1989	A discharge of 3,692 lbs/day occurred.	NOI
Phenolics	11/29/1989	Reported value of 2,871 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	11/29/1989	Recorded value was 2,871 lbs/day.	BAC1
Phenolics	11/29/1989	Reported value was 2,871 lb/day, and no permit value was provided.	BAC1
Phenolics	11/29/1989	Reported value of 2871 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	11/29/1989	A discharge of 2,871 lbs/day occurred.	BAC1
Phenolics	11/29/1989	Permittee discharged 2,871 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	11/29/1989	Recorded value was 2,871 lbs/day.	BAC1
Phenolics	11/29/1989	Recorded value was 2,871 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/29/1989	Recorded value was 2,871 lbs/day. Permit values were a daily maximum of 10.6 lbs/day and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/29/1989	Reported discharge of 2871 lbs/day. No other parameters given.	NOI
Phenolics	11/30/1989	Reported value of 2,469 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	11/30/1989	Recorded value was 2,469 lbs/day.	BAC1
Phenolics	11/30/1989	Reported value was 2,469 lb/day, and no permit value was provided.	BAC1

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Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	11/30/1989	Reported value of 2469 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	11/30/1989	A discharge of 2,469 lbs/day occurred.	BAC1
Phenolics	11/30/1989	Permittee discharged 2,469 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	11/30/1989	Recorded value was 2,469 lbs/day.	BAC1
Phenolics	11/30/1989	Recorded value was 2,469 lbs/day. Permit value was a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/30/1989	Recorded value was 2,469 lbs/day. Permit values were a daily maximum of 10.6 lbs/day and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	11/30/1989	Reported discharge of 2469 lbs/day. No other parameters given.	NOI
Phenolics	11/30/1989	A discharge of 2,469 lbs/day occurred.	NOI
Phenolics	12/1/1989	Reported value of 595 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	12/1/1989	Recorded value was 595 lbs/day.	BAC1
Phenolics	12/1/1989	Reported value was 595 lb/day, and no permit value was provided.	BAC1
Phenolics	12/1/1989	Reported value of 595 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	12/1/1989	Permittee discharged 595 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	12/1/1989	Recorded value was 595 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	12/2/1989	Reported value of 468 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	12/2/1989	Recorded value was 468 lbs/day.	BAC1
Phenolics	12/2/1989	Reported value was 468 lb/day, and no permit value was provided.	BAC1
Phenolics	12/2/1989	Reported value of 468 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	12/2/1989	Permittee discharged 468 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	12/2/1989	Recorded value was 468 lbs/day. Permit value was a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	12/3/1989	Reported value of 512 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	12/3/1989	Recorded value was 512 lbs/day.	BAC1

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Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	12/3/1989	Reported that from 11/28 to 12/3 they had recovered approximately 300-400 lbs. of dead fish and crabs from an area approximately one-half mile upstream and to one mile downstream from the outfall.	BAC1
Phenolics	12/3/1989	Reported value was 512 lb/day, and no permit value was provided.	BAC1
Phenolics	12/3/1989	Reported value of 512 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	12/3/1989	Permittee discharged 512 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 monthly average.	BAC1
Phenolics	12/3/1989	Recorded value was 512 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5 lbs/day.	BAC1
Phenolics	12/4/1989	Reported value of 279 Lb/Day was in violation of the daily maximum of 10.6 Lb/Day.	BAC1
Phenolics	12/4/1989	Recorded value was 279 lbs/day.	BAC1
Phenolics	12/4/1989	Reported value was 279 lb/day, and no permit value was provided.	BAC1
Phenolics	12/4/1989	Reported value of 279 lb/day was discharged into the Calcasieu River resulting in the mortality of numerous fish and crabs.	BAC1
Phenolics	12/4/1989	Permittee discharged 279 lbs/day. Permit values were 10.6 lbs/day daily maximum, and 4.5 lbs/day monthly average.	BAC1
Phenolics	12/4/1989	Recorded value was 279 lbs/day. Permit values were a daily maximum of 10.6 lbs/day, and a monthly average of 4.5.	BAC1
Phenolics	12/5/1989	Reported value of 500 lbs/day was released.	BAC1
Phenolics	12/21/1989	Recorded value was 300 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	3
Phenolics	12/26/1989	Recorded value was 358 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenolics	12/27/1989	Recorded value was 325 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	3
Phenolics	12/27/1989	Recorded value was 325 lbs/day. Permit values were a daily average of 15.6 lbs/day and a daily maximum of 60.1 lbs/day.	3
Phenolics	12/28/1989	Recorded value was 249 lbs/day. Permit value was 60.1 lbs/day.	3
Phenolics	11/18/1991	Permittee was authorized to discharge "before Sabine river water" a daily average of 130 lbs/day and a daily maximum of 650 lbs/day. Permittee was authorized to discharge "after Sabine river water" a daily average of 15 lbs/day and a daily maximum of 32 lbs/day.	3
Phenolics	9/13/1997	A spilled of one drum occurred to the ground.	NOI
Phenolics	11/29/1997	A discharge of 2,871 lbs/day occurred.	NOI
Phenolics	02/00/1981	Reported value of 141 lbs/day was in violation of the permit average of 130 lbs/day.	3

Table 7-2
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CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolics	05/00/1989	Recorded value was 1,243 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	003A
Phenolics	06/00/1981	Reported value of 214 lbs/day was in violation of the permit average of 3.0 lbs/day.	BAC1
Phenolics	06/00/1986	Recorded value was 15 lbs/day. Permit value was a daily minimum of 16 lbs/day.	3
Phenolics	06/00/1986	Recorded value was 211 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenolics	06/00/1986	Reported value of 16 lbs/day was in violation of the daily minimum permit limit of 15 lbs/day. Three exceedances occurred.	3
Phenolics	06/00/1986	Reported monthly average of 16 was in violation of the limit of 15.	NOI
Phenolics	06/00/1986	Permittee discharged an average of 16 lbs/day. Permit value was an average of 15 lbs/day.	NOI
Phenolics	06/00/1989	Recorded value was 136.5 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	003A
Phenolics	07/00/1989	Recorded value was 131.3 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	003A
Phenolics	09/00/1985	Reported value of 16 was in violation of the limit of 15.	NOI
Phenolics	09/00/1985	Permittee discharged a monthly average of 16 lbs/day. Permit value was 15 lbs/day.	NOI
Phenolics	10/00/1985	Reported monthly average of 275 was in violation of the limit of 15.	NOI
Phenolics	10/00/1985	Permittee discharged an average of 275 lbs/day. Permit value was an average of 15 lbs/day.	NOI
Phenolics	11/00/1986	Recorded value was 228.2 lbs/day. Permit value was a daily maximum of 60.1 lbs/day.	003A
Phenolics	11/00/1986	Reported value of 228.2 lbs/day was in violation of the daily maximum permit limit of 60.1 lbs/day. Two exceedances occurred.	003A
Phenolics	11/00/1989	Recorded value was 5,124 lbs/day. Permit value was a daily maximum of 10.6 lbs/day.	1
Phenolics	11/00/1989	Six violations occurred. Recorded value was 5,124 lbs/day. Permit values were a daily average of 4.5 lbs/day, and a daily maximum of 10.6 lbs/day.	BAC1
Phenolics	11/00/1989	An exceedance occurred.	NOI
Phenolics	12/00/1989	Recorded value was 605.9 lbs/day. Permit value was a daily maximum of 10.6 lbs/day.	1
Phenols, Average	01/00/1981	Recorded value was 230 lbs/day. Permit value was a daily average of 130 lbs/day.	3
Phenols, Average	02/00/1981	Recorded value was 141 lbs/day. Permit value was a daily average of 130 lbs/day.	3
Phenols, Average	02/00/1981	Recorded value was 3.2 lbs/day. Permit value was a daily average of 3.0 lbs/day.	BAC1
Phenols, Average	03/00/1981	Recorded value was 170 lbs/day. Permit value was a daily average of 130 lbs/day.	3
Phenols, Average	04/00/1981	Recorded value was 215 lbs/day. Permit value was a daily average of 130 lbs/day.	3

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CHEMICAL	DATE	VIOLATION	OUTFALL
Phenols, Average	06/00/1981	Recorded value was 357 lbs/day. Permit value was a daily average of 130 lbs/day.	3
Phenols, Average	06/00/1981	Recorded value was 214 lbs/day. Permit value was a daily average of 3.0 lbs/day.	BAC1
Phenols, Average	08/00/1981	Recorded value was 681 lbs/day. Permit value was a daily average of 15 lbs/day.	3
Phenols, Average	09/00/1981	Recorded value was 135 lbs/day. Permit value was a daily average of 15 lbs/day.	3
Phenols, Average	11/00/1989	Recorded value was 1,390 lbs/day. Permit value was 4.5 lbs/day.	BAC1
Phenols, Average	12/00/1989	Recorded value was 145.7 lbs/day. Permit value was 4.5 lbs/day.	BAC1
Phenols, Maximum	4/26/1981	Recorded value was 10.3 lbs/day. Permit value was a daily maximum of 7.0 lbs/day.	BAC1
Phenols, Maximum	8/6/1981	Recorded value was 419 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenols, Maximum	8/11/1981	Recorded value was 331 lbs/day. Permit value was a daily maximum of 32 lbs/day.	3
Phenols, Maximum	05/00/1989	Reported value of 1243 lbs/day was in violation of the daily maximum permit limit of 60.1 lbs/day. Two exceedances occurred.	003A
Phenols, Maximum	05/00/1989	Two excursions occurred. Reported value was 1,243 lbs/day. Permit value was 60.1 lbs/day.	003A
Phenols, Maximum	06/00/1986	Reported value of 211 lbs/day was in violation of the daily maximum permit limit of 32 lbs/day.	3
Phenols, Maximum	06/00/1986	Reported value was 211 lbs/day. Permit value was 32 lbs/day.	3
Phenols, Maximum	06/00/1989	Reported value of 136.5 lbs/day was in violation of the daily maximum permit limit of 60.1 lbs/day. Four exceedances occurred.	003A
Phenols, Maximum	06/00/1989	Four excursions occurred. Reported value was 136.5 lbs/day. Permit value was 60.1 lbs/day.	003A
Phenols, Maximum	07/00/1989	Reported value of 131.3 lbs/day was in violation of the daily maximum permit limit of 60.1 lbs/day.	003A
Phenols, Maximum	07/00/1989	Reported value was 131.3 lbs/day. Permit value was 60.1 lbs/day.	003A
Phenols, Maximum	11/00/1986	Two excursions occurred. Recorded value was 228.2 lbs/day. Permit value was 60.1 lbs/day.	003A
Phenols, Maximum	11/00/1989	Reported value of 5124 lbs/day was in violation of the daily maximum permit limit of 10.6 lbs/day. Six exceedances occurred.	1
Phenols, Maximum	11/00/1989	Six excursions occurred. Reported value was 5,124 lbs/day. Permit value was 10.6 lbs/day.	1
Phenols, Maximum	12/00/1989	Reported value of 605.9 lbs/day was in violation of the daily maximum permit limit was 10.6 lbs/day. Five exceedances occurred.	1
Phenols, Maximum	12/00/1989	Five excursions occurred. Reported value was 605.9 lbs/day. Permit value was 10.6 lbs/day.	1
Phenols, Maximum	12/00/1989	Five violations occurred. Recorded value was 605.9 lbs/day. Permit value was 10.6 lbs/day.	BAC1

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenols, Minimum	06/00/1986	Three excursions occurred. Reported value of 16 lbs/day was in violation of the permit limit of 15 lbs/day.	3
Solvent	11/00/1989	The source document stated "...by discharging pollutants in excess of the permit effluent limitations during November and December 1989. This noncompliance was precipitated by a large volume of solvent being discharged into the wastewater treatment and subsequently to Bayou D'Inde. This discharge exceed [sic] the effluent limitations for phenolics, TOC, BOD, and TSS and precipitated a fishkill in Bayou D'Inde."	NOI
Toluene	11/25/1989	A discharge over reportable quantities occurred (no measurements of the discharge or permit values were provided).	BAC1
Toluene	11/26/1989	Permit value was 1,163 lbs/day. Permit value was a daily maximum of 1,000 lbs/day.	BAC1
Zinc	11/16/1993	Permittee discharged 4.20 lbs/day. Permit limit was 3.00 lbs/day.	1
Zinc	5/26/1981	Recorded value from outfalls 002A and 002B was 137 lbs/day. Permit value was a daily maximum of 54 lbs/day.	002A
Zinc	5/26/1981	Reported value of 137 lbs/day was in violation of the permit maximum of 54 lbs/day for sum of outfalls 002A & 002B.	SUM
Zinc	7/14/1981	Reported value of 56.9 lbs/day was in violation of the permit value of 54 lbs/day for sum of outfalls 002A & 002B.	SUM
Zinc	11/19/1981	Permittee was authorized to discharge a daily average of 22 lbs/day and a daily maximum of 50 lbs/day.	002B
Zinc	12/3/1981	Reported value for outfalls 002A and 002B of 85.9 lbs/day was in violation of the permit value of 54 lbs/day.	SUM
Zinc	3/2/1995	Daily maximum discharge of 28.8 pounds/day was in violation of the permit limit of 24 pounds/day.	3
Zinc	12/18/1995	Reported value of 0.28 mg/l was in violation of the daily maximum permit limit of 0.10 mg/l.	8
Zinc	12/18/1995	Reported value of 0.28 mg/l was in violation of the permit limit of 0.10 mg/l.	8
Zinc	6/18/1996	Reported value of 304.3 lbs/day was in violation of the daily maximum permit limit of 1.92 lbs/day.	2
Zinc	6/18/1996	Reported value of 152.44 lbs/day was in violation of the daily average permit limit of .96 lbs/day.	2
Zinc	6/18/1996	Reported value of 304.3 lbs/day was in violation of permit limit of 1.92 lbs/day.	2
Zinc	6/18/1996	Reported value of 152 lbs/day was in violation of permit limit of .96 avg lbs/day.	2
Zinc	00/00/0000	Reported value of 0.3 mg/l was in violation of the daily maximum of 0.1 mg/l.	NOI

Table 7-2
Citgo Petroleum Corporation - Lake Charles Operations
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc	02/00/1981	Reported value of 23.7 lbs/day was in violation of the permit average of 22 lbs/day for sum of outfalls 002A & 002B.	SUM
Zinc	03/00/1995	March daily average of 12.6 pounds/day was in violation of the permit limit of 12 pounds/day.	3
Zinc	05/00/1981	Reported value of 24 lbs/day was in violation of the permit average of 22 lbs/day for sum of outfalls 002A & 002B.	SUM
Zinc	11/00/1983	A violation of an unreported amount occurred.	002B
Zinc, Average	02/00/1981	Recorded value from outfalls 002A and 002B was 23.7 lbs/day. Permit value was a daily average of 22.0 lbs/day.	002A
Zinc, Average	05/00/1981	Recorded value from outfalls 002A and 002B was 24 lbs/day. Permit value was a daily average of 22 lbs/day.	002A
Zinc, Daily Avg	06/00/1996	Reported value of 151.99 lbs/dy was in violation of permit limit of .96 lbs/dy.	002A
Zinc, Daily Max	06/00/1996	Reported value of 303.42 lbs/dy was in violation of permit limit of 1.92 lbs/dy.	002A
Zinc, Daily Max	12/00/1995	Reported value of 0.3 mg/l was in violation of permit limit of 0.1 mg/l.	008A
Zinc, Maximum	7/14/1981	Recorded value from outfalls 002A and 002B was 56.9 lbs/day. Permit value was a daily maximum of 54.0 lbs/day.	002A
Zirconium	3/24/1989	A spill of 50 gallons occurred.	NOI
Zirconium	3/24/1989	A spill of approximately 50 gallons occurred.	NOI
Zirconium	3/24/1989	A spill of 50 gallons was reported with no other parameters given.	NOI
Zirconium	3/24/1989	Approximately 50 gals. were discharged at the Lake Charles Port - Calcasieu River.	NOI
Zirconium	3/24/1989	A spill of 50 gallons occurred.	NOI
Zirconium	3/24/1989	A spill of 50 gallons occurred.	NOI
Zirconium	6/25/1990	Approximately two gallons spilled at the "A" dock to the Calcasieu River.	NOI

NOI - No Outfall Identified

Information obtained from permit files.

Table 7-3
OxyChem Petrochemicals
Facility
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Arsenic, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 137 ppb.	NOI
Arsenic, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 137 ppb.	NOI
Arsenic, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 137 ppb.	NOI
Benzene	11/25/1990	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Benzene	12/13/1991	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Benzene	3/11/1992	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Benzene	1/1/1989	An estimated 35 lbs/yr were discharged to receiving streams or water bodies.	NOI
Chromium, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 343 ppb.	NOI
Chromium, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 343 ppb.	NOI
Chromium, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 343 ppb.	NOI
Copper, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 69 ppb.	NOI
Copper, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 69 ppb.	NOI
Copper, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 69 ppb.	NOI
EDC	4/11/1994	A discharge of approximately 53 pounds occurred.	NOI
Ethylbenzene	11/25/1990	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Ethylbenzene	12/13/1991	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Ethylbenzene	3/11/1992	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Ethylbenzene	1/1/1989	An estimated 37 lbs/yr were discharged to receiving streams or water bodies.	NOI
Mercury	1/6/1994	Reported value of 1.5 pounds was in violation of the permit limit of 1 pound.	NOI
Mercury, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 0.6 ppb.	NOI
Mercury, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 0.6 ppb.	NOI
Mercury, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 0.6 ppb.	NOI
Methyl Chloride	11/25/1990	Permittee was authorized to discharge a daily maximum of 295 ppb.	NOI
Methyl Chloride	12/13/1991	Permittee was authorized to discharge a daily maximum of 295 ppb.	NOI
Methyl Chloride	3/11/1992	Permittee was authorized to discharge a daily maximum of 295 ppb.	NOI

Table 7-3
OxyChem Petrochemicals
Facility
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Methylene Chloride	11/25/1990	Permittee was authorized to discharge a daily maximum of 170 ppb.	NOI
Methylene Chloride	12/13/1991	Permittee was authorized to discharge a daily maximum of 170 ppb.	NOI
Methylene Chloride	3/11/1992	Permittee was authorized to discharge a daily maximum of 170 ppb.	NOI
Nickel, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 200 ppb.	NOI
Nickel, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 200 ppb.	NOI
Nickel, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 200 ppb.	NOI
PCBs, total	11/25/1990	Permittee was authorized to discharge a daily maximum of 1 ppb.	NOI
PCBs, total	12/13/1991	Permittee was authorized to discharge a daily maximum of 1 ppb.	NOI
PCBs, total	3/11/1992	Permittee was authorized to discharge a daily maximum of 1 ppb.	NOI
Selenium, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 110 ppb.	NOI
Selenium, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 110 ppb.	NOI
Selenium, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 110 ppb.	NOI
Toluene	11/25/1990	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Toluene	12/13/1991	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Toluene	3/11/1992	Permittee was authorized to discharge a daily maximum of 10 ppb.	NOI
Toluene	1/1/1989	An estimated 24 lbs/yr were discharged to receiving streams or water bodies.	NOI
Xylene	1/1/1989	An estimated 37 lbs/yr were discharged to receiving streams or water bodies.	NOI
Zinc, Total	11/25/1990	Permittee was authorized to discharge a daily maximum of 686 ppb.	NOI
Zinc, Total	12/13/1991	Permittee was authorized to discharge a daily maximum of 686 ppb.	NOI
Zinc, Total	3/11/1992	Permittee was authorized to discharge a daily maximum of 686 ppb.	NOI

NOI - No Outfall Identified
Information obtained from permit files.

Table 7-4
Firestone Tire and Rubber - Lake Charles, LA
Enforcement History by Contaminant

CHEMICAL NAME	DATES	RESULTS (Minimum)	RESULTS (Maximum)	RESULTS (Units)	EXCEEDANCES (number of days)	OUTFALL
Sodium Hydroxide	12/1944		Fish Kill		1	NOI
Styrene Monomer	3/1994		23,500	gallons	1	NOI
TOC	4/1996		52	mg/L/day max	3	4
TOC	4/1996		52	mg/L/day max	3	004A
Ammonia	01/97-04/97	121	166	lbs./day max	9	1
Ammonia	02/91-03/91	13.9	22.53	lbs./day avg	6	1
Ammonia	02/91-05/92	21.5	41	lbs./day max	20	BAC1
Ammonia	02/91-05/92	21.5	41	lbs./day max	20	1
Oil & Grease	03/83-01/95	16	89	mg/L/day max	13	3
Oil & Grease	03/83-01/95	16	89	mg/L/day max	13	4
Oil & Grease	03/83-01/95	16	89	mg/L/day max	13	004A
Oil & Grease	03/93-05/59	163	392.49	lbs./day max	31	BAC1
Oil & Grease	03/93-05/59	163	392.49	lbs./day max	31	1
TOC	05/83-10/83	81	194	mg/L/day max	4	3
TOC	05/83-10/83	81	194	mg/L/day max	4	4
Oil & Grease	12/94-02/95	106	122	lbs./day avg	3	BAC1
Ammonia	12/96-03/97	54	74	lbs./day avg	5	1

NOI - No Outfall Identified

Information obtained from permit files.

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Acenaphthene	12/00/1991	Facility was in violation for nonsubmission of required periodic reports.	101
Arsenic, Total	3/25/1988	Fish consumption: Calculated concentration of 1.0 ug/l was in violation of the criteria of 0.0175 ug/l.	NOI
Benzene	3/31/1992	Reported value of 0.271 mg/l was in violation of the permit limit of 0.134 mg/l.	1
Benzene	3/31/1992	Reported value of 0.023 lbs/day was in violation of the permit limit of 0.022 lbs/day.	1
Benzene	6/30/1992	Quantity Average was <.001; Quantity Maximum was <.01; Concentration Average was <.0024; Concentration Maximum was <.0024.	101A
Benzene	2/25/1998	A release of 41.4 pounds of benzene occurred over a duration of 210 minutes.	NS
Bis (2 ethylhexyl) Pthalate	00/00/1992	Recorded value of 1.99 lbs/day was in violation of the permit limit of 1.56 lbs/day.	7
Bis (2 ethylhexyl) Pthalate	00/00/1992	Recorded value of 1.65 lbs/day was in violation of the permit value of 1.56 lbs/day.	7
Bis (2 ethylhexyl) Pthalate	00/00/1992	Recorded value of 1.27 lbs/day was in violation of the permit limit of 0.51 lbs/day.	BAC1
Bis (2 ethylhexyl) Pthalate	00/00/1992	Recorded value of 1.75 lbs/day was in violation of the permit limit of 0.51 lbs/day.	BAC1
Bis(2-Ethylhexy)Pthalate, Max	1/6/1992	Reported value of 1.99 lbs. was in violation of permit limit of 1.56 lbs.	7
Bis(2-Ethylhexy)Pthalate, Max	1/6/1992	Reported value of 1.27 lbs. was in violation of permit limit of 0.51 lbs.	BAC1
Bis(2-Ethylhexy)Pthalate, Max	1/8/1992	Reported value of 1.65 lbs. was in violation of permit limit of 1.56 lbs.	7
Bis(2-Ethylhexy)Pthalate, Max	1/8/1992	Reported value of 1.75 lbs. was in violation of permit limit of 0.51 lbs.	BAC1
Bis(2-ethylhexyl) phthalate	5/11/1988	Permittee was authorized to discharge a daily average of 0.19 lbs/day and a daily maximum of 0.51 lbs/day.	NOI
Bis(2-ethylhexyl) phthalate	6/28/1988	Reported value of 0.92 lb/day was in violation of the permit limit of 0.51 lb/day.	BAC1
Bis(2-ethylhexyl) phthalate	1/6/1992	Reported value of 1.27 lbs/day was in violation of the daily average limit of 0.19 lbs/day and the daily maximum of 0.51 lbs/day.	1
Bis(2-ethylhexyl) phthalate	1/6/1992	Reported value of 1.27 lbs/day was in violation of the daily average of 0.19 lbs/day and the daily maximum of 0.51 lbs/day.	1
Bis(2-ethylhexyl) phthalate	1/6/1992	Reported value of 1.99 lbs/day was in violation of the daily average limit of 0.57 lbs/day and the daily maximum of 1.56 lbs/day.	007A
Bis(2-ethylhexyl) phthalate	1/6/1992	Reported value of 1.99 lbs/day was in violation of the daily average of 0.57 lbs/day and the daily maximum of 1.56 lbs/day.	007A

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Bis(2-ethylhexyl) phthalate	1/8/1992	Reported value of 1.75 lbs/day was in violation of the daily average limit of 0.19 lbs/day and the daily maximum limit of 0.51 lbs/day.	1
Bis(2-ethylhexyl) phthalate	1/8/1992	Reported value of 1.75 lbs/day was in violation of the daily average of 0.19 lbs/day and the daily maximum of 0.51 lbs/day.	1
Bis(2-ethylhexyl) phthalate	1/8/1992	Reported value of 1.65 lbs/day was in violation of the daily average of 0.57 lbs/day and the daily maximum of 1.56 lbs/day.	007A
Bis(2-ethylhexyl) phthalate	06/00/1988	Reported value of 0.92 lbs/day was in violation of the permitted daily maximum of 0.51 lb/day.	1
Bis(2-ethylhexyl) phthalate	06/00/1988	Reported value of 0.48 lb/day was in violation of the permitted daily average of 0.19 lb/day.	1
Bis(2-ethylhexyl)phthalate	6/28/1988	Reported value of 0.92 lb/day was in violation of permit limit of .51 lb/day.	BAC1
Bis(2-ethylhexyl)phthalate	6/28/1988	Reported value of 0.92 lb/day was in violation of the permit limit of 0.51 lb/day.	BAC1
Bis(2-ethylhexyl)phthalate	06/00/1988	Reported value of 0.48 lb/day was in violation of daily average of 0.19 lb/day.	1
Bis(2-ethylhexyl)phthalate	06/00/1988	Reported value of 0.92 lb/day was in violation of daily maximum of 0.51 lb/day.	1
Bis(2-Ethylhxy) Pthalate, Mx	1/6/1992	Reported value of 1.99 lbs. was in violation of the permit limit of 1.56 lbs.	7
Bis(2-Ethylhxy) Pthalate, Mx	1/6/1992	Reported value of 1.27 lbs. was in violation of the permit limit of 0.51 lbs.	BAC1
Bis(2-Ethylhxy) Pthalate, Mx	1/8/1992	Reported value of 1.65 lbs. was in violation of the permit limit of 1.56 lbs.	7
Bis(2-Ethylhxy) Pthalate, Mx	1/8/1992	Reported value of 1.75 lbs. was in violation of the permit limit of 0.51 lbs.	BAC1
butadiene	5/4/1995	A release of 1.4 pounds occurred over an unkwown duration.	NS
butadiene	5/4/1995	A release of 1.4 pounds occurred over an unknown duration.	NS
Naphthalene	6/30/1991	Quantity Average was <.045; Quantity Maximum was <.045; Concentration Average was <.05; Concentration Maximum was <.05.	101A
Naphthalene	8/31/1991	Quantity Average was .057; Quantity Maximum was .101; Concentration Average was 0.0217; Concentration Maximum was .0337.	101A
Naphthalene	9/30/1991	Quantity Average was .04; Quantity Maximum was .11; Concentration Average was .025; Concentration Maximum was .05.	101A
Naphthalene	10/31/1991	Quantity Average was .04; Quantity Maximum was 0.13; Concentration Average was .01; Concentration Maximum was .039.	101A
Naphthalene	11/30/1991	Quantity Average was .04; Quantity Maximum was .07; Concentration Average was .01; Concentration Maximum was .328.	101A

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Naphthalene	1/31/1992	Quantity Average was 1.12; Quantity Maximum was 4.42; Concentration Average was .92; Concentration Maximum was 3.66.	101A
Naphthalene	4/30/1993	Quantity Average was .07; Quantity Maximum was 0.3; Concentration Average was .025; Concentration Maximum was .098.	101A
Phenol	3/31/1992	Reported value of 0.017 lb/day was in violation of the permit value of 0.008 lb/day.	1
Phenol	3/31/1992	Reported value of 0.198 mg/l was in violation of the permit value of 0.047 mg/l.	1
Phenol, Single Compound	8/31/1991	Quantity Average was .08; Quantity Maximum was .09; Concentration Average was .031; Concentration Maximum was .032.	101A
Phenol, Single Compound	9/30/1991	Quantity Average was .03; Quantity Maximum was .026; Concentration Average was .02; Concentration Maximum was .028.	101A
Phenol, Single Compound	10/31/1991	Quantity Average was .04; Quantity Maximum was .12; Concentration Average was .02; Concentration Maximum was .036.	101A
Phenol, Single Compound	11/30/1991	Quantity Average was .04; Quantity Maximum .05; Concentration Average 0.01; Concentration Maximum .297.	101A
Phenol, Single Compound	12/31/1991	Quantity Average was .03; Quantity Maximum was .06; Concentration Average was .01; Concentration Maximum was .03.	101A
Phenol, Single Compound	2/29/1992	Quantity Average was .019; Quantity Maximum was .08; Concentration Average was .005; Concentration Maximum was .02.	101A
Zinc	3/31/1992	Reported value of 1.39 mg/l was in violation of the permit limit of 1.0 mg/l.	001B
Zinc	1/12/1993	Reported value of 1.85 Lbs/D was in violation of the daily maximum of 1.322 Lbs/D.	10
Zinc	1/12/1993	Reported value of 1.85 Lbs/D was in violation of the permit limit of 1.322 Lbs/D Daily Max.	10
Zinc	1/31/1993	Reported value of .85/2.13 lbs/day was in violation of the permit limit of .616/1.232 lbs/day.	10
Zinc	1/12/1994	Reported value of 1.85 lbs/day was in violation of the permit limit of 1.322 lbs/day.	10
Zinc	1/12/1994	Reported value of 0.823 lbs/day was in violation of daily average of 0.616 lbs/day.	10
Zinc	3/10/1994	Reported value of 2.633 Lbs/D was in violation of the daily maximum of 1.232 Lbs/D.	10
Zinc	3/10/1994	Reported value of 2.633 Lbs/D was in violation of the daily maximum of 1.232 Lbs/D.	10
Zinc	3/10/1994	Reported value of 2.633 lb/day was in violation of the permit limit of 1.232 lb/day.	10
Zinc	3/10/1994	Reported value of 2.633 lb/day was in violation of the permit limit of 1.232 lb/day.	10
Zinc	3/10/1994	Reported value of 2.633 lbs/d daily max. was in violation of the permit limit of 1.232 lbs/d daily max.	10

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc	3/10/1994	Reported value of 1.583 lbs/day was in violation of the daily average of 0.616 lbs/day.	010A
Zinc	4/7/1994	Reported value of 0.18 mg/l was in violation of the permit limit of 0.07 mg/l.	10
Zinc	6/2/1994	Reported value of 3.742 lbs/day was in violation of the permit limit of 1.232 lbs/day Daily Max.	10
Zinc	6/2/1994	Reported value of 3.742 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	3/2/1995	Reported value of 1.43 lbs/day was in violation of the permit limit of 1.232 lbs/day.	10
Zinc	6/2/1995	Reported daily max of 2.152 was in violation of the permit max of 1.232.	10
Zinc	6/2/1995	Reported daily avg of 1.398 was in violation of the permit avg of 0.616.	10
Zinc	6/23/1995	Reported daily max of 2.152 was in violation of the permit max of 1.232.	10
Zinc	6/23/1995	Reported daily avg of 1.398 was in violation of the permit avg of 0.616.	10
Zinc	3/13/1997	Reported value of 1.395 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	3/13/1997	Reported value of 2.864 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	3/13/1997	Reported value of 1.395 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	3/13/1997	Reported value of 2.864 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	4/3/1997	Reported value of 1.373 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	4/24/1997	Reported value of 2.168 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	4/24/1997	Reported value of 1.396 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	5/1/1997	Reported value of 4.471 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	10
Zinc	5/8/1997	Reported value of 2.801 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	5/20/1997	Reported value of 2.497 lbs/day was in violation of the daily average, which was not provided.	NOI
Zinc	01/00/1993	Reported value of 0.851 #/D was in violation of permit limit of 0.616 #/D D. Ave.	10
Zinc	01/00/1993	Reported value of 2.134 #/D was in violation of permit limit of 1.232 #/D D. Max.	10
Zinc	01/00/1993	Reported value of 0.851 lbs/day was in violation of the daily average permit limit of 0.616 lbs/day.	10
Zinc	01/00/1993	Reported value of 2.134 lbs/day was in violation of the daily maximum permit limit of 1.232 lbs/day.	10
Zinc	01/00/1993	Reported value of 2.134 lbs/dy was in violation of the daily maximum of 1.232 lbs/dy.	010A
Zinc	01/00/1993	Reported value of 0.851 lbs/dy was in violation of daily average of 0.616 lbs/day daily average.	010A
Zinc	01/00/1994	Reported value of 0.823 lbs/dy was in violation of the daily average of 0.616 lbs/dy.	010A

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc	01/00/1994	Reported value of 1.825 lbs/dy was in violation of the daily maximum of 1.232 lbs/day.	010A
Zinc	01/00/1994	Reported value of 1.825 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	010A
Zinc	03/00/1994	Reported value of 2.633 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	010A
Zinc	04/00/1994	Reported value of 0.670 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	04/00/1994	Reported value of 0.670 lbs/day daily avg. was in violation of the permit limit of 0.616 lbs/day daily avg.	10
Zinc	04/00/1994	Reported value of 0.670 lbs/day daily avg. was in violation of the permit limit of 0.616 lbs/day daily avg.	10
Zinc	04/00/1994	Reported value of 0.670 lbs/day was in violation of the daily average of 0.616 lbs/day.	10
Zinc	04/00/1994	Reported value of 0.670 lbs/day was in violation of the daily average of 0.616 lbs/day.	010A
Zinc	04/00/1994	Recorded value of .670 lbs/day was in violation of the permit limit of .616 lbs/day.One excursion was reported.	010A
Zinc	06/00/1994	Reported value of 2.115 lbs/day was in violation of the daily average of 0.616 lbs/day.	010A
Zinc	06/00/1994	Reported value of 3.742 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	010A
Zinc, Average	01/00/1993	Reported value of 0.851 lbs/day was in violation of the permit limit of 0.616 lbs/day.	10
Zinc, Average	01/00/1993	Reported value of 0.851 lbs. was in violation of the permit limit of 0.616 lbs.	10
Zinc, Average	01/00/1993	Recorded value of .851 lbs/day was in violation of the permit limit of .616 lbs/day.One excursion was reported.	010A
Zinc, Average	01/00/1994	Recorded value of .823 lbs/day was in violation of the permit limit of .616 lbs/day.One excursion was reported.	010A
Zinc, Average	03/00/1994	Recorded value of 1.583 lbs/day was in violation of the permit limit of .616 lbs/day. One excursion was reported.	010A
Zinc, Average	06/00/1994	Recorded value of 2.115 lbs/day was in violation of the permit limit of .616 lbs/day.One excursion was reported.	010A
Zinc, Daily Avg	01/00/1994	Recorded value was 0.23 lbs/day. The permitted daily average was .616 lbs/day, and the permitted daily maximum was 1.232 lbs/day.	010A
Zinc, Daily Avg	01/00/1994	Reported value of 0.823 lbs/day was in violation of the permit limit of 0.616 lbs/day.	010A
Zinc, Daily Avg	01/00/1994	Reported value of 0.823 lbs/day was in violation of the permit limit of 0.616 lbs/day.	010A
Zinc, Daily Avg	01/00/1994	Reported value was 0.23 lbs/day and no permit limit was provided.	010A
Zinc, Daily Avg	03/00/1994	Recorded value was 1.583 lbs/day. The permitted daily average was .616 lbs/day and the permitted daily maximum was 1.232 lbs/day.	010A
Zinc, Daily Avg	03/00/1994	Reported value of 1.583 lbs/day was in violation of the daily average of .616 lbs/day.	010A
Zinc, Daily Avg	03/00/1994	Reported value of 1.583 lbs/day was in violation of the permit limit of .616 lbs/day.	010A

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc, Daily Avg	03/00/1994	Reported value of 1.583 lbs/day was in violation of the permit limit of .616 lbs/day.	010A
Zinc, Daily Avg	03/00/1994	Reported value was 1.583 lbs/day and no permit value was provided.	010A
Zinc, Daily Avg	04/00/1994	Recorded value was .670 lbs/day. The permitted daily average was .616 lbs/day and the permitted daily maximum was 1.232 lbs/day.	010A
Zinc, Daily Avg	04/00/1994	Reported value of .670 lbs/day was in violation of the daily average of .616 lbs/day.	010A
Zinc, Daily Avg	04/00/1994	Reported value of .670 lbs/day was in violation of the permit limit of .616 lbs/day.	010A
Zinc, Daily Avg	04/00/1994	Reported value of .670 lbs/day was in violation of the permit limit of .616 lbs/day.	010A
Zinc, Daily Avg	04/00/1994	Reported value was .670 lbs/day and no permit value was provided.	010A
Zinc, Daily Max	1/1/1994	Recorded value was 1.825 lbs/day. The permittee was authorized to discharge a daily average of .616 lbs/day and a daily maximum of 1.232 lbs/day.	010A
Zinc, Daily Max	1/12/1994	Reported value of 1.825 lbs/day was in violation of the permit limit of 1.232 lbs/day.	010A
Zinc, Daily Max	1/12/1994	Reported value of 1.825 lbs/day was in violation of the permit limit of 1.232 lbs/day.	010A
Zinc, Daily Max	01/00/1994	Reported value was 1.825 lbs/day and no permit value was provided.	010A
Zinc, Daily Max	03/00/1994	Recorded value was 2.633 lbs/day. The permitted daily average was .616 lbs/day and the permitted daily maximum was 1.232 lbs/day.	010A
Zinc, Daily Max	03/00/1994	Reported value of 2.633 lbs/day was in violation of the daily maximum of 1.232 lbs/day.	010A
Zinc, Daily Max	03/00/1994	Reported value of 2.633 lbs/day was in violation of the permit limit of 1.232 lbs/day.	010A
Zinc, Daily Max	03/00/1994	Reported value of 2.633 lbs/day was in violation of the permit limit of 1.232 lbs/day.	010A
Zinc, Daily Max	03/00/1994	Reported value was 2.633 lbs/day and no permit value was provided.	010A
Zinc, Maximum	01/00/1993	Reported value of 2.134 lbs/day was in violation of the permit limits of 1.232 lbs/day.	10
Zinc, Maximum	01/00/1993	Reported value of 2.134 lbs. was in violation of the permit limit of 1.232 lbs.	10
Zinc, Maximum	01/00/1993	Recorded value of 2.134 lbs/day was in violation of the permit limit of 1.232 lbs/day.One excursion was reported.	010A
Zinc, Maximum	01/00/1994	Recorded value of 1.825 lbs/day was in violation of the permit limit of 1.232 lbs/day.One excursion was reported.	010A
Zinc, Maximum	03/00/1994	Recorded value of 2.633 lbs/day was in violation of the permit limit of 1.232 lbs/day.One excursion was reported.	010A
Zinc, Maximum	06/00/1994	Recorded value of 3.742 lbs/day was in violation of the permit limit of 1.232 lbs/day. One excursion was reported.	010A
Zinc, Total	5/11/1988	Permittee was authorized to discharge a daily average of 2.1 lbs/day and a daily maximum of 5.2 lbs/day.	NOI
Zinc, Total	1/12/1994	Reported value of 1.825 lb/day was in violation of the permit limit of 1.232 lb/day.	10

Table 7-5
Westlake Polymers
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc, Total	1/12/1994	Reported value of 1.825 lb/day was in violation of the permit limit of 1.232 lbs/day.	10
Zinc, Total	01/00/1994	Reported value of 0.823 lbs/day was in violation of the permit limit of 0.616 lbs/day daily av.	010A
Zinc, Total	01/00/1994	Reported value of 1.825 lbs/day was in violation of the permit limit of 1.232 lbs/day daily mx.	010A
Zinc, Total	03/00/1994	Reported value of 2.633 lbs/dy was in violation of the permit limit of 1.232 daily mx.	NOI
Zinc, Total	03/00/1994	Reported value of 1.583 lbs/dy was in violation of the permit limit of 0.616 lbs/dy daily av.	NOI
ZINC, Total	03/00/1997	Reported value of 1.395 LBS/DY was in violation of the daily average of 0.616 LBS/DY.	010A
ZINC, Total	03/00/1997	Reported value of 2.864 LBS/DY was in violation of the daily maximum of 1.232 LBS/DY.	010A
Zinc, Total	04/00/1994	Reported value of 0.670 lbs/dy was in violation of the permit limit of 0.616 lbs/dy daily av.	010A
ZINC, Total	04/00/1997	Reported value of 2.168 LBS/DY was in violation of the daily maximum of 1.232 LBS/DY.	010A
ZINC, Total	04/00/1997	Reported value of 1.396 LBS/DY was in violation of the daily average of 0.616 LBS/DY.	010A
ZINC, Total	05/00/1997	Reported value of 2.801 LBS/DY was in violation of the daily average of 0.616 LBS/DY.	010A
ZINC, Total	05/00/1997	Reported value of 4.471 LBS/DY was in violation of the daily maximum of 1.232 LBS/DY.	010A
Zinc, Total	06/00/1994	Reported value of 2.115 lbs/dy was in violation of the permit limit of a daily average of 0.616 lbs/dy.	010A
Zinc, Total	06/00/1994	Reported value of 3.742 lbs/dy was in violation of the permit limit of a daily maximum of 1.232 lbs/day.	010A
ZINC, Total	06/00/1994	Reported value of 2.115 lbs/dy was in violation of the daily average of 0.616 lbs/dy.	010A
ZINC, Total	06/00/1994	Reported value of 3.742 lbs/dy was in violation of the daily maximum of 1.232 lbs/dy.	010A
Zinc, Total	07/00/1995	Reported daily average value of 0.985 lbs/dy was in violation of the permit limit of a daily average of 0.616 lbs/dy.	010A
ZINC, Total	08/00/1997	Reported value of 0.907 LBS/DY was in violation of the daily average of 0.616 LBS/DY.	010A

NOI = No outfall indicated.
Information obtained from permit files.

Table 7-6
Montell USA (formerly Himont USA)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Ammonia	8/4/87	Reported value of 26 lbs./day as in violation of the permit limit 260 lbs./day.	NOI
Ammonia	9/9/91	Reported value of 24.42 lbs./day was in violation of permit limit of 20 lbs./day.	NOI
Ammonia	1/7/92	Reported value of 66.6 lbs./day was in violation of the permit limit of 20 lbs./day.	NOI
Ammonia	1/28/92	Reported value of 17.3 lbs./day was in violation of the permit limit of 15 lbs./day.	NOI
Ammonia	1/28/92	Reported value of 0.77 lbs./day was in violation of the permit limit.	NOI
Ammonia	2/4/92	Reported value of 1.05 lbs./day was in violation of the permit limit.	NOI
Ammonia	2/11/92	Reported value of 0.91 lbs./day was in violaton of the permit limit.	NOI
Ammonia	2/18/92	Reported value of 0.87 lbs./day was in violation of the permit limit.	NOI
Ammonia	2/25/92	Reported value of 1.16 lbs./day was in violation of the permit limit.	NOI
Black Smoke	2/27/93	A release of black smoke occurred, causing intermittent heavy flaring over the duration of one hour, in violation of the permit.	NOI
Carbon	1/12/95	A release of approximately 1,500 lbs of carbon occurred over a druation of 79 minutes during a fire.	NOI
Carbon Dioxide	1/12/95	A release of 3,300 lbs. of carbon dioxide occurred over a duration of 79 minutes during a fire.	NOI
Carbon Monoxide	8/23/85	Reported release of 397 lbs. was in violation of the permit limit	NOI
Carbon Monoxide	1/12/95	A release of less than 5 lbs. of CO occurred over a duration of 79 minutes during a fire.	NOI
Chlorine	11/17/91	Reported release of 10 to 20 lbs. over approximately 1 hours was in violation of the permit limit.	NOI
Chlorine	6/10/94	Reported release of 15 lbs. of chlorine vapor for approximately 8 minutes was in violation of the permit limit.	NOI
Chromate	6/21/74	A release of an unkown quantity of chromate spilled and was in violation of permit limit.	NOI
HCL	6/9/88	Reported release of approximately 200 lbs. was in violation of the permit limit.	NOI
Hydrocarbon	8/25/85	Reported release of 48 lbs was in violation of the permit limit.	NOI
Isopropyl Alcohol	11/6/89	Reported value of 183 ppm was in violation of the permit limit.	002
Isopropyl Alcohol	10/14/91	A total of approximately 600 gallons (approximately 3,900 lbs) were spilled in Process Unit 3. Approximately 925 lbs. entered the Calcasieu River, while the remainder was successfully diverted.	NOI
Lubricating Oil	8/15/95	A release of approximately 100 lbs. of lubricating oil and 20 lbs of ammonia occurred over a duration of 10 seconds in violation of the permit limit.	002
NaOH	12/6/90	Reported release of 65 gallons of 4 wt % NAOH (22.7 lbs of NaOH) was in violation of the permit limit.	NOI
NaOH	2/8/92	Reported release of approximately 2,500 gallons of waste water, containing 50 lbs. of NaOH, was released into Calcasieu River in violation of the permit limit.	NOI

Table 7-6
Montell USA (formerly Himont USA)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Nitrogen Oxides	8/23/85	Reported release of 181 lbs. was in violation of the permit limit.	NOI
Nitrogen Oxides	1/12/95	A release of less than 20 lbs. of nitrogen oxides occurred over a duration of 79 minutes during a fire.	NOI
Nonspecific	10/26/90	Reported release of 400 gallons of polymer stabilizer F-1031M was in violation of the permit limit. The release contained approximately 193 lbs. of calcium stearate (CAS No. 1592-23-0) and 637 lbs. of Irganox 1076 (CAS No. 2082-79-3). At least 75% of this material went through the surface drainage system, which is in violation of the permit.	NOI
Nonspecific	3/3/97	Aqueous Material - Approximately 700 gallons of aqueous stabilizer F-1031M entered the K-line chemical sewer and overflowed to the surface drainage system. The 700 gallons of diluted F-1031M contained and estimated 244 lbs of calcium stearate (CAS No. 1592-23-0) abd 807 lbs. of Irganox 1076 (CAS No. 2082-79-3).	NOI
Not Specified	5/19/85	The facility was in violation for failing to notify the Air Quality Division regarding an upset within the required period of time.	NOI
Not Specified	10/91	The facility was in violation for failure to submit data for the parameters identified in Part III of the order for the month of October 1991.	NOI
Not Specified	8/13/92	The facility was in violation for the reporting requirements in that the Permittee had failed to submit data for the parameters identified in Part III for the months of October and November, 1991.	NOI
Not Specified	6/28/93	The facility was in violation for failing to plug or cap 8 valves.	NOI
Not Specified	94	The facility violated AQD regulations four times. No other information provided.	NOI
Oil and Grease	3/17/86	Reported value of 16.7 was in violation of the permit limit of 55 mg/L.	NOI
Oil and Grease	3/19/86	Reported value of 1.0 was in violatoin of the permit limit. No units were indicated.	NOI
Oil and Grease	5/12/89	The facility was in violation for failure to properly transfer samples.	NOI
Oil and Grease	6/16/93	Reported value of 119 mg/L was in violation of the permit limit of 15 mg/L.	NOI
Oil and Grease	6/18/93	Reported value of 16 mg/l was in violation of ther permit limt of 15 mg/L.	NOI
Oil and Grease	6/19/93	Reported value of 16 mg/l was in violation of ther permit limt of 15 mg/L.	NOI
Particulate	8/23/85	Reported release of 134 lbs was in violation of the permit limit.	NOI
PCBs	10/27/81	The facility was in violation for failure to mark one heat transfer system with "ML PCB" label.	NOI
PCBs	10/27/81	The facility was in violation for failure to test two heat transfer systems containing 1,500 gallons of fluid.	NOI
PCBs	10/27/81	The facility was in violation for improper disposal of PCBs.	NOI
pH	12/90	Reported value of 9.8 was in violation of the permit limit of 9.0.	NOI
pH	9/25/91	The facility was in violation for failure to provide a continous record of the pH and temperature.	NOI
pH	2/8/92	Reported value of 9.8 was in violation of the permit limit of 9.0.	NOI
pH	6/15/92	Reported value of 9.5 was in violation of the permit limit of 9.0.	NOI

Table 7-6
Montell USA (formerly Himont USA)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
pH	6/16/92	Reported value of 9.5 was in violation of the permit limit of 9.0.	NOI
pH	6/17/92	Reported value of 9.5 was in violation of the permit limit of 9.0.	NOI
pH	7/15/92	Reported value of 9.5 was in violation of the permit limit of 9.0. The pH excursion occurred approximately 115 minutes.	NOI
pH	6/1/93	The facility as in violation for allowing the temperature and pH chart to be improperly changed, which resulted in a recording not being made for approximately 13 hours.	NOI
pH	6/4/93	Reported value of 9.7 was in violation of the maximum permit limit of 9.0.	NOI
pH	6/5/93	Reported value was in violation of permit limit. No other information provided.	NOI
pH	11/14/93	Reported value of 9.8 was in violation of the permit limit of 9.0.	NOI
pH	1/8/94	The facility was in violation for failure to properly record continuously.	NOI
pH	8/15/95	Reported value of 9.8 was in violation of the maximum permit limit of 9.0.	NOI
pH	4/16/96	Reported value was in violation of the maximum permit limit of 9.0.	NOI
pH	12/7/96	Reported value was in violation of the maximum permit limit of 9.0.	NOI
pH	2/7/98	Reported value was in violation of the maximum permit limit of 9.0.	NOI
Polyethylene	8/25/97	A release of less than 100 lbs occurred over a duration of 15 minutes in violation of the permit limit.	NOI
Polypropylene Pellets	7/23/90	Reported release of several thousand pounds of polypropylene pellets overflowed a retaining wall on the west side of facility and entered a ditch that flowed into Bayou d'Inde.	NOI
Polypropylene Pellets	7/24/90	Reported value was in violation of the permit limit.	NOI
Polypropylene Pellets	10/5/90	Reported release of polypropylene pellets in other than trace amounts as in violation of permit limits.	NOI
Polypropylene Pellets	1/12/98	Reported value of 300 lbs was in violation of the permit limit.	NOI
Propylene	6/2/93	The facility was in violation when an electrical failure at the propylene storage area caused J & K lines to shut down for several hours.	NOI
Propylene	1/8/94	Reported release of 80 lbs. of propylene occurred over a duration of 30 minutes.	NOI
Smoke	5/19/85	A release of an uknown quantity of heavy black smoke occurred over a 2-day period when the unit was being depressurized.	NOI
Smoke	5/25/85	A release of an uknown quantity of smoke occurred over a duration of 15 minutes.	NOI
Smoke	5/27/98	A release of an unknown quantity of smoke occurred over a duration of 40 minutes in violation of the permit limit.	001
Various	9/1/90	The facility was in violation for failure to properly monitor the temperature and pH chart at Outfall 001, for approximately 13 hours, in violation of the permit limit.	NOI
Various	10/23/92	The facility was in violation for various leaking components.	NOI
Various	1/19/93	The facility was in violation for various leaking components.	NOI
Various	6/14/93	The facility was in violation for leaking components.	NOI
Various	10/1/93	The facility was in violation for leaking components.	NOI

Table 7-6
Montell USA (formerly Himont USA)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Various	4/5/94	The facility was in violation for leaking components.	NOI
Various	9/26/94	A release of less than 10 lbs. of a polymer dust occurred over a duration of 23 hours.	NOI
VOC	8/8/92	The facility was in violation for failing to plug or cap 2 valves.	NOI

NOI - No Outfall Identified

Table 7-7
Historic Results for Reach 1
Bayou d'Inde

Year	1984[1]	1989[2]	1992[3]	1994[4]	1996[5]
Compound					
Aldrin (μg/Kg)	---	---	14-77	---	---
Dieldrin (μg/Kg)	---	---	11-47	---	---
Bis(2-ethylhexyl)phthalate (μg/Kg)	---	1100-5700	160-1200	586-1269	530-2200
Hexachlorobenzene (μg/Kg)	---	76-264000	2300-27000	7429-16667	730-7500
Hexachlorobutadiene (μg/Kg)	---	770-77000	1500-3800	543-3056	600-810
Total PCBs (μg/Kg)	---	---	---	---	---
HPAH (μg/Kg)	---	---	7920-17870	---	720-23700
LPAH (μg/Kg)	---	---	1208-8610	---	10050-10050
Arsenic (mg/Kg)	0.28-1.03	2-2.2	3-5.1	3-7	2.4-8.7
Chromium (Hex) (mg/Kg)	---	---	70.7-114	---	---
Copper (mg/Kg)	17.4-362.32	362-377	86.7-376	6-218	7.8-639
Lead (mg/Kg)	11.2-51.6	30-150	87.9-149	6-201	12.3-440
Mercury (mg/Kg)	0.29-4.1	1.6-6.3	1.5-14.2	6-58	0.01-3
Zinc (mg/Kg)	64.87-155	147-164	113-162	113-162	17.8-238

Notes:
[1] 1983-85 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report.
[2] 1988-89 EPA Toxics Study of Lower Calcasieu River
[3] 1992 EPA Bayou d'Inde Expanded Site Inspection
[4] 1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River and Ship Channel Water and Sediment Sampling Report
[5] 1996 EPA Finding Report for the Focased Site Assessment-Bayou d'Inde

Table 7-8
Historic Results for Reach 2
Bayou d'Inde

Year	1984[1]	1989[2]	1992[3]	1994[4]	1996[5]
Compound					
Aldrin (μg/Kg)	---	---	21-21	---	---
Dieldrin (μg/Kg)	---	---	6.7-6.7	---	---
Bis(2-ethylhexyl)phthalate (μg/Kg)	---	---	230-240	40-80	---
Hexachlorobenzene (μg/Kg)	---	---	---	---	---
Hexachlorobutadiene (μg/Kg)	---	---	---	690-690	---
Total PCBs (μg/Kg)	---	---	1800-2400	---	---
HPAH (μg/Kg)	---	---	580-4440	---	---
LPAH (μg/Kg)	---	---	96-5560	---	---
Arsenic (mg/Kg)	0.29-1.08	---	1.2-3.3	1-3	---
Chromium (Hex) (mg/Kg)	---	---	68.1-434	---	---
Copper (mg/Kg)	0.7407-182.5	---	45.4-140	13-129	---
Lead (mg/Kg)	9.4-3.8	30-30	23.2-69.2	9-122	---
Mercury (mg/Kg)	0.21-0.85	0.28-2.7	0.24-1.9	16-16	---
Zinc (mg/Kg)	16.915-204.6	---	126-181	113-162	---

Notes:
[1] 1983-85 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report.
[2] 1988-89 EPA Toxics Study of Lower Calcasieu River
[3] 1992 EPA Bayou d'Inde Expanded Site Inspection
[4] 1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River and Ship Channel Water and Sediment Sampling Report
[5] 1996 EPA Finding Report for the Focased Site Assessment-Bayou d'Inde

Table 7-9
Historic Results for Reach 3
Bayou d'Inde

Year	1984[1]	1989[2]	1992[3]	1994[4]	1996[5]
Compound					
Aldrin (μg/Kg)	---	---	2-2	---	---
Dieldrin (μg/Kg)	---	---	---	---	---
Bis(2-ethylhexyl)phthalate (μg/Kg)	---	2600-2600	48-110	98-98	---
Hexachlorobenzene (μg/Kg)	---	---	---	---	---
Hexachlorobutadiene (μg/Kg)	---	---	100-100	---	---
Total PCBs (μg/Kg)	---	---	160-22200	---	---
HPAH (μg/Kg)	---	---	239-24900	---	---
LPAH (μg/Kg)	---	---	55-114400	---	---
Arsenic (mg/Kg)	---	---	0.97-7.3	1-1	---
Chromium (Hex) (mg/Kg)	---	---	21-2610	---	---
Copper (mg/Kg)	---	---	19.1-184	14-14	---
Lead (mg/Kg)	---	10-60	15.4-82.1	17-17	---
Mercury (mg/Kg)	---	0.17-0.68	0.08-3.7	-	---
Zinc (mg/Kg)	---	---	1-771	113-162	---

Notes:
[1] 1983-85 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report.
[2] 1988-89 EPA Toxics Study of Lower Calcasieu River
[3] 1992 EPA Bayou d'Inde Expanded Site Inspection
[4] 1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River and Ship Channel Water and Sediment Sampling Report
[5] 1996 EPA Finding Report for the Focased Site Assessment-Bayou d'Inde

Table 7-9
Historic Results for Reach 3
Bayou d'Inde

Table 7-10
Historic Results for Reach 4
Bayou d'Inde

Year	1984[1]	1989[2]	1992[3]	1994[4]	1996[5]
Compound					
Aldrin (μg/Kg)	---	---	---	---	---
Dieldrin (μg/Kg)	---	---	---	---	---
Bis(2-ethylhexyl)phthalate (μg/Kg)	---	---	83-1900	---	---
Hexachlorobenzene (μg/Kg)	---	---	---	---	---
Hexachlorobutadiene (μg/Kg)	---	---	---	---	---
Total PCBs (μg/Kg)	---	---	185-358	---	---
HPAH (μg/Kg)	---	---	540-1020	---	---
LPAH (μg/Kg)	---	---	94-412	---	---
Arsenic (mg/Kg)	0.36-0.92	---	1.9-4	---	---
Chromium (Hex) (mg/Kg)	---	---	12.5-20.1	---	---
Copper (mg/Kg)	10.79-40.095	57-57	19.3-31.9	---	---
Lead (mg/Kg)	22-45.8	20-60	45.1-66.3	---	---
Mercury (mg/Kg)	0.36-0.56	0.35-0.6	0.52-1	---	---
Zinc (mg/Kg)	47.96-181	253-253	105-129	113-162	---

Notes:
[1] 1983-85 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report.
[2] 1988-89 EPA Toxics Study of Lower Calcasieu River
[3] 1992 EPA Bayou d'Inde Expanded Site Inspection
[4] 1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River and Ship Channel Water and Sediment Sampling Report
[5] 1996 EPA Finding Report for the Focased Site Assessment-Bayou d'Inde

Table 7-12
COPCs Identified for the Bayou Energy System-
Bayou d'Inde

COPCs	COPC for Bayou d'Inde (BERA CDM 2002b)	COPC for Bayou d'Inde (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**Yes**	**Yes**
hexachlorobenzene	**Yes**	No	ND	**Yes**
hexachlorobutadiene	**Yes**	No	ND	**Yes**
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	NE	**Yes**
aroclor-1254	**Yes**	**Yes**	**Yes**	**Yes**
aldrin	**Yes**	**Yes**	ND	**Yes**
delta-bhc	No	No	ND	No
dieldrin	No	**Yes**	ND	**Yes**
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	**Yes**	**Yes**
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	**Yes**	**Yes**
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	**Yes**	**Yes**
mercury	**Yes**	No	**Yes**	**Yes**
nickel	No	No	No	No
zinc	**Yes**	No	**Yes**	**Yes**

1 - Detected at less than 5 percent in the energy system.

2 - Reference area conditions were greater than what was observed in the energy system.

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 7-11
Wilcoxon Rank Sum Test Results
Bayou d'Inde AOC

Area of Concern	Energy Area	Probability (p-value) [1] Aroclor 1254	Arsenic	Barium	bis(2-ethylhexyl)phthalate	Chromium	Copper
Bayou d'Inde	Bayou	**$2.99x10^{-4}$ (0.043)**	**0.011**	**0.003**	**$2.11x10^{-5}$ (0.003)**	**0.007**	**$1.03x10^{-9}$ ($1.48x10^{-7}$)**
Bayou d'Inde	Marsh	**$1.5x10^{-5}$ (0.002)**	**0.012**	**0.003**	**$1.21x10^{-5}$ (0.002)**	**0.007**	**$6.11x10^{-10}$ ($8.80x10^{-8}$)**

Area of Concern	Energy Area	Probability (p-value) [1] Lead	Mercury	Nickel	Pyrene	Zinc	2,3,7,8-TCDD TEQ
Bayou d'Inde	Bayou	**$3.22x10^{-7}$ ($4.64x10^{-5}$)**	**$2.25x10^{-6}$ ($3.24x10^{-4}$)**	0.294	**0.004**	**$1.22x10^{-8}$ ($1.76x10^{-6}$)**	**$1.96x10^{-4}$ (0.028)**
Bayou d'Inde	Marsh	**$1.06x10^{-8}$ ($1.53x10^{-6}$)**	**$1.88x10^{-9}$ ($2.71x10^{-7}$)**	0.295	**0.005**	**$6.47x10^{-5}$ (0.009)**	**$1.10x10^{-4}$ (0.016)**

[1] If p-value < critical value (alpha = 0.05) then there is a statistically significant difference between the AOC and reference areas. Bold = Significant Difference. Values in parentheses are Bonferroni adjusted p-values < critical value.

[2] Insufficient data for analysis.

Shading indicates that reference area conditions are greater than the energy system.

Table 7-13
COPCs Identified for the Marsh Energy System -
Bayou d'Inde

COPCs	COPC for Bayou d'Inde (BERA CDM 2002b)	COPC for Bayou d'Inde (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**Yes**	**Yes**
hexachlorobenzene	**Yes**	No	ND	**Yes**
hexachlorobutadiene	**Yes**	No	ND	**Yes**
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	NE	**Yes**
Aroclor 1254	**Yes**	**Yes**	**Yes**	**Yes**
aldrin	**Yes**	**Yes**	ND	**Yes**
delta-bhc	No	No	ND	No
dieldrin	**No**	**Yes**	ND	**Yes**
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD TEQ	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	**Yes**	**Yes**
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	**Yes**	**Yes**
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	**Yes**	**Yes**
mercury	**Yes**	No	**Yes**	**Yes**
nickel	No	No	No	No
zinc	**Yes**	No	**Yes**	**Yes**

1 - Detected at less than 5 percent in the energy system.

2 - Reference area conditions were greater than what was observed in the energy system.

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Section 8
Bayou Verdine - Nature and Extent

This section describes the nature and extent investigation of the Bayou Verdine AOC. Section 8.1 reviews the reaches and energy areas within Bayou Verdine. The historical activities, including industrial development, are located in Section 8.2. An overview of the analytical program is provided in Section 8.3. Presentation of the data from the RI in Section 8.4 includes the results of the PCA as well as the summary statistics of COPCs in Bayou Verdine. Section 8.5 describes the fate and transport of the COPCs in the AOC, and 8.6 presents the conclusions for Bayou Verdine.

8.1 Introduction

Bayou Verdine is approximately 7 km long, located between the cities of Westlake and Mossville, and north-northwest of Lake Charles in Calcasieu Parish, Louisiana (Figure 2-2). Bayou Verdine's headwaters originate in the farmland north of Mossville and flow primarily south-southeast, entering the Calcasieu River on the north end of Coon Island Loop.

8.1.1 Physical Setting

Relief in the area of the bayou ranges from 1 to 5 m above MSL. The bayou and surrounding area are located within the 100-year flood plain of the Calcasieu River Basin (Figure 2-6). Its headwaters are fresh water that mixes with intermediate to saline water of the Calcasieu River to the south. According to the USFWS National Wetland Inventory Map, the upper reaches of Bayou Verdine (from point of origin to I-10) are comprised of a palustrine wetland system that is periodically flooded during storm events and a riverine segment that is permanently flooded.

The upper reaches of the bayou have water depths ranging from 0.1 to 1.0 m. Through the Conoco facility and downstream of I-10, water depths increase to 1.2 to 2.1 m and are not tidally influenced. The lower segment of the bayou is tidally influenced, with up to 3 to 6 inches of daily water level fluctuation (USACE 1976), and has depths of up to 6 m. The bayou has an estimated average rate of flow of approximately 8 cfs in its southern reaches (USACE 1996). Near the confluence of Bayou Verdine and the Coon Island Loop, Bayou Verdine and the shallow groundwater are in direct communication (IT Corporation 1995).

In addition, three ditches drain into Bayou Verdine; they carry surface-runoff spill and permitted discharges from local industries. The Vista West Ditch, which passes through Sasol and Conoco, is located just downstream from Old Trousdale Road and is approximately 1.6 km in length. The Faubacher Ditch, which is slightly over 1.6 km passes through Sasol and Conoco properties east of the Vista West Ditch. The ditch originates in a residential area before passing through Conoco's land treatment area and Sasol's Chemical Plant and discharging into Bayou Verdine at the Conoco refinery downstream of the Vista West Ditch. The KCSRR Ditch runs along the

KCSRR railroad tracks and discharges into Bayou Verdine south of Faubacher Ditch. The ditch is approximately 2.4 km in length (Figure 8-1).

8.1.2 Energy Systems and Reaches

Bayou Verdine is classified exclusively as a bayou energy system and divided into five reaches (Figure 8-1). The reaches were created based on similar conditions divided by recognizable features such as the Old Trousdale Road and the mouth of the bayou. The use of reaches for this investigation is to assist in evaluating areas that have similar physical characteristics (e.g., grain size, TOC or similar inputs [e.g., outfalls]). By describing contamination by reaches, it is expected that samples from within a reach will have similar fate and transport mechanisms although not necessarily the same contaminants. For Bayou Verdine, the reaches are described as follows:

- **Reach 1**: Bayou Verdine from the confluence with the Calcasieu River to I-10, approximately 1,700 m in length.
- **Reach 2**: Bayou Verdine from I-10 to Old Trousdale Road (Rd), approximately 1,050 m in length.
- **Reach 3**: Bayou Verdine from Old Trousdale Rd to New Trousdale Rd, approximately 1,100 m in length.
- **Reach 4**: Bayou Verdine from New Trousdale Rd to Old Spanish Trail Rd, approximately 1,500 m in length.
- **Reach 5**: Bayou Verdine from Old Spanish Trail Road to approximately 1,500 m upstream, approximately 1,500 m in length.

Overall conditions result in net sediment transport from the bayou. Sediments are received from the undeveloped land to the northwest, Concoco, Sasol, and PPG. Sediment is transported through the bayou to the Calcasieu River, entering at Coon Island Loop. Flow in Bayou Verdine is generally sustained by runoff from industrial, agricultural, and rural residential areas and shallow groundwater under gaining stream conditions. The upper portions (Reaches 4 and 5) of the bayou are generally undisturbed in geometry and vegetation. The lower portions of Bayou Verdine (Reaches 1 through 3) have been channelized but are not routinely dredged. Overall, Bayou Verdine is a low-flow system.

At the confluence of Bayou Verdine and Coon Island Loop, the bayou discharges into a swift, deep channel, which is a conduit for brackish to saline water from the ship channel. The engineered confluence is wider than the natural opening and allows for greater tidal influence and storm surge up the bayou.

Development along Bayou Verdine has defined the current nature of the bayou. Industrial discharges (current and historic), accidental releases and stormwater runoff

have contributed to organic and inorganic impacts to surface water, sediment, and biota within the bayou.

8.2 Industrial Setting and Historical Contamination

This section depicts the industrial setting along Bayou Verdine, describing the facilities that are currently discharging, or historically discharged, either stormwater or wastewater into the bayou. In addition, previous investigations of Bayou Verdine are discussed to compare whether concentrations of contaminants have increased or decreased over time.

8.2.1 Industrial Setting

The land around Bayou Verdine is characterized by undeveloped land, mixed rural, residential, commercial, and heavy industrial use; however, industrial applications predominate in the southern section (Reaches 1 through 3) of the bayou. Industries that have been permitted to discharge into Bayou Verdine include PPG; Conoco; Lyondell; Sasol; formerly CONDEA Vista (CONDEA); and Tetra Technologies under the NPDES program (Figure 8-2).

Historical/Current Permitted Dischargers in Bayou Verdine
PPG
Conoco
Lyondell
Sasol (formerly CONDEA)
Tetra Technologies

8.2.1.1 PPG

PPG is located along the west side of Bayou Verdine to the south of I-10, (Figure 8-2) and primarily borders Reach 1 of Bayou Verdine. It is a chemical manufacturing facility producing both inorganic and halogenated organic compounds.

The plant was originally constructed in 1940 to manufacture magnesium during World War II and was operated by Mathieson Alkali Works. The facility was re-named PPG Industries in 1968. In 1960, PPG began producing chlorinated organics (EPA 1998a).

PPG Manufactures:
1, 2-DCA (syn. EDC)
Ethyl chloride
Perchloroethene
Trichloroethene
1,1,1-trichloroethane
Hydrogen chloride
Chlorine
Sodium
Hydroxide
Vinyl chloride monomer

PPG (NPDES Permit No. LA0000761) is authorized to discharge process wastewater through several designated outfalls. Only one outfall discharges to Bayou Verdine (outfall 004). PPG 004 receives flow from the North Dock Area. PPG also discharges to Bayou d'Inde (outfall 001) and the Calcasieu River (outfalls 002 and 003). Each of these outfalls was active as of 1996 (Curry et al 1997). The outfalls are monitored for TSS, BOD, pH, TOC, total residual chlorine (TRC), mercury, copper, lead, and several volatile and semivolatile organic compounds (Curry et al 1997). Compliance records available for the period from January 1979 through October 1998 indicate that several permit discharge violations were reported for outfall 004. Significant releases include release of chlorinated hydrocarbons, copper, and mercury. Chronic release of undefined chlorinated hydrocarbons from April 1985 through September 1997 ranged in quantity from 0.1 to

11,950 pounds (lbs) of material above discharge limits. Copper discharge limits were exceeded by 1.5 to 94.5 pounds per day (lbs/day) from January 1989 through October 1990, and mercury spills from November 1987 through January 1990 reportedly discharged through outfall 004 in quantities ranging from 0.7 to 12 lbs. Outfall 004 (Figure 8-2) discharges into Bayou Verdine (Reach 1) approximately 245 m from where the bayou flows into Coon Island Loop. Flow rate for outfall 004 is approximately 25,000 gpm (Curry et al 1997). Exhibit 8-1 summarizes the sources to outfall 004.

PPG also has an outfall (outfall 003) at the North Docks, which is located along the west side of Bayou Verdine, where it discharges into the Calcasieu River at Coon Island Loop. This area is a repository of discharges or spills from the PPG tank farm (EPA 1998a). PPG has exceeded permit levels for chlorinated hydrocarbons on multiple occasions from outfall 003. Spills directly into the Coon Island Loop include vanadium, 1,2-dichloroethane (EDC), crude EDC/trichloroethylene (TCE) blend, and chlorinated hydrocarbons (Table 8-1). Releases in this area may result in contaminant transport into Bayou Verdine by tidal surge or other physical processes. Exhibit 8-1 summarizes the sources to outfall 003. Enforcement histories for the PPG outfalls are provided in Table 7-1.

Exhibit 8-1 Approved Discharges into or Near Bayou Verdine for PPG (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
003	Calcasieu River at Coon Island Loop	Plant runoff, catch basin effluent, washdown, storage tank overflow, and small volumes of once-through cooling water during periods of heavy rain
004	Bayou Verdine Reach 1	Plant runoff, catch basin effluent, washdown, storage tank overflow, and primary discharge for once-through cooling water from Plant A

The soil and groundwater in the North Dock and adjacent plant area are heavily contaminated from accidental spills and leaking underground transfer pipes (Curry et al 1997). Contamination has been found in all water-bearing units down to the Chicot Aquifer. The upper three units (10, 20, and 30-foot units) have a direct hydrologic connection with Bayou Verdine and are discharging via two contamination plumes (Curry et al 1997). Two significant groundwater plumes that may impact Bayou Verdine are the EDC plume, which extends into the North Dock area, and the perchloroethene and trichloroethene plume that extends into the southern end of the North Dock area. It should be noted that this RI does not address groundwater contamination, as other State and Federal programs are addressing it. However, known contamination is noted because of its potential affect on the sediment and surface water in Bayou Verdine.

8.2.1.2 Conoco

Conoco is a petroleum refinery located primarily on the north and east side of Bayou Verdine to the north of I-10. The facility covers approximately 675 acres, 75 of which are

Conoco Manufactures:
Natural gas liquids
Gasoline
Kerosene
Diesel and fuel oil
Petroleum and calcined coke
Jet fuels
Lube oil feedstock
Flow enhancer

occupied by the refinery process areas. Conoco's facilities border Reaches 2 and 3 and have been in operation since 1942.

The Lake Charles Refinery is Conoco's largest, with a 226,000 barrel-per-day capacity (Conoco 2002). The refinery processes both heavy, high-sulfur crude and low-sulfur crude and produces a full range of fuel products. It also provides the feedstock for Excel Paralube, Conoco's joint venture facility that produces high-quality lubricating base oils, representing approximately 10 percent of U.S. lubricating base oil production. Conoco has recently upgraded the Lake Charles Refinery to process synthetic crude oil from the Petrozuata heavy-oil joint venture in Venezuela.

Conoco (NPDES Permit No. LA0003026) is authorized to discharge into Bayou Verdine through outfalls 001, 002, 004, 006, 007, 008, and 009. Discharge through outfalls 003 and 005 enters the Calcasieu River. Historical discharge exceedances and spills into Bayou Verdine include EDC, crude oil, diesel, hexavalent chromium, and cobalt among others. With the exception of outfalls 001, 002, and 006, discharge is primarily surface water runoff. However, outfalls 001, 002, and 006 receive process wastewater or overflow from waste treatment or storage areas (e.g., outfall 006 receives overflow from the wastewater sedimentation pond). More contaminated effluent streams are likely to emerge from outfalls 001, 002, and 006. Enforcement histories for the Conoco outfalls are provided in Table 8-1. Exhibit 8-2 lists the permitted discharges as of 1991.

Exhibit 8-2 Approved Discharges into Bayou Verdine for Conoco (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
001 and 002	Reach 2	Treated process wastewater, ballast water, crude tank drawn water, utility water, cooling tower blowdown, sanitary wastewater, and treated runoff from a process area. These are considered the primary outfalls.
004	Reach 2 (via KCSRR Ditch)	Stormwater runoff from the west central plant area.
006	Reach 2	Overflow wastewater from the sedimentation pond. (Requested deletion from permit in 1995 [Curry et al 1997])
007,008, and 009	Reach 2	Treated sanitary wastewater from package units located in remote areas of the facility. (Requested deletion of 009 from permit [Curry et al 1997])
010	Reach 2	Treated sanitary wastewater from package unit.

8.2.1.3 Lyondell

The plant was constructed in 1934 on approximately 1,200 acres and operated under Mathieson Alkali Works, Inc., Mathieson Chemical Corporation, Olin Mathieson Chemical Corporation, and Olin Corporation (Olin). In 1996, ARCO purchased Olin's toluene diisocyanate (TDI) and aliphatic diisocyanate

Lyondell Manufactures:
TDI/ toluene diamine(TDA)
ADI (luxate)
Nitric acid
Trichloroisocyanuric acid
Hydrazine
Hexamethylene diisocyanate (HDI)

(ADI) businesses, which was then bought by Lyondell in 1998.

Outfalls 025 and 026 (Figure 8-2) have been permitted by EPA (EPA Permit No. LA0005347) to discharge stormwater runoff into Bayou Verdine, Reach 1, since 1987 (Curry et al 1997). In 1993, the outfalls were permitted for ammonia, oil and grease (O & G), pH, and TOC and were part of the total permit limit issued for outfalls 016, 017, 019, 020, 022, 025, 026, 027, 032, 033, and 034, which do not discharge into Bayou Verdine. There were no exceedances for outfalls 025 and 026 into Bayou Verdine as of 1998. Exhibit 8-3 lists the Lyondell Bayou Verdine permitted discharges as of 1991. Table 8-2 presents the enforcement history of Lyondell/Olin up to 1998.

Exhibit 8-3 Approved Discharges into Bayou Verdine for Lyondell (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
025 and 026	Reach 1	Stormwater runoff

8.2.1.4 Sasol

In 2001, Sasol purchased the former CONDEA companies that include the facility in Lake Charles located north of Conoco. The facility began operations as early as 1965 under a division of Conoco. It was purchased by Vista Chemical Company in 1984 and then by CONDEA in 1991.

CONDEA had two outfalls permitted under NPDES Permit No. LA0003336. Both outfalls discharge into Reach 2 of Bayou Verdine (Figure 8-2; Curry et al 1997). Outfalls 001 and 001B received flow from the Alcohol Unit, East Lake Charles Chemical Plant Sanitary Sewers, Ethoxylate Unit, Normal Paraffin Unit, stormwater, Ethylene Unit, Steam Plant, Linear Alkyl Benzene Plant, Vinyl Chloride Monomer Plant, and blowdown. Exhibit 8-4 summarizes sources to outfalls 001 and 001B.

Exhibit 8-4 Approved Discharges into Bayou Verdine for Sasol (formerly CONDEA, Curry et al 1997)

Outfall	Discharges To	Approved Discharges
001 and 001B	Reach 2 (via Vista West Ditch)	Treated wastewater and process water, once through cooling water, blowdown, washdown, caustic, acid wash, and contaminated stormwater

Outfall 001 is monitored for TSS, BOD, TOC, ammonia, benzene, toluene, 1,2-dichloroethane, chloroform, methylene chloride, sodium hydroxide, total chromium, total zinc, and temperature and has a flow of approximately 1,650 gpm (Curry et al 1997). Outfall 001B, via the Vista West Ditch to Bayou Verdine in Reach 2, was designated as the emergency outfall for all of the above. Vista also listed 10 stormwater runoff outfalls but indicated that none of them met the definition of an outfall for which a permit is required. Table 8-3 presents the enforcement history for CONDEA up to 1998.

8.2.1.5 Tetra Technologies

Tetra Manufactures:
Liquid and dry calcium chloride

Tetra Technologies, Inc. (Tetra) purchased the facility in 1989 from Texas United Chemical Corporation, which is located on the west side of Bayou Verdine to the south of I-10 and encompasses 16 acres. The Liquid Calcium Chloride Plant is located in this area. Secondary containment structures are provided for the acid storage tanks, reactors, and loading/unloading areas at the facility. Stormwater collected from these areas is treated prior to discharge through outfall 001 into Reach 1 of Bayou Verdine (Figure 8-2). The remaining stormwater from the area (comprised of offices, dry plant, parking and warehousing) is directed to a common discharge on the east side of the property and on to Bayou Verdine (Reach 1). In addition, treated sanitary wastewater is discharged through outfall 001, combined with the stormwater described above. Table 8-4 presents the enforcement history of Tetra up to 1998. Exhibit 8-5 summarizes sources to outfall 001.

Exhibit 8-5 Approved Discharges into Bayou Verdine for Tetra (LDEQ 1997)

Outfall	Discharge Area	Approved Discharges
001	Reach 1	Treated sanitary wastewater and stormwater

8.2.2 Historical Contamination

Three previous studies were identified in the CEEAG database that collected samples within the Bayou Verdine AOC. These studies include:

- Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency - Region VI, Louisiana Department of Environmental Quality and U.S. Geological Survey, March 1990**.** (Conducted in 1988-89, see Appendix A)

- Site Inspection for Bayou Verdine, Prepared by PRC Environmental Management, Inc., for U.S. Environmental Protection Agency - Region VI, May 1994. (Conducted in 1993, see Appendix A)

- Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River, Prepared by McLaren/Hart Environmental Engineering - ChemRisk Division for PPG Industries, Inc., 1994. (Conducted in 1993-94, see Appendix A)

Historical contamination of COPCs identified in this RI/FS is discussed in this section. Samples used in this summary were samples collected within the Bayou Verdine AOC boundaries established for the Calcasieu Estuary RI/FS. Samples located outside this boundary were not used for historical comparison.

8.2.2.1 Volatile Organic Compounds

Within the Bayou Verdine AOC, 1,2-dichloroethane (1,2-DCA, syn. EDC) was detected in the 1988-89 EPA toxics study, the 1993 EPA study and the 1993-94 PPG study (Tables 8-5 through 8-7). In the 1988-89 toxics study, EDC was detected at only one location with a result of 4 µg/Kg. The location was approximately 2,265 m upstream from the confluence of Bayou Verdine and Calcasieu River (approximately 260 m upstream of Faubacher Ditch).

In the 1993 EPA study, EDC was detected twice, below the Old Trousdale Road (Reaches 1 and 2) and once in Reach 4. Values ranged from 14 to 32 µg/Kg, with the highest detection in Reach 2, approximately 1,900 m from the mouth of Bayou Verdine and just below the KCSRR Ditch.

The 1993-94 PPG study collected samples below I-10 in Reach 1. EDC values ranged from 5.95 to 5,000 µg/Kg, with the highest detection approximately 1,365 m from the mouth of Bayou Verdine.

Overall, EDC was detected in minor amounts (5,000 µg/Kg or less). Higher concentrations were primarily below I-10 although minor concentrations of EDC were also noted below the Vista West Ditch and the KCSRR West Ditch.

8.2.2.2 Semivolatile Organic Compounds

8.2.2.2.1 Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate (BEHP) was detected in the 1988-89 EPA toxics study, the 1993 EPA study, and the 1993-94 PPG study (Tables 8-5 through 8-7). B2EHP was detected at only one location in Bayou Verdine during the 1988-89 EPA toxics study. A sample had a result of 33,000 µg/Kg and was approximately 2,265 m upstream from the confluence of Bayou Verdine and Calcasieu River (approximately 260 m upstream of Faubacher Ditch).

During the 1993 EPA study, BEHP was detected in Reaches 1, 2, and 4, with the highest concentrations in Reaches 1 and 2. Values ranged from 41 to 19,000 µg/Kg. Results of 19,000 and 18,000 µg/Kg were located just downstream of Faubacher Ditch and Vista West Ditch, respectively. A result of 12,000 µg/Kg was detected 280 m upstream from the confluence of Bayou Verdine and Coon Island Loop just upstream of PPG outfall 004.

Overall, BEHP was detected in the highest concentration in Reach 2 midway between Vista West Ditch and Faubacher Ditch down to an area past Faubacher Ditch. A second impacted area was just upstream of the PPG outfall 004 in Reach 1.

8.2.2.2.2 Hexachlorobenzene

Hexachlorobenzene (HCB) was measured in the 1993-94 PPG study, downstream of I-10 (Tables 8-5 through 8-7). The highest concentration of HCB (45,205 µg/Kg) was located at the confluence of Bayou Verdine and the Coon Island Loop near the PPG

docks. Values varied throughout the rest of Reach 1, ranging from 393 to 26,316 µg/Kg. Overall, the most impacted area was near the PPG North Dock area.

8.2.2.3 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) were measured in the 1993 EPA study and the 1993-94 PPG study (Tables 8-5 through 8-7). Total PAHs (the summation of 18 PAH compounds) were detected primarily south of the Vista West Ditch in Reaches 1 and 2, with one detection in Reach 4 (3,030 µg/Kg). In the 1993 EPA study, the highest detection (1,468,000 µg/Kg) was located downstream of Faubacher Ditch. Values ranged from 3,107 µg/Kg in Reach 1 to 1,468,000 µg/Kg in Reach 2.

In the 1993-94 PPG study, values ranged from 1,390 to 666,575 µg/Kg, with the highest detected at the confluence of Bayou Verdine and Coon Island Loop. Values near 100,000 µg/Kg were noted approximately 1,000 to 1,500 m from the mouth of Bayou Verdine, increasing downstream.

Overall, historic data indicates that total PAHs have been most highly concentrated in Reach 2 between the Vista West Ditch and I-10. Consistently high to moderate values have been noted throughout Reach 1.

8.2.2.4 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) were detected at various locations in Reaches 1, 2, and 4 in the 1993 EPA study and the 1993-94 PPG study (Tables 8-5 through 8-7). Total PCB concentrations ranged from 46 to 110 µg/Kg in the 1993 EPA study, with the highest detection in Reach 2, downstream of the KCSRR Ditch. In the 1993-94 PPG study, values ranged from 80 to 465 µg/Kg, with two values exceeding 400 µg/Kg from 265 to 427 m upstream of the mouth of Bayou Verdine.

Overall, historic PCB data indicates that two PCB areas have been noted, downstream of the KCSRR Ditch and at the mouth of Bayou Verdine. Concentrations were low to moderate and extent was limited.

8.2.2.5 Metals

Several COPC metals were detected in the 1988-89 EPA toxics study, 1993 EPA study, and the 1993-94 PPG study. Of these studies, only arsenic was analyzed in the 1993 EPA study and the 1993-94 PPG study; and only chromium in the 1988-89 EPA toxics study.

8.2.2.5.1 Arsenic

Arsenic was detected in both the 1993 EPA study and the 1993-94 PPG study, with ranges of values of 1.6 to 6 mg/Kg and 1.78 to 10 mg/Kg, respectively (Tables 8-5 through 8-7). In the 1993 EPA study, the highest result was located in Reach 1 just south of I-10. However, a concentration of 5.5 mg/Kg was detected downstream of Vista West Ditch and in Reach 4 near Old Spanish Trail Road, indicating the variability of arsenic.

The highest detection in the 1993-94 PPG study was located approximately 1,300 m upstream from the confluence of Bayou Verdine and the Coon Island Loop. Values are variable from I-10 to approximately 600 m upstream of the mouth of Bayou Verdine. At 600 m, the values become consistent all the way downstream to the mouth of the bayou.

Overall, the arsenic concentrations are low to moderate, with the highest result measured at I-10 in Reach 1; consistent measurements were noted in the lower 600 m of Reach 1, as well.

8.2.2.5.2 Barium

Barium was measured in all three studies, with the highest detected values in the 1993-94 PPG study (Tables 8-5 through 8-7). In the 1988-89 EPA toxics study, values ranged from 74 to 226 mg/Kg, with the highest detections south of I-10 in Reach 1.

In the 1993 EPA study, barium was detected in Reaches 1, 2, and 4, with the highest detection located just south of Old Spanish Trail Road in Reach 4, with a result of 358 mg/Kg. Samples ranged from 46.7 to 358 mg/Kg. Values decrease within Reach 4 and then increase below the Vista West Ditch. Downstream of I-10 in Reach 1, barium values decrease again until the highest detection at the mouth of Bayou Verdine.

Barium results vary in the 1993-94 PPG study from 31 to 580 mg/Kg. The highest result was located approximately 1,300 m upstream of the mouth of Bayou Verdine.

Overall, barium was detected across the bayou; however, the highest detections were seen in Reach 1 downstream of I-10. A second trend is noted downstream of the Vista West Ditch where concentrations were noted as rising in the area downstream of the ditch.

8.2.2.5.3 Chromium

Chromium was only measured during the 1988-89 EPA toxics study (Tables 8-5 through 8-7). Chromium ranged from 15 mg/Kg in Reach 3 to 217 mg/Kg in Reach 2 between the Vista West Ditch and Faubacher Ditch. Chromium values decreased to less than 100 mg/Kg downstream of I-10 in Reach 1.

Overall, chromium was highest in the Reach 2 area between the Vista West Ditch and the Faubacher Ditch.

8.2.2.5.4 Copper

Copper was measured in all three studies, with the highest measured values being from the 1993-94 PPG study downstream of I-10 in Reach 1 (Tables 8-5 through 8-7). In the 1988-89 EPA toxics study, copper ranged from 7 to 58 mg/Kg, with the lowest detection in Reach 3 and the highest in Reach 2 just south of Vista West Ditch. Copper values decrease downstream of I-10 in Reach 1.

In the 1993 EPA study, values ranged from 8.9 to 112 mg/Kg, with the highest detections in Reach 2 south of the Vista West Ditch and downstream of the KCSRR Ditch. Values decrease downstream of I-10 in Reach 1.

Copper results in the 1994 PPG study ranged from 3.29 to 150 mg/Kg, with the highest detection located approximately 966 m upstream from the mouth of Bayou Verdine.

Historically, the occurrence of copper has been downstream of the Vista West Ditch and in upper Reach 1. However, the locations sampled limit interpretation as the entire bayou was not sampled in all studies.

8.2.2.5.5 Lead

Lead was measured in all three studies as shown in Tables 8-5 through 8-7. Lead values ranged from 12 to 129 mg/Kg in the 1988-89 EPA toxics study, with the highest detections located downstream of I-10 in Reach 1.

In the 1993 EPA study, values ranged from 11 to 41.8 mg/Kg and tend to increase moving upstream, with the highest detection located in Reach 1 at approximately 1,000 m upstream of Coon Island Loop. Within Reach 2, concentrations are higher downstream of Vista West Ditch and the KCSRR Ditch.

Values ranged from 7.62 to 217 mg/Kg in the 1993-94 PPG study, with the highest and lowest values located approximately 996 to 1,000 m upstream of the mouth of Bayou Verdine.

Historically, lead has been detected downstream of the Vista West Ditch and approximately 900 m upstream of the mouth of Bayou Verdine.

8.2.2.5.6 Mercury

Mercury was measured in all three studies (Tables 8-5 through 8-7). The 1988-89 EPA toxics study had only two measurements for mercury in Bayou Verdine, each located in Reach 1. Values ranged from 0.1 to 0.2 mg/Kg.

Mercury results in the 1993 EPA study ranged from 0.06 to 0.62 mg/Kg, with values below 0.1 mg/Kg in Reach 4 and increasing to above 0.1 mg/Kg near I-10 in Reach 2. The highest concentration was located downstream of the KCSRR Ditch.

In the 1993-94 PPG study, mercury results ranged from 0.12 to 0.97 mg/Kg, with the highest detection located approximately 1,000 m upstream of the mouth of Bayou Verdine. Values steadily increased from I-10 to the maximum value.

Overall, the highest concentrations were noted near the mouth of Bayou Verdine in Reach 1.

8.2.2.5.7 Nickel

Nickel was measured in all three studies, with the highest value measured in Reach 1 during the 1993-94 PPG study (Tables 8-5 through 8-7). In the 1988-89 EPA toxics study, nickel increased from 15 mg/Kg in Reach 1 to 42 mg/Kg in Reach 2 between Faubacher Ditch and Vista West Ditch.

Results from the 1993 EPA study showed that nickel values increased from Reach 4 to downstream of the Vista West Ditch, and an area just downstream of the Faubacher Ditch. Values ranged from 9.9 to 60.8 mg/Kg.

Nickel values ranged from 4.11 to 68.42 mg/Kg in the 1993-94 PPG study, with values decreasing from a high at approximately 1,000 m upstream of the mouth of Bayou Verdine to the confluence at Coon Island Loop. Values from I-10 to this maximum (1,000 m point) were notably more variable.

Overall, nickel values were highest in the mid portion of Reach 1 (1,000 m upstream of the mouth of Bayou Verdine). Areas with elevated detections were noted downstream of the Vista West Ditch in 1988 and 1993.

8.2.2.5.8 Zinc

Historical zinc concentrations are depicted in Tables 8-5 through 8-7. In the 1988-89 EPA toxics study, zinc concentrations ranged from 369 to 1,234 mg/Kg, with values highest near Vista West Ditch and decreasing downstream toward Faubacher Ditch (Tables 8-5 through 8-7).

Zinc concentrations in the 1993 EPA study ranged from 32.7 to 2,830 mg/Kg. Concentrations are lowest in Reach 4, peaking at a point at the mouth of the Vista West Ditch, decreasing slightly until a point at the KCSRR Ditch confluence, decreasing downstream again toward the mouth of Bayou Verdine. In the 1993-94 PPG study, zinc concentrations ranged from 13.29 to 2,806 mg/Kg, with the highest detection located approximately 1,300 m upstream of the mouth of Bayou Verdine.

Overall, zinc concentrations were highest downstream of the Vista West Ditch and the KCSRR Ditch. A third concentrated area is located approximately 1,300 m upstream of the mouth of Bayou Verdine.

8.3 RI Data Analysis and Interpretation Overview

The following discussions focus on data collected during Phase I and Phase II of the RI. Comparison to historical data trends is discussed in Section 8.6. The analytical program and the results of the data validation and interpretation are presented in Sections 4.6.1 and 4.8. Section 8.3.1 provides a summary of the parameters collected and analyzed. An overview of the data interpretation presented in Section 8.3.2 will describe the objectives of the principal component analysis (PCA), which will be used through the remainder of this section to describe the nature and extent of the contamination as well as the fate and transport of COPCs.

8.3.1 Analytical Program

Samples from Phase I and Phase II were collected within the Bayou Verdine area of concern, which is from where it flows into Coon Island Loop to approximately 7 km upstream. Determination of the nature and extent of contamination in Bayou Verdine was a combined effort by the EPA and Conoco. Conoco collected and analyzed samples from approximately 300 m upstream of the mouth of the bayou to where Bayou Verdine crosses Spanish Trail Road. EPA collected and analyzed samples throughout the remainder of the bayou, but in limited quantity.

The RI for Bayou Verdine included collecting and analyzing sediment, surface water, and porewater samples (Figures 4-2 and 4-8) for a combination of compounds in accordance with EPA SW-846, EPA CLP, and ASTM standard methods. The compounds of interest included VOCs, SVOCs, pesticides, herbicides, PCBs, PCB congeners, dioxin/furans, metals (filtered and non-filtered for surface water), and TPHs. Surface sediment samples were collected from the 0 to 15 cm depth interval in Phase I and from 0 to 10 cm depth interval in Phase II. Multi-depth samples were only collected in Phase I at the intervals: 0 to 15, 15 to 30, and 30 to 45 cm intervals. Surface water samples were collected at mid-depth of the water column in the middle of the bayou. Porewater samples were collected with sediment samples and extracted at the laboratory.

Sample Locations in Bayou Verdine For Chemistry Only (Phases I and II)

- 73 Surface sediment
- 7 Multi-depth sediment
- 12 Surface water
- 2 Porewater

In addition to the chemical parameters discussed above, selected samples were analyzed for chemical/physical properties, which may have included grain size analysis, TOC for sediment only, DOC for porewater only, and pH. Field parameters for sediment were limited to penetrometer measurements and VOC screening. Ancillary properties for surface water samples included alkalinity, ammonia, hardness, and TKN. Field parameters for surface water included temperature, pH, DO, ORP, conductivity, and salinity.

8.3.2 Data Interpretation Overview

Data were interpreted by use of statistical tests such as Wilcoxon Rank Sum (WRS) and the PCA to determine primary COPCs and their fate and transport in the estuary. In this section, an overview of the WRS test is provided in Section 8.3.2.1 to describe how it was used in the data interpretation. In Section 8.3.2.2, a brief overview of the PCA is provided explaining the objectives of this analysis. The development of energy system specific COPCs is described in Section 8.3.2.3 and the general fate and transport mechanisms that will explain the extent of contamination of these COPCs in each of the energy systems is provided in Section 8.3.2.4 through 8.3.2.7.

8.3.2.1 WRS Test

This section describes the results of the WRS test to determine if there is a statistically significant difference between the energy area in Bayou Verdine and reference area

conditions. COPCs that were not detected in the reference area were not compared using the WRS test; however, these non-detected COPCs are retained for evaluation. Use of the WRS Test is discussed in Section 4.8.2.3. Results are presented in Table 8-8.

The WRS test compares the probabilities (p-values) with a critical value (alpha) in order to determine whether there is a statistically discernable difference in the median concentrations between the two groups tested (energy area in the AOC versus the reference area). For purposes of interpreting the p-values, two levels of significance were established and presented in Exhibit 8-6.

Exhibit 8-6 Levels of Significance

Level of Significance	Interpretation of Difference
p-value < alpha	Medians may be different
Adjusted p-value < alpha	Medians are different

For the first level of significance (medians may be different), the p-values were compared directly with an alpha value of 0.05 or 95 percent upper confidence limit (UCL) of the median of the COPCs. For the second level of significance (medians are different), an adjusted p-value was calculated using the Bonferroni adjustment method:

adjusted p-value = n(p-value),

where, n is the number of comparison tests conducted.

The test does not indicate whether higher concentrations were observed in the energy area or the reference area, only that there was significant statistical difference between the two areas. To determine which area had higher concentrations, box plots comparing the two systems were examined and are presented in Appendix E.

8.3.2.2 PCA

As discussed in Section 4, PCA was used to accomplish the following objectives:

- Objective 1: Study the correlations of multivariate data sets by grouping variables (analytical constituents or parameters) in principal components (also known as factors or groups). Variables within each factor are more highly correlated with each other than with variables in other factors.

- Objective 2: Summarize many variables by a few factors or groups. Essentially, this is a data reduction technique whereby several original variables may be represented by one or a few "indicator" variables or by the factor itself.

- Objective 3: Interpret each factor according to the "meaning" of the variables. Such interpretation may provide useful information regarding geochemical fate and transport.

Sediment composition is heterogeneous, which means that chemicals found in sediment will vary from one location to the next. The PCA groups the measured

parameters into factors, which are parameters that tend to correlate with one another. By identifying parameters that correlate, sediment conditions can be better understood and explain why one location varies from another. Understanding the variability in the surface sediment, conclusions can be made in regard to sources and the fate and transport of contaminants.

Factors from the PCA will be discussed in Section 8.5.2 if one or more COPCs are grouped within that factor.

8.3.2.3 COPC Selection

The COPC list provided in Table 4-2 presents all of the COPCs in the Calcasieu Estuary, however, not all of these COPCs are present in each AOC or energy system. To limit discussion, energy system specific COPCs for each AOC were determined. COPCs that may not be present in a specific energy system, were not risk drivers, or were not statistically significant different than reference area conditions are not discussed.

The HHRA and BERA state which COPCs are the primary risk drivers for each AOC. An energy system specific COPC was determined if the following two conditions exist:

- The COPC was identified as a risk driver in the HHRA or the BERA
- The concentration of the COPC was determined to be statistically significant different and at a greater concentration from reference area conditions

If either of these criteria failed, the COPC was determined not to be a COPC for a particular energy system. In some cases, there was insufficient data to compare a COPC with reference area conditions (i.e., low Frequency of Detectss in a particular energy system). In these instances, the ranges of concentrations of a particular energy system are compared to reference area conditions by examining mean and median values by the use of box plots (Appendix E). If the range is comparable then they are not discussed in the following subsections. Additional information regarding these COPCs is presented in the HHRA or the BERA.

8.3.2.4 Fate and Transport Mechanisms

The major mechanisms that tend to guide chemical fate and transport in estuarine systems are:

- Adsorption
- Precipitation/Co-precipitation
- Salting out
- Complexation

- Biotransformation
- Hydrolysis
- Photolysis

Contaminant occurrence and extent in the Bayou Verdine AOC is dependent upon physical conditions, the contaminants, their concentrations and the dominant processes given these conditions. Details on these fate and transport processes are provided in Section 5.0. Sections 8.4 and 8.5 will discuss the general physical and chemical parameters, the extent of contamination, and the processes controlling COPC behavior in Bayou Verdine.

8.4 General Physical and Chemical Parameters for the Bayou Verdine AOC

This section presents the results of the sediment and surface water characteristics of the bayou energy system in Bayou Verdine.

8.4.1 Sediment Characteristics

8.4.1.1 Particle Size

Particle size analysis was conducted on all 10 SQT samples in Phase II (Figure 8-3). Clay content decreases upstream from the mouth of Bayou Verdine to Reach 3 and then increases in Reach 5. Sand increases within the bayou from the mouth to Reach 2, decreasing upstream. Reach 3 exhibits more silt particles than clay or sand, reaching a maximum in Bayou Verdine in Reach 5. Exhibit 8-7 summarizes the average particle size in each of the reaches, with the exception of Reach 4 where particle size analysis was not performed.

Exhibit 8-7 Mean[1] (Standard Deviation) of Particle Size Analysis

Reach of Bayou Verdine	Percent Clay	Percent Silt	Percent Sand
Reach 1	34.27 (9.92)	26.26 (4.89)	39.47 (13.12)
Reach 2	33.92 (2.93)	18.70 (3.82)	47.38 (0.91)
Reach 3	26.95 (-)	37.29 (-)	35.76 (-)
Reach 4	NA	NA	NA
Reach 5	48.1 (13.73)	41.87 (0.40)	10.03 (13.45)
Reference Area	23.94 (11.70)	40.2 (11.02)	35.86 (16.34)

1 – Based on regression on ordered statistics (ROS). See Appendix E.
(-) – No standard deviation due to only one sample analyzed
NA – Not analyzed

Bayou Verdine sediment tended to have a higher percentage of clay particles than the reference area. Mean percentages of silt tended to be lower, with the exception of Reach 5, which was higher. Mean percentages of sand were similar, with the exception of Reach 5, which was lower. The higher percentage of clay particles may be indicative of the amount of rural drainage in Reach 5.

8.4.1.2 Total Organic Carbon

TOC provides an indication of the total organic material present and includes the carbon both from naturally occurring organic material and from organic chemical contaminants. TOC in sediment was measured in both Phase I and Phase II. The mean TOC concentration for the entire bayou was approximately 24,327 mg/Kg, with a standard deviation of 56,635 mg/Kg. The coefficient of variation was 2.3, indicating the concentrations were highly variable within the bayou. Highest mean values were within Reach 2 but had a range of TOC values from 9,710 mg/Kg to 424,500 mg/Kg. Reaches 1, 3, and 5 had similar values, with low coefficient of variation, and Reach 4 exhibited the lowest concentrations. Exhibit 8-8 lists the mean concentrations by reach and compares them to reference area conditions.

Exhibit 8-8 Bayou Verdine Mean[1] (Standard Deviation) TOC

Reach of Bayou Verdine	TOC (mg/Kg)	Reference Area
Reach 1	20,568 (16,686)	
Reach 2	48,708 (107,448)	
Reach 3	16,572 (7,305)	43,356 (24,874)
Reach 4	6,524 (3,322)	
Reach 5	11,950 (3,172)	

1 – Based on ROS. See Appendix E

TOC concentrations tended to be lower than the reference area, with the exception of Reach 2.

8.4.2 Surface Water Characteristics

Surface water characteristics are presented in this section comparing to reference area conditions.

8.4.2.1 Total Dissolved Solids

Dissolved solids refer to any minerals, salts, metals, cations, or anions that may be dissolved in the estuarine water. Sources of dissolved solids may be from soil erosion, waste discharge, saltwater intrusion, urban runoff, eroding stream banks, and stirred-up bottom sediments from activities such as dredging. In addition to measuring total dissolved solids, salinity and conductivity were measured to describe the conditions within the bayou. Salinity and conductivity are related and essentially equivalent through conversion factors.

Salinity is the measure of the amount of dissolved salts in the surface water. Salinity levels control to some degree the types of animals and plants that may live in a particular area of the estuary. Salinity measurement is also important in determining if dissolved organic carbon will precipitate or "salt out."

Conductivity estimates the amount of total dissolved ions in water. Conductivity is controlled by geology, size of the watershed, evaporation rates, and other sources of ions to the bayou such as wastewater, saltwater intrusion, or urban and agricultural

runoff. An increase in conductivity could signal the introduction of a wastewater or runoff source or a saltwater influence.

Mean values for TDS were similar for Bayou Verdine and the reference area. The reference area exhibited a greater range, possibly due to agricultural or urban runoff or saltwater intrusion (entrained tidal surge) due to closer proximity to the Gulf of Mexico.

Exhibit 8-9 Total Dissolved Solids (mg/L) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
TDS[2] in Bayou Verdine	3,500	20,000	11,967	7,738
TDS[2] in Reference Area	6,000	32,000	13,467	10,245

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only

Salinity values were recorded during Phase II at each of the SQT sample locations. Salinity varied from 2 to 21.5 ppt, with the highest salinity located in Reach 1 and then decreasing to below 5 ppt in Reach 2 (possibly due to fresh water inflow from Vista West, Faubacher, or KCSRR Ditches). Reach 5 was primarily fresh water, with salinity values approaching zero. Based upon the USFWS salinity classification system, there are four types of salinity systems in Bayou Verdine. Reach 1 would be classified as polyhaline (18 to 30 ppt) near the confluence of the Calcasieu River and changing to mesohaline (5 to 18 ppt) near I-10. Reach 2 is an oligohaline (0.5 to 5 ppt) system. Salinity measurements were not taken within Reaches 3 and 4, but it is assumed that they become more of a fresh water system as Reach 5 is classified as a fresh water system (0 to 0.5 ppt). Exhibit 8-10 presents summary statistics of the salinity for Bayou Verdine and the reference area.

Exhibit 8-10 Salinity (ppt) Levels in Bayou Verdine and Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Salinity[2] in Bayou Verdine	2	21.5	13	9
Salinity[2] in Reference Area	6	36	14	12

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only.

Salinity was slightly higher in the reference area most likely due to its closer proximity to the Gulf of Mexico and the lack of freshwater sources into the reference areas.

Conductivity levels were highest (greater than 30,000 µS/cm) in Reach 1 with concentrations less than 10,000 µS/cm throughout the rest of the bayou, generally consistent with salinity values. Mean conductivity levels were higher in the reference area most likely due to the higher salinity levels. Exhibit 8-11 presents summary statistics for conductivity.

Exhibit 8-11 Conductivity (µs/cm) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Conductivity[2] in Bayou Verdine	547	33,450	9,062	13,357
Conductivity[2] in Reference Area	1,350	53,800	21,363	18,967

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only.

8.4.2.2 Hardness

Hardness is the measure of multivalent cations and is proportional or equivalent to the concentration of calcium and magnesium concentration of the water. Generally, as hardness increases, toxicity decreases. Hardness was measured as calcium carbonate ($CaCO_3$) in water samples in Reaches 1 through 4, with values increasing downstream toward the mouth of Bayou Verdine. The downstream portions of the bayou (Reaches 1 and 2) are considered very hard based on U.S. Department of Interior and Water Quality Association standards (> 180 mg/L). The rest of the bayou ranges from moderately hard (between 60 and 120 mg/L) to hard (120 to 180 mg/L). The average fresh water value for southern Louisiana is 140 mg/L (USACE 1998). Hardness values are shown in Exhibit 8-12.

Exhibit 8-12 Hardness, as $CaCO_3$, (mg/L) in Bayou Verdine and Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Hardness[2], as $CaCO_3$ in Bayou Verdine	80	246	128	58
Hardness[2], as $CaCO_3$ in Reference Area	1,295	1,295	-	-

1 – Values based on ROS. See Appendix E.
2 – Results from Phase I only

Hardness was significantly higher in the reference area than in Bayou Verdine, indicating higher concentrations of calcium and magnesium in the reference areas.

8.4.2.3 Alkalinity and pH

Increases or decreases of pH may be an indication of anthropogenic effects such as wastewater discharge, freshwater recharge, groundwater input, or contamination from urban or agricultural runoff. Measurement of pH may isolate a particular area that might be receiving discharges from these sources. Alkalinity is the measure of a solution's resistance to changes in pH, i.e., buffering capacity. Typically, water with a high alkalinity will resist the adverse affects of acidic contamination. The higher the alkalinity, the less likely an acidic (natural or manmade) constituent will be to cause a significant change in pH.

Surface water pH values in Bayou Verdine ranged from 7.26 to 8.15 standard units, which is considered neutral. Within Bayou Verdine, total alkalinity values ranged from 85 to 191 mg/L. Highest alkaline values are in Reach 2 and just downstream of I-10, and overall concentrations were greater than in the reference areas. Exhibits 8-13

and 8-14 summarize the pH and alkalinity, respectively, conditions present in Bayou Verdine and the reference area.

Exhibit 8-13 pH (standard units) Levels in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Median[1]
pH[2] in Bayou Verdine	7.26	8.15	7.51
pH[2] in Reference Area	6.67	8.135	7.27

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only

Exhibit 8-14 Total Alkalinity (mg/L) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Total Alkalinity[2] in Bayou Verdine	85	191	126	41
Total Alkalinity[2] in Reference Area	42.1	42.1	-	-

1 – Values based on ROS. See Appendix E.
2 – Results from Phase I only (1 result).

The reference area exhibited a broader range in pH values than in Bayou Verdine but had similar mean values. The alkalinity was higher in Bayou Verdine, indicating a greater potential to neutralize acidic inputs.

8.4.2.4 Nitrogen

Nitrogen was measured as TKN and ammonia. Nitrate and nitrite are inorganic ions occurring naturally as part of the nitrogen cycle (Smith, 1990). TKN is the organic form of nitrogen and includes both the dissolved and particulate form, whereas ammonia is the dissolved form of nitrogen. Ammonia, at low levels, is an important nutrient for estuarine organisms, whereas it becomes toxic at high concentrations. In contrast to freshwater systems where phosphorous is the limiting nutrient factor, nitrogen is the primary limiting nutrient in the seaward portions of most estuarine environments (Paerl 1993). If high levels of nitrogen are introduced into the estuary, a significant increase of algae or large aquatic plants may occur NOAA/EPA (1988) suggests that nitrogen levels to avoid algae blooms to be between 0.1 and 1 mg/L.

TKN, the summation of ammonia and organic nitrogen, was similar in the shallow lake and ship channel energy system to what was observed in the reference areas. Exhibit 10-15 summarizes TKN results for Phase I and Exhibit 10-16 presents the summary statistics for ammonia.

Exhibit 8-15 TKN (mg/L) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
TKN[2] in Bayou Verdine	0.51	0.85	0.56	0.15
TKN[2] in Reference Area	0.95	0.95	-	-

1 – Values based on ROS. See Appendix E.
2 – Results from Phase I only.

Exhibit 8-16 Ammonia, as N, (mg/L) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Ammonia[2] as N in Bayou Verdine	0.11	0.26	0.11	0.08
Ammonia[2] as N in Reference Area	0.0064	0.0064	-	-

1 – Values based on ROS. See Appendix E.
2 – Results from Phase I only

The one result of TKN was slightly higher in the reference area, whereas the ammonia levels were significantly lower. The higher ammonia levels that were present in Bayou Verdine may be the result of wastewater input.

Ammonia concentrations were higher than what was observed in the reference areas. According to EPA (1989b), the criteria maximum concentrations (CMC) for total ammonia for pH, temperatures and salinity found in Bayou Verdine range from 44 to 50 mg/L. The criteria continuous concentrations (CCC), according to EPA (1989b), range from 6.6 to 12 mg/L. Ammonia levels were below the CMC and CCC values for Bayou Verdine.

8.4.2.5 Dissolved Oxygen

Dissolved oxygen is typically an indicator of high quality for aquatic life and helps determine the ability of aerobic organisms to survive. The concentration is dependent upon temperature, salinity, wind, water turbulence, atmospheric pressure and presence of oxygen demanding compounds and organisms, and photosynthesis. The percent saturation is the measured dissolved oxygen level divided by the greatest amount of oxygen that the water can hold at that temperature and atmospheric conditions. Low dissolved oxygen levels typically indicate an excessive demand on the system from organic material deposited from pollution sources or from natural sources such as leaves and grass. Exhibit 8-17 summarizes the DO in Bayou Verdine and the reference area.

Exhibit 8-17 Dissolved Oxygen, in Percent Saturation in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Dissolved Oxygen[2] (%) in Bayou Verdine	5.09	18.47	11.20	5.09
Dissolved Oxygen[2] (%) in Reference Area	7.50	12.76	10.36	1.55

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only

Dissolved oxygen levels exhibited a smaller range in the reference area, but mean percentages were similar. Typically, values over 80 percent represents high quality water, which will support various flora and fauna, whereas values less than 80 percent indicate poor water quality conditions.

8.4.3 Porewater

Porewater is the water occupying space between sediment particles. DOC, salinity, conductivity, hardness, total alkalinity, ammonia as N, unionized ammonia, and pH were measured at 10 sample locations in Bayou Verdine. DOC and salinity are presented in this section, whereas discussion of the other parameters is presented in the BERA.

8.4.3.1 Dissolved Organic Carbon

Dissolved organic carbon (DOC) is the organic fraction of carbon in water that is filterable. DOC plays a role in the fate and transport of trace elements in the subsurface as well as influences the bioavailability of hydrophobic compounds. In saline environments, dissolved organic matter is precipitated from the water to the sediment phase where it can effectively sorb hydrophobic chemicals (Chapman et al 2001). Exhibit 8-18 summarizes the porewater dissolved organic carbon levels in Bayou Verdine and the reference area.

Exhibit 8-18 Porewater DOC (mg/L) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
DOC[2] in Bayou Verdine	1.60	5.33	3.15	1.13
DOC[2] in Reference Area	2.29	13.52	4.78	3.41

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only

Within Bayou Verdine, DOC had a coefficient of variation of 0.36, signifying that values did not vary greatly throughout the bayou. The maximum detected value was located in Reach 2, which corresponds to the high TOC found in sediment in the same reach. Mean DOC concentrations were slightly higher in the reference areas most likely due to the vegetation surrounding the water body.

8.4.3.2 Salinity

As discussed previously, salinity and conductivity are measures of TDS in water. Salinity values are presented in Exhibit 8-19.

Exhibit 8-19 Porewater Salinity (ppt) in Bayou Verdine and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Salinity[2] in Bayou Verdine	2	50	15.3	15.7
Salinity[2] in Reference Area	12	24	17.1	3.8

1 – Values based on ROS. See Appendix E.
2 – Results from Phase II only

Porewater salinity values were comparable with reference area conditions, although varied significantly more. However, salinity in the porewater within Bayou Verdine was high in comparison to overlying surface water salinity, which had a mean value of 13 ppt. Highest porewater salinity concentrations were located in Reach 1 and

consistently decreased upstream in the remaining reaches. The difference between salinity measurements between surface water and porewater are most likely related to sediment type and duration of exposure (Chapman et al 2001). Equilibrium between surface water and porewater is slow in sediments containing high amounts of fine particles such as clay and silt (Chapman et al 2001).

8.5 Nature and Extent for the Bayou Energy System

The results and discussion section is organized into four sections: COPCs identified for the bayou energy system (Section 8.5.1), the results of the PCA (Section 8.5.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 8.5.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix E provides details of the PCA and complete summary statistics for all compounds detected in the bayou energy system in Bayou d'Inde.

8.5.1 COPCs for the Bayou Energy System in Bayou Verdine

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 8.5.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 8.5.1.2 presents the bayou energy system COPCs identified.

8.5.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 8-8. Contaminants that were determined to be statistically significant different than the reference area are:

- PAHs
- PCBs
- Inorganics (arsenic, barium, mercury, and zinc)

8.5.1.2 COPCs Selection

Energy system specific COPCs for the bayou energy system in Lower Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significant different than reference area conditions (Table 8-9). The following COPCs were selected for the bayou energy system in Lower Calcasieu:

- VOCs (1,2-dichloroethane and trichloroethane)

- PAHs (as low and high molecular weight PAHs)
- PCBs
- Inorganics (barium, mercury, and zinc)

The extent as well as the fate and transport of these COPCs will be discussed in Sections 8.5.2 (PCA) and 8.5.3 (Isolated Chemistry).

8.5.2 PCA

The PCA revealed four dominant factors that accounted for most of the variability (83 percent) in surface sediment within Bayou Verdine. These factors are:

- Medium to high level contamination due to dioxins, PAHs, and metals (Dioxin/PAH/Metal factor) that accounted for 31 percent of the variance.
- Background metals (Background Metal factor) that accounted for 16 percent of the variance.
- Medium to high level contamination due to pesticides, VOCs, SVOCs, metals (Pesticide/VOC/SVOC/Metal Factor) that accounted for 15 percent of the variance.
- Medium to high level furan/dioxins and metals (Furan/Dioxin/Metal Factor) that accounted for 21 percent of the variance.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

8.5.2.1 Dioxin/PAH/Metal Factor

This section presents the extent of the dioxin/PAH/metal factor (Factor 1) and discussion as to the primary fate and transport process for contaminants in this factor.

8.5.2.1.1 Results

The Dioxin/PAH/Metal factor is comprised of metals, PAHs, and dioxins, as well as TOC and pH in sediment. The key parameters, based on highest correlation, were lead, chromium, copper, 1,2-benzphenanthracene, benzo(b)fluoranthene, fluoranthene, and pyrene. TOC and pH also correlated within this factor. This factor controls 31 percent of the variance in the bayou. Parameters such as TOC, pH, and sodium (and other cations) are also contained in this factor. These parameters control the mobility and the fate and transport of chemicals in this group. Summary statistics for the parameters that group within this factor are presented in Exhibit 8-20 through 8-22.

Exhibit 8-20 Summary Statistics of Inorganics (mg/Kg) in Dioxin/PAH/Metal Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Mercury	37/101	0.0239	0.57	0.14	0.15	1.08
Lead	101/101	6.2	139	25.0	20.7	0.83
Sodium	25/25	110	8,660	1,418	2,320	1.64
Aluminum	25/25	3,390	13,400	7,513	3,189	0.4
Copper	95/101	2.8	317	42	65	1.5
Cyanide	3/25	0.36	1.4	-	-	-
Chromium	91/91	3.2	1,240	109	198	1.82

1 – Values based on ROS. See Appendix E.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

Exhibit 8-21 Summary Statistics of PAHs/SVOCs (µg/Kg) in Dioxin/PAH/Metal in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Pyrene	72/98	17	160,000	10,370	23,924	2.3
Fluoranthene	53/98	69	40,000	3,152	6,915	2.2
Benzo(a)anthracene	52/98	65	53,000	3,964	8,580	2.2
Benzo(b)fluoranthene	58/98	43	58,000	4,118	8,702	2.1
1,2-Benzphenanthracene	67/98	100	120,000	9,510	19,214	2.0
Benzo(a)pyrene	47/98	120	71,000	5,006	12,108	2.4
Benzo(k)fluoranthene	17/98	25	3,600	-	-	-
Dibenzo(a,h)anthracene	19/98	150	9,800	-	-	-
Diesel Range Organics	9/9	18,500	14,000,000	2,905,833	5,260,472	1.8

1 – Values based on ROS. See Appendix E.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

Exhibit 8-22 Summary Statistics of Dioxins (ρg/g) in Dioxin/PAH/Metal in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total HpCDD	11/11	41	6,300	1,077	2,215	2.1
OCDD	11/11	280	25,000	5,440	8,222	1.5
Total HxCDD	11/11	4.7	490	107	161	1.5
Total TCDD	11/11	0.8	37	10	14	1.5
Total HpCDF	11/11	5.1	2,800	608	939	1.5

1 – Values based on ROS. See Appendix E.

Lead was used as the indicator variable for this factor.

Surface Sediment

Figure 8-4 presents the results of lead as an indicator parameter for the dioxin/PAH/metal factor. These groups of contaminants were prevalent in Reaches 1 and 2, with elevated concentrations and tend to decrease from the rail spur in Reach 2 upstream. Figure 8-4 indicates that contamination is highest downstream of the Vista West Ditch and just upstream of I-10 in Reach 2.

Dioxin, reported as 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD TEQ), was detected in Reaches 1 through 5 (Figure 8-5). The highest concentrations were detected in Reach 2, with elevated concentrations approximately 180 m downstream of the Vista West Ditch and approximately 60 m upstream of I-10.

PAHs in Factor 1 are located from the rail spur in middle Reach 3 through upper Reach 1. Highest concentrations are located downstream of the KCSRR Ditch to I-10.

The metals chromium, copper, lead, and mercury were found in multiple locations in the bayou, with elevated concentrations located primarily in Reaches 1 and 2. Highest concentrations were found in Reach 2 from Vista West Ditch to approximately 250 m downstream and from the Faubacher Ditch to I-10.

Subsurface Sediment

Both metals (chromium, copper, lead, and mercury) and PAHs (1,2-benzphenanthracene, benzo(a)anthracene, benzo(b)anthracene, fluoranthene, and pyrene) were detected in subsurface sediments. Dioxin was not measured in any subsurface samples. BVR2007 exhibited the highest concentrations for both metal and PAH concentrations (Figure 8-4). Concentrations tended to decrease both upstream and downstream with various depths having higher concentrations depending on the COPC. In Reaches 1 and 2, metals concentrations are typically higher in surface sediment than in the subsurface, with the exception of chromium, which was higher in the 30 to 45-cm interval. In Reach 3, the 15 to 30-cm interval tended to have the higher concentrations, with chromium exceeding surface concentration by a factor of six. Reach 4 showed metal concentrations decreasing in the subsurface.

PAH concentrations at BVR1011 and BVR2007, which had the highest concentrations in the surface and subsurface sediment, did not vary significantly with depth. Similar to metals, individual PAHs concentrations were variable with depth either decreasing or increasing in the subsurface. Pyrene was the most widely detected PAH in the subsurface. PAH concentrations tended to decrease in the subsurface in Reaches 1 and 2, with the 15 to 30-cm depth interval having higher concentrations in Reaches 3 and 4.

Surface Water

Mercury was detected in surface water samples collected in the bayou energy system in Lower Calcasieu. Exhibit 8-23 presents the total and dissolved (if detected)

concentrations of these contaminants and compares them to EPA AWQC (Ambient Water Quality Regulations; as published in the Federal Register 1995) CCC (chronic) and CMC (acute) values and/or LDEQ Water Quality Regulation (LDEQ 2000) for both freshwater and marine environments. For systems with salinity between 1 and 10 ppt, the more stringent of either fresh or marine values should be used to compare with mean dissolved concentrations. In cases where the dissolved phase was not detected, the surface water criteria for that contaminant was converted to an unfiltered criterion using a conversion factor provided in LDEQ 2000.

Exhibit 8-23 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Dioxin/PAH/Metal Factor in Surface Water, Bayou Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Mercury	ND	0.000271	0.0017[2]	**0.00001**[2]	0.0017[3]	**0.000021**[3]

1 – Based on ROS. See Appendix E. If only two samples, an average was calculated. ND: Not Detected
2 – LDEQ Water Quality Regulations based on 200 mg/L hardness for dissolved concentrations.
2 – LDEQ Water Quality Regulations based on 50 mg/L hardness for dissolved concentrations.

Mercury exceeded both the fresh and marine water surface water criteria. Mercury was detected in 4 of 11 stations with a maximum concentration observed of 0.0006 mg/L at station BVR3C1WM (in Reach 3).

8.5.2.1.2 Discussion

This section interprets the results of the factor analysis as a group and by individual contaminant groups (i.e., organics and inorganics).

Factor 1 includes parameters that are the result of releases of contamination into the AOC. The mean concentrations of all the parameters in this group are relatively high. The coefficient of variation is also very high for this group of chemicals, indicating a high level of variability and large range of concentrations (i.e., selected locations will have very high concentrations). This observation also indicates releases of contamination because very small to very high concentrations are present in the AOC. PAHs in this group are the high molecular weight PAHs (HPAHs).

The correlation with TOC, cations, and pH indicate that contaminants were released into the water phase and were subsequently removed to the sediments by adsorption processes, precipitation, or salting out. The most likely cause would be salting out, a controlling process throughout most of the bayou as evidenced by the high sodium concentrations in sediment and porewater salinity. Removal to the sediments appears to occur in Reaches 1 through 3. Accumulation of these adsorbed sediments may occur upstream of I-10 prior to flow through concrete culverts beneath the interstate. The culverts may act to slow surface water velocities, allowing contaminants that have adsorbed to fine particles to settle. In addition, visual inspection of this area shows that the bayou widens slightly, creating a settling pool during normal flows or a surge pond during storm events.

Organics

Hydrophobic compounds, such as dioxins and PAHs, tend to sorb to organic matter in the sediment as shown by the high concentrations of TOC within Reach 2. Normalizing these compounds to TOC showed that the HPAHs are dominant in the bayou, with elevated concentrations throughout Reach 2 and an area in Reach 1 from 315 to 1,000 m upstream of the mouth of the bayou. HPAHs are generally immobile in terms of chemical transportation. The compounds in this group bind tightly to sediments, and transport appears to occur only by physical movement or migration of the sediments. The variable TOC concentrations in the bayou indicate that the sediments are disturbed, possibly re-suspended and mobilized downstream. The compounds in this group bind tightly to sediments, and transport appears to occur only by physical movement or migration of the sediments.

Historically, Reaches 1 and 2 have had high PAH contamination according to the 1993 EPA study and the 1993-94 PPG study. PPG, Conoco, Sasol (formerly CONDEA), and Tetra have formerly violated discharge limits by potentially releasing crude, slurry and sweet gas oils, chlorinated hydrocarbons, gasoline, and diesel (Tables 7-1, and 8-1 through 8-4).

Diesel range organics (DRO) analyses indicate elevated concentrations in the area upstream of I-10, near the KCSRR West Ditch. The DRO analytical procedure is a gas chromatograph (GC)/flame ionization detector (FID) method that reports combined concentrations of long chain hydrocarbons, ranging from C9 through C22. This range encompasses the lighter aliphatics and heavier aromatics (from benzene to benzo [g,h,i]perylene). The DRO values measured indicate that longer chain hydrocarbons are present in addition to the aromatics measured by GC/mass spectrometer analytical methods. These heavier compounds are typical components of coke oil or other heavy oils. The source of contamination to these locations may be the Conoco Coke production process or diesel fuels and/or motor oils associated with KCSRR operations.

The source of PAHs is probably located near BVR1011 and BVR2007. This observation is based on the high concentrations present in the subsurface (Figure 8-4). Concentrations in both BVR1011 and BVR2007 did not vary significantly in comparison to other stations, indicating that physical movement of sediment has not affected these locations. Concentrations of PAHs in the subsurface decreased up and downstream of these locations. Stations such as BVR3007 had higher concentrations in the 15 to 30-cm depth interval, indicating that PAHs may have settled fine-grained particles in the bayou and eventually were covered by sedimentation.

Dioxins are very persistent in the aquatic environment. Dioxins have very low water solubility and sediments are a common reservoir for dioxins. In the aquatic environment, dioxins strongly adsorb to sediments and are highly soluble in lipids. Various biological studies have demonstrated that TCDD is generally resistant to biodegradation although TCDD in exposed sediments may be susceptible to

photodegradation. Without photodegradation, half-life in deeper soils may be as long as 12 years (EPA 1993).

Dioxin, when normalized to TOC, has the highest concentrations downstream of the Vista West Ditch and decreases upstream from Reach 2. Dioxin concentrations tend to decrease slightly to I-10 where elevated concentrations were detected both upstream and downstream of the I-10 culverts. Dioxins are typically produced from either the combustion of chlorinated organic compounds and chlorination of aromatic compounds. Sources of dioxins into Bayou Verdine include, but are not limited to, atmospheric deposition or chlorination of wastewater effluent. Since the values vary widely in the bayou and tend to concentrate in Reach 2, a possible source is from discharge of wastewater effluent from Vista West Ditch.

Inorganics

Metals contamination (copper, chromium, lead, and mercury) was found throughout the bayou. Elevated concentrations were noted in Reaches 1 and 2 and in isolated locations in Reach 3. Highest median and detected concentrations were found in Reach 2 for all four metals and tended to decrease upstream and downstream for this reach (although only slightly for mercury). Metals correlate with each other, indicating they are easily transported within the bayou and out into the Calcasieu River. Highest metals concentrations are located downstream of Vista West Ditch, at BVR2C1SS, indicating that the ditch is a possible source.

Behavior of copper, chromium, and lead is dictated by metal compound; oxides, carbonates, hydroxides, and sulfides are most commonly formed in the environment. Formation of these compounds depends upon water concentration and pH. The result is removal of the metals from the dissolved phase and evorporation into the sediments. However, lead and copper can also be more soluble in higher salinity waters due to chloride complexing.

Salinity affects major cations (sodium, calcium, etc.) because of increased ionic strength of the solution, which reduces activity of the species in solution. The result is increased solubility and decreased partitioning compared to freshwater. Saline water ions can also compete with metals for adsorption sites on sediments. Hanor and Chan in 1979 found that ion exchange between magnesium from seawater and adsorbed barium occurred in the mixing zone of the Hudson River, mobilizing barium. This effect may be present at the confluence of the major ditches in Reach 2.

Elemental metals such as copper and lead typically are not directly affected by changes in reduction/oxidation potential. Exceptions include chromium and arsenic. For example, chromium is usually discharged as a Cr^{6+} anion (usually CrO_4^{2-} depending upon pH and ORP). However, the Cr^{6+} is converted to Cr^{3+} in sediments and then the precipitates on a hydroxide or non-chromium oxyhydroxide. Adsorption onto particulate matter may also act as an important transport mechanism. Sorption of zinc and similar metals by hydrous metal oxides, clay

minerals, and organic materials may be an important fate process in the aquatic environment, resulting in enriched suspended loads and bed sediment relative to the water column. Where suspended solids make up a high proportion of the total solids load, most of the zinc transported will be sorbed to the suspended and colloidal particles (Kubota *et al.* 1974). TSS load within the water column can be an effective means of transporting many otherwise immobile compounds. Limited TSS data in Bayou Verdine make it difficult to assess the variability of the sediment load across the reaches but seem to indicate that sediment load transport may be effective in metals distribution.

Iron and manganese oxidation in areas of increased DO remove chromium, copper, lead, and zinc via co-precipitation. King (1998) found that when ferrous iron, present in river flow, mixed with higher DO, pH, and alkalinity seawater within an estuary the iron led co-precipitation of a suite of other metals. Given the surface runoff source of much of the freshwater input to the more saline water of Bayou Verdine, co-precipitation is considered an ongoing process across the bayou. The broad occurrence and range of detections support this interpretation.

Copper, chromium, lead, and mercury in the subsurface indicate that the possible sources may be the same as those associated with PAH contaminants.

8.5.2.2 Background Metals

This section presents the extent of the background metals factor (Factor 2) and discussion as to the primary fate and transport processes controlling behavior of contaminants in this factor.

8.5.2.2.1 Results

Surface Sediment

The Background Metals factor is composed of metals that are comparable to reference area conditions. Summary statistics of constituents in this factor are presented in Exhibit 8-24.

Exhibit 8-24 Summary Statistics of Metals (mg/Kg) in Background Metal Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Iron	25/25	74	16,000	808	2,226	0.64
Beryllium	26/91	0.23	1.5	0.4	0.3	0.79
Potassium	24/25	292	1,720	717	382	0.53
Cobalt	22/25	2.1	38.4	7.6	8.9	1.18
Magnesium	25/25	559	5,000	1,775	1,155	0.65
Manganese	25/25	101	1,860	348	408	1.17
Vanadium	91/91	7.7	85.4	19.1	10.9	0.57
Barium	91/91	28.3	365	155	64	0.41

Arsenic	89/91	0.86	18.7	3.9	2.6	0.66

1 – Values based on ROS. See Appendix E.

8.5.2.2.2 Discussion

These metals typically represent background conditions.

8.5.2.3 Pesticide/VOC

The Pesticide/VOC factor was the third factor to account for the variability in surface sediment. The results and discussion of contaminants in this factor in Bayou Verdine are presented in this section.

8.5.2.3.1 Results

This factor groups pesticides, 1,2-dichloroethane (EDC), and thallium within this factor. Exhibit 8-25 through 8-27 presents the summary statistics for these contaminants.

Exhibit 8-25 Summary Statistics of Pesticides (µg/Kg) in Pesticide/VOC Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aldrin	5/70	2.6	3.1	-	-	-
Beta-BHC	3/70	3.4	57	-	-	-
4,4'-DDT	4/70	4.8	48	-	-	-
Delta-BHC	6/70	4.6	55	-	-	-

1 – Values based on ROS. See Appendix E.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

Exhibit 8-26 Summary Statistics of Organics (µg/Kg) in Pesticide/VOC Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
EDC	17/105	15	19,000,000	-	-	-
Bis(2-chloroethyl)ether	3/101	630	49,000	-	-	-

1 – Values based on ROS. See Appendix E.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

Exhibit 8-27 Summary Statistics of Metals (mg/Kg) in Pesticide/VOC Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Thallium	7/91	0.54	1.9	-	-	-

1 – Values based on ROS. See Appendix E.
(-) – Mean value is not calculated for less than 20% detected due to estimation of distribution becomes less accurate.

EDC was used as an indicator variable for this factor.

Surface Sediment

Elevated concentration of contaminants grouped in this factor was primarily located in the middle reaches of Bayou Verdine (Figure 8-6). Highest concentrations were located within close proximity of Vista West Ditch in Reaches 2 and 3. For EDC, in particular, approximately 120 m of bayou are highly contaminated (80 m upstream and 40 m downstream of Vista West Ditch).

Within the other areas of Bayou Verdine, pesticides, EDC, or thallium were detected at low concentrations or not at all.

Subsurface Sediment

EDC was detected in the subsurface at station BVR3007. In the 15 to 30-cm interval, BVR3007 was reported to have a concentration of 20 µg/Kg.

Surface Water

Contaminants grouped within this factor were not detected in the surface water.

8.5.2.3.2 Discussion

Various VOCs indicative of chlorinated process byproducts are present in the sediments from the middle of Reach 3 to approximately 100 m downstream of Vista West Ditch in Reach 2 (Figure 8-6). Compounds with the greatest Frequency of Detectsion and/or concentration include EDC, tetrachloroethene (PCE), TCE, 1,2-DCE, chlorobenzene, 4-bromofluorobenzene, dibromofluromethane, and dichloromethane. Each of these VOCs is readily volatilized and degraded. The presence of PCE, TCE, and 1,2-DCE at, or downstream of, BVR2C3SS indicates ongoing biodegradation (anaerobic reductive dechlorination). The lack of large areal extent is to be expected given the volatile nature of the contaminants. The presence of the contaminants in the sediments at the elevated concentrations noted (location BVR2C3SS: PCE 38,000 µg/Kg; TCE 50,000; total 1,2-DCE 46,000) indicates deposition of material entrained in finer grained sediments and organic matter, limiting direct contact with the overlying waters and subsequent dissolution and volatilization.

EDC is present in the sediments at significant concentrations. The current findings may be related to be the 1994 EDC spill into Bayou Verdine. The downstream extent is 27 µg/Kg at R2EDC10SS; the upstream extent is defined as non-detect (66U µg/Kg) at BVR3007 (Figure 8-5). Chemical degradation of halogenated alkanes is controlled by hydroxyl radicals. The presence of EDC in the anoxic sediments appears to be limiting exposure to hydroxyl radicals, preventing significant degradation. Subsequently, EDC undergoes anaerobic dechlorination to chloroethane (biologically remediated). The volatility of chloroethane limits its use as a definitive marker of this process; however, the significant concentrations of EDC observed indicate that it is not having a substantial impact on this contaminated sediment

Aldrin is a representative pesticide and can describe general pesticide behavior. Aldrin biodegrades slowly; however, it is not highly water soluble or expected to readily leach from soils. Aldrin has been classified as moderately persistent, having a half-life in soil ranging from 20 to 100 days, with high sorptive capability.

The broad low-level detection of pesticides indicates localized entry into the bayou from various locations, representative of normal use, not indicative of spills or accidental release.

8.5.2.4 Furan/Dioxin/Metal

The Furan/Dioxin/Metals factor was the fourth factor to account for the variability in surface sediment. The results and discussion of furans detected in Bayou Verdine are presented in this section.

8.5.2.4.1 Results

Exhibits 8-28 and 8-29 present the results of the contaminants that comprise the furans/dioxin/metals factor. This factor includes the chlorinated furans octachlorodibenzo-furan (OCDF), pentachlorodibenzo-furans (PeCDFs), heptachlorodibenzo-furans (HpCDFs), hexachlorodibenzo-furans (HxCDFs), and tetrachlorodibenzo-furans (TCDFs). In addition, pentachlorodibenzo-p-dioxin (PeCDD), nickel, zinc, and calcium correlated in this factor.

Exhibit 8-28 Summary Statistics of Dioxins/Furans (ρg/g) in Furan/Dioxin/Metal Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total PeCDF	8/11	3.6	410	86	138	1.61
OCDF	9/11	10	4,400	805	1,513	1.51
Total PeCDD	4/11	9.92	32	9	11	1.18
Total HpCDF	11/11	5.1	2,800	608	939	1.54
Total HxCDF	7/11	120	1,000	259	317	1.22
Total TCDF	11/11	0.8	37	10	14	0.87

1 – Values based on ROS. See Appendix E.

Exhibit 8-29 Summary Statistics of Metals (mg/Kg) in Furan/Dioxin/Metal Factor in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Nickel	84/101	3.3	117	19	21	1.09
Zinc	101/101	8	1,670	451	476	1.05
Calcium	25/25	1,870	39,400	7,054	9,749	1.38

1 – Values based on ROS. See Appendix E.
(-) – Mean values less than 20 percent are not calculated due to estimation of distribution becomes less accurate.

Nickel was used as the indicator variable for this factor.

Surface Sediment

Dioxin/furan and metal concentrations were detected primarily in Reaches 1, 2, and 3, with the most heavily contaminated area just upstream and downstream of Vista West Ditch from approximately BVR3007 to BVR2002 (Figure 8-7). Dioxin/furan and metals concentrations tend to decrease upstream and downstream from this area.

Subsurface Sediment

At multi-depth locations, zinc concentrations decreased in the subsurface. Highest concentration detected in the subsurface was at BVR3007 with a result of 562 mg/Kg. Nickel concentrations tended to decrease or not vary significantly in the subsurface, with the exception of BVR3007. The concentration at BVR3007 increased in the 15 to 30 cm interval, but was not detected at the deeper interval.

Dioxin/furans were not analyzed in the subsurface in Bayou Verdine.

Surface Water

Zinc, in the dissolved phase, was detected in Bayou Verdine in Reaches 1 and 2. Highest concentrations were located in Reach 1 and decreased upstream into Reach 2. Exhibit 8-30 compares mean values of dissolved zinc in surface water with criterion set forth by LDEQ. Mean concentrations of zinc exceeded both the marine surface water acute and chronic criterion.

Exhibit 8-30 Mean & Standard Deviation of Total and Dissolved Concentrations (mg/L) in Furan/Dioxin/Metal Factor in Surface Water, Bayou Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Zinc	ND	0.18	0.205[2]	0.187[2]	**0.09**[3]	**0.081**[3]

1 – Based on ROS. See Appendix E. If only two samples, an average was calculated. ND: Not Detected
2 – LDEQ Water Quality Regulations based on 200 mg/L hardness for dissolved concentrations.
3 – LDEQ Water Quality Regulations based on 50 mg/L hardness for dissolved concentrations.

8.4.2.2.2 Discussion

TCDF in the water column can be expected to partition strongly to sediment and suspended particulate matter. TCDF sorbs strongly to soils and, based upon its high K_{oc} value, (see Table 5-1) it is expected to adsorb very strongly to organic matter and resist leaching. Bioconcentration in aquatic organisms may be significant. Based on a high K_{ow} value, TCDF is expected to accumulate in aquatic receptors (Gutenmann *et al.* 1992). Based on its structural similarity to dioxin, TCDF is expected to accumulate to high concentrations in aquatic and semi-aquatic mammals and fish-eating birds. Data are not available regarding the biological degradation of TCDF in soil (HSDB 1997). Concentrations are elevated but not as high as the constituents in the dioxin/PAH/metals factor, which may indicate that furans are less variable and have a smaller range of concentrations.

As discussed in the dioxin/PAH/metal factor, general precipitation (or co-precipitation) directly or with iron oxyhydroxides and sorption of zinc by hydrous metal oxides, clay minerals, and organic materials is the dominant fate in the aquatic environment, resulting in enriched suspended loads and bed sediment relative to the water column. Where suspended solids make up a high proportion of the total solids load, most of the zinc transported will be associated with the suspended and colloidal particles (Kubota *et al.* 1974). TSS load within the water column can be an effective means of transporting many otherwise immobile compounds. Limited TSS data in Bayou Verdine makes it difficult to assess the variability of the sediment load across the reaches, but the broad extent of metals indicate that sediment load transport may be effective in metals distribution.

Iron and manganese oxidation in areas of increased DO remove chromium, copper, lead, and zinc via co-precipitation. King (1998) found that when ferrous iron, (present in river flow) mixed with seawater (with higher DO, pH, and alkalinity) within an estuary, the iron led co-precipitation of a suite of other metals. Given the surface runoff source of much of the freshwater input to the more saline water of Bayou Verdine, co-precipitation is considered an ongoing process across the bayou. The broad occurrence and range of detections support this interpretation.

There were no spills or enforcement history identified for zinc in Bayou Verdine.

8.5.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the three major PCA factor groups previously discussed. These include:

- Low molecular weight PAHs (LPAHs)

These COPCs did not group with the other major factors for one or more of the following reasons:

- The Frequency of Detectsion is typically low
- The distribution of contamination was different than observed for the compounds for the three major factors

Each of these COPCs is discussed in the following sections

8.5.3.1 Low Molecular Weight PAHs

This section describes the low molecular weight PAHs (LPAHs) detected in Bayou Verdine.

8.5.3.1.1 Results

Surface Sediment

LPAHs (Exhibit 8-31) were detected in Bayou Verdine in isolated areas in Reaches 1 through 3. Highest concentration of LPAHs was located up and downstream of I-10,

with the highest concentration of LPAHs at BVR2007, with a value of 108,300 µg/Kg (Figure 8-8).

Exhibit 8-31 Summary Statistics of Factor 1 PAHs (µg/Kg) in Surface Sediment

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
LPAHs	59/88	60	108,300	12,234	24,538

1 – Values based on ROS. See Appendix E.

Subsurface Sediment

LPAHs were observed above 11,000 µg/Kg at various locations in Bayou Verdine (Figure 8-8). In Reach 1, concentrations tend to decrease with depth, with the exception of BVR1C1. Concentrations increased in the 15 to 30-cm depth, but were undetected in the 30 to 45-cm depth interval. Within Reach 2, concentrations increase with depth, with the exception of BVR2002. At station BVR2C1, LPAHs were undetected in the surface sediment and at the 30 to 45-cm interval, but was observed to have a concentration of 910 µg/Kg in the 15 to 30-cm interval. BVR3007, also was undetected in the surface sediment, but had a concentration of 4,300 µg/Kg in the 15 to 30-cm interval. Within Reach 4 at station BVR4004, LPAHs were detected at the surface and at the 30 to 45-cm interval, but was undetected in the 15 to 30-cm interval.

8.5.3.1.2 Discussion

LPAH contaminants appear to have entered Bayou Verdine near the Conoco Lube Tank Farm and from the North Docks of PPG. The greatest concentration is located between BVR3001 and R3AB02SS when normalized to TOC. The contaminated sediments appear to be relatively stable as the system is not routinely subjected to significant inflow (surface runoff or active outfalls), and salinity fluctuations appear to be minimal. Although the LPAHs occurrence is fairly well defined, LPAHs do occur throughout Reaches 1 through 3. When normalized to TOC, elevated LPAH values are in Reach 3 and at the North Docks. Acenaphthene should biodegrade rapidly under aerobic conditions in soil and water; biodegradation half-lives range from 1 to 60 days, respectively. However, acenaphthene may persist under anaerobic conditions. It has also been noted that high concentrations under aerobic conditions prove toxic to microorganisms preventing biodegradation.

LPAHs are not expected to hydrolyze or bioconcentrate in the environment; however, photolysis in direct sunlit media is possible. This may be an important factor if impacted sediments become dewatered and exposed to sunlight. The range of K_{oc} values indicate that LPAHs will be slightly mobile in soil, with moderate leaching potential. However, primary transport of these chemicals appears to be the result of physical mechanisms, such as scouring and stream flow turbulence, as opposed to chemical desorption or dissolution. Many of the LPAHs are soluble in a number of organic solvents (methanol, ethanol, benzene, toluene, etc.) but relatively insoluble in water. LPAHs are susceptible to oxidation by ozone, peroxides, and other oxidants

(EPA 1987). LPAH affinity for organic carbon controls behavior in water as well. The compounds will likely adsorb to particulate matter, enabling transport.

Historically, Reaches 1 and 2 have had high PAH contamination according to the 1993 EPA study and the 1993-94 PPG study. PPG, Conoco, Sasol (formerly CONDEA), and Tetra have formerly violated discharge limits by potentially releasing crude, slurry and sweet gas oils, chlorinated hydrocarbons, gasoline, and diesel (Tables 7-1, and 8-1 through 8-4). Of particular importance is the high concentration (14,000,000 µg/Kg) of diesel range organics in Reach 2 south of KCSRR Ditch and upstream of I-10.

8.6 Summary and Conclusions

This section summarizes the COPCs found in Bayou Verdine and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport.

8.6.1 Summary

Bayou Verdine is divided into five geographic reaches to facilitate data presentation and discussion. The reaches are defined in Section 8.1.2 and Figure 8-1. Bayou Verdine can be characterized as a moderately saline, channelized, moderately low-flow system with significant industrial inflow in the lower three reaches (Reaches 1 through 3). The upper reaches (Reaches 4 and 5) are generally a less-saline, shallow and narrow vegetated low-flow system.

The drainage area for the upper reaches is generally rural to agricultural. The portions of Bayou Verdine from Reaches 1 through 3 receive surface runoff and wastewater discharge from several industrial facilities (Sasol, Conoco, Lyondell, KCSRR and PPG), see Figure 8-2. Contaminants appear to enter the bayou as overland flow or through outfalls. The lower three reaches of Bayou Verdine (Reaches 1, 2, and 3) are subjected to daily tidal fluctuation, tidal storm surge, and seasonal salinity and flow fluctuations.

The greatest extent and concentration of contaminants are seen in Reaches 1 and 2, generally from the Vista West Ditch to below I-10 and from middle Reach 1 to the mouth of Bayou Verdine. The primary contaminant group is HPAHs, however Reach 2 is impacted by dioxin/furans and various VOCs. Concentrations of HPAHs are high as are VOCs, while dioxin/furans are moderately low.

Contaminants of Interest in Bayou Verdine:

PAHs,
Dioxin/Furans,
Metals,
EDC,
and various other
Chlorinated
Hydrocarbons

LPAHs are found near the Conoco Lube Tank Farm in Reach 3. Concentrations are moderately high in this area and exceed levels noted historically. Zinc is the only metal that is consistently elevated above levels noted in the reference area. Zinc is found throughout Reaches 2 and 3 from New Trousdale Road to the Vista West Ditch.

Contaminant occurrence indicates that several sources are present throughout Bayou Verdine. The upstream reaches are relatively un-impacted by industry. The Conoco Lube Tank Farm area appears to be the source of LPAHs and minor HPAHs in Reach 3.

Potential Sources to Bayou Verdine – Reach 3

Conoco Lube Tank Farm

Reach 2 is primarily impacted by releases through the Vista West Ditch and Vinyl Chloride Monomer (VCM) waste water treatment unit discharge, Fabaucher Ditch, releases via Conoco Outfalls 001 and 004, and releases through KCSRR Ditch. Reach 2 is the most heavily impacted segment of Bayou Verdine.

Potential Sources to Bayou Verdine – Reach 2:

Vista West Ditch
VCM Wastewater Treatment Plant
Fabaucher Ditch
Conoco Outfalls 001 and 004
KCSRR Ditch

Reach 1 appears to be impacted by releases through outfalls that discharged to the upper third of the reach from I-10 through the PPG Derivatives Area (Plant B). Potential sources include the former Conoco, Olin, and Lyondell outfalls that discharge into Bayou Verdine below I-10. Releases to the lower reaches (Reaches 1 and 2) appear to come from PPG outfall 004 and activities (periodic spills and releases) at the North Dock area.

Potential Sources to Bayou Verdine – Reach 1

Olin, Lyondell or Conoco outfalls in upper Reach 1
PPG Outfall 004
North Dock Area spill/releases

8.6.2 Conclusions

The primary contaminants of concern to Bayou Verdine are HPAHs, LPAHs, VOCs, dioxin/furans, and zinc, as discussed in Section 8.5.1. Minor PCBs, SVOCs, and pesticides are also present. Contaminants appear to be deposited into the bayou as dissolved constituents, much of which becomes locally adsorbed to sediments or particulate material. Distribution of these contaminants suggests that the sediments or particulates that the chemicals adsorb to may be transported away from the area where the contaminants first entered the bayou.

Concentrations of HPAHs are similar to those observed in previous studies. Vertically, the concentrations of HPAHs tend to be highest in the 15 to 30-cm interval upstream, in Reaches 3 and 4. Meanwhile, HPAHs tend to be highest in the upper (0 to 15-cm) interval in Reaches 1 and 2.

Distribution of PAHs in Bayou Verdine (HPAHs and LPAHs)

- Concentrated occurrence at the Conoco Lube Tank Farm; the area between Vista West Ditch and I-10; and at the mouth of Bayou Verdine
- Upper Reaches – deeper sediments (15 to 30 cm) are higher in concentration in Reaches 3 and 4.
- Lower Reaches – surface sediments (0 to 15 cm) are higher in concentration in Reaches 1 and 2.

LPAHs tend to be higher in concentration, however they appear to be occurring in Reach 3 more prevalently than in 1993/1994. It should be noted that the maximum detected value was from BVR2007, upstream of I-10, concentrations in Reach 3 were elevated but not as extreme as this maximum. Vertical distribution is similar to the HPAH distribution.

Historically, dioxin/furans were not analyzed, however dioxin sediment core analyses indicate that only the shallow interval (0 to 15-cm) is impacted, dioxin was not detected at depth.

PCBs were detected in previous studies throughout Reaches 1 and 2, the highest concentrations were noted at the KCSRR Ditch and near the PPG outfall 004 at the mouth of Bayou Verdine. This distribution correlates with current RI findings.

VOCs consisted primarily of EDC and a suite of other chlorinated hydrocarbons including PCE, TCE, 1,2-DCE, chlorobenzene, 4-bromofluorobenzene, dibromofluoromethane and dichloromethane. The greatest concentration of EDC was found near the Vista West Ditch and is well delineated. The EDC appears to be concentrated in a compact area, perhaps present as dense non-aqueous liquid (DNAPL) resting on top of a shallow clay layer. It has been reported that a shallow clay layer dips to the west (dipping upstream from the Vista West Ditch) possibly influencing the upstream extent of the EDC plume. The miscellaneous other VOCs noted extend throughout Reach 2. Concentrations of these other VOCs are moderately high, ranging up to 50,000 µg/kg. RI results are higher, compared to historic concentrations.

EDC

Present in the shallow sediments slightly up and downstream of Vista West Ditch

PAHs, SVOCs, and dioxin/furans are compounds that partition readily to sediments. The attraction to TOC particles or sediment sorption sites is generally strong. There is competition for available sorption sites, and a hierarchy among these chemical groups exists. Typically, compounds with higher partitioning coefficients will accumulate at higher concentration in the sediments or suspended particulate matter. Partitioning coefficients are most important for the following: HPAHs, dioxin/furans, PCBs, pesticides, LPAHs, and SVOCs. Partitioning is less important for most VOCs.

Once adsorbed, the compounds tend to migrate with the matrix material. Reductions in salinity can lead to increased turbulence and suspension of colloidal phase material. This effect can lead to re-suspension of contaminants. Likewise, physical transport of sediment by bed load shear forces appears to be occurring.

Inflow of freshwater into saline water:

- Promotes flocculation of suspended sediments
- Facilitates particle re-suspension

The predominantly silty sand media in Reaches 1 through 3 appears to be subjected to fresh and saline water inflow (some as significant, periodic events) that have been shown to affect

sediment bed stability. Organic matter is known to promote flocculation of suspended sediments in estuarine waters (Eisma 1986) and this combined with inflow of freshwater (enough to reduce salinity to below 3 ppt) has been shown to facilitate sediment particle re-suspension. This results in transport of charge-stabilized colloidal suspensions to downstream portions of the bayou or estuary (Johnson and Leenheer 1989). Distribution of contaminants near the larger outfalls indicates that this phenomenon may be having an effect. The surface water salinities noted indicate that the conditions are right and there appears to be localized decreases in many contaminant concentrations at the confluence of these freshwater outfalls or ditches. The sediment concentrations generally increase within 100 to 200 m of the confluence.

Surface water salinity is variable, both spatially and temporally. Salinity observations during the RI ranged from 0 to 21 ppt. In Bayou Verdine, the impact of freshwater inflow from Fabaucher and Vista West Ditch is seen to locally reduce salinity from 15 ppt to 4 ppt. These areas correspond to broad distribution of PAHs, dioxin/furans, indicating that re-suspension and partitioning is occurring throughout this area.

Sediment transport is evidenced by the broad distribution of HPAHs from New Trousdale Road in Reach 3 to the mouth of Bayou Verdine at Coon Island Loop. While multiple sources exist, the broad distribution (observed at BVR3001, BVR3007, BVR2002, BVR2007, BVR1002, BVR1B1CS and BVR1011) along the length of the bayou is indicative of contaminant transport and sediment movement.

The combined processes of adsorption of organic compounds onto suspended particles, salinity-induced flocculation of suspended particles and salting out from the aqueous phase effectively removes many hydrophobic COPCs from the water column. This correlates with the RI data where none of the primary COPCs were noted in surface water.

Primary Transport Processes:

- Salting Out [chemical precipitation]
- Flocculation
- Sediment bed load scouring

Tidal driven flow also appears to strongly affect contaminant distribution. Tidal surge has the combined effect of increased turbulence and shear forces facilitating physical transport and the conveyance of more saline waters into the bayou. Tidal surge associated with coastal storm systems generally create or add to a vertically stratified salinity regime whereby the lower saline body moves upstream while the freshwater layer at the top of the water column moves seaward. These same conditions tend to create strong shear forces along the sediment surface (Grabemann *et al* 1997). The areas most likely affected by tidal surge are Reaches 1 and 2. Reach 1 is closest to the ship channel and its geometry is such that there are no barriers to prevent storm surge in the lower 1,500 m (from Coon Island Loop to I-10). Tidal surge reworking of the sediments is apparent by variable grain size. Sediments in Reaches 1 and 2 are predominantly silty sands.

Multiple sources appear to have contributed to the contamination seen in Bayou Verdine. The data indicates that the release of PAHs, dioxins, and zinc are higher in shallow surface sediments indicating recent deposition versus burial of impacted sediments by clean sediments.

Releases from process areas or outfalls mix with the moderately saline waters of Bayou Verdine, where contamination partitions to the solid or particulate material present. Initial deposition is likely localized, however, tidal surge or freshwater inflow from process waters tends to facilitate sediment transport. The distribution in Reach 2 is an excellent example of how effective freshwater inflow, turbulent flow bed mixing, and particle re-suspension can be in transporting contamination over a relatively large area. The resulting direction of movement is downstream. The addition of tidal surge conditions (increased salinity and re-suspension of sediments) sets the stage for impacted sediment transport to the Calcasieu Ship Channel.

Figure 8-2
Bayou Verdine Industry
and
NPDES Outfall (Current and Historical) Locations

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

NPDES Outfall Status

- Unknown
- Active
- Inactive
- Reach Extent
- Ditches
- Bayou Verdine AOC Boundary

Industrial Area

- Certainteed
- Condea Vista
- Conoco
- Lyondell
- PPG
- Olin
- Tetra
- Water

Note: NPDES outfall locations are based on information provided as of 1998. Outfalls may be currently inactive or relocated.

Locations shown are based on coordinates supplied in the permits or information provided by the respective companies. The location represent sampling locations and may not be the point of entry into the surface water body (e.g. Bayou d'Inde, Bayou Verdine, Upper or Lower Calcasieu).

N
W E
S

Kilometers
0 0.25 0.5

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Region 6

Prepared by CDM

Map Filename: Figure8-2RI_IndustNPDES_BV.mxd 08/14/2002

Figure 8-3
Bayou Verdine Grain Size Distribution

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

BVST007
Clay: 55.06%
Sand: 2.73%
Silt: 42.21%

BVST010
Clay: 35.91%
Sand: 22.19%
Silt: 41.9%

BVST009
Clay: 53.34%
Sand: 5.18%
Silt: 41.49%

Reach 5

Vista West Ditch

BVST003
Clay: 31.85%
Sand: 46.74%
Silt: 21.4%

Reach 3

Reach 4

BVST008
Clay: 26.95%
Sand: 35.76%
Silt: 37.29%

Faubacher Ditch

Reach 2

Moosville

BVST005
Clay: 35.99%
Sand: 48.02%
Silt: 15.99%

KCSRR West Ditch

BVST004
Clay: 24.58%
Sand: 55.1%
Silt: 20.33%

Reach 1

BVST002
Clay: 38.3%
Sand: 34.57%
Silt: 27.13%

BVST006
Clay: 45.57%
Sand: 26.83%
Silt: 27.6%

BVST001
Clay: 28.63%
Sand: 41.4%
Silt: 29.97%

Clooney Island Loop

Coon Island Loop

Legend

- Reach Extent
- Ditches
- Bayou Verdine
- Water

Grain Size Distribution

- Percent Clay
- Percent Sand
- Percent Silt

N
W E
S

Kilometers
0 0.25 0.5

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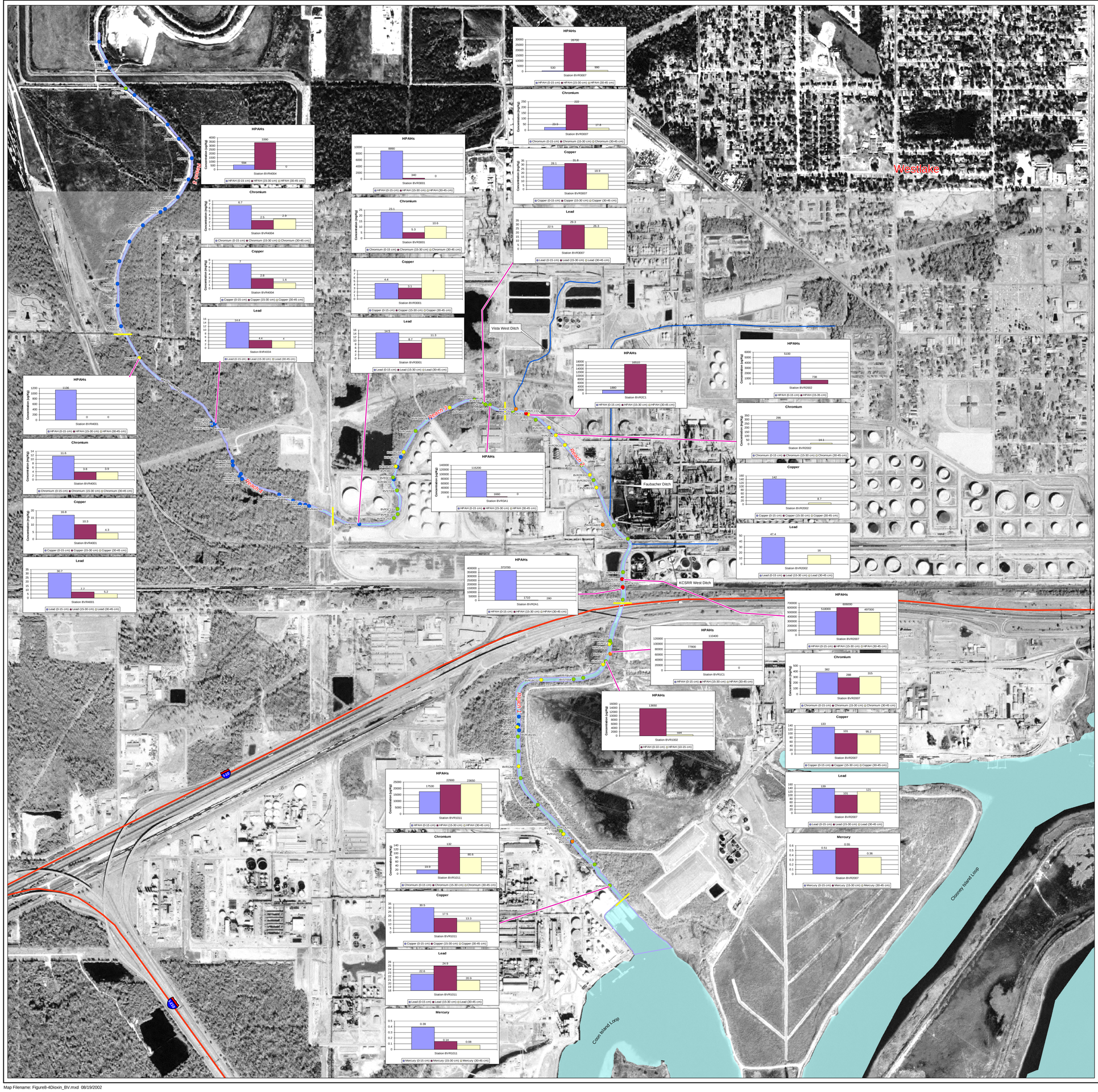
Map Filename: figure8-3GrainSizeDist_BV.mxd 08/14/2002

Figure 8-4
Dioxin/PAH/Metal Factor
Bayou Verdine AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Reach Extent
- Interstate
- Ditches
- Bayou Verdine
- Water

Lead (mg/kg)

- 6 - 17
- 18 - 29
- 30 - 47
- 48 - 72
- 73 - 139

Lead is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup values.

Contaminants grouped in this factor are:
Diesel
Pyrene
Benzo(a)anthracene
Fluoranthene
Benzo(b)fluoranthene
1,2-Benzphenanthracene
Total HpCDD
Total HxCDD
OCDD
Benzo(a)pyrene
Lead
Total TCDD
Sodium
Mercury
Chromium
Benzo(k)fluoranthene
Aluminum
Copper
Cyanide
Total HpCDF
Dibenzo(a,h)anthracene

N
W E
S

Kilometers
0 0.125 0.25 0.5

United States Environmental Protection Agency
Region 6

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Map Filename: Figure8-4Dioxin_BV.mxd 08/19/2002

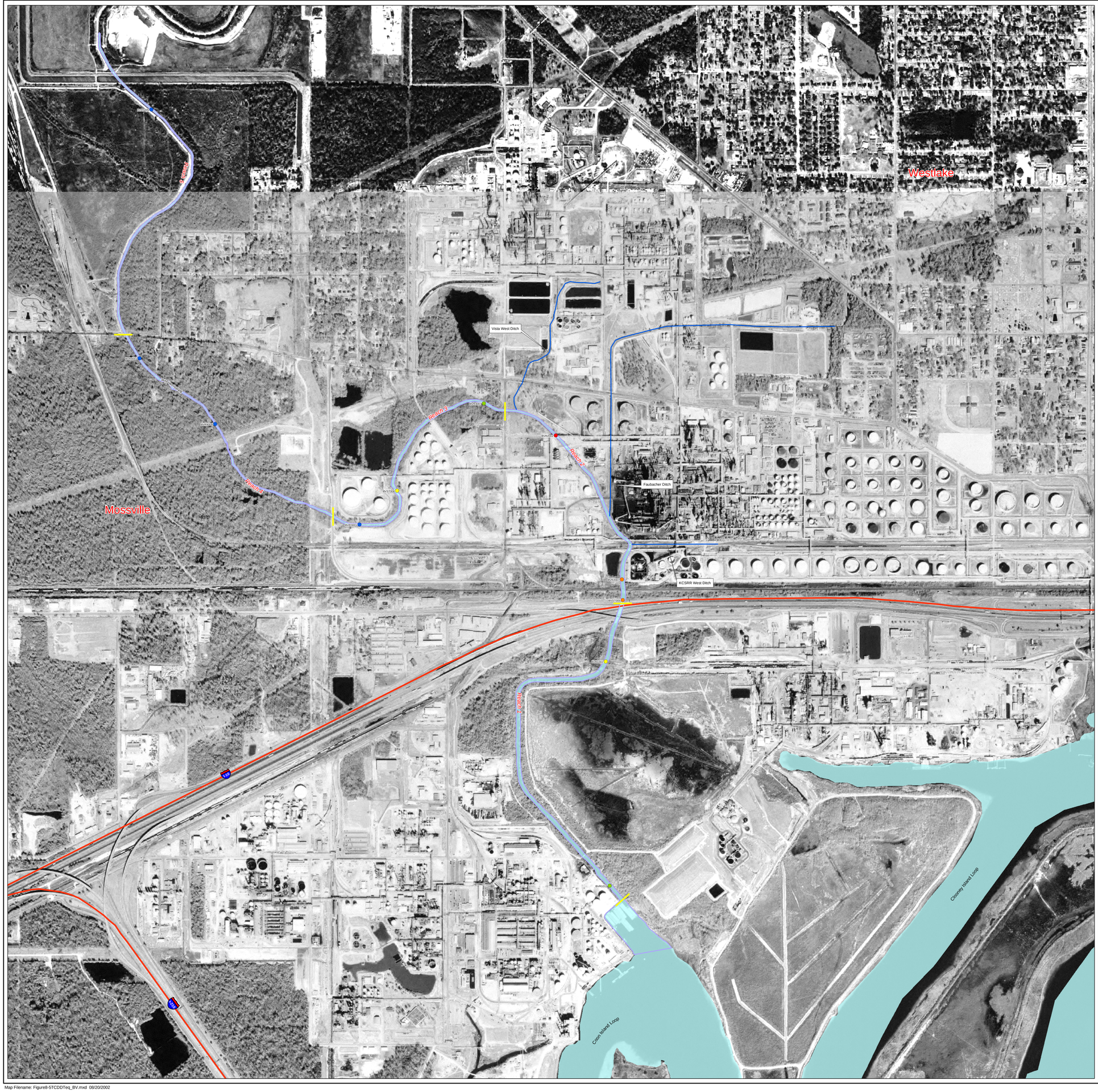

Figure 8-5
2,3,7,8-TCDD TEQ
Bayou Verdine AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extent
- Interstate
- Ditches
- Bayou Verdine
- Water

2,3,7,8-TCDD TEQ (pg/g)

- 1 - 3
- 4 - 17
- 18 - 25
- 26 - 55
- 56 - 90

Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin/furan compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin/furan compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD. The concentration of dioxin/furans are multiplied by the TEF and then summed to provide the 2,3,7,8-TCDD TEQ result.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.125 0.25 0.5

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Map Filename: Figure8-5TCDDTeq_BV.mxd 08/20/2002

Figure 8-6
Pesticide/VOC/SVOC/Metal Factor
Bayou Verdine AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extent
- Interstate
- Ditches
- Bayou Verdine
- Water

1,2-Dichloroethane (ug/kg)

- 1 - 590000
- 590001 - 4100000
- 4100001 - 6300000
- 6300001 - 9400000
- 9400001 - 19000000

1,2-Dichloroethane Non-Detects (ug/kg)

- 1 - 590000

1,2-Dichloroethane is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Aldrin
1,2-Dichloroethane
Bis(2-chloroethyl)ether
Beta-BHC
4,4'-DDT
Delta-BHC
Thallium

N
W E
S

Kilometers
0 0.015 0.03 0.06

Prepared by CDM

Map Filename: Figure8-6DCEResults_BV.mxd 08/19/2002

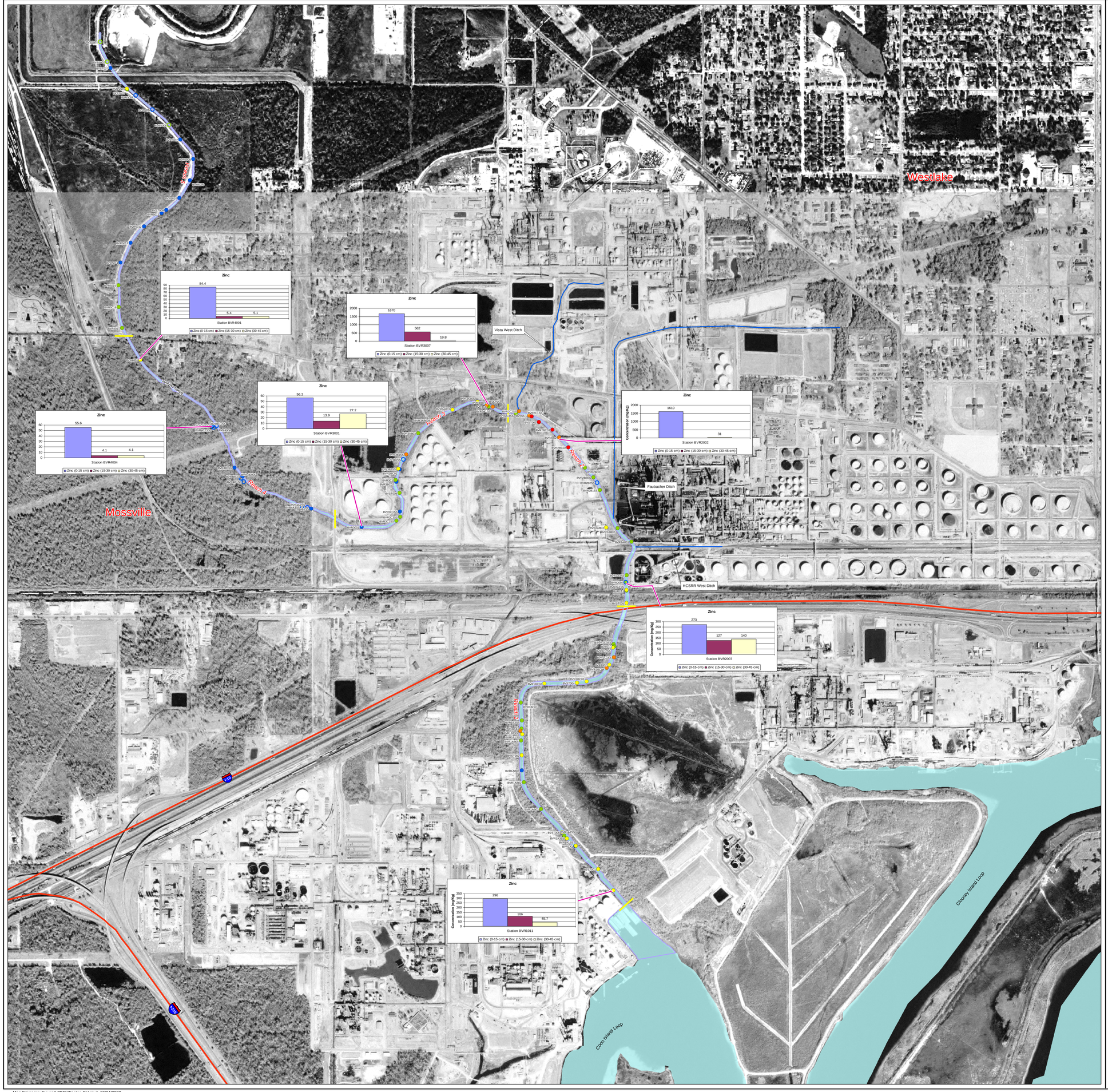

Figure 8-7
Dioxin/Furan/Metal Factor
Bayou Verdine AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Reach Extent
Interstate
Ditches
Bayou Verdine
Water

Nickel (mg/kg)

3 - 10
11 - 19
20 - 31
32 - 58
59 - 117

Nickel Non-Detects (mg/kg)

3 - 10
11 - 19

Nickel is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total PeCDF
Total HxCDF
Total HpCDF
OCDF
Total PeCDD
Total TCDF
Nickel
Zinc
Calcium

N
W E
S

Kilometers
0 0.125 0.25 0.5

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Map Filename: Figure8-7DFMFactor_BV.mxd 10/24/2002

Figure 8-8
Low Molecular Weight PAHs
Bayou Verdine AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Reach Extent
- Interstate
- Ditches
- Bayou Verdine
- Water

LPAHs (ug/kg)

- 60 - 1898
- 1899 - 6758
- 6759 - 15156
- 15157 - 31000
- 31001 - 101400

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

LPAHs consist of the following:
1,1-Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

N
W E
S

Kilometers
0 0.125 0.25 0.5

Prepared by CDM

Map Filename: Figure8-8LPAH_BV.mxd 08/20/2002

Figure 8-1
Bayou Verdine AOC and Reaches

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Reach 5
Reach 4
Reach 3
Reach 2
Reach 1
Vista West Ditch
Faubacher Ditch
KCSRR West Ditch
I-10
I-210

Legend

- Interstate
- Reach Extent
- Ditches
- Bayou Verdine

N
W E
S

Kilometers

0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Map Filename: figure8-1BayouVerdine.mxd 07/14/2002

Table 8-1
Conoco, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Chlorinated Hydrocarbons (as Ethylene Dichloride)	12/27/82	A wastewater bypass occurred that contained 164 ppm and 96 lbs of chlorinated hydrocarbons. No permit value was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	12/26/83	Reported value of 5501 lbs/day was in violation of the permit limit of 3375 lbs/day.	201
Cobalt	3/31/94	A release of approximately 1,600,000 pounds occurred. No permit value was provided.	NOI
Crude Oil	12/13/87	Reported value was 25 barrels and no permit value was provided.	NOI
Crude Oil	12/23/89	Reported value was 700 barrels and no permit limit provided.	NOI
Crude Oil	3/23/90	A spill of approximately 300 bbl occurred.	NOI
Crude Oil	11/16/91	A spill of 1-3 bbls occurred.	NOI
Crude Oil	12/3/92	Confirmation of crude oil spill of approximately 1 - 2 gallons.	NOI
Crude Oil, Saltwater	2/20/88	Reported value was 4 barrels oil and 8 barrels saltwater and no permit limit was provided.	NOI
Diesel	1/9/86	Spill of 1 barrel to the water from Conoco dock facility in Westlake, LA.	NOI
Diesel	8/28/86	Diesel spill of 40-50 gallons at the Conoco Inc. dock facilities in Westlake, LA.	NOI
Diesel	8/29/86	Spill of 3 barrels at the Conoco Inc. dock facilities in Westlake, LA.	NOI
Diesel	2/18/96	Spill of 2 gallons into the river.	NOI
Diesel Fuel	12/13/87	Approximately 2-5 barrels were spilled into a slip adjacent to No. 1 Dock facility.	NOI
Diesel Fuel	4/22/88	Reported value was 2-3 barrels and no permit value was provided.	NOI
Diesel Fuel	6/4/91	Reported value was apx. 122 barrels spilled between Docks #1 and #2 and no permit limits were provided.	NOI
Diesel Fuel	6/4/91	Approximately 122 barrels were spilled between Docks No. 1 and 2 as the result of a flange leak on a 6" bunker fuel diesel line. The discharge lasted ten minutes.	NOI
Diesel Oil	4/22/88	Approximately 2-3 barrels were spilled at Conoco's Lake Charles Refinery Docks when a barge operator overfilled his tank.	NOI
Diesel Oil	10/11/88	Approximately 1 gallon of diesel oil was released from a diesel transfer pipe into a small tributary of the Calcasieu River. The floating oil was contained and picked up. No significant environmental impact was observed.	NOI
Diesel Oil	10/21/88	Approximately 10-15 barrels of finished diesel oil was released into the Calcasieu river from a hole in the side of a barge at Conoco Dock #2.	NOI
EDC	3/23/94	Leak quantity was 269,889 lbs.	NOI
EDC	3/24/94	Leak quantity was 1,190,169 lbs.	NOI
EDC	3/30/94	Leak quantity was 253,101 lbs.	NOI

Table 8-1
Conoco, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
EDC	3/31/94	A leak occurred at a section of buried pipeline. The amount of EDC released was initially estimated to be 1602 pounds. The EDC was released into a small drainage ditch which flows east to west along Old Highway 90 then north to south to Conoco's dock at the old Calcasieu River (ship channel). According to Mr. Brunettm Conoco constructed earthen dams lined with visquene to isolate five areas of the ditch. Mr. Brunett stated that surface water from the isolated areas were recovered and placed in on-site frac tanks and in tank 415 of the dock area. Backhoes were used to excavate two feet of upper sediment from the ditch. Approximately 3600 tons of sediment were placed in 25 cubic yard roll-off boxes for temporary storage on-site. A meeting was held on May 31, 1994 during which the estimate of the amount of the release was increased from 1602 pounds to approximately 1600 barrels. It was also estimated that approximately 38,000 barrels of EDC/water mixture had been collected to date.	NOI
EDC	3/31/94	Reported pipeline leak of EDC near Marine Terminal Dock No. 1 constituted an unauthorized discharge. No specific value was given, no permit value was provided.	NOI
EDC	3/31/94	Reported value of 1,600,000 pounds of EDC was released. No permit value was provided.	NOI
EDC	3/31/94	Leak quantity was 66,040 lbs.	NOI
EDC	3/31/94	A pipeline leak was discovered at the Conoco Marine Docks Facility. Approximately 1,600,000 pounds was spilled. As of September 26, 1994, unaccounted for EDC equaled 925,227 pounds.	NOI
Ethylene Dichloride	3/31/94	A discharge initially estimated at approximately 1,600 lbs occurred. This release estimate was increased to 630,000 lbs on June 1, 1994.	NOI
Fuel Oil	6/15/85	Pipeline rupture at the pipe rack to #1 dock spilled 500 bbls on the slip adjacent to #1 dock.	NOI
Gas Oil	2/5/86	Spill of 84 gallons at Conoco dock facility.	NOI
Gasoline	11/17/87	Approximately 25-30 gallons were released from a faulty 10" blind flange.	NOI
Gasoline	7/26/88	Reported value was 2-3 bbl spilled to ground and water and no permit limits were provided.	NOI
Gasoline	7/26/88	Approximately 2-3 barrels of gasoline were released at the Conoco docks into the Calcasieu river when a pump sump overfilled (check valve failure). Note: Internal report referenced the contaminant as "slop oil."	NOI
Heavy Oil	5/8/90	A spill of 55 bbl of heavy oil occurred.	NOI
Hexavalent Chromium	8/24/82	Reported value of 3.39 lbs/day was in violation of the permit limit of 2.03 lbs/day. Outfall was listed as "Total Effluent".	NOI
Hexavalent Chromium	9/27/82	An exceedance occurred (2.60 lbs/day). Permit limit was a value of 2.03 lbs/day. Outfall was listed as "Total".	NOI

Table 8-1
Conoco, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Hexavalent Chromium	6/14/86	Permittee was authorized to discharge a daily average of 0.63 lbs/day, and a daily maximum of 1.4 lbs/day to the sum of Outfalls 001 and 002.	SUM
Hexavalent Chromium	9/8/87	Permittee was ordered to the following interim limitations; a daily average of 1.4 lbs/day, and a daily maximum of 3.0 lbs/day.	NOI
Kerosene	4/26/86	Approximately 2-5 barrels were spilled into the ship channel during loading of a kerosene barge at the Dock No. 1 facility.	NOI
Kerosene	6/5/86	Approximately 10-15 barrels were spilled into the Old Spanish Trail road ditch.	NOI
Naphtha	2/2/88	Between 1-3 barrels were spilled at Conoco's Lake Charles Refinery Docks when a barge operator overfilled his tank.	NOI
Naphtha	2/2/88	Reported value was 1-3 barrels and no permit limit provided.	NOI
Naphtha	4/16/90	A spill of one barrel occurred.	NOI
Naphtha	6/14/90	Less than five barrels of naptha leaked at a casing vent under the west end of the I-10 bridge.	NOI
Naphtha	6/14/90	Reported value was 2 bbls and no permit value was provided.	NOI
Naphtha	6/14/90	A spill of 2-5 bbl occurred under the I-10 bridge on the west side.	NOI
Oil	11/15/87	Approximately 3-5 gallons spilled from the waste oil collection system at Dock No. 3.	NOI
Oil	6/8/88	Spill of less than 1 barrel to water. Spill reported by Vista Chemical Co. and later discovered that it was Conoco's oil.	NOI
Oil	6/22/88	The reported quantity of the oil spill ranged from "2 bbl" to "2 gal".	NOI
Oil	8/2/88	Approximately 5 gallons of oil were released to a stormwater drainage ditch and carried to the Bayou Verdine tributary of the Calcasieu River.	NOI
Oil	2/16/90	A spill of less than one barrel occurred.	NOI
Oil	2/16/90	A spill of less than one barrel occurred.	NOI
Oil	11/17/90	Spill of "less than 2 barrels" to ground and water.	NOI
Oil	10/31/91	A discharge of approximately 2-5 barrels occurred from the Oil Recovery System.	NOI
Oil Sheen	8/2/88	Oil and water emulsion accumulated at ditch culvert.	NOI
petroleum crude oil	3/11/94	Reported value was 21 gallons and no permit limits were provided.	NOI
Phenol	2/3/87	Discharge of 37 ppd. in violation of state permit limit of 18.6 ppd.	2
Phenol	2/3/87	An exceedance of the daily maximum occurred (36.50 lbs/day) from the sum of Outfalls 001 and 002. The permit limit was noted as 25 lbs/day.	SUM
Phenol	2/5/87	Discharge of 36.5 lbs/day in violation of permit limit of 18.6 lbs/day.	2
Phenol, Daily Max.	10/27/80	Reported value of 14.5 lbs/day was in violation of the permit limit 6.6 lbs/day.	BAC1

Table 8-1
Conoco, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Phenolic Compounds	6/14/86	Permittee was authorized to discharge a daily average of 6.2 lbs/day, and a daily maximum of 25 lbs/day to the sum of Outfalls 001 and 002.	SUM
Phenols, Maximum	2/3/87	A discharge of 36.5 lbs/day was in violation of the permit limit of 25 lbs/day.	2
Phenols, Maximum	2/3/87	A discharge of 36.5 lbs/day was in violation of the permit limit of 25 lbs/day.	BAC1
Phenols, Maximum	2/5/87	Reported value of 36.5 lbs/day was in violation of the daily maximum permit limit of 25 lbs/day.	2
Slop Oil	7/11/85	About 15-20 gallons were released into the Calcasieu River at the No. 1 dock oil recovery tank.	NOI
Slurry Oil	4/19/89	Reported value of approximately 2-3 gallons were spilled into West Lake.	NOI
Slurry Oil	4/19/89	A spill of 2-3 gallons occurred.	NOI
Slurry Oil	4/19/89	There was an unauthorized discharge of 2-3 gallons of slurry oil.	NOI
Sweet Gas Oil	5/20/96	A discharge of approximately 2 barrels occurred. No permit value was provided.	NOI
Total Chromium	6/14/86	Permittee was authorized to discharge a daily average of 7.4 lbs/day, and a daily maximum of 21 lbs/day to the sum of Outfalls 001 and 002.	SUM
Total Chromium	9/8/87	Permittee was ordered to the following interim limitations; a daily average of 22.2 lbs/day, and a daily maximum of 37.8 lbs/day.	NOI
Total Phenol	9/8/87	Permittee was ordered to the following interim limitations; a daily average of 13 lbs/day, and a daily maximum of 37 lbs/day.	NOI
Zirconium, Total	3/31/94	Reported value was approximately 1,500 barrels and no permit limits were provided.	NOI
Zirconium, Total	3/31/94	Reported value was approximately 1,602 pounds and no permit limits were provided.	NOI

Table 8-2
Lyondell (formerly Olin/ARCO)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
2,4-Dinitrotoluene	10/25/1995	Reported value of 24.3 lbs/day was in violation of the daily maximum of 1.77 lbs/day. Reported value of 5.19 lbs/day was in violation of the daily average of 0.70 lbs/day.	010A
2,4-Dinitrotoluene	10/00/1995	Reported value of 24.3 lbs/dy was in violation of the daily maximum of 1.77 lbs/dy. Reported value of 5.19 was in violation of the daily average of 0.70 lbs/dy.	010A
Chlorobenzene	06/00/1990	Reported value of .16 (units not specified) was in violation of the permit limit of .05 (units not specified).	410A
Chloroform	10/6/1994	Reported value of 28.2 pounds was in violation of the permit value of 3.4 pounds.	10
Chloroform	10/7/1994	Reported value of 11.1 pounds was in violation of the permit value of 3.4 pounds.	10
Chloroform	10/8/1994	Reported value of 18.1 pounds was in violation of the permit value of 3.4 pounds.	10
Chloroform	10/9/1994	Reported value of 17.1 pounds was in violation of the permit value of 3.4 pounds.	10
Chloroform	7/12/1995	Reported value of 5.90 pounds per day was in violation of the permit limit of 3.4 pounds per day.	10
Chloroform	7/13/1995	Reported value of 5.88 lbs/day was in violation of the daily maximum of 3.40 lbs/day.	010A
Chloroform	8/3/1995	Reported value of 3.84 pounds per day was in violation of the permit limit of 3.4 pounds per day.	10
Chloroform	8/3/1995	Reported value of 3.83 lbs/day was in violation of the daily maximum of 3.40 lbs/day.	010A
Chloroform	07/00/1995	Reported value of 5.88 lbs/day was in violation of the daily maximum of 3.4 lbs/day.	010A
Chloroform	08/00/1995	Reported value of 3.83 lbs/dy was in violation of the daily maximum of 3.40 lbs/dy.	010A
Chromium	11/1/1992	Permittee was authorized to discharge a daily average of 6 lbs/day and a daily maximum of 12 lbs/day. The source document reflected an Interim Permit Limitation for the duration of November 1, 1992 though March 31, 1993. Sum of outfalls: 001, 010, 029.	SUM
DNT	10/26/1995	Reported value of 24.3 pounds per day was in violation of the permit limit of 1.77 pounds per day.	10
Phosgene	9/10/1984	A release occurred.	NOI
Toluene Diamine (TDA)	6/12/1986	A release of 500 gallons occurred.	NOI
Toluenediamine and Chlorobenzene	11/21/1993	A vacuum truck spillled approximately 2,000 pounds of reactor material to the ground.	NOI
Total Chlorinated Hydrocarbons	11/1/1992	Permittee was authorized to discharge a daily average of 1,305 lbs/day and a daily maximum of 3,715 lbs/day. The source document reflected an Interim Permit Limitation for the duration of November 1, 1992 through March 31, 1993.	10
Zinc	3/26/1991	Reported value of 1817 lbs from Outfall Sum (001 + 010, combined) was in violation of the daily maximum permit limit of 176 lbs.	SUM

Table 8-2
Lyondell (formerly Olin/ARCO)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Zinc	11/1/1992	Permittee was authorized to discharge a daily average of 88 lbs/day and a daily maximum of 176 lbs/day. The source document reflected an Interim Permit Limitation for the duration of November 1, 1992 through March 31, 1993. Sum of outfalls: 001, 010, 029.	SUM
Zinc	03/00/1991	Reported value of 159 (units not specified) was in violation of the daily average permit limit of 88 (units not specified).	SUM
Chlorobenzene	11/19/1993	Approximately 2,000 pounds of reactor material containing 195 pounds of chlorobenzene (MCB) were discharged to the ground at the Olin Lake Charles Plant.	NOI
Toluenediamine	11/19/1993	Approximately 2,000 pounds of reactor material containing 70 pounds of Toluenediamine were discharged to the ground at the Olin Lake Charles Plant.	NOI
Toluenediamine	10/23/1996	A leak from the east Rainwater Tank pump accumulated in the containment curbing and seeped through the cracks in the curbing to the stormwater Outfall 022. Quantity release of <0.01# TDA and <0.01# Touidine did not exceed the reportable quantity of ten pounds.	22
Toluenediisocyanate (TDI)	8/12/1993	Approximately 1,000 pounds of TDI residue were spilled from the top of a railcar into the east and middle chlorine racks and the east/west roadway.	NOI
Chloroform	10/6/1994	There was an unauthorized on-site discharge of 28.2 lbs of chloroform.	NOI
DNT	10/26/1995	Reported value of 24.3 pounds per day was a violation of the permit limit of 1.77 pounds per day.	10

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Aluminum Triethyl	2/28/95	Reported value was 7 gallons and no permit value was provided.	NOI
Benzene	11/20/87	There was an unauthorized discharge of approximately 14 pounds to the air.	NOI
Benzene	2/9/88	Reported value of 3.1 lbs was in violation of a permit limit of 2.1 lbs.	BAC1
Benzene	2/7/89	Reported value of 7.41 was in violation of the permit condition of 2.10.	BAC1
Benzene	2/8/89	Reported value of 8.0 lbs was in violation of the daily maximum of 2.1 lbs.	BAC1
Benzene	2/8/89	Reported value of 8.0 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene	5/9/90	A leak described as minor occurred.	30
Benzene	6/18/90	Discharge of 15.6 lbs was in violation of the daily maximum of 2.1 lbs.	BAC1
Benzene	4/2/91	Discharge of 2.2 lbs/day in violation of permit limit of 2.1 lbs/day.	BAC1
Benzene	8/9/91	Approximately 0.02 lbs were released into the atmosphere.	NOI
Benzene	11/20/91	Interim effluent discharge limitations were issued, pursuant to which Permittee was authorized to discharge a daily avg of 1.6 lbs/day and a daily max of 2.1 lbs/day. These interim limitations were in effect from the effective date of the Order until March 31, 1992.	BAC1
Benzene	8/14/92	10000 gals of water contaminated with benzene were released to an unspecified stormwater outfall. Estimated total quantity of benzene discharged (to air and water) was 70 lbs.	NS
Benzene	10/1/92	Reported a release of 15 to 20 gallons of water containing benzene. The amount of benzene was calculated to be 0.06 lbs.	NOI
Benzene	12/6/92	A railcar entered the plant leaking benzene. The external shell had some corrosion and there was benzene between the shell and the external tank. Because of the cold temperature, most of the benzene was solid and could be collected, but approximately 40 lbs. were released.	NOI
Benzene	12/6/92	Approximately 40 lbs. were discharged to the ground at the Vista LAB Plant.	NOI
Benzene	12/30/92	Approximately 3 gallons spilled to the ground.	NOI
Benzene	12/30/92	Reported value was 3 gallons and no permit value was provided.	NOI
Benzene	5/21/93	120 lbs. of oil containing Benzene were spilled to the ground at the benzene stripper in the ethylene unit. An estimated 12 lbs of benzene were present within the 120 lbs.	NOI
Benzene	9/16/94	Failure to sample for benzene.	2
Benzene	1/12/97	A bypass of approximately 85,000 gallons of process wastewater with 0.014 ppm Benzene occurred.	NOI

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Benzene	07/00/1990	Reported value of 3 lbs/day was in violation of the permit limit of 2.1 lbs/day.	BAC1
Benzene, Max	2/9/88	Reported value of 3.1 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	2/7/89	Reported value of 7.41 was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/12/90	Reported value of 4.190 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/12/90	Reported value of 4.19 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/12/90	Reported value of 4.19 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/12/90	Reported value of 4.19 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.530 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	6/19/90	Reported value of 2.53 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	8/2/90	Reported value of 2.93 mgl was in violation of the permit limit of 2.1 mgl.	BAC1
Benzene, Max	8/2/90	Reported value of 2.93 mgl was in violation of the permit limit of 2.1 mgl.	BAC1
Benzene, Max	8/2/90	Reported value of 2.93 mgl was in violation of the permit limit of 2.1 mgl.	BAC1
Benzene, Max	8/2/90	Reported value of 2.93 lbs/day was a violation of the permit limit of 2.1 lbs/day.	BAC1
Benzene, Max	4/2/91	Reported value of 2.2 lbs/day was in violation of the permit limit of 2.1 lbs/day.	4
Benzene, Max	4/2/91	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	4/2/91	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	02/00/1988	Reported value of 3.140 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	02/00/1989	Reported value of 7.41 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	02/00/1989	Reported value of 7.41 lbs/day was in violation of the permit limit of 2.1 lbs/day.	BAC1

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Benzene, Max	04/00/1991	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	04/00/1991	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	04/00/1991	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	04/00/1991	Reported value of 2.2 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	06/00/1990	Reported value of 4.19 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	06/00/1990	Reported value of 4.19 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	06/00/1990	Reported value of 4.19 was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	06/00/1990	Reported value of 4.190 lbs/day was in violation of the permit limit of 2.1 lbs/day.	BAC1
Benzene, Max	07/00/1990	Reported value of 3 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	07/00/1990	Reported value of 3 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	07/00/1990	Reported value of 3 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	08/00/1990	Reported value of 2.93 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	08/00/1990	Reported limit of 2.93 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Benzene, Max	08/00/1990	Reported value of 2.93 lbs was in violation of the permit limit of 2.1 lbs.	BAC1
Butanol	12/16/93	A spill of 700 lbs occurred.	NOI
Butyl Alcohol	7/24/90	Butyl Alcohol was spilled from a leaking railcar.	NS
Chlorinated Hydrocarbon Mixture	11/14/94	Approximately 100 gallons discharged. This mixture contained 0.0075 pounds of 1,2-dichloroethane. The ph of the water was 5.02 standard units.	54
Chlorinated Hydrocarbons	9/21/84	Approximately 374 lbs were discharged during the by-pass period of this date. No permit limit was provided.	201
Chlorinated Hydrocarbons	9/22/84	Approximately 880 lbs. were discharged during the by-pass period of this date. No permit limit was provided.	201
Chlorinated Hydrocarbons	10/17/84	During the by-pass period, 291 lbs. were discharged through this outfall. No permit limit was provided.	201
Chlorinated Hydrocarbons	1/3/85	232 lbs. were discharged between the hour of 1924 on January 3, 1985, and 0943 on January 4, 1985. 37 lbs were discharged between the hour of 2026 and 2343 on January 4, 1985. No permit limit was provided.	201
Chlorinated Hydrocarbons	2/10/85	During the bypass of this date, 74 lbs. were discharged.	201
Chlorinated Hydrocarbons	2/11/85	During the bypass of this date, 62 lbs. were discharged.	201
Chlorinated Hydrocarbons	4/26/85	Reported value was 1.77 lbs, and no permit value was indicated.	201
Chlorinated Hydrocarbons	4/26/85	Reported values were 24.4 ppm and .27 pounds, and no permit values were indicated.	NOI

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Chlorinated Hydrocarbons (as Ethylene Dichloride)	5/20/84	Grab samples of a partial by-pass which occurred on this date reflected values for this contaminant of 22 ppm and 72.2 pounds. The source document also indicated that 636 lbs of this contaminant were discharged via Outfall 201 during the by-pass. No permit limits were provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	9/21/84	Grab samples of the partial by-pass of this date reflected values for this contaminant of 194 ppm and 832 pounds. No permit limit was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	9/22/84	Grab samples of the partial by-pass of this date reflected values for this contaminant of 222 ppm and 421 pounds. No permit limit was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	10/17/84	Grab samples of the partial by-pass of this date reflected values for this contaminant of 159.8 ppm and 238.6 pounds. No permit limit was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	1/3/85	Grab samples of the partial by-pass of this date reflected values for this contaminant of 370 ppm and 285 pounds. No permit limit was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	1/4/85	Grab samples of the partial by-pass of this date reflected values for this contaminant of 186 ppm and 2.7 pounds. No permit limit was provided.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	2/10/85	Analysis of the partial by-pass of this date reflected values for this contaminant of 60 PPM and 144 Lbs.	NOI
Chlorinated Hydrocarbons (as Ethylene Dichloride)	2/11/85	Analysis of the partial by-pass of this date reflected values for this contaminant of 435 PPM and 40 Lbs.	NOI
Cobalt	1/3/91	There was an exceedance of the daily maximum permit limit of 4.14 lbs/day. The discharge value was not provided.	BAC1
Cobalt	5/26/91	32.8 lbs leaked to the ground between the Quench Column and the R201C furnace.	NOI
Cobalt	9/2/92	Reported value of 11.6 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
Cobalt	9/2/92	Reported value of 11.6 pounds per day was in violation of the permit limit of 4.14 pounds per day.	BAC1
Cobalt	9/2/92	Reported value of 11.6 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
Cobalt	03/00/1994	Reported value of 34.80 lbs/day was in violation of the daily average of 3.18 lbs/day.	1
Cobalt	03/00/1994	Reported value of 171.688 lbs/day was in violation of the daily maximum of 4.14 lbs/day.	1
Cobalt	04/00/1990	Reported value of 5.965 lbs/dy was in violation of daily maximum of 4.14 lbs/dy.	1
Cobalt	05/00/1994	Reported value of 7.661 lbs/dy was in violation of the daily maximum of 4.14 lbs/dy.	1
Cobalt	09/00/1994	Reported value of 14.37 lbs/dy was in violation of the daily maximum of 4.14 lbs/dy.	1
Cobalt	11/00/1996	Reported daily maximum value of 4.3 lbs/day was in violation of the permit limit of 4.14 lbs/day.	1
DDC ethylene dichloride	8/9/96	Reported value was 21 lbs/day in violation of the permit limit of 4.14 lbs/day.	NOI

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
DDC ethylene dichloride	8/9/96	Reported value of 21 lbs/day was in violation of the permit limit of 4.14 lbs/day.	NOI
Dichloroethane (EDC)	7/23/94	Approximately 0.124 pounds was discharged into Turtle Pond and then into Bayou Verdine.	53
EDC	10/27/85	Reported values were 46 ppm and 356.7 lbs.	NOI
EDC	10/28/85	Reported values were 79 ppm and 805.8 lbs.	NOI
EDC	10/29/85	Reported values were 80 ppm and 145 lbs.	NOI
EDC	10/29/85	Reported values were 107 ppm and 87.6 lbs.	NOI
EDC	10/30/85	Reported values were 80 ppm and 36.4 lbs.	NOI
EDC	4/20/86	Reported value was 116 ppm and 0.60 lbs.	NOI
EDC	8/30/88	Reported discharge of 17.2 lbs/day was in violation of the permit condition of 4.14 lbs/day.	BAC1
EDC	10/4/88	Reported discharge of 8.04 lbs/day was in violation of the permit condition of 4.14 lbs/day.	BAC1
EDC	10/11/88	Reported discharge of 4.90 lbs/day was in violation of the permit condition of 4.14 lbs/day.	BAC1
EDC	1/5/89	Reported discharge of 8.02 lbs/day was in violation of the permit condition of 4.14 lbs/day.	BAC1
EDC	3/7/89	Reported value of 8.73 was in violation of the permit limit of 4.14.	BAC1
EDC	3/8/89	Reported value of 8.73 lbs/day was in violation of the permit limit of 4.14 Mx.	BAC1
EDC	3/9/89	There was an unauthorized discharge of an unspecified amount. The source document indicated that Air Quality Division, Lake Charles, had the report.	NOI
EDC	5/30/89	Reported value of 8.2 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC	5/30/89	The permit Condition was 4.14 lbs./day and the EDC discharge was 8.20.	BAC1
EDC	6/27/89	Reported value of 3,000 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC	6/27/89	Reported value was 34 ppm to 54 ppm. No permit limit was provided.	BAC1
EDC	6/27/89	Reported value of 34 ppm to 54 ppm was in violation of the daily maximum permit limit of 4.14 lbs/day. Report did not give violation amount in lbs/day.	BAC1
EDC	6/30/90	A tank was being cleaned using steam, the tank developed a leak, allowing 50-100 gallons to spill.	NOI
EDC	7/3/90	A discharge of 11.2 lbs occurred.	NOI
EDC	10/5/90	Reported value of 357 lbs flowed to the Secondary Wastewater Treatment Facility.	NOI
EDC	12/25/90	Reported value of 6.9 lbs was in violation of the permit limit of 4.14 lbs/day max.	BAC1
EDC	7/13/91	Reported value of 266 lbs. was in violation of the permit limit of 202 lbs. EDC. The release began at 0700 hrs on 7-31-91 and ended at 1600 hrs. on 7-14-91. Vista Chemical Company attributed the exceedance to mechanical malfunction.	NOI

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
EDC	11/20/91	Interim effluent discharge limitations were issued, pursuant to which Permittee was authorized to discharge a daily avg of 3.18 lbs/day and a daily max of 4.14 lbs/day. These interim limitations were in effect from the effective date of the Order until December 31, 1993.	BAC1
EDC	9/2/92	Reported value of 11.6 lbs/day was in violation of permit limits of 4.14 lbs/day.	BAC1
EDC	11/16/93	Reported value of 9.73 lbs/day was in violation of the daily maximum of 4.14 lbs/day.	BAC1
EDC	11/30/93	Reported value of 4.25 lbs was in violation of the daily maximum of 4.14 lbs.	BAC1
EDC	12/6/93	Reported value of 6.204 lbs. in violation of permit limit of 4.14 lbs.	BAC1
EDC	3/30/94	Reported value of 172 pounds was in violation of daily average of 34.8 pounds per day.	BAC1
EDC	3/30/94	Approximately 172 pounds were discharged, in violation of the daily maximum discharge limit of 4.14 pounds per day.	BAC1
EDC	3/30/94	Approximately 172 pounds were discharged, in exceedance of the permit limit of 4.14 pounds per day. This discharge further caused the daily average to reach a value of 34.8 pounds per day, in exceedance of the permit limit of 3.18 pounds per day.	BAC1
EDC	3/30/94	Reported value of 172 lbs. was twice the permit limit at the West Ditch.	NOI
EDC	4/5/94	Reported value of 5.9 pounds in violation of permit limit of 4.14 pounds per day.	BAC1
EDC	5/3/94	Reported value of 7.66 pounds in violation of permit limit of 4.14 pounds per day.	BAC1
EDC	8/19/94	Reported value was 0.320 ppm, no permit value was provided.	BAC1
EDC	8/25/94	Reported value of .075 lbs. were discharged.	54
EDC	9/20/94	Reported value of 14.37 pounds in violation of permit limit of 4.14 pounds per day.	BAC1
EDC	12/3/94	Reported value was 0.07 pounds, no permit value was provided.	54
EDC	11/12/96	Reported value of 4.31 pounds was in violation of the daily maximum of 4.14 pounds.	BAC1
EDC	08/00/1988	Reported discharge of 4.2 lbs/day was in violation of the permit condition of 3.18 lbs/day.	BAC1
EDC (Avg)	08/00/1988	Reported value of 4.2 lbs/day was in violation of the permit limit of 3.18 lbs/day.	BAC1
EDC (Max)	9/21/94	Reported value of 14.37 lbs/day was in violation of permit limit of 4.14 lbs/day.	BAC1
EDC (Max)	08/00/1988	Reported value of 17.2 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC (Max)	11/00/1996	Reported value of 4.3 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
EDC, Ave.	03/00/1994	Reported value of 34.8 lb/d was in violation of the permit limit of 3.18 lb/d.	BAC1
EDC, Avg	11/30/93	Reported value of 3.46 lbs was in violation of the permit limit of 3.18 lbs.	BAC1
EDC, Avg	00/00/0000	Reported value of 4.2 was in violation of the permit limit of 3.18 mgl.	BAC1
EDC, Avg	11/00/1993	Reported value of 3.465 lb/d was in violation of the permit limit of 3.18 lb/d.	BAC1
EDC, Avg	11/00/1993	Reported daily average of 3.46 lbs./day was in violation of the permit limit of 3.18 lbs./day.	BAC1
EDC, Avg	11/00/1993	Reported value of 3.465 lbs/day was in violation of permit limit of 3.18 lbs/day.	BAC1
EDC, Avg	12/00/1993	Reported value of 6.204 lbs/day was in violation of permit limit of 4.14 lbs/day.	BAC1
EDC, Max	8/30/88	Reported value of 17.2 was in violation of the permit limit of 4.14 mgl.	BAC1
EDC, Max	10/4/88	Reported value of 8.04 was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	10/11/88	Reported value of 4.9 was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	1/6/89	Reported value of 8 was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	3/7/89	Reported value of 2977 lbs was in violation of the permit limit of 2521 lbs.	BAC1
EDC, Max	5/30/89	Reported value of 8.20 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	7/3/90	Reported value of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	7/3/90	Reported value of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	7/3/90	Reported limit of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	7/3/90	Reported value of 11.19 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC, Max	12/26/90	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	1/3/91	Reported value of 6.92 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC, Max	1/3/91	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	1/3/91	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	1/3/91	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	12/26/91	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	12/26/91	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
EDC, Max	9/2/92	Reported value of 11.6 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	9/2/92	Reported value of 11.6 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	11/16/93	Reported value of 9.743 lb/d was in violation of the permit limit of 4.14 lb/d.	BAC1
EDC, Max	11/16/93	Reported value of 9.73 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	11/17/93	Reported value of 9.7 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	11/30/93	Reported value of 4.25 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	12/6/93	Reported value of 6.204 lb/d was in violation of the permit limit of 4.14 lb/d.	BAC1
EDC, Max	12/6/93	Reported value of 6.204 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	3/30/94	Reported value of 172 lb/day was in violation of the permit limit of 4.14 lb/day.	BAC1
EDC, Max	4/5/94	Reported value of 5.9 lb/d was in violation of the permit limit of 4.14 lb/d.	BAC1
EDC, Max	5/3/94	Reported value of 7.6 lb/d was in violation of the permit limit of 4/14 lb/d.	BAC1
EDC, Max	11/12/96	Reported value of 4.3 lbs was in violation of the daily maximum of 4.14 lbs.	NOI
EDC, Max	01/00/1989	Reported value of 8.9 was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	01/00/1989	Reported value of 8.00 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC, Max	01/00/1991	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	01/00/1991	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	01/00/1991	Reported value of 6.92 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	03/00/1989	Reported value of 8.73 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC, Max	07/00/1990	Reported value of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	07/00/1990	Reported value of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	07/00/1990	Reported value of 11.19 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	10/00/1988	Reported value of 8.04 was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	10/00/1988	Reported value of 8.04 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
EDC, Max	11/00/1993	Reported value of 9.743 lbs/day was in violation of permit limit of 4.14 lbs/day.	BAC1

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
EDC, Max	12/00/1990	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	12/00/1990	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
EDC, Max	12/00/1990	Reported value of 6.8 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
Hexanol	12/16/93	A spill of 1,086 lbs occurred.	NOI
Lead, Total	02/00/1988	Reported value of 5.6 lbs was in violation of the permit limit of 3.18 lbs.	BAC1
Lead, Total	08/00/1988	Reported value of 4.2 was in violation of the permit limit of 3.18 lbs.	BAC1
Methyl Chloride	4/14/87	Reported value was 66 lb/day. Permit limit was reported as "no limit."	BAC1
Methyl Chloride	4/14/87	There was an unauthorized discharge of 66.83 pounds of Methyl Chloride through the complex NPDES Outfall, EPA-001 (the receiving body of water was Bayou Verdine).	BAC1
Methyl Chloride	12/6/88	There was an unauthorized discharge of 10 pounds. No permit limit provided.	NOI
Methylene Chloride	3/17/87	Reported value was 320 lbs. Permit limit was "no limit."	BAC1
Napthhalene, daily max	12/26/90	Reported value of 6.8 lbs/day was in violation of the permit limit of 4.14 lbs/day.	BAC1
Napthhalene, daily max	02/00/1988	Reported value of 12.48 was in violation of the permit limit of 4.14 lbs.	BAC1
Napthhalene, daily max	03/00/1989	Reported value of 8.73 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
Napthhalene, daily max	05/00/1989	Reported value of 8.2 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
Napthhalene, daily max	08/00/1988	Reported value of 17.2 was in violation of the permit limit of 4.14 lbs.	BAC1
Napthhalene, daily max	09/00/1992	Reported value of 11.6 lbs was in violation of the permit limit of 4.14 lbs.	BAC1
N-Octanol	6/21/89	An unknown amount leaked near the base of the Octanol Storage Tank FB-503B.	NOI
Phenol, Daily Avg.	01/00/1992	Reported value of <0.05 mg/l was in violation of the permit limit of 0.015 mg/1.	BAC1
Phenol, Daily Max.	1/7/91	Reported value of 0.067 lbs/day was in violation of the permit limit of 0.017 lbs/day.	BAC1
Phenol, Daily Max.	1/7/92	Reported value of 0.13 mg/l was in violation of the permit limit of 0.026 mg/l.	BAC1
Phenol, Daily Max.	01/00/1992	Reported value of <0.025 lbs/day was in violation of the permit limit of 0.010 lbs/day.	BAC1
Toluene	2/7/89	Recorded value of 1.63 was in violation of the permit condition of 0.72.	BAC1
Toluene	2/8/89	Reported value of 1.4 lbs was in violation of the daily maximum of 0.72 lbs.	BAC1
Toluene	2/8/89	Reported value of 1.4 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene	7/3/90	A discharge of 3.5 lbs occurred.	NOI

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Toluene, Avg	6/30/90	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	6/30/90	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	6/30/90	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	6/30/90	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	06/00/1990	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	06/00/1990	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	06/00/1990	Reported value of 0.401 lbs was in violation of the permit limit of 0.35 lbs.	BAC1
Toluene, Avg	06/00/1990	Reported value of .401 lbs/day was in violation of the permit limit of .35 lbs/day.	BAC1
Toluene, Avg	12/00/1989	Reported value of 1.08 lbs was in violation of the permit limit of .35 lbs.	BAC1
Toluene, Max	2/7/89	Reported value of 1.63 was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	12/26/89	Reported value of 4.13 lbs was in violation of the permit limit of .72 lbs.	BAC1
Toluene, Max	6/30/90	Reported value of 0.900 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	6/30/90	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	6/30/90	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	6/30/90	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	7/3/90	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	7/3/90	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	7/3/90	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	7/3/90	Reported value of .126 mgl/day was in violation of the permit limit of 0.10 mgl/day.	BAC1
Toluene, Max	7/3/90	Reported value of 3.54 lbs/day was in violation of the permit limit of 0.72 lbs/day.	BAC1
Toluene, Max	02/00/1989	Reported value of 1.63 lbs was in violation of the permit limit of .72 lbs.	BAC1
Toluene, Max	02/00/1989	Reported value of 1.63 lbs/day was in violation of the permit limit of 0.72 lbs/day.	BAC1
Toluene, Max	06/00/1990	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	06/00/1990	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1

Table 8-3
Sasol, Inc. (formerly CONDEA Vista)
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Toluene, Max	06/00/1990	Reported value of 0.9 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	06/00/1990	Reported value of .900 lbs/day was in violation of the permit limit of .72 lbs/day.	BAC1
Toluene, Max	07/00/1990	Reported value of 0.126 mgl was in violation of the permit limit of 0.1 mgl.	BAC1
Toluene, Max	07/00/1990	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	07/00/1990	Reported value of 0.126 mgl was in violation of the permit limit of 0.1 mgl.	BAC1
Toluene, Max	07/00/1990	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	07/00/1990	Reported value of 3.54 lbs was in violation of the permit limit of 0.72 lbs.	BAC1
Toluene, Max	07/00/1990	Reported value of 0.126 mgl was in violation of the permit limit of 0.1 mgl.	BAC1
Toluene, Max	12/00/1989	Reported value of 4.13 lbs was in violation of the permit limit of .72 lbs.	BAC1
Vanadium, Total	3/29/94	Approximately 172 lbs. were released through the 001 outfall discharge line. The daily maximum permit limit was 4.14 lbs/day. Contaminated groundwater may have infiltrated the stormwater diversion box through cracks in the floor of the box.	BAC1
Vinyl Chloride	2/20/88	There was an unauthorized discharge of approximately 10 lbs of vinyl chloride. (Source document also refers to material spilled as Ethyl Chloride.)	NOI
Vinyl Chloride	6/6/88	There was an unauthorized discharge or release of 2.9 lbs to the air.	NOI
Vinyl Chloride	9/28/88	Unauthorized discharge or release of 4.2# to the air.	NOI
Vinyl Chloride	10/6/88	There was an unauthorized discharge or release of one pound to the air.	NOI
Vinyl Chloride	5/26/91	13.2 lbs leaked to the ground between the Quench Column and the R201C furnace.	NOI
Zinc	11/20/91	Interim effluent discharge limitations were issued, pursuant to which Permittee was authorized to discharge a daily avg. of 55 lbs/day and a daily max of 125 lbs/day. Interim limitations were in effect from the effective date of the Order until May 31, 1992.	BAC1

NOI - No Outfall Identified

SUM - Combination of outfalls

Information obtained from permit files.

Table 8-4
Tetra Technologies, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Hydrogen Chloride	NS	Facility was in violation for the release of hydrochloric acid the duration lasted for approximately one minute.	NOI
Hydrogen Chloride	NS	A release of an unknown quantity of hydrogen chloride occurred over a duration of five minutes.	NOI
Hydrogen Chloride	NS	A release of 583 lbs of Hydrogen chloride occurred over a duration of ten minutes.	NOI
Not Identified	11/21/89	Facility was in violation for failure to submit monitoring reports for July and August 1989.	NOI
Not Identified	9/14/94	A release of an unknown quantitiy of an uspecified contaminant occurred.	NOI
Not Identified	1/00/1994	Facility was in violation for failing to obtain a required second sample.	NOI

Table 8-4
Tetra Technologies, Inc.
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Calcium Chloride	6/11/96	A reported 9161 lbs of Calcium Chloride spilled over a period of fifteen (15) minutes, most of it was believed to ultimately enter the Calcasieu River. Units and permit limits were not specified.	NOI
Crude Oil	4/20/94	A release of eight bbls of crude oil occurred over a non-specified duration.	NOI
Ethylene	5/28/96	A release of non-specified amount of ethylene occurred over a non-specified duration.	NOI
HCL	8/21/89	A release of 4.16 lbs of hydrochloric acid occurred over a duration of two minutes	NOI
HCL	9/17/89	A release of an unknown quantity of hydrochloric acid occurred over a duration of 3-5 seconds	NOI
HCL	9/18/89	A release of .3815 lbs of hydrochloric acid occurred over a duration of five seconds	NOI
HCL	2/20/91	A release of approximately 200 gallons of hydrochloric acid occurred over a duration of 10 minutes.	NOI
HCL	3/25/91	A release of approximately 70 gallons of hydrochloric acid occurred over a duration of 10 minutes.	NOI
HCL	11/27/91	A release fo 30 gallons of hydrochloric acid occurred	NOI
HCL	4/10/92	A release of 8.3 lbs of hydrochloric acid occurred over a duration of one minute.	NOI
HCL	5/20/92	A release of an unknown amount of hydrochloric acid occurred over a duration of five minutes.	NOI
HCL	5/21/92	A release of 78.7 lbs of hydrochloric acid occurred over a duration of five minutes.	NOI
HCL	3/1/93	A release of two fallons of hydrochloric acid occurred over a duration of two minutes	NOI
HCL	4/28/93	A release of 114 lbs of hydrogen chloride occurred over a duration of three minutes.	NOI
HCL	11/18/93	A release of approximately 76 lbs of hydrogen chloride occurred over a duration of one minute.	NOI
HCL	2/10/94	A release of approximately 40 gallons of hhydrochloric acid occurred over a duration of two minutes.	NOI
HCL	12/28/94	A release of approximately 150 lbs of hydrochloric gas occurred over a duration of 15 minutes.	NOI
HCL	9/15/95	A release of an unknown quantity of hydrogen chloride occurred over a duration of five minutes.	NOI
HCL	10/13/95	A release of 10 lbs occurred over an undetermined duration.	NOI
HCL	2/6/96	A release of 10 lbs occurred over a duration of 15 minutes.	NOI
HCL	NS	A release of 12 lbs of hydrochloric gas occurred over a duration of two minutes	NOI
HCL	NS	A release of an unknown amount of hydrochloric acid occurred.	NOI
HCL	NS	A release of less than 5 lbs of hydrochloric acid occurred over a duration of one minute.	NOI
HCL	NS	A release of an unknown quantity of hydrochloric acid occurred.	NOI

Table 8-5
Historic Results for Reach 1
Bayou Verdine

Year	1989[1]	1993[2]	1994[3]
Compound			
Arsenic (mg/Kg)	3.58	1.90 - 6.00	1.78 - 10.00
Barium (mg/Kg)	116.0 - 226.0	46.7 - 139.0	31.64 - 580.56
Chromium (mg/Kg)	54 - 72	- - -	- - -
Copper (mg/Kg)	19.2 - 22.0	8.9 - 49.5	3.29 - 150.00
Lead (mg/Kg)	20.0 - 129.0	11.0 - 41.8	7.62 - 216.58
Mercury (mg/Kg)	0.10 - 0.20	0.06 - 0.10	0.12 - 0.97
Nickel (mg/Kg)	15.0 - 18.2	10.5 - 22.7	4.11 - 68.42
Zinc (mg/Kg)	369 - 475	33 - 107	13 - 2,806
Total PAH (μg/Kg)	- - -	3,107 - 54,200	1,390 - 666,575
Aldrin (μg/Kg)	- - -	2.4 - 3.0	2.02 - 11.86
Total BHCs (μg/Kg)	- - -	2.4 - 28.7	2.02 - 11.86
Hexachlorobenzene (μg/Kg)	- - -	- - -	392 - 45,205
Total PCB (μg/Kg)	- - -	46 - 86	80 - 465
Bis(2-ethylhexyl)phthalate (μg/Kg)	- - -	41 - 12,000	393 - 45,205
Hexachlorobutadiene (μg/Kg)	- - -	- - -	393 - 45,205
1,1,2-Trichloroethane (μg/Kg)	- - -	14 - 18	6 - 5,000
1,2-Dichloroethane (μg/Kg)	- - -	14 - 18	6 - 5,000
Acetone (μg/Kg)	- - -	31 - 75	11 - 5,000

Notes:
[1]1988-89 EPA Toxics Study of the Lower Calcasieu River
[2]1993 EPA Site Inspection for Bayou Verdine
[3]1993-94 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu Ship Channel

Table 8-6
Historical Results for Reach 2
Bayou Verdine

Year	1989[1]	1993[2]
Compound		
Arsenic (mg/Kg)	- - -	1.6 - 5.5
Barium (mg/Kg)	151	171 - 263
Chromium (mg/Kg)	217	- - -
Copper (mg/Kg)	58	32.5 - 112.0
Lead (mg/Kg)	32.0	17.6 - 38.4
Mercury (mg/Kg)	- - -	0.17 - 0.62
Nickel (mg/Kg)	42.0	9.9 - 60.8
Zinc (mg/Kg)	1234	88 - 2,830
Total PAH (μg/Kg)	- - -	24,000 - 1,468,000
Aldrin (μg/Kg)	- - -	3.6 - 5.5
Total BHCs (μg/Kg)	- - -	3.7 - 6.5
Hexachlorobenzene (μg/Kg)	- - -	- - -
Total PCB (μg/Kg)	- - -	70 - 110
Bis(2-ethylhexyl)phthalate (μg/Kg)	33,000	2,100 - 19,000
Hexachlorobutadiene (μg/Kg)	- - -	- - -
1,1,2-Trichloroethane (μg/Kg)	- - -	21 - 32
1,2-Dichloroethane (μg/Kg)	4	21 - 32
Acetone (μg/Kg)	- - -	42 - 280

Notes:
[1]1988-89 EPA Toxics Study of the Lower Calcasieu River
[2]1993 EPA Site Inspection for Bayou Verdine

Table 8-7
Historic Results for Reaches 3 and 4
Bayou Verdine

Year	1989[1]	1993[2]
Compound	**Reach 3**	**Reach 4**
Arsenic (mg/Kg)	3.1	2.20 - 5.50
Barium (mg/Kg)	74.0	147.0 - 358.0
Chromium (mg/Kg)	15.0	- - -
Copper (mg/Kg)	7.0	10.8 - 53.4
Lead (mg/Kg)	12.0	22.0 - 26.8
Mercury (mg/Kg)	- - -	0.07 - 0.08
Nickel (mg/Kg)	6.0	20.6 - 37.1
Zinc (mg/Kg)	79	54 - 1,290
Total PAH (μg/Kg)	- - -	3,030
Aldrin (μg/Kg)	- - -	2.5 - 3.3
Total BHCs (μg/Kg)	- - -	2.5 - 4.8
Hexachlorobenzene (μg/Kg)	- - -	- - -
Total PCB (μg/Kg)	- - -	49 - 65
Bis(2-ethylhexyl)phthalate (μg/Kg)	- - -	48 - 820
Hexachlorobutadiene (μg/Kg)	- - -	- - -
1,1,2-Trichloroethane (μg/Kg)	- - -	15 - 20
1,2-Dichloroethane (μg/Kg)	- - -	15 - 20
Acetone (μg/Kg)	- - -	22 - 94

Notes:
[1]1988-89 EPA Toxics Study of the Lower Calcasieu River
[2]1993 EPA Site Inspection for Bayou Verdine

Table 8-8 Wilcoxon Rank Sum Test Results
Bayou Verdine AOC

		Probability (p-value) [1]					
Area of Concern	**Energy Area**	**Aroclor 1254**	**Arsenic**	**Barium**	**bis(2-ethylhexyl)phthalate**	**Chromium**	**Copper**
Bayou Verdine	Bayou	-- [2]	**0.016**	**0.004**	0.182	0.138	0.073
		Probability (p-value) [1]					
Area of Concern	**Energy Area**	**Lead**	**Mercury**	**Nickel**	**Pyrene**	**Zinc**	**2,3,7,8-TCDD TEQ**
Bayou Verdine	Bayou	0.474	**0.033**	0.83	**0.013**	**0.03**	0.233

[1] If p-value < critical value (alpha = 0.05) then there is a statistically significant difference between the AOC and reference areas. Bold = Significant Difference. Values in parentheses are Bonferroni adjusted p-values < critical value.

[2] Insufficient data for analysis.

Shading indicates that reference area conditions are greater than the energy system.

Table 8-9
COPCs Identified for the Bayou Energy System
Bayou Verdine

COPCs	COPC for Bayou Verdine (BERA CDM 2002b)	COPC for Bayou Verdine (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	-	-	NE	**Yes**
trichloroethane	-	-	NE	**Yes**
acetone	-	-	NE	No
SVOCs				
bis(2-ethylhexyl)phthalate	-	-	No	No
hexachlorobenzene	-	-	ND	No
hexachlorobutadiene	-	-	ND	No
3- & 4-Methylphenol	-	-	ND	No
carbon disulfide	-	-	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	-	-	NE	**Yes**
Low PAHs	-	-	NE	**Yes**
High PAHs	-	-	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	-	-	ID	No[3]
aroclor-1254	-	-	ID	No[3]
aldrin	-	-	ND	**Yes**
delta-bhc	-	-	ND	No
dieldrin	-	-	ND	**Yes**
endosulfan sulfate	-	-	ND	No
endrin aldehyde	-	-	ND	No
endrin ketone	-	-	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	-	-	ID	Yes
Inorganics				
arsenic	-	-	**Yes**	No[4]
barium	-	-	**Yes**	**Yes**
chromium (total)	-	-	No	No
copper	-	-	No	No
lead	-	-	No	No
mercury	-	-	**Yes**	**Yes**
nickel	-	-	No	No
zinc	-	-	**Yes**	**Yes**

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Section 9
Upper Calcasieu Nature and Extent

This section describes the nature and extent investigation of the portions of the Calcasieu Estuary called the Upper Calcasieu AOC. Section 9.1 reviews the reaches and energy areas within Upper Calcasieu. Historical activities, including industrial development, permitted discharges; accidental spills and releases are discussed in Section 9.2. An overview of the analytical program is provided in Section 9.3. Presentation of the physical and chemical data from the RI is provided in Section 9.4, Section 9.5 presents the nature and extent discussion for the bayou energy system, and Section 9.6 presents the nature and extent discussion for the marsh energy system. Nature and extent evaluations for the river, shallow lake, and ship channel energy systems are provided in Sections 9.7 through 9.9, respectively. Section 9.10 provides the overall summary and conclusions for Upper Calcasieu.

9.1 Introduction

The Upper Calcasieu AOC is defined as that region of Calcasieu Estuary that extends from the saltwater barrier on the Calcasieu River north of Lake Charles, southwest into Lake Charles, west to Clooney Island Loop, and southwest to the southern end of Coon Island Loop (Figure 2-2). The Upper Calcasieu AOC is approximately 25 km in length. Coon Island Loop connects with the ship channel just north of the I-210 Bridge. Upper Calcasieu receives discharge from several sources along the banks of the associated river, ship channel, and lakes. Bayou Verdine and Contraband Bayou are the two major tributaries that discharge into the Upper Calcasieu. The ship channel in Upper Calcasieu is 125 m wide and up to 14 m deep. The ship channel is routinely dredged below the I-10 Bridge (USACE 1976).

9.1.1 Physical Setting

The surface elevation in the area around Upper Calcasieu area averages about 3 m above MSL, and the area is located within the 100-year floodplain of the Calcasieu River Basin (Figure 2-6). The Calcasieu River above Lake Charles ranges from 62 to 372 m wide. Lake Charles is approximately 1860 m wide.

The ship channel ranges from 4.6 to 14 m deep below the I-10 Bridge. Sampling of the ship channel during the RI was limited to the shallow (4.6 m) shelf on both sides of the ship channel as the USACE routinely dredges the center of the channel from the Gulf of Mexico through the western side of Lake Charles (USACE 1976).

Water in Upper Calcasieu is intermediate to brackish and tidally influenced. Salinity stratification is noted seasonally, controlled primarily by density driven flow as a result of tidal influence, the freshwater river, and storm surge. Density-driven flood tide (upstream flow) currents have been observed regardless of tide stage in previous studies (DeRouen and Stevenson 1987). Dredging of the ship channel through to the Port of Lake Charles has accentuated these effects.

A salinity control structure was installed by USACE in 1968. The saltwater barrier is a tainter gate structure constructed in a short channel 17 m wide. The sill of the structure is 4 m below mean low Gulf level. The barrier is operated between March and October, with navigation and retaining structures closed except for vessel passage. From October to February, periods of generally high water levels, the gates are open, allowing free flow of water. The saltwater barrier effectively protects the upper Calcasieu River from saltwater intrusion. The barrier effectively divides the river into a freshwater and estuarine system.

Bayou Verdine receives discharge from several industrial properties, as noted in Section 8, then discharges to Upper Calcasieu at the northern end of Coon Island Loop. The industries that discharge into Bayou Verdine are not listed or discussed herein; however, the nature and extent discussion will address the quality of sediments in the northern end of Coon Island Loop, noting contaminant suites and gradients where appropriate.

Contraband Bayou receives treated effluent from the City of Lake Charles municipal wastewater treatment plant, which then enters the ship channel between Clooney and Coon Island Loops (Curry et al 1997). Lake Charles itself hosts numerous smaller point and non-point sources that are likely insignificant contributors and, therefore, they are not specifically identified. Other industries in the Upper Calcasieu AOC are discussed in Section 9.2.

9.1.2 Energy Systems

Upper Calcasieu is a diverse segment of the estuary that consists of an element of every energy system present in Calcasieu Estuary. The AOC contains bayou, marsh, natural river, shallow lake, and ship channel energy systems (Figure 9-1).

The river is approximately 17 m wide and 4.6 m deep. Flow within the natural river (on the north end of AOC) tends to be higher than the bayous, ranging from 17 to 110 kiloliters per second (kl/s; 600 to 4000 cfs), estimated at the saltwater barrier (USACE 1976). Salinity in this energy system is generally low (i.e., freshwater) and is controlled by the saltwater barrier. The river experiences a moderate (less than 15 cm) tidal fluctuation. Flood tide currents (upstream flow) have been observed throughout the segment during salinity-stratified conditions. This density-driven current generally increases salinity in the area and makes the segment a net sediment transporter (DeRouen and Stevenson 1987). On both sides of the river, two elongated marsh areas and other smaller marshes exist (i.e., marsh energy system). These areas are hydraulically connected to the river but do not receive constant flow-through.

Clooney Island Loop, approximately one-half of Coon Island Loop, and the ship channel from Lake Charles to Coon Island Loop represent the dredged, brackish, sometimes salt-wedge salinity regime portion of Upper Calcasieu. Although the dredged portion of the ship channel is excluded from the study area, shallow submerged sediment shelves (1 to 5 m deep) surround Clooney Island, the western side of Coon Island Loop, and the channel between Lake Charles and Coon Island

Loop. These typically narrow, shallow shelves comprise the ship channel energy system (Figure 9-1).

Lake Charles (an undredged, natural lake) and the east side of Coon Island Loop make up the shallow lake energy system. These areas are generally shallow (1 to 3 m deep), saline, and are net sediment sinks. The western side of Lake Charles is part of the dredged ship channel (and turning basin) and, therefore excluded from the study area. However, this feature tends to influence flow, salinity, and tidal fluctuations. Tidal activity and salinity generally increase downstream throughout the area.

Contraband Bayou is a low-flow natural bayou that drains residential areas of south Lake Charles in the vicinity of I-210. Near its confluence with the Calcasieu River Ship Channel, the bayou receives discharge from the Lake Charles POTW, as well as runoff from the southern portion of the Port of Lake Charles facility. Contraband Bayou experiences moderate tidal fluctuation and has intermediate to brackish salinity conditions.

Sediment character is as diverse as the energy systems. Sections 9.5 through 9.9 provide details on the environmental condition of Upper Calcasieu. Discharges (current and historic), stormwater runoff, and accidental releases (documented and undocumented) have contributed to organic and inorganic impacts to surface water, sediment, and biota within Upper Calcasieu.

9.2 Industrial Setting and Historical Contamination

This section describes the industrial setting along Upper Calcasieu, including facilities descriptions for those industries that historically discharged or currently discharge to Upper Calcasieu. In addition, results from previous investigations conducted in Upper Calcasieu are discussed to identify if contaminant suites or concentrations have varied over time. This temporal information will be used to support the chemical fate and transport discussions.

9.2.1 Industrial Setting

Land use within the drainage basin of Upper Calcasieu AOC is generally mixed. It consists of rural residential, agricultural, industrial, and urban land use. Industrial manufacturing facilities and municipal discharges are the most concentrated sources of discharge; however, non-point discharge is also possible, but was not investigated.

Historic or Current Permitted Dischargers to Upper Calcasieu:

Lyondell (formerly ARCO and Olin Chemicals)
Conoco
PPG

Several industries are located along the banks of the ship channel, primarily on Clooney Island Loop and Coon Island Loop. The industries with potential to discharge to the Upper Calcasieu estuary include:

- Lyondell (formerly ARCO and Olin Chemicals)

- Conoco
- PPG

Each of these facilities is described in the following subsections.

9.2.1.1 Lyondell

The Lyondell (formerly ARCO and Olin Chemicals) facility currently occupies 1,200 acres approximately one mile west of the City of Lake Charles and immediately southwest of Westlake, Louisiana. Conoco and I-10 border the site on the north and Clooney Island Loop of the Calcasieu River on the south. Bayou Verdine borders the facility on the west, while marshes lie immediately to the east.

Lyondell Manufactures:

Toluene diamine
Toluene diisocyanate
Isophorone diisocyanate
Methylene dicyclohexyl diisocyanate
Octadecyl Isocyanate
Nitric acid
Trichloroisocyanuric acid
Hydrazine
Hydrazine hydrate
Purified hydrazine
Hexamethylene diisocyanate trimer
Hexamethylene diisocyanate biuret

The plant was constructed in 1934 on approximately 1,200 acres and operated under Mathieson Alkali Works, Inc., Mathieson Chemical Corporation, Olin Mathieson Chemical Corporation, and Olin Corporation (Olin) (Kearney 1987). In 1996, ARCO purchased the operation, which was then bought by Lyondell in 1998.

Outfalls 001, 010, and 028 (Figure 9-2) have been permitted by EPA (EPA Permit No. LA0005347) to discharge to Calcasieu River (Curry 1997). Exhibit 9-1 lists the Lyondell discharges as of 1991. Enforcement histories for the Lyondell/Olin/ARCO outfalls are provided in Table 8-2.

Exhibit 9-1 Lyondell Approved Discharges to Calcasieu River (Curry 1997)

Outfall	Discharge Area	Approved Discharges
001, 010, and 028	Clooney Island Loop	Primary outfalls for non-process wastewater and stormwater runoff from the major production areas.

9.2.1.2 Conoco

Conoco is a petroleum refinery located primarily on the north and east side of Bayou Verdine to the north of I-10. The facility covers approximately 675 acres. Conoco has a large dock area on the Clooney Island Loop. Conoco discharges to the Calcasieu River through outfalls 003 and 005 (Figure 9-2). Conoco's facilities have been in operation since 1942.

Conoco Manufactures:

Natural gas liquids
Gasoline
Kerosene
Diesel and fuel oils
Petroleum and calcined coke
Jet fuels
Lube oil feedstock

The Lake Charles Refinery is Conoco's largest, with a 226,000 barrel-per-day capacity (Conoco 2002). The refinery processes both heavy, high-

sulfur crude and low-sulfur crude and produces a full range of fuel products. It also provides the feedstock for Excel Paralube, producing high-quality lubricating base oils. Conoco recently upgraded the Lake Charles Refinery to process synthetic crude oil from the Petrozuata heavy-oil joint venture in Venezuela.

Conoco's marine dock facility consists of three separate docks at the northern portion of a bend in the Calcasieu River known locally as Clooney Loop. The Conoco docks have been in operation since Conoco's Westlake Refinery began operations in the 1940s. The Conoco dock #3 has been recently upgraded to a steel and concrete structure. A new aboveground pipe rack was added the same time the #3 dock was rebuilt in 2000. The Conoco docks primarily receive and send shipments of various petroleum products and feedstock to the nearby Conoco Westlake Refinery and Excel Paralubes. Historically, the Conoco docks have been used to transmit shipments of raw materials for use in nearby chemical manufacturing operations.

Conoco (NPDES Permit No. LA0003026) is authorized to discharge through outfalls 003 and 005 to the Calcasieu River. Discharge is primarily surface water runoff. Enforcement histories for the Conoco outfalls are provided in the Tables Section in Table 8-1. Exhibit 9-2 lists the permitted discharges as of 1991.

Exhibit 9-2 Conoco Discharges into Upper Calcasieu (Curry 1997)

Outfall	Discharge Area	Approved Discharges
003	Calcasieu River	Groundwater seepage, hydrostatic test water and stormwater from the Conoco East Tank Farm.
005	Calcasieu River	Secondary outfall for sanitary wastewater. Primary outfall for this waste stream is outfall 001.

9.2.1.3 PPG

PPG is located along the west side of Bayou Verdine to the south of I-10, (Figure 9-2) and primarily borders Reach 1 of Bayou Verdine. It is a chemical manufacturing facility producing both inorganic and halogenated organic compounds.

The plant was originally constructed in 1940 to manufacture magnesium during World War II and was operated by Mathieson Alkali Works. The facility was re-named PPG Industries in 1968. In 1960, PPG began producing chlorinated organics (GTI 1990).

PPG Manufactures:

1, 2-DCA (syn. EDC)
Ethyl chloride
Perchloroethene
Trichloroethene
1,1,1-trichloroethane
Hydrogen chloride
Chlorine
Sodium
Hydroxide
Vinyl chloride monomer

PPG (NPDES Permit No. LA0000761) is authorized to discharge process wastewater through several designated outfalls. Only one outfall discharges to Bayou Verdine (outfall 004). PPG 004 receives flow from the North Dock area. PPG also discharges to Bayou d'Inde (outfall 001) and the

Calcasieu River (outfalls 002 and 003). Each of these outfalls was active as of 1996 (Curry 1997). The outfalls are monitored for TSS, BOD, pH, TOC, total residual chlorine (TRC), mercury, copper, lead, and several volatile and semivolatile organic compounds (Curry 1997).

Compliance records available for the period from January 1979 through October 1998 indicate that several permit discharge violations were reported for outfall 004. Significant releases include release of chlorinated hydrocarbons, copper, and mercury. Chronic release of undefined chlorinated hydrocarbons from April 1985 through September 1997 ranged in concentration from 0.1 to 11,950 pounds (lbs) of material above discharge limits. Copper discharge limits were exceeded by 1.5 to 94.5 pounds per day (lbs/day) from January 1989 through October 1990, and mercury spills from November 1987 through January 1990 were reportedly discharged through outfall 004 in quantities ranging from 0.7 to 12 lbs. Outfall 004 (Figure 9-2) discharges into Bayou Verdine (Reach 1) approximately 245 m from where the bayou flows into Coon Island Loop. Flow rate for outfall 004 is approximately 25,000 gpm (Curry 1997). PPG also has an outfall (outfall 003) at the North Docks located along the west side of Bayou Verdine where it enters the Calcasieu River at Coon Island Loop. This area is a likely repository of discharges or spills from the PPG tank farm. PPG has exceeded permit levels for chlorinated hydrocarbons on multiple occasions from outfall 003. Spills directly into the Coon Island Loop include vanadium, 1,2-dichloroethane (EDC), crude EDC/trichloroethylene (TCE) blend, and chlorinated hydrocarbons (Table 7-1). Releases in this area may result in contaminant transport into Bayou Verdine by tidal surge or other physical processes. Exhibit 9-3 summarizes the discharges from PPG outfalls to Upper Calcasieu. Enforcement histories for the PPG outfalls are provided in Table 7-1.

Exhibit 9-3 Approved PPG Discharges into Upper Calcasieu (Curry 1997)

Outfall	Discharge Area	Approved Discharges
003	Calcasieu River at Coon Island Loop	Plant runoff, catch basin effluent, washdown, storage tank overflow, and small volumes of once-through cooling water during periods of heavy rain
004	Bayou Verdine Reach 1	Plant runoff, catch basin effluent, washdown, storage tank overflow, and primary discharge for once-through cooling water from Plant A

The soil and groundwater in the North Dock and adjacent plant area are heavily contaminated from accidental spills and leaking underground transfer pipes (Curry 1997). Contamination has been found in all water-bearing units down to the Chicot Aquifer. The upper three units (10, 20, and 30-foot units) have a direct hydrologic connection with Bayou Verdine and are discharging via two contamination plumes (Curry 1997). Two significant groundwater plumes that may impact Bayou Verdine are the EDC plume, which extends into the North Dock area, and the perchloroethene and trichloroethene plume that extends into the southern end of the North Dock area. It should be noted that this RI does not address groundwater contamination, as it is addressed by other state and federal programs. However, known contamination is

noted because of its potential effect on the sediment and surface water in Bayou Verdine.

9.2.2 Historical Contamination

Multi-media samples were collected during four previous studies from the Upper Calcasieu Area of Concern (AOC). These studies include:

- Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report, Prepared by McNeese State University for the Louisiana Department of Wildlife and Fisheries, June 1987. (Conducted in 1983-1985, see Appendix A).

- Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency-Region VI, Louisiana Department of Environmental Quality and U.S. Geological Survey, March 1990. (Conducted in 1988-1989, see Appendix A).

- Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report, Prepared by McLaren/Hart Environmental Engineering – ChemRisk Division for PPG Industries, Inc., June 1995. (Conducted in 1994, See Appendix A).

- Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River, Prepared by McLaren/Hart Environmental Engineering – ChemRisk Division for PPG Industries, Inc., 1994. (Conducted in 1993, See Appendix A).

The occurrences of COPCs identified in Section 4 (Table 4-2) in sediments are discussed in this section. Data collected within the Upper Calcasieu Estuary AOC boundary was partitioned into five energy systems: bayou, marsh, river, ship channel, and shallow lake, to reflect the differing physical and geochemical dynamics of each area. Incidentally, no sediment samples were collected in the marsh energy system during any of the previous investigations. The samples discussed in the following sections were not collected as part of the Calcasieu Estuary RI/FS, the intent is to compare historical contamination with current conditions. Historical surface water samples are not discussed since their concentrations are more variable with time, sources, and season. Further, the station locations discussed in this section are not included on the RI maps.

Overall, the results from previous studies tend to correlate well with the findings of the RI. Where sufficient data exists for persistent compound, the results indicate fairly stable sediment concentrations. Interpretation is limited by the number of sediment samples and their locations.

Previous studies indicate impacted sediments in the West Slip of Clooney Island Loop; the ship channel of Clooney Island Loop; the ship channel of Coon Island Loop, near the confluence with Bayou Verdine and near the confluence with the main ship

channel; and the eastern shallow lake side of Coon Island Loop. These areas were found to be impacted by PAHs, low levels of copper, lead, zinc, and EDC.

9.2.2.1 Historical Contamination - Bayou System

9.2.2.1.1 Volatile Organic Compounds, Semivolatile Organic Compounds, Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyls, and Pesticides

Only during the *1987 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex* investigation that any sediment samples in Contraband Bayou were collected and analyzed for organic compounds. No analytes where detected in the sediment samples collected from the bayou.

9.2.2.1.2 Metals

Arsenic, chromium, copper, lead, mercury and zinc were analyzed in 17 sediment samples from six locations during the *1987 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex* investigation.

Arsenic and chromium were detected in all sediment samples collected from Contraband Bayou with concentrations ranging from 0.42 to 2.80 mg/Kg and 1.36 to 52.60 mg/Kg respectfully. The highest sediment concentration for both compounds occurred in Contraband Bayou about 180 m along the south fork of the bayou at sample location 6100-12-C2.

Copper was also detected in all sediment samples collected from the bayou with concentrations ranging from 8.25 to 63.69 mg/Kg. The highest sediment concentration occurred in Contraband Bayou approximately 600 m east of the mouth of the bayou at sample location 6100-12-C1.

Lead, mercury, and zinc possessed maximum detected sediment concentrations at sample location 6100-12-C3, occurring in Contraband Bayou at the east fork of the bayou near the City of Lake Charles wastewater treatment facility. Lead was detected in all sediment samples with concentrations ranging from 11.22 to 230.00 mg/Kg, mercury was detected in 65% of the samples collected with concentrations ranging from 0.08 to 0.27 mg/Kg, and zinc was detected in all sediment samples with concentrations ranging from 22.22 to 255.00 mg/Kg.

9.2.2.2 Historical Contamination – Shallow Lake System

9.2.2.2.1 Volatile Organic Compounds

Acetone, carbon disulfide, and 1,2-dichloroethane were detected in only one investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation. Eleven sediment samples were collected from the Upper Calcasieu – shallow lake energy system area (Coon Island Loop area) and analyzed for VOCs.

Acetone was found in sediment samples at concentrations ranging from 13.33 to 12,285.71 µg/Kg. The highest sediment concentration was detected at location 6100-

02-CIL113, near the southeast side of Coon Island approximately 240 m northwest of Lyondell/Olin outfall 003.

Carbon disulfide was detected in sediment samples at concentrations ranging from 11.76 to 34.62 µg/Kg. The highest concentration was detected at location 6100-02-CIL111, adjacent to the southeast side of Coon Island approximately 135 m northwest of Lyondell/Olin outfall 003. Also at this location, the maximum sediment concentration of 1,2-dichloroethane was determined. Concentrations of 1,2-dichloroethane in sediment samples ranged from 8.57 to 65.38 µg/Kg.

Only two sediment samples were collected from the Upper Calcasieu – shallow lake energy system area (Lake Charles area) and analyzed for VOCs. Samples, 6100-06-17U1 and 6100-06-17U2, located in the northeast sector of Lake Charles nearly 400 m east of the Calcasieu Ship Channel turning basin abutting the west side of the lake, were collected during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation. No VOCs were detected in either sample.

9.2.2.2.2 Semivolatile Organic Compounds

Bis(2-ethylhexyl)phthalate was detected in only one investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*. Eleven sediment samples were collected from the Upper Calcasieu – shallow lake energy system area (Coon Island Loop area) and analyzed for SVOCs.

Bis(2-ethylhexyl)phthalate was found in sediment samples at concentrations ranging from 44.59 to 116.13 µg/Kg. The highest sediment concentration occurred at sample location 6100-02-CIL083, situated on the north end of Coon Island, south of the Coon Island Loop turning basin and approximately 530 m south of the PPG North Dock area.

Similar to VOCs from previous section, only two sediment samples were collected from the Upper Calcasieu – shallow lake energy system area (Lake Charles area) and analyzed for SVOCs. Neither of the samples, 6100-06-17U1 or 6100-06-17U2, collected during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation, contained SVOCs.

9.2.2.2.3 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAH) concentrations in nine sediment samples were reported in only one study, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation. Total PAH (the summation of 18 PAH compounds) was found in sediment concentrations ranging from 28 to 63,539 µg/Kg. The maximum concentration was detected at sample location 6100-02-CIL101, near the midpoint of the east arm of the Coon Island Loop and about 560 m north of Lyondell/Olin outfall 003.

Sediment samples collected from the Upper Calcasieu shallow lake energy system area (Lake Charles area) were not analyzed for PAHs.

9.2.2.2.4 Pesticides and Polychlorinated Biphenyls

Only one of the four previous investigations examined shallow lake sediment samples (both the Coon Island Loop and Lake Charles areas) for pesticides and total PCBs. During the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation, none of the aforementioned compounds were detected in any of the sediment samples.

9.2.2.2.5 Metals

Arsenic, copper, lead, mercury, and zinc were analyzed in 19 sediment samples from the Upper Calcasieu – shallow lake energy system area (Coon Island Loop area) during the *1987 LDWF Ecosystem Analysis of the Calcasieu River*, *1990 EPA Toxics Study of the Lower Calcasieu River*, and *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigations.

Barium and nickel were analyzed in 12 sediment samples from the Upper Calcasieu – shallow lake energy system area (Coon Island Loop area) during the *1990 EPA Toxics Study of the Lower Calcasieu River* and the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigations.

Chromium was analyzed in eight sediment samples from the Upper Calcasieu – shallow lake energy system area (Coon Island Loop area) during the *1987 LDWF Ecosystem Analysis of the Calcasieu River* and the *1990 EPA Toxics Study of the Lower Calcasieu River* investigations.

Arsenic was detected in sediment samples from all but the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation. Sediment concentrations ranged from 0.25 to 8.39 mg/Kg. The highest concentration value occurred in the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation at sample location 6100-02-CIL101, near the midpoint of the east arm of the Coon Island Loop and about 560 m north of Lyondell/Olin outfall 003.

Copper, as with arsenic, was detected in sediment samples from the three previous investigations. Sediment samples produced copper concentrations ranging from 3.51 to 53.84 mg/Kg. The highest concentration value occurred in the *1987 LDWF Ecosystem Analysis of the Calcasieu River* investigation at sample location 6100-12-V1, on the north end of Coon Island just to the north of the Coon Island Loop turning basin.

Lead, detected in sediment samples from the three previous investigations, was observed at concentrations ranging from 2.78 to 104.19 mg/Kg. The peak concentration value occurred in the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*

investigation at sample location 6100-02-CIL101, near the midpoint of the east arm of the Coon Island Loop and about 560 m north of Lyondell/Olin outfall 003. In addition, during the same study, mercury was observed at concentrations ranging from 0.11 to 0.66 mg/Kg. The peak concentration value occurred at sample location 6100-02-CIL093, near the upper extent of the east arm of the Coon Island Loop and approximately 503 m south of Lyondell/Olin outfall 010.

Zinc, also detected in sediment samples from the three previous investigations, was detected at the highest concentration value during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation. The concentrations for zinc ranged from 28.75 to 346.00 mg/Kg with the maximum value located at 6100-06-25E0, near the upper extent of the east arm of the Coon Island Loop and about 650 m south of Lyondell/Olin outfall 010.

Barium, detected in sediment samples from two previous investigations, had concentrations ranging from 41.49 to 1756.86 mg/Kg. The highest detected value was in the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation at location 6100-02-CIL091, near the upper extent of the east arm of the Coon Island Loop and about 450 m south of Lyondell/Olin outfall 010. The highest detected concentration value for nickel was also found during the same investigation. The range of values for nickel was 8.22 to 48.65 mg/Kg, with the elevated concentration value at sample location 6100-02-CIL081, positioned on the north end of Coon Island, east of the Coon Island Loop turning basin and approximately 90 m southwest of Olin outfall 010.

Chromium, detected in sediment samples from two previous investigations, had concentrations ranging from 4.20 to 259.95 mg/Kg. The highest detected concentration value was established by the *1987 LDWF Ecosystem Analysis of the Calcasieu River* investigation at sample location 6100-12-V1 on the north end of Coon Island just to the north of the Coon Island Loop turning basin.

Sediment samples collected from the Upper Calcasieu – shallow lake energy system area (Lake Charles area) were only collected during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation. Two sediment samples were collected and chromium, copper, lead, and mercury were detected in at least one of the samples.

Chromium and lead had constant sediment concentrations of 10 mg/Kg and 30 mg/Kg respectfully for both locations 6100-06-17U1 and 6100-06-17U2, situated in the northeast sector of Lake Charles about 400 m east of the Calcasieu Ship Channel turning basin along the west side of the lake. Mercury was detected at both locations with values of 0.11 mg/Kg and 0.14 mg/Kg, with the higher concentration at location 6100-06-17U1. Copper was detected in only one sediment sample at location 6100-06-17U2.

9.2.2.3 Historical Contamination –River System

9.2.2.3.1 Volatile Organic Compounds, Semivolatile Organic Compounds, Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyls, and Pesticides

Only during the *1987 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex* investigation that any sediment samples in Calcasieu River (located near the saltwater barrier) were collected and analyzed for organic compounds. No organic compounds where detected in the ten sediment samples collected from that portion of the river.

9.2.2.3.2 Metals

Arsenic, chromium, copper, lead, mercury, and zinc were analyzed in 10 sediment samples from three locations during the *1987 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex* investigation.

Arsenic and chromium were detected in all sediment samples collected from Calcasieu River with concentrations ranging from 0.49 to 1.83 mg/Kg and 0.46 to 28.49 mg/Kg, respectively. The highest sediment concentration for both compounds occurred along the Calcasieu River approximately 406 m west of the saltwater barrier at sample location 6100-12-U3.

Lead was also detected in all sediment samples collected from the bayou with concentrations ranging from 4.0 to 52.3 mg/Kg. The highest sediment concentration occurred along the Calcasieu River approximately 406 m west of the saltwater barrier at sample location 6100-12-U1.

Copper, mercury, and zinc possessed maximum detected sediment concentrations at sample location 6100-12-U2, found along the Calcasieu River approximately 406 m west of the saltwater barrier. Copper was detected in all sediment samples with concentrations ranging from 2.63 to 137.58 mg/Kg, mercury was detected in 10% of the samples collected with a concentration of 0.79 mg/Kg, and zinc was detected in 82% of the sediment samples with concentrations ranging from 9.90 to 316.23 mg/Kg.

9.2.2.4 Historical Contamination – Ship Channel System

9.2.2.4.1 Volatile Organic Compounds

Acetone and carbon disulfide were detected in two previous investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations. Five sediment samples were collected from the Upper Calcasieu – Ship Channel energy system area (the portion of the ship channel between Clooney Island Loop and the Coon Island Loop) and analyzed for VOCs.

Acetone was detected at concentrations ranging from 35.2 to 37.0 µg/Kg. The maximum concentration was detected at sample location 6100-03-CSC02, situated along the Calcasieu Ship Channel at the confluence of the first inlet to Prien Lake and the ship channel, approximately 300 m northeast of the I-210 Bridge. This sample was collected during the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel*

Water and Sediment Sampling investigation. Also detected during the same investigation, carbon disulfide generated a maximum concentration value at sample location 6100-03-CSC01, next to the junction of the Calcasieu Ship Channel with the west arm of the Coon Island Loop. The sediment concentration of carbon disulfide ranged from 7 to 11 µg/Kg within the Upper Calcasieu – Ship Channel energy system area.

1,2-Dichloroethane was detected in only one ship channel sample. This sample was from the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation. 1,2-Dichloroethane was detected at a concentration of 7.41 µg/Kg at sample location 6100-02-SCI01, found along the Calcasieu Ship Channel near the south end of Coon Island and about 1800 m south of the confluence with the Contraband Bayou and the ship channel.

Acetone, carbon disulfide, and 1,2-dichloroethane were detected in only one investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*. Thirty-three sediment samples were collected from the Upper Calcasieu – Ship Channel energy system area (Coon Island) and analyzed for VOCs.

Acetone was found in sediment samples at concentrations ranging from 10.77 to 458.33 µg/Kg. The highest sediment concentration was detected at sample location 6100-02-CIL071, found along the west side of the Coon Island Loop turning basin about 180 m southwest of PPG outfall 002.

Carbon disulfide was detected in sediment samples at concentrations ranging from 5.88 to 176.92 µg/Kg. The highest concentration was detected at sample location 6100-02-CIL022, positioned on the lower west arm of the Coon Island Loop about 406 m north of the confluence with the Calcasieu Ship Channel.

1,2-Dichloroethane was detected in sediment samples at concentrations ranging from 5.13 to 25.00 µg/Kg. The highest concentration was detected at sample location 6100-02-BD01, positioned along the west side of the Coon Island Loop turning basin nearly 140 m southwest of PPG outfall 002.

Sediment samples in Upper Calcasieu ship channel energy system area (Clooney Island Loop area) were collected and analyzed for VOCs during the *1990 EPA Toxic Study of the Lower Calcasieu River*, *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*, and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations. No VOCs were detected in the two sediment samples collected from that portion of the ship channel.

9.2.2.4.2 Semivolatile Organic Compounds

Bis(2-ethylhexyl)phthalate was detected in only one investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*. Thirty-three sediment samples were collected from the

Upper Calcasieu ship channel energy system area (Coon Island) and analyzed for SVOCs.

Bis(2-ethylhexyl)phthalate was found in sediment samples at concentrations ranging from 104.17 to 464.29 µg/Kg. The highest sediment concentration occurred at sample location 6100-02-BD01, positioned along the west side of the Coon Island Loop turning basin nearly 140 m southwest of PPG outfall 002.

Similar to VOCs from previous section, sediment samples were collected from in the Upper Calcasieu ship channel energy system areas (both the Clooney Island Loop area and the portion of the ship channel between Clooney Island Loop and the Coon Island Loop). None of the samples collected during each of the three previous investigations contained SVOCs.

9.2.2.4.3 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbon (PAH) concentrations in 17 sediment samples from the Upper Calcasieu ship channel energy system area (Coon Island area) were reported in only one investigation, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*. Total PAHs (the summation of 18 PAH compounds) were found in sediment samples with concentrations ranging from 404 to 1,052,308 µg/Kg. The maximum concentration was detected at sample location 6100-02-ED01, found along the northwest corner of Coon Island in the PPG North Dock area about 90 m southeast of PPG outfall 003.

Sediment samples collected from the Upper Calcasieu ship channel energy system areas (both the Clooney Island Loop area and the portion of the ship channel between Clooney Island Loop and the Coon Island Loop) were not analyzed for PAHs.

9.2.2.4.4 Polychlorinated Biphenyls and Pesticides

Only during the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation that sediment samples were examined for PCBs and pesticides within the Upper Calcasieu Ship Channel (Coon Island Loop, Clooney Island Loop, and the portion of the ship channel between Clooney Island Loop and the Coon Island Loop). Out of 32 sediment samples collected, no PCBs or pesticides were detected in the ship channel areas.

9.2.2.4.5 Metals

Arsenic, barium, copper, lead, and zinc were analyzed in 36 sediment samples from the ship channel energy system area (Coon Island area) during the *1990 EPA Toxics Study of the Lower Calcasieu River*, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Mercury and nickel were analyzed in 34 sediment samples from the ship channel energy system area (Coon Island area) during the *1990 EPA Toxics Study of the Lower Calcasieu River* and the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigations.

Chromium was analyzed in three sediment samples from the ship channel energy system area (Coon Island area) during the *1990 EPA Toxics Study of the Lower Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Arsenic, copper, nickel, and zinc possessed maximum detected sediment concentrations at sample location 6100-02-BD01, situated adjacent to the west side of the Coon Island Loop turning basin nearly 140 m southwest of PPG outfall 002. Arsenic was detected in 90% of the sediment samples with concentrations ranging from 1.30 to 16.67 mg/Kg, copper was detected in all of the samples collected with concentrations ranging from 2.82 to 189.52 mg/Kg, nickel was detected in 85% of the sediment samples with concentrations ranging from 6.86 to 186.67 mg/Kg, and zinc was detected in all of the sediment samples collected with concentrations ranging from 19.05 to 1,304.76 mg/Kg.

Barium, detected in sediment samples from three previous investigations, had concentrations ranging from 13.08 to 780.95 mg/Kg. The highest detected value was determined during the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation at sample location 6100-02-94BD02, situated on the northwest corner of the Coon Island Loop turning basin about 176 m southwest of PPG outfall 002. The highest detected concentration value for lead was also found during the same investigation. The range of values for lead was 7.85 to 544.44 mg/Kg, with the elevated concentration value at sample location 6100-02-CIL023, located on the lower west arm of the Coon Island Loop about 383 m north of the junction with the Calcasieu Ship Channel. Again, during the same investigation, the highest detected concentration value for mercury was found, with concentrations ranging from 0.20 to 1.30 mg/Kg, at sample location 6100-02-CIL013, located on the lower west arm of the Coon Island Loop about 175 m north of the junction with the Calcasieu Ship Channel.

Chromium, detected in sediment samples from two previous investigations, had concentrations ranging from 11 to 26 mg/Kg. The highest detected value was determined during the 1990 EPA Toxics Study of the Lower Calcasieu River investigation at sample location 6100-06-23E0, positioned adjacent to the northwest corner of Coon Island in the PPG North Dock area and about 170 m southeast of PPG outfall 003.

Arsenic, barium, chromium, copper, lead, nickel, and zinc were analyzed two sediment samples from Upper Calcasieu – Ship Channel energy system area (Clooney Island Loop area) during the *1990 EPA Toxic Study of the Lower Calcasieu River* investigation.

Arsenic, chromium, copper, lead, nickel and zinc were detected in both sediment samples collected from the Clooney Island Loop portion of the Calcasieu Ship Channel. Concentrations for each compound were 1.3 and 2.1 mg/Kg for arsenic, 25 and 27 mg/Kg for chromium, 14 and 28 mg/Kg for copper, 11 and 20 mg/Kg for lead, 8 and 11 mg/Kg for nickel, and for zinc 55 and 181 mg/Kg. The maximum concentration for each of those compounds was found at sample location 6100-06-26E0, approximately 50 m north of Lyondell/Olin outfall 027, which is located along the Clooney Island Loop on the southeast side of the island.

Barium, detected in both sediment samples collected from the Clooney Island Loop portion of the Calcasieu Ship Channel, was detected at concentrations of 428 and 555 mg/Kg with the higher concentration at location 6100-06-27E0, approximately 1,208 m south of Lyondell/Olin outfall 027, which is located along the Clooney Island Loop on the southeast side of the island.

Arsenic, barium, copper, lead, nickel, and zinc were analyzed in five sediment samples from the ship channel energy system area (the portion of the ship channel between Clooney Island Loop and the Coon Island Loop) during the *1990 EPA Toxics Study of the Lower Calcasieu River*, the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River*, and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Chromium was analyzed for three sediment samples during the *1990 EPA Toxics Study of the Lower Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations. Likewise, mercury was analyzed for three sediment samples during the *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations.

Arsenic, chromium, copper, lead, nickel and zinc possessed maximum concentrations at the same sample location, 6100-03-CSC01, right at junction of the Calcasieu Ship Channel with the west arm of the Coon Island Loop, during *1994 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island of the Calcasieu River* investigation. The range of detected concentration values for sediment samples collected in the ship channel energy system area (the portion of the ship channel between Clooney Island Loop and the Coon Island Loop) consisted of; 1.4 to 6.0 mg/Kg for arsenic, 9.0 to 26.0 for chromium, 5.2 to 30.0 mg/Kg for copper, 6.8 to 56.0 mg/Kg for lead, 6.0 to 15.0 mg/Kg for nickel, and 20.9 to 86.0 mg/Kg for zinc. The only detected concentration for mercury in sediment was also at this same location with a value of 1.0 mg/Kg.

Barium, detected in sediment samples from two previous investigations in the ship channel energy system area (the portion of the ship channel between Clooney Island Loop and the Coon Island Loop), had concentrations ranging from 79.5 to 807.0

mg/Kg. The highest detected value was determined during the *1990 EPA Toxics Study of the Lower Calcasieu River* investigation at sample location 6100-06-28E0, situated along the Calcasieu Ship Channel between the Clooney Island Loop and Coon Island Loop approximately 730 m south of the confluence with the Contraband Bayou and the ship channel.

9.2.3 Summary of Historical Data

Historical data from the four previous studies indicate that the occurrence of the primary COPCs is consistent with the findings of the RI. Concentrations of detected COPCs tend to correlate with concentrations established in the RI. The following tables 9-1 through 9-4 summarize the range of results for each study by energy system; bayou, river, shallow lake, and ship channel.

The areas that exhibited the greatest impact in the limited study areas were:

- The ship channel within Coon Island Loop near the confluence with Bayou Verdine
- The confluence of Coon Island Loop with the ship channel
- The eastern shallow lake portion of Coon Island Loop

The historical record indicates that the above-referenced areas are impacted by PAHs and low levels of chromium, copper, lead, mercury, and zinc. Isolated detections of EDC were also found in Coon Island Loop.

9.3 Data Analysis and Interpretation Overview

The following discussions focus on data collected during Phase I and Phase II of the RI. The analytical program and the results of the data validation and interpretation are presented in Sections 4.6.1 and 4.8. Section 9.3.1 provides a summary of the samples collected and parameters analyzed. An overview of the data interpretation presented in Section 9.3.2 will describe the objectives of the PCA that is used through the remainder of this section to describe the nature and extent of the contamination as well as the fate and transport of COPCs.

9.3.1 Analytical Program

Samples from Phase I and Phase II were collected within the Upper Calcasieu AOC, which extends from the saltwater barrier to approximately I-210 (Figure 9-1). Sampling was conducted throughout the AOC, which included the bayou, river, shallow lake, and ship channel energy systems.

The RI for the Upper Calcasieu AOC consisted of collecting and analyzing sediment, surface water, and porewater samples (Figures 4-2, 4-4, 4-6, and 4-9) for a variety of pre-determined compounds in accordance with EPA SW-846, EPA CLP, and ASTM standard methods. The compounds of interest included VOCs, SVOCs, pesticides, herbicides, PCBs, PCB congeners, dioxin/furans, metals (filtered and non-filtered for surface water), and TPHs. Surface sediment samples were collected from the 0 to 10-

cm depth interval in Phases I and II. Multi-depth samples were typically collected in Phases I and II at 0 to 10-cm, 10 to 20-cm, and 20 to 30-cm depth intervals. Surface water samples were collected at mid-depth of the water column because no salinity stratification was measured at the time of sampling. Porewater samples were collected with sediment samples and extracted at the laboratory.

In addition to the chemical parameters discussed above, selected samples were analyzed for chemical/physical properties, which may have included particle size analysis, TOC for sediment only, DOC for porewater only, and pH. Field parameters for sediment were limited to penetrometer measurements and VOC screening. Ancillary properties for surface water samples included alkalinity, ammonia, hardness, and TKN. Field parameters for surface water included temperature, pH, DO, ORP, conductivity, and salinity.

Sample Locations in Upper Calcasieu for Chemistry Only Phases I and II

- 136 Surface sediment
- 8 Multi-depth sediment
- 11 Surface water
- 8 Porewater

9.3.2 Data Interpretation Overview

Data were interpreted by use of statistical tests such as Wilcoxon Rank Sum (WRS) and the PCA to determine primary COPCs and their fate and transport in the estuary. In this section, an overview of the WRS test is provided in Section 9.3.2.1 to describe how it was used in the data interpretation. In Section 9.3.2.2, a brief overview of the PCA is provided, explaining the objectives of this analysis. The development of energy system specific COPCs is described in Section 9.3.2.3, and the general fate and transport mechanisms that will explain the nature and extent of contamination of these COPCs in the energy systems is provided in Section 9.3.2.4.

9.3.2.1 WRS Test

This section describes the results of the WRS test to determine if there is a statistically significant difference between the energy areas in Upper Calcasieu and reference area conditions. COPCs that were not detected in the reference area were not compared using the WRS test; however, these non-detected COPCs are retained for evaluation. Use of the WRS test is discussed in Section 4.8.2.3. Results are presented in Table 9-5.

The WRS test compares the probabilities (p-values) with a critical value (alpha) in order to determine whether there is a statistically discernible difference in the median concentrations between the two groups tested (energy area in the AOC versus the reference area). For purposes of interpreting the p-values, two levels of significance were established and presented in Exhibit 9-4.

Exhibit 9-4 Levels of Significance

Level of Significance	Interpretation of Difference
p-value < alpha	Medians may be different
Adjusted p-value < alpha	Medians are different

For the first level of significance (medians may be different), the p-values were compared directly with an alpha value of 0.05 or 95 percent upper confidence limit (UCL) of the median of the COPCs. For the second level of significance (medians are different), an adjusted p-value was calculated using the Bonferroni adjustment method:

adjusted p-value = n(p-value),

where, n is the number of comparison tests conducted.

The test does not indicate whether higher concentrations were observed in the energy area or the reference area, only that there was significant statistical difference between the two areas. To determine which area had higher concentrations, box plots comparing the two systems were examined and are presented in Appendix F.

9.3.2.2 PCA

As discussed in Section 4, PCA was used to accomplish the following objectives:

- Objective 1: Study the correlations of multivariate data sets by grouping variables (analytical constituents or parameters) in principal components (also known as factors or groups). Variables within each factor are more highly correlated with each other than with variables in other factors.

- Objective 2: Summarize many variables by a few factors or groups. Essentially, this is a data reduction technique whereby several original variables may be represented by one or a few "indicator" variables or by the actual factor.

- Objective 3: Interpret each factor according to the "meaning" of the variables. Such interpretation may provide useful information regarding geochemical fate and transport.

Sediment composition is heterogeneous, which means that chemicals found in sediment will vary from one location to the next. The PCA groups the measured parameters into factors, which are parameters that tend to correlate with one another. By identifying parameters that correlate, sediment conditions can be better understood and explain why one location varies from another. By understanding the variability in the surface sediment, conclusions can be made in regard to sources and the fate and transport of contaminants.

9.3.2.3 COPC Selection

The COPC list provided in Table 4-2 presents all of the COPCs in the Calcasieu Estuary; however, not all of these COPCs are present in each AOC or energy system. To limit discussion, energy system specific COPCs for each AOC were determined. COPCs that may not be present in a specific energy system, were not risk drivers, or were not statistically significant different than reference area conditions are not discussed.

The HHRA and BERA state which COPCs are the primary risk drivers for each AOC. An energy system specific COPC was determined if the following two conditions exist:

- The COPC was identified as a risk driver in the HHRA or the BERA
- The concentration of the COPC was determined to be statistically significant different and at a greater concentration from reference area conditions.

If either of these criteria failed, the COPC was determined not to be a COPC for a particular energy system. In some cases, there was insufficient data to compare a COPC with reference area conditions (i.e., low frequency of detects in a particular energy system). In these instances, the ranges of concentrations of a particular energy system are compared to reference area conditions. If the range is comparable, then they are not discussed in the following subsections. This selection process may omit some COPCs in an energy system that may pose risk to both human health and to the surrounding ecology. Additional information regarding these COPCs is presented in the HHRA or the BERA.

9.3.2.4 Fate and Transport Mechanisms

The major mechanisms that tend to guide chemical fate and transport in estuarine systems are:

- Adsorption
- Precipitation/Co-precipitation
- Salting out
- Complexation
- Biotransformation
- Hydrolysis
- Photolysis

Contaminant occurrence and extent in the Upper Calcasieu AOC is dependent upon physical conditions, the contaminants, their concentrations, and the dominant processes given these conditions. Theoretical details on these fate and transport processes are provided in Section 5.0. Sections 9.5 through 9.9 will discuss the general physical and chemical parameters, the nature and extent of contamination, and the processes controlling COPC behavior in Upper Calcasieu.

9.4 General Physical and Chemical Parameters for the Upper Calcasieu AOC

This section presents the results of the sediment and surface water characteristics of the bayou energy system in Upper Calcasieu.

9.4.1 Sediment Characteristics

9.4.1.1 Particle Size

Particle size analysis was conducted at predetermined locations in Phase I and on all SQT samples in Phase II (Figure 9-3). The marsh areas in Upper Calcasieu were observed to have the higher percentage of fine particles (clay and silt) in comparison to the other energy areas. The bayou, river, and shallow lakes tended to have similar percentages, with sand accounting for less than 50 percent of the mean particle size. The percentage of sand in the ship channel was greater than other energy areas due to the high flow of water, which does not allow fine particles to settle. Exhibit 9-5 summarizes the average particle size in each of the reaches.

Exhibit 9-5 Mean[1] (Standard Deviation) of Particle Size Analysis within Upper Calcasieu

Energy System	Percent Clay	Percent Silt	Percent Sand
Bayou	27.88 (7.72)	31.13 (9.64)	40.99 (15.72)
Marsh	34.7 (10.57)	58.1 (0.55)	7.97 (9.69)
River	29.91 (13.12)	38.65 (20.46)	32.15 (11.68)
Shallow Lake	24.74 (19.06)	35.45 (20.72)	39.97 (26.0)
Ship Channel	18.98 (10.45)	29.23 (10.92)	51.65 (16.40)
Reference Area	23.94 (11.70)	40.2 (11.02)	35.86 (16.34)

1 – Values based on regression on ordered statistics (ROS). See Appendix F.

In comparison with the reference areas, the bayou, river, and shallow lakes had similar mean particle size. The marsh and ship channel had different percentages due to the difference in source areas and flow rate in these areas.

9.4.1.2 Total Organic Carbon

TOC provides an indication of the total organic material present in sediment and includes the carbon both from naturally occurring organic material and from organic chemical contaminants. TOC in sediment was measured in both Phase I and Phase II. TOC concentrations were highest in the marsh energy system most likely due to the low energy that allows organic material to settle out in these areas. Exhibit 9-6 lists the mean concentrations by specific reach and compares them to reference area conditions.

Exhibit 9-6 Mean[1] (Standard Deviation) of TOC in Bayou Energy System

Energy System	TOC (mg/Kg)
Bayou	36,737 (22,340)
Marsh	98,167 (16,169)
River	12,633 (7,739)
Shallow Lake	26,705 (21,921)

Ship Channel	24,846 (17,385)
Reference Area	43,356 (24,874)

1 – Values based on ROS. See Appendix F.

The bayou, river, shallow lake, and ship channel energy systems were not as high in comparison with marsh and reference area conditions. This may be due to different flows and types of vegetation in the reference areas.

9.4.2 Surface Water Characteristics

Surface water characteristics are presented in this section, comparing to reference area conditions.

9.4.2.1 Total Dissolved Solids

Dissolved solids refer to any minerals, salts, metals, cations, or anions that may be dissolved in the estuary. Sources of dissolved solids may result from soil erosion, saltwater influence, waste discharge, urban runoff, eroding stream banks, and stirred-up bottom sediments from activities such as ship traffic or dredging. In addition to measuring total dissolved solids, salinity and conductivity were measured to describe the conditions within the bayou. Total dissolved solids are proportional to salinity and conductivity.

Salinity is the measure of the amount of dissolved salts (solids) in the estuary. Salinity levels control to some degree the types of animals and plants that may live in a particular area of the estuary. Salinity measurement is also important in determining if dissolved organic particles will precipitate out of solution or "salt out".

Conductivity estimates the amount of total dissolved ions (solids) in water. Conductivity is controlled by geology, size of the watershed, evaporation of water, and other sources of ions to the bayou or estuary such as wastewater, saltwater influence, or urban and agricultural runoff. An increase in conductivity could signal the introduction of a wastewater or runoff source or a saltwater influence.

Mean TDS values did not vary greatly among the five energy systems (Exhibit 9-7). The shallow lake and ship channel energy systems had a higher mean concentration, which is most likely due to the higher salinity values (Exhibit 9-8). In addition, due to flow rate and geometry, the ship channel does not allow fine particles to settle, which may contribute to the TDS concentration. Mean concentrations were also higher in Phase I than in Phase II due to limited rainfall prior to the sampling event and, thus, a lack of freshwater inflow into the estuary. Mean TDS concentrations were similar to what was observed in the reference areas. Reference area TDS values are from Phase II.

Exhibit 9-7 Total Dissolved Solids (mg/L) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	18,000/3,800	21,000/20,000	19,667/13,817	1,754/7,132

Marsh	16,350/ -	20,000/ -	18,044/ -	1,266/ -
River	18,000/1,400	20,000/21,000	19,010/10,975	514.7/10,745
Shallow Lake	16,000/2,200	21,000/25,000	19,550/14,965	1,348/9,738
Ship Channel	1,000/3,000	19,000/26,000	20,571/14,795	933/9,099
Reference Area	6,000	32,000	13,467	10,245

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Overall, salinity values were slightly lower during Phase II, possibly due to more freshwater inflow during that time. Higher salinity values were observed in the shallow lake and ship channel energy systems. The ship channel facilitates seasonal salinity wedge development. It is also a conduit for storm driven saltwater intrusion into the estuary from the Gulf of Mexico. Higher salinity values in the shallow lakes (specifically eastern Coon Island Loop and the west slip of Clooney Island Loop) may be due to their proximity to the ship channel and their downstream location relative to the bayou and marsh energy systems. Salinity values for the reference area are from Phase II only.

Exhibit 9-8 Salinity Levels (ppt) in Upper Calcasieu and Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	18/3	21/20	19.67/14.86	1.75/8.07
Marsh	17/ -	20/ -	18.38/ -	1.32/ -
River	18/1	21/22	19.21/11.38	0.95/11.44
Shallow Lake	15/2	22/27	19.88/15.63	1.79/10.82
Ship Channel	19/3	23/28	20.99/15.21	1.10/10.18
Reference Area	6	36	14	12

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

In Phase I, Upper Calcasieu would be classified as polyhaline (18 to 30 ppt) based upon the USFWS salinity classification system. In Phase II, the Upper Calcasieu salinity decreased, shifted to a mesohaline (5 to 18 ppt) salinity system. In comparing Phase II conditions, Upper Calcasieu had similar mean concentrations to that of the reference areas. This salinity comparison for Phase I and fluctuation consistency cannot be evaluated without Phase I salinity data for the reference area.

Mean conductivity levels in both Phase I and Phase II were slightly lower than reference area conditions, which may be due to slightly lower salinity levels (Exhibit 9-9). Conductivity values for the reference area are form Phase II only.

Exhibit 9-9 Conductivity (µg/cm) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	3,400/2,750	30,600/28,500	21,233/10,527	20,708/9,708
Marsh	2,500/ -	32,300/ -	25,125/ -	11,490/ -

River	3,000/224	33,500/34,550	25,297/16,848	12,334/19,154
Shallow Lake	3,100/343	34,700/42,400	17,523/20,815	14,821/18,392
Ship Channel	3,300/134	35,500/43,700	21,828/16,519	14,784/18,214
Reference Area	1,350	53,800	21,363	18,967

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Conductivity values varied slightly within each energy system; however, there were no outlying values that would indicate a source of dissolved ions in the vicinity. Values were slightly lower than what was observed in the reference areas, which may be due to lower salinity concentrations.

9.4.2.2 Hardness

Hardness is the measure of multivalent cations (positively charged particles) and is proportionate or equivalent to the concentration of calcium and magnesium in the surface water. Generally, as hardness increases, toxicity decreases. Surface water in Upper Calcasieu is considered very hard based on U.S Department of Interior and Water Quality Association standards (> 180 mg/L, Exhibit 9-10). The average fresh water value for the area is 140 mg/L (USACE 1998). Hardness was only measured in Phase I.

Exhibit 9-10 Hardness (mg/L as $CaCO_3$) in Upper Calcasieu and Reference Area

Energy Area	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Marsh	2,890	2,890	-	-
River	-	-	-	-
Shallow Lake	3,300	3,620	-	-
Ship Channel	-	-	-	-
Reference Area	1,295	1,295	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Hardness is typically a function of the geology of the area and/or influenced by point sources such as industries that discharge dissolved cations in effluent waters (EPA 1986). The higher values in the Upper Calcasieu in comparison with reference area conditions are not anticipated to be industrial discharge related and may result from local geologic conditions. In comparison, wastewater from chemical industries typically has maximum concentrations of 1,000 mg/L, as $CaCO_3$, and electric utilities have maximum concentrations of 5,000 mg/L, as $CaCO_3$ (EPA 1986).

9.4.2.3 Alkalinity and pH

Increases or decreases of pH may be an indication of anthropogenic effects such as wastewater discharge or contamination from urban or agricultural runoff. Measurement of pH may isolate a particular area that might be receiving discharges from these or other sources. Alkalinity is the measure of a solution's resistance to changes in pH. Typically, water with a high alkalinity will resist the adverse affects of

acidic contamination. The higher the alkalinity, the less likely a natural or manmade contaminant will cause a significant change in pH.

Exhibits 9-11 and 9-12 summarize the pH and alkalinity conditions present in the bayou energy system in Upper Calcasieu and the reference area. Alkalinity was only measured in Phase I.

Exhibit 9-11 pH (standard units) Levels in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value Phase I/II	Maximum Detected Value Phase I/II	Median[1] Phase I/II
Bayou	7.47/7.0	8.09/7.31	7.58/7.2
Marsh	7.21/ -	8.91/ -	8.23/ -
River	7.32/5.92	8.97/7.44	8.29/6.79
Shallow Lake	7.70/6.44	9.04/7.91	8.41/7.52
Ship Channel	7.67/6.29	9.25/7.9	8.62/7.15
Reference Area	6.67	8.135	7.27

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Estuarine waters typically have pH values ranging from 7 to 7.5 (EPA 1993). Values were typically lower in Upper Calcasieu than what was observed in the reference areas, with the exception of the shallow lake energy system.

Exhibit 9-12 Total Alkalinity (mg/L as $CaCO_3$) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Marsh	71.2	71.2	-	-
River	-	-	-	-
Shallow Lake	75.6	80.65	-	-
Ship Channel	-	-	-	-
Reference Area	42.1	42.1	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Estuaries typically have alkalinity values ranging from 30 to 160 mg/L as $CaCO_3$ (EPA 1993). Conditions in the reference area and in Upper Calcasieu are within this range. The higher values in Upper Calcasieu are not anticipated to be related to industrial discharge and, like hardness, may result from different geologic conditions (rocks or soils) in the area.

9.4.2.4 Nitrogen

Nitrogen was measured as nitrate-nitrite, TKN, and ammonia (Exhibit 9-13, 9-14, and 9-15). Nitrate and nitrite are inorganic ions occurring naturally as part of the nitrogen cycle (Smith 1990). TKN is the organic form of nitrogen and includes both the dissolved and particulate form, whereas ammonia is the dissolved form of nitrogen. Ammonia, at low levels, is an important nutrient for estuarine organisms, whereas it

becomes toxic at high concentrations. In contrast to freshwater systems where phosphorous is the limiting nutrient factor, nitrogen is the primary limiting nutrient in the seaward portions of most estuarine environments (Paerl 1993). If high levels of nitrogen are introduced into the estuary, a significant increase of algae or large aquatic plants may occur. NOAA/EPA (1988) suggest that nitrogen levels to avoid algae blooms to between 0.1 and 1 mg/L.

American Water Works Association (AWWA) recommends that for maximum diversity in estuarine environments, the nitrate-nitrite should not exceed 0.1 mg/L for maximum diversity and 1.0 mg/L for moderate diversity (Exhibit 9-13). Values are from Phase I only.

Exhibit 9-13 Nitrate-Nitrite (mg/L) in Upper Calcasieu and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Marsh	0.67	0.67	-	-
River	-	-	-	-
Shallow Lake	0.12	0.12	-	-
Ship Channel	-	-	-	-
Reference Area	0.06	0.06	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Based on nitrate-nitrite levels, the reference areas would support a more diverse environment, whereas Upper Calcasieu would only support a moderate diversity.

TKN, the summation of ammonia and organic nitrogen, was similar in the shallow lake energy system to what was observed in the reference area. TKN was measured in Phase I only, and the summary statistics are presented in Exhibit 9-14.

Exhibit 9-14 TKN (mg/L) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Marsh	-	-	-	-
River	-	-	-	-
Shallow Lake	1	1	-	-
Ship Channel	-	-	-	-
Reference Area	0.95	0.95	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Ammonia concentrations were slightly higher than what was observed in the reference area (Exhibit 9-15). Ammonia in surface water was measured in Phase I only.

Exhibit 9-15 Ammonia, as N, (mg/L) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Marsh	0.2	0.2	-	-
River	-	-	-	-
Shallow Lake	0.48	0.48	-	-
Ship Channel	-	-	-	-
Reference Area	0.0064	0.0064	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

According to EPA (1989b), the criteria maximum concentrations (CMC) for total ammonia (adjusted for pH, temperature, and salinity found in Upper Calcasieu) range from 44 to 50 mg/L. The criteria continuous concentrations (CCC), according to EPA (1989b), range from 6.6 to 12 mg/L. Measured ammonia levels for Upper Calcasieu were below the adjusted CMC and CCC values.

9.4.2.5 Dissolved Oxygen

Dissolved oxygen is typically an indicator of high quality for aquatic life and helps determine the ability of aerobic organisms to survive. The concentration is dependent upon temperature, salinity, wind, water turbulence, atmospheric pressure, and presence of oxygen demanding compounds and organisms and photosynthesis. The percent saturation is the measured dissolved oxygen level divided by the greatest amount of oxygen that the water can hold at that temperature and atmospheric conditions. Low dissolved oxygen levels typically indicate an excessive demand on the system from organic material deposited from pollution sources or from natural sources such as leaves and grass. Dissolved oxygen (in percent saturation) is presented in Exhibit 9-16.

Exhibit 9-16 Dissolved Oxygen, in Percent Saturation, in Upper Calcasieu and the Reference Area

Parameter	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	7.05/4.15	10.13/11.27	8.91/7.26	2.0/2.7
Marsh	12.18/ -	16.03/ -	13.71/ -	1.33/ -
River	7.61/5.92	16.48/8.66	11.06/7.16	2.86/1.26
Shallow Lake	2.95/7.16	19.9/10.78	10.68/8.55	3.54/1.28
Ship Channel	9.39/6.33	15.82/11.26	11.93/8.02	1.84/1.15
Reference Area (Phase II)	7.50	12.76	10.36	1.55

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

Typically, values over 80 percent represent high quality water, which will support various flora and fauna, whereas values less than 80 percent indicate poor water quality conditions.

9.4.2.6 Biochemical and Chemical Oxygen Demand

BOD_5, is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions in five days. COD, however, does not differentiate between biologically available and inert organic matter and is a better indicator of medium- to long-term demand. COD is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. COD values will always be greater than or equal to BOD_5 values and these data are typically measured when there are nearby industrial sources. High BOD_5 /COD values may deplete the water system of oxygen needed to support fish and other aquatic life. In an estuary, the rate of oxygen consumption is dependent upon temperature, presence of certain kinds of microorganisms, and the type of organic and inorganic material in the water (EPA 1993). BOD_5 values between 1 and 2 mg/L represent clean water. BOD_5 values between 2 and 5 mg/L are considered moderately clean. BOD_5 values exceeding 5 mg/L indicate a nearby pollution source. The various sources of organic enrichment include urban and agricultural runoff, sanitary sewer overflows, landfills and septic systems.

Exhibit 9-17 presents the chemical oxygen demand and COD values observed in Phase I. BOD_5 and COD were measured in Phase I and were not analyzed in the reference area.

Exhibit 9-17 BOD_5 and COD (mg/L) in Upper Calcasieu

Energy System	Minimum Detected Value (BOD_5/COD)	Maximum Detected Value (BOD_5/COD)	Mean[1] (BOD_5/COD)	Standard Deviation (BOD_5/COD)
Bayou	-	-	-	-
Marsh	2.1/71	2.1/71	-	-
River	-	-	-	-
Shallow Lake	1.6/111	1.6/111	-	-
Ship Channel	-	-	-	-

1 – Values based on ROS. See Appendix F.
(-) – Not measured or not calculated due to limited data.

BOD_5 and COD concentrations were not abnormal for the Upper Calcasieu.

9.4.3 Porewater

Porewater is the water occupying space between sediment particles. DOC, salinity, conductivity, hardness, total alkalinity, ammonia as N, unionized ammonia, and pH were measured at 10 sample locations in Upper Calcasieu. DOC and salinity are presented in this section, whereas discussion of the other parameters is presented in the BERA.

9.4.3.1 Porewater Dissolved Organic Carbon

DOC is the organic fraction of carbon in water that is filterable. DOC plays a role in the fate and transport of trace elements in the subsurface as well as influences the bioavailability of hydrophobic compounds. In saline environments, dissolved organic

matter is removed from the water to the sediment phase, which can effectively sorb hydrophobic chemicals (Chapman 2001). Exhibit 9-18 presents the summary statistics for porewater DOC.

Exhibit 9-18 Porewater DOC (mg/L) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	6.66	24.12	13.48	6.89
Marsh	-	-	-	-
River	2.61	13.69	-	-
Shallow Lake	2.61	15.51	9.63	5.08
Ship Channel	2.61	21.66	11.27	6.20
Reference Area	2.29	13.52	4.78	3.41

1 – Values based on ROS. See Appendix F.
2 – Results from Phase II only.
(-) – Not measured or not calculated due to limited data.

The higher DOC values found in the Upper Calcasieu energy systems in comparison with reference area conditions may be due to vegetation or the presence of organic contamination.

9.4.3.2 Porewater Salinity

As discussed previously, salinity is an indicator measure of TDS in water. Porewater salinity values are presented in Exhibit 9-19.

Exhibit 9-19 Porewater Salinity (ppt) in Upper Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	17	22	20	1.99
Marsh	-	-	-	-
River	11	20	-	-
Shallow Lake	13	21	19	4.78
Ship Channel	12	26	22	3.45
Reference Area	12	24	17	3.8

1 – Values based on ROS. See Appendix F.
2 – Results from Phase II only.
(-) – Not measured or not calculated due to limited data.

Porewater salinity did not vary greatly from reference area conditions. Salinity is higher in porewater than in surface water and is most likely related to sediment type and duration of sediment exposure to surface water salinity conditions (Chapman 2001). Equilibrium between surface water and porewater is slow in sediments containing high amounts of fine particles such as clay and silt (Chapman 2001).

9.5 Nature and Extent for the Bayou Energy System

The results and discussion section is organized into three sections: COPCs identified for the bayou energy system (Section 9.5.1), the results of the PCA (Section 9.5.2), and contaminants that showed little or no correlation to other contaminants or parameters

(Section 9.5.3). Contraband Bayou is the only energy system that was classified as a bayou in Upper Calcasieu.

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix F provides details of the PCA and complete summary statistics for all compounds detected in the bayou energy system in Upper Calcasieu.

9.5.1 COPCs for the Bayou Energy System in Upper Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 9.5.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 9.5.1.2 presents the bayou energy system COPCs identified.

9.5.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 9-5. Contaminant concentrations that were determined to be statistically significant different than the reference area are:

- PAHs (as pyrene)
- Pesticides (aldrin and dieldrin)
- Inorganics (nickel)

9.5.1.2 COPCs Selection

Energy system specific COPCs for Upper Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and the concentration was determined to be statistically significant different than reference area conditions (Table 9-6). In addition, contaminants are only discussed if they were observed in at least two locations or more than 5 percent of the sample for the energy system was detected. The following COPCs were selected for the bayou energy system in Upper Calcasieu:

- PAHs (as low- and high-molecular weight PAHs)

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 9.5.2 (PCA) and 9.5.3 (Isolated Chemistry).

9.5.2 PCA

The PCA revealed two dominant factors that accounted for most of the variability (62 percent) in surface sediment within Upper Calcasieu. These factors are:

- A background metal group that accounts for 29 percent of the variability and contains the following COPCs: copper, mercury, and lead
- A medium- to high-level contamination PAH group that accounts for 33 percent of the variability and contains some PAH COPCs-.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

Zinc and nickel were part of individual factors and together controlled approximately 37 percent of the variability in sediment combined. However, these contaminants are not considered a primary COPC for this energy system and will not be discussed further. Factor analysis and statistical results are presented in Appendix F.

9.5.2.1 Background Metals Factor

This section presents the extent of the Metals Factor and discussion as to the fate and transport of contaminants in this factor.

9.5.2.1.1 Results

The metals factor contains copper, mercury, cadmium, silver, and lead (Exhibit 9-20) as well as sand and silt, which are controlling constituents in the fate and transport of these metals.

Exhibit 9-20 Summary Statistics of Metals (mg/Kg) in Metals Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Copper	9/9	4.81	53.8	24.5	19.4	0.79
Mercury	6/9	0.0149	0.26	0.08	0.09	1.1
Cadmium	7/9	0.029	2.1	0.4	0.90	2.2
Silver	6/9	0.15	0.87	0.44	0.29	0.66
Lead	9/9	8.53	55.4	25.9	16.4	0.63

1 – Values based on ROS. See Appendix F.

Although these metals explain some of the variability in sediment, they are at concentrations similar to or lower than reference area conditions. Thus, the nature and extent of this factor will not be discussed.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system for Upper Calcasieu.

Surface Water

One surface water sample was collected in the bayou energy system where both copper and lead were detected. The total copper concentration was 0.016 mg/L, and

the dissolved concentration was 0.0063 mg/L. The total lead concentration was 0.009 mg/L, and the dissolved concentration was not detected. Dissolved concentrations for copper or lead did not exceed CCC or CMC values (NOAA 1999).

9.5.2.1.2 Discussion

The bayou energy system consists of Contraband Bayou and no significant sources of these metals are known to exist in the bayou. As noted previously, the metals contained in this factor are not statistically significant different than reference area conditions. Historic data is within these same ranges and is consistent with this finding. Therefore, these metals are assumed to be at background concentrations and are not discussed further.

9.5.2.2 PAH Factor

This section presents the extent of the PAH Factor and discussion of the fate and transport of contaminants in this factor in the bayou energy system (i.e., Contraband Bayou) of Upper Calcasieu.

9.5.2.2.1 Results

The PAH Factor is comprised of five HPAHs, which include benzo(a)anthracene; 1,2-benzphenanthrene, benzo(b)fluoranthene, pyrene, and fluoranthene. In addition, TOC is grouped in this factor, which is a controlling factor in the fate and transport of these contaminants. Summary statistics for the parameters that group within this factor are presented in Exhibit 9-21.

Exhibit 9-21 Summary Statistics of PAHs (µg/Kg) in PAH Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Benzo(a)anthracene	5/8	48.1	178	72.53	63.11	0.87
1,2-benzphenanthrene	5/8	49.5	165	76.71	50.34	0.66
benzo(b)fluoranthene	6/9	68.5	333	117.92	112.68	0.96
Pyrene	7/9	82.2	252	151.65	51.82	0.34
Fluoranthene	7/9	79.5	280	147.90	67.66	0.46

1 – Values based on ROS. See Appendix F.

Pyrene was used as an indicator variable to discuss the contamination present in the bayou energy system (Contraband Bayou) of Upper Calcasieu.

Surface Sediment

Pyrene, with a coefficient of variation of 0.34, is slightly variable in Contraband Bayou. When normalized to percent TOC, values did not vary significantly from location to location. The highest concentration for all PAHs in this factor is located at UCST019 (Figure 9-4). This location is situated across the bayou from the Port of Lake Charles (the south bank), which is highly vegetated and currently undeveloped.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system.

Surface Water

HPAHs were not detected in surface water in the bayou energy system.

9.5.2.2.2 Discussion
The most likely source of HPAHs is spills in the Port of Lake Charles. Distribution appears to be aqueous release with subsequent adsorption to particulates followed by tidal driven transport into Contraband Bayou and settling out with these fine particles. Extent of HPAHs is localized. The flow through the bayou does not appear to be significant enough to transport the sediments out of Contraband Bayou. Previous studies did not analyze for PAHs in Contraband Bayou.

9.5.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the two major PCA factor groups previously discussed. These include LPAHs.

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection was typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

9.5.3.1 LPAHs

This section presents the nature and extent of LPAHs in the bayou energy system in Upper Calcasieu and describes its fate and transport in the environment.

9.5.3.1.1 Results
Surface Sediment

LPAHs were detected at three locations in the bayou energy system (Contraband Bayou). Summary statistics are presented in Exhibit 9-22.

Exhibit 9-22 Summary Statistics of LPAHs (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
LPAHs	3/9	58	284.3	160.1	130.9	0.82

1 – Values based on ROS. See Appendix F.

UCST016 had the highest LPAH concentration, with acenaphthene comprising approximately 85 percent of the LPAH concentration (241 µg/Kg). LPAHs were also detected at UCST015 and UCST019 (Figure 9-5).

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system in Upper Calcasieu.

Surface Water

LPAHs were not detected in the surface water in the bayou energy system in Upper Calcasieu.

9.5.3.1.2 Discussion

Distribution of LPAHs is slightly more extensive in Contraband Bayou than the distribution of HPAHs and appears to be the result of the slightly higher solubilities of LPAHs. LPAHs are detected all the way up the bayou to station UCST015. The greater extent of LPAHs over HPAHs is due to their affinity to adsorb to smaller particles and the slightly higher solubilities, resulting in greater transport in the aqueous or suspended particle phase than most HPAHs. Samples have not been collected from Contraband Bayou in the previous studies; therefore, no temporal evaluation of sediment stability is available.

9.6 Nature and Extent for the Marsh Energy System

The results and discussion section is organized into two sections: COPCs identified for the marsh energy system (Section 9.6.1) and the results of the PCA (Section 9.6.2).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix F provides details of the PCA and complete summary statistics for all compounds detected in the marsh in Upper Calcasieu.

9.6.1 COPCs for the Marsh Energy System in Upper Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 9.6.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 9.6.1.2 presents the bayou energy system COPCs identified.

9.6.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 9-5. Contaminants that were determined to be statistically significant different than the reference area or did not have sufficient data to compare are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PCBs (as Aroclor 1254)
- Dioxins/Furans (as 2,3,7,8-TCDD TEQs)
- PAHs (as pyrene)
- Pesticides (aldrin and dieldrin)
- Inorganics (arsenic, barium, nickel, and zinc)

9.6.1.2 Marsh Area COPC Selection

Energy system specific COPCs for Upper Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significant different than reference area conditions (Table 9-7). In addition, contaminants are only discussed if they were observed in at least two locations or more than 5 percent of the sample for the energy system was detected. The following COPCs were selected for the marsh energy system in Upper Calcasieu:

- Dioxins/Furans

Zinc, a primary COPC, was not grouped in a factor and was carried forth due to insufficient data to compare to reference area conditions. This was due to a low frequency of detection in the marsh energy system (two out of eight sample locations). In comparing the two values with reference area conditions, both results (17.1 and 50.4 mg/Kg) were less than the mean concentration of the reference area (59.62 mg/Kg). Therefore, zinc will not be considered a primary COPC.

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 9.6.2.

9.6.2 Marsh Area PCA

The PCA revealed two dominant factors that accounted for most of the variability (90 percent) in surface sediment within Upper Calcasieu marshes. These factors are:

- A medium- to high-level contamination dioxin/furan factor that accounts for 62 percent of the variability. Total PeCDD, HxCDD, TCDD, HpCDD, and TCDF are the COPCs included in this factor.
- A Background Metals Factor that accounts for 28 percent of the variability in sediment. Chromium, lead, and nickel are contained in this factor.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

9.6.2.1 Dioxin/Furan Factor

This section presents the extent of the Dioxin/Furan Factor and discussion as to the fate and transport of contaminants in this factor.

9.6.2.1.1 Results

This factor contains Total PeCDD, HxCDD, TCDD, HpCDD, and TCDF as well constituents such as silt, clay, sand, pH, TOC, CEC, and copper. Grain size, pH, TOC, and CEC are constituents that will be used to explain the fate and transport of these contaminants within the marsh areas of Upper Calcasieu. Summary statistics for these contaminants are presented in Exhibit 9-23.

Exhibit 9-23 Summary Statistics of Dioxin/Furans (ρg/G) in Dioxin/Furan Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total PeCDD	3/3	20	96	66.3	50.3	0.76
Total HxCDD	3/3	310	590	486.7	197.2	0.41
Total TCDD	3/3	6.5	38	25.2	19.9	0.79
Total HpCDD	3/3	910	1,300	1,137	240.0	0.21
Total TCDF	3/3	15	41	26.7	15.1	0.57

1 – Values based on ROS. See Appendix F.

Other constituents are presented in Exhibit 9-24, with the exception of grain size and TOC, which was presented in Section 9.4.

Exhibit 9-24 Summary Statistics of Other Constituents in Dioxin/Furan Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
CEC (meq/100g)	3/3	28.3	39.5	33.8	6.2	0.18
Copper (mg/Kg)	8/8	7.4	46.7	23.4	15.8	1.15

1 – Values based on ROS. See Appendix F.

Dioxins/furans in this factor will be summarized as 2,3,7,8-TCDD TEQs, which will also be the indicator variable for this factor.

Summary statistics for 2,3,7,8-TCDD is presented in Exhibit 9-25.

Exhibit 9-25 Summary Statistics of 2,3,7,8-TCDD TEQs (ρg/G) in Dioxin/Furan Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
2,3,7,8-TCDD TEQs	3/3	24.99	34.98	28.79	6.81	0.24

1 – Values based on ROS. See Appendix F.

Surface Sediment

Within the marsh energy system, 2,3,7,8-TCDD TEQs did not vary significantly. The highest observed concentration was located at UCR3010, which is located in the marsh area south of the saltwater barrier (Figure 9-6). This sample is also located at the upstream entrance into this marsh area.

Subsurface Sediment

Subsurface samples were not collected in the marsh energy system of Upper Calcasieu.

Surface Water

Copper was the only contaminant in this factor detected in the surface water. It was detected at one location, with total concentration of 0.016 mg/L and a dissolved concentration of 0.0063 mg/L. Dissolved concentrations for copper did not exceed CCC or CMC values (NOAA 1999).

9.6.2.1.2 Discussion

The distribution of 2,3,7,8-TCDD TEQs in the marsh appears to be the result of settling of transported particulates. This is evidenced by its presence at station UCR3010. There are no industrial inputs in the area. However, the location is near the upstream entrance to the marsh and may indicate 2,3,7,8-TCDD TEQ transport due to tidal action. Temporal evaluations are not provided as previous studies did not sample the marshes.

9.6.2.2 Background Metal Factor

This section presents the extent of the Background Metal Factor and discussion as to the fate and transport of contaminants in this factor.

9.6.2.2.1 Results

This factor contains contaminants that are similar to reference area conditions, with the exception of arsenic. Arsenic was shown to be statistically significant different (lower than reference area) from reference area conditions (Appendix F). In addition, many of these contaminants are negatively correlated, which includes arsenic as well as lead, cobalt, sodium, and nickel. Summary statistics for these contaminants are presented in Exhibit 9-26.

Exhibit 9-26 Summary Statistics of Inorganics (mg/Kg) in Background Metal Factor in Surface Sediment, Marsh Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aluminum	5/8	95	220	161.99	45.36	0.28
Vanadium	8/8	10.5	22.6	16.71	4.31	0.26

Chromium	8/8	7.2	15.2	10.94	2.93	0.27
Lead	8/8	8.8	25.9	16.11	6.97	0.43
Arsenic	8/8	0.72	6.6	2.8	2.1	0.74
Cobalt	7/8	1.2	8.1	3.62	2.76	0.76
Sodium	8/8	5,880	17,400	11,136	4,268.5	0.38
Nickel	8/8	3.2	11.4	7.25	3.12	0.43
Beryllium	8/8	0.17	0.88	0.48	0.26	0.54
Potassium	8/8	1,320	2,260	1,680	358.4	0.21
Manganese	8/8	44.7	126	74.8	28.46	0.38
Calcium	8/8	1,670	3,420	2,458	621.7	0.25
Magnesium	8/8	2,270	4,830	3,404	838.2	0.25

1 – Values based on ROS. See Appendix F.

Surface Sediment

Although these metals explain some of the variability in sediment, they are at concentrations similar to or lower than reference area conditions. Previous studies did not sample the marshes. Thus, the nature and extent of this factor will not be discussed further.

9.7 Nature and Extent of River Energy System

The Upper Calcasieu AOC consists of the natural river portion of the Calcasieu River in the estuary from the northern end of Lake Charles upstream to the saltwater barrier. The section is organized into three discussions: COPCs identified for the river energy system (Section 9.7.1), the results of the PCA (Section 9.7.2), and occurrence of isolated contaminants that showed little or no correlation to other contaminants or parameters (Section 9.7.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix F provides details of the PCA and complete summary statistics for all compounds detected in the river energy system in Upper Calcasieu.

9.7.1 COPCs for the River Energy System in Upper Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 9.7.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 9.7.1.2 presents the river energy system COPCs identified.

9.7.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 9-5. Contaminants that were determined to be statistically significant different than the reference area or did not have sufficient data to compare are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PCBs (as Aroclor 1254)
- PAHs (as pyrene)
- Pesticides (aldrin and dieldrin)
- Inorganics (arsenic, barium, nickel, and zinc)

9.7.1.2 River Energy System COPC Selection

Energy system specific COPCs for Upper Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significant different than reference area conditions (Table 9-8). In addition, contaminants are only discussed if they are observed in at least two locations or more than 5 percent of the sample for the energy system was detected. The following COPCs were selected for the bayou energy system in Upper Calcasieu:

- PAHs
- Inorganics (zinc)

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 9.7.2 (PCA) and 9.7.3 (Isolated Chemistry).

9.7.2 River Energy System PCA

The PCA revealed two dominant factors that accounted for most of the variability (58 percent) in surface sediment within the river energy system in Upper Calcasieu. These factors are:

- A background metal group (Background Metal Factor) that accounts for 28 percent of the variability in surface sediment.
- A low-level metal contamination group (Metal Factor) that accounts for 30 percent of the variability in surface sediment. Zinc is the only primary COPC in this factor.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

9.7.2.1 Background Factor

This section presents the extent of the Background Metal Factor and discussion as to the occurrence of contaminants in this factor.

9.7.2.1.1 Results

This factor groups inorganics that are at low-level concentrations and similar to reference area conditions. One exception is arsenic, which had concentrations lower than the reference area. Exhibit 9-27 presents the summary statistics for this factor.

Exhibit 9-27 Summary Statistics of Inorganics (mg/Kg) in Background Metal Factor in Surface Sediment, River Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aluminum	10/10	4,320	17,100	9,465	4,619	0.49
Vanadium	10/10	7.9	27.8	16	6.9	0.43
Potassium	10/10	731	2,240	1,288	611.8	0.47
Beryllium	10/10	0.18	0.8	0.47	0.22	0.46
Magnesium	10/10	986	3,870	2,056	1,080.9	0.53
Arsenic	10/10	0.51	4.8	2.52	1.38	0.55

1 – Values based on ROS. See Appendix F.

Surface Sediment

Although these metals explain some of the variability in sediment, they are at concentrations similar to or lower than reference area conditions. Thus, the nature and extent of this factor will not be discussed.

9.7.2.2 Metal Factor

This section presents the extent of the low-level contamination Metal Factor and discussion as to the fate and transport of contaminants in this factor.

9.7.2.2.1 Results

This factor contains several metals, including one primary COPC, zinc. Exhibit 9-28 presents the summary statistics for this factor.

Exhibit 9-28 Summary Statistics of Inorganics (mg/Kg) in Metal Factor in Surface Sediment, River Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Nickel	12/12	3.3	14.2	6.28	3.47	0.55
Chromium	10/10	5.6	76.4	16.91	27.6	1.63
Barium	10/10	29.6	713	125.46	285.21	2.27
Zinc	10/12	10.9	222	42.94	71.77	1.67
Sodium	10/10	1,270	13,700	5,406	4,063	0.75
Silver	5/12	0.13	1.7	0.45	0.60	1.33
Copper	12/12	2.47	29.7	11.70	9.63	0.82

1 – Values based on ROS. See Appendix F.

Surface Sediment

Although these metals explain some of the variability in sediment, they are at concentrations similar to or lower than reference area conditions. Thus, the nature and extent of this factor will not be discussed.

9.7.3 River Energy System Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the two PCA factor groups previously discussed. These include:

- HPAHs
- LPAHs

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection was typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

9.7.3.1 PAHs

This section presents the nature and extent of PAHs in the river energy system in Upper Calcasieu and describes their fate and transport in the environment.

9.7.3.1.1 Results

Surface Sediment

HPAH concentrations were detected at a slightly greater frequency and varied more than LPAHs in the river energy system (Exhibit 9-29). Detected locations are shown in Figure 9-7.

Exhibit 9-29 Summary Statistics of PAHs (µg/Kg) in Surface Sediment, River Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
HPAH	4/12	49	2,232.4	1,635	1,436	0.88
LPAH	3/12	158.4	312.1	246.8	93.4	0.38

1 – Values based on ROS. See Appendix F.

The highest concentrations of HPAHs and LPAHs were located at station UCST030, which is located near the east shore of Calcasieu River upstream of Lake Charles. Benzo(a) anthracene, benzo(b) fluoranthene, benzo(a) pyrene, and fluoranthene were the dominant HPAHs. Phenanthrene was the dominant LPAH. Adjacent sampling

points did not show similar data. However, minimal data points were collected, and there were a high number of samples with elevated detection limits. Elevated occurrences of HPAHs and LPAHs appear isolated; however it is difficult to determine based on limited data.

Subsurface Sediment

Subsurface sediment samples were not collected in the river energy system in Upper Calcasieu.

Surface Water

PAHs were not detected in surface water samples.

9.7.3.1.2 Discussion

Minor detection (3 and 4 of 12 samples for LPAH and HPAH, respectively) of PAHs was noted for the Upper Calcasieu river energy system. The maximum HPAH detection was associated with an undeveloped segment of river bank and no evidence of sources. The second highest detection was associated with a local small boat slip, a likely and seemingly localized occurrence.

Based on the infrequent detection of HPAHs and LPAHs and the elevated detection limits (Figure 9-7), it is difficult to determine if the detections were isolated occurrences or more widespread contamination masked by elevated detection limits.

Historically, PAHs were not detected in the river system, although the number of samples collected was limited.

9.8 Nature and Extent for the Shallow Lake Energy System

The shallow lake energy system consists of three areas, including Lake Charles, the West Slip of Clooney Island Loop, and the central and eastern portions of Coon Island Loop. The results and discussion section is organized into three sections: COPCs identified for the shallow lake energy system (Section 9.8.1), the results of the PCA (Section 9.8.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 9.8.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix F provides details of the PCA and complete summary statistics for all compounds detected in the shallow lake energy system in Upper Calcasieu.

9.8.1 COPCs for the Shallow Lake Energy System in Upper Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 9.8.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 9.8.1.2 presents the river energy system COPCs identified.

9.8.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 9-5. Contaminants that were determined to be statistically significant different (e.g., higher concentrations) than the reference area or did not have sufficient data to statistically compare data sets are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PAHs (as pyrene)
- Inorganics (arsenic, barium, copper, and lead)

9.8.1.2 Shallow Lake COPC Selection

Energy system specific COPCs for Upper Calcasieu shallow lake energy system were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significant different than reference area conditions (Table 9-9). In addition, contaminants are only discussed if they are observed in at least two locations or more than 5 percent of the samples for the energy system. The following COPCs were selected for the shallow lake energy system in Upper Calcasieu:

- SVOCs (bis[2-ethylhexyl]phthalate)
- HPAHs and LPAHs
- Dioxins/Furans
- Inorganics (copper and lead)

The nature and extent as well as the fate and transport of these COPCs will be discussed in Sections 9.8.2 (PCA) and 9.8.3 (Isolated Chemistry).

9.8.2 PCA

The PCA revealed three dominant factors that accounted for most of the variability (74 percent) in surface sediment within the shallow lake energy system in Upper Calcasieu. These factors are:

- A medium- to high-level contamination Dioxin/Furan/Metal Factor that accounts for 29 percent of the variability in surface sediment. This factor groups BEHP, some dioxins/furans, and copper.

- A medium- to high-level contamination PAH Factor that accounts for 25 percent of the variability in surface sediment. This factor also groups lead with the PAHs.

- A medium- to high-level contamination Furan/PAH Factor that accounts for 20 percent of the variability in surface sediment.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

9.8.2.1 Dioxin/Furan/Metal Factor

This section describes the nature and extent of the dioxins/furans and metals grouped within this factor. Exhibits 9-30 through 9-32 present the summary statistics for the constituents grouped within this factor.

9.8.2.1.1 Results

Surface Sediment

Exhibit 9-30 Summary Statistics for Dioxin/Furans (ρg/g) in the Dioxin/Furan/Metal Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total HpCDF	7/8	52	1,100	325	403.71	1.24
OCDD	8/8	570	35,000	10,626	12,413	1.17
OCDF	8/8	7.3	1,400	449.2	535.04	1.19
Total HpCDD	8/8	57	6,900	1,861	2,564.9	1.38
Total TCDD	8/8	0.81	19	12.3	6.4	0.52
Total HxCDF	7/8	23	448	133.7	163.4	1.22
Total HxCDD	8/8	10	811	359.5	311.8	0.87

1 – Values based on ROS. See Appendix F.

Exhibit 9-31 Summary Statistics for Metals (mg/Kg) in the Dioxin/Furan/Metal Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Zinc	33/44	14.1	868	91.68	173.3	1.89
Copper	43/44	3.7	170	25.46	29.92	1.18
Mercury	23/44	0.035	0.808	0.11	0.18	1.61
Cobalt	18/37	2.5	10.6	4.54	2.49	0.55
Manganese	37/37	15.2	867	185.04	208.92	1.12
Magnesium	37/37	594	12,600	3,034	2,552	0.84
Iron	36/37	1,340	27,200	9,671	7,099	0.73
Vanadium	36/37	5.1	47.5	16.35	10.74	0.66

Potassium	33/37	509	4,800	1,527	1,127	0.74
Chromium	37/37	2.2	454	37.43	96.26	2.46
Calcium	37/37	548	75,900	10,122	18,935	1.87
Beryllium	18/37	0.26	1.5	0.55	0.43	0.79
Cadmium	9/44	0.12	0.92	0.22	0.15	0.69

1 – Values based on ROS. See Appendix F.

Exhibit 9-32 Summary Statistics for Other Constituents (µg/Kg) in the Dioxin/Furan/Metal Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Benzo(k)fluoranthene	7/37	115	310	-	-	-
Bis(2-ethylhexyl)phthalate	11/42	59	2,000	222.7	389.1	1.75
Aroclor 1254	5/44	38	930	-	-	-

1 – Values based on ROS. See Appendix F.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Copper is used as the indicator variable for this factor.

Surface Sediment

Dioxin/furan concentrations were detected at a high frequency in the shallow lake energy system. The coefficient of variation was fairly low (Exhibit 9-30). Detected locations are shown in Figure 9-8.

Elevated concentrations of contaminants are located primarily in the West Slip adjacent to Clooney Island Loop and the shallow area to the east of Coon Island. Isolated areas of elevated concentrations were observed in Lake Charles (location UCR2022 and UCR2036). Within the West Slip, elevated concentrations were observed throughout the area. Highest concentrations tended to be near where the slip enters the Clooney Island Loop. Benzo(k)fluoranthene, Aroclor 1254, copper, and total HxCDD, HpCDD, HpCDF, OCDD, and OCDF maximum detections were observed in the West Slip, primarily at station UCR2031.

In Coon Island Loop, the primary contaminants are copper. Concentrations tend to be highest at the mid point of the shallow lake area east of the island and extend across the shallows to the west. Elevated levels of lead were detected in the ship channel sample stations UCR1-17-SD and UCR1-13-SD (not shown on Figure 9-8 but on the west side of Coon Island) adjacent to this shallow lake area.

Subsurface Sediment

Copper was detected in the surface at stations UCR2030, UCR1-15-SD, UCR1-23-SD, and UCR1-32-SD. Copper concentrations either decreased or remained relatively the same with increasing depth (Figure 9-8). At station UCR2030, copper concentrations decreased substantially with depth.

At station UCR1-32-SD, BEHP was detected in the subsurface with concentrations increasing slightly in the 10 to 20-cm depth interval. It was not detected at the 20 to 30-cm interval.

At station UCR2030, 2,3,7,8-TCDD TEQ was analyzed in the subsurface. Concentrations decreased from 43 pg/g in the surface sediment to 3 pg/g in the 20 to 30-cm depth interval.

Surface Water

Copper was detected in surface water samples collected in the shallow lake energy system in Upper Calcasieu. Exhibit 9-31 presents the total and dissolved (if detected) concentrations of these contaminants and compares them to EPA AWQC (Ambient Water Quality Regulations; Fed. Reg. 1995) CCC (chronic) and CMC (acute) values and/or LDEQ Water Quality Regulation (LDEQ 2000) for both freshwater and marine environments. For systems with salinity between 1 and 10 ppt, the more stringent of either fresh or marine values should be used to compare with mean dissolved concentrations. In cases where the dissolved phase was not detected, the surface water criteria for that contaminant was converted to unfiltered criteria using a conversion factor provided in LDEQ 2000.

Exhibit 9-31 Mean and Standard Deviation of Total and Dissolved Concentrations in Dioxin/Furan/Metal Factor in Surface Water, Shallow Lake Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Copper (mg/L)	0.00775 (0.0021)	0.00635 (0.0002)	0.035[3]	0.022[3]	**0.00363**	**0.00363**
BEHP (µg/L)	1[2]	-	400[4]	360[4]	400[4]	360[4]

1 – Based on ROS. See Appendix F. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected in one sample.
3 – LDEQ Water Quality Regulations based on 200-mg/L hardness for dissolved concentrations.
4 – AWQC: Federal Reg. May 1995

Average dissolved copper concentrations exceeded both the marine acute and chronic criterion. Both locations where it was detected (UCR2014 and UCR2015) exceeded criterion set by LDEQ.

9.8.2.1.2 Discussion

The Dioxin/Furan Metals Factor surface sediments from the shallow lake energy system tend to be highest in the West Slip of Clooney Island Loop and the eastern portion of Coon Island Loop. The primary contaminants in Clooney Island Loop include various HPAHs, copper, dioxin/furans, and Aroclor 1254. The concentrations are higher in the West Slip than the remaining shallow lake areas. The suite of contaminants is also larger in the West Slip.

Coon Island Loop primary contaminants are low-level metals, specifically copper and lead, noted throughout the shallow lake area. Limited various low level HPAHs were also detected.

Distribution of the highest concentration of HPAHs was found in Clooney Island Loop from the West Slip area to the Conoco Dock area (sample location UCR2026). The concentrations decrease at that point, but the extent of HPAH in surface sediments continues into the ship channel to the area between Coon Island Loop and Contraband Bayou (Section 9.8.3). This distribution appears to be due to the physical transport and settling of adsorbed particulate matter. Concentrations decreased significantly with depth in all impacted areas. Subsurface sample values were an order of magnitude lower than the surface sediment mean concentration.

Historic data indicates that the distribution of PAHs was highest in the Coon Island Loop shallow lake area. The maximum PAH concentration (63,539 μg/Kg) was found during the 1993 study 560 m north of Lyondell outfall 003. Historic PAH results were higher than surface sediment results from the RI.

Copper was detected at a maximum of 53.84 mg/Kg, as identified in the 1987 study. Historic copper results are lower than the RI findings.

9.8.2.2 PAH Factor

This section describes the nature and extent of the PAH factor in the shallow lake energy system in Upper Calcasieu.

9.8.2.2.1 Results

The PAH factor groups several PAHs of high- and low-molecular weight as well as the metals barium and lead. Important physical characteristics were grouped in this factor and include sand and silt where silt is inversely correlated to the contaminants.

Exhibits 9-32 and 9-33 present the summary statistics for compounds presented in this factor.

Exhibit 9-32 Summary Statistics for PAHs (μg/Kg) in the PAH Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Benzo(a)anthracene	10/39	70.2	1,100	148	262	1.77
Phenanthrene	9/39	62.1	820	105	172	1.65
Benzo(a)pyrene	11/40	74.8	1,300	135	267	1.98
Indeno(1,2,3-cd)pyrene	7/39	68.3	317	-	-	-
Anthracene	6/37	68	550	-	-	-
Benzo(g,h,i)perylene	7/38	66.2	1,100	-	-	-
Benzo(b)fluoranthene	12/41	74.6	3,309	231	636	2.76
1,2-benzphenanthracene	13/39	82.3	2,500	346	588	1.70

1 – Values based on ROS. See Appendix F.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 9-33 Summary Statistics for Metals (mg/Kg) in the PAH Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Barium	36/37	24.8	6,800	148	262	1.77
Lead	44/44	4.6	100	29.7	19.0	0.64

1 – Values based on ROS. See Appendix F.

1,2-Benzphenanthracene was used as the indicator variable for this factor.

Surface Sediment

Elevated concentrations are primarily located in the shallow area to the east of Coon Island Loop (Figure 9-9). Concentrations are variable, with the highest concentrations located at station UCR1-23-SD, which is located approximately 1,500 m to the south of the mouth of Bayou Verdine.

In the West Slip, adjacent to Clooney Island Loop, PAHs were detected but at concentrations lower than what was observed around Coon Island. Highest observed concentrations were located near Lyondell/Olin outfall 008.

In Lake Charles, three samples were observed to have elevated PAH concentrations. Stations UCR2027 and UCST003 were observed to have similar PAH concentrations as the West Slip.

Subsurface Sediment

HPAHs were detected in the subsurface at stations UCR1-23-SD and UCR1-32-SD (Figure 9-9). At station UCR1-23-SD, HPAHs decrease with depth, whereas HPAHs increase with depth at UCR1-32-SD. At station UCR1-32-SD, HPAHs increase from 2,700 µg/Kg in surface sediment to 5,090 in the 10 to 20-cm interval to 12,530 in the 20 to 30-cm interval.

LPAHs were only detected at station UCR1-32-SD, where concentrations increased with depth. LPAHs were undetected in the surface sediment, however concentrations increased to 2,240 µg/Kg in the 10 to 20-cm interval and then to 9,320 µg/Kg in the 20 to 30-cm interval.

Surface Water

Total lead was detected at one location in the shallow lake energy system at station UCR2020 (0.0250 mg/L). Concentrations did not exceed LDEQ criterion.

9.8.2.2.2 Discussion

Detections in the PAH Factor are primarily found in the shallow area east of Coon Island. The highest concentrations in this area are significantly less than the concentrations measured in UST028, at the mouth of Bayou Verdine. The distribution

is varied and may indicate either moderate localized sediment transport or variation in salinity conditions when the PAHs entered the area, resulting in varied distance that the compounds traversed (maximum detection was 1500 m from the mouth of Bayou Verdine) before salting-out.

The vertical distribution of HPAHs in UCR1-32-SD (location is approximately 825 m from the mouth of Bayou Verdine) may indicate that more contaminants were entering the shallow eastern side of Coon Loop or salinity was lower in the area, allowing further migration of contaminants before sufficient salinity led to salting-out.

Concentrations observed in Clooney Island Loop are low, and distribution appears to be associated with Lyondell outfall 008. Distribution of lead in Clooney Island Loop is widespread; however, the concentrations are generally low.

9.8.2.3 Furan/PAH Factor

This section describes the nature and extent of the Furan/PAH factor in the shallow lake energy system in Upper Calcasieu.

9.8.2.3.1 Results

The Furan/PAH Factor groups furans, a dioxin, and two PAHs into a factor in the shallow lake energy system. This factor includes the penta-dioxin/furans as well as tetra-furans. Exhibits 9-34 and 9-35 present the summary statistics for these contaminants.

Exhibit 9-34 Summary Statistics for Dioxin/Furans (ρg/g) in the Furan/PAH Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total TCDF	8/8	0.82	182	57.1	64.0	1.12
Total PeCDF	7/8	18	307	66.0	131	1.98
Total PeCDD	7/8	7	97	38.7	36.7	0.95

1 – Values based on ROS. See Appendix F.

Exhibit 9-35 Summary Statistics for PAHs (µg/Kg) in the Furan/PAH Factor for the Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Pyrene	19/41	45	3,600	469	903	1.93
Fluoranthene	14/40	51	1,200	218	321	1.47

1 – Values based on ROS. See Appendix F.

Pyrene was the indicator variable for this factor.

Surface Sediment

Figure 9-10 depicts the extent of contaminants grouped in the Furan/PAH Factor. Highest concentrations are located in the shallow area to the east of Coon Island. Samples with the highest concentrations were UCR1032, UCR1-23-SD, and UCR1-20-SD. The maximum concentration observed was at station UCR1032, which is approximately 825 m south of Bayou Verdine.

Elevated concentrations were also observed in West Slip. Concentrations were highest near where the West Slip joins the Calcasieu River Ship Channel and decreases to the west. Highest concentration in this area was observed at UCST012, which is located approximately 50 m to the east from Lyondell outfall 008.

UCR2027 and UCST003 in Lake Charles were also observed to have elevated concentrations. However, most of the samples were not detected due to high detection limits.

Subsurface Sediment

Dioxin/furans and PAHs in the subsurface were discussed as 2,3,7,8-TCDD TEQ in Section 9.8.2.2

Surface Water

PAHs were not detected in the surface water for the shallow lake energy system. Dioxin/furans in surface water were not analyzed.

9.8.2.3.2 Discussion

Distribution of the Furan/PAH Factor compounds is similar to that noted for the PAHs in Section 9.8.2.2 – PAH Factor, however the extent of pyrene and fluoranthene does not extend as far into eastern Coon Island Loop as the 1,2-BPA and associated compounds. The furan compounds discussed in this section are detected at fewer locations but show a similar distribution as fluoranthene. The difference in distribution may be due to slightly higher water solubilities, lower K_{oc} and Log K_{ow} for these two compounds when compared to benzo(a)anthracene and others from the PAH factor group of compounds.

Vertical distribution of the 2,3,7,8-TCDD TEQ is limited primarily to the surface (0 to 10-cm) interval. Only one sample was available for a dioxin/furan vertical profile, the extent of this distribution is unknown, however at station UCR2030 TCDD TEQ concentrations decreased near non-detect.

The results indicate that the dioxin/furan distribution is limited vertically and that deposition to the shallow lake portion of Upper Calcasieu has been recent.

9.9 Nature and Extent for the Ship Channel Energy System

The ship channel energy system consists of the un-dredged portions of the ship channel from the I-210 Bridge upstream through the western portion of Coon Island Loop (to the turning basin), the Clooney Island Loop, and up to the mouth of Lake Charles. Data results and discussion are organized into three sections: COPCs identified for the ship channel energy system (Section 9.9.1), the results of the PCA (Section 9.9.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 9.9.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix F provides details of the PCA and complete summary statistics for all compounds detected in the ship channel energy system in Upper Calcasieu.

9.9.1 COPCs for the Ship Channel Energy System in Upper Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. The energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 9.9.1.1 presents the results of the statistical comparison of these COPCs between the ship channel energy system and reference area. Section 9.9.1.2 presents the ship channel energy system COPCs identified.

9.9.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 9-5 and Appendix F. Contaminants that were determined to be statistically significant different than the reference area or that did not have sufficient data to compare are inorganics (arsenic, copper, and lead).

Lead and copper concentrations were higher than the reference area. Arsenic was not higher and will not be discussed further.

9.9.1.2 Ship Channel Energy System COPC Selection

Energy system specific COPCs for Upper Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and were determined to be statistically significant different than reference area conditions (Table 9-10). In addition, contaminants are only discussed if they were observed in at least two locations or more than 5 percent of the samples for the energy system. The following COPCs were selected for the ship channel energy system in Upper Calcasieu:

- HPAHs and LPAHs

- Inorganics (copper and lead)

The nature and extent, as well as the fate and transport of these COPCs will be discussed in Sections 9.9.2 (PCA) and 9.9.3 (Isolated Chemistry).

9.9.2 Ship Channel Energy System PCA

The PCA revealed four dominant factors that accounted for most of the variability (76 percent) in surface sediment within the ship channel energy system in Upper Calcasieu. These factors are:

- A medium- to high-level contamination PAH Factor that accounts for 33 percent of the variability in surface sediment. This factor groups predominantly HPAHs and two LPAHs.
- A Background Metal Factor that accounts for 17 percent of the variability in surface sediment.
- An SVOC/Metal Factor that accounts for 12 percent of the variability in surface sediment. This factor includes lead.
- A low-level contamination Metal Factor that accounts for 14 percent of the variability in surface sediment. This factor includes copper.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

9.9.2.1 PAH Factor

This section describes the nature and extent of the COPCs grouped within the PAH Factor.

9.9.2.1.1 Results

This factor is composed primarily of PAHs but also includes zinc and chromium as well as important constituents such as clay and silt, which control fate and mobility of other contaminants. Aroclor 1260 was grouped within this factor, possibly due to correlation with clay and silt content. Exhibits 9-36 and 9-37 present the summary statistics for the constituents grouped within this factor.

Exhibit 9-36 Summary Statistics for PAHs (µg/Kg) in the PAH Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Fluoranthene	21/47	43.8	50,100	1,342	10,151	7.56
Pyrene	23/47	57	189,000	4,330	40,376	9.32
Phenanthrene	14/46	51.5	12,700	413.2	2,479	6.0
1,2-benzphenanthracene	18/47	54	279,000	6,096	60,292	9.89
Benzo(a)anthracene	16/46	66.1	109,000	2,479	23,733	9.57
Benzo(k)fluoranthene	13/45	38.8	9,090	266.2	1,914	7.19
Benzo(b)fluoranthene	16/47	44.7	82,200	1,863	17,656	9.48
Benzo(a)pyrene	16/47	35.1	83,500	1,874	17,953	9.58
Benzo(g,h,I)perylene	14/45	46.2	21,200	570.4	4,534	7.95
Anthracene	9/44	26.6	9,530	264.5	2,043	7.73

1 – Values based on ROS. See Appendix F.

Exhibit 9-37 Summary Statistics for Metals and PCBs in the PAH Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Zinc (mg/Kg)	31/51	10.4	131	29.2	27.4	0.94
Chromium (mg/Kg)	39/39	1.5	28.5	9.1	5.8	0.64
Aroclor 1260 (µg/Kg)	4/51	38	230	-	-	-

1 – Values based on ROS. See Appendix F.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Pyrene was used as the indicator variable for this factor.

Surface Sediment

The high coefficient of variation indicates a high variability in sediment concentrations with isolated areas high in concentration. There are two locations along the ship channel that exhibit high concentrations of contaminants grouped in this factor. These areas include along the north side of Clooney Island Loop and the north side of Calcasieu River near the confluence of Bayou Verdine (Figure 9-11). Maximum concentrations for PAHs and zinc were observed at station UCST028 (near the confluence of Bayou Verdine and Coon Island Loop), east of the PPG North Docks. Several sources are possible including various activities associated with discharges from Bayou Verdine and product storage and distribution activities associated with the PPG dock Approximately 150 m downstream from the North Docks; elevated concentrations of PAHs were also observed at station UCR1-34-SD. Concentrations were found to decrease by an order of magnitude at station UCR1-34-SD and were not detected at sample station UCR1-16-SD and UCST005. This pattern indicates rapid salting-out of these PAHs and very little secondary transport from the UCST028 area.

In Clooney Island Loop, PAHs in the surface sediment are primarily near station UCR2026, which is located adjacent to Conoco Docks. Elevated concentrations were also observed at UCR2038, located near the discharge point of Lyondell/Olin outfall 019.

Low level PAH contamination was observed between the West Slip and UCR2038, to the south of station UCR2026, between Clooney Island Loop and Lake Charles, and slightly upstream of Coon Island between Coon Island and Contraband Bayou (Figure 9-11). The source of these areas appears to be Clooney Island Loop, and the distribution of contaminants represents transport of sediment particles. These areas have minor PAH contamination, at significantly lower levels than the West Slip or North Dock area.

Subsurface Sediment

Subsurface samples were collected at stations UCR2026, UCR1-13-SD, UCR1-17-SD, and UCR1-34-SD. COPCs of interest were not detected in the subsurface at UCR2026.

Aroclor 1260 was detected in the subsurface at both the 10 to 20- and 20 to 30-cm interval at station UCR1-17-SD. Concentrations slightly increased from 73 to 83 µg/Kg.

At station UCR1-13-SD, 1,2-benzphenanthrene and pyrene were detected at the 10 to 20-cm sediment layer at concentrations of 410 and 470 µg/Kg, respectively. These contaminants were not detected in the surface sediment samples. Aroclor 1260 was detected in the subsurface at UCR1-13-SD, as well. Concentrations increase from 38 to 69 µg/Kg from the surface to the 10 to 20-cm interval. Aroclor 1260 concentrations decreased to 45 µg/Kg in the 20 to 30-cm interval. Stations UCR1-17-SD and UCR1-13-SD are located on the eastern side of the Coon Island Loop ship channel, and likely have higher TOC concentrations and fine grained material, leading to accumulation of Aroclors in the past. Possible sources are most likely local air or water discharges due to compound affinity to bind to soils.

Several PAHs were detected in the subsurface at station UCR1-34-SD (Figure 9-11). Most PAHs either were consistent or increased with depth. Notably, phenanthrene and pyrene increased significantly with depth.

Surface Water

PAHs were not detected in the surface water in the ship channel energy system in Upper Calcasieu.

9.9.2.1.2 Discussion

Elevated PAHs were detected in the ship channel along the north side of Clooney Island Loop and near the confluence of Coon Island Loop and Bayou Verdine east of the PPG North Dock area. The elevated PAHs extended along Coon Island Loop some 150 m downstream on the west side of Coon Island where concentrations began

to dissipate. Subsurface concentrations of several LPAHs and HPAHs increased significantly with depth in this area.

PAH concentrations in Clooney Island Loop were highest near the Conoco Docks. This is consistent with product storage and distribution activities associated with the site as well as the site release history. Elevated concentrations at the Lyondell/ARCO outfall 019 may indicate either repeated small quantity releases or impacted sediment accumulation in this area, as available data does not indicate major release through this outfall.

Low level concentrations between the West Slip and UCR2038 location to the south of location UC2026, the area between Clooney Island Loop and Lake Charles and upstream of Coon Island between Coon Island Loop and Contraband Bayou are indicative of adsorbed particle transport. The distribution patterns are consistent with above discussed PAH release areas and subsequent surge driven sediment transport.

Historic data indicates significant concentrations of PAHs in the northeast portion of Coon Island Loop (1,052,308 µg/Kg detected 90 m south of PPG outfall 003 in the 1994 study). Extent of PAH contamination is consistent with the RI findings, PAH concentrations tend to decrease significantly midway to the main ship channel.

Available information indicates that the PAHs entering the upper portion of Coon Island Loop readily salt out upon contact with waters of the Loop. The data suggests that the HPAHs are generally immobile, with LPAHs having slightly greater lateral distribution.

9.9.2.2 Background Metal Factor

This section summarizes the constituents found in the ship channel energy system that are at background concentrations.

9.9.2.2.1 Results

This factor groups several metals and TOC. Since COPCs are not grouped in this factor, only summary statistics are presented (Exhibit 9-38).

Exhibit 9-38 Summary Statistics for Metals in the Background Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Potassium	34/39	325	2,550	927.5	488.7	0.53
Beryllium	21/39	0.09	1.1	0.35	0.31	0.89
Aluminum	37/37	670	13,100	5,822	3,113	0.53
Vanadium	37/39	2.5	20.9	10.4	5.0	0.48
Sodium	39/39	1,730	11,500	4,691	2,472	0.53
Iron	30/39	613	15,200	4,536	3,382	0.75
Cobalt	22/39	1	8	2.33	1.81	0.78

1 – Values based on ROS. See Appendix F.

9.9.2.3 SVOC/Metal Factor

This section presents the constituents grouped in the SVOC/Metal factor.

9.9.2.3.1 Results

This factor groups BEHP and lead together and shows a negative correlation to sand. Exhibit 9-39 presents the summary statistics for BEHP and lead.

Exhibit 9-39 Summary Statistics for SVOCs/Metal Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
BEHP (µg/Kg)	8/15	83	29,000	-	-	-
Lead (mg/Kg)	50/51	2.3	297	25.6	52.4	2.04

1 – Values based on ROS. See Appendix F.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Lead was used as an indicator variable.

Surface Sediment

Elevated concentrations are primarily located around Coon Island (Figure 9-12). Elevated concentrations of lead were observed where Bayou Verdine drains into the Calcasieu River. Elevated concentrations of both lead and BEHP were observed on the southwest side of Coon Island. The maximum concentration for BEHP was observed at station UCR1-08-SD, which is located on the west side of the dredged river and adjacent to Lockport Marsh. The maximum concentration of lead was observed at station UCR1-17-SD with station UCR1-13-SD, approximately 225 m downstream, having a measured value of 195 mg/Kg.

Subsurface Sediment

In the subsurface, BEHP and lead both increased with depth (Figure 9-12). At stations UCR2026, which is located in the Clooney Island Loop near the Conoco Docks, BEHP was not detected at the surface and had an observed value of 75,000 µg/Kg in the 20 to 30-cm interval. At station UCR1-34-SD, which is located downstream of PPG Docks near the confluence of Bayou Verdine, BEHP increased from 12,000 to 75,000 µg/Kg.

Lead also increased in the subsurface at stations UCR1-13-SD and UCR1-34-SD (Figure 9-12). Observed concentrations at UCR1-13-SD were higher in the subsurface than what was observed in surface sediment, with concentrations ranging from 195 to 354 mg/Kg.

Surface Water

Lead was detected in the surface water at two locations (UCR1001 and UCR2017), and BEHP was detected at one location (UCR2017). Total lead concentrations ranged from 0.0018 to 0.009 mg/L, and dissolved lead concentrations ranged from 0.007 to 0.0084 mg/L. BEHP had an observed concentration of 2 µg/L.

9.9.2.3.2 Discussion

Lead and BEHP are the primary COPCs in this factor and are primarily detected at Coon Island Loop. Concentrations were highest in the southwest corner of Coon Island Loop across from Lockport Marsh (stations UCR1-13-SD and UCR1-17-SD). Lead may be attributed to oil and gas industry activities on Coon Island.

BEHP was found to be highest in the subsurface sediment near the Conoco Docks and downstream of the PPG North Dock area, near the confluence of Bayou Verdine and Coon Island Loop. Their presence indicates former releases, which have remained in place long enough for sedimentation to cover them.

Very low concentrations of both lead and BEHP were detected in surface water. This indicates possible sources nearby, as both compounds are highly sorptive. Lead may form more soluble compounds in saline water, which may account for its presence. BEHP may sorb to suspended particulate matter, and this suspended material may be the source of BEHP in the UCR2017 surface water sample.

Historic data for lead is generally consistent in terms of distribution and concentration with the RI data. The BEHP distribution was similar; however, concentrations were less.

9.9.2.4 Metal Factor

This section describes the nature and extent and discussion of the fate and transport of COPCs grouped in the Metal Factor.

9.9.2.4.1 Results

This factor groups metals that are at low levels with some comparable to reference area conditions. This factor also includes Aroclor 1254. Summary statistics are provided in Exhibit 9-40.

Exhibit 9-40 Summary Statistics for Metals (mg/Kg) and Aroclor 1254 (µg/Kg) in the Metal Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aroclor 1254	6/51	28	210	-	-	-
Manganese	37/39	5.1	1,250	109.1	243.6	2.23
Calcium	35/39	451	208,000	11,173	41,365	3.51
Magnesium	37/39	567	12,300	2,049	2,184	1.07
Arsenic	39/39	0.32	6.6	2.11	1.35	0.64

Copper	49/51	1.2	379	20.6	67.4	3.26

1 – Values based on ROS. See Appendix F.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Copper was used as the indicator variable for this factor.

Surface Sediment

Elevated concentrations were located along the north side of Clooney Island Loop between Lyondell outfalls 028 and 019 as the well as southwest side of Coon Island (Figure 9-13). The maximum concentration for copper was located at station UCST037. In this area, including across the dredged channel, concentrations ranged from 33.3 to 379 mg/Kg. In the southwestern corner of Coon Island area, copper concentrations ranged from 2.6 to 44 mg/Kg.

Subsurface Sediment

Copper increased in the subsurface at stations UCR1-13-SD and UCR1-34-SD (Figure 9-13). At station UCR1-13-SD, copper increased from 33.7 to 81.1 mg/Kg. At station UCR1-34-SD, copper concentrations increased from 39.9 to 129 mg/Kg.

Surface Water

Copper was detected at the two locations sampled in the ship channel energy system for Upper Calcasieu. Total copper concentrations ranged from 0.0099 to 0.011 mg/L and in the dissolved phase from 0.0069 to 0.007 mg/L.

9.9.2.4.2 Discussion
Copper is the primary COPC in this factor. The remaining metals are either considered background metals or are not significantly elevated. The elevated concentrations were located in the southwestern side of Coon Island Loop and near the Lyondell outfalls 028 and 019 on the north side of Clooney Island. Concentrations increased with depth on Coon Island Loop. Copper was also present in two locations at low levels in surface water. Copper behaves as lead, forming more soluble chloride compounds in saline waters, controlling copper distribution.

Historic data for copper indicates low-level concentrations primarily in the confluence of Coon Island Loop and the main ship channel. Low levels were detected in Clooney Island Loop. All levels were generally lower than the RI results.

9.10 Summary and Conclusions

This section summarizes the COPCs found in Upper Calcasieu and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport.

9.10.1 Summary

Upper Calcasieu is divided into five energy systems: bayou, marsh, river, shallow lake, and ship channel. The energy systems are defined in Section 9.1.2 and Figure 9-1.

Potential Sources to Upper Calcasieu:

Lyondell (formerly ARCO, Olin), Conoco and PPG
Lake Charles POTW

Contraband Bayou represents the bayou system in Upper Calcasieu and is a moderately saline low-flow bayou. It receives effluent from the Lake Charles municipal wastewater treatment facility. Low salinity marsh areas are present in the river above Lake Charles. The shallow lakes areas include Lake Charles, the West Slip of Clooney Island Loop, and the eastern portion of Coon Island Loop; they are confined and shallow low-flow systems, with generally limited circulation. The ship channel includes the main ship channel from the I-210 Bridge to Lake Charles and the slightly smaller limbs of Clooney Island Loop and western Coon Island Loop.

The areas that define the Upper Calcasieu portion of the estuary represent a mixture of land uses and energy systems. The portions of the river above Lake Charles are considerably less saline and are protected somewhat from storm surge and tidal influence, which increase salinities throughout the rest of the estuary. Lake Charles and the natural river segment between Lake Charles and the saltwater barrier experience seasonal salinity shifts, and the installation of the saltwater barrier is evidence of the severity of saltwater intrusion in the region.

Upper Calcasieu in Coon Island Loop and Clooney Island Loop receives surface runoff and wastewater discharge from industrial facilities (Lyondell, Conoco, and PPG), see Figure 9-2. Contraband Bayou receives effluent from the Lake Charles POTW. Additional non-point sources are present throughout. Primary introduction of contaminants to the system appears to occur in Clooney Island Loop and Coon Island Loop.

Contaminants of primary interest in Upper Calcasieu are those contaminants that increase human health or ecological risk. The varied settings of Upper Calcasieu lead to rather isolated occurrence of COPCs; the following is an overview of the five energy systems within Upper Calcasieu.

Contaminants of Potential Concern in Upper Calcasieu:

HPAHs, LPAHs, Dioxin/Furans, Copper and Lead

The largest set of contaminants and generally the highest concentrations are found in the shallow lake portion of Coon Island Loop and the Clooney Island Loop West Slip area. Discharges from Lyondell, Conoco and PPG have impacted these sediments with PAHs, dioxin/furans, and various metals.

9.10.2 Conclusions

The distribution of COPCs in Upper Calcasieu is generally limited to Clooney Island Loop, Coon Island Loop, and the ship channel between them. Evidence of flow

driven transport is noted in the ship channel, with limited constituents noted upstream. The presence of COPCs in the remainder of Upper Calcasieu, e.g., the bayou, river, marsh energy areas, and Lake Charles are minimal. Contaminants in Clooney Island Loop and Coon Island Loop appear to impact the region of Upper Calcasieu from the ship channel at Coon Island Loop up to the confluence with Lake Charles.

COPCs of interest in Clooney Island Loop are PAHs (HPAHs and LPAHs), dioxin/furans, copper, and Aroclor 1254. The highest concentrations are found in the West Slip area through the Conoco Dock area. The primary contaminants in the Coon Island Loop shallow lake area are low-level concentration of metals, noted throughout the shallow lake area. Limited various low-level HPAHs were also noted. It should be noted that HPAH distribution indicates extensive salting out of these contaminants from their entry into Coon Island Loop and the concentrations seen in the adjacent ship channel portion of Coon Island Loop. Historic data indicates that this distribution is consistent for the shallow lake area.

Distribution of the highest concentration of HPAHs is found in Clooney Island Loop from the West Slip area to the Conoco Dock area (sample location UCR2026). The concentrations decrease at UCR2026, but the extent of HPAH contamination in surface sediments continues well into the ship channel.

In general, PAH distribution in Upper Calcasieu sediment tends to concentrate in the shallow lake energy system. HPAH distribution extends to the area between Coon Island Loop and Contraband Bayou. This distribution appears to be due to the physical transport and settling of adsorbed particulate matter that can be attributed to historical oil drilling activities on Coon Island.

A limited number of detections, some with elevated concentrations of BEHP, were noted in the upper Coon Island Loop area near the confluence of Bayou Verdine. Lead detections correlated with these BEHP concentrations and although lead levels were not particularly elevated, they appear to be associated with BEHP deposition.

Potential sources to contamination in Upper Calcasieu are the distribution, storage, and transportation of products and waste in these three industrial areas. The elevated concentrations at the Conoco Docks are consistent with product storage and distribution activities associated with the site as well as the site releases history. Elevated concentrations in the West Slip are reflective of industrial releases from the Olin/Lyondell facility. Detections of contaminants from industrial discharges such as the PPG outfalls 002 through 004, barge spills, and upstream releases are well documented and appear to have contributed to current sediment quality

Low-level concentrations between the West Slip and the confluence of Clooney Island Loop with the main ship channel, the main ship channel between Clooney Island Loop and Lake Charles, and the area between Coon Island Loop and Contraband

Bayou are indicative of adsorbed particle transport. The distribution indicates surge driven sediment transport.

Available information indicates that the PAHs entering the upper portion of Coon Island Loop readily salt out upon contact with waters of the loop. The data suggests that the HPAHs are generally immobile, with LPAHs having a slightly greater lateral distribution.

Overall, contaminants appear to be highest in the West Slip of Clooney Island Loop and the eastern portion of Coon Island Loop. The data indicates that moderate fine or suspended particle transport is occurring in the ship channel portions of Clooney Island Loop and Coon Island Loop in Upper Calcasieu. Distribution and concentration gradients of the COPCs indicate sediment accumulation in the shallow lake portions of Clooney Island Loop and Coon Island Loop. Overall, sediment stability tends to be moderate. It appears that re-suspension of fine grained material (organic or inorganic) facilitates physical transport throughout Upper Calcasieu.

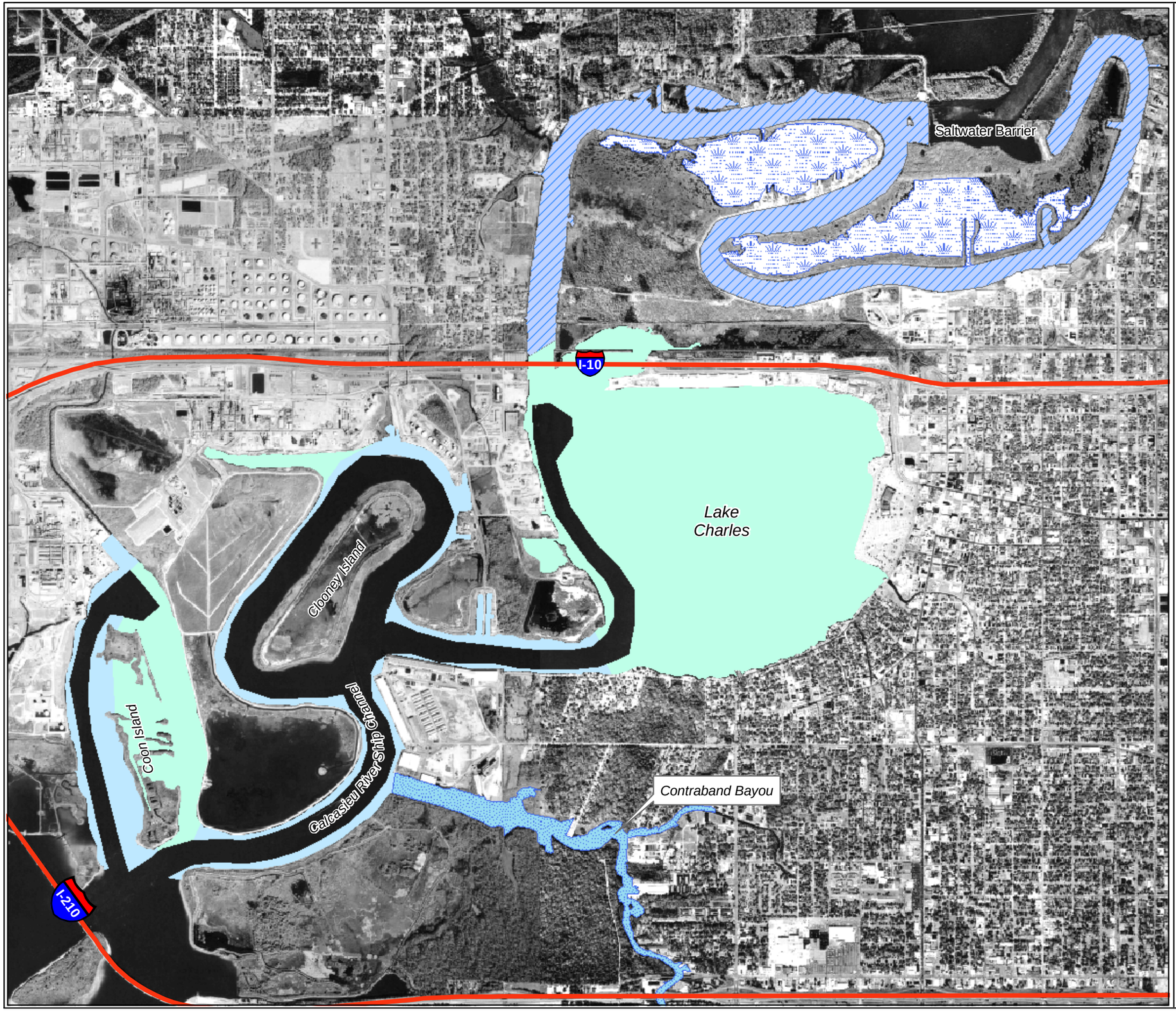

Figure 9-1
Upper Calcasieu Energy Areas and Reaches

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu Area of Concern

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

N
W E
S

Kilometers

0 0.25 0.5 1

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Region 6

Prepared by CDM

Mapfilename: Figure9-1UPCAEnergyAreasReaches-1117size.mxd 9/10/02

Figure 9-2
Upper Calcasieu Industries
and
Current and Historical NPDES Outfalls

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Saltwater Barrier
Calcasieu River
I-10
Lake Charles
Cloorey Island
Coon Island
Calcasieu River Ship Channel
Contraband Bayou
I-210
Facility: Con Outfall No.: 023
Facility: Con Outfall No.: 024
Facility: Con Outfall No.: 025
Facility: Con Outfall No.: 003
Facility: Con Outfall No.: 006
Facility: Con Outfall No.: 005
Facility: Oli Outfall No.: 025
Facility: Lyo Outfall No.: 032
Facility: Lyo Outfall No.: 019
Facility: Lyo Outfall No.: 026
Facility: Oli Outfall No.: 026
Facility: Con Outfall No.: 026
Facility: Con Outfall No.: 049
Facility: Oli Outfall No.: 019
Facility: Lyo Outfall No.: 029
Facility: Oli Outfall No.: 008
Facility: Oli Outfall No.: 020
Facility: Con Outfall No.: 027
Facility: Oli Outfall No.: 016
Facility: Oli Outfall No.: 017
Facility: Oli Outfall No.: 029
Facility: Oli Outfall No.: 022
Facility: Oli Outfall No.: 028
Facility: Con Outfall No.: 022
Facility: PPG Outfall No.: 004
Facility: Oli Outfall No.: 010
Facility: PPG Outfall No.: 003
Facility: PPG Outfall No.: 002
Facility: Oli Outfall No.: 410
Facility: Con Outfall No.: 001
Facility: Oli Outfall No.: 027
Facility: Con Outfall No.: 101
Facility: Oli Outfall No.: 030
Facility: WWTP Outfall No.: 001

Legend

- Interstate
- Upper Calcasieu AOC Boundary

NPDES Outfall Status

- Unknown
- Active
- Inactive

Energy Systems

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Industrial Property

- Arch Chemical
- Condea Vista
- Conoco
- GA Gulf
- Lyondell
- Olin
- PPG
- Tetra

N
W E
S

Kilometers

0 0.25 0.5 1

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Region 6

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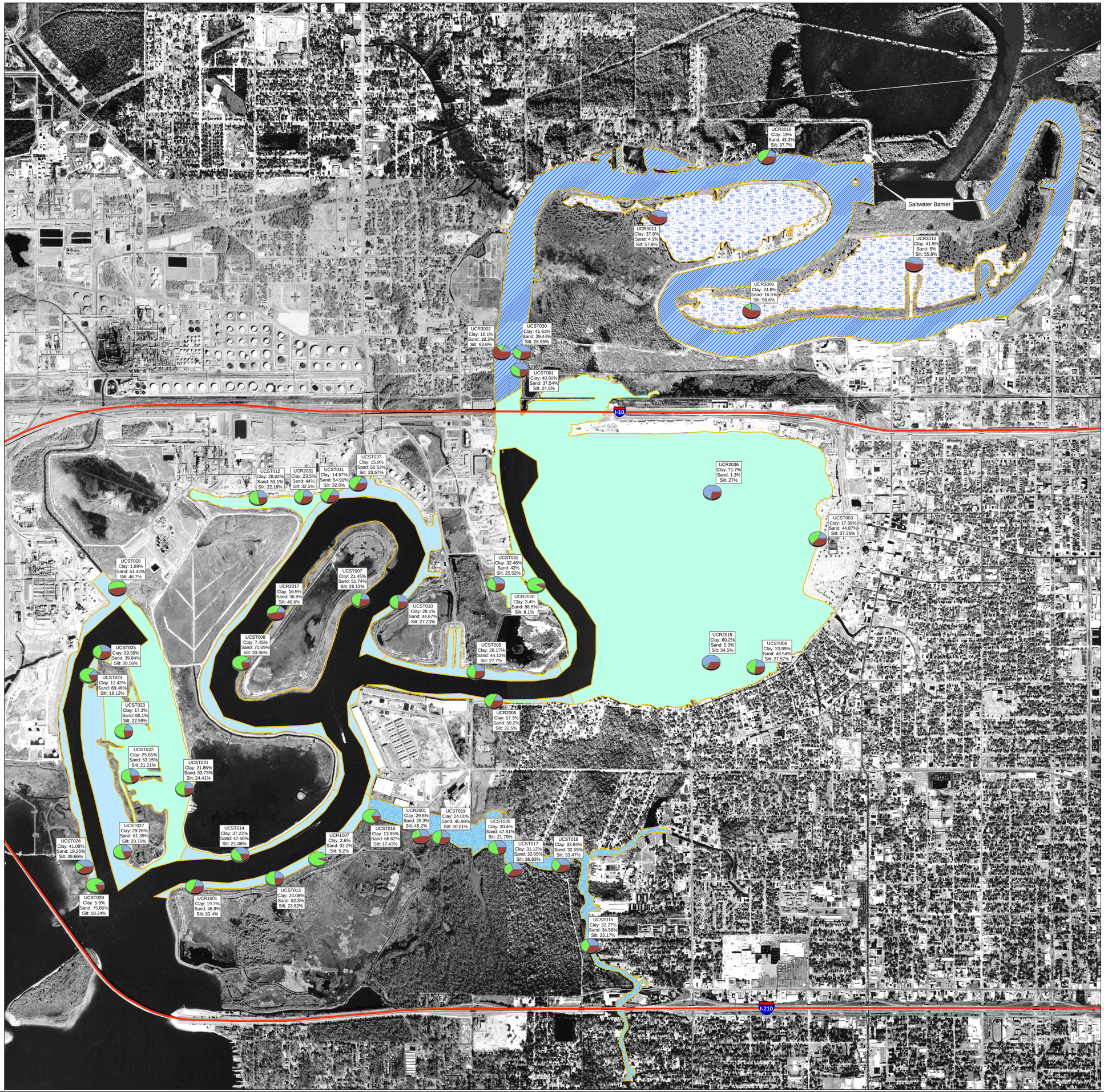
Mapfilename: Figure9-2UPCANPDESOutfalls-1117size.mxd 9/10/02

Figure 9-3
Upper Calcasieu Grain Size Distribution
in Surface Sediment

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

- Percent Clay
- Percent Sand
- Percent Silt

N
W E
S

Kilometers
0 0.25 0.5 1

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Region 6

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Map Filename: Figure9-3UCGrainsizeDistribution-Esize.mxd 09/04/2002

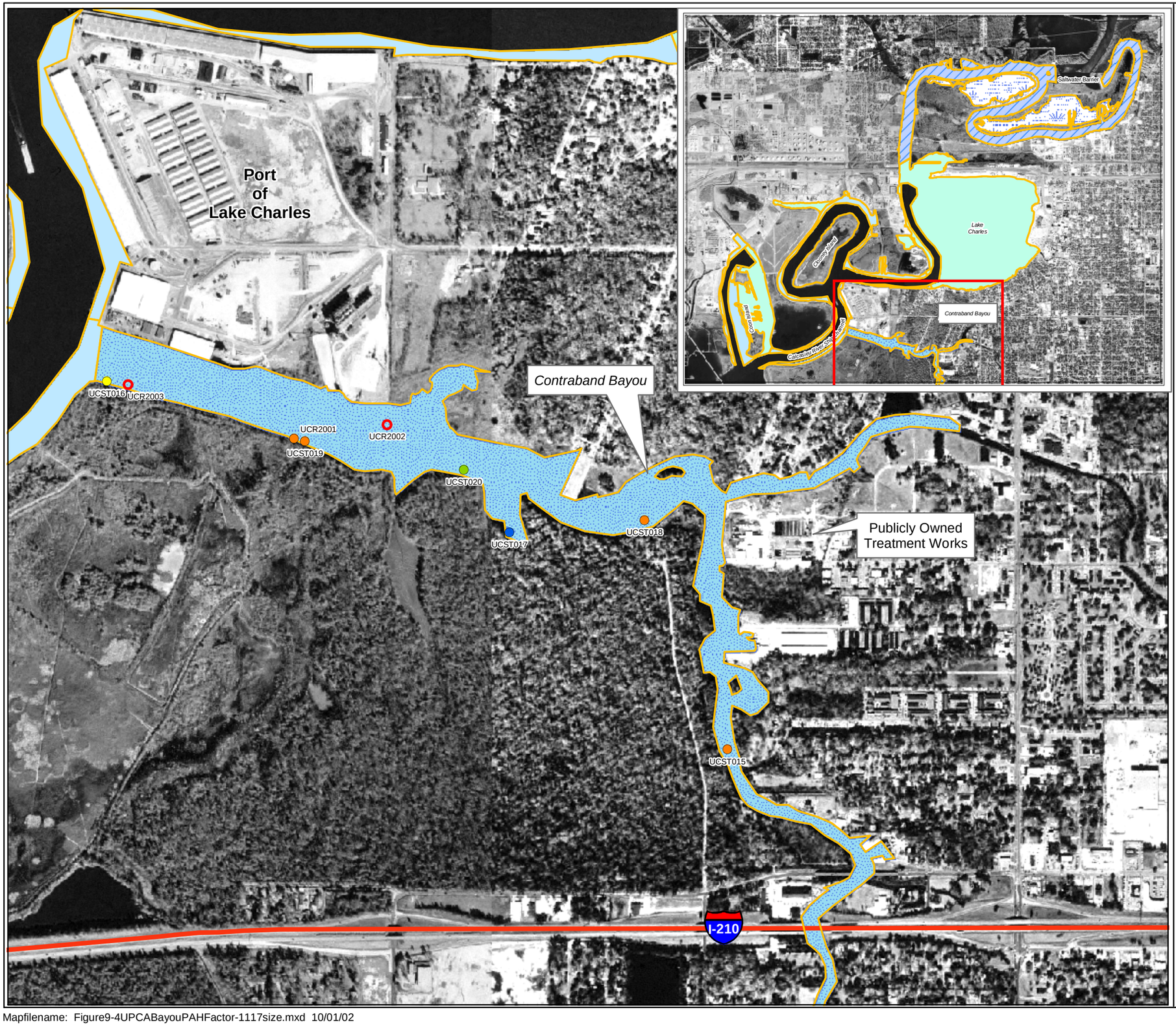

Figure 9-4
PAH Factor
Upper Calcasieu AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Pyrene (ug/kg)

- 80 - 82
- 83 - 108
- 109 - 135
- 136 - 639
- 640 - 870

Pyrene Non-Detects (ug/kg)

- 640 - 870

Pyrene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Benzo(a)anthracene
1,2-Benzphenanthracene
Benzo(b)fluoranthene
Pyrene
Fluoranthene

N
W E
S

Kilometers

0 0.25 0.5

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Region 6

Prepared by CDM

Mapfilename: Figure9-4UPCABayouPAHFactor-1117size.mxd 10/01/02

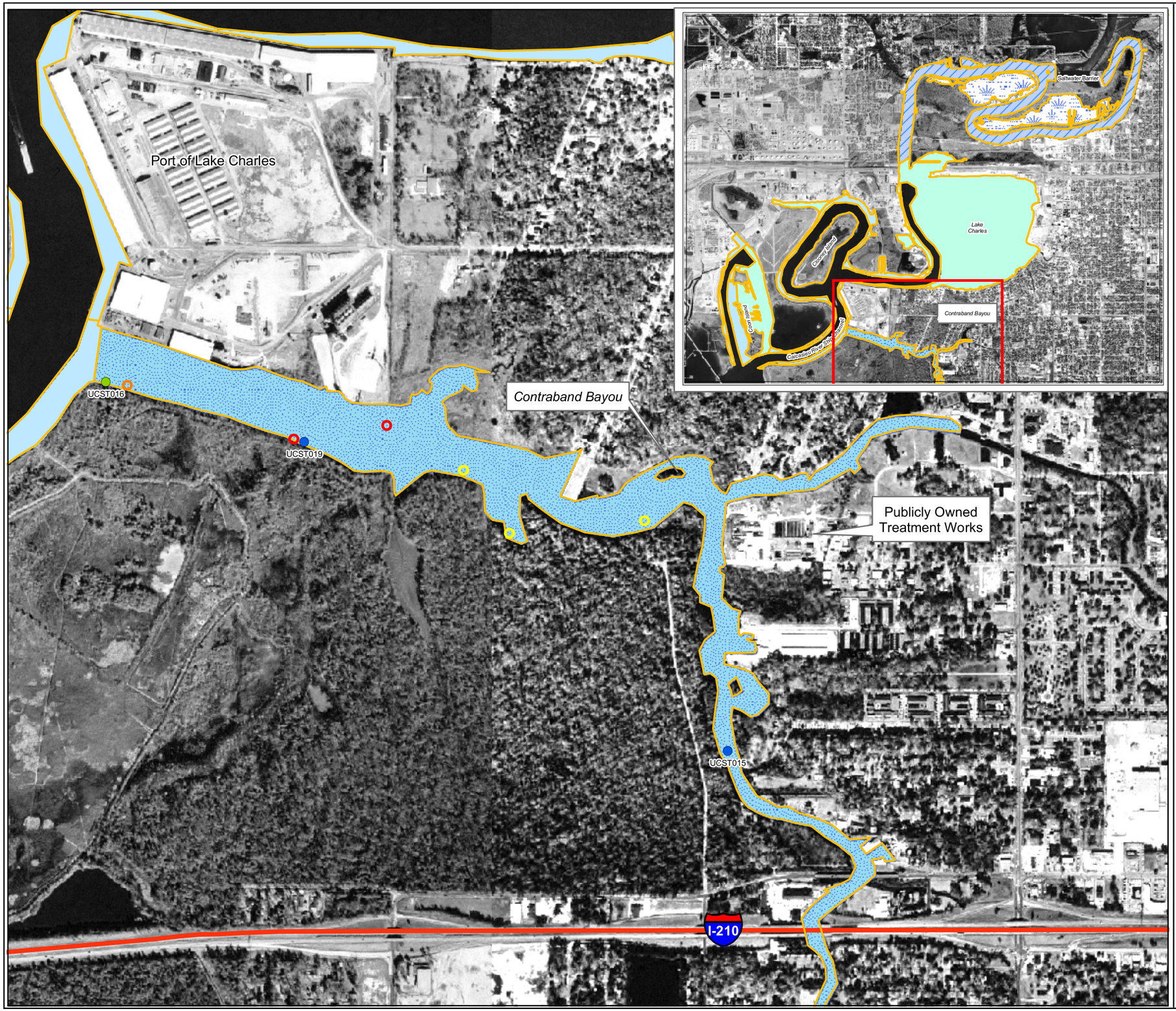

Figure 9-5
Low Molecular Weight PAHs
Upper Calcasieu AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

LPAH (ug/kg)

- 58 - 138
- 139 - 284

LPAH Non-Detects (ug/kg)

- 306 - 582
- 583 - 5120
- 5121 - 6960

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

LPAHs consist of the following:
1-Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

N
W E
S

Kilometers

0 0.25 0.5

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Prepared by CDM

Mapfilename: Figure9-5UPCABayouLPAH-1117size.mxd 10/01/02

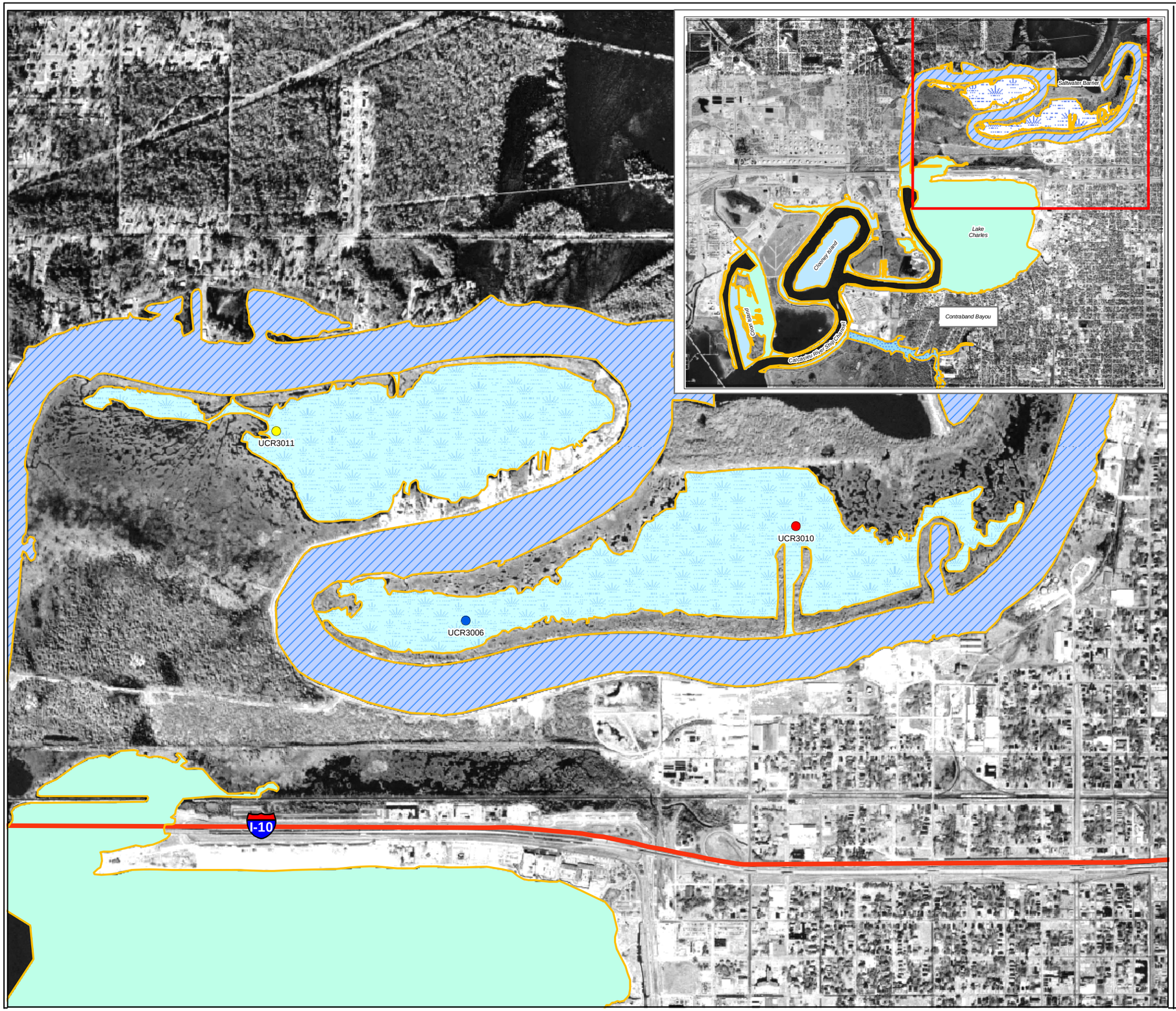

Figure 9-6
Dioxin/Furan Factor
Upper Calcasieu AOC
Marsh Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- River
- Shallow Lake
- Ship Channel
- Marsh

2,3,7,8-TCDD TEQ (pg/g)

- 24 - 25
- 26 - 27
- 28 - 35

Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin/furan compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin/furan compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD. The concentration of dioxin/furans are multiplied by the TEF and then summed to provide the 2,3,7,8-TCDD TEQ result.

2,3,7,8-TCDD TEQ is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total PeCDD
Total HxCDD
Total TCDD
Total HpCDD
Total TCDF
Copper
2,3,7,8-TCDD TEQ

N
W E
S

Kilometers

0 0.25 0.5

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Mapfilename: Figure9-6UPCAMarshTCDD-1117size.mxd 10/01/02

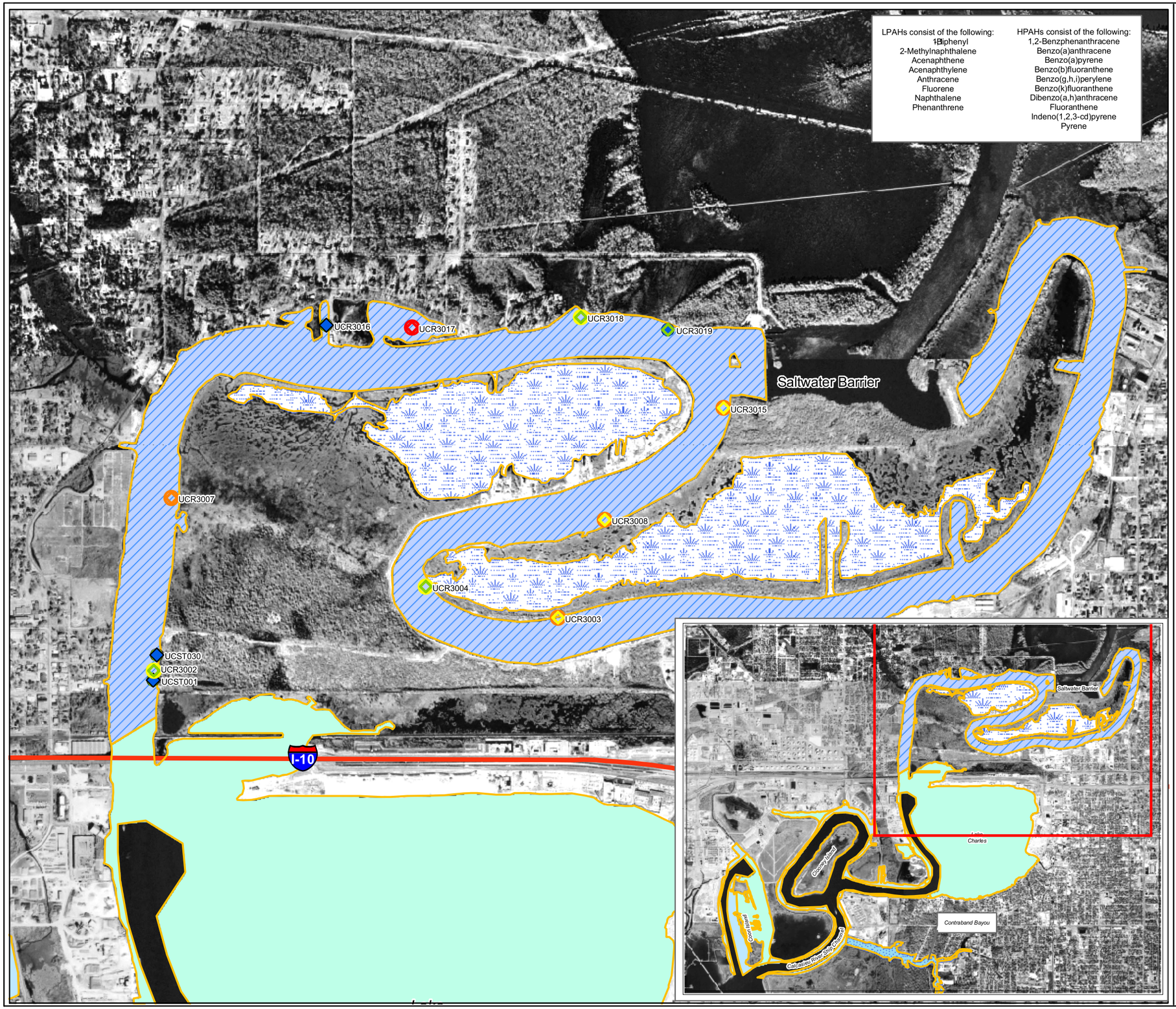

Figure 9-7
High and Low Molecular PAHs
Upper Calcasieu AOC
River Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

LPAHs (ug/kg)

- 158 - 312

LPAH Non-Detects (ug/kg)

- 3600 - 4160
- 4161 - 5040
- 5041 - 5920
- 5921 - 11200

HPAHs (ug/kg)

- 48
- 49 - 2233

HPAH Non-Detects (ug/kg)

- 4700 - 5200
- 5201 - 7400
- 7401 - 14000

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers

0 0.25 0.5

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Region 6

Prepared by CDM

Mapfilename: Figure9-7UPCARiverPAH-1117size.mxd 10/01/02

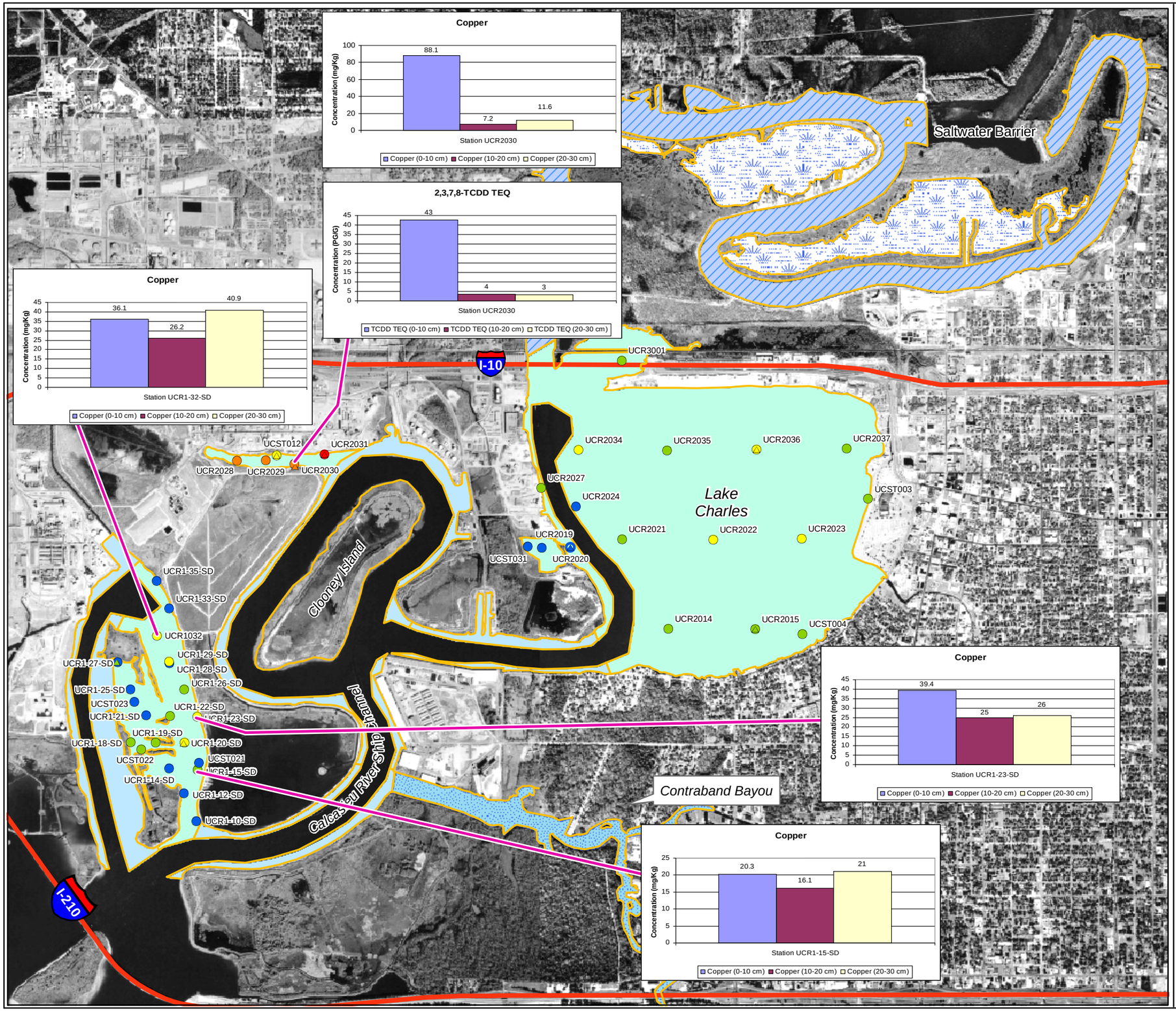

Figure 9-8
Dioxin/Furan/Metal Factor
Upper Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Copper (mg/kg)

- 2 - 13
- 14 - 24
- 25 - 43
- 44 - 88
- 89 - 170

Copper Non-Detects (mg/kg)

- 2-13

2,3,7,8-TCDD TEQ (pg/g)

- 1
- 1 - 8
- 8 - 29
- 29 - 43
- 43 - 62

Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin/furan compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin/furan compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD. The concentration of dioxin/furans are multiplied by the TEF and then summed to provide the 2,3,7,8-TCDD TEQ result.

Copper is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:

Total HpCDF	Zinc	Potassium
OCDD	Copper	Chromium
OCDF	Mercury	Calcium
Total HpCDD	Cobalt	Beryllium
Total TCDD	Manganese	Cadmium
Total HxCDF	Magnesium	Benzo(k)fluoranthene
Total HxCDD	Iron	Bis(2-ethylhexyl)phthalate
	Vanadium	Aroclor 1254

N
W E
S

Kilometers

0 0.25 0.5 1

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Region 6

Prepared by CDM

Mapfilename: Figure9-8UPCALakeCopper-1117size.mxd 10/01/02

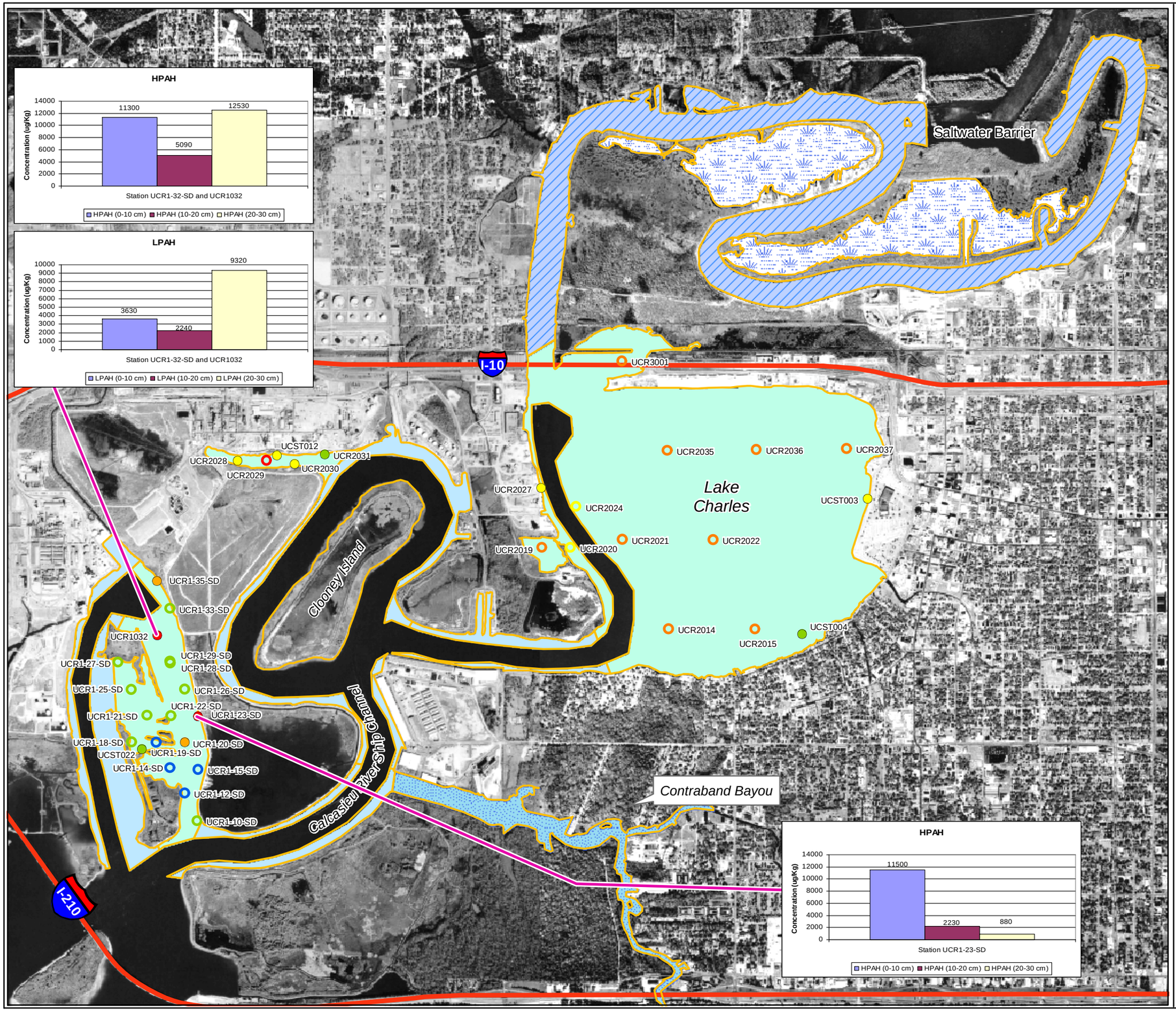

Figure 9-9
PAH Factor
Upper Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

1,2-Benzphenanthracene (ug/kg)

- 82 - 310
- 311 - 530
- 531 - 1200
- 1201 - 2500

1,2-Benzphenanthracene Non-Detects (ug/kg)

- 33 - 81
- 82 - 310
- 311 - 530
- 531 - 1200
- 1201 - 2500

1,2-Benzphenanthracene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Benzo(a)anthracene
Phenanthrene
Benzo(a)pyrene
Indeno(1,2,3)pyrene
Anthracene
benzo(g,h,i)perylene
benzo(f) fluroanthene
1,2-benzphenanthracene
Barium
Lead

N
W E
S

Kilometers
0 0.25 0.5 1

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Mapfilename: Figure9-9UPCALakePAHFactor-1117size.mxd 10/01/02

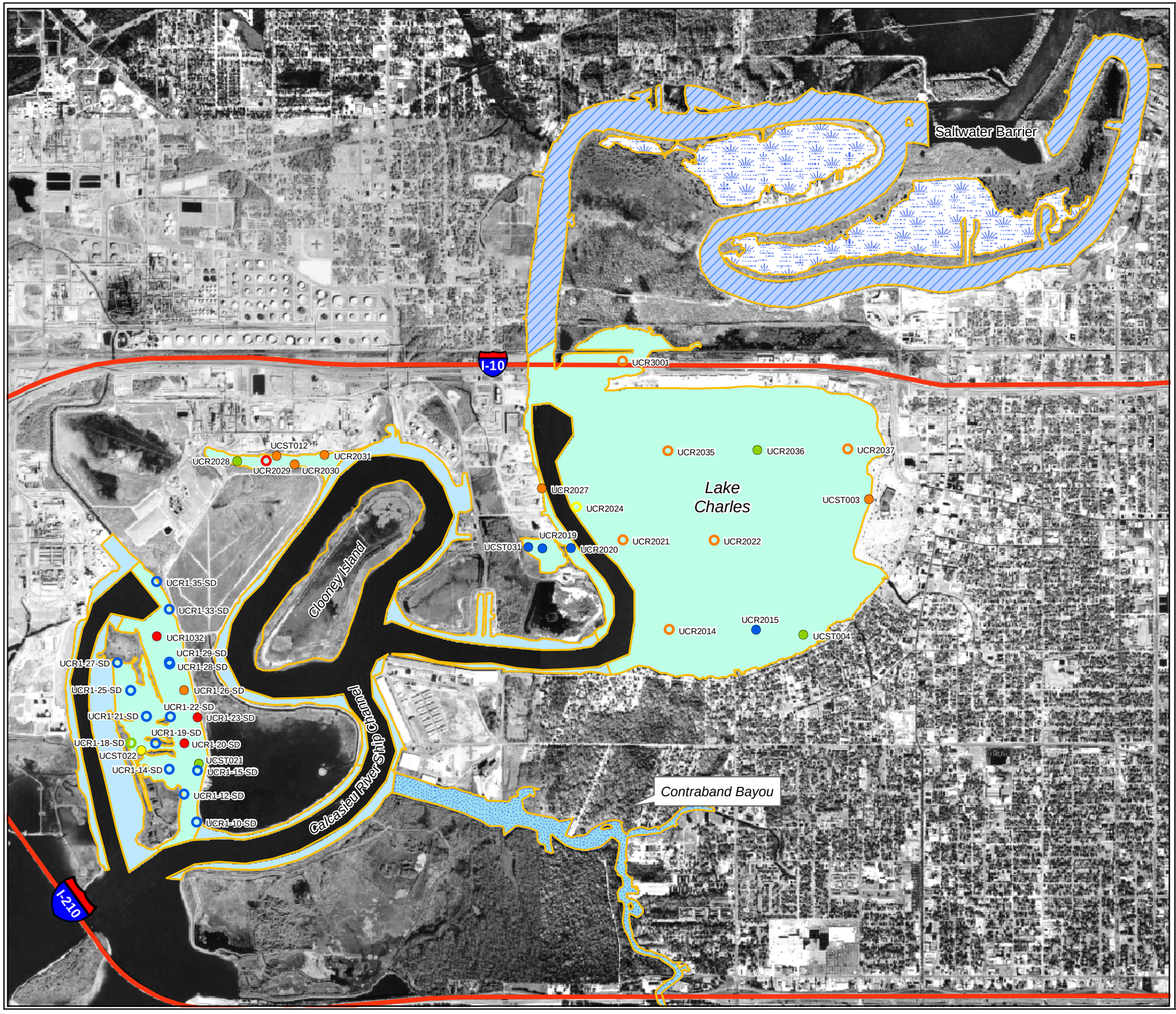

Figure 9-10
Furan/PAH Factor
Upper Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Pyrene (ug/kg)

- 33 - 110
- 111 - 200
- 201 - 433
- 434 - 1500
- 1501 - 3600

Pyrene Non-Detects (ug/kg)

- 33 - 110
- 111 - 200
- 201 - 433
- 434 - 1500
- 1501 - 3600

Pyrene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total TCDF
Total PeCDF
Pyrene
Total PeCDD
Fluoranthene

N
W E
S

Kilometers

0 0.25 0.5 1

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Mapfilename: Figure9-10UPCALakePyrene-1117size.mxd 10/01/02

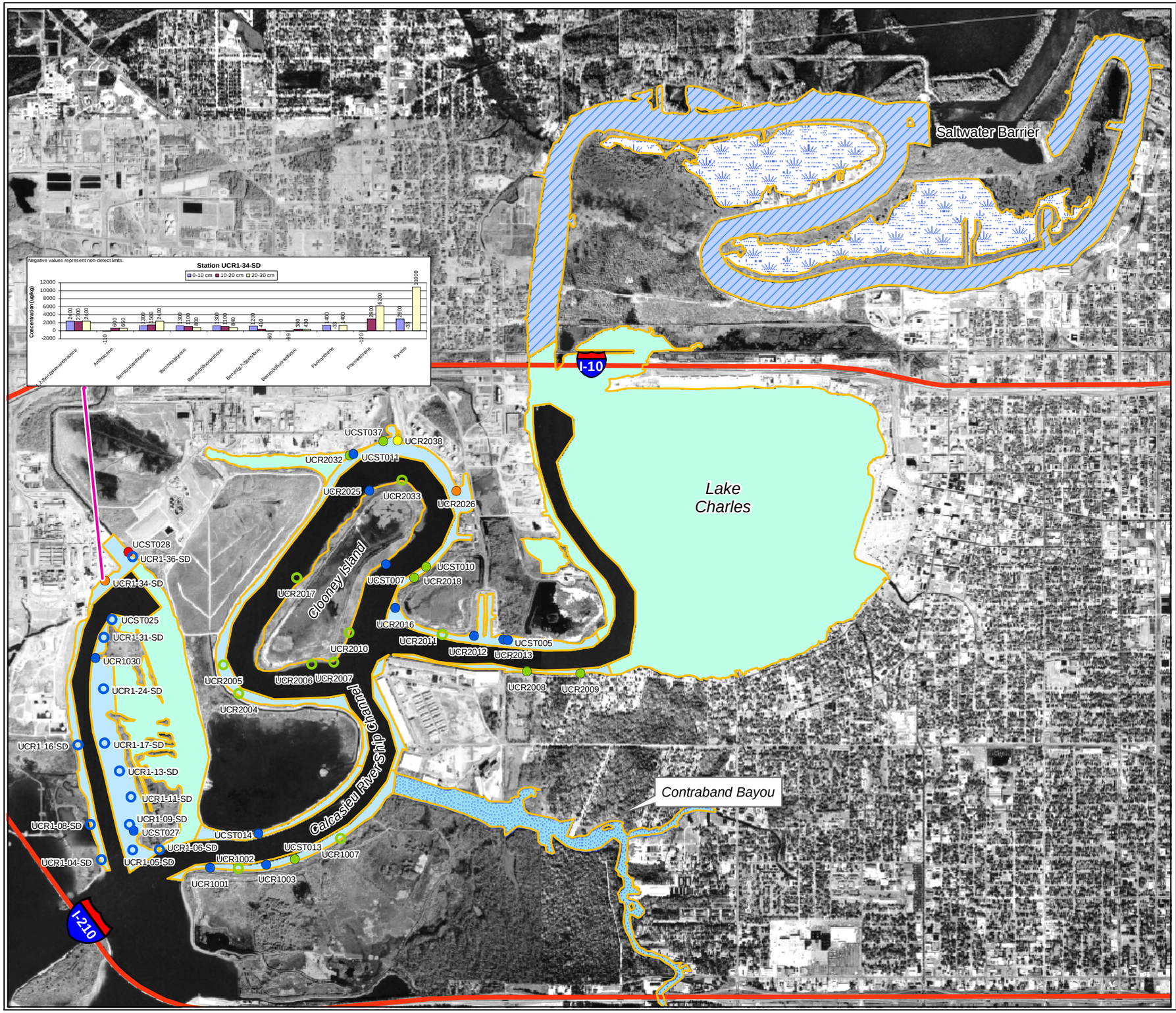

Figure 9-11
PAH Factor
Upper Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Pyrene (ug/kg)

- 33 - 280
- 281 - 1050
- 1051 - 2200
- 2201 - 3600
- 3601 - 189000

Pyrene Non-Detects (ug/kg)

- 33 - 280
- 281 - 1050
- 1051 - 2200
- 2201 - 3600
- 3601 - 189000

Pyrene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.
Contaminants grouped in this factor are:

Fluoranthene	Benzo(a)pyrene
Pyrene	Benzo(g,h,I)perylene
Phenanthrene	Anthracene
1,2-Benzphenanthracene	Zinc
Benzo(a)anthracene	Chromium
Benzo(k)fluoranthene	Aroclor 1260
Benzo(b)fluoranthene	

N
W E
S

Kilometers

0 0.25 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure9-11UPCAShipPAHFactor-1117size.mxd 10/02/02

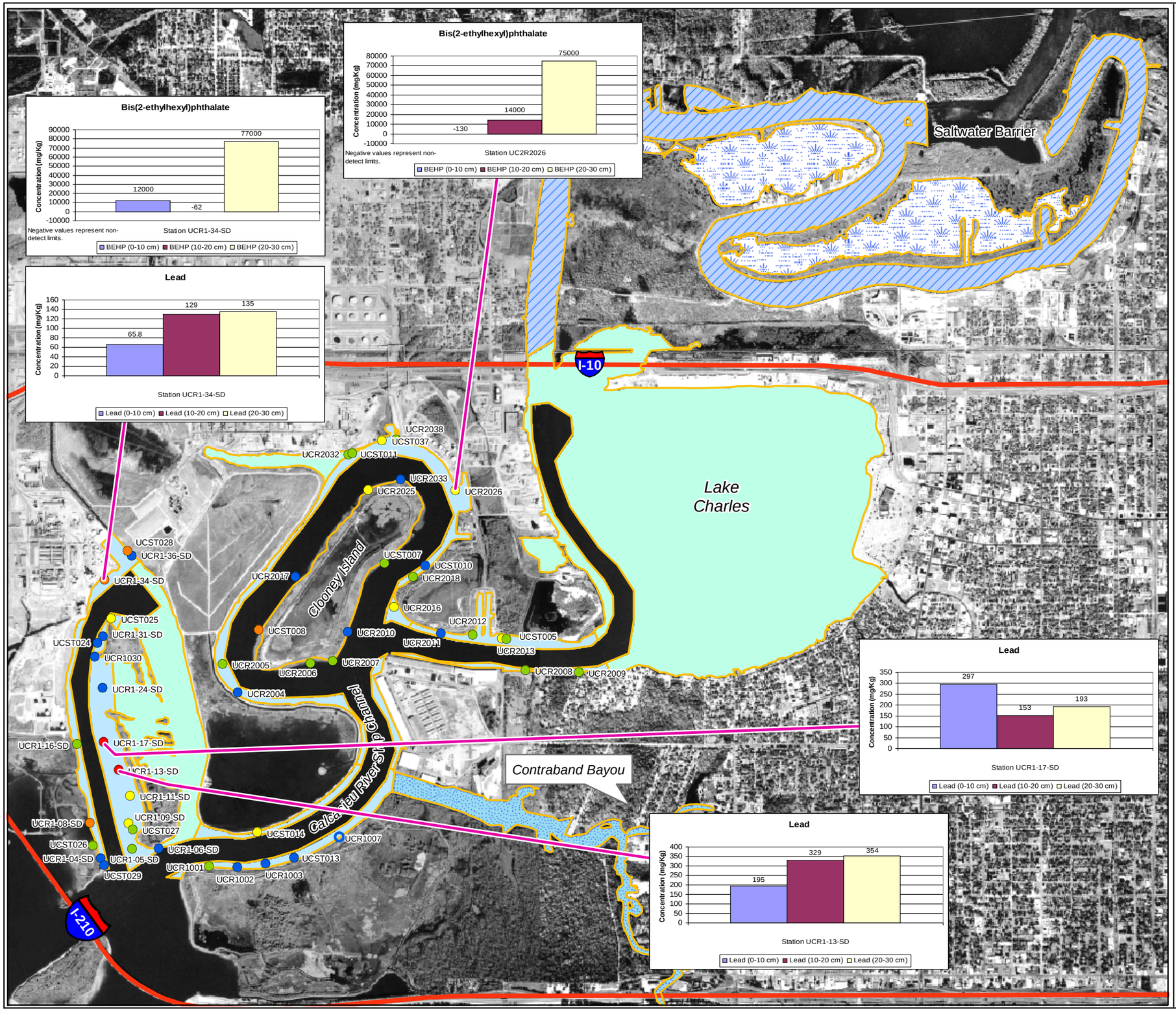

Figure 9-12
Bis(2-ethylhexyl)phthalate / Lead Factor
Upper Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Lead (mg/kg)

- 2 - 11
- 12 - 18
- 19 - 36
- 37 - 66
- 67 - 297

Lead Non-Detects (mg/kg)

- 2 - 11

Lead is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Bis(2-ethylhexyl)phthalate
Lead

N
W E
S
Kilometers
0 0.25 0.5 1

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Region 6

Prepared by CDM

Mapfilename: Figure9-12UPCAShipBEHP-1117size.mxd 10/07/02

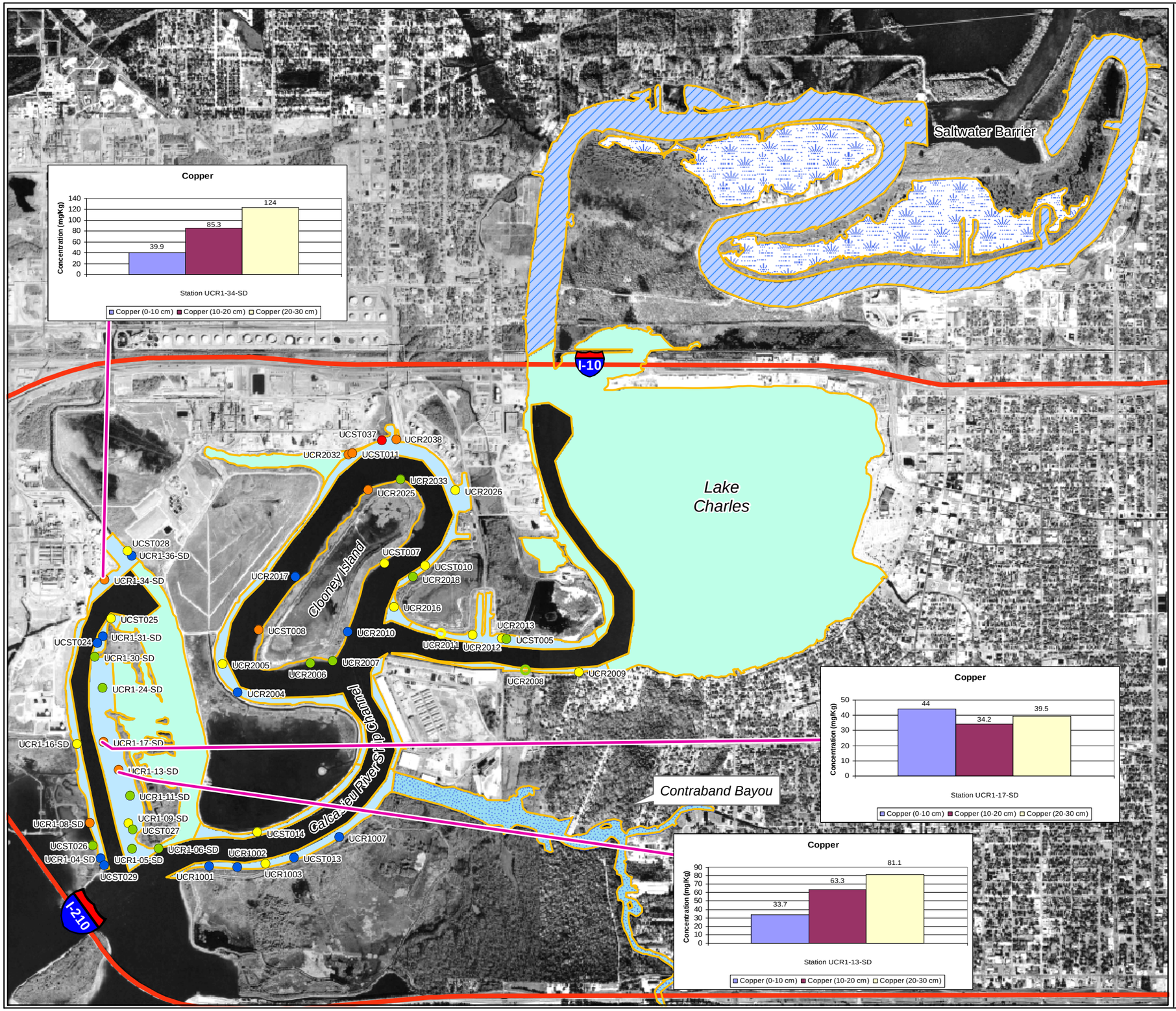

Figure 9-13
Metal Factor
Upper Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Upper Calcasieu AOC Boundary

Energy Areas

- Bayou
- Marsh
- River
- Shallow Lake
- Ship Channel

Copper (mg/kg)

- 1 - 5
- 6 - 8
- 9 - 21
- 22 - 53
- 54 - 379

Copper Non-Detects (mg/kg)

- 6 - 8
- 9 - 21

Copper is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Aroclor 1254
Manganese
Calcium
Magnesium
Arsenic
Copper

N
W E
S

Kilometers

0 0.25 0.5 1

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Region 6

Prepared by CDM

Mapfilename: Figure9-13UPCAShipCopper-1117size.mxd 10/07/02

Table 9-1
Historic Results for the Bayou Energy System
Upper Calcasieu

Year	1984[1]	1989[2]	1993[3]	1994[4]
Compound				
1,2-Dichloroethane (μg/Kg)	- - -	- - -	- - -	- - -
Acetone (μg/Kg)	- - -	- - -	- - -	- - -
Aldrin (μg/Kg)	- - -	- - -	- - -	- - -
Arsenic (mg/Kg)	0.4-2.8	- - -	- - -	- - -
Barium (mg/Kg)	- - -	- - -	- - -	- - -
Bis(2-ethylhexyl) phthalate (μg/Kg)	- - -	- - -	- - -	- - -
Carbon disulfide (μg/Kg)	- - -	- - -	- - -	- - -
Chromium (mg/Kg)	1.36-52.6	- - -	- - -	- - -
Copper (mg/Kg)	8.25-63.69	- - -	- - -	- - -
Dieldrin (μg/Kg)	- - -	- - -	- - -	- - -
Endosulfan sulfate (μg/Kg)	- - -	- - -	- - -	- - -
Endrin (μg/Kg)	- - -	- - -	- - -	- - -
Endrin aldehyde (μg/Kg)	- - -	- - -	- - -	- - -
Endrin ketone (μg/Kg)	- - -	- - -	- - -	- - -
Hexachlorobenzene (μg/Kg)	- - -	- - -	- - -	- - -
Hexachlorobutadiene (μg/Kg)	- - -	- - -	- - -	- - -
Lead (mg/Kg)	11-230	- - -	- - -	- - -
Mercury (mg/Kg)	0.08-0.27	- - -	- - -	- - -
Nickel (mg/Kg)	- - -	- - -	- - -	- - -
Total BHCs (μg/Kg)	- - -	- - -	- - -	- - -
Total PAHs (μg/Kg)	- - -	- - -	- - -	- - -
Trichloroethene (μg/Kg)	- - -	- - -	- - -	- - -
Zinc (mg/Kg)	22-255	- - -	- - -	- - -

Notes:
[1]1983-1985 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report
[2]1988-89 EPA Toxics Study of the Lower Calcasieu River
[3]1993 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River
[4]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 9-2
Historic Results for the River Energy System
Upper Calcasieu

Year	1984[1]	1989[2]	1993[3]	1994[4]
Compound				
1,2-Dichloroethane (μg/Kg)	-	-	-	-
Acetone (μg/Kg)	-	-	-	-
Aldrin (μg/Kg)	-	-	-	-
Arsenic (mg/Kg)	0.49-1.83	-	-	-
Barium (mg/Kg)	-	-	-	-
Bis(2-ethylhexyl) phthalate (μg/Kg)	-	-	-	-
Carbon disulfide (μg/Kg)	-	-	-	-
Chromium (mg/Kg)	0.46-28.49	-	-	-
Copper (mg/Kg)	2.63-137.58	-	-	-
Dieldrin (μg/Kg)	-	-	-	-
Endosulfan sulfate (μg/Kg)	-	-	-	-
Endrin (μg/Kg)	-	-	-	-
Endrin aldehyde (μg/Kg)	-	-	-	-
Endrin ketone (μg/Kg)	-	-	-	-
Hexachlorobenzene (μg/Kg)	-	-	-	-
Hexachlorobutadiene (μg/Kg)	-	-	-	-
Lead (mg/Kg)	4-52	-	-	-
Mercury (mg/Kg)	0.79	-	-	-
Nickel (mg/Kg)	-	-	-	-
Total BHCs (μg/Kg)	-	-	-	-
Total PAHs (μg/Kg)	-	-	-	-
Trichloroethene (μg/Kg)	-	-	-	-
Zinc (mg/Kg)	9.9-316.2	-	-	-

Notes:

[1]1983-1985 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report

[2]1988-89 EPA Toxics Study of the Lower Calcasieu River

[3]1993 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River

[4]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 9-3
Historic Results for the Shallow Lake Energy System (Coon Island Loop)
Upper Calcasieu

Year	1984[1]	1989[2]	1993[3]	1994[4]
Compound				
1,2-Dichloroethane (μg/Kg)	-	-	8.57-65.38	-
Acetone (μg/Kg)	-	-	13.33-12285.71	-
Aldrin (μg/Kg)	-	-	-	-
Arsenic (mg/Kg)	0.25-0.65	3.2	1.89-8.39	-
Barium (mg/Kg)	-	266	41.49-1756.86	-
Bis(2-ethylhexyl) phthalate (μg/Kg)	-	-	44.59-116.13	-
Carbon disulfide (μg/Kg)	-	-	11.76-34.62	-
Chromium (mg/Kg)	4.2-259.9	157	-	-
Copper (mg/Kg)	6.788-53.839	50	3.51-40.28	-
Dieldrin (μg/Kg)	-	-	-	-
Endosulfan sulfate (μg/Kg)	-	-	-	-
Endrin (μg/Kg)	-	-	-	-
Endrin aldehyde (μg/Kg)	-	-	-	-
Endrin ketone (μg/Kg)	-	-	-	-
Hexachlorobenzene (μg/Kg)	-	-	-	-
Hexachlorobutadiene (μg/Kg)	-	-	-	-
Lead (mg/Kg)	3-16	45	4.19-104.19	-
Mercury (mg/Kg)	0.11-0.21	0.5	0.28-0.66	-
Nickel (mg/Kg)	-	22	8.22-48.65	-
Total BHCs (μg/Kg)	-	-	-	-
Total PAHs (μg/Kg)	-	-	28.38-63538.71	-
Trichloroethene (μg/Kg)	-	-	-	-
Zinc (mg/Kg)	28.75-133.06	346	38.46-313.89	-

Notes:

[1]1983-1985 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report

[2]1988-89 EPA Toxics Study of the Lower Calcasieu River

[3]1993 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River

[4]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 9-4
Historic Results for the Ship Channel Energy System (Clooney Island Loop)
Upper Calcasieu

Year	1984[1]	1989[2]	1993[3]	1994[4]
Compound				
1,2-Dichloroethane (μg/Kg)	-	-	-	-
Acetone (μg/Kg)	-	-	-	-
Aldrin (μg/Kg)	-	-	-	-
Arsenic (mg/Kg)	-	1.3-2.1	-	-
Barium (mg/Kg)	-	428-555	-	-
Bis(2-ethylhexyl) phthalate (μg/Kg)	-	-	-	-
Carbon disulfide (μg/Kg)	-	-	-	-
Chromium (mg/Kg)	-	25-27	-	-
Copper (mg/Kg)	-	14-28	-	-
Dieldrin (μg/Kg)	-	-	-	-
Endosulfan sulfate (μg/Kg)	-	-	-	-
Endrin (μg/Kg)	-	-	-	-
Endrin aldehyde (μg/Kg)	-	-	-	-
Endrin ketone (μg/Kg)	-	-	-	-
Hexachlorobenzene (μg/Kg)	-	-	-	-
Hexachlorobutadiene (μg/Kg)	-	-	-	-
Lead (mg/Kg)	-	11-20	-	-
Mercury (mg/Kg)	-	-	-	-
Nickel (mg/Kg)	-	8-11	-	-
Total BHCs (μg/Kg)	-	-	-	-
Total PAHs (μg/Kg)	-	-	-	-
Trichloroethene (μg/Kg)	-	-	-	-
Zinc (mg/Kg)	-	55-181	-	-

Notes:
[1]1983-1985 LDWF Ecosystem Analysis of the Calcasieu River/Lake Complex Report
[2]1988-89 EPA Toxics Study of the Lower Calcasieu River
[3]1993 PPG Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River
[4]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 9-5 Wilcoxon Rank Sum Test Results
Upper Calcasieu AOC

Area of Concern	Energy Area	Probability (p-value) [1] Aroclor 1254	Arsenic	Barium	bis(2-ethylhexyl)phthalate	Chromium	Copper
Upper Calcasieu	Bayou	-- [2]	0.077	0.289	-- [2]	0.289	0.328
Upper Calcasieu	Marsh	-- [2]	**0.024**	**0.014**	-- [2]	0.414	0.148
Upper Calcasieu	Ship Channel	0.135	**0.006**	**0.038**	0.653	0.449	**0.044**
Upper Calcasieu	Shallow Lake	0.053	**0.021**	**0.018**	**0.023**	0.397	**0.014**
Upper Calcasieu	River	-- [2]	**0.014**	**0.028**	-- [2]	0.735	0.271

Area of Concern	Energy Area	Probability (p-value) [1] Lead	Mercury	Nickel	Pyrene	Zinc	2,3,7,8-TCDD TEQ
Upper Calcasieu	Bayou	0.41	0.484	**0.009**	**0.017**	0.797	0.127
Upper Calcasieu	Marsh	0.201	-- [2]	**0.001**	-- [2]	-- [2]	**0.008**
Upper Calcasieu	Ship Channel	**0.017**	0.941	**4.58x10-6 (0.001)**	0.098	**$2.16x10^{-5}$ (0.003)**	0.143
Upper Calcasieu	Shallow Lake	**0.033**	0.716	0.06	**0.041**	0.229	**0.025**
Upper Calcasieu	River	0.204	0.859	**$4.79x10^{-5}$ (0.007)**	**0.01**	**0.005**	0.558

[1] If p-value < critical value (alpha = 0.05) then there is a statistically significant difference between the AOC and reference areas. Bold = Significant Difference. Values in parentheses are Bonferroni adjusted p-values < critical value.

[2] Insufficient data for analysis.

Shading indicates that reference area conditions are greater than the energy system.

Table 9-6
COPCs Identified for the Bayou Energy System - Upper Calcasieu

COPCs	COPC for Upper Calcasieu (BERA CDM 2002b)	COPC for Upper Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	No[1]
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	NE	No[1]
aroclor-1254	**Yes**	**Yes**	ID	No[1]
aldrin	No	**Yes**	ND	No[1]
delta-bhc	No	No	ND	No
dieldrin	**Yes**	**Yes**	ND	No[1]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD TEQ	**Yes**	**Yes**	No	No
Inorganics				
arsenic	No	**Yes**	No	No
barium	No	No	No	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	No	No
lead	**Yes**	No	No	No
mercury	**Yes**	No	No	No
nickel	No	No	**Yes**	No
zinc	**Yes**	No	No	No

1 - Detected at less than 5 percent in the energy area.
2 - Reference area conditions were greater than what was observed in the energy area
ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 9-7
COPCs Identified for the Marsh Energy System - Upper Calcasieu

COPCs	COPC for Upper Calcasieu (BERA CDM 2002b)	COPC for Upper Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	No[1]
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	No[1]
benzo(a)anthracene	-	-	NE	No[1]
benzo(a)pyrene	-	-	NE	No[1]
benzo(b)fluoroanthene	-	-	NE	No[1]
benzo(g,h,I)perylene	-	-	NE	No[1]
benzo(k)fluoranthene	-	-	NE	No[1]
chrysene	-	-	NE	No[1]
dibenzo(a,h)anthracene	-	-	NE	No[1]
fluorene	-	-	NE	No[1]
phenanthrene	-	-	NE	No[1]
pyrene	-	-	**Yes**	No[1]
Total PAHs	**Yes**	No	NE	No[1]
Low PAHs	**Yes**	No	NE	No[1]
High PAHs	**Yes**	No	NE	No[1]
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	ID	No[1]
aroclor-1254	**Yes**	**Yes**	ID	No[1]
aldrin	No	**Yes**	ND	No[1]
delta-bhc	No	No	ND	No
dieldrin	**Yes**	**Yes**	ND	No[1]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD TEQ	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	ID	No[2]
barium	No	No	No	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	No	No
lead	**Yes**	No	No	No
mercury	**Yes**	No	ID	No[1]
nickel	No	No	**Yes**	No
zinc	**Yes**	No	ID	No[2]

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 9-8
COPCs Identified for the River Energy System - Upper Calcasieu

COPCs	COPC for Upper Calcasieu (BERA CDM 2002b)	COPC for Upper Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	No[1]
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	ID	No[1]
aroclor-1254	**Yes**	**Yes**	ID	No[1]
aldrin	No	**Yes**	ND	No[1]
delta-bhc	No	No	ND	No
dieldrin	**Yes**	**Yes**	ND	No[1]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	No	No
Inorganics				
arsenic	No	**Yes**	**Yes**	No[2]
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	No	No
lead	**Yes**	No	No	No
mercury	**Yes**	No	ID	No
nickel	No	No	**Yes**	No
zinc	**Yes**	No	**Yes**	No[2]

1 - Detected at less than 5 percent in the energy area.
2 - Reference area conditions were greater than what was observed in the energy area
ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 9-9
COPCs Identified for the Shallow Lake Energy System - Upper Calcasieu

COPCs	COPC for Upper Calcasieu (BERA 2002b)	COPC for Upper Calcasieu (HHRA 2002a)	Statisticaly Significant Different to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**Yes**	**Yes**
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	-	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	No	No
aroclor-1254	**Yes**	**Yes**	No	No
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	**Yes**	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	**Yes**	No[4]
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	**Yes**	**Yes**
mercury	**Yes**	No	No	No
nickel	No	No	No	No
zinc	**Yes**	No	No	No

3 - Detected at less than 5 percent in the energy area or at only one location.

4 - Reference area conditions were greater than what was observed in the energy area.

ID - Insufficient Data NE - Not evaluated

Table 9-10
COPCs Identified for the Ship Channel Energy System - Upper Calcasieu

COPCs	COPC for Upper Calcasieu (BERA CDM 2002b)	COPC for Upper Calcasieu (HHRA 2002a)	Statisticaly Significant Different to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**Yes**	No
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	No
benzo(a)anthracene	-	-	NE	No
benzo(a)pyrene	-	-	NE	No
benzo(b)fluoroanthene	-	-	NE	No
benzo(g,h,I)perylene	-	-	NE	No
benzo(k)fluoranthene	-	-	NE	No
chrysene	-	-	NE	No
dibenzo(a,h)anthracene	-	-	NE	No
fluorene	-	-	NE	No
phenanthrene	-	-	NE	No
pyrene	-	-	No	No
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	No	No
aroclor-1254	**Yes**	**Yes**	No	No
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	**Yes**	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	No	No
Inorganics				
arsenic	No	**Yes**	**Yes**	No[4]
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	**Yes**	**Yes**
mercury	**Yes**	No	No	No
nickel	No	No	No	No[4]
zinc	**Yes**	No	No	**Yes**

3 - Detected at less than 5 percent in the energy area or at only one location.

4 - Reference area conditions were greater than what was observed in the energy area.

ID - Insufficient Data NE - Not evaluated

CDM

Section 10
Lower Calcasieu – Nature and Extent

This section describes the nature and extent investigation of the portion of Calcasieu Estuary called the Lower Calcasieu AOC. Section 10.1 reviews the reaches and energy areas within Lower Calcasieu. Historical activities, including industrial development, permitted discharges, accidental spills, and releases are discussed in Section 10.2. An overview of the analytical program is provided in Section 10.3. Presentation of the data from the RI is provided in Section 10.4, including the results of the PCA as well as the summary statistics of the COPCs in Lower Calcasieu. Section 10.5 describes the fate and transport of COPCs, and Section 10.6 presents the summary and conclusions for Lower Calcasieu.

10.1 Introduction

The Lower Calcasieu study area comprises the portion of Calcasieu Estuary from the I-210 Bridge (just south of Coon Island Loop) to the outlet of Moss Lake a distance of approximately 11 km (Figure 10-1). Lower Calcasieu is comprised of the ship channel interconnected to shallow lakes, small lagoons, and a bayou. A description of the physical setting and energy systems follows.

10.1.1 Physical Setting

Lower Calcasieu is comprised of the ship channel and interconnected shallow lakes and lagoons (Figure 10-1). The ship channel is 125 m wide and 15 m deep and is routinely dredged (USACE 1976). Prien Lake is located on the east side of the ship channel, and the mouth of the lake is located across the ship channel from Lockport Marsh. The lake runs parallel to the ship channel, with openings across from Lockport Marsh and north of Indian Marais. Prien Lake lies within the old channel of the Calcasieu River. Prien Lake is approximately 4.8 km in length.

Historic or Current Permitted Dischargers to Lower Calcasieu:

Citgo, Montell USA, L.A. Pigments, Westlake Group and W.R. Grace

Indian Marais lagoon has a 230,000-kiloliter capacity and is partially contained within an earthen embankment built-up along the west side of the ship channel on Citgo property mid-way between Prien Lake and Moss Lake. Indian Marais flows west to east through the Citgo refinery and discharges into the Calcasieu River Ship Channel to the south of Indian Marais Lagoon. The lagoon is about 3 m deep with a 300-m long pier parallel to the ship channel. The lagoon is partially bermed (2 to 3-m) and may still occasionally receive stormwater runoff as process use and outfall discharges were terminated in 1992. . In 1992 sheet piling was installed adjacent to the ship channel to reduce communication of the Indian Marais Lagoon with the Calcasieu River. Although the sheet piling reduced communication the sheet piling did not eliminate sediment scouring that may occur during times of high tide. Moss Lake flows into the ship channel from the west and is fed by Bayou Olsen. Bayou Olsen drains the area

south and west of Bayou d'Inde. The Bayou Olsen and Moss Lake segment is approximately 5 km in length.

Relief in the lower portion of the Calcasieu Estuary ranges from 1.6 to 4.6-m above MSL. The area surrounding Lower Calcasieu is located within the 100-year floodplain of the Calcasieu River Basin (Figure 2-6).

Much of the adjacent land in the Lower Calcasieu study area is undeveloped, but several industrial facilities have outfalls to the ship channel between Prien Lake and Moss Lake (Figure 10-2). The industries with potential to discharge to the estuary include:

- Bridgestone Firestone
- CitCon
- Citgo
- Conoco
- Entergy
- Himont
- LA Pigment
- Lake Charles Harbor
- Lyondell
- Montell
- OxyChem/Equistar
- PPG
- W.R. Grace

The ship channel is used extensively throughout Lower Calcasieu, providing transport for over 40 million tons of product annually. The channel is dredged to 125 m wide and 15 m deep (USACE 1976). Dredging of the ship channel is routine and occurs on average about every 2 to 4 years. The USACE maintains the design geometry of the channel to accommodate large, deep draft vessel passage. Design of the ship channel in Lower Calcasieu has remained constant since the channel was enlarged to its current size in the 1960s.

10.1.2 Lower Calcasieu Energy Systems

The Lower Calcasieu area contains four energy systems: shallow lakes (Prien and Moss Lakes and the areas to the south of Prien Lake and east of the ship channel), low-flow bayou (Bayou Olsen and Bayou Guy), the ship channel, and Indian Marais lagoon. Indian Marais lagoon is considered a potential sediment source and is susceptible to sediment scouring and breaching, thereby acting as a sediment source.

The ship channel is a high-flow, tidally influenced, saline to brackish environment. The channel is routinely dredged (generally every 2 to 4 years) to clear accumulated sediment and debris. Increased water salinity and vegetation losses have weakened soils, leading to increased sloughing.

Prien Lake is located on the east side of the ship channel; the mouth of the lake is located across from Lockport Marsh. Rhodamine dye tests indicate that Prien Lake receives flow from the mouth of Bayou d'Inde (Curwick 1988). Flow through Prien Lake may exit through two openings to the ship channel; however, flow rates through the shallow lake are low and the geometry is such that circulation throughout is limited. The Prien Lake segment is approximately 4.8 km in length.

Indian Marais lagoon is partially contained by a pier approximately 300-m long (a partial earthen embankment) built-up along the side of the ship channel. The former lagoon is bermed with an embankment (2 to 3-m high) that separates Indian Marais Lagoon from the surrounding land area. The Indian Marais passes to the west of the lagoon and drains areas to the west.

Bayou Guy is located at the southern most boundary of the Lower Calcasieu AOC. It is a low-flow bayou that drains predominately rural residential and undeveloped land east of the ship channel. At the mouth, water mixes with the Calcasieu River Ship Channel.

Moss Lake flows into the ship channel from the west and is fed by Bayou Olsen. Bayou Olsen drains the area south and west of Bayou d'Inde. Moss Lake is generally a moderate flow surface water body with uniform circulation and significant tidal influence. The Bayou Olsen and Moss Lake segment is approximately 9.6 km in length. The bayou is generally a vegetated low-flow system. The bayou is subject to tidal surge, and salinity is brackish in both Bayou Olsen and Moss Lake.

Overall, Lower Calcasieu is tidally influenced with 6 to 12-inches of daily fluctuation (USACE 1976). Salinity stratification tends to be density driven and seasonal. Observations during the RI indicated a mixed salinity regime; however, during warmer months, a salt-wedge regime has been reported (Duke 1985). Density-driven flood tide (upstream) currents have been noted along the bottom of the ship channel, generally 6 m below the surface (Duke 1985; DeRouen and Stevenson 1987). Salinity of the Lower Calcasieu area surface water ranges from brackish to saline.

These systems are interconnected, yielding a network of sediment sources, exporters, and sinks. The nature of Lower Calcasieu makes this portion of the estuary a net sediment exporter.

10.2 Industrial Setting and Historical Contamination

This section describes the industrial setting along Lower Calcasieu, including facilities descriptions for those industries that historically or currently discharged to the system. In addition, results from previous investigations conducted in Lower Calcasieu are discussed to identify if contaminant suites or concentrations have varied over time. This temporal information will be used to support the chemical fate and transport discussions.

10.2.1 Industrial Setting

Land use within the drainage basin of Lower Calcasieu Estuary is generally mixed. It consists of rural, agricultural, industrial, and urban land use. Industrial facilities are the most concentrated sources of discharge; however, significant non-point discharge (urban and agricultural runoff) is also possible (Figure 10-2).

10.2.1.1 Citgo

Citgo currently owns and operates the Lake Charles manufacturing complex. The complex is the eighth largest petroleum refinery in the nation and currently covers 1,600 acres. The facility is located roughly 6 miles southwest of Lake Charles on the west bank of the ship channel and the south bank of Bayou d'Inde (Figure 10-2). In the early 1940s, the petroleum refinery was constructed by Cities Service Company to produce aviation fuel. The Citgo complex is comprised of three manufacturing operations: a refinery, lubricating oil plant, and petrochemical plant. The Lube Plant discharges to Bayou d'Inde and is not discussed further in this section. The Citgo refinery is wholly owned and operated by Citgo and has the capacity to process 320,000 barrels of crude oil per day, supporting the production of a variety of refined petroleum products. The petrochemical plant produces a variety of ethylene and propylene products. Both process areas discharge to the Lower Calcasieu ship channel.

Citgo products:

Fuel oils
Naptha
Petroleum coke
Gasolines
Benzene
Methyl-tertiary butyl ethyl
Sulfuric acid
Ethane
Propylene
Butyl rubber
Isobutylene
Isoprene

Citgo used the Indian Marais Lagoon to process wastewater through outfall 003. In June of 1992, Outfall 003 flow was re-routed to discharge directly to the Calcasieu River Ship Channel. Indian Marais Lagoon in-flow was reportedly re-routed. It appears that flow enters the lagoon during heavy rains, primarily from surface runoff.

Citgo holds NPDES permit LA0005941 that authorizes discharge to Calcasieu River. Exhibit 10-1 summarizes the permitted Citgo outfalls. Enforcement histories for the Citgo outfalls are provided in Table 7-2.

Exhibit 10-1 Approved Citgo Discharges into Lower Calcasieu (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
003	Calcasieu River	Treated process wastewater from the Refinery. Discharge includes process wastewater, ballast water and stormwater runoff. Outfall discharged to Indian Marais until 1992 when it was re-routed to discharge directly to the Calcasieu river. The outfall is monitored for phenolic compounds, Cr^{6+}, sulfide, total chromium, total zinc, ammonia, pH, BOD, TOC, TSS, and O and G.
004	Calcasieu River	Non-contact cooling water, regeneration wastewater and rinse water from the power plant. As of 1991, average flow through 004 was 64 MGPD.

006	Calcasieu River	Stormwater from the northeast side of the refinery and treated sanitary wastewater from the Butyl Rubber Plant.
008	Indian Marais	Stormwater runoff from the refinery Spent Catalyst Disposal Area. The outfall discharges to Indian Marais, flow is intermittent.
009	Calcasieu River	Stormwater runoff from the Lube Plant Tank Farm and Citgo's dock facility on the Calcasieu River. Flow through the outfall is intermittent.
010	Calcasieu River	Stormwater runoff from the West Tank Farm of the refinery, area of approximately 300 acres. Drainage area may also include the South Tank Farm and Land Farm.
013	Indian Marais	Surface runoff and treated sanitary wastewater discharge from the Citgo Contractor Compound.

There are 71 SWMUs within the Citgo refinery area, most of which are associated with wastewater processes and/or stormwater runoff. The two largest process units with potential environmental concerns are described below.

West Impoundment

This unit is a 670,000 gallon unlined surface impoundment that was active from the late 1960s until 1980. The unit reportedly underwent closure in 1994. The unit was used to manage phenolics and metal contaminated oily wastes, tank bottom sludges and slop oil residues. Contaminated soils and groundwater are associated with this unit (Curry et al 1997).

Surge Pond

The Surge Pond is an unlined surface impoundment, contained within and embankment in the original Indian Marais channel (Curry et al 1997). The unit had a capacity of 60 million gallons and was active from the early 1940s until 1994. The unit received F037 sludges, runoff from the land treatment unit, process water and ship ballast. Prior to 1970 the unit discharged directly to the Calcasieu River, after 1970 it discharged to the Equalization Basin and then through Outfall 003 to Calcasieu River. Groundwater has been impacted on the eastern side of the Surge Pond, possibly due to up-gradient Citgo sites (the Tail Gas #2 Unit and the Sulphur Recover Unit). Contaminants potentially discharging to Lower Calcasieu from this area include PAHs, and various VOCs (Curry et al 1997).

10.2.1.2 W. R. Grace

W.R. Grace has owned and operated a manufacturing facility in Carlyss, Louisiana since 1953. The facility covers 58 acres and is located approximately 2,500 feet west of the Calcasieu River, south of Citgo Petroleum Corporation. The facility's sole product is a silica-alumina petroleum cracking catalyst. Manufacturing processes at the facility do not use any organic chemicals. The types of waste byproducts generated from the manufacturing of the catalyst include silicone dioxide, alumina, sodium sulfate anhydrous, and ammonia sulfate. Surface drainage from the plant flows south to Young's Bayou and then to Bayou Olsen.

W.R. Grace holds NPDES permit LA0001333, which authorizes discharge from outfalls 001 and 002 to the Calcasieu River via Young's Bayou. Internal flow collected by outfall 101 is also authorized to discharge to outfall 001. Exhibit 10-2 summarizes permitted discharge to these outfalls.

Exhibit 10-2 Approved W.R. Grace Discharges into Calcasieu River (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
001	Calcasieu River via Young's Bayou	Treated process wastewater, sanitary wastewater and stormwater. Estimated average flow is 2.8 MGPD.
002	Calcasieu River via Young's Bayou	Non-process area stormwater collected from a roadside ditch.

Minor insoluble metals have been noted in the effluents. W.R. Grace discharge is not considered a significant impact to Lower Calcasieu.

10.2.1.3 Montell USA

Montell USA Incorporated is located on 200 acres in Westlake, Louisiana. In March 1995, Montell assumed ownership of Himont Chemical. Himont had assumed ownership of Hercules Inc. in November 1983. Montell is surrounded by Louisiana Highway 1134 to the north, the Calcasieu River to the east, Citgo Petroleum Corporation to the south, and Louisiana Highway 108 to the west. Montell produces polypropylene and high molecular weight polyethylene. The bulk of the product is sold as produced and the remainder is extruded as pellets and then sold. Waste byproducts generated at the facility include olefin polymer and cation and anion resin. Montell discharges to the ship channel under NPDES permit LA0003689 through outfalls 001 and 002. In addition, a series of wastewater ponds are used in the wastewater treatment process. Exhibit 10-3 summarizes permitted discharge to these outfalls. Table 7-6 presents the enforcement history for Montell.

Exhibit 10-3 Approved Montell Discharges into Calcasieu River (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
001	Calcasieu River	Process wastewater and sanitary wastewater.
002	Calcasieu River	Stormwater drainage and once-through non-contact cooling water.

10.2.1.4 Westlake Group

Westlake Group operates three facilities in Lower Calcasieu, Westlake Vinyl, Westlake Petrochemicals and Westlake Styrene. Westlake Group has permitted outfalls, which discharge to Lower Calcasieu.

Westlake Petrochemicals, Vinyl and Stryene manufacturing processes came under the control of Westlake Group in December 1996. The Complex is located on 320 acres formerly owned and developed by Citgo Petroleum Corporation, purchased from Citgo in 1989. The property is bordered by LA-108 on the north, the Citgo Tank Farm to the east, Dave Dugas Road to the south and South Boudin Road to the west. The facilities are adjacent to one another and discharge is combined and exists the facility under either the Westlake Petrochemicals or Westlake Group name.The Westlake Petrochemicals Ethylene Manufacturing Facility permit was issued in March 1990, the Styrene Plant began operations in April 1992 and the Vinyl Plant began operations in February 1999.

The ethylene production at Westlake Petrochemicals produces limited solid waste (approximately 1,500 tons were reported from 1990 to 1995). Air emissions are generally the source of release from the ethylene plant. The styrene plant is located south of the Petrochemical plant. It houses a styrene monomer unit and wastewater treatment facility. The vinyl plant is located within the Petrochemicals plant. It consists of a Chlor-Alkali facility located in the Westlake Marine Terminal complex. The process purifies salt water and separates the chlorine from the brine, creating chlorine gas and caustic soda. The chlorine gas is fed directly to the Westlake EDC plant located west of the ship channel, adjacent to the styrene plant.

Treated wastewater is discharged through outfall 001A. Stormwater from the complex is discharged through outfalls 002, 003 and 004. Combined flow to the Calcasieu River is approximately 1.91 MGD. Table 10-1 presents the enforcement history for the Westlake Group facilities.

Exhibit 10-4 summarizes permitted outfalls and discharge areas.

Exhibit 10-4 Westlake Group Discharges into Lower Calcasieu AOC (Curry et al 1997)

Outfall	Discharge Area	Approved Discharges
001	Calcasieu River	Process, wash and contaminated stormwater flow combined with caustic tank effluent.
002	Calcasieu River	Stormwater from non-process areas of the Styrene plant.
003	Calcasieu River	Stormwater from the ABB Lummus Ethylene Unit.
004	Calcasieu River	Stormwater from the Co-products storage area. Storage area is 17 acres in size with approximately 15 bullet tanks with a capacity of 100,000 gallons. Propylene, crude C4's and demethanizer bottoms are stored in the area.

10.2.1.5 LA Pigment

LA Pigment produces a titanium dioxide, which is a white pigment used as a whitener and opacifer in paints, plastics, paper, ceramics, and other consumer products. Operations began in 1992 under the ownership of Kronos Louisiana, Inc. and transferred operations to LA Pigment in October of 1993.

The initial phase of the production generates metal chlorides, unreacted coke, and process inerts that are transferred to a neutralization tank and treated with quick lime to convert the metal chlorides to non-soluble metal hydroxides. This stream is sent to a series of filter presses where the removed water is discharged via outfall 001 and the filter cakes are sent to an on-site landfill.

The finishing process generates wash water that is clarified and discharged via outfall 002. In addition, LA Pigment has two on-site boilers to generate steam and a desulphurization unit to increase sulphur recovery. This results in continuous blowdown of a waste stream that contains 93 percent water, iron, sodium salts, and sodium thiosulfate at three to five gallons per minute.

LA Pigment operates a non-hazardous waste landfill, which began in September of 1993 and includes a surface impoundment. The landfill is excavated to 20 feet deep and is double lined. A leachate detection and collection system is installed at the landfill. Collected leachate is pumped into the settling pond for treatment prior to being discharged under and LAPDES permit.

Exhibit 10-5 summarizes the approved discharges for LA Pigment into Lower Calcasieu. Enforcement history for the outfalls is presented in Table 10-2.

Exhibit 10-5 LA Pigment Petrochemical Discharges into Lower Calcasieu AOC (LDEQ 1995)

Outfall	Discharge Area	Approved Discharges
001	Lower Calcasieu	Treated process wastewater from the chlorination plant, laboratory drains, boiler blowdown, once through non-contact cooling water, filter backwash, and from the CPI separator
002	Lower Calcasieu	Finishing process water discharge
003	Lower Calcasieu	Storm water discharge
004	Lower Calcasieu	Landfill leachate and settling pond discharge
005	Lower Calcasieu	Uncontaminated storm water runoff from the solid waste landfill site

10.2.2 Historical Contamination

Multi-media samples were collected during four previous studies from the Lower Calcasieu AOC. These studies include:

- Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency-Region VI, Louisiana Department of Environmental Quality and U.S. Geological Survey, March 1990. (Conducted in 1988-1989, see Appendix A).

- Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report, Prepared by McLaren/Hart Environmental Engineering – ChemRisk Division for PPG Industries, Inc., June 1995. (Conducted in 1994, See Appendix A).

- Bayou d'Inde Expanded Site Inspection – Final Report, Prepared by PRC Environmental Management, Inc. for the U.S. Environmental Protection Agency-Region VI, September 1993. (Conducted in 1992, See Appendix A).

The occurrences of COPCs identified in Section 4 (Table 4-2) in sediments are discussed in this section. None of the sample location or data are presented graphically. Only those data collected within the Lower Calcasieu AOC boundary were partitioned into four energy systems, bayou, marsh, ship channel, and shallow lake, to reflect the differing physical and geochemical dynamics of each area. Incidentally, no sediment samples were collected in the marsh or bayou energy systems during any of the previous investigations. The samples discussed in the following sections were not part of the Calcasieu Estuary RI/FS; the intent was to compare historical contamination with current conditions. Historical surface water samples are not discussed since their concentrations are more variable with time, sources, and season.

10.2.2.1 Historical Contamination – Shallow Lake System

10.2.2.1.1 Volatile Organic Compounds

Acetone was detected only during one investigation, *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation and likewise, carbon disulfide was detected only during one investigation, the *1992 EPA Bayou d'Inde Expanded Site Inspection*. Of the sediment samples collected from the Lower Calcasieu shallow lake energy system area and analyzed for VOCs, four were collected and analyzed for acetone and three were collected and analyzed for carbon disulfide.

Acetone was found in one sediment sample at a concentration of 27 µg/Kg. This sediment sample was detected at location 6100-03-CSC13, positioned in the upper reach of Prien Lake, just over 67 m southeast of the junction of the Calcasieu Ship Channel, with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde.

Carbon disulfide was detected in two sediment samples at concentrations of 2 and 12 µg/Kg. The higher concentration was detected at location 6100-04-BDI03, which is found along the southwest corner of the upper reach of Prien Lake, bordering on the eastern end of the passage between the upper and lower reaches of Prien Lake, and approximately 777 m south of the second inlet to Prien Lake.

10.2.2.1.2 Semivolatile Organic Compounds

Bis(2-ethylhexyl)phthalate was detected in both the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation and the *1992 EPA Bayou d'Inde Expanded Site*

Inspection. Four sediment samples were collected from the Lower Calcasieu shallow lake energy system area and analyzed for SVOCs.

Bis(2-ethylhexyl)phthalate was detected in two sediment samples at concentrations of 110 and 1100 µg/Kg. The higher sediment concentration occurred at sample location 6100-06-14U0, situated in the upper reach of Prien Lake, about 104 m southeast of the junction of the Calcasieu Ship Channel with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde.

10.2.2.1.3 Polycyclic Aromatic Hydrocarbons

PAH concentrations in two sediment samples were reported in only one study, the *1992 EPA Bayou d'Inde Expanded Site Inspection*. Total PAH (the summation of 18 PAH compounds) was found in the two sediment samples with concentrations of 225 and 795 µg/Kg. The maximum concentration was detected at sample location 6100-04-BDI01, situated in the upper reach of Prien Lake, nearly 84 m southeast of the junction of the Calcasieu Ship Channel with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde.

10.2.2.1.4 Pesticides and Polychlorinated Biphenyls

Only one of the four previous investigations examined shallow lake sediment samples for pesticides and total PCBs. During the *1992 EPA Bayou d'Inde Expanded Site Inspection*, three sediment samples were collected and analyzed for pesticides and total PCBs.

Endrin aldehyde was detected in one sample with a concentration of 0.8 µg/Kg at sample location 6100-04-BDI01, situated in the upper reach of Prien Lake, nearly 84 meters southeast of the junction of the Calcasieu Ship Channel with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde. No PCBs were detected in any of the sediment samples.

10.2.2.1.5 Metals

Arsenic, barium, copper, lead, mercury, nickel, and zinc were analyzed in three sediment samples collected during the *1992 EPA Bayou d'Inde Expanded Site Inspection*. Barium, chromium, copper, lead, and zinc were analyzed in one sediment sample during the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* Investigation. Chromium, lead, and mercury were analyzed in three sediment samples during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* Investigation.

Arsenic was detected in two of the three sediment samples during the *1992 EPA Bayou d'Inde Expanded Site Inspection*. Sediment concentrations values were 1.6 and 2.0 mg/Kg. The higher concentration value occurred at sample location 6100-04-BDI03. The highest detected concentration value for nickel was also found during the *1992 EPA Bayou d'Inde Expanded Site Inspection*. The range of values for nickel was 6.0 to 16.8 mg/Kg, with the elevated concentration value at sample location 6100-04-BDI03. This sample location was found along the southwest corner of the upper reach of

Prien Lake, bordering on the eastern end of the passage between the upper and lower reaches of Prien Lake, and approximately 777 m south of the second inlet to Prien Lake.

Copper, detected during the *1992 EPA Bayou d'Inde Expanded Site Inspection* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation, was identified in all four sediment samples, with concentrations ranging from 4.3 to 16.4 mg/Kg. The highest concentration value occurred during the *1992 EPA Bayou d'Inde Expanded Site Inspection* at sample location 6100-04-BDI03, the same location that the maximum concentration was observed for arsenic and nickel.

Zinc, also detected in all four sediment samples from the *1992 EPA Bayou d'Inde Expanded Site Inspection* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation, was detected at the highest concentration value during the *1992 EPA Bayou d'Inde Expanded Site Inspection.* The concentrations for zinc ranged from 9.4 to 37.4 mg/Kg, with the maximum value located at 6100-04-BDI03, the same location that the maximum concentration was observed for arsenic, nickel, and copper.

Barium, detected in all four sediment samples from the *1992 EPA Bayou d'Inde Expanded Site Inspection* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigation, had concentrations ranging from 80.5 to 366.0 mg/Kg. The highest detected value was in the *1992 EPA Bayou d'Inde Expanded Site Inspection* at location 6100-04-BDI01, situated in the upper reach of Prien Lake, nearly 84 m southeast of the junction of the Calcasieu Ship Channel with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde.

Lead, detected in sediment samples from all three previous investigations, was observed at concentrations ranging from 8.1 to 50.0 mg/Kg. Peak concentration values occurred during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation at sample locations 6100-06-14U0 and 6100-06-16U0. Sample location 6100-06-14U0 was situated in the upper reach of Prien Lake, about 104 m southeast of the junction of Calcasieu Ship Channel with the second inlet to Prien Lake directly across from the mouth of Bayou d'Inde. Sample location 6100-06-16U0 was positioned along the southwest corner of the upper reach of Prien Lake, bordering on the eastern end of the passage between the upper and lower reaches of Prien Lake approximately 789 m south of the second inlet to the lake.

Mercury was observed in three of the five sediment samples at concentrations ranging from 0.12 to 0.28 mg/Kg during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation and the 1992 EPA Bayou d'Inde Expanded Site Inspection. The maximum concentration value occurred at sample location 6100-06-16U0, which was positioned along the southwest corner of the upper reach of Prien Lake bordering on the eastern end of the passage between the upper and lower reaches of Prien Lake approximately 789 m south of the second inlet to the lake.

Chromium, detected in all four sediment samples from the *1988-89 EPA Toxics Study of the Lower Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling* investigations, had concentrations ranging from 8.0 to 30.0 mg/Kg. The highest detected concentration value was established during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation. The sediment value was located at 6100-06-16U0, which is found along the southwest corner of the upper reach of Prien Lake, bordering on the eastern end of the passage between the upper and lower reaches of Prien Lake, and approximately 789 m south of the second inlet to Prien Lake.

10.2.2.2 Historical Contamination – Ship Channel System

10.2.2.2.1 Volatile Organic Compounds

Acetone and carbon disulfide were detected in two previous investigations, the *1992 EPA Bayou d'Inde Expanded Site Inspection* and the *1994 PPG Bayou d'Inde/PPG Canal* investigation. Sediment samples were collected from the Lower Calcasieu ship channel energy system area and analyzed for VOCs.

Acetone was detected in 11 of the 13 sediment samples at concentrations ranging from 11 to 167 µg/Kg. The maximum concentration was detected at sample location 6100-03-CSC08, located along the Lower Calcasieu Ship Channel, nearly 120 m south of the I-210 Bridge. This sample was collected during the *1994 PPG Bayou d'Inde/PPG Canal* investigation. Detected in seven out of nine sediment samples, carbon disulfide generated a maximum concentration value during the same investigation at sample location 6100-03-CSC07, located along the Lower Calcasieu Ship Channel, about 124 m south of the I-210 Bridge.

10.2.2.2.2 Semivolatile Organic Compounds

Hexachlorobutadiene was detected in only one investigation, the *1992 EPA Bayou d'Inde Expanded Site*. Three sediment samples were collected from the Lower Calcasieu ship channel energy system area during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* and the *1992 EPA Bayou d'Inde Expanded Site Inspection* and analyzed for SVOCs.

Hexachlorobutadiene was found in one sediment samples at a concentration of 9800 µg/Kg, occurring at sample location 6100-06-12U0, located along the Lower Calcasieu ship channel, approximately 256 m south of the I-210 Bridge, at the junction of Bayou d'Inde with the second inlet to Prien Lake.

10.2.2.2.3 Polycyclic Aromatic Hydrocarbons and Polychlorinated Biphenyls

Sediment samples collected during all of the previous investigations conducted on the Lower Calcasieu ship channel energy system areas were not analyzed for PAHs. Only two sediment samples were collected for PCB analysis; none were detected.

10.2.2.2.4 Pesticides

Aldrin and hexachlorobenzene were detected during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation and the *1992 EPA Bayou d'Inde Expanded Site*

Inspection. Four sediment samples were collected for pesticides analysis from the Lower Calcasieu – Ship Channel energy system area.

Aldrin was detected in only one sediment sample, with a concentration of 190 µg/Kg and hexachlorobenzene was detected in two sediment samples, with concentrations of 6000 and 27,000 µg/Kg. Both compounds revealed maximum concentrations at sample location 6100-06-12U0, which is located along the Lower Calcasieu ship channel, approximately 256 m south of the I-210 Bridge near the junction of Bayou d'Inde with the second inlet to Prien Lake.

10.2.2.2.5 Metals

Arsenic, barium, copper, lead, mercury, nickel, and zinc were detected in sediment samples collected during all three of the previous investigations that were conducted on the Lower Calcasieu ship channel energy area. Chromium was analyzed and detected in two of the previous investigations, the *1988-89 Toxics – Lower Calcasieu River* and the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling investigations*.

Maximum concentration values for barium, nickel, and zinc were witnessed during the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling investigation* at sample location 6100-03-CSC15, which is found along the Lower Calcasieu ship channel, approximately 372 m south of the I-210 Bridge. Barium was detected in all 17 sediment samples, with concentrations ranging from 5 to 983 mg/Kg. Nickel was detected in all eight sediment samples, with concentrations ranging from 6 to 24 mg/Kg. Zinc was detected in all 17 sediment samples, with concentrations ranging from 5 to 120 mg/Kg.

Copper, detected in all 15 sediment samples from all three previous investigations, had concentrations ranging from 5 to 50 mg/Kg. The highest detected value was observed during the *1988-89 EPA Toxics Study of the Lower Calcasieu River* investigation at sample location 6100-06-12U0, located along the Lower Calcasieu ship channel, approximately 256 m south of the I-210 Bridge, at the junction of Bayou d'Inde with the second inlet to Prien Lake. The highest detected concentration value for chromium in all 16 sediment samples was also found during the same investigation. The range of values for chromium was 3 to 50 mg/Kg, with the elevated concentration value at sample location 6100-06-13U0, located along the Lower Calcasieu ship channel, approximately 258 m south of the I-210 Bridge, at the junction of Bayou d'Inde with the second inlet to Prien Lake. Likewise, in six of the eight sediment samples collected during the same investigation, the highest detected concentration value for mercury was discerned at sample location 6100-06-12U0, the same location that the maximum concentration was observed for copper. Mercury concentrations ranged from 0.3 to 2.1 mg/Kg in the Lower Calcasieu ship channel.

The maximum concentrations values for both arsenic and lead that were observed occurred during the same investigation, the *1994 Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling*. Both compounds were

detected in sediment samples collected during all three investigations. Arsenic, detected in all 14 sediment samples, had concentrations ranging from 0.85 to 7.00 mg/Kg. The highest detected value was attained at sample location 6100-03-CSC11, which was located along the ship channel, approximately 265 m south of the I-210 Bridge, near the junction of Bayou d'Inde with the second inlet to Prien Lake. Lead, detected in all 19 sediment samples, had concentrations ranging from 8 to 57 mg/Kg. The highest detected value was attained at sample location 6100-03-CSC05, which was found along the Lower Calcasieu ship channel, just over 28 m north of the I-210 Bridge.

10.2.2.3 Summary of Historical Data

Historical data from the three previous studies indicate that the occurrences of the primary COPCs are consistent with the finding of the RI. The distribution of the COPCs between the energy system areas throughout the Lower Calcasieu AOC were limited by the number and location of sediment samples collected, but when COPCs in samples were detected, the concentration trends tended to correlate to the concentrations established in the RI. Tables 10-3 and 10-4 summarize the range of results for shallow lake and ship channel energy areas.

In general, the data indicates that about 50 percent of the highest detected sediment concentrations occurred at the confluence of the second inlet to Prien Lake, the mouth of Bayou d'Inde, and the Calcasieu Ship Channel. Approximately 30 percent of the highest detected sediment concentrations were revealed to be within 150 m of that confluence. Historical data results are compared to RI findings in Sections 10.5 and 10.6.

10.3 Data Analysis and Interpretation Overview

The following discussions focus on data collected during Phase I and Phase II of the RI. The analytical program and the results of the data validation and interpretation are presented in Sections 4.6.1 and 4.8. Section 10.3.1 provides a summary of the samples collected and parameters analyzed. An overview of the data interpretation presented in Section 10.3.2 will describe the objectives of the PCA, which will be used through the remainder of this section to describe the extent of the contamination as well as the fate and transport of COPCs.

10.3.1 Analytical Program

Samples from Phase I and Phase II were collected within the Lower Calcaseiu AOC, which is from the I-210 Bridge to Moss Lake (Figure 10-1). Sampling was conducted throughout the AOC, which included a bayou, Indian Marais Lagoon (other energy system), shallow lake, and ship channel energy system.

The RI for the Lower Calcasieu AOC included collecting and analyzing sediment, surface water, and porewater samples (Figures 4-3, 4-4, 4-6, and 4-9) for a combination of compounds in accordance with EPA SW-846, EPA CLP, and ASTM standard methods. The compounds of interest included VOCs, SVOCs, pesticides, herbicides, PCBs, PCB congeners, dioxins/furans, metals (filtered and non-filtered for surface water), and TPHs. Surface sediment samples were collected from the 0 to 10-cm depth interval in Phases I and II. Multi-depth samples were typically collected in Phases I and II at: 0 to 10-cm, 10 to 20-cm, and 20 to 30-cm depth intervals. Surface water samples were collected at mid-depth of the water column because of the lack of a salinity gradient at the time of sampling. Porewater samples were collected with sediment samples and extracted at the laboratory.

Sample Locations in Lower Calcasieu For Chemistry Only (Phases I and II)

- 153 surface sediment
- 1 multi-depth sediment
- 23 surface water
- 8 porewater

In addition to the chemical parameters discussed above, samples were analyzed for chemical/physical properties, which may have included particle size analysis, TOC for sediment only, DOC for porewater only, and pH. Field parameters for sediment were limited to penetrometer measurements and VOC screening. Ancillary properties for surface water samples included alkalinity, ammonia, hardness, and TKN. Field parameters for surface water included temperature, pH, DO, ORP, conductivity, and salinity.

10.3.2 Data Interpretation Overview

Data were interpreted by use of statistical tests such as WRS and the PCA to determine primary COPCs and their fate and transport in the estuary. In this section, an overview of the WRS test is provided in Section 10.3.2.1 to describe how it was used in the data interpretation. In Section 10.3.2.2, a brief overview of the PCA is provided, explaining the objectives of this analysis. The development of energy system specific COPCs is described in Section 10.3.2.3, and the general fate and transport mechanisms that will explain the extent of contamination of these COPCs in each of the energy systems is provided in Section 10.3.2.4.

10.3.2.1 WRS Test

This section describes the results of the WRS test to determine if there is a statistically significant difference between the energy areas in Lower Calcasieu and reference area conditions. COPCs that were not detected in the reference area were not compared using the WRS test; however, these non-detected COPCs are retained for evaluation. Use of the WRS test is discussed in Section 4.8.2.3. Results are presented in Table 10-5.

The WRS test compares the probabilities (p-values) with a critical value (alpha) in order to determine whether there is a statistically discernible difference in the median concentrations between the two groups tested (energy area in the AOC versus the

reference area). For purposes of interpreting the p-values, two levels of significance were established and are presented in Exhibit 10-6.

Exhibit 10-6 Levels of Significance

Level of Significance	Interpretation of Difference
p-value < alpha	Medians may be different
Adjusted p-value < alpha	Medians are different

For the first level of significance (medians may be different), the p-values were compared directly with an alpha value of 0.05 or 95 percent UCL of the median of the COPCs. For the second level of significance (medians are different), an adjusted p-value was calculated using the Bonferroni adjustment method:

adjusted p-value = n(p-value),

where, n is the number of comparison tests conducted.

The test does not indicate whether higher concentrations were observed in the energy area or the reference area. A review of box-plots of contaminants by energy area (Appendix G) indicates which area had higher observed concentrations.

10.3.2.2 PCA

As discussed in Section 4, PCA was used to accomplish the following objectives:

- Objective 1: Study the correlations of multivariate data sets by grouping variables (analytical constituents or parameters) in principal components (also known as factors or groups). Variables within each factor are more highly correlated with each other than with variables in other factors.

- Objective 2: Summarize many variables by a few factors or groups. Essentially, this is a data reduction technique whereby several original variables may be represented by one or a few "indicator" variables or by the factor itself.

- Objective 3: Interpret each factor according to the "meaning" of the variables. Such interpretation may provide useful information regarding geochemical fate and transport.

Sediment composition is heterogeneous, which means that chemicals found in sediment will vary from one location to the next. The PCA groups the measured parameters into factors, which are parameters that tend to correlate with one another. By identifying parameters that correlate, sediment conditions can be better understood and explain why one location varies from another. Understanding the variability in the surface sediment, conclusions can be made in regard to sources and the fate and transport of contaminants.

Factors from the PCA will be discussed in Section 10.5 if one or more COPCs are grouped within that factor.

10.3.2.3 COPC Selection

The COPC list provided in Table 4-2 presents all of the COPCs in the Calcasieu Estuary; however, not all of these COPCs are present in each AOC or energy system. To limit discussion, energy system specific COPCs for each AOC were determined. COPCs that may not be present in a specific energy system, are not risk drivers, or were not statistically significantly different than reference area conditions are not discussed.

The HHRA and BERA state which COPCs are the primary risk drivers for each AOC (Section 7.1 in the HHRA and in Appendix G2 of the BERA). An energy system specific COPC was determined if the following two conditions exist:

- The COPC is identified as a risk driver in the HHRA or the BERA.
- The COPC was determined to be statistically significant different and at a greater concentration from reference area conditions.

If either of these criteria failed, the COPC was determined not to be a COPC for a particular energy system. In some cases, there were insufficient data to compare a COPC with reference area conditions (i.e., low frequency of detects in a particular energy system). In these instances, the ranges of concentrations of a particular energy system are compared to reference area conditions by examining mean and median values by the use of box plots (Appendix G). If the range is comparable, then they are not discussed in the following subsections. Additional information regarding these COPCs is presented in the HHRA or the BERA.

10.3.2.4 Fate and Transport Mechanisms

The major mechanisms that tend to guide chemical fate and transport in estuarine systems are:

- Adsorption
- Precipitation/Co-precipitation
- Salting out
- Complexation
- Biotransformation
- Hydrolysis
- Photolysis

Contaminant occurrence and extent in the Lower Calcasieu AOC is dependent upon physical conditions, the contaminants, their concentrations, and the dominant processes given these conditions. Details on these fate and transport processes are

provided in Section 5.0. Sections 10.4 through 10.8 will discuss the general physical and chemical parameters, the extent of contamination, and the processes controlling COPC behavior in Lower Calcasieu.

10.4 General Physical and Chemical Parameters for the Lower Calcasieu AOC

This section presents the results of the sediment and surface water characteristics of the four energy systems in Lower Calcasieu.

10.4.1 Sediment Characteristics

10.4.1.1 Particle size

Particle size analysis was conducted at predetermined locations in Phase I and on all SQT samples in Phase II (Figure 10-3). The percentage of fine particles, such as clay and silt, were higher in the shallow lake and ship channel energy systems (Exhibit 10-7). The high percentage in the shallow lake is due to the shallow nature of these areas and the low velocity attributed to these areas, allowing smaller particles to settle. Within the ship channel, samples were collected near the shoreline, which may not be extensively affected by flow in the channel.

Indian Marais Lagoon sediments contain a high percentage of sand. This appears to be due to sediment scouring. This is based upon the composition of sediments from surrounding low-flow areas. The ship channel inlet area upstream of the lagoon (LCR1019) and the shallow lake areas in Lower Calcasieu each have a greater percentage of fine-grained sediments than those in the lagoon. The operation history of the lagoon would imply that sediments within the unit were typically fine grained (the lagoon was used as a settling basin), and available records indicate that sediments were left in place once in-flow was re-routed directly to the ship channel.

The bayou energy system (Bayou Olsen and Bayou Guy) typically have higher sand percentages due to velocities in the bayous that are able to transport finer particles out of the system.

Exhibit 10-7 Mean[1] (Standard Deviation) Particle Size Analysis within Lower Calcasieu

Energy System	Percent Clay	Percent Silt	Percent Sand
Bayou	18.74 (5.53)	31.75 (5.46)	49.51 (10.16)
Other	20.82 (11.08)	16.99 (0.43)	65.06 (18.29)
Shallow Lake	31.91 (19.20)	42.65 (11.61)	25.30 (20.98)
Ship Channel	36.86 (18.15)	36.73 (15.52)	26.41 (30.09)
Reference Area	23.94 (11.70)	40.2 (11.02)	35.86 (16.34)

1 – Values based on regression on ordered statistics (ROS). See Appendix G.

The ship channel and shallow lake exhibited higher clay percentages, whereas Indian Marais Lagoon had a significantly lower percentage of silt and a higher percentage of sand. The reference area is considered a bayou energy system but more closely resembles the particle size distribution of the shallow lake energy area probably

because of the low-flow characteristics. The Lower Calcasieu bayous may also be higher than average in sand because of surface rocks.

10.4.1.2 Total Organic Carbon

TOC provides an indication of the total organic material present in sediment and includes the carbon both from naturally occurring organic material and from organic chemical contaminants. TOC in sediment was measured in both Phase I and Phase II. TOC concentrations were highest in the bayou possibly due to vegetation and low energy of the system, allowing organic material to settle. Exhibit 10-8 lists the mean concentrations by reach and compares them to reference area conditions.

Exhibit 10-8 Mean[1] (Standard Deviation) of TOC in Bayou Energy System

Energy System	TOC (mg/Kg)
Bayou	86,418 (50,520)
Other	36,354 (8,832)
Shallow Lake	65,389 (67,564)
Ship Channel	37,088 (59,010)
Reference Area	43,356 (24,874)

1 – Values based on ROS. See Appendix G.

The bayou and shallow lake energy system were observed to have higher TOC concentrations than reference area conditions. This may be due to flow differences and vegetation in the reference areas.

10.4.2 Surface Water Characteristics

Surface water characteristics are presented in this section and are compared to reference area conditions.

10.4.2.1 Total Dissolved Solids

Dissolved solids refer to any minerals, salts, metals, cations, or anions that may be dissolved in the estuarine waters. Sources of dissolved solids may be from soil erosion, saltwater influence, waste discharge, urban runoff, eroding stream banks, and stirred-up bottom sediments from activities such as ship traffic or dredging. In addition to measuring total dissolved solids, salinity and conductivity were measured to describe the conditions within the bayou. Salinity and conductivity are related and essentially equivalent through conversion factors.

Salinity is the measure of the amount of dissolved salts (solids) in the estuary. Salinity levels control to some degree the types of animals and plants that may live in a particular area of the estuary. Salinity measurements are also important in determining if dissolved organic carbon will precipitate out of solution or "salt out".

Conductivity estimates the amount of total dissolved ions (solids) in water. Conductivity is controlled by salinity of a system, geology, size of the watershed, evaporation of water, and other sources of ions to the bayou or estuary such as

wastewater, urban, or agricultural runoff. An increase in conductivity could signal the introduction of wastewater or saltwater influence.

Mean total dissolved solids were higher in Phase I than what was observed in Phase II (Exhibit 10-9). The higher concentration may be due to the higher salinity levels found during the Phase I field effort. The highest mean total dissolved solid concentration was found in the bayou energy system (Bayou Olsen and Bayou Guy), which are located along the southernmost extent of the AOC and are affected by saltwater influence.

Exhibit 10-9 Total Dissolved Solids (mg/L) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	18,000/5,500	26,000/20,000	23,833/8,920	2,357/8,043
Other	20,000/13,000	21,000/18,000	-/15,333	-/2,836
Shallow Lake	17,000/2,920	26,000/30,000	21,760/11,481	2,846/9,884
Ship Channel	17,000/ -	26,000/ -	21,233/ -	1,990/ -
Reference Area[2]	6,000	32,000	13,467	10,245

1 – Values based on ROS. See Appendix G.
2 – Phase II only.
(-) – Not measured or not calculated due to limited data.

Salinity concentrations were highest in the bayou and ship channel energy system (Exhibit 10-10). The ship channel is a conduit for saltwater movement up into the estuary. The bayou has a high salinity concentration due to its closer proximity to the gulf and saltwater influence.

Exhibit 10-10 Salinity Levels (ppt) in Lower Calcasieu and Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	19/5	27/20	25/8.4	2.4/8.6
Other	20/15	22/18	20.8/ -	1.0/ -
Shallow Lake	12.3/2	24.5/32	19.6/11.3	2.2/10.8
Ship Channel	17/ -	27/ -	22/ -	2.4/ -
Reference Area[2]	6	36	14	12

1 – Values based on ROS. See Appendix G.
2 – Phase II Only.
(-) – Not measured or not calculated due to limited data.

In Phase I, Lower Calcasieu would be classified as polyhaline (18 to 30 ppt) based upon the USFWS salinity classification system. In Phase II, the bayou and shallow lake energy systems shifted to a mesohaline (5 to 18 ppt) salinity system. However, a limited number of locations were measured in Phase II and they may not accurately describe conditions as well as in Phase I. In comparing Phase II conditions, the Lower Calcasieu AOC had lower mean concentrations to that of the reference areas.

Mean conductivity levels were comparable for each of the energy systems and the reference area, with the exception of the Indian Marais Lagoon (other energy system; Exhibit 10 -11).

Exhibit 10-11 Conductivity (µs/cm) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	3,500/869	42,100/12,750	19,550/3,734	19,498/6,469
Other	3,200/2,400	3,400/2,830	3,275/2,550	103/323
Shallow Lake	3,167/456	42,200/49,400	20,572/5,296	15,422/18,367
Ship Channel	3,200/ -	41,800/ -	21,611/ -	15,563/ -
Reference Area[2]	1,350	53,800	21,363	18,967

1 – Values based on ROS. See Appendix G.
2 – Phase II only.
(-) – Not measured or not calculated due to limited data.

Conductivity typically correlates to salinity and other dissolved ions in the water. Since salinity concentrations are typical of what was observed in Lower Calcasieu, Indian Marais Lagoon has significantly lower concentration of dissolved ions. Conductivity is comparable to the reference area for all areas except Indian Marais Lagoon. Conductivity is an order of magnitude less even though salinity and TDS were comparable to the reference areas. Lower Calcasieu measurements for Phase II suggest potentially sizeable ranges of general water chemistry parameters.

10.4.2.2 Hardness

Hardness is the measure of multivalent cations and is proportionate or equivalent to the concentration of calcium and magnesium in the surface water. Generally, as hardness increases, toxicity decreases. Surface water in Lower Calcasieu is considered very hard based on U.S Department of Interior and Water Quality Association standards (> 180 mg/L, Exhibit 10-12). The average fresh water value for the area is 140 mg/L (USACE 2002).

Exhibit 10-12 Hardness (mg/L as $CaCO_3$) in Lower Calcasieu and Reference Area

Energy Area	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake[2]	3,580	4,400	3,927	500
Ship Channel[2]	3,850	3,850	-	-
Reference Area	1,295	1,295	-	-

1 – Values based on ROS. See Appendix G.
2 – Results from Phase I only.
(-) – Not measured or not calculated due to limited data.

Hardness is typically a function of the geology of the area and/or influenced by point sources such as industries that discharge dissolved cations in effluent waters (EPA 1986). The higher values in Lower Calcasieu in comparison with reference area conditions may be due to geologic conditions (high calcium carbonate content of

sediments). In comparison, wastewater from chemical industries has maximum concentrations of 1,000 mg/L, as $CaCO_3$, and electric utilities have a maximum concentration of 5,000 mg/L, as $CaCO_3$ (EPA 1986).

10.4.2.3 Alkalinity and pH

Increases or decreases of pH may be an indication of anthropogenic effects such as wastewater discharge or contamination from urban or agricultural runoff. Measurement of pH may isolate a particular area that might be receiving discharges from these or other sources. Alkalinity is the measure of a solution's resistance to changes in pH. Typically, water with a high alkalinity will resist the adverse affects of acidic contamination. The higher the alkalinity, the less likely a natural or manmade contaminant will cause a significant change in pH.

Exhibits 10-13 and 10-14 summarize the pH and alkalinity conditions present in the bayou energy system in Lower Calcasieu and the reference area. Alkalinity was only measured in Phase I.

Exhibit 10-13 pH Levels in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Median[1]
Bayou	7/7.03	8.61/7.82	7.83/7.63
Other	6.98/7.02	7.98/7.66	7.63/7.19
Shallow Lake	6.87/6.23	8.61/7.96	8.16/6.45
Ship Channel	5.29/ -	8.57/ -	8.1/ -
Reference Area	6.67	8.135	7.27

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

Estuarine waters typically have pH values ranging from 7 to 7.5 (EPA 1993). During Phase I, pH was higher than average conditions in the Lower Calcasieu; however, pH values were more typical in Phase II.

Exhibit 10-14 Total Alkalinity (mg/L as $CaCO_3$) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake[2]	1.2	1.4	1.3	0.11
Ship Channel[2]	84.7	84.7	-	-
Reference Area	42.1	42.1	-	-

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

Estuaries typically have alkalinity values ranging from 30 to 160 mg/L as $CaCO_3$ (EPA 1993). Conditions in the reference area and in Lower Calcasieu are not out of this range. The higher values in Lower Calcasieu in comparison with reference area conditions may be due to the different geologic conditions (rocks or soils) in the area.

10.4.2.4 Nitrogen

Nitrogen was measured as nitrate-nitrite, TKN, and ammonia. Nitrate and nitrite are inorganic ions occurring naturally as part of the nitrogen cycle (Smith 1990). TKN is the organic form of nitrogen and includes both the dissolved and particulate form, whereas ammonia is the dissolved form of nitrogen. Ammonia, at low levels, is an important nutrient for estuarine organisms, whereas it becomes toxic at high concentrations. In contrast to freshwater systems where phosphorous is the limiting nutrient factor, nitrogen is the primary limiting nutrient in the seaward portions of most estuarine environments (Paerl 1993). If high levels of nitrogen are introduced into the estuary, a significant increase of algae or large aquatic plants may occur NOAA/EPA (1988) suggests that nitrogen levels to avoid algae blooms to between 0.1 and 1 mg/L.

AWWA recommends that for maximum diversity in estuarine environments, the nitrate-nitrite should not exceed 0.1 mg/L for maximum diversity and 1.0 mg/L for moderate diversity (Exhibit 10-15). Based on nitrate-nitrite levels, the reference areas would support a more diverse environment, whereas Lower Calcasieu would only support a moderate diversity, based upon Phase I values.

Exhibit 10-15 Nitrate-Nitrite (mg/L) in Lower Calcasieu and the Reference Area

Parameter	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake	0.04	0.15	0.1	0.06
Ship Channel	0.15	0.15	-	-
Reference Area	0.06	0.06	-	-

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

TKN, the summation of ammonia and organic nitrogen, was similar in the shallow lake and ship channel energy system to what was observed in the reference areas. Exhibit 10-16 summarizes TKN results, which were measured in Phase I.

Exhibit 10-16 TKN (mg/L) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake	1.2	1.4	1.3	0.11
Ship Channel	1.2	1.2	-	-
Reference Area	0.95	0.95	-	-

1 – Values based on ROS. See Appendix G.
2 – Results from Phase I only
(-) – Not measured or not calculated due to limited data.

Ammonia concentrations were slightly higher, based upon Phase I values, than what was observed in the reference areas (Exhibit 10-17). According to EPA (1989b), the

CMC for total ammonia for pH, temperatures, and salinity found in Lower Calcasieu range from 44 to 50 mg/L. The CCC, according to EPA (1989b), range from 6.6 to 12 mg/L. Ammonia levels were below the CMC and CCC values for Lower Calcasieu.

Exhibit 10-17 Ammonia, as N, (mg/L) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake	0.32	0.42	0.37	0.06
Ship Channel	0.44	0.44	-	-
Reference Area	0.0064	0.0064	-	-

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

10.4.2.5 Dissolved Oxygen

DO is typically an indicator of high quality water for aquatic life and helps determine the ability of aerobic organisms to survive. The concentration is dependent upon temperature, salinity, wind, water turbulence, atmospheric pressure, presence of oxygen demanding compounds and organisms, and photosynthesis. The percent saturation is the measured dissolved oxygen level divided by the greatest amount of oxygen that the water can hold at that temperature and atmospheric conditions. Low dissolved oxygen levels typically indicate an excessive demand on the system from organic material deposited from pollution sources or from natural sources such as leaves and grass. Exhibit 10-18 summarizes DO measurements from Phase I.

Exhibit 10-18 Dissolved Oxygen, in Percent Saturation, in Lower Calcasieu and the Reference Area

Parameter	Minimum Detected Value (Phase I/II)	Maximum Detected Value (Phase I/II)	Mean[1] (Phase I/II)	Standard Deviation (Phase I/II)
Bayou	6.29/7.89	11.52/12.0	8.7/10.2	1.7/1.7
Other	4.4/8.59	10.1/10.92	8.1/9.7	3.1/1.3
Shallow Lake	5.4/6.42	12.9/9.47	9.0/8.3	1.5/0.8
Ship Channel	7.0/ -	11.8/ -	8.9/ -	1.2/ -
Reference Area (Phase II)	7.50	12.76	10.36	1.55

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

Typically, values over 80 percent represent water that is of high quality, which will support various flora and fauna, whereas values less than 80 percent indicate poor water quality conditions.

10.4.2.6 Biochemical and Chemical Oxygen Demand

BOD_5 is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions in five days. COD, however, does not differentiate between biologically available and inert organic matter and is a better indicator of medium- to long-term demand. COD is a measure of the total

quantity of oxygen required to oxidize all organic material into carbon dioxide and water. COD values will always be greater than or equal to BOD_5 values, and these data are typically measured when there are nearby industrial sources. High BOD_5 /COD values may deplete the water system of oxygen needed to support fish and other aquatic life. In an estuary, the rate of oxygen consumption is dependent upon temperature, presence of certain kinds of microorganisms and the type of organic and inorganic material in the water (EPA 1993). BOD_5 values between 1 and 2 mg/L represent clean water. BOD_5 values between 2 and 5 mg/L are considered moderately clean. BOD_5 values exceeding 5 mg/L indicate a nearby pollution source. The various sources of organic enrichment include urban and agricultural runoff, sanitary sewer overflows, landfills, and septic systems.

Exhibit 10-19 presents the chemical oxygen demand and COD values observed in Phase I. BOD_5 and COD were not analyzed in the reference areas.

Exhibit 10-19 BOD_5 and COD (mg/L) in Lower Calcasieu

Energy System	Minimum Detected Value (BOD_5/COD)	Maximum Detected Value (BOD_5/COD)	Mean[1] (BOD_5/COD)	Standard Deviation (BOD_5/COD)
Bayou	-	-	-	-
Other	-	-	-	-
Shallow Lake	1.1/26.6	3/163	2.2/107.5	1.2/86.4
Ship Channel	2.9/136	2.9/136	-	-

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

BOD_5 and COD concentrations were not abnormal for Lower Calcasieu.

10.4.3 Porewater

Porewater is the water occupying space between sediment particles. DOC, salinity, conductivity, hardness, total alkalinity, ammonia as N, unionized ammonia, and pH were measured at 10 sample locations in Lower Calcasieu during Phase II. DOC and salinity are presented in this section, whereas discussion of the other parameters is presented in the BERA.

10.4.3.1 Porewater Dissolved Organic Carbon

DOC is the organic fraction of carbon in water that is filterable. DOC plays a role in the fate and transport of trace elements in the subsurface as well as influences the bioavailability of hydrophobic compounds. In saline environments, dissolved organic matter is removed from the water to the sediment phase, which can effectively sorb hydrophobic chemicals (Chapman et al 2001). Exhibit 10-20 presents the summary statistics for DOC in porewater.

Exhibit 10-20 Porewater DOC (mg/L) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	3.49	11.88	6.32	3.85
Other	3.37	5.15	4.45	1.16
Shallow Lake	3.05	25.04	7.04	10.76
Ship Channel	-	-	-	-
Reference Area	2.29	13.52	4.78	3.41

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

The higher DOC values found in the Lower Calcasieu energy systems in comparison with reference area conditions may be due to vegetation or the presence of organic contamination.

10.4.3.2 Porewater Salinity

As discussed previously, salinity and conductivity are measures of TDS in water. Salinity and conductivity values are presented in Exhibit 10-21.

Exhibit 10-21 Porewater Salinity (ppt) in Lower Calcasieu and the Reference Area

Energy System	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation
Bayou	13	20	16.4	2.8
Other	19	19	19	-
Shallow Lake	16	24	20.6	3.4
Ship Channel	-	-	-	-
Reference Area	12	24	17.1	3.7

1 – Values based on ROS. See Appendix G.
(-) – Not measured or not calculated due to limited data.

Porewater salinity did not vary greatly from reference area conditions. Salinity is slightly higher in porewater than in surface water (comparing with Phase II conditions) and is most likely related to sediment type and duration of sediment exposure to surface water salinity conditions (Chapman et al 2001). Equilibrium between surface water and porewater is slow in sediments containing high amounts of fine particles such as clay and silt (Chapman et al 2001).

10.5 Nature and Extent for the Bayou Energy System

The results and discussion section is organized into three sections: COPCs identified for the bayou energy system (Section 10.5.1), the results of the PCA (Section 10.5.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 10.5.3). Bayou Olsen and Bayou Guy are the two energy systems that were classified as a bayou in Lower Calcasieu.

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key

contaminants that were not presented in a factor will be presented in individual figures.

Appendix G provides details of the PCA and complete summary statistics for all compounds detected in the bayou energy system in Lower Calcasieu.

10.5.1 COPCs for the Bayou Energy System in Lower Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. The energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 10.5.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 10.5.1.2 presents the bayou energy system COPCs identified.

10.5.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 10-5. Contaminant concentrations that were determined to be statistically significantly different than the reference area are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PCBs
- Inorganics (zinc)

10.5.1.2 COPCs Selection

Energy system specific COPCs for Lower Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and were determined to be statistically significant different than reference area conditions (Table 10-6). In addition, contaminants are only discussed if they are observed in at least two locations or if more than 5 percent of the samples for the energy system were detected. The following COPCs were selected for the bayou energy system in Lower Calcasieu:

- Bis(2-ethylhexyl)phthalate
- PAHs (as low and high molecular weight PAHs)

The extent as well as the fate and transport of these COPCs will be discussed in Sections 10.5.2 (PCA) and 10.5.3 (Isolated Chemistry).

10.5.2 PCA

The PCA revealed three dominant factors that accounted for most of the variability (55 percent) in surface sediment within Lower Calcasieu in the bayou energy system. These factors are:

- A Background Metal Factor that accounts for 27 percent of the variability

- A Background and Major Cation Factor that accounts for 28 percent of the variability

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

Zinc and nickel were part of individual factors and combined they controlled approximately 37 percent of the variability in sediment. However, these contaminants are not considered a primary COPC for this energy system and will not be discussed in this section. PCA and statistical results are presented in Appendix G.

10.5.2.1 Background Metals Factor

This section presents the nature of the Background Metals Factor.

10.5.2.1.1 Results and Extent

The factor represents constituents with concentrations similar to what was observed in the reference areas. It contains compounds such as lead, chromium, copper, mercury, nickel, and zinc but at low-level concentrations (Exhibit 10-22).

Exhibit 10-22 Summary Statistics of Metals (mg/Kg) in Background Metal Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Lead	17/17	9	41.8	21.85	9.15	0.42
Chromium	12/12	8	35.3	15.88	9.40	0.56
Copper	17/17	8.7	51.6	19.25	12.53	0.65
Mercury	7/17	0.12	0.28	0.14	0.11	0.82
Beryllium	12/12	0.76	1.5	1.11	0.21	0.19
Iron	12/12	3,470	17,500	9,578	4,662	0.49
Nickel	17/17	6.4	20.8	12.9	4.9	0.38
Zinc	8/17	29.1	84.2	43.3	20.7	0.48

1 – Values based on ROS. See Appendix G.

Although these metals explain some of the variability in sediment, they are at concentrations similar to or lower than reference area conditions. Therefore, the extent of these compounds will not be discussed further.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system for Lower Calcasieu.

Surface Water

Surface water samples were not collected in the bayou energy system in Lower Calcasieu.

10.5.2.1.2 Discussion

As noted previously, the metals contained in this factor are not statistically significant different than reference area conditions. Therefore, these metals are assumed to be at background concentrations and are not further discussed.

10.5.2.2 Background Major Cation Factor

This section presents the summary statistics for the major cations found in the bayou energy system in Lower Calcasieu.

10.5.2.2.1 Results

This factor represents major cations and metals found in the bayou energy system. Summary statistics are presented in Exhibit 10-23.

Exhibit 10-23 Summary Statistics of Cations/Metals (mg/Kg) in Major Cation Factor in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Sodium	12/12	11,000	28,500	18,325	5,420	0.30
Magnesium	12/12	3,360	7,220	5,408	1,093	0.20
Calcium	12/12	1,820	4,770	3,138	930	0.30
Manganese	12/12	67.9	659	184.8	190	1.03
Carbon disulfide	5/12	3	7	4.84	1.39	0.29
Barium	12/12	26.5	88.5	51.4	20.6	0.40
Potassium	12/12	1,690	3,110	2,443	418	0.17

1 – Values based on ROS. See Appendix G.

These major cations do not represent any COPCs for the bayou energy system in Lower Calcasieu; their extent in surface sediment will not be discussed further.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system.

Surface Water

Surface water samples were not collected in the bayou energy system.

10.5.2.2.2 Discussion

As noted previously, the metals contained in this factor are not statistically significantly different than reference area conditions. Therefore, these metals are assumed to be at background concentrations and are not further discussed.

10.5.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the two major PCA factor groups previously discussed. These include:

- BEHP
- PAHs

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection is typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

10.5.3.1 Bis(2-ethylhexyl)phthalate

This section presents the extent of BEHP in the bayou energy system in Lower Calcasieu and describes its fate and transport in the environment.

10.5.3.1.1 Results

Surface Sediment

BEHP was detected at 10 locations within Bayou Olsen and Bayou Guy (Figure 10-4). The summary statistics for the bayou energy system are presented in Exhibit 10-24.

Exhibit 10-24 Summary Statistics of BEHP (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
BEHP	10/17	68	1,400	277	373	1.35

1 – Values based on ROS. See Appendix G.

Elevated concentrations of BEHP were primarily in Bayou Olsen, with the maximum detected concentration located at LCR2078, which is approximately 1,500 m upstream from the mouth of the bayou as it enters Moss Lake. Samples collected in the immediate vicinity of this location were observed to have low concentrations. Further downstream, station LCR2077 was observed to have elevated concentrations and decreased moving downstream to the mouth of the bayou.

Bayou Guy had three locations where BEHP was observed in the surface sediment. Concentrations were in the 70 to 350 µg/Kg range.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system in Lower Calcasieu.

Surface Water

Surface water samples were not collected in the bayou energy system in Lower Calcasieu.

10.5.3.1.2 Discussion

The occurrence of BEHP in Lower Calcasieu is limited. The maximum of 1,400 µg/Kg was noted in Bayou Olsen midway up the bayou from Moss Lake. The next highest detection was one-half the maximum concentration (771 µg/Kg). The extent is limited to the bayou. Low levels are detected in Bayou Guy but at lower concentrations. Historically, BEHP was detected in the shallow lakes at comparable concentrations; Bayou Olsen and Bayou Guy were not sampled. Overall, BEHP distribution in Lower Calcasieu indicates a consistent low-level source.

10.5.3.2 PAHs

This section describes the extent of PAHs observed in the bayou energy system in Lower Calcasieu.

10.5.3.2.1 Results

Sediment

Both HPAHs and LPAHs were detected in the bayou energy system in Lower Calcasieu (Figure 10-5). HPAHs are the more dominant PAHs found and were located only in Bayou Olsen. Summary statistics are provided in Exhibit 10-25.

Exhibit 10-25 Summary Statistics of PAHs (µg/Kg) in Surface Sediment, Bayou Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
HPAH	3/18	73	1,364	545.7	917.4	1.68
LPAH	2/18	141.8	245	-	-	-

1 – Values based on ROS. See Appendix G.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Station LCST009 was observed to have the maximum concentration for both HPAHs and LPAHs. This station is located approximately 170 m upstream from the mouth of Bayou Olsen. Houses and boat docks are located from the mouth of Bayou Olsen to approximately 600 m upstream. The sample is located in a shallow area sheltered by outgoing flow from Bayou Olsen by three small islands.

Concentrations decrease moving upstream from LCST009 to LCST025 where PAHs were also observed. This location is an adjacent shallow area of Bayou Olsen to the east of an inactive and abandoned hazardous waste site under LDEQ jurisdiction.

Subsurface Sediment

Subsurface samples were not collected in the bayou energy system in Lower Calcasieu.

Surface Water

Surface water samples were not collected in the bayou energy system in Lower Calcasieu.

10.5.3.2.2 Discussion

Distribution of PAHs in the bayous of Lower Calcasieu is limited and highly variable. Potential sources include anthropogenic residential boating and industrial site activity. Local industrial use of PAHs along Bayou Olsen (both high and low molecular weight compounds) is documented; however, history of release is minimal. Current extent does not appear to be a concern for Lower Calcasieu.

10.6 Nature and Extent for the Other Energy System

The results and discussion section is organized into two sections: COPCs identified for the other energy system (Section 10.6.1) and the results of the PCA (Section 10.6.2). This energy system describes the other energy system (Indian Marais Lagoon) as well as a sample located in the Indian Marais.

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix G provides details of the PCA and complete summary statistics for all compounds detected in the marsh in Lower Calcasieu.

10.6.1 COPCs for the Other Energy System in Lower Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 10.6.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 10.6.1.2 presents the other energy system COPCs identified.

10.6.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 10-5. Contaminant concentrations that were determined to be statistically significantly different than the reference area or did not have sufficient data to compare are:

- SVOCs (bis[2-ethylhexyl]phthalate)

- PCBs (as Aroclor 1254)
- Dioxins/Furans (as 2,3,7,8-TCDD TEQs)
- PAHs (as pyrene)
- Inorganics (arsenic, barium, chromium, copper, lead, mercury, and zinc)

10.6.1.2 COPCs Selection

Energy system specific COPCs for Lower Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and were determined to be statistically significantly different than reference area conditions (Table 10-7). In addition, contaminants are only discussed if they are observed in at least two locations or if more than 5 percent of the samples for the energy system were detected. The following COPCs were selected for the other energy system in Lower Calcasieu:

- Bis(2-ethylhexyl)phthalate
- PAHs
- PCBs
- Dioxins/Furans
- Inorganics (barium, chromium, copper, lead, mercury, and zinc)

The extent as well as the fate and transport of these COPCs will be discussed in Sections 10.6.2 through 10.6.3.

10.6.2 PCA

The PCA revealed two dominant factors that accounted for most of the variability (87 percent) in surface sediment within the other energy system in Lower Calcasieu. These factors are:

- A medium- to high-level contamination Metal and Major Cation Factor that accounts for 42 percent of the variability. Factor included the COPCs arsenic, copper, chromium, lead, mercury, and zinc.
- A PAH Factor that accounts for 45 percent of the variability in sediment.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

10.6.2.1 Metal/PCB/PAH Factor

This section presents the extent of the metal/PCB/PAH factor and discussion as to the fate and transport of contaminants in this factor.

10.6.2.1.1 Results

This factor contains five of the six inorganic COPCs as well as Aroclor 1254 and PAHs. Summary statistics for these contaminants are presented in Exhibits 10-26 and 10-27.

Exhibit 10-26 Summary Statistics of Inorganics (mg/Kg) in Metal/PCB/PAH Factor in Surface Sediment, Other Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Magnesium	7/7	1,760	5,630	2,981	1,512	0.51
Cadmium	4/7	0.092	0.29	0.18	0.09	0.47
Arsenic	7/7	1.96	5.2	3.30	1.2	0.36
Aluminum	7/7	5,370	18,500	9,181	5,672	0.62
Potassium	7/7	950	2,720	1,598	788	0.49
Cobalt	6/7	2.3	7.1	3.9	1.8	0.47
Selenium	5/7	1	3.5	1.5	0.8	0.75
Calcium	7/7	929	5,490	2,090	1,876	0.90
Iron	7/7	5,170	13,900	8,244	3,298	0.40
Nickel	4/7	9.1	30.3	14.1	9.1	0.65
Copper	7/7	22.4	285	104	102	0.99
Sodium	6/7	4,370	22,400	8,128	8,134	1.00
Silver	4/7	0.1	0.3	0.16	0.08	0.51
Chromium	7/7	19.1	205	84.3	67	0.79
Lead	7/7	51.1	793	330	298	0.9
Zinc	7/7	41.5	322	149	107	0.72
Manganese	7/7	47	105	68.3	22.9	0.34
Mercury	7/7	0.14	2.5	0.94	0.87	0.92

1 – Values based on ROS. See Appendix G.

Exhibit 10-27 Summary Statistics of Organics (µg/Kg) in Metal/PCB/PAH Factor in Surface Sediment, Other Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aroclor 1254	3/6	140	860	214	409	1.91
Napthalene	3/7	110	1,500	425	978	2.30
Indeno(1,2,3-cd)pyrene	4/7	345	2,780	871	1,099	1.26

1 – Values based on ROS. See Appendix G.

Lead, based on its ranking and frequency of detection, is the indicator variable for this factor.

Surface Sediment

Elevated concentrations are primarily located on the north end of the Indian Marais Lagoon and decrease moving toward the ship channel (Figure 10-6). Maximum

concentrations were typically observed at LCR1031, which is along the shoreline on the north side.

Subsurface Sediment

Subsurface samples were collected at station LCR1031. Metal concentrations were typically higher at the surface and decreased to the 10 to 20-cm interval (Exhibit 10-28). Metal concentrations increased from the 10 to 20-cm to the 20 to 30-cm interval. Copper concentrations were higher at the 20 to 30-cm than at the surface.

Exhibit 10-28 Subsurface Results for Inorganics (mg/Kg) at Station LCR1031

Parameter	0 to 10-cm	10 to 20-cm	20 to 30-cm
Arsenic	4.4	1.1	2.2
Barium	137	26.5	64.1
Chromium	205	11.1	19.1
Copper	285	97.1	434
Lead	793	48.8	132
Mercury	2.5	0.34	0.99
Zinc	322	45.2	152

Aroclor 1254 was not detected in the subsurface.

Surface Water

Surface water samples were not collected in this energy system.

10.6.2.1.2 Discussion

The distribution of metals in surface sediment in the northern end (closed end of the lagoon) indicates that the surface layer (0 to 10-cm) has been subjected to moderate scouring and re-working, moving the upper 10 cm toward the shoreline. The vertical profile (decrease in concentration at 10 to 20-cm and subsequent increase at the 20 to 30-cm interval) infers changes in source during deposition of the middle layer. The history of Indian Marais Lagoon indicates that flow to the lagoon was re-routed in 1992. This active (pre-1992) period appears to correlate to the 20 to 30-cm interval. The decrease correlates with the 10 to 20-cm interval, and the higher concentration in the surface sediments indicates the addition of material. The difference in upper and middle interval concentrations indicates that material from the 10 to 20-cm layer has been exported away from the sample locations.

The presence of Aroclor 1254 is indicative of recent deposition. The number of detections and range of concentrations possibly indicate a nearby terrestrial source versus air deposition.

10.6.2.2 PAH Factor

This section presents the extent of the PAH Factor and discussion as to the fate and transport of contaminants in this factor.

10.6.2.2.1 Results

This factor is comprised of both high and low molecular weight PAHs. Exhibit 10-29 presents the summary statistics for this factor.

Exhibit 10-29 Summary Statistics for the PAH Factor (µg/Kg) in Surface Sediment, Other Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Phenanthrene	4/7	1,360	140,000	23,566	69,113	2.93
Pyrene	7/7	360	149,000	27,600	71,253	2.58
1,2-benzphenanthracene	7/7	350	83,100	16,871	38,061	2.26
Benzo(a)anthracene	7/7	110	42,400	8,522	19,357	2.27
Benzo(b)fluoranthene	7/7	190	21,200	4,746	9,272	1.95
Benzo(g,h,I)perylene	5/7	561	16,800	3,752	7,352	1.96
Fluoranthene	7/7	100	22,200	4,835	9,709	2.01
Acenaphthene	3/7	252	15,900	3,262	7,253	2.22
Benzo(k)fluoranthene	6/7	76.8	6,630	1,571	2,791	1.78
Benzo(a)pyrene	7/7	170	23,600	5,949	9,749	1.64
Fluorene	3/7	279	13,300	3,031	6,459	2.13
Dibenzo(a,h)anthracene	4/7	376	10,400	2,071	4,963	2.40
Anthracene	6/7	120	21,700	5,288	9,293	1.76
2-Methylnapthalene	6/7	53	15,400	3,813	6,662	1.75
Acenaphthylene	4/7	53	8,740	1,341	4,682	3.49

1 – Values based on ROS. See Appendix G.

Pyrene is an HPAH and is used as the indicator variable for this factor. An HPAH was selected, as the HPAHs tend to have slightly lower coefficient of variation values than the LPAHs.

Surface Sediment

PAHs, similar to the metals factor, are primarily located on the northern half of Indian Marais Lagoon (Figure 10-7). LCR1031 tends to be the location with the highest detected values, with stations decreasing in concentrations toward the confluence of the lagoon and the Calcasieu River Ship Channel.

Subsurface Sediment

PAHs were analyzed in subsurface sediment at station LCR1031. HPAHs and LPAHs were summed to examine whether a specific category increases or decreases with depth. At this station, HPAHs decreased from surface sediment concentration of 85,130 to 22,840 µg/Kg and then slightly increased to 31,100 µg/Kg in the 20 to 30-cm interval. LPAHs, however, increase with depth from 56,300 in surface sediment to 89,000 µg/Kg at 10 to 20-cm and 207,700 µg/Kg in the 20 to 30-cm depth interval.

Surface Water

Surface water samples were not collected in this energy system.

10.6.2.2.2 Discussion
The occurrence and distribution of both HPAHs and LPAHs in surface sediment indicates, recent deposition at these locations. The vertical profile at location LCR1031 shows a general increase in both total HPAH and total LPAH concentrations with depth. The highest concentrations are found in the 20 to 30-cm interval and likely represent the pre-1992 operating period concentrations. The concentrations decreased by approximately one-half from the 20 to 30-cm interval to the 10 to 20-cm and 0 to 10-cm (surface) intervals. The 0 to 10-cm and 10 to 20-cm interval concentrations are fairly consistent in comparison to the deep sample.

Historically, Indian Marais Lagoon was not sampled. No additional temporal evaluation can be provided.

10.6.3 Isolated Chemistry

A few COPCs that were detected in 5 percent or greater of the samples did not group with the two major PCA factor groups previously discussed. These include:

- BEHP
- Dioxins/Furans

These COPCs did not group with the other major factors for one or more of the following reasons:

- The frequency of detection is typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

10.6.3.1 BEHP

This section describes the extent of BEHP observed in the Indian Marais Lagoon in Lower Calcasieu.

10.6.3.1.1 Results
Surface Sediment

BEHP was detected at three locations in Indian Marais Lagoon. Summary statistics are provided in Exhibit 10-30.

Exhibit 10-30 Summary Statistics of BEHP (µg/Kg) in Surface Sediment, Other Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
BEHP	3/7	66	670	196	280	1.4

1 – Values based on ROS. See Appendix G.

The maximum concentration was observed at station LCR1030. Concentrations decreased toward where the lagoon empties into the ship channel. A concentration of 160 µg/Kg was reported in Indian Marais Lagoon.

Subsurface Sediment

BEHP was not detected in the subsurface.

Surface Water

Surface water samples were not collected within this energy system.

10.6.3.1.2 Discussion

BEHP detections are low-level concentrations in less than one-half of the samples detected. The distribution is comparable to the metals, PAHs, and dioxins/furans in that impacted material is found in the back of the lagoon, away from the mouth where it appears that material is removed by tidal surge action.

The significance of the distribution of BEHP is not in the impact BEHP might have on the estuary; the concentrations are not elevated but in the line of evidence provided in describing sediment stability from within Indian Marais Lagoon. The BEHP distribution is a marker for the extent of sediment scouring that is observed at the lagoon.

10.6.3.2 Dioxins/Furans

This section describes the extent of dioxins/furans (presented as 2,3,7,8-TCDD TEQs) observed in the other energy system in Lower Calcasieu.

10.6.3.2.1 Results

Surface Sediment

Dioxins/furans were only measured at station LCR1031 that had a 2,3,7,8-TCDD TEQ concentration of 39.09 pg/g.

Subsurface Sediment

Within the subsurface, the 10 to 20-cm interval reported a concentration of 5.35 pg/g, and the 20 to 30-cm interval reported a concentration of 17.64 pg/g.

Surface Water

Surface water samples were not collected within this energy system.

10.6.3.2.2 Discussion

Dioxins/Furans (presented as 2,3,7,8 TCDD TEQ) were sampled for in two locations within Indian Marais Lagoon surface sediments. Subsurface samples were taken from one of the locations, LCR1031. The results indicate that the highest concentration in the lagoon is in the surface sediment. The concentration in the subsurface (10 to 20-cm and 20 to 30-cm, respectively) is one-half the concentration noted in the surface sample. The lateral distribution, as defined by these two samples, extends throughout the length of the Indian Marais Lagoon. The highest location is in the back of the lagoon as noted with BEHP. However, the dioxins/furans show evidence of a concentration gradient from the back of the lagoon toward the mouth. This trace is to be expected based upon the nature of the dioxins/furan compounds compared to BEHP. The BEHP tends to have a greater affinity to adsorb to smaller particulates and/or suspended sediment than dioxins/furans. The stability of the smaller particulates would be less than larger grain-size material under sediment scouring conditions, as noted by the dioxins/furan concentration gradients.

Historically, sediments from the Indian Marais Lagoon were not analyzed for dioxins/furans. No additional temporal evaluation is available.

10.7 Nature and Extent of Shallow Lake Energy System

The results and discussion section is organized into three sections: COPCs identified for the shallow lake energy system (Section 10.7.1), the results of the PCA (Section 10.7.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 10.7.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix G provides details of the PCA and complete summary statistics for all compounds detected in the shallow lake energy system in Lower Calcasieu.

10.7.1 COPCs for the Shallow Lake Energy System in Lower Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 10.7.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 10.7.1.2 presents the shallow lake energy system COPCs identified.

10.7.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 10-5. Contaminants that were determined to be statistically significantly different than the reference area or did not have sufficient data to compare are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PAHs (as pyrene)
- Dioxins/Furans (as 2,3,7,8-TCDD TEQ)
- Inorganics (arsenic, barium, copper, and nickel)

10.7.1.2 COPCs Selection

Energy system specific COPCs for Lower Calcasieu shallow lake energy system were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significantly different than reference area conditions (Table 10-8). In addition, contaminants are only discussed if they are observed in at least two locations or if more than 5 percent of the samples collected for the energy system were positive detections. The following COPCs were selected for the shallow lake energy system in Lower Calcasieu:

- BEHP
- PAHs
- Dioxins/Furans
- Inorganics (copper)

The extent as well as the fate and transport of these COPCs will be discussed in Sections 10.7.2 (PCA) and 10.7.3 (Isolated Chemistry).

10.7.2 PCA

The PCA revealed three dominant factors that accounted for most of the variability (72 percent) in surface sediment within the shallow lake energy system in Lower Calcasieu. These factors are:

- A background/low-level contamination Metal Factor that accounts for 31 percent of the variability in surface sediment
- A total TCDD/TCDF TCDD/TCDF Factor that accounts for 20 percent of the variability in surface sediment.
- A Dioxin/Furan Factor that accounts for 21 percent of the variability in surface sediment.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

10.7.2.1 Metal Factor

This section presents the extent of the Metal Factor and discussion as to the fate and transport of contaminants in this factor.

10.7.2.1.1 Results

This factor groups inorganics that are low-level concentrations and similar to reference area conditions with the exception of copper. In addition, this factor includes important physical parameters such as sand and clay, which may explain the contaminant's mobility in the system. Exhibit 10-31 presents the summary statistics for this factor.

Exhibit 10-31 Summary Statistics of Inorganics (mg/Kg) in Metal Factor in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Nickel	71/76	1.3	32.9	11.5	6.3	0.55
Vanadium	69/69	10.6	126	51.6	32.4	0.63
Beryllium	45/69	0.27	1.5	0.69	0.34	0.49
Chromium	68/69	2.1	47.6	17.6	10.7	0.61
Zinc	54/76	10.6	126	51.6	32.4	0.63
Iron	69/69	1,360	24,300	10,983	6,651	0.61
Cobalt	61/69	1.4	13.4	5.61	2.80	0.50
Potassium	68/69	296	5,610	2,510	1,177	0.47
Lead	76/76	3.4	60.4	23.3	14.2	0.61
Mercury	27/76	0.0532	0.68	0.13	0.14	1.08
Copper	62/69	3.7	93.6	23.6	18.4	0.78
Manganese	69/69	12.9	895	213	198	0.93
Magnesium	69/69	417	10,800	4,704	2,550	0.54
Arsenic	69/69	0.59	17.6	4.51	2.84	0.63

1 – Values based on ROS. See Appendix G.

Copper, although it does not rank as high as iron or lead in the analysis (PCA), was used as the indicator variable as it was statistically significant different than the reference areas.

Surface Sediment

Elevated concentrations of copper are present in several areas within the shallow lake energy system (Figure 10-8) although primarily in Prien Lake and Moss Lake. Maximum concentration was located at station LCR2039, which is located south of the old ship channel and in an area that is predominantly clay and silt (approximately 60 percent combined clay and silt).

In Prien Lake, copper concentrations are highly variable, ranging from 3.7 mg/Kg at station LCR2015 to 78.1 mg/Kg at station LCR2018, with no spatial trend. Higher concentrations in Prien Lake are correlated with clay and inversely correlated with sand. At station LCR2018, sediment is comprised of approximately 57 percent clay.

In Moss Lake, elevated concentrations are primarily in the center of the lake. Concentrations decrease toward the north and the ship channel. Copper concentrations range from 6.8 mg/Kg at station LCR2072 to 44.3 mg/Kg at station LCR2064.

Subsurface Sediment

Subsurface sediment samples were not collected in the shallow lake energy system.

Surface Water

Copper, lead, mercury, nickel, and zinc were detected in surface water samples collected in the shallow lake energy system in Lower Calcasieu. Exhibit 10-32 presents the total and dissolved (if detected) concentrations of these contaminants and compares them to EPA AWQC (as reported in the Federal Register 1995) CCC (chronic) and CMC (acute) values and/or LDEQ Water Quality Regulation (LDEQ 2000) for both freshwater and marine environments. For systems with salinity between 1 and 10 ppt, the more stringent of either fresh or marine values should be used to compare with mean dissolved concentrations. In cases where the dissolved phase was not detected, the surface water criteria for that contaminant was converted to unfiltered criteria using a conversion factor provided in LDEQ 2000.

Exhibit 10-32 Mean and Standard Deviation of Total and Dissolved Concentrations (mg/L) in Metal Factor in Surface Water, Shallow Lake Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Copper	0.008 (0.003)	0.009 (0.020)	0.035[4]	0.022[4]	**0.00363**	**0.00363**
Lead	0.001 (0.001)	0.001 (0.001)	0.138[4]	0.00531[4]	0.209	0.00808
Mercury	0.000061[2]	ND	0.0017[3,4]	**0.00001[3,4]**	0.0017[3]	**0.000021[3]**
Nickel	0.0057 (0.0015)	0.0044 (0.0008)	2.49[4]	0.279[4]	0.074	0.0082
Zinc	0.0095 (0.0143)	0.0098 (0.0259)	0.205[4]	0.187[4]	0.09	0.081

1 – Based on ROS. See Appendix G. If only two samples, an average was calculated. ND: Not Detected
2 – Only detected in one sample.
3 – Converted to filtered basis using the conversion factors (Hg: 0.85)
4 – LDEQ Water Quality Regulations based on 200-mg/L hardness for dissolved concentrations.

Copper concentrations exceed both the marine acute and chronic criteria at all locations in the shallow lake energy system. The maximum copper concentration detected was at station LCR2018, with a concentration of 0.0643 mg/L. This station coincides with the maximum copper concentration found in surface sediment in Prien Lake. In addition, mercury exceeded both the fresh and marine surface water chronic criteria. Mercury was only detected as total mercury at station LCR2058, which is located on the north side of Moss Lake (Figure 10-8).

No other contaminants exceeded criteria.

10.7.2.1.2 Discussion

The metals factor consists of generally low-level concentrations of metals. With the exception of copper, the group does not significantly (i.e., statistically) differ from the reference areas. Copper concentrations are statistically higher than the reference areas. Distribution of copper is widespread throughout Prien and Moss lakes. The highest concentrations are found in sediments with a composition of greater than 50 percent silt and clay. No spatial trend is noted in the distribution of copper in Prien Lake; copper is scattered throughout. However, in Moss Lake, the highest concentrations tend to be along the middle of the lake. This area is where the boat access channel exists in an east-west orientation. Concentrations tend to decrease southward toward the ship channel.

10.7.2.2 TCDD/TCDF Factor

This section presents the extent of the TCDD/TCDF Factor and discussion as to the fate and transport of contaminants in this factor.

10.7.2.2.1 Results

This factor groups total TCDD and TCDF as well as physical parameters such as calcium, sodium, TOC, CEC, and pH that may explain the fate and transport in the energy system. Exhibits 10-33 and 10-34 present the summary statistics for this factor.

Exhibit 10-33 Summary Statistics of Organics in TCDD/TCDF Factor in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total TCDF (pg/g)	16/16	5.6	490	123	141	1.14
Total TCDD (pg/g)	16/16	2.1	32	17.0	8.6	0.50
Dichloromethane (µg/kg)	7/69	2	290	33.1	70.2	2.12

1 – Values based on ROS. See Appendix G.

Exhibit 10-34 Summary Statistics of Inorganics (mg/Kg) in TCDD/TCDF Factor in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Sodium	64/69	1,640	48,600	13,458	10,935	0.81
Calcium	67/69	244	8,020	2,726	1,843	0.68

1 – Values based on ROS. See Appendix G.

Total TCDD is used as the indicator variable for this factor.

Surface Sediment

Total TCDD was elevated in multiple locations in the shallow lake energy system in Lower Calcasieu (Figure 10-9). The maximum concentration was observed at LCR2058, which is located along the north edge of Moss Lake. Elevated concentrations were observed at all three locations in Moss Lake.

Within Prien Lake, stations LCR2018 and LCST001 reported elevated concentrations, which are located on the west side of the lake. South of Prien Lake and the old ship channel, station LCR2039 was also observed to have elevated concentrations of total TCDD and TCDF.

When normalized to TOC, elevated concentrations are primarily in Prien Lake although the maximum normalized concentration was observed in Moss Lake at station LCR2066. This station is located on the eastern edge of Moss Lake adjacent to the ship channel.

Subsurface Sediment

Subsurface samples were not collected in the shallow lake energy system in Lower Calcasieu.

Surface Water

Total TCDD and Total TCDF were not analyzed in the surface water in the shallow lake energy system in Lower Calcasieu.

10.7.2.2.2 Discussion

The distribution of tetra – dioxins/furans (TCDD/TCDF) and the high correlation with calcium, sodium, and TOC are evidence of chemical precipitation guided deposition in Lower Calcasieu. Evaluation of the TOC normalized total TCDD/total TCDF data indicates that the most impacted area (overall concentration and greater spatial distribution) is Prien Lake. The maximum total TCDD and TCDF concentration was found in eastern Moss Lake near the confluence with the ship channel. This area tends to be the contact zone for waters of the ship channel and Moss Lake. The geometry dictates a decrease in surface water velocity and an increase in TOC due to greater algae in the warmer shallow waters of the lake. This shallow lake also tends to have higher salinities than the upper layer (upper 2 m) of the water in the ship channel. The difference in salinity may be the primary reason for increased TCDD/TCDF in location LCR2066. This is noted in the resulting sediment chemistry.

10.7.2.3 Dioxin/Furan/SVOCs Factor

This section presents the extent of the dioxin/furan/SVOCs Factor and discussion as to the fate and transport of contaminants in the shallow lake energy system.

10.7.2.3.1 Results

The dioxin/furan factor groups the hexa-, hepta-, and octa- dioxins/furans and penta-furans as well as acetone, BEHP, and cyanide. BEHP, however, is negatively correlated to the other constituents grouped in this factor (high concentrations are at locations where low concentrations of dioxins/furans were observed). Exhibits 10-35 and 10-36 present the summary statistics for this factor.

Exhibit 10-35 Summary Statistics of Organics in Dioxin/Furan/SVOCs Factor in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value (pg/g)	Maximum Detected Value (pg/g)	Mean[1] (pg/g)	Standard Deviation	Coefficient of Variation
Total HpCDF	13/16	15	500	144	164	1.14
Total HxCDF	10/16	13.3	240	74.3	83.8	1.13
OCDF	14/16	11	2,000	451	597	1.32
Total HpCDD	15/16	210	880	457	231	0.51
OCDD	16/16	1,100	8,100	4,148	2,205	0.53
Total PeCDF	10/16	6	120	33.4	38.1	1.14
Total HxCDD	16/16	39	250	108.5	56.4	0.52

1 – Values based on ROS. See Appendix G.

Exhibit 10-36 Summary Statistics of SVOCs/Metals in Dioxin/Furan/SVOCs Factor in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Acetone (µg/Kg)	38/69	7	290	35.5	50.5	1.42
BEHP (µg/Kg)	24/76	36	120,000	1,968	19,487	9.90
Cyanide (mg/Kg)	24/69	0.08	3.3	0.17	0.50	2.93

1 – Values based on ROS. See Appendix G.

Since both dioxins/furans and BEHP are COPCs, both will be discussed in this factor. Total HpCDD is used as the indicator variable for dioxins/furans.

Surface Sediment

An elevated concentration of dioxins/furans was located in the southern half of Prien Lake (Figure 10-10). Elevated BEHP concentrations were also primarily located in southern Prien Lake at stations LCR2021, LCR2023, and LCR2031. The maximum concentration was observed at station LCR2021. Moss Lake was observed to have elevated concentrations along the eastern edge, adjacent to the ship channel with concentrations ranging from 66 to 3,000 µg/Kg. The remaining locations in the shallow lake energy system were less than 570 µg/Kg.

Subsurface Sediment

Subsurface sediment samples were not collected in the shallow lake energy system in Lower Calcasieu.

Surface Water

Contaminants grouped in this factor were not detected in the shallow lake energy system in Lower Calcasieu. Dioxins/furans were not analyzed in the surface water in the shallow lake energy system in Lower Calcasieu.

10.7.2.3.2 Discussion

Distribution of the heavier hexa, hepta, octa, and penta-dioxins/furans in Lower Calcasieu are present at 60 percent or more of the locations sampled. The concentrations of OCDD are highest, ranging from 1,100 to 8,100 pg/g, with a mean concentration of 4,148 pg/g. This grouping of dioxins/furans is typically associated from atmospheric deposition from municipal waste incineration (Brzuzy 1996).

As noted in the results section, BEHP is negatively correlated to dioxin/furan detections. The BEHP tendency to adsorb to suspended material may help explain this relationship. BEHP is found at moderate to high concentrations just as the dioxins/furans; however, they are not found in the same locations. Upon examining the distribution of both compounds, it appears that the dioxins/furans and BEHP are depositing along a primary circulation pattern in Prien Lake. Rhodamine dye tests and a series of aerial photos both illustrate a dominant circulation pattern in Prien Lake. Flow enters the lake at the north end and circulates along the east side of the lake, around the southern end, and exits through either the confluence with the ship channel or out through the old river meander. The direction exiting flow takes is likely dependent upon tidal stage (flood or ebb tide) and tidal strength.

The difference in distribution may be due to the size of the particle to which the dioxin/furan or BEHP binds. BEHP tends to bind to suspended particles and so would be transported further along the circulation path, as is noted.

Historically, dioxins/furans were not analyzed. No temporal analysis of dioxins/furans is available for the Lower Calcasieu shallow lakes.

10.7.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the two major PCA factor groups previously discussed. These include:

- HPAHs and LPAHs
- 2,3,7,8-TCDD TEQs (was not included in the PCA)

COPCs that did not group with the other major factors for one or more of the following reasons:

- The frequency of detection is typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

10.7.3.1 PAHs

This section presents the extent of PAHs in the shallow lake energy system in Lower Calcasieu and describes its fate and transport in the environment.

10.7.3.1.1 Results

Surface Sediment

HPAH concentrations were detected at a slightly greater frequency and varied more than LPAHs in the shallow lake energy system (Exhibit 10-37). Detected locations are shown in Figure 10-11.

Exhibit 10-37 Summary Statistics of PAHs (µg/Kg) in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
HPAH	26/79	21	5,220	470	1,259	2.68
LPAH	7/79	20.1	1,368	314	590	1.88

1 – Values based on ROS. See Appendix G.

Elevated concentrations of HPAHs were observed in Prien Lake, with the maximum concentration located at station LCR2017 (Figure 10-11). This station is located on the eastern edge of Prien Lake along the shoreline. The area along the shore is a residential development with several boat docks around the sampling location. Elevated LPAHs were also detected at this location; however, the maximum concentration was observed at station LCR2043.

Subsurface Sediment

Subsurface sediment samples were not collected in the shallow lake energy system in Lower Calcasieu.

Surface Water

PAHs were not detected in surface water samples.

10.7.3.1.2 Discussion

HPAHs and LPAHs were detected throughout Prien and Moss Lakes. The HPAHs were detected at slightly greater frequency and with greater variation in concentrations than the LPAHs. The distribution of both LPAH and HPAHs appears to be in line with flow from the mouth of Prien Lake across from Bayou d'Inde and Coon Island Loop. These areas are adjacent to or in line with recreational boat traffic from the residential area and may represent anthropogenic release from boating activities.

Historically, samples were collected from the shallow lakes and analyzed for PAHs in the 1992 expanded site inspection. Two samples were analyzed for PAHs from the lakes. The concentrations of total HPAHs were an order of magnitude greater than that measured for the LPAHs. The limited number of samples collected hinders evaluation of the historic distribution of PAHs.

10.7.3.2 2,3,7,8-TCDD TEQ

This section describes the distribution of dioxins/furans presented as 2,3,7,8-TCDD TEQs for the shallow lake energy system in Lower Calcasieu.

10.7.3.2.1 Results

Summary statistics are provided in Exhibit 10-38 for 2,3,7,8-TCDD TEQ. Elevated concentrations were observed in Prien Lake, with it having the maximum concentration at station LCR2018 (Figure 10-12).

Exhibit 10-38 Summary Statistics of 2,3,7,8-TCDD TEQ (pg/g) in Surface Sediment, Shallow Lake Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
2,3,7,8-TCDD TEQ	16/16	2.04	30.6	10.4	8.7	0.83

1 – Values based on ROS. See Appendix G.

Concentrations decrease away from this location. Stations LCR2010 and LCR2020 were also observed to have slightly elevated concentrations and are located toward the middle of the lake.

Stations LCR2047 and LCR2053 were observed to have elevated concentrations. LCR2047 is located in the old ship channel, and LCR2053 is located north of where Bayou Guy enters into the ship channel. The distribution of 2,3,7,8-TCDD is similar to what was observed for the Dioxins/Furan Factor in Section 10.7.2.3.

Subsurface Sediment

Subsurface samples were not collected in the shallow lake energy system in Lower Calcasieu.

Surface Water

Dioxins/furans were not analyzed in the surface water in the shallow lake energy system in Lower Calcasieu.

10.7.3.2.2 Discussion

2,3,7,8-TCDD TEQ distribution in the shallow lakes of Lower Calcasieu were found to be highest in LCR2018 near the southern end of Prien Lake. Slightly lower concentrations were found north of this location, near the mouth of Prien Lake, across from Bayou d'Inde. Limited TEQ detections are noted below Prien Lake within the

old river meander near Bayou Guy. The concentrations are moderately elevated; however, distribution in this area is also limited. The overall distribution of the various dioxin/furan compounds is similar; frequency of detections and concentrations vary and are the primary differences in these discussions for the shallow lakes areas.

10.8 Nature and Extent for the Ship Channel Energy System

The results and discussion section is organized into three sections: COPCs identified for the ship channel energy system (Section 10.8.1), the results of the PCA (Section 10.8.2), and contaminants that showed little or no correlation to other contaminants or parameters (Section 10.8.3).

Graphical presentation will illustrate the concentrations of an indicator variable that will be representative of the other parameters or constituents in that factor. Key contaminants that were not presented in a factor will be presented in individual figures.

Appendix G provides details of the PCA and complete summary statistics for all compounds detected in the ship channel energy system in Lower Calcasieu.

10.8.1 COPCs for the Ship Channel Energy System in Lower Calcasieu

To focus on the COPCs that are the primary risk drivers, energy system specific COPCs were selected for discussion. These energy system specific COPCs were identified by comparing the primary risk drivers from the HHRA and the BERA and comparing those COPCs to reference area conditions. Section 10.8.1.1 presents the results of the statistical comparison of these COPCs between energy system and reference area. Section 10.8.1.2 presents the ship channel energy system COPCs identified.

10.8.1.1 Comparison to Reference Areas

Results of the WRS test are presented in Table 10-5. Contaminants that were determined to be statistically significantly different than the reference area or did not have sufficient data to compare are:

- SVOCs (bis[2-ethylhexyl]phthalate)
- PAHs (as pyrene)

10.8.1.2 COPCs Selection

Energy system specific COPCs for Lower Calcasieu were selected by determining if the COPC is a risk driver in the HHRA or the BERA and was determined to be statistically significantly different than reference area conditions (Table 10-9). In addition, contaminants are only discussed if they are observed in at least two

locations or if more than 5 percent of the samples for the energy system had positive detections. The following COPCs were selected for the ship channel energy system in Lower Calcasieu:

- SVOCs (bis[2-ethylhexyl]phthalate)
- HPAHs and LPAHs

The extent as well as the fate and transport of these COPCs will be discussed in Sections 10.8.2 (PCA) and 10.8.3 (Isolated Chemistry).

10.8.2 PCA

The PCA revealed three dominant factors that accounted for most of the variability (63 percent) in surface sediment within the ship channel energy system in Lower Calcasieu. These factors are:

- A Background Metals Factor that accounts for 23 percent of the variability in surface sediment.
- A medium- to high-level contamination Dioxin/Furan/Metals Factor that accounts for 23 percent of the variability in surface sediment.
- A medium- to high-level contamination PAH/Dioxin Factor that accounts for 17 percent of the variability in surface sediment.

These factors present groups of parameters and/or contaminants that tend to correlate with each other and explain variability in the data set.

10.8.2.1 Background Metal Factor

This section describes the extent of the dioxins/furans and metals grouped within this factor.

10.8.2.1.1 Results

The Background Metal Factor metals that have concentrations similar to what was observed in the reference areas. Exhibit 10-39 presents the summary statistics for the constituents grouped within this factor.

Exhibit 10-39 Summary Statistics for Metals (mg/Kg) in the Background Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Nickel	37/52	0.78	29.3	8.40	5.83	0.69
Iron	52/52	453	28,000	7,600	6,124	0.81
Beryllium	28/52	0.07	1.2	0.50	0.37	0.74
Potassium	51/52	111	4,740	1,928	1,180	0.61
Cobalt	44/52	0.69	20.6	18.6	17.9	0.96
Zinc	37/52	8.2	104	31.3	22.7	0.73
Aluminum	52/52	318	20,300	8,486	5,359	0.63
Chromium	50/52	1.2	58.9	13.1	10.8	0.82
Vanadium	51/52	0.54	71	17.6	12.4	0.71
Arsenic	52/52	0.18	29.6	3.62	4.79	1.32
Manganese	52/52	3.5	1,770	188	309	1.64
Copper	42/52	3.3	80.8	18.6	17.9	0.96

1 – Values based on ROS. See Appendix G.

Since this factor presents metals similar to background concentrations, their extent in the ship channel energy system in Lower Calcasieu will not be discussed further.

10.8.2.2 Dioxin/Furan/Metal Factor

This section describes the extent of contaminants grouped in this factor within the ship channel energy system in Lower Calcasieu.

10.8.2.2.1 Results

This factor groups hexa- and octa- dioxin and furans as well as total (penta) PeCDFs and total (hepta) HpCDDs. Other contaminants include: barium, cyanide, mercury and diesel and include pH. Exhibits 10-40 and 10-41 present the summary statistics for contaminants in this factor.

Exhibit 10-40 Summary Statistics for Dioxins/Furans (pg/g) in the Dioxin/Furan/Metal Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total PeCDF	4/10	8.5	150	19.0	53.2	3.32
OCDF	6/10	13	1,300	181	515	2.84
Total HxCDF	5/10	11	230	30.3	96.1	3.17
Total HxCDD	10/10	7.1	180	80.9	51.6	0.64
Total HpCDD	10/10	56	780	326	248	0.76
OCDD	10/10	430	4,000	1,913	1,215	0.64

1 – Values based on ROS. See Appendix G.

Exhibit 10-41 Summary Statistics for Other Contaminants in the Dioxin/Furan/Metal Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Diesel (µg/Kg)	4/10	67,000	280,000	73,174	105,903	1.44
Barium (mg/Kg)	52/52	16	1,430	158	248	1.57
Cyanide (mg/Kg)	26/52	0.07	1.4	0.18	0.29	1.60
Mercury (mg/Kg)	10/52	0.08	1.7	-	-	-

1 – Values based on ROS. See Appendix G.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Total HxCDD was used as the indicator variable for this factor.

Surface Sediment

Contaminants grouped in this factor were observed to have elevated concentrations along the shoreline of the Citgo facility, directly across the channel from the Citgo facility, and across the channel from LC Harbor/Terminal (Figure 10-13). Highest concentration of dioxins/furans was observed at station LCR1027, which is located where Indian Marais lagoon enters into the ship channel. LCR1027 also had a diesel concentration of 240,000 (µg/Kg). Directly south and across the ship channel, station LCR1036 was also observed to have elevated concentrations of dioxins/furans and was the location where the maximum concentration of diesel was observed. Station LCR1020 is located on the northern edge of the Citgo facility on the western shore of the ship channel, and was also observed to have elevated concentrations. This area is slightly off the channel in a shallow area that may be less affected by other locations along the channel.

Subsurface Sediment

Multi-depth sediment samples were not collected in the ship channel in Lower Calcasieu.

Surface Water

Barium and mercury were detected in surface water samples collected in the ship channel energy system in Lower Calcasieu. Exhibit 10-42 presents the total and dissolved (if detected) concentrations of these contaminants and compares them to EPA AWQC (as reported in the Federal Register 1995) CCC (chronic) and CMC (acute) values and/or LDEQ Water Quality Regulation (LDEQ 2000) for both freshwater and marine environments. For systems with salinity between 1 and 10 ppt, the more stringent of either fresh or marine values should be used to compare with mean dissolved concentrations. In cases where the dissolved phase was not detected, the surface water criteria for that contaminant was converted to an unfiltered criterion using a conversion factor provided in LDEQ 2000.

Exhibit 10-42 Mean and Standard Deviation of Total and Dissolved Concentrations (mg/L) in Metal Factor in Surface Water, Shallow Lake Energy System

Analyte	Mean Total[1]	Mean Dissolved[1]	Fresh Acute	Fresh Chronic	Marine Acute	Marine Chronic
Barium	0.1035 (0.007)	0.0071 (0.081)	-	-	-	-
Mercury	0.000049[2]	0.000058[2]	0.002[3]	**0.000012[3]**	0.002[3]	**0.000025[3]**

1 – Based on ROS. See Appendix G. If only two samples, an average was calculated. ND: Not detected
2 – Only detected in one sample.
3 – LDEQ Water Quality Regulations based on 200-mg/L hardness for dissolved concentrations.
(-) – No criteria established by LDEQ.

Mercury was detected at station LCR1024, which is located directly across the ship channel from the Citgo facility. Mercury concentrations exceed both the fresh and marine chronic criteria established by LDEQ.

10.8.2.2.2 Discussion

The highest dioxin/furan detection was found across from the mouth of Indian Marais Lagoon. The occurrence tends to correlate with elevated diesel detections as well. Distribution tends to be limited to the area near the Citgo facility; concentrations decrease upstream and downstream of this area.

Mercury is present in 10 of 52 sediment samples collected from the Lower Calcasieu AOC ship channel energy system. The concentrations range from 0.08 to 1.7 mg/Kg. Historically, samples analyzed for mercury (1989 EPA Toxics study) had positive detections in six of eight samples at similar concentrations. Mercury was detected in the surface water in the RI and indicates recent release to the ship channel.

10.8.2.3 PAH/Dioxin Factor

This section describes the extent of contaminants grouped in the PAH/Dioxin Factor in the ship channel energy system in Lower Calcasieu.

10.8.2.3.1 Results

This factor groups PAHs, dioxins, and acetone as well as silt, which is important in determining fate and transport of these contaminants. The PAHs, however, are negatively correlated with the dioxins, acetone, and silt. These PAHs tend to be elevated in areas where there is a low silt percentage as well as low concentrations of dioxins and acetone. Summary statistics are provided in Exhibits 10-43 and 10-44.

Exhibit 10-43 Summary Statistics for PAHs in the PAH/Dioxin Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Pyrene	12/52	53	7,400	395	1,273	3.23
Fluoranthene	10/52	47	7,600	-	-	-

1 – Values based on ROS. See Appendix G.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Exhibit 10-44 Summary Statistics for Other Constituents in the PAH/Dioxin Factor for the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Total PeCDD	6/10	7.1	28	15.4	11.3	0.74
Total TCDD	9/10	0.66	31	15.3	13.1	0.86
Acetone	30/52	3	170	22.9	33.5	1.47

1 – Values based on ROS. See Appendix G.

Pyrene was used as the indicator variable for this factor and is indicative of both LPAHs and HPAHs

Surface Sediment

Contaminants grouped within this factor are primarily along the Citgo facility shoreline and across the ship channel from the facility (Figure 10-14). Maximum concentrations were observed at station LCR1055, which is located between Citgo outfalls 4 and 6. A loading/unloading dock is also located at this location.

Concentrations decrease upstream and downstream as well as across the channel from this location. There are select samples where elevated concentrations of PAHs were observed. Station LCR1041, which is located between Conoco and Citgo in Lower Calcasieu and station LCR1046, which is located along the shoreline of the Westlake facility.

Dioxins, which are negatively correlated to PAHs according to the PCA, were also observed to have elevated concentrations adjacent to the Citgo facility but detected at different sample locations. The difference may be due to the lack of samples collected for dioxin/furan analysis. Since silt correlated with dioxins, PAHs may be more correlated with smaller grain size particles.

Subsurface Sediment

Multi-depth subsurface samples were not collected in the ship channel energy system in Lower Calcasieu

Surface Water

Dioxin was not analyzed in surface water. PAHs and acetone were not detected in surface water samples.

10.8.2.3.2 Discussion

The PAHs tend to be elevated in areas adjacent to Citgo. The dioxins tend to be associated with elevated silt concentrations. These areas are not necessarily the same. Distribution of dioxins in the ship channel is elevated primarily at and downgradient of the Citgo facility with low levels clustered below Citgo near LCR1033 on the eastern bank of the ship channel below the Citgo facility. The PAH (HPAHs,

specifically pyrene) distribution correlates with the (overall lower concentration) distribution of LPAHs. The area at LCR1033 is a major bend in the ship channel and likely represents a surface water velocity drop along the shallow shelf where these samples were collected. The maximums noted at Citgo are located near the shipping dock and below NPDES outfalls 004 and 006.

10.8.3 Isolated Chemistry

Several COPCs that were detected in 5 percent or greater of the samples did not group with the two major PCA factor groups previously discussed. These include:

- BEHP
- PCBs

This COPC did not group with the other major factors for one or more of the following reasons:

- The frequency of detection is typically low.
- The distribution of contamination was different than observed for the compounds for the four major factors.

Each of these COPCs is discussed in the following sections.

10.8.3.1 BEHP

This section presents the extent of BEHP in the ship channel energy system in Lower Calcasieu and describes its fate and transport in the environment.

10.8.3.1.1 Results

Surface Sediment

BEHP was highly variable in the ship channel based on its coefficient of variation (Exhibit 10-45). However, there are three areas where elevated concentrations of BEHP were observed: along the western edge of the ship channel adjacent to Lockport Marsh, adjacent to the Citgo facility, and adjacent and south of the Westlake facility (Figure 10-15)

Exhibit 10-45 Summary Statistics for BEHP (µg/Kg) in the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
BEHP	22/52	42	30,000	768	5,995	7.81

1 – Values based on ROS. See Appendix G.

The maximum concentration of BEHP was observed at LCR1019, which is located at the north corner of the Citgo facility along the west edge of the ship channel. This area is somewhat set back from the channel and shallow in depth. Concentration of

BEHP along the Citgo facility ranges from 87 to 510 µg/Kg and with a variable spatial distribution.

Near the Westlake facility, BEHP concentration ranges from 280 to 1,400 µg/Kg, with concentrations decreasing downstream of station LCR1051. Along Lockport Marsh, BEHP ranges from 42 to 300 µg/Kg and is concentrated in an area approximately 500 m in diameter and encompasses a station across the channel.

Subsurface Sediment

Multi-depth subsurface sediment samples were not collected in the ship channel energy system in Lower Calcasieu.

Surface Water

BEHP was detected at three locations, with concentrations that range from 2 to 5 µg/L. The locations were widely distributed and did not exceed AWQC.

10.8.3.1.2 Discussion

The distribution of BEHP in the Lower Calcasieu ship channel energy system tends to be highest in the shallow inlet near the Westlake facility, upstream of Citgo. The limited number of detections and the distribution of BEHP are in the backwater, quiet locations, which align with previous findings, indicating association with fine grained or suspended material. Occurrence of BEHP within the ship channel is limited.

10.8.3.2 PCBs

This section presents the extent of total PCBs in the ship channel energy system in Lower Calcasieu and describes its fate and transport in the environment.

10.8.3.2.1 Results

Both Aroclor 1254 and Aroclor 1260 were detected in the ship channel energy system in Lower Calcasieu (Figure 10-16). Aroclor 1254 was the most frequently detected PCB in the energy system (Exhibit 10-45).

Exhibit 10-45 Summary Statistics for PCBs (µg/Kg) in the Ship Channel Energy System

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean[1]	Standard Deviation	Coefficient of Variation
Aroclor 1254	6/52	13	590	-	-	-
Aroclor 1260	1/52	60	60	-	-	-

1 – Values based on ROS. See Appendix G.
(-) – Mean value not calculated due to estimation of distribution becomes less accurate for less than 20% detected.

Aroclor 1254 was primarily detected from the Citgo facility downstream to Moss Lake. The maximum concentration observed for Aroclor 1254 was at station LCR1026 and decreased upstream and downstream of this location.

Aroclor 1260 was only detected at one location, LCR1036. This location is directly south and across the ship channel from where Indian Marais joins the Calcasieu River Ship Channel.

Subsurface Sediment

PCBs were not analyzed in the subsurface in the ship channel energy system.

Surface Water

PCBs were not detected in the surface water in the ship channel energy system.

10.8.3.2.2 Discussion
PCB detections were limited. Distribution was clustered around the Citgo facility, specifically near Indian Marais Lagoon. Aroclor 1260 was detected only once, at the bend on the eastern side of the ship channel below Indian Marais Lagoon at station LCR1036. The areas with detected concentrations are areas with either possible nearby sources (Indian Marais Lagoon) or protected shallow water where velocity decreases, allowing settling and accumulation of contaminants with fine-grained materials.

10.9 Summary and Conclusions

This section summarizes the COPCs found in Lower Calcasieu and presents an overview of their relation to historic data, reference areas results, spatial distribution, sediment stability, and chemical fate and transport.

10.9.1 Summary

Lower Calcasieu is divided into four energy systems: bayou, shallow lake, other (Indian Marais Lagoon), and ship channel. The energy systems are defined in Section 10.1.2 and Figure 10-1.

Potential Sources to Lower Calcasieu:

Citgo, Montell USA, LA Pigments, and W.R. Grace

Bayous Olsen and Guy represent the bayou system in Lower Calcasieu. Both bayous are saline, low-flow systems. Bayou Guy receives runoff from predominantly rural residential areas. Bayou Olsen receives industrial discharge from W. R. Grace Inc. and rural residential runoff. Both systems are net sediment exporters, and receiving bodies are Moss Lake for Bayou Olsen and the Old Calcasieu River channel below Prien Lake to Bayou Guy.

The shallow lake areas include Prien Lake and Moss Lake; they are semi-confined shallow low-flow systems with limited circulation. Moss Lake tends to have the larger opening to the ship channel. The ship channel system includes the main ship channel from the I-210 Bridge south the southern end of Moss Lake.

The areas that define Lower Calcasieu represent a mixture of land uses and point and non-point contaminant sources. Additional input to the Lower Calcasieu system includes flow from Upper Calcasieu, Bayou Verdine, and Bayou d'Inde sources. The most significant introduction of contaminants to the system appears to occur near the Citgo facility. Contaminants of primary interest in Lower Calcasieu are those contaminants that increase human health or ecological risk. The layout of Lower Calcasieu tends to lead to somewhat isolated occurrence of COPCs; the following is an overview of contaminant distribution within Lower Calcasieu.

Contaminants of Potential Concern in Lower Calcasieu:

Dioxins/Furans, HPAHs, LPAHs, BEHP and Various metals

Overall, the most impacted area within Lower Calcasieu is the Indian Marais Lagoon. The largest set of contaminants and highest concentrations are found in the lagoon. Former discharge has impacted lagoon sediments. Primary COPCs are PAHs and various metals, primarily lead, copper, chromium, and zinc.

The shallow lake areas, specifically Prien Lake, tend to have broad distribution of moderate-, to low-level concentrations of dioxins/furans, PAHs and some metals. Copper, lead, mercury, nickel, and zinc were present in Prien Lake in the surface water. Copper exceeded the ambient water quality criteria set for acute and chronic marine exposure and chronic freshwater exposure limits. Mercury exceeded the chronic ambient water quality criteria for freshwater systems.

Data from the ship channel portion of Lower Calcasieu had limited detections of dioxins/furans, PAHs, BEHP, and mercury. The distribution is primarily associated with the Citgo facility and the Indian Marais Lagoon. Distribution appears to represent some degree of sediment transport downstream of the potential sources, e.g., the Citgo outfalls 004 and 006 or the Indian Marais Lagoon, to a shallow shelf on the eastern side of the ship channel where velocities appear to decrease and settling occurs.

10.9.2 Conclusions

The distribution of COPCs in Lower Calcasieu is mostly concentrated in the Indian Marais Lagoon and is present in generally disperse, low-level concentrations in the ship channel and Prien Lake. Minor distribution of PAHs and various metals are present in Moss Lake.

Evidence of flow-driven transport is noted in the ship channel, with select COPC distribution noted between LCR1055 to LCR1036 (from Citgo facility to the ship channel bend south of the Citgo facility) and in Prien Lake. Distribution of dioxins/furans and BEHP in Prien Lake appear to be the result of sediment accumulation in the southern end of the lake. The specific origin of the dioxins/furans and BEHP is unknown, but based upon observed surface water circulation patterns associated with Prien Lake, it is likely that the contaminants have originated outside

of the lake. The presence of COPCs in the remainder of Lower Calcasieu, e.g., the Bayou Guy, Bayou Olsen, and Moss Lake, are minimal.

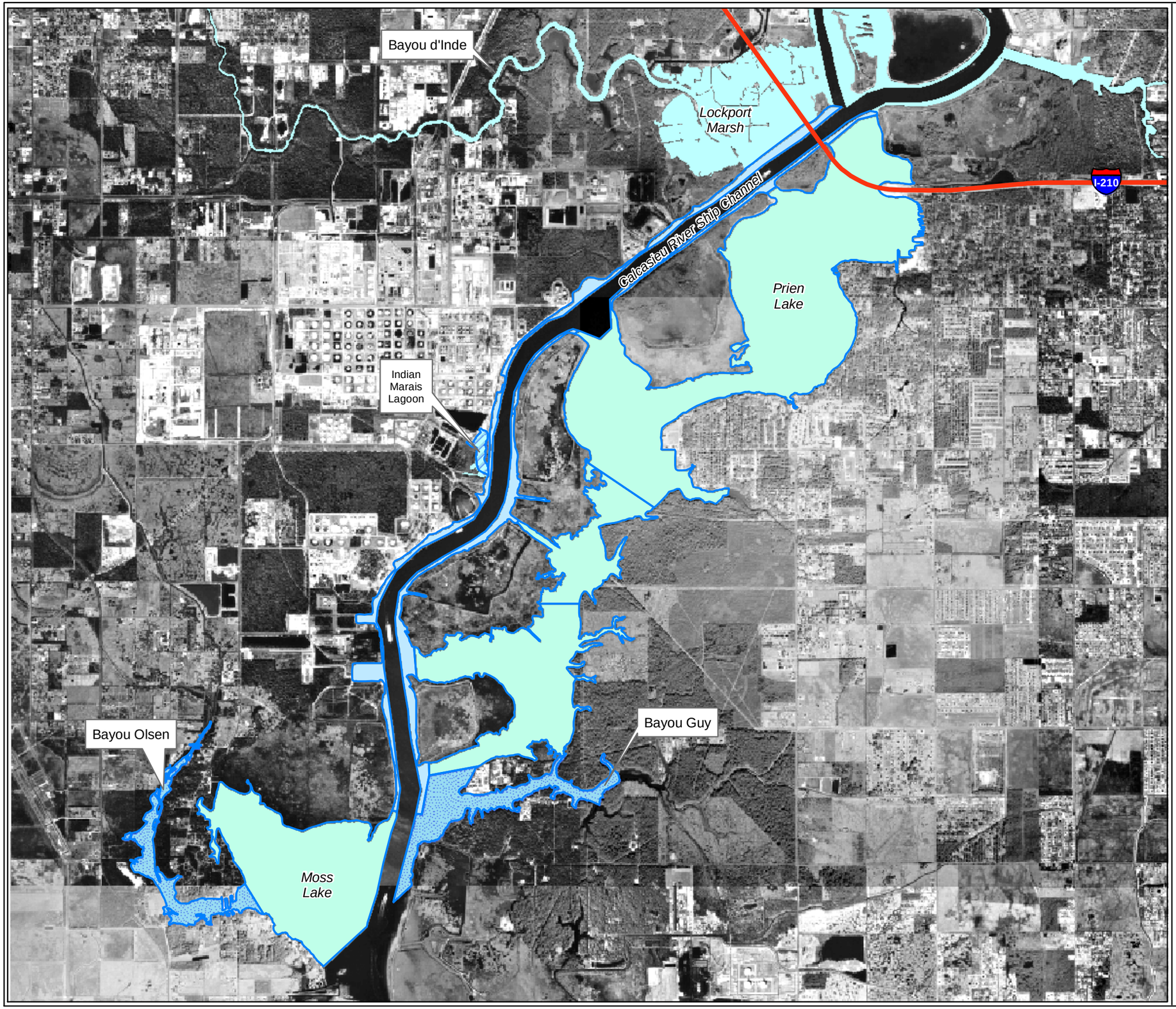
COPCs of interest in Lower Calcasieu are PAHs (HPAH and LPAH), dioxins/furans, and various metals. The highest concentrations are found in the Indian Marais Lagoon, and lower levels of a sub-set of COPCs are noted in Prien Lake. It should be noted that minor sediment transport and deposition appears to be occurring downgradient of the Citgo facility and within Prien Lake. Limited historic data is available for use in evaluating sediment stability over time. Vertical core data show the highest concentrations in the 0 to 10-cm interval in Indian Marais Lagoon. Likewise, cores indicate the sediment scouring has occurred in Indian Marais Lagoon. PAH data in the subsurface indicates material is present in the shallow surface sediments but that concentration levels are lower than in the past. Subsurface data is limited to the Indian Marais Lagoon in Lower Calcasieu.

In general, PAH and dioxin/furan distribution in Lower Calcasieu sediment tends to be concentrated in the Indian Marais Lagoon. Minor miscellaneous detections are also noted in the shallow lakes, primarily Prien Lake. Minor PAH distribution extends a short distance to the area downstream of the Citgo facility within the ship channel. This distribution appears to be due to physical transport of fine-grained material and subsequent settling due to velocity drops in downstream bends of the ship channel. Concentrations indicate that the ship channel effectively exports much of the sediment that enters.

The leading potential source of contaminants appears to be the Citgo outfalls within the area. Overall, contaminants appear to be highest in the Indian Marais Lagoon. The data suggests that moderate fine or suspended particle transport is occurring, with limited deposition occurring within the ship channel near station LCR1033. Overall, sediment stability appears to be dynamic. Current conditions have led to accumulation; however, the site is susceptible to storm surge scouring. It appears that material moves out of the lagoon into the ship channel during periods of high flow and that once material enters the ship channel the compounds are carried out of the system. The data indicate that in Lower Calcasieu deposition along the shoulder of the ship channel is minor; the ship channel is an effective sediment exporter.

Figure 10-1
AOC and Energy Areas
Lower Calcasieu AOC

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana



Legend

- Interstate
- Lower Calcasieu Area of Concern

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

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Mapfilename: Figure10-1LWCAAOCandEnergyAreas-1117size.mxd 10/9/02

Figure 10-2
Lower Calcasieu Industries
and
Current and Historical NPDES Outfalls

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Westlake Polymers

Westlake Petrochemicals
&
Westlake Styrene

Westlake Vinyl

I-210

108

Calcasieu Ship Channel

Prien Lake

Moss Lake

Bayou Guy

Bayou Olsen

Facility: LAP Outfall No.: 002
Facility: LAP Outfall No.: 001
Facility: LAP Outfall No.: 003
Facility: LAP Outfall No.: 004
Facility: LAP Outfall No.: 005
Facility: Mon Outfall No.: 002
Facility: Mon Outfall No.: 001
Facility: WPT Outfall No.: 003
Facility: WPT Outfall No.: 001
Facility: WPT Outfall No.: 002
Facility: WPT Outfall No.: 004
Facility: Cit Outfall No.: 006
Facility: Cit Outfall No.: 004
Facility: Cit Outfall No.: 011
Facility: Cit Outfall No.: 003
Facility: Cit Outfall No.: 009
Facility: Con Outfall No.: 002
Facility: Con Outfall No.: 201
Facility: Con Outfall No.: 001
Facility: WRG Outfall No.: 002
Facility: WRG Outfall No.: 001
Facility: Con Outfall No.: 001
Facility: Con Outfall No.: 002

Note: NPDES outfall locations are based on information provided as of 1998. Outfalls may be currently inactive or relocated.

Locations shown are based on coordinates supplied in the permits or information provided by the respective companies. The location represent sampling locations and may not be the point of entry into the surface water body (e.g. Bayou d'Inde, Bayou Verdine, Upper or Lower Calcasieu).

A

Facility: Con Outfall No.: 001
Facility: Con Outfall No.: 008
Facility: Con Outfall No.: 003
Facility: Con Outfall No.: 004
Facility: Con Outfall No.: 103
Facility: Con Outfall No.: 005
Facility: Con Outfall No.: 010
Facility: Con Outfall No.: 012
Facility: Con Outfall No.: 013
Facility: Con Outfall No.: 006
Facility: Con Outfall No.: 011
Facility: Con Outfall No.: 009
Facility: Con Outfall No.: 007

Legend

NPDES Outfall Status
- Unknown
- Active
- Inactive
- Interstate
- Lower Calcasieu AOC Boundary

Energy Systems
- Bayou
- Marsh
- Shallow Lake
- Ship Channel

Industrial Property
- Bridgestone/ Firestone
- CitCon
- Citgo
- Conoco
- Conoco/Citgo
- Entergy
- Himont/Montell
- LA Pigment
- LC Harbor/terminal
- Lyondell
- OxyChem/Equistar
- PPG
- Venco
- WR Grace
- Westlake

N
W E
S

Kilometers
0 0.5 1 2

United States Environmental Protection Agency Region 6

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Mapfilename: Figure10-2LWCANPDESOutfalls-1117size.mxd 9/10/02

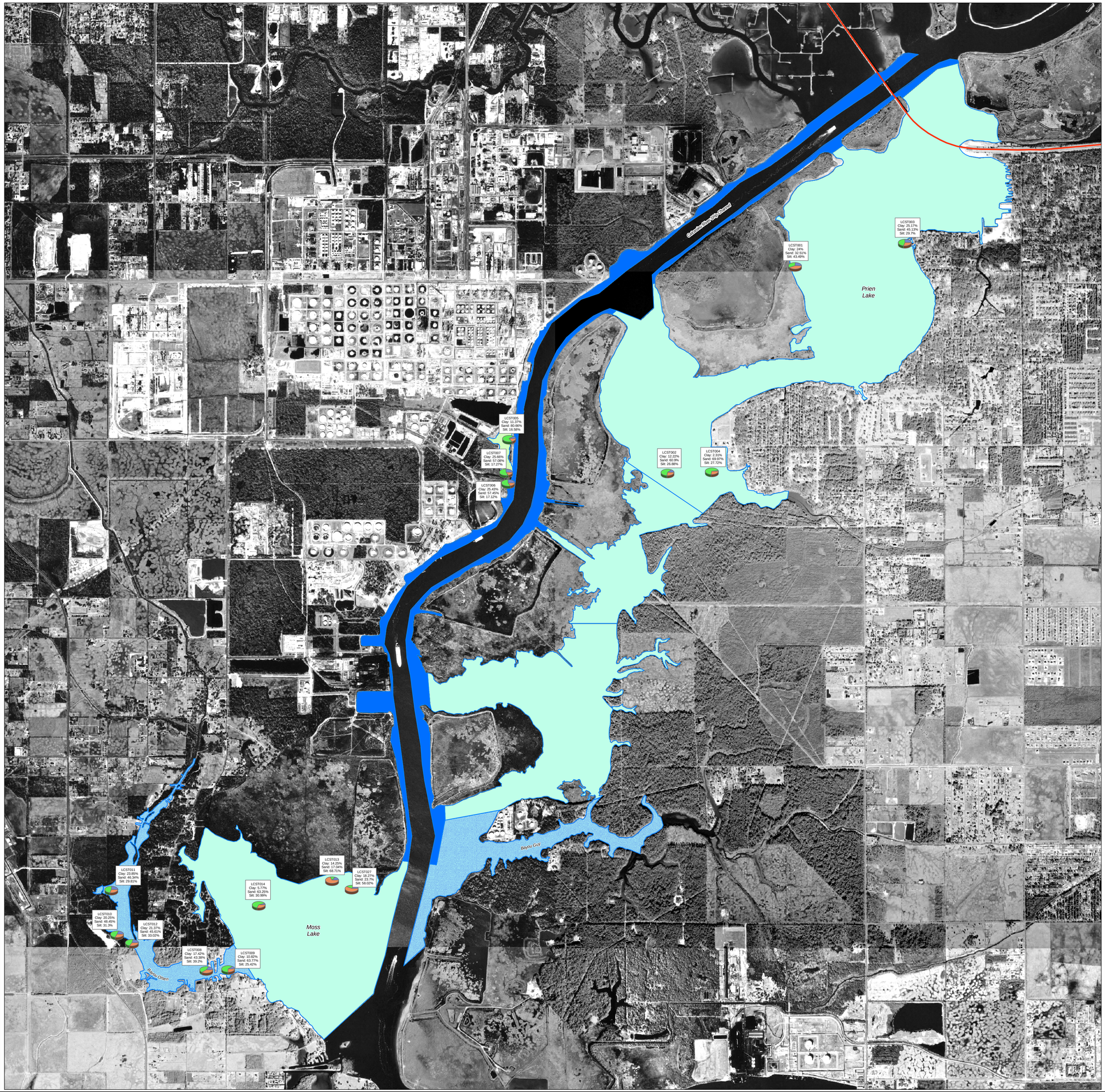

Figure 10-3
Lower Calcasieu Grain Size Distribution
in Surface Sediment

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Percent Clay
- Percent Sand
- Percent Silt
- Interstate
- Lower Calcasieu Area of Concern

Energy Area

- Bayou
- Shallow Lake
- Ship Channel
- Other

N
W E
S

Kilometers
0 0.35 0.7 1.4

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Region 6

Prepared by CDM

Map Filename: Figure10-3UCGrainsizeDistribution-Esize.mxd 09/04/2002

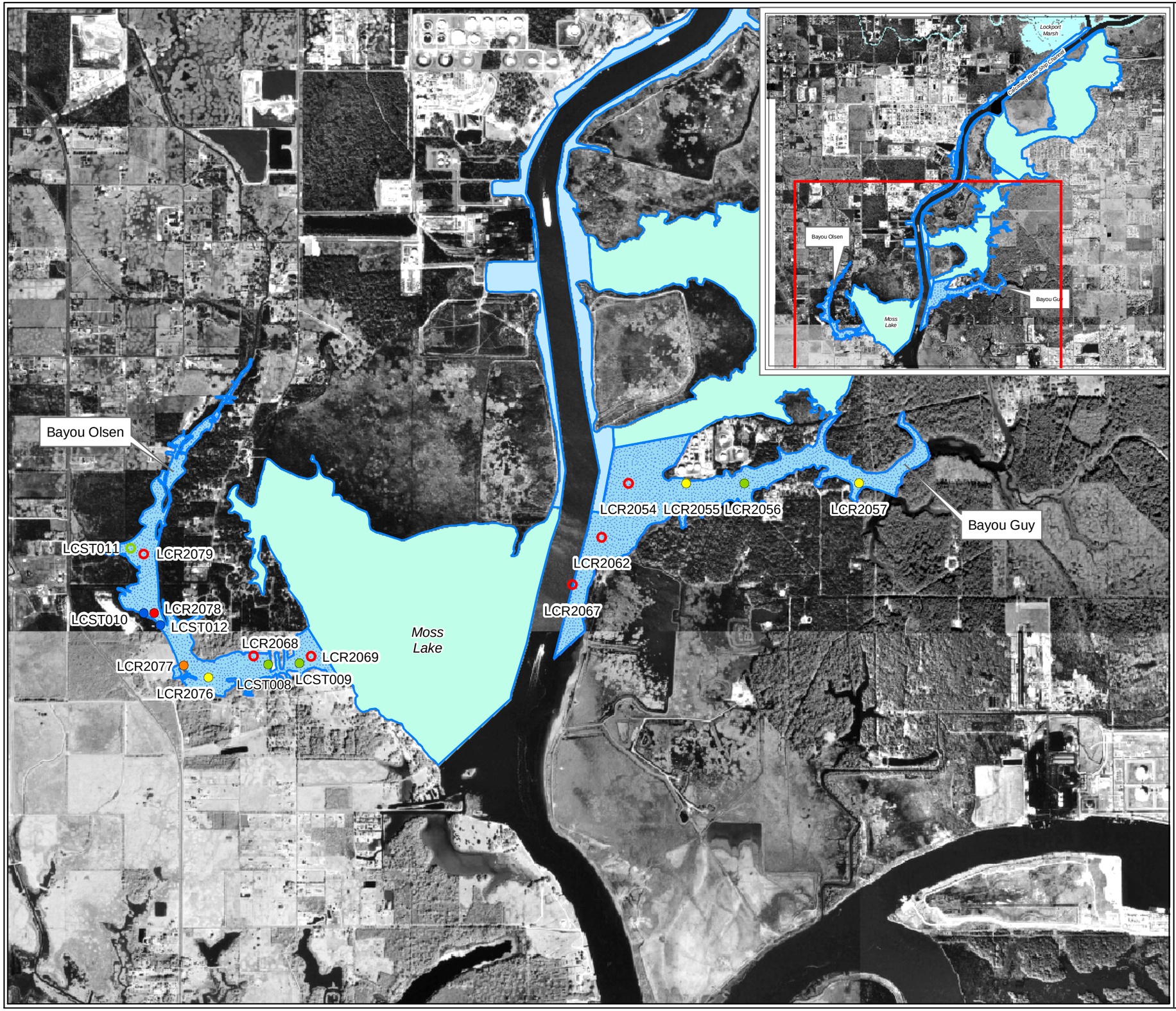

Figure 10-4
Bis(2-ethylhexyl)phthalate
Lower Calcasieu AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Bis(2-ethylhexyl)phthalate (ug/kg)

- 68 - 73
- 74 - 180
- 181 - 340
- 341 - 770
- 771 - 1700

Bis(2-ethylhexyl)phthalate Non-Detects (ug/kg)

- 74 - 180
- 181 - 340
- 341 - 770
- 771 - 1700

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers

0 0.5 1

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Region 6

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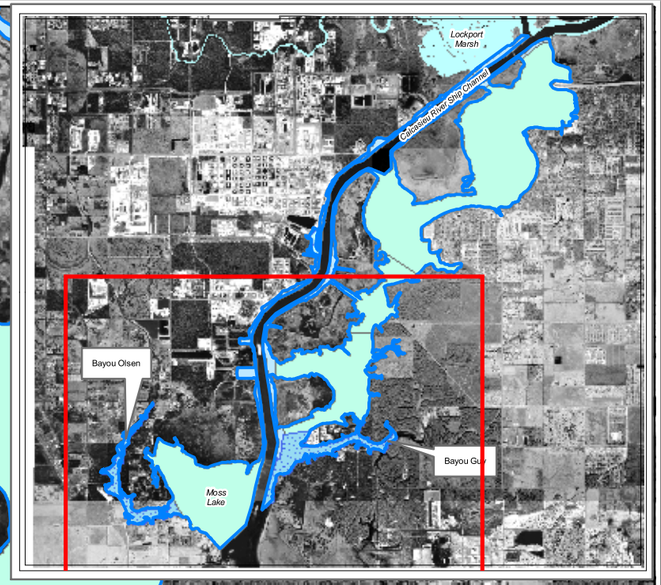
Mapfilename: Figure10-4LWCABayouBEHP-1117size.mxd 10/9/02

LPAHs consist of the following:
1-Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

HPAHs consist of the following:
1,2-Benzphenanthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Dibenzo(a,h)anthracene
Fluoranthene
Indeno(1,2,3-cd)pyrene
Pyrene



Bayou Olsen
Bayou Guy
Moss Lake
LCR2079
LCST011
LCR2078
LCST010
LCST012
LCST025
LCR2077
LCR2068
LCST008
LCR2076
LCR2069
LCST009
LCR2054
LCR2055
LCR2056
LCR2057
LCR2062
LCR2067

Figure 10-5
High and Low Molecular Weight PAHs
Lower Calcasieu AOC
Bayou Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Interstate
Lower Calcasieu AOC Boundary

Energy Areas
Bayou
Other
Shallow Lake
Ship Channel
Water

LPAHs (ug/kg)
142 - 245

LPAH Non-Detects (ug/kg)
323 - 620
621 - 6960
6961 - 8800
8801 - 13600

HPAHs (ug/kg)
73 - 289
290 - 700
701 - 11000

HPAH Non-Detects (ug/kg)
290 - 700
701 - 11000
11001 - 14000
14001 - 17000

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.5 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-5LWCABayouPAHs-1117size.mxd 10/9/02

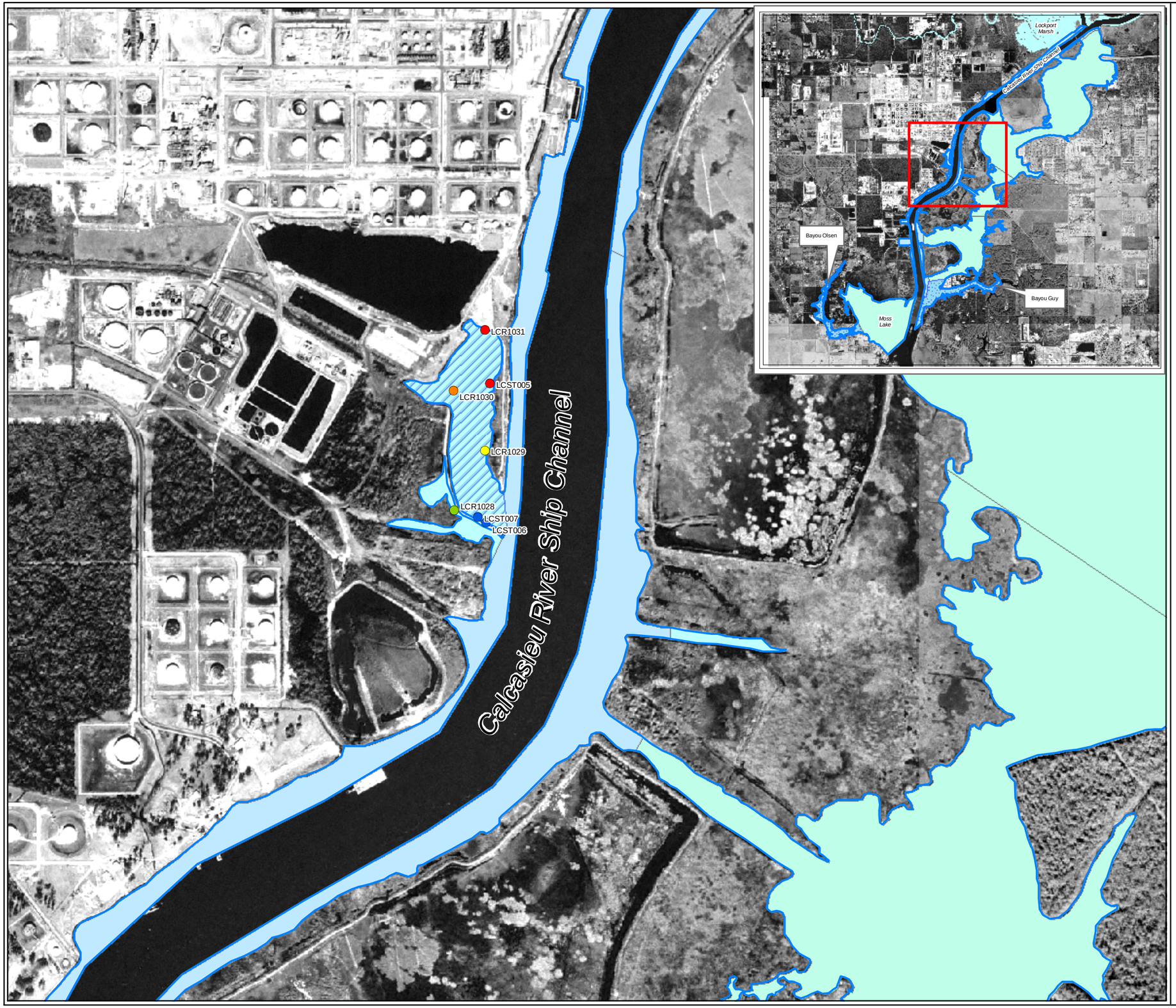


Figure 10-6
Metal/PCB/PAH Factor
Lower Calcasieu AOC
Other Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Lead (mg/kg)

- 51 - 66
- 67 - 100
- 101 - 293
- 294 - 387
- 388 - 793

Lead is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:

Magnesium	Sodium
Cadmium	Silver
Arsenic	Chromium
Aluminum	Lead
Potassium	Zinc
Cobalt	Manganese
Selenium	Mercury
Calcium	Aroclor 1254
Iron	Naphthalene
Nickel	Indeno(1,2,3-cd)pyrene
Copper	

N
W E
S

Kilometers

0 0.25 0.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-6LWCAOtherLead-1117size.mxd 10/9/02

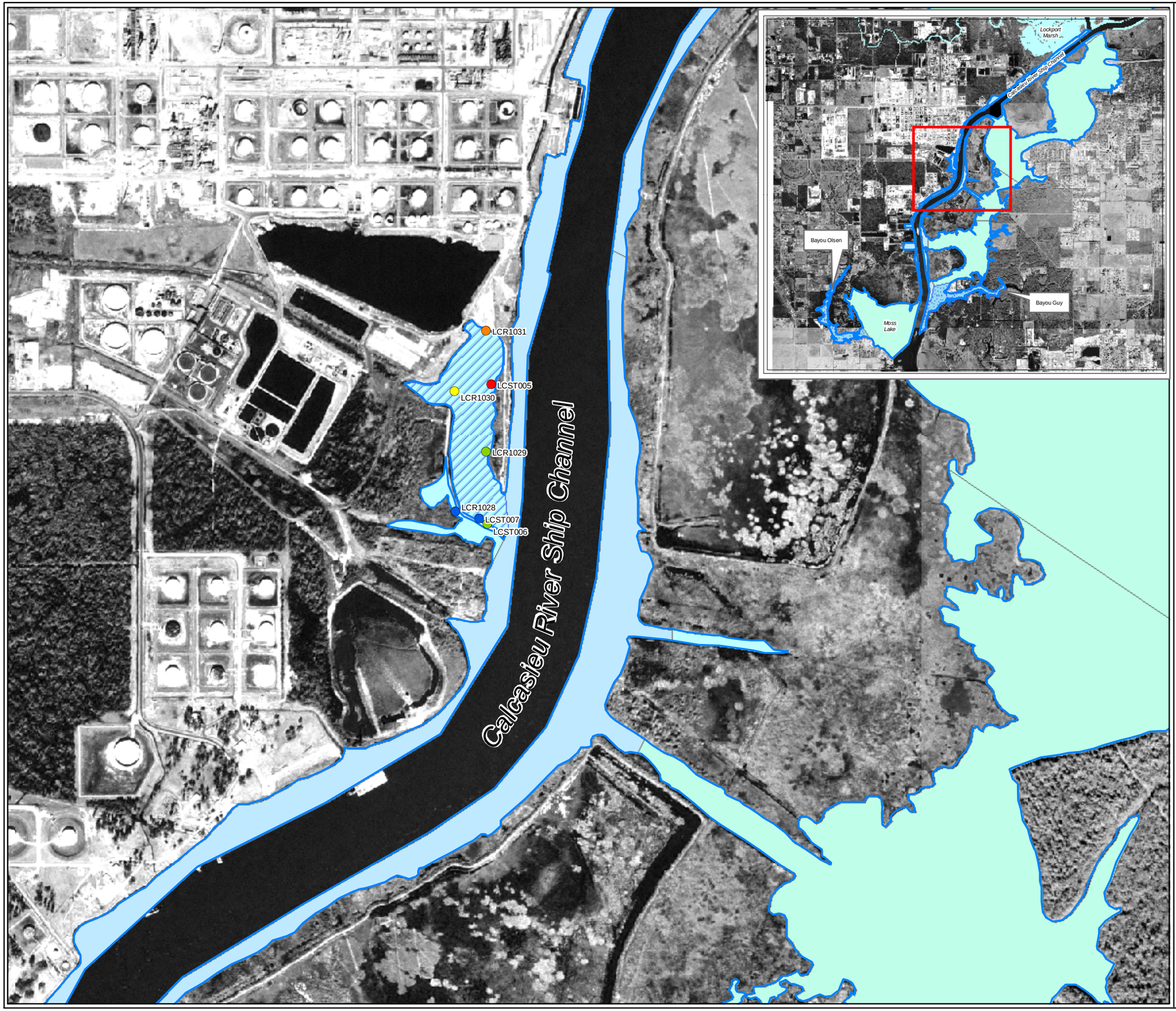


Figure 10-7
PAH Factor
Lower Calcasieu AOC
Other Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Pyrene (ug/kg)

- 360 - 1550
- 1551 - 4900
- 4901 - 10000
- 10001 - 24000
- 24001 - 149000

Pyrene is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Phenanthrene
Pyrene
1,2-Benzphenanthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Fluoranthene
Acenaphthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Fluorene
Dibenzo(a,h)anthracene
2-Methylnaphthalene
Acenaphthylene

N
W E
S

Kilometers

0 0.25 0.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-7LWCAOtherPAHFactor-1117size.mxd 10/9/02

Bayou d'Inde

Lockport Marsh

I-210

Calcasieu River Ship Channel

Prien Lake

Bayou Olsen

Bayou Guy

Moss Lake

LCR2002 LCR2003 LCR2004 ECOUC004 LCR2005 LCR2006 LCR2007 LCR2008 LCR2009 LCR2010 LCR2011 LCR2012 LCR2013 LCST003 LCR2015 LCR2016 LCR2017 LCR2014 LCST001 LCR2018 LCR2019 LCR2020 LCR1021 LCR2024 LCR2021 LCR2022 LCR2023 LCR2025 LCR2026 LCR2027 LCR2028 LCR2029 LCR2030 LCR2031 LCR2032 LCR2033 LCR2034 LCR2035 LCR2036 LCST002 LCST004 LCR2037 LCR2038 LCR2039 LCR2040 LCR1037 LCR2041 LCR2042 LCR2043 LCR2044 LCR2046 LCR2047 LCR2048 LCR2049 LCR2050 LCR2051 LCR2052 ECOLC007 LCR2053 LCST013 LCST027 LCR2075 LCR2058 LCR2059 LCR2060 LCR2061 LCST014 LCR2063 LCR2064 LCR2065 LCR2066 LCR2070 LCR2071 LCR2072 LCR2073 LCR2074

Figure 10-8
Metal Factor
Lower Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Copper (mg/kg)

- 4 - 15
- 16 - 29
- 30 - 45
- 46 - 66
- 67 - 94

Copper Non-Detects (mg/kg)

- 4 - 15
- 16 - 29
- 30 - 45
- 46 - 66

Copper is used as the indicator variable for this factor.
An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Nickel
Vanadium
Beryllium
Chromium
Zinc
Iron
Cobalt
Potassium
Lead
Mercury
Copper
Manganese
Magnesium
Arsenic

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-8LWCALakeCopper-1117size.mxd 10/9/02

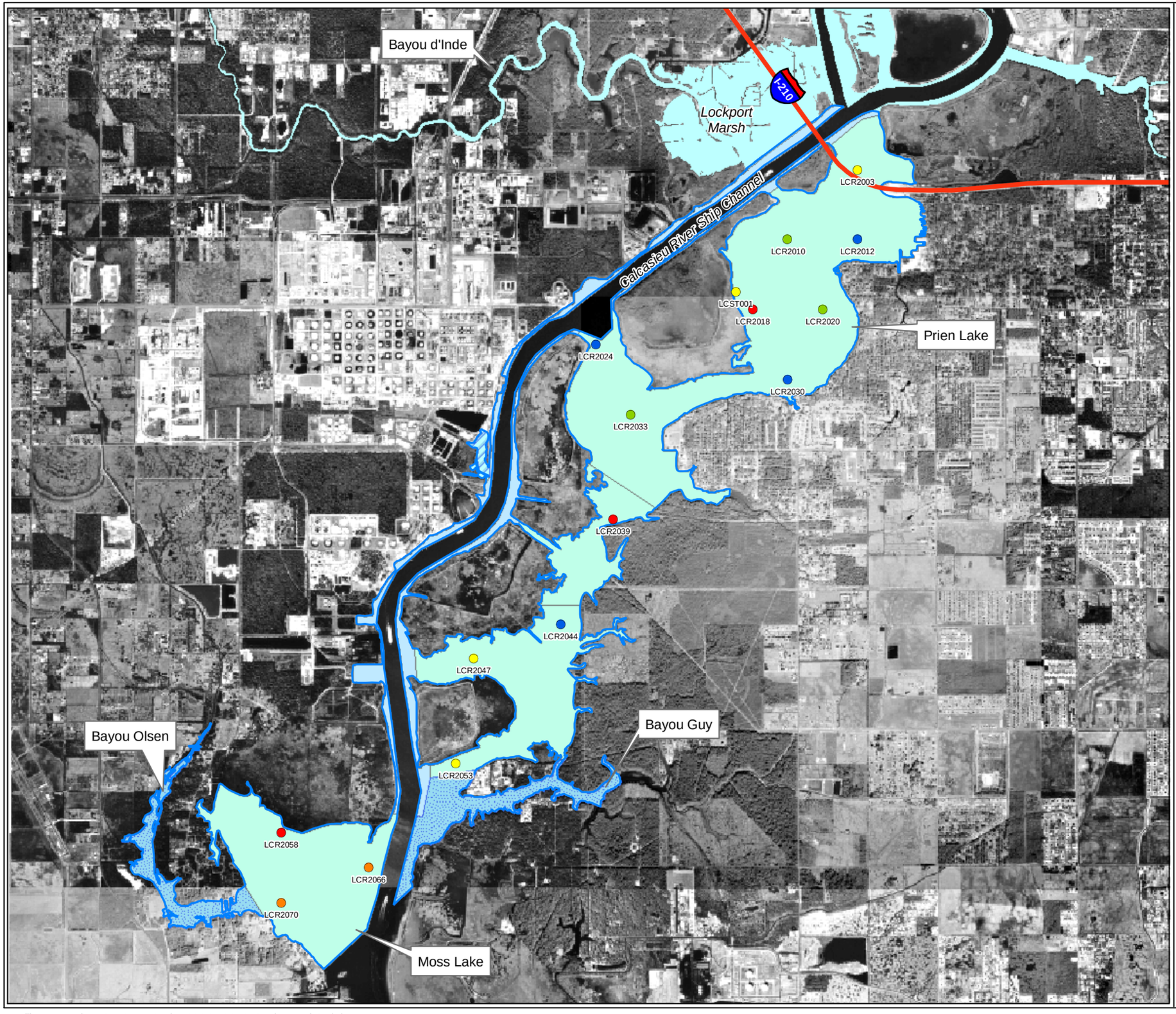


Figure 10-9
TCDD/TCDF Factor
Lower Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Total TCDD (pg/g)

- 2 - 9
- 10 - 14
- 15 - 19
- 20 - 22
- 23 - 32

Total TCDD is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total TCDF
Total TCDD
Dichloromethane
Sodium
Calcium

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-9LWCALakeTCDDTCDF-1117size.mxd 10/9/02

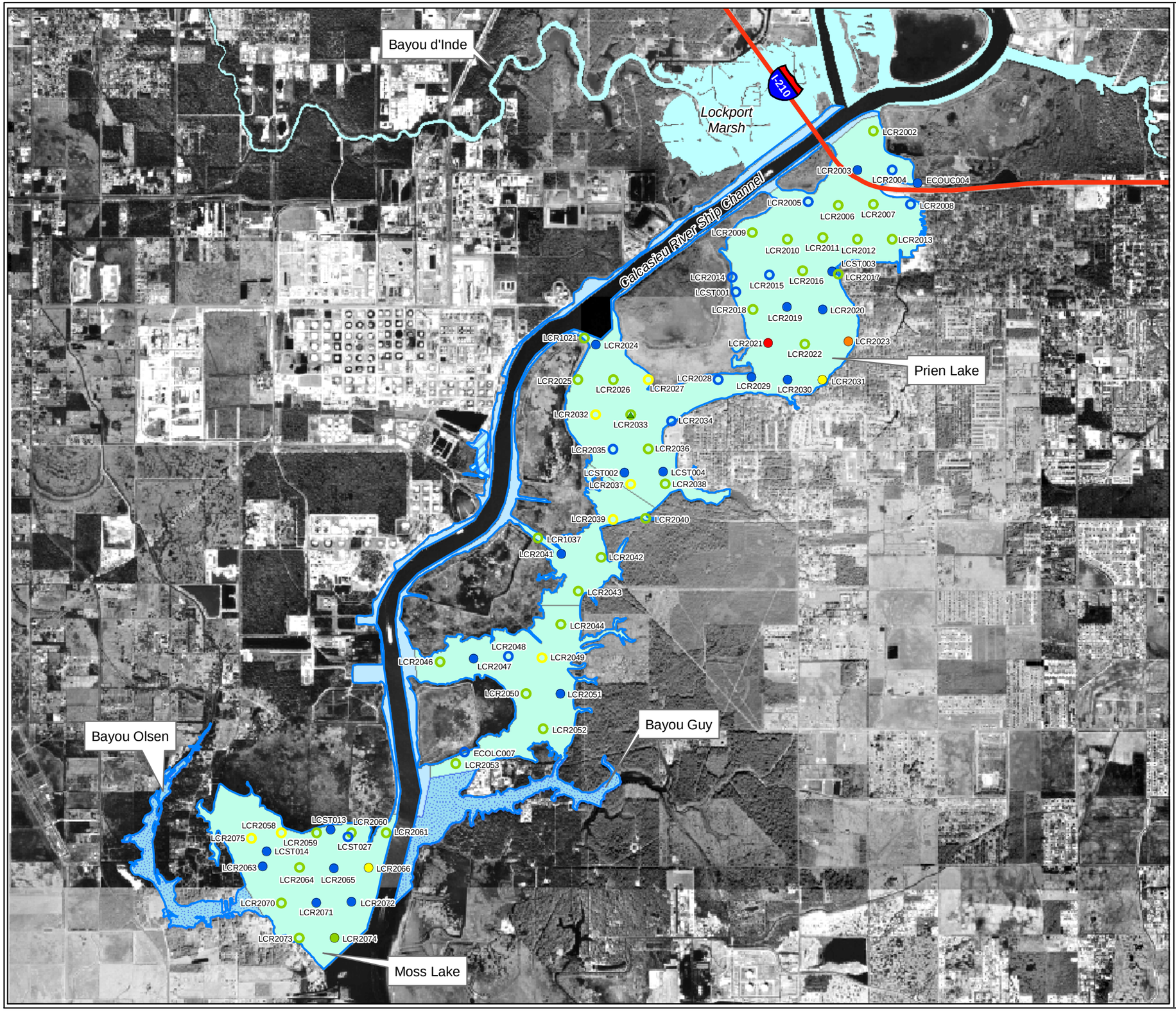


Figure 10-10
Dioxin/Furan/SVOC Factor
Lower Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Interstate

Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Bis(2-ethylhexyl)phthalate (ug/kg)

- 36 - 570
- 571 - 1600
- 1601 - 4200
- 4201 - 8900
- 8901 - 120000

Bis(2-ethylhexyl)phthalate Non-Detects (ug/kg)

- 36 - 570
- 571 - 1600
- 1601 - 4200
- 4201 - 8900
- 8901 - 120000

Total HpCDD (pg/g)

- 360

Total HpCDD is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:

Total HpCDF	Total PeCDF
Total HxCDF	Total HxCDD
OCDF	Acetone
Total HpCDD	Bis(2-ethylhexyl)phthalate
OCDDe	Cyanide

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-10LWCALakeDFSVPCFactor-1117size.mxd 10/9/02

LPAHs consist of the following:
1',1-Biphenyl
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene

HPAHs consist of the following:
1,2-Benzphenanthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Dibenzo(a,h)anthracene
Fluoranthene
Indeno(1,2,3-cd)pyrene
Pyrene

Bayou d'Inde
Lockport Marsh
I-210
Calcasieu River Ship Channel
Prien Lake
Bayou Olsen
Bayou Guy
Moss Lake

LCR2002 LCR2003 LCR2004 LCR2006 ECOUC004 LCR2005 LCR2007 LCR2008 LCR2009 LCR2010 LCR2012 LCR2011 LCR2013 LCR2017 LCR2014 LCR2015 LCR2016 LCST003 LCST001 LCR2020 LCR2018 LCR2019 LC2R2102 LCR1021 LCR2024 LCR2021 LCR2022 LCR2023 LCR2027 LC2R2101 LCR2025 LCR2026 LCR2028 LCR2029 LCR2030 LCR2031 LC2R2100 LCR2033 LCST015 LCR2032 LCR2034 LCR2035 LCR2036 LCST002 LCST004 LCR2037 LCR2038 LCR2039 LCR2040 LCR1037 LCR2041 LCR2042 LCR2043 LCR2044 LCR2048 LCR2046 LCR2047 LCR2049 LCR2050 LCR2051 ECOLC007 LCR2052 LCR2053

LCR2059 LCR2060 LCST013 LCR2058 LCST027 LCR2061 LCR2075 LCST014 LCR2063 LCR2064 LCR2065 LCR2066 LCR2070 LCR2071 LCR2072 LCR2070 LCR2073 LCR2074

Figure 10-11
High and Low Molecular Weight PAHs
Lower Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

LPAHs (ug/kg)

- 20 - 423
- 424 - 2640

LPAH Non-Detects (ug/kg)

- 424 - 2640
- 2641 - 6000
- 6001 - 13600
- 13601 - 31200

HPAHs (ug/kg)

- 21 - 529
- 530 - 1158
- 1159 - 5220

HPAH Non-Detects (ug/kg)

- 530 - 1158
- 1159 - 5220
- 5600 - 17000
- 19000 - 39000

At locations where PAHs were detected, HPAH, LPAH, and TPAHs were summed using only the detected results and excluding all non-detects. At locations where PAHs were not detected, HPAH, LPAH, and TPAHs were summed using the lowest detection limit for each individual PAH.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N W E S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY Region 6

Prepared by CDM

Mapfilename: Figure10-11LWCALakePAHs-1117size.mxd 10/9/02

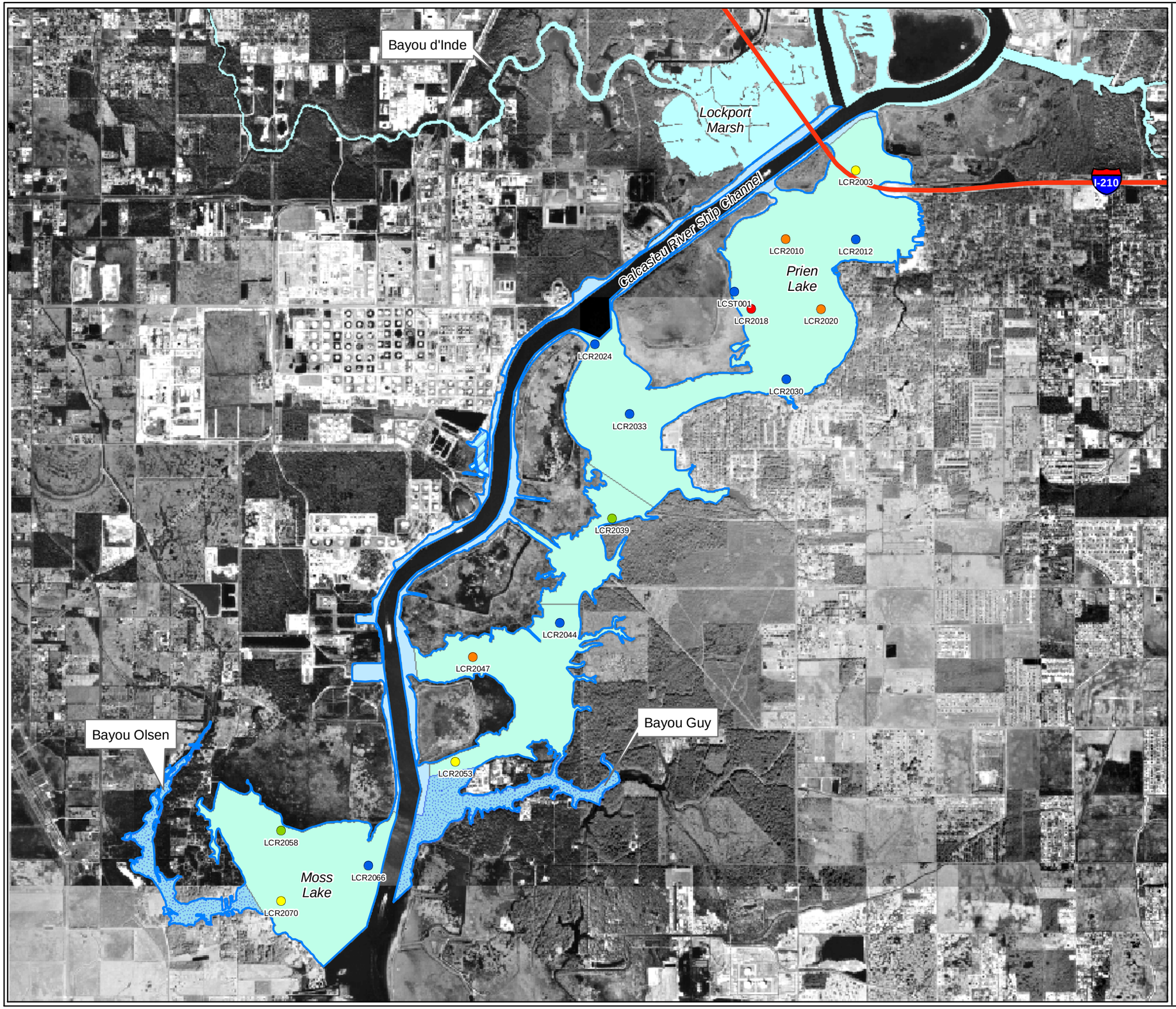


Figure 10-12
2,3,7,8-TCDD TEQ
Lower Calcasieu AOC
Shallow Lake Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

2,3,7,8-TCDD TEQ (pg/g)

- 2 - 5
- 6 - 7
- 8 - 14
- 15 - 23
- 24 - 31

Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin/furan compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin/furan compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD. The concentration of dioxin/furans are multiplied by the TEF and then summed to provide the 2,3,7,8-TCDD TEQ result.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-12LWCALakeTCDD-1117size.mxd 10/9/02

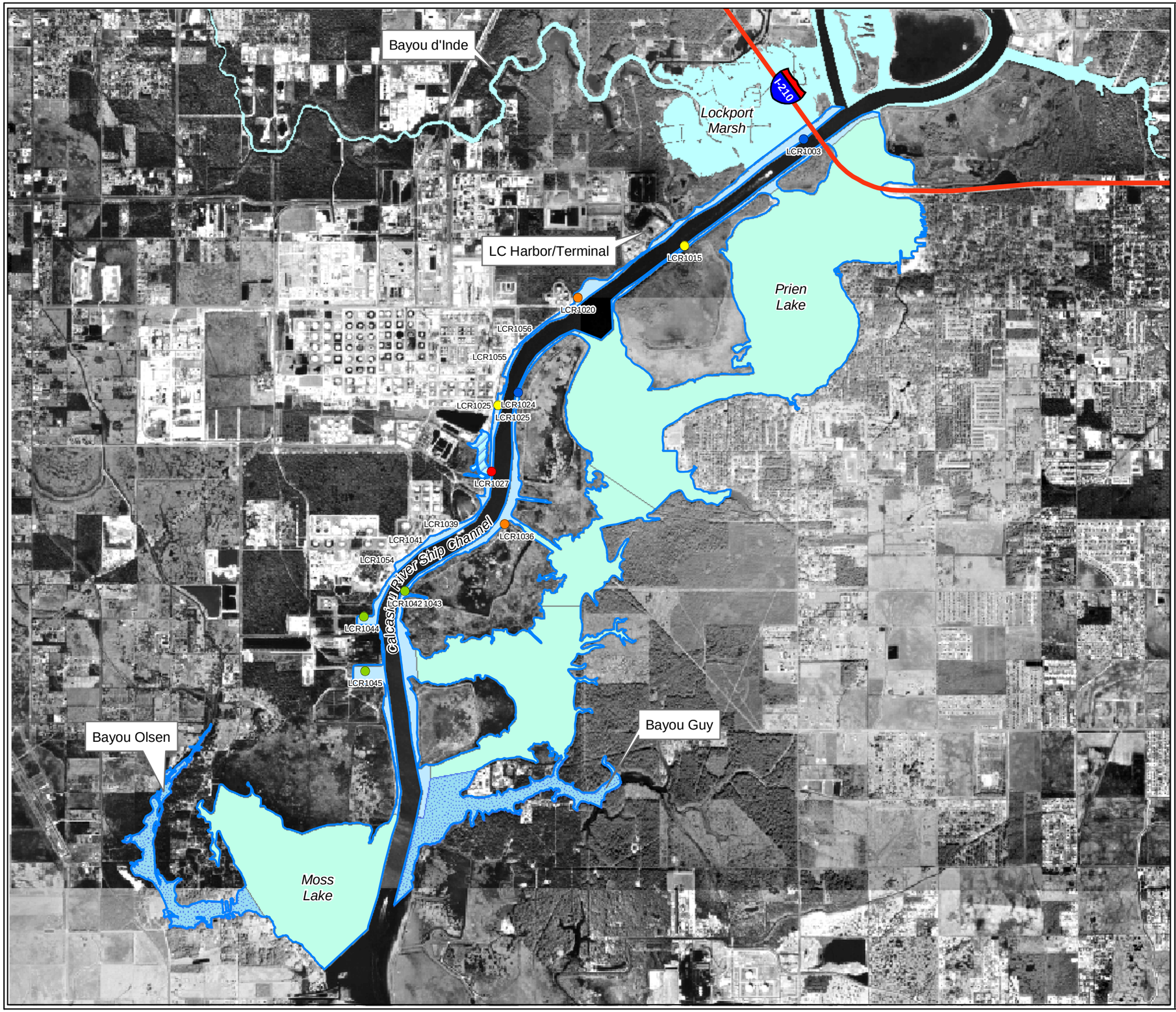


Figure 10-13
Dioxin/Furan/Metal Factor
Lower Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Interstate
Lower Calcasieu AOC Boundary

Energy Areas

Bayou
Other
Shallow Lake
Ship Channel
Water

Total HxCDD (pg/g)

7 - 30
31 - 69
70 - 86
87 - 130
131 - 180

Total HxCDD is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Total PeCDF
OCDF
Total HxCDF
Total HxCDD
Total HpCDD
OCDD
Diesel
Barium
Cyanide
Mercury

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-13LWCAShipDFMFactor-1117size.mxd 10/9/02

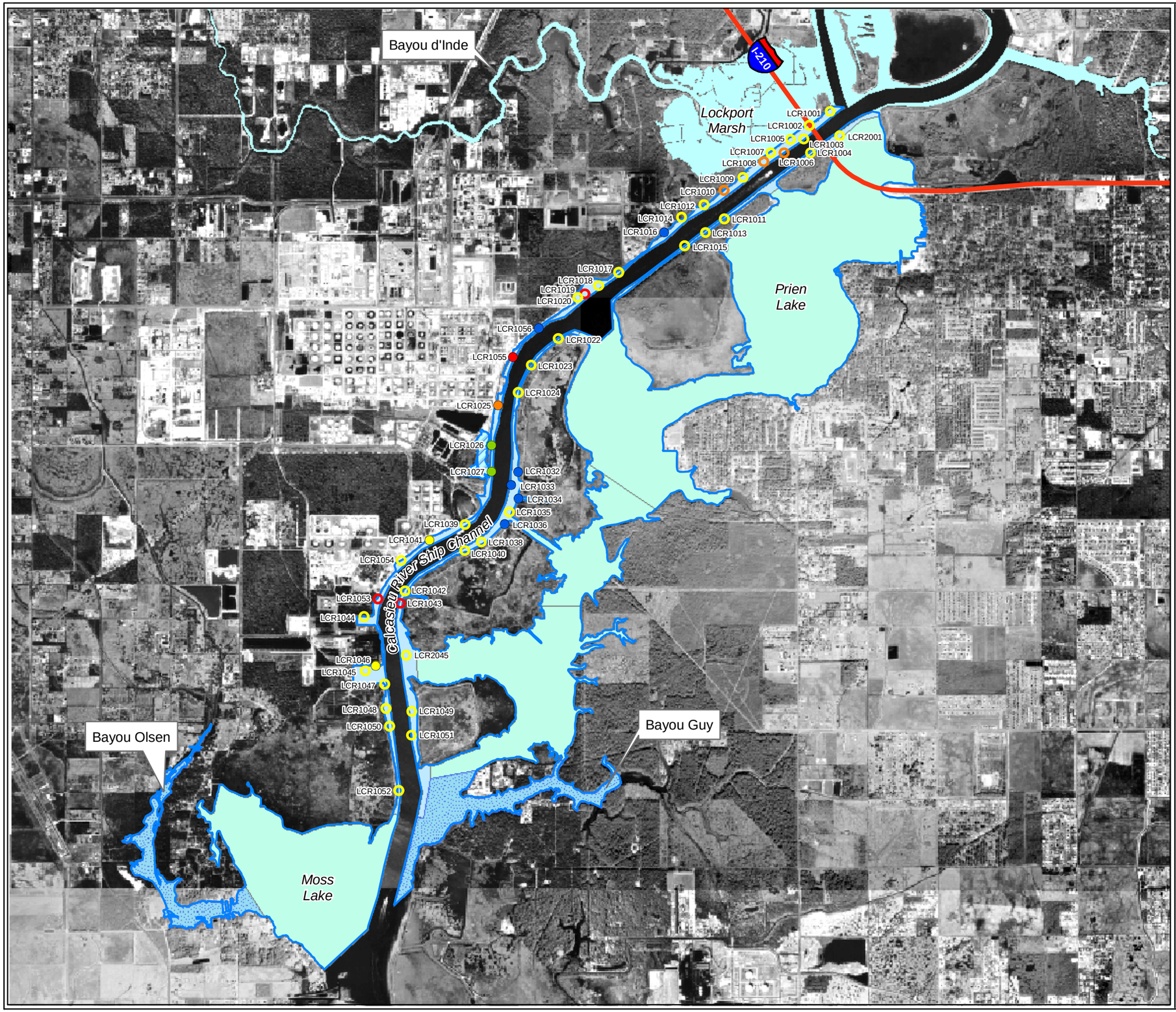


Figure 10-14
PAH/Dioxin Factor
Lower Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu AOC Boundary

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Pyrene (ug/kg)

- 53 - 130
- 131 - 320
- 321 - 1600
- 1601 - 3100
- 3101 - 7600

Pyrene Non-Detects (ug/kg)

- 321 - 1600
- 1601 - 3100
- 3101 - 7600

Pyrene is used as the indicator variable for this factor. An indicator variable is a contaminant or COPC that was ranked high from the PCA and is described in Section 4.8.2.3.

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

Contaminants grouped in this factor are:
Pyrene
Fluoranthene
Total PeCDD
Total TCDD
Acetone

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-14LWCAShipPyrene-1117size.mxd 10/9/02

Figure 10-15
Bis(2-ethylhexyl)phthalate
Lower Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Interstate
Lower Calcasieu AOC Boundary

Energy Areas

Bayou
Other
Shallow Lake
Ship Channel
Water

Bis(2-ethylhexyl)phthalate (ug/kg)

42 - 120
121 - 180
181 - 510
511 - 1400
1401 - 30000

Bis(2-ethylhexyl)phthalate Non-Detects (ug/kg)

181 - 510
511 - 1400
1401 - 30000

This figure presents ranges of concentrations.
These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers
0 0.5 1 2

Region 6

Prepared by CDM

Mapfilename: Figure10-15LWCAShipBEHP-1117size.mxd 10/11/02

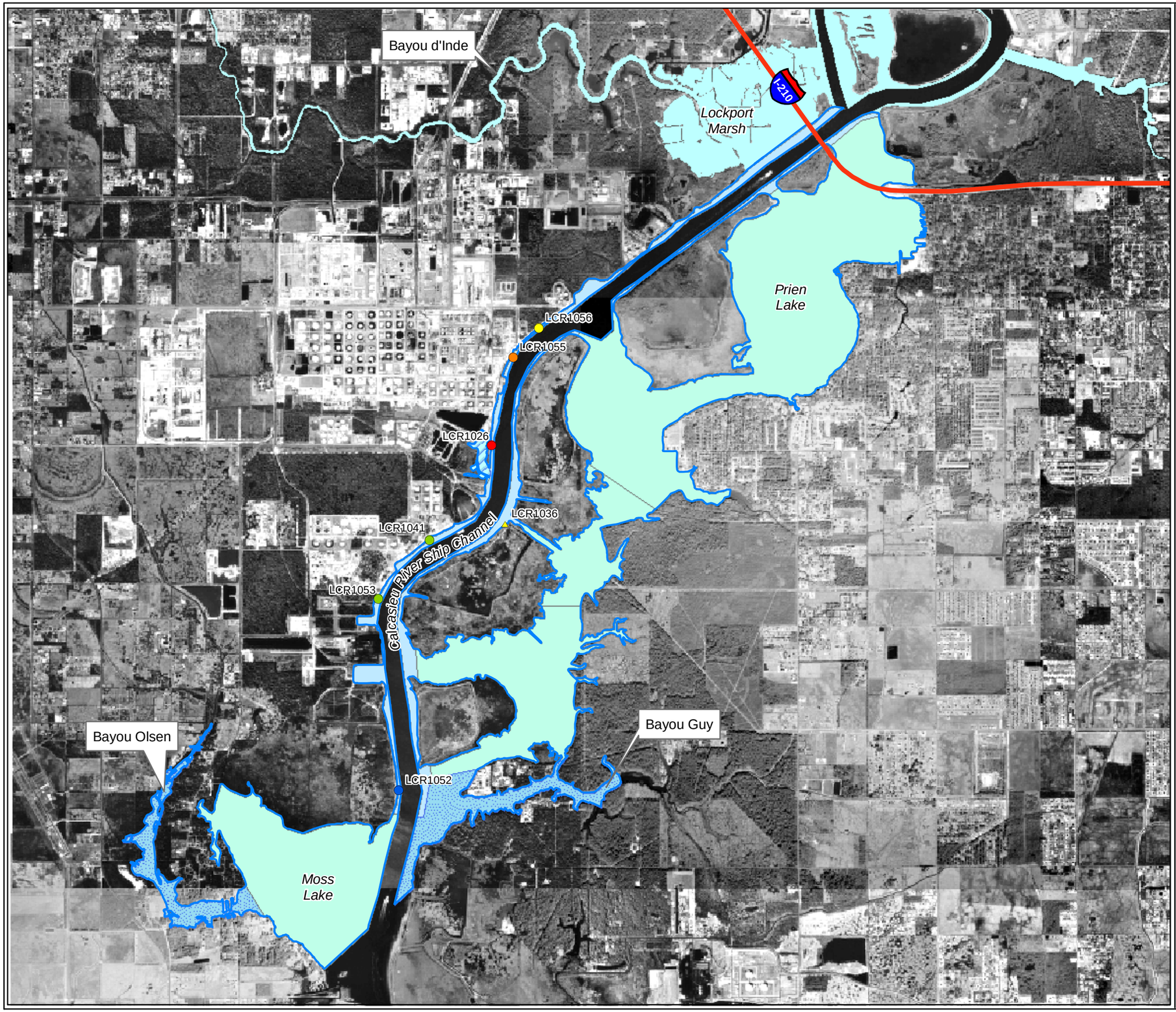


Figure 10-16
PCBs (Aroclor 1254/1260)
Lower Calcasieu AOC
Ship Channel Energy System

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

- Interstate
- Lower Calcasieu Area of Concern

Energy Areas

- Bayou
- Other
- Shallow Lake
- Ship Channel
- Water

Aroclor 1254 (ug/kg)

- 13
- 14 - 36
- 37 - 63
- 64 - 110
- 111 - 590

Aroclor 1260 (ug/kg)

- 60

This figure presents ranges of concentrations. These values are not related to risk concentration values or cleanup levels.

N
W E
S

Kilometers

0 0.5 1 2

UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY
Region 6

Prepared by CDM

Mapfilename: Figure10-16LWCA_Aroclor1254_1260-1117size.mxd 10/11/02

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

CHEMICAL	DATE	VIOLATION	OUTFALL
Acenaphthene	10/00/1991	Facility was in violation for nonsubmission of the required periodic reports.	101
Acenaphthene	11/00/1991	Facility was in violation for nonsubmission of periodic reports.	1
Acenaphthene	12/00/1997	One excursion was reported.	201A
Acenaphthene (max)	12/00/1997	Recorded value of 0.34 lbs/day was in violation of the permit limit of 0.28 lbs/day. One excursion was reported.	001A
Benzene	9/8/1992	Facility was in violation for failure to monitor benzene components for two successive months.	NS
Benzene	9/8/1992	Facility was in violation for failure to mark each peice of equipment.	NS
Benzene	9/8/1992	Facility was in violation of failure to monitor Benzene components for two successive months before placing them on a quarterly report.	NS
Benzene	9/8/1992	Facility was in violation in failure to distinguish components in Benzene service.	NS
Benzene	11/30/1992	Facility was in violation for failure to distinguishly mark component in benzene service.	NS
Benzene	11/30/1992	Facility was in violation failure to monitor benzene components for a 2 month period and for failure to distinguish mark components in benzene service. Facility also failed to submit test results in a 60 day time frame after the completion of such test.	NS
Benzene	12/7/1992	Failure to distinguish components in benzene service.	NS
Benzene	4/8/1997	Facility was in violation for failing to install appropriate control equipment when emissions exceed 10 Mg/yr. Emissions from facility were 23.58 Mg/yr.	NS
Benzene	11/1/1997	One excursion was reported.	201A
Benzene	2/1/1998	The recorded value of < 0.24 lbswas in violation of the permit limit 0 .18 lbs. The DMR states that, "[t]here was one exceedance from Outfall 001 during the month of February, 1998." The DMR refers to a cover letter, which is not attached, for an explanation of the exceedance.One excursion were reported.	001A
Benzene	2/25/1998	Recorded value of 66 lbs/day was in violation of the permit limit of 65 lbs/day.	1
Benzene	3/3/1998	A release of an unknown amount occurred over an unknown duration.	NS
Benzene	3/4/1998	A release of 154 pounds of Benzene occurred over a period of 4 hours.	NS
Benzene	3/4/1998	A release of 300,000 gallons occurred over an unknown duration.	NS
Benzene	3/17/1998	Recorded value of 0.80 lbs/day was in violation of the permit limit 0.65 lbs/day.	1
Benzene	3/20/1998	Recorded value of 0.75 lbs/day was in violation of the permit limit of 0.65 lbs/day.	1
Benzene	01/ /1998	Recorded value of 0.24 lbs/day was in violation of the permit limit 0.18 lbs/ day.	1
Benzene	03/ /1998	Recorded value of 0.805 lbs/day was in violation of the permit limit of 0.65 lbs/day.	1
Benzene	03/00/1998	Recorded value of 0.805 lbs/day was in violation of the permit limit of 0.650 lbs/day. One excusion was reported.	001A

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Benzene	11/00/1997	One excursion was reported.	301A
Benzene	12/00/1997	One excursion was reported.	201A
Benzene, Avg	11/00/1997	Recorded value of <0.19 lbs/day was in violation of the permit limit of 0.18 lbs/day. One excursion was reported.	001A
Benzene, Avg	12/00/1997	Recorded value of <0.20 lbs/day was in violation of the permit limit of 0.18 lbs/day. One excursion was reported.	001A
Benzene, Max	3/17/1998	Recorded value of 0.80 lbs/day was in violation of permit limit of 0.65 lbs/day.	1
Benzene, Max	03/00/1998	Recorded value of 0.805 lbs/day was in violation of permit limit. One excursion was reported.	201A
Benzene, Max	11/00/1997	Recorded value of 0.75 lbs/day was in violation of the permit limit of 0.65 lbs/day. One excursion was reported.	001A
Chloroform	1/13/1997	Recorded value of 0.23 lbs/day was in violation of permit limit of 0.12 lbs/day.	1
Chloroform	1/17/1997	Recorded value of 0.23 lbs/day was in violation of the permit limit of 0.12 lbs/day.	NS
Chloroform	2/25/1998	Recorded value of 25 lbs/day was in violation of the permit limit of 22 lbs/day.	1
Chloroform	01/00/1997	Recorded value was in violation of the permit limit.	1
Fluorene	04/00/1991	Facility was in violation for failure to report data on Fluorene for April, 1991 at outfall 001.	101
Fluorene	04/00/1991	Facility was in violation for failure to report Fluorene on the April, 1991 DMR for outfall 101.	101
Fluorene	12/00/1997	One excursion was reported.	201A
Fluorene (max)	12/00/1997	Recorded value of 0.30 lbs/day was in violation of the permit limit of 0.28 lbs/day. One excursion was reported.	001A
Naphthalene	12/6/1991	Recorded value of 4.42 lbs/day was in violation of the permit limit of 0.1 lbs/day.	101
Naphthalene	12/6/1991	Recorded value of 3.66 mg/l was in violation of the permit limit 0.059 mg/l	101
Naphthalene	12/6/1991	Recorded value of 4.42 lbs/day was in violation of permit limit of 0.1 lbs.	101
Naphthalene	3/12/1993	Recorded value of 98 mg/l was in violation of the permit limit of 22 mg/l.	101
Naphthalene	12/16/1997	Recorded value of 1.15 lbs/day was in violation of the permit limit 0.28 lbs/day.	1
Naphthalene	12/29/1997	Recorded value of 0.73 lbs/day was in violation of the permit limit 0.28 lbs/day.	1
Naphthalene	12/29/1997	Recorded value of 0.73 lbs/day was in violation of the permit limit of 0.28 lbs/day.	NS
Naphthalene	08/00/1991	Recorded value of 0.11 lbs/day was in violation of the permit limit of 0.1 lbs/day. One excursion was reported.	101
Naphthalene	12/00/1997	Three exceedances were reported to have occurred at the Internal Outfall 201 (MWK Sump/Outfall 101) for the parameter of Naphthalene.	1
Naphthalene	12/00/1997	Two unrelated individual occurences of exceedances of the permitted daily maximum of 0.28 lbs/day for Naphthalene resulted in an exceedance of the permitted monthly average of 0.10 lbs/day for Naphthalene.	1
Naphthalene	12/00/1997	Facility was in violation for exceedence (no data given).	201

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Naphthalene	12/00/1997	Three excursions were reported.	001A
Naphthalene	12/00/1997	Three excursions were reported.	001A
Naphthalene	12/00/1997	Three excursions were reported.	201A
Naphthalene	12/00/1997	Three excursions were reported.	201A
Naphthalene, avg	3/11/1993	Recorded value of .025 mg/l was in violation of the permit limit of .022 mg/l.	101
Naphthalene, avg	03/00/1993	Recorded value of 0.07 lbs/day was in violation of the permit limit of 0.04 lbs/day. Recorded value of 0.025 mg/l was in violation of the permit limit of 0.022 mg/l. Two excursions were reported.	101
Naphthalene, avg	03/00/1993	Recorded value of 0.07 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101A
Naphthalene, avg	03/00/1993	Recorded value of 0.025 mg/l was in violation of the permit limit of 0.022 mg/l. One excursion was reported.	101A
Naphthalene, avg	07/00/1991	Recorded value of .057 lbs/dy was in violation of the permit limit of 0.04 lbs/dy. One excursion was reported.	101
Naphthalene, avg	07/00/1991	Recorded value of 0.057 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101
Naphthalene, avg	12/00/1991	Recorded value of 1.12 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101
Naphthalene, avg	12/00/1991	Recorded value of 0.92 mg/l was in violation of the permit limit of 0.022 mg/l. One excursion was reported.	101
Naphthalene, avg	12/00/1991	Recorded value of 1.12 lbs/day was in violation of the permit limit of 0.04 lbs/day. Recorded value of 0.92 mg/l was in violation of the permit limit of 0.022 mg/l. Two excursions were reported.	101A
Naphthalene, avg	12/00/1997	Recorded value of <0.17 lbs/day was in violation of the permit limit of 0.10 lbs/day.	001A
Naphthalene, avg	12/00/1997	Recorded value of <0.28 lbs/day was in violation of the permit limit of 0.10 lbs/day.	001A
Naphthalene, daily avg.	12/6/1991	The recorded value of 1.12 mg/l was in violation of the permit limit of 0.04 mg/l.	101
Naphthalene, daily avg.	03/00/1993	Recorded value of 0.07 lbswas in violation of the permit limit of 0.04 lbs.	101
Naphthalene, daily avg.	03/00/1993	Recorded value of .025 mg/l was in violation of permit limit of .022 mg/l.	101
Naphthalene, daily avg.	07/00/1991	The recorded value of 0.084 lbswas in violation of the permit limit of 0.04 lbs.	101
Naphthalene, daily avg.	07/00/1991	Recorded value of 0.032 lbswas in violation of the permit limit of 0.04 lbs.	101
Naphthalene, daily avg.	08/00/1991	Recorded value of 0.11 lbswas in violation of the permit limit of 0.04 lbs.	101
Naphthalene, daily avg.	12/00/1991	Recorded value of 1.12 lbs/day was in violation of the permit limit of 0.04 lbs/day.	101A
Naphthalene, daily avg.	12/00/1991	Recorded value of 0.92 mg/l was in violation of the permit limit of 0.022 mg/l.	101A
Naphthalene, max	12/6/1991	Recorded value of 3.66 mg/l was in violation of permit limit of .059 mg/l.	101
Naphthalene, max	3/11/1993	The recorded value of .3 lbswas in violation of the permit limit of 0.1 lbs.	101
Naphthalene, max	3/11/1993	The recorded value of .07 lbswas in violation of the permit limit of .04 lbs.	101

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Naphthalene, max	3/11/1993	Recorded value of .098 mgwas in violation of the permit limit of .059 mg.	101
Naphthalene, max	03/00/1993	Recorded value of 0.3 lbs/day was in violation of the permit limit of 0.1 lbs/day. Recorded value of 0.098 mg/l was in violation of the permit limit of 0.059 mg/l. Two excursions were reported.	101
Naphthalene, max	03/00/1993	Recorded value of 0.3 lbs/day was in violation of the permit limit of 0.1 lbs.day. One excursion was reported.	101A
Naphthalene, max	03/00/1993	Recorded value of 0.098 mg/l was in violation of the permit limit of 0.059 mg/l. One excursion was reported.	101A
Naphthalene, max	07/00/1991	Recorded value of .101 lbs/dy was in violation of the permit limit of 0.1 lbs/dy. One excursion was reported.	101
Naphthalene, max	07/00/1991	Recorded value of 0.101 lbs/day was in violation of the permit limit of 0.1 lbs/day. One excursion was reported.	101
Naphthalene, max	10/00/1991	Recorded value of .328 mg/l was in violation of the permit limit of .059 mg/l. One excursion was reported.	101
Naphthalene, max	10/00/1991	Recorded value of 0.328 mg/l was in violation of the permit limit of 0.059 mg/l. One excursion was reported.	101A
Naphthalene, max	12/00/1991	Recorded value of 4.42 lbs/day was in violation of the permit limit of 0.1 lbs/day. One excursion was reported.	101
Naphthalene, max	12/00/1991	Recorded value of 3.66 mg/l was in violation of the permit limit of 0.059 mg/l. One excursion was reported.	101
Naphthalene, max	12/00/1991	Recorded value of 4.42 lbs/day was in violation of the permit limit of 0.1 lbs/day. Recorded value of 3.66 mg/l was in violation of the permit limit of 0.059 mg/l. Two excursions were reported.	101A
Naphthalene, max	12/00/1997	Recorded value of 1.15 lbswas in violation of the permit limit 0.28 lbs.	001A
Naphthalene, max	12/00/1997	Recorded value of 1.91 lbs/day was in violation of the permit limit of 0.28 lbs/ day.	001A
Napthhalene, daily max	3/11/1993	Recorded value of .098 mg/l was in violation of permit limit of .059 mg/l.	101
Napthhalene, daily max	3/11/1993	Recorded value of 0.3 lbs/day was in violation of permit limit of 0.1 lbs/day.	101
Napthhalene, daily max	3/11/1993	Recorded value of .098 mg/l was in violation of the permit limit of .059 mg/l.	101
Napthhalene, daily max	3/11/1993	Recorded value of .2850 lbs/day was in violation of the permit limit of 0.1 lbs/day.	101
Napthhalene, daily max	09/00/1991	Recorded value of 0.13 lbs/day was in violation of the permit limit of 0.1 lbs/day.	101A
Napthhalene, daily max	10/00/1991	Recorded value of 0.328 mg/l was in violation of the permit limit of 0.059 mg/l.	101A
Napthhalene, daily max	12/00/1991	Recorded value of 3.66 mg/l was in violation of the permit limit of 0.059 mg/l.	101A
Napthhalene, daily max	12/00/1991	Recorded value of 4.42 lbs/day was in violation of the permit limit of 0.1 lbs/day.	101A
Naththalene	08/00/1991	Recorded value of 0.025 lbs/day was in violation of the permit limit of 0.022 lbs/day. One excursion was reported.	101
Phenanthrene	04/00/1991	Facility was in violation for failure to report data on Phenanthrene for April, 1991 at outfall 001.	1
Phenanthrene	04/00/1991	Facility was in violation for failure to report Phenathrene on the April, 1991 DMR for outfall 101.	101
Phenol	7/11/1991	Recorded value of .03 mg/l was in violation of the permit limit of .026 mg/l	101

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Phenol	7/18/1991	Recorded value of .032 mg/l was in violation of the permit limit of .026 mg/l.	101
Phenol	8/9/1991	Recorded value of .028 mg/l was in violation of the permit limit of .026 mg/l.	101
Phenol	8/16/1991	Recorded value of .0384 mg/l was in violation of the permit limit of .026 mg/l.	101
Phenol	10/25/1991	There were high concentrations of phenol on Outfall 101, 10-25-91. The mass limitation was exceeded for phenol on the same day.	101
Phenol	07/00/1991	Two excursions were reported.	101A
Phenol	09/00/1991	One excursion was reported.	101A
Phenol	10/00/1991	Two excursions were reported.	101A
Phenol, Avg	1/17/1992	The recorded value of 0.08 lbswas in violation of the permit limit of .04 lbs.	101
Phenol, Avg	07/00/1991	Recorded value of 0.08 lbs/day was in violation of the permit limit of 0.03 lbs/day. One excursion was reported.	101
Phenol, Avg	07/00/1991	Recorded value of 0.031 mg/l was in violation of the permit limit of 0.015 mg/l. One excursion was reported.	101
Phenol, Avg	07/00/1991	Recorded value of .08 lbs/dy was in violation of the permit limit of 0.03 lbs/dy. Recorded value of .031 mg/l was in violation of the permit limit of 0.015 mg/l.	101A
Phenol, Avg	08/00/1991	Recorded value of 0.02 mg/l was in violation of the permit limit of 0.015 mg/l. One excursion was reported.	101
Phenol, Avg	08/00/1991	Recorded value of 0.020 mg/l was in violation of the permit limit of 0.015 mg/l. One excursion was reported.	101A
Phenol, Avg	09/00/1991	Recorded value of 0.12 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101
Phenol, Avg	09/00/1991	Recorded value of 0.036 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101
Phenol, Avg	09/00/1991	Recorded value of 0.04 lbs/dy was in violation of the permit limit of 0.03 lbs/dy. Recorded value of 0.020 mg/l was in violation of the permit limit of 0.015 mg/l.	101A
Phenol, Avg	10/00/1991	Recorded value of 0.04 lbs/day was in violation of the permit limit of 0.03 lbs/day. One excursion was reported.	101
Phenol, Avg	10/00/1991	Recorded value of 0.04 lbs/day was in violation of the permit limit of 0.03 lbs/day.	101A
Phenol, Daily Avg.	07/00/1991	Recorded value of 0.08 lbswas in violation of the permit limit of 0.03 lbs.	101
Phenol, Daily Avg.	08/00/1991	Recorded value of 0.02 mgwas in violation of the permit limit of 0.015 mg.	101
Phenol, Daily Avg.	09/00/1991	Recorded value of 0.04 lbs/day was in violation of the permit limit of 0.03 lbs/day.	101A
Phenol, Daily Avg.	09/00/1991	Recorded value of 0.02 mg/l was in violation of the permit limit of .015 mg/l.	101A
Phenol, Daily Avg.	10/00/1991	Recorded value of 0.04 lbs/day was in violation of the permit limit of 0.03 lbs/day.	101A
Phenol, Daily Max.	01/00/1992	Recorded value of 0.08 lbswas in violation of the permit limit of 0.04 lbs.	101
Phenol, Daily Max.	07/00/1991	Recorded value of 0.032 mgwas in violation of the permit limit of 0.026mg.	101
Phenol, Daily Max.	07/00/1991	Recorded value of 0.09 lbswas in violation of the permit limit of 0.04 lbs.	101

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Phenol, Daily Max.	07/00/1991	Recorded value of 0.031 mgwas in violation of the permit limit of 0.026 mg.	101
Phenol, Daily Max.	08/00/1991	Recorded value of 0.02 mgwas in violation of the permit limit of 0.026 mg.	101
Phenol, Daily Max.	08/00/1991	Recorded value of 0.028 mgwas in violation of the permit limit of 0.026mg.	101
Phenol, Daily Max.	09/00/1991	Recorded value of 0.036 mg/l was in violation of the permit limit of 0.026 mg/l.	101A
Phenol, Daily Max.	09/00/1991	Recorded value of 0.12 lbs/day was in violation of the permit limit of 0.1 lbs/day.	101A
Phenol, Daily Max.	10/00/1991	Recorded value of 0.05 lbs/day was in violation of the permit limit of 0.04 lbs/day.	101A
Phenol, Daily Max.	10/00/1991	Recorded value of 0.297 mg/l was in violation of the permit limit of .026 mg/l.	101A
Phenol, Max	11/15/1991	The recorded value of .03 mgwas in violation of the permit limit of 0.02 mg.	101
Phenol, Max	11/15/1991	Recorded value of .03 mg/l was in violation of the permit limit .026 mg/l.	101
Phenol, Max	11/15/1991	Recorded value of .06 lbs/day was in violation of the permit limit of .04 lbs/day.	101
Phenol, Max	1/17/1992	Recorded value of 0.08 lbs/day was in violation of the permit limit 0.04 lbs/day.	101
Phenol, Max	07/00/1991	Recorded value of 0.09 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101
Phenol, Max	07/00/1991	Recorded value of 0.032 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101
Phenol, Max	07/00/1991	Recorded value of .09 lbs/dy was in violation of the permit limit of 0.04 lbs/dy. Recorded value of .032 mg/l was in violation of the permit limit of 0.026 mg/l.	101A
Phenol, Max	08/00/1991	Recorded value of 0.028 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101
Phenol, Max	08/00/1991	Recorded value of 0.028 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101A
Phenol, Max	09/00/1991	Recorded value of 0.04 lbs/day was in violation of the permit limit of 0.03 lbs/day. One excursion was reported.	101
Phenol, Max	09/00/1991	Recorded value of 0.02 mg/l was in violation of the permit limit of 0.015 mg/l. One excursion was reported.	101
Phenol, Max	09/00/1991	Recorded value of 0.12 lbs/dy was in violation of the permit limit of 0.04 lbs/dy. Recorded value of 0.036 mg/l was in violation of the permit limit of 0.026 mg/l.	101A
Phenol, Max	10/00/1991	Recorded value of 0.05 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101
Phenol, Max	10/00/1991	Recorded value of .297 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101
Phenol, Max	10/00/1991	Recorded value of 0.05 lbs/day was in violation of the permit limit of 0.04 lbs/day. Recorded value of 0.297 mg/l was in violation of the permit limit of 0.026 mg/l.	101A
Phenol, Max	11/00/1991	Recorded value of 0.06 lbs/day was in violation of the permit limit of 0.04 lbs/day. Two excursion was reported.	101
Phenol, Max	11/00/1991	Recorded value of 0.03 mg/l was in violation of the permit limit of 0.026 mg/l.	101

Table 10-1
Historic Results for Shallow Lake Energy System
Westlake Group

Phenol, Max	11/00/1991	Recorded value of 0.03 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101A
Phenol, Max	11/00/1991	Recorded value of 0.06 lbs/day was in violation of the permit limit of 0.04 lbs/day. One excursion was reported.	101A
Phenol, Max.	11/15/1991	The recorded value of 0.06 mgwas in violation of the permit limit of 0.04 mg.	101
Toluene	3/17/1998	Recorded value of 0.59 lbs/day was in violation of the permit limit 0.38 lbs/day.	1
Toluene	3/20/1998	Recorded value of 0.59 lbs/day was in violation of the permit limit of 0.19 lbs/day.	1
Toluene	03/ /1998	Recorded value of 0.59 lbs/day was in violation of the permit limit 0.38 lbs/day.	1
Toluene, Avg	00/00/0000	Recorded value of 0.04 mgwas in violation of the permit limit of 0.26 mg/l.	101
Toluene, Avg	00/00/0000	Recorded value of 0.05 lbs/day was in violation of the permit limit of 0.04 lbs/day.	102
Toluene, Avg	03/00/1991	Recorded value of 0.05 lbs/dy was in violation of permit limit of 0.04 lbs/dy. Recorded value of 0.04 mg/l was in violation of the permit limit of 0.026 mg/l. Two excursions were reported.	101A
Toluene, Avg	09/00/1992	Recorded value of 0.04 mg/l was in violation of the permit limit of 0.026 mg/l. One excursion was reported.	101
Toluene, Avg	09/00/1992	Recorded value of 0.05 lbs/day was in violation of permit limit of 0.04 lbs/day. One excursion was reported.	101
Toluene, Max	9/4/1992	Recorded value of 0.105 mg/l was in violation of the permit limit of 0.080 mg/l.	101
Toluene, Max	9/4/1992	Recorded value of 0.10 mg/l was in violation of the permit limit of 0.08 mg/l.	101
Toluene, Max	3/17/1998	Recorded value of 0.59 lbs/day was in violation of permit limit of 0.38 lbs/day.	1
Toluene, Max	03/00/1991	Recorded value of 0.10 mg/l was in violation of permit limit of 0.08 mg/l. One excursion was reported.	101A
Toluene, Max	09/00/1992	Recorded value of 0.10 mg/l was in violation of the permit limit of 0.08 mg/l. One excursion was reported.	101

NS - Not Specified
Information obtained from permit files.

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Mercury	6/3/1994	Recorded value was in violation of the permit limit of 0.004 mg/l.	4
Not legible	5/23/1997	A release of 1.1 pounds of an illegible dust occurred over a duration of 29 minutes.	NS
Not Specified	08/04/ 996	The release of 53.57 ppm exceeded permit level of 50 ppm. (The contaminant was not specified in document.)	101
titanium dioxide	2/20/1995	Louisiana Pigment Company released four pounds of titanium dioxide into the atmosphere. This exceeded the permit limit of 0.88 lb/hr.	NS
titanium dioxide	2/21/1995	Louisiana Pigment Company released four pounds of titanium dioxide into the atmosphere.	NS
titanium dioxide	5/5/1995	A release of .2 lbs occurred over a duration of 2 minutes.	NS
titanium dioxide	5/9/1995	Louisiana Pigment Company released 0.2 pounds of titanium dioxide into the atmosphere. This was less than the PM-10 permit limit of 0.88 lb/hr.	NS
titanium dioxide	5/10/1995	A release of .20 lbs occurred over a duration of 3 minutes.	NS
titanium dioxide	5/10/1995	A release of 0.2 pounds of titanium dioxide occurred over a duration of three minutes. This was less than the PM-10 permit limit of 0.88 lbs/hr.	NS
titanium dioxide	5/15/1995	Louisiana Pigment Company released an estimated half-pound of titanium dioxide into the atmosphere. The duration of the emission was ten minutes.	NS
titanium dioxide	5/16/1995	A release of .15 lbs occurred over a duration of 10 minutes.	NS
titanium dioxide	6/23/1995	A release of 0.43 pounds of titanium dioxide occurred overa duration of four minutes.	NS
titanium dioxide	6/23/1995	A release of 0.43 pounds of titanium dioxide occurred over a duration of four minutes. The PM-10 permit limit is 0.88 lbs/hr.	NS
titanium dioxide	6/25/1995	A release of an estimated half-pound of titanium dioxide occurred over a duration of 30 minutes. The permit limit of PM-10 is 0.4 lbs/hr.	NS
titanium dioxide	6/25/1995	A release of an estimated 0.8 pounds of titanium dioxide occurred over a duration of five minutes. The permit limit of PM-10 is 0.4 lbs/hr.	NS
titanium dioxide	6/26/1995	A release of two pounds of titanium dioxide occurred over a duration of five minutes. The permitted emission limit for PM-10 is 0.898 lbs/hr.	NS
titanium dioxide	6/26/1995	A release of one pound of titanium dioxide occurred over a duration of five minutes. The permitted emission limit for PM-10 is 0.4 lbs/hr.	NS
titanium dioxide	6/26/1995	A release of an estimated .5-pound of titanium dioxide occurred over aduration of five minutes. The permitted emission limit for PM-10 is 0.88 lbs/hr.	NS
titanium dioxide	6/27/1995	A release of an estimated two pounds of titanium dioxide occurred over a duration of five minutes. The PM-10 permit limit is 3.898 lbs/hr.	NS
titanium dioxide	6/28/1995	A release of two pounds of titanium dioxide occured over a duration of three minutes.	NS
titanium dioxide	7/4/1995	A release of an estimated half-pound of titanium dioxide occurred over a duration of three minutes. The permit limit of PM-10 is 0.19 lbs/hr.	NS

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
titanium dioxide	7/9/1995	A release of 1.5 pounds of titanium dioxide occurred over a duration of five minutes. This emission point has a permit limit of 3.898 lbs/hr of PM-10.	NS
titanium dioxide	7/13/1995	A release of approximately one pound of titanium dioxide occurred over a duration of ten minutes. The permit limit of PM-10 is 0.88 lbs/hr.	NS
titanium dioxide	7/16/1995	A release of an unknown amount of titanium dioxide occurred overan indeterminae duration.	NS
titanium dioxide	7/16/1995	A release of less than one pound of titanium dioxide occurredover a duration of ten minutes.	NS
titanium dioxide	7/16/1995	A release of 0.2 pounds of titanium dioxide occurred over a duration of ten minutes. The PM-10 permit limit is 0.40 lbs/hr.	NS
titanium dioxide	7/22/1995	A release of 0.5 pounds of titanium dioxide occurred.over an indeterminate period.	NS
titanium dioxide	7/22/1995	A release of 0.5 pounds of titanium dioxide occurred overa duration of of 30 minutes. The PM-10 permit limit is 0.40 lb/hr.	NS
titanium dioxide	7/23/1995	A release of 0.5 lbs of titanium dioxide occurred.over an indeterminate period.	NS
titanium dioxide	7/23/1995	A release of 0.5 lbs. of tatanium oxide occurred overa duration of 30 minutes.	NS
titanium dioxide	8/5/1995	A release of an estimated quarter pound of titanium dioxide occurred overa duration of five minutes. This emission point has a permit limit is 0.4 lbs/hrof PM-10. This emission did not exceed the permit limit.	NS
titanium dioxide	8/17/1995	A release of 2 lbs occurred over a duration of 4 hours and 13 minutes.	NS
titanium dioxide	8/18/1995	Louisiana Pigment Company released two pounds of titanium dioxide into the atmosphere. The permitted emission limit of PM-10 is 0.4 lbs/hr.	NS
titanium dioxide	8/31/1995	Louisiana Pigment Company released approximately one pound of titanium dioxide into the atmosphere. The PM-10 permit limit is 0.88 lb/hr.	NS
titanium dioxide	10/3/1995	Facility discharged into the air from 16:15 hours to 16:21 hours an unknown quantity of titanium dioxide.	NS
titanium dioxide	10/6/1995	Facility discharged into the air from 11:42 hours to 11:45 hours an unknown quantity of titanium dioxide.	NS
titanium dioxide	10/6/1995	Louisiana Pigment Company released 0.3 pounds of titanium dioxide into the atmosphere. The permitted emission limit for PM-10 is 0.40 lb/hr.	NS
titanium dioxide	10/6/1995	Louisiana Pigment Company released 0.25 pounds of titanium dioxide into the atmosphere. The permitted emission limit is 3.898 lb/hr.	NS
titanium dioxide	10/12/1995	Facility discharged into the air from 16:20 hours to 16:22 hours an unknown quantity of titanium dioxide.	NS
titanium dioxide	10/12/1995	Louisiana Pigment Company released approximately 2 pounds of titanium dioxide into the atmosphere.	NS
titanium dioxide	11/8/1995	A release of one-tenth of a pound of titanium dioxide occurred over aduration of five minutes. The permit limit of PM-10 is 0.88 lbs/hr.	NS

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
titanium dioxide	11/8/1995	A release of a minor amount of titanium dioxide occurred over a duration of five minutes. The release is estimated to be approximately equivalent to the permit limit 0.11 lbs/hr.	NS
titanium dioxide	11/14/1995	A release of less than one pound of titanium dioxide occurredover a duration of five minutes.	NS
titanium dioxide	11/14/1995	A release of 0.9 pounds of titanium dioxide occurred over a period of five minutes. The PM-10 permit limit is 0.88 lb/hr.	NS
titanium dioxide	11/21/1995	Louisiana Pigment Company released 0.8 pounds of titanium dioxide into the atmosphere. The permit limit for titanium dioxide is 0.11 lbs/hr.	NS
titanium dioxide	11/21/1995	A release of an unknown amount of titanium dioxide occurred over a duration of seven minutes.	NS
titanium dioxide	12/28/1995	A release of approximately three pounds of titanium dioxide occurred over a duration of 15 minutes. The permit limit for this emisssion point is 0.88 lbs/hr of PM-10.	NS
titanium dioxide	12/29/1995	A release of approximately two pounds of titanium dioxide occurred over a duration of five minutes. The permit limit for this emission point is 0.4 lbs/hr of PM-10.	NS
titanium dioxide	2/10/1996	A release into the atmosphere of an estimated 1/10 pound of titanium dioxide which was not in excess of the permit limit of 0.88 lbs/hour for PM-10 occurred between 8:00 hours and 8:05 hours.	NS
titanium dioxide	3/7/1996	A release into the atmosphere of 2.24 pounds of titaium dioxide in excess of the permit limit of 0.88 lbs/hour occurred between 12:45 hours March 7, 1996 and 1:02 hours March 8, 1996.	NS
titanium dioxide	4/13/1996	Louisiana Pigment Company released an unmeasurable amount of titanium dioxide into the atmosphere.	NS
titanium dioxide	12/5/1996	A release approximately 1.2 pounds of titanium dioxide occurred over a duration of 10 minutes. This exceeded the permit level of 0.88 pounds/hour.	NS
titanium dioxide	12/9/1996	A release of 1.9 pounds of titanium dioxide occurred over aduration of 15 minute. This exceeded the permit lelvel of 0.88 pounds/hour.	NS
titanium dioxide	8/6/1997	A release of approximately 1.54 pounds of titanium dioxide occurred overa duration of 35 minutes. This exceeded the permit limit of 0.88 poundsper hour.	NS
titanium dioxide	8/25/1997	1.7 pounds of titanium ore was released.	NS
titanium dioxide	8/25/1997	Recorded value of 1.7 exceeds the permit limit of .14	NS
titanium dioxide	9/29/1997	A release of approximately 1.2 pounds of titanium dioxide occurredover a duration of 30 minutes. This exceeded the permit limit ofPM-10 of 0.88 lb/hr.	NS
Titanium Tetrachloride	3/28/1993	A release of 65 lbs occurred over an unknown time of the time of notification.	NS
Titanium Tetrachloride	3/28/1994	A release of 65 lbs occurred over a duration of 3 min.	NS
Titanium Tetrachloride	4/26/1994	As a result of two separate plumes, a total release of 6.08 lbs occurred over a duration of 37 min.	NS
Titanium Tetrachloride	6/30/1994	A release of 45.3 lbs. occurred over a duration of 4 mins.	NS
Titanium Tetrachloride	7/28/1994	A release of 412 lbs. occurred over a duration of 4 min.	NS
Titanium Tetrachloride	9/1/1994	A release of 7.55 lbs. occurred over a duration of 6 min.	NS
Titanium Tetrachloride	9/6/1994	A release of 3.6 lbs. occurred over a duration of 6 min.	NS

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Titanium Tetrachloride	9/12/1994	A release of 1.8 lbs. occurred over a duration of 13 min.	NS
Titanium Tetrachloride	2/20/1995	A release of 1.1 lbs occurred for an undetermined amount of time.	NS
Titanium Tetrachloride	2/20/1995	A release of 1.1 lbs occurred for an undetermined amount of time.	NS
Titanium Tetrachloride	2/20/1995	A release of an unknown amount occurred over a duration of 13 minutes.	NS
Titanium Tetrachloride	2/20/1995	Louisiana Pigment Company released 4.05 pounds of titanium tetrachloride into the atmosphere. This exceeded the permit limit of one pound.	NS
Titanium Tetrachloride	3/9/1995	A release of 10.2 lbs occured over a duration of 22 minutes.	NS
Titanium Tetrachloride	3/9/1995	Louisiana Pigment Company released 10.2 pounds of titanium tetrachloride into the atmosphere. This exceeded the permit limit of one pound.	NS
Titanium Tetrachloride	4/11/1995	A release of an unknown amount occurred over a duration of 10 minutes.	NS
Titanium Tetrachloride	4/11/1995	A release of 5.39 lbs. occurred over a duration of 15 minutes.	NS
Titanium Tetrachloride	4/11/1995	Louisiana Pigment Company released 5.39 pounds of titanium tetrachloride into the atmosphere. This exceeded the permit limit of one pound.	NS
Titanium Tetrachloride	4/24/1995	A release of an unknown amount occured over an undetermined amount of time.	NS
Titanium Tetrachloride	4/25/1995	A release of .1 (unspecified units) occurred over an unknown amount of time.	NS
Titanium Tetrachloride	4/25/1995	Louisiana Pigment Company released 0.1 pound of titanium tetrachloride into the atmosphere.	NS
Titanium Tetrachloride	4/25/1995	Louisiana Pigment Company released an unknown quantity of titanium tetrachloride into the atmosphere.	NS
Titanium Tetrachloride	4/25/1995	A release of 0.5 pounds of titanium tetrachloride occurred. This is below the Reportable Quantity (RQ) for titanium tetrachloride of one pound.	NS
Titanium Tetrachloride	5/10/1995	A release of .7 lbs and .9 lbs occurred over a duration of 7 minutes.	NS
Titanium Tetrachloride	5/10/1995	Louisiana Pigment Company released 1.57 pounds of titanium tetrachloride into the atmosphere. This exceeded the permit limit of one pound.	NS
Titanium Tetrachloride	5/13/1995	A release of an unknown amount occurred over a duration of 5 minutes.	NS
Titanium Tetrachloride	5/13/1995	A release of 22 lbs occurred over a duration of 5 minutes.	NS
Titanium Tetrachloride	5/13/1995	Louisiana Pigment Company released 22 pounds of titanium tetrachloride into the atmosphere. This exceeded the permit limit of one pound.	NS
Titanium Tetrachloride	5/26/1995	A release of 1.37 lbs occurred over a duration of 10 minutes.	NS
Titanium Tetrachloride	5/26/1995	Louisiana Pigment Company released 7.37 pounds of titanium tetrachloride into the atmosphere.	NS
Titanium Tetrachloride	6/2/1995	Louisiana Pigment Company released 3.58 pounds of titanium tetrachloride into the atmosphere. This exceeded the reportable quantity of one pound.	NS
Titanium Tetrachloride	6/7/1995	A release of six pounds of titanium tetrachloride occurred over a period of 25 minutes.	NS

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Titanium Tetrachloride	6/7/1995	A release of 7.2 pounds of titanium tetrachloride occurred over a duration of 15 minutes. This exceeded the reportable quantity of one pound.	NS
Titanium Tetrachloride	6/10/1995	A release of 14.4 pounds of titanium tetrachloride occurredover a duration of four minutes.	NS
Titanium Tetrachloride	6/10/1995	A release of 14.3 pounds of titanium tetrachloride occurred over a duration of four minutes. This exceeded the reportable quantity one pound.	NS
Titanium Tetrachloride	6/27/1995	A release of four pounds of titanium tetrachloride occurred over a duration of three minutes.	NS
Titanium Tetrachloride	6/27/1995	A release of 3.61 pounds of titanium tetrachloride occurred over a duration of five minutes. This exceeded the reportable quantity of one pound.	NS
Titanium Tetrachloride	8/17/1995	A release of 3.5 lbs occurred over a duration of 1 hour and 40 minutes.	NS
Titanium Tetrachloride	8/17/1995	A release of 3.6 pounds of titanium tetrachloride occurred over aduration of five minutes.	NS
Titanium Tetrachloride	9/14/1995	Facility released an unknown quantity of titanium tetrachloride into the atmosphere at 11:05 hours.	NS
Titanium Tetrachloride	9/15/1995	Louisiana Pigment Company released an unknown quantity of titanium tetrachloride into the atmosphere. The release was determined not to exceed the reportable quantity and therefore the notification was made as a courtesy only.	NS
Titanium Tetrachloride	9/16/1995	Facility released an unknown quantity of titanium tetrachloride into the atmosphere at 1:30 hours.	NS
Titanium Tetrachloride	9/16/1995	Louisiana Pigment Company released 148.6 pounds of titanium tetrachloride into the atmosphere.	NS
Titanium Tetrachloride	9/29/1995	Facility discharged into the air from 7:26 hours to 7:45 hours an unmeasurable quantity of titanium tetrachloride.	NS
Titanium Tetrachloride	1/30/1996	Louisiana Pigment Company released an unknown quantity of titanium tetrachloride into the atmosphere over a 44 minute period.	NS
Titanium Tetrachloride	1/30/1996	A release from a gasket in the CP 1 Process Unit of titanium tetrachloride in the estimated amount of .9 pounds which is well below the permit limit of 1000 pound reportable quantity occurred from approximately 6:50 p.m. until 7:35 p.m..	NS
Titanium Tetrachloride	2/22/1996	A release of chlorine and titanium tetrachloride occurred at 4:17 p.m. when these elements backed up from the process into the aluminum feed piping, burning ahole in the feed line. The release did not leave the plant nor was there any off-site impact.	NS
Titanium Tetrachloride	12/15/1996	Louisiana Pigment Company released approximately 13.3 pounds of titanium tetrachloride into the atmosphere over a 57 minute period of time.	NS
Titanium Tetrachloride	12/15/1996	A release of an unknown amount of titanium tetrachloride occurred over an indeterminate duration.	NS
Titanium Tetrachloride	8/22/1997	Unknown quantity of titanium tetrachloride was released.	NS
Titanium Tetrachloride	8/22/1997	A release of approximately 1.8 pounds of titanium tetrachloride occurred over a duration of 20 minutes. The reportable quantity (RQ) for titanium tetrachloride is 1,000 pounds. Therefore, Louisiana Pigment did not exceed the RQ.	NS

Table 10-2
LA Pigment
Enforcement History by Contaminant

CHEMICAL	DATE	VIOLATION	OUTFALL
Titanium Tetrachloride	3/25/1998	Recorded value of 29.4 lbs was in violation of the permit limits.	NS
Titanium Tetrachloride	3/27/1998	Permittee is authorized to discharge titanium tetrachloride from the Westlake Facility.	NS
Titanium Tetrachloride	3/29/1998	Permittee is authorized to discharge titanium tetrachloride from the Westlake Facility.	NS
Total Vanadium, D. Max	07/00/1994	The recorded value of 3.6 lbs/dy was in violation of the permit limit of 2.8 lbs/dy. One excursion was reported.	001A
Total Vanadium, D. Max	07/00/1994	The recorded value of 0.899 mg/l was in violation of the permit limit of 0.400 mg/l. One excursion was reported.	001A
Total Zirconium, D. MAX	11/00/1993	The recorded value of 0.3037 mgwas in violation of the permit limit 0.100 mg.One excursion was reported	004A
Total Zirconium, D. MAX	11/00/93	The recorded value of 0.3037mgwas in violation of the permit value 0.100mg.One excursion was reported.	004A
Vanadium	7/26/1994	The recorded value of 3.58 lbs/day was in violation of the permit limit of 2.8 lbs/day.	1
Vanadium	7/27/1994	Recorded value of Vanadium was in violation of the permit limits.	1
Vanadium, max.	7/26/1994	The maximum daily was 0.89 mg/l was in violation of the permit limit of 0.4 mg/l.	1
Zinc	2/9/1996	The recorded value of 0.0716 mgwas in violation of the permit limit of 0.071 mg.	5
Zinc	2/10/1996	The recorded value of 8.554 mgwas in violation of the permit limit of 0.868 mg.	5
Zirconium	11/7/1993	The recorded value of 0.3 mg was in violation of the permit limit of 0.1 mg.	4
Zirconium, max.	11/1/1993	Recorded value of 0.3037 mg/l was in violation of permit limit of 0.100 mg/l.	1
Zirconium, max.	11/00/1993	Recorded value of 0.3037 mg/l in violation of permit limit of 0.100 mg/l.	1

NOI - No Outfall Identified

Information obtained from permit files.

Table 10-3
Historic Results for Shallow Lake Energy System
Lower Calcasieu

Year	1989[1]	1992[2]	1994[3]
Compound			
Arsenic (mg/Kg)	- - -	1.6 - 2.0	- - -
Barium (mg/Kg)	- - -	81 - 366	362
Chromium (mg/Kg)	8 - 30	- - -	9
Copper (mg/Kg)	- - -	4.3 - 16.4	8
Lead (mg/Kg)	10.0 - 50.0	8.1 - 29.1	13
Mercury (mg/Kg)	0.23 - 0.28	0.12	- - -
Nickel (mg/Kg)	- - -	6.0 - 16.8	- - -
Zinc (mg/Kg)	- - -	9.4 - 37.4	29
Total PAHs (μg/Kg)	- - -	225 - 795	- - -
Aldrin (μg/Kg)	- - -	- - -	- - -
Total BHCs (μg/Kg)	- - -	- - -	- - -
Dieldrin (μg/Kg)	- - -	- - -	- - -
Endosulfan sulfate (μg/Kg)	- - -	- - -	- - -
Endrin (μg/Kg)	- - -	- - -	- - -
Endrin aldehyde (μg/Kg)	- - -	0.8	- - -
Endrin ketone (μg/Kg)	- - -	- - -	- - -
Hexachlorobenzene (μg/Kg)	- - -	- - -	- - -
PCBs, total (μg/Kg)	- - -	- - -	- - -
4-Methylphenol (μg/Kg)	- - -	- - -	- - -
Bis(2-ethylhexyl) phthalate (μg/Kg)	1,100	110	- - -
Hexachlorobutadiene (μg/Kg)	- - -	- - -	- - -
1,2-Dichloroethane (μg/Kg)	- - -	- - -	- - -
Acetone (μg/Kg)	- - -	- - -	27
Carbon disulfide (μg/Kg)	- - -	2 - 12	- - -
Trichloroethene (μg/Kg)	- - -	- - -	- - -

Notes:
[1]1988-89 EPA Toxics Study of the Lower Calcasieu River
[2]1992 EPA Bayou d'Inde Expanded Site Inspection
[3]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 10-4
Historic Results for the Ship Channel Energy System
Lower Calcasieu

Year	1989[1]	1992[2]	1994[3]
Compound			
Arsenic (mg/Kg)	1.4 - 2.7	0.9 - 1.0	2.0 - 7.0
Barium (mg/Kg)	248 - 404	103 - 147	5 - 983
Chromium (mg/Kg)	20 - 50	- - -	6 - 38
Copper (mg/Kg)	23.0 - 50.0	10.2 - 10.3	5.0 - 49.0
Lead (mg/Kg)	13.0 - 50.0	9.8 - 16.3	8.0 - 57.0
Mercury (mg/Kg)	0.30 - 2.10	- - -	1.00 - 1.00
Nickel (mg/Kg)	13.0 - 17.0	6.0 - 19.0	11.0 - 24.0
Zinc (mg/Kg)	60.0 - 85.0	12.9 - 18.0	5.0 - 120.0
Total PAHs (μg/Kg)	- - -	- - -	- - -
Aldrin (μg/Kg)	190	- - -	- - -
Total BHCs (μg/Kg)	- - -	- - -	- - -
Dieldrin (μg/Kg)	- - -	- - -	- - -
Endosulfan sulfate (μg/Kg)	- - -	- - -	- - -
Endrin (μg/Kg)	- - -	- - -	- - -
Endrin aldehyde (μg/Kg)	- - -	- - -	- - -
Endrin ketone (μg/Kg)	- - -	- - -	- - -
Hexachlorobenzene (μg/Kg)	6,000 - 27,000	- - -	- - -
PCBs, total (μg/Kg)	- - -	- - -	- - -
4-Methylphenol (μg/Kg)	- - -	- - -	- - -
Bis(2-ethylhexyl) phthalate (μg/Kg)	- - -	- - -	- - -
Hexachlorobutadiene (μg/Kg)	9,800	- - -	- - -
1,2-Dichloroethane (μg/Kg)	- - -	- - -	- - -
Acetone (μg/Kg)	- - -	- - -	11 - 168
Carbon disulfide (μg/Kg)	- - -	- - -	3 - 24
Trichloroethene (μg/Kg)	- - -	- - -	- - -

Notes:
[1]1988-89 EPA Toxics Study of the Lower Calcasieu River
[2]1992 EPA Bayou d'Inde Expanded Site Inspection
[3]1994 PPG Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Table 10-5 Wilcoxon Rank Sum Test Result
Lower Calcasieu AOC

Area of Concern	Energy Area	Probability (p-value) [1] Aroclor-1254	Arsenic	Barium	bis(2-ethylhexyl)phthalate	Chromium	Copper
Lower Calcasieu	Bayou	-- [2]	**0.02**	0.279	**0.004**	0.061	0.053
Lower Calcasieu	Ship Channel	**0.045**	**0.018**	**0.049**	**0.001**	0.637	0.629
Lower Calcasieu	Shallow Lake	0.576	**0.05**	**0.02**	**0.001**	0.149	**0.008**
Lower Calcasieu	Other	0.404	**0.03**	**0.017**	**0.021**	**0.017**	**$1.37x10^{-4}$ (0.020)**

Area of Concern	Energy Area	Probability (p-value) [1] Lead	Mercury	Nickel	Pyrene	Zinc	2,3,7,8-TCDD TEQ
Lower Calcasieu	Bayou	0.541	0.092	0.058	0.275	**0.024**	-- [2]
Lower Calcasieu	Ship Channel	0.093	0.36	**$2.36x10^{-4}$ (0.034)**	**0.03**	**$1.41x10^{-4}$ (0.020)**	0.558
Lower Calcasieu	Shallow Lake	0.737	0.196	**0.003**	**0.023**	0.798	**0.028**
Lower Calcasieu	Other	**$1.37x10^{-4}$ (0.020)**	**$2.15x10^{-4}$ (0.031)**	0.125	**0.017**	**0.034**	**0.014**

[1] If p-value < critical value (alpha = 0.05) then there is a statistically significant difference between the AOC and reference areas. Bold = Significant Difference. Values in parentheses are Bonferroni adjusted p-values < critical value.

[2] Insufficient data for analysis.

Shading indicates that reference area conditions are greater than the energy system.

Table 10-6
COPCs Identified for the Bayou Energy System
Lower Calcasieu

COPCs	COPC for Lower Calcasieu (BERA CDM 2002b)	COPC for Lower Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	**Yes**
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	No
benzo(a)anthracene	-	-	NE	No
benzo(a)pyrene	-	**Yes**	NE	No
benzo(b)fluoroanthene	-	-	NE	No
benzo(g,h,I)perylene	-	-	NE	No
benzo(k)fluoranthene	-	-	NE	No
chrysene	-	-	NE	No
dibenzo(a,h)anthracene	-	-	NE	No
fluorene	-	-	NE	No
phenanthrene	-	-	NE	No
pyrene	-	-	No	No
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	ID	No[3]
aroclor-1254	**Yes**	**Yes**	ID	No[3]
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	No	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	No	No
Inorganics				
arsenic	No	**Yes**	**Yes**	No[4]
barium	No	No	No	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	No	No
lead	**Yes**	No	No	No
mercury	**Yes**	No	No	No
nickel	No	No	No	No
zinc	**Yes**	No	**Yes**	No[4]

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 10-7
COPCs Identified for the Other Energy System
Lower Calcasieu

COPCs	COPC for Lower Calcasieu (BERA CDM 2002b)	COPC for Lower Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	**Yes**
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	No
benzo(a)anthracene	-	-	NE	No
benzo(a)pyrene	-	**Yes**	NE	No
benzo(b)fluoroanthene	-	-	NE	No
benzo(g,h,I)perylene	-	-	NE	No
benzo(k)fluoranthene	-	-	NE	No
chrysene	-	-	NE	No
dibenzo(a,h)anthracene	-	-	NE	No
fluorene	-	-	NE	No
phenanthrene	-	-	NE	No
pyrene	-	-	**Yes**	No
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	**Yes**	NE	**Yes**
aroclor-1254	**Yes**	**Yes**	No	**Yes**
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	No	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	**Yes**	**Yes**
barium	No	No	**Yes**	**Yes**
chromium (total)	**Yes**	No	**Yes**	**Yes**
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	**Yes**	**Yes**
mercury	**Yes**	No	**Yes**	**Yes**
nickel	No	No	No	No
zinc	**Yes**	No	**Yes**	**Yes**

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Table 10-8
COPCs Identified for the Shallow Lake Energy System
Lower Calcasieu

COPCs	COPC for Lower Calcasieu (BERA CDM 2002b)	COPC for Lower Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	ID	**Yes**
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	**Yes**	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	No	NE	No
aroclor-1254	**Yes**	No	No	No
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	No	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	**Yes**	**Yes**
Inorganics				
arsenic	No	**Yes**	**Yes**	No[4]
barium	No	No	**Yes**	No
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	**Yes**	**Yes**
lead	**Yes**	No	No	No
mercury	**Yes**	No	No	No
nickel	No	No	**Yes**	No[4]
zinc	**Yes**	No	No	No

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

CDM

Table 10-9
COPCs Identified for the Ship Channel Energy System
Lower Calcasieu

COPCs	COPC for Lower Calcasieu (BERA CDM 2002b)	COPC for Lower Calcasieu (HHRA CDM 2002a)	Statistically Significant Difference to Reference Area	Nature and Extent Discussed
VOCs				
1,2-dichloroethane	No	No	ND	No
trichloroethane	No	No	ND	No
acetone	No	No	ND	No
SVOCs				
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**Yes**	**Yes**
hexachlorobenzene	No	No	ND	No
hexachlorobutadiene	No	No	ND	No
3- & 4-Methylphenol	No	No	ND	No
carbon disulfide	No	No	ND	No
PAHs				
acenaphthylene	-	-	NE	**Yes**
benzo(a)anthracene	-	-	NE	**Yes**
benzo(a)pyrene	-	**Yes**	NE	**Yes**
benzo(b)fluoroanthene	-	-	NE	**Yes**
benzo(g,h,I)perylene	-	-	NE	**Yes**
benzo(k)fluoranthene	-	-	NE	**Yes**
chrysene	-	-	NE	**Yes**
dibenzo(a,h)anthracene	-	-	NE	**Yes**
fluorene	-	-	NE	**Yes**
phenanthrene	-	-	NE	**Yes**
pyrene	-	-	**Yes**	**Yes**
Total PAHs	**Yes**	No	NE	**Yes**
Low PAHs	**Yes**	No	NE	**Yes**
High PAHs	**Yes**	No	NE	**Yes**
PCBs/Pesticides				
PCB Congeners	**Yes**	No	**Yes**	**Yes**
aroclor-1254	**Yes**	No	**Yes**	**Yes**
aldrin	No	**Yes**	ND	No[3]
delta-bhc	No	No	ND	No
dieldrin	No	**Yes**	ND	No[3]
endosulfan sulfate	No	No	ND	No
endrin aldehyde	No	No	ND	No
endrin ketone	No	No	ND	No
Dioxin/Furans				
2,3,7,8-TCDD	**Yes**	**Yes**	No	No
Inorganics				
arsenic	No	**Yes**	**Yes**	No[4]
barium	No	No	**Yes**	**Yes**
chromium (total)	**Yes**	No	No	No
copper	**Yes**	No	No	No
lead	**Yes**	No	No	No
mercury	**Yes**	No	No	No
nickel	No	No	**Yes**	No[4]
zinc	**Yes**	No	**Yes**	No[4]

1 - Detected at less than 5 percent in the energy area.

2 - Reference area conditions were greater than what was observed in the energy area

ID - Insufficient Data NE - Not Evaluated by WRS Test ND - Not Detected in Reference Area

Section 11
Nature and Extent of Biota Contamination

11.1 Introduction

Tissue samples were collected and analyzed for chemical characterization to complete human health and ecological risk evaluations. The resulting data were used to assess risks to fish and wildlife resources and to human health. These sample data will also support the feasibility study and potential future remedial actions. Due to the migratory nature of certain types of biota collected, this section is outlined by group (of biota type) and by AOC for sedentary species only (as described in the Phase II SAP) but not by energy area as discussed in previous sections. The three areas in the estuary are Upper Calcasieu, Bayou d'Inde, and Lower Calcasieu and the reference area.

11.1.1 Tissue Design Strategy

An ecological site reconnaissance-sampling program of fish and invertebrate tissues was conducted in spring 2000 (Phase I). This sampling program included a number of fish and invertebrate species, including a few large, predatory fish species that in some cases dominated the data set (e.g., black drum). Samples were taken from a number of sub-areas within Bayou d'Inde, Upper Calcasieu, and Lower Calcasieu and the reference area. Each sample was analyzed for a broad suite of metals and organic parameters, and a subset of samples was also analyzed for dioxins and furans. For some organic parameters (e.g., individual aroclors), the detection limits were orders of magnitude above levels associated with effects to wildlife (Moore et al. 1999). Thus, the Phase II sampling program was implemented throughout 2001 and served two purposes: (1) the data were used in a screening level ecological risk assessment (SERA) to update which chemicals and locations potentially pose risks to the wildlife, based on assessment endpoints identified at the BERA workshop (MacDonald et al. 2000), and (2) the data on chemical levels in fish and invertebrate tissues were used as inputs to wildlife exposure models in the BERA and for human health risk assessment.

The following ecosystem objectives were established at the BERA workshop (MacDonald et al. 2000) that had direct relevance to the design of the Phase II sampling program:

- Maintain and, if necessary, restore aquatic environmental conditions that will support an abundant and diverse fish community
- Maintain and, if necessary, restore aquatic, wetland, and terrestrial habitats that will support abundant, diverse, and self-sustaining populations of aquatic-dependent birds
- Maintain and, if necessary, restore aquatic, wetland, and terrestrial habitats that will support abundant, diverse, and self-sustaining populations of aquatic dependent mammals

The fish and wildlife species that were the focus of the Phase II sampling program range from relatively small predators with limited foraging ranges (e.g., kingfishers) to large predators with broad foraging ranges (e.g., black drum, dolphins). Several wildlife focal species are also highly opportunistic feeders (e.g., raccoons, mink). Potential prey species are highly variable in terms of their preferred habitat (e.g., sheltered bayous versus open water), size, mobility, and foraging range. The point estimates or distributions that were developed in the BERA for prey tissue concentrations in the wildlife exposure models need to be appropriately scaled. For example, kingfishers have small foraging ranges and feed on small fish, which themselves have small ranges. The prey of the kingfisher exhibit high spatial variability in tissue residues depending on proximity to a contaminant source. Since neither the kingfisher nor their prey spatially averages their exposures over a wide range, separate exposure analysis was required for kingfishers inhabiting different sub-areas in the Calcasieu Estuary. Conversely, for wildlife species that forage widely (e.g., dolphins) on prey that spatially average their exposures (e.g., black drum), a single exposure analysis for the estuary was considered appropriate. These two examples required different Phase II sampling designs. For kingfishers, it was necessary to sample small fish from a number of locations using a "randomized block" design in which samples are randomly chosen from each of the sub-areas, with the size of the sub-area scaled approximately to the foraging range of the kingfishers. For dolphins, it was necessary to randomly sample large fish from the entire estuary.

Two approaches were used to develop the Phase II sampling design. First, the feeding ecology of the fish and wildlife focal species was assessed, and second, likely prey species (or types) were identified and their likely foraging areas were estimated. A statistical analysis was conducted on the tissue residue data collected during the Phase I sampling program. The objective of these analyses was to determine numbers of samples in need of collection during Phase II to reliably develop measures of centrality and variability over spatial scales of interest for the different predator-prey combinations. The statistical analyses, however, were limited since the Phase I data set were dominated by non-detects as a result of high detection limits for many of the organic chemicals (e.g., aroclors, dioxins, and furans). Also, the Phase I data set has insufficient sample sizes for invertebrates and small fish species to permit useful statistical analysis. The Phase II design combined these two approaches for the sampling program in the Calcasieu Estuary.

11.1.1.1 Prey Sampling Strategy

The selected prey species were organized into four logical groups. Each group reflects a particular combination of size range, pelagic versus demersal distribution in the water column, trophic level, and foraging range. The sorting criteria and the resulting prey groups are discussed below. The grouped prey species are presented in Exhibit 11-1.

Body Size

Fish and invertebrate species found in the southern United States of America (USA) vary widely in terms of body size. Body sizes range from tiny gobies (Gobiidae) less

than 1 cm in length to alligator gars that can reach nearly 3 m in length. Most fish local to the estuary, however, are approximately ¼ to ½ m in length.

Water Column Distribution

The estuarine habitat found in Southern Louisiana favors demersal fish. Tidal, coastal, swampy, or marshy areas tend to be shallow and have mostly muddy bottoms that provide a good substrate and food source for demersal fish prey items such as crustaceans, annelids, mollusks, and algae. The majority of fish species listed for this geographic location are bottom fish. Examples include catfishes (ictaluridae), blennies (Bleniidae), suckers (Castomidae), some killifish (Fundulidae), gobies, wormfishes (Microdesmidae), flounders (all families), and rockfishes (Sebastidae).

Pelagic fish include silversides (Atherinidae), sunfishes (Centrachidae), herrings (Clueidae), pupfishes (Cyprinodontidae), anchovies (Engraulidae), killifishes, gars (Lepisosteidae), mullets (Muglidae), poecilids (Poecilidae), and drums (Sciaenidae).

Trophic Level

The trophic level occupied by an organism is related to the amount of energy, in terms of food, required by the organism. Organisms capable of utilizing inorganic chemicals, e.g., plants or food of low energy content, are considered to be on a lower trophic level, whereas, for example, predatory species requiring food of high-energy content are considered to be on a higher trophic level. The trophic level number indicates the level of the organism in the food chain (World Health Organization [WHO] 1989).

The selected set of fish and invertebrate species includes a combination of feeding strategies and prey or food items. This had the effect of giving a wide range of trophic level values. Prey species at different trophic levels are likely to have substantially different levels of bioaccumulative chemicals in their tissues. There are prey species that are exclusively phytoplanktivores such as herring, shad, sardine, and menhaden (Clupeidae). There are also purely carnivorous species such as blue crab, bass (Centrarchidae), anchovy, gar (Lepisosteidae), and most sebastids (Sebastidae). Most of the reported species, however, are omnivores.

The trophic level for planktivores is low and is set at 2.0. For omnivores, numeric trophic levels ranged from 2.1 for mullets to 3.4 for silversides (Atherinidae) and pupfishes. Carnivores occupy even higher trophic levels.

Foraging Range

The foraging range of each prey species is a combination of foraging strategy, diet requirements, and body size. A general observation is that larger fish tend to travel more than smaller fish, crabs, and clams. The latter group tends to find suitable habitat in quiet bays and inlets and remains there, whereas larger fish are more likely to enter open water and travel extensively in search of food. There are exceptions to this observation. Anchovies, for example, tend to be small yet cover large distances. On the other hand, gars can be very large yet tend to move little. Species with large foraging

ranges are likely to exhibit less spatial variation in tissue residues than will species with small foraging ranges.

Prey Groups
Exhibit 11-1 below represents the five groups of prey species likely to occur in the Calcasieu Estuary. Species within a particular group are interchangeable since predators will be unlikely to have distinct preferences for one species over another within a group.

Exhibit 11-1 Prey Groups of the Calcasieu Estuary

Group 1	Small bentho-pelagic fish and small benthic invertebrates that inhabit shallow water and have a localized distribution. The trophic level ranges from 2 to 2.5. Tissue residue levels were expected to vary substantially depending on proximity to contaminant sources.
Group 2	Small to large pelagic fish that inhabit water of any depth and have a broad distribution. The trophic level ranges from 2 to 2.5. Tissue residue levels were not expected to vary widely between sub-areas in the Calcasieu Estuary.
Group 3	Medium pelagic fish that inhabit water of any depth and have a broad foraging range. The trophic level ranges from 2 to 2.5. Tissue residue levels were not expected to vary widely between sub-areas in the Calcasieu Estuary.
Group 4	Medium to large bento-pelagic fish that inhabit water of any depth and have a broad foraging range. The trophic level ranges from 2.5 to 3.5. Tissue residue levels were expected to be quite high for bioaccumulative chemicals but were unlikely to vary widely between sub-areas in the Calcasieu Estuary.
Group 5	Large pelagic fish that inhabit shallow water and have a local distribution. The trophic levels were expected to be quite high for bioaccumulative chemicals in contaminated sub-areas in the Calcasieu Estuary. Otherwise, trophic levels would be lower.

Each of the fish and wildlife focal species for the estuary tend to feed upon one, or at most, two of the above prey groups. The majority of fish and wildlife focal species feed upon prey Group 1, although several species also feed upon prey in Groups 2, 3, and/or 4.

11.1.1.2 Sample Size Rationale

The sample size for the Phase II tissue sampling was based upon the following:

- Sampling of small fish and invertebrates with more limited mobility (i.e., Group 1) was a crucial component to develop credible exposure estimates for most of the fish and wildlife focal species for the ecological risk assessment. These species exhibit considerable spatial variation across the Calcasieu Estuary; therefore, obtaining sufficient sample numbers from each of the sub-areas was critical. The results of this sampling permitted development of separate exposure estimates in different sub-areas for individuals of focal species with small foraging ranges (e.g., kingfishers).

- Sampling of fish species with a greater tendency to forage over a wider range (i.e., Groups 2 through 4) was also required for some wildlife focal species (e.g., osprey and dolphin). These species exhibit less spatial variation across the Calcasieu Estuary, and, thus, the sampling program would not require as detailed sampling at the sub-area spatial scale. For these groups, it was adequate to obtain samples at a

higher level of resolution (e.g., Upper Calcasieu, Lower Calcasieu, Bayou d'Inde) for both ecological and human health risk assessment.

- No sampling of Group 5 fish species (i.e., gar) was required for the ecological risk assessment.

- Sampling from Groups 4 and 5 (fillets only) was necessary only for human health risk assessment.

11.1.1.3 Sample Collection

Sampling locations for tissue collection were predetermined based on the randomly generated Triad locations (Figure 4-7). At each of the sampling stations, multiple samples of Group 1 fish and invertebrates (i.e., three to five samples of each subgroup) were collected within a 100-m radius of the designated coordinates. The dimensions of each sampling station were expanded to 500-m for collecting Groups 2, 3, and 4 fish samples. The coordinates of alternate sampling stations were also identified if the primary sampling station did not yield sufficient samples.

11.1.2 Biota Tissue Sample Analytical Protocol

Biota tissue samples collected from the Calcasieu Estuary and the reference area were analyzed off site. A subcontract laboratory and/or a PRP laboratory were used to analyze for chemicals of interest. The analytical protocol included TAL metals, SVOCs, PCBs, PCB congeners, pesticides, and dioxin/furans. Dioxin/furans and PCB congeners analyses were limited to 20 percent of the total biota samples collected. Analytical protocols included EPA SW-846 (EPA 1997a) and USGS and EPA CLP standard methods.

Exhibit 11-2 Description of Groups for the Calcasieu Estuary

Type	Group	Description of Group	Size Class (cm)
Fish	1	Small sedentary species – low trophic level (<2.5)	<15 cm
Invertebrates	1A	Small sedentary bivalves	<7.5 cm
Invertebrates	1B	Small sedentary crustaceans	<7.5 cm
Invertebrates	2A	Small migratory crustaceans	<12.5 cm
Invertebrates	2B	Large migratory crustaceans	>12.5 cm
Fish	2A	Small migratory species - low trophic level (<2.5)	<15 cm
Fish	2B	Small migratory species - high trophic level (>2.5)	<15 cm
Fish	3A	Medium migratory species - low trophic level (<2.5)	15 to <30 cm
Fish	3B	Medium migratory species - high trophic level (>2.5)	15 to <30 cm
Fish	4A	Large migratory species - low trophic level (>2.5)	30 to 90 cm
Fish	4B	Large migratory species - high trophic level (>2.5)	30 to 90 cm

Biota tissue sample results were segregated into different groups based on the aforementioned criteria. Results evaluation is presented in Exhibit 11-2 according to group criteria. Numbers of samples collected from each group are presented in Exhibit 11-3.

Exhibit 11-3 Number of Samples Collected per Group

Group	Tissue Type	No. Of Samples Collected
1	Whole body	159
1A	Shellfish	45
1B	Shellfish	9
2A	Shellfish	75
2A	Whole body	47
2B	Shellfish	30
2B	Whole body	28
3A	Whole body	66
3B	Fish Fillet	19
3B	Whole body	126
4A	Whole body	57
4B	Fish Fillet	104
4B	Whole body	73

11.2 Biota Tissue – Nature and Extent of Contamination

The tissue-sampling program in the reference area, Upper Calcasieu, Lower Calcasieu, and Bayou d'Inde included the collection and analysis of fish and invertebrate samples for a combination of compounds in accordance with EPA SW-846 and USGS and EPA CLP standard methods. The compounds of interest included SVOCs, pesticides, PCBs, PCB congeners, dioxin/furans, and metals.

This section describes the extent to which these compounds exceeded analytical detection limits. Comparisons of analytical results between the reference area and AOCs are also presented. These comparisons are based on geometric mean concentrations of COPCs in biological tissue. Data tables identifying detected analytes are presented in Appendix H.

11.2.1 Nature and Extent of Tissue Contamination

This section describes the analytes detected for all Groups 1, 2, 3, and 4 tissue samples collected throughout the estuary.

11.2.1.1 Shellfish

11.2.1.1.1 Group 1A

Group 1A shellfish tissue results were obtained from small (<7.5 cm) sedentary bivalves (e.g., clams, mussels, oysters). Exhibits 11-4 and 11-5 present the range, mean, and standard deviation of the COPCs most frequently detected of the Group 1A shellfish.

SVOCs PAHs

The SVOC analysis of Group 1A shellfish tissue samples identified the detection of 18 SVOC analytes. Benzaldehyde, benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene were the most frequently detected analytes at mean concentrations of 421

µg/Kg, 20.9 µg/Kg, 1.62 µg/Kg, and 0.60 µg/Kg, respectively. Benzaldehyde was the only SVOC detected in all three Group 1A shellfish in the reference area at a mean concentration of 1,500 µg/Kg. No PAHs were detected in the reference area samples.

Pesticides

The pesticide analysis of Group 1A shellfish tissue samples indicated the presence of 11 analytes with low detection of frequency. 4,4-DDE was detected most frequently at a mean concentration of 2.12 µg/Kg.

Exhibit 11-4 Summary Statistics for Detects (µg/Kg) in Group 1A Shellfish

Parameter	Frequency of Detection	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	21/21	31	2000	421.71	617.05
Benzo(a)pyrene	18/23	0.84	240	20.97	65.59
Benzo(g,h,I)perylene	15/18	1	3.3	1.62	0.62
Indeno(1,2,3-cd)pyrene	15/18	0.34	1.1	0.60	0.23
4,4-DDE	8/39	1	3.7	2.12	0.99
Aroclor 1254	8/39	17	74	12.50	16.62
2,3,7,8-TCDD TEQ (pg/g)	7/7	1.4	20.25	6.72	8.66

PCBs (Aroclors) and PCB Congeners

The Group 1A shellfish tissue sample collected and analyzed for PCB aroclors and PCB congeners indicated detections of PCB Aroclor 1254 as the most frequently detected aroclor. The mean concentration of Aroclor 1254 was 12.5 µg/Kg. Nine PCB congeners were detected, and the most frequently detected and highest concentrations were for PCB-118, PCB-105, and PCB-162 at 5,729 pg/g, 1,426 pg/g, and 1,016 pg/g, respectively. Only one reference area was analyzed for PCB arolors and PCB congeners. The same PCB congeners detected in the reference area were significantly power concentration at PCB-118 (73 pg/g), PCB-105 (21.8 pg/g), and PCB-162 (18.7 pg/g.

Dioxin/Furans

Group 1A shellfish tissue samples collected and analyzed for dioxin/furans identified several compounds above detection limits. The most frequently detected dioxin/furans compound was 2,3,7,8-TCDF. TEQs are used to report the *toxicity-weighted masses* of mixtures of dioxins and furans. The TEQ method of dioxin reporting is more meaningful than simply reporting the *total number of grams* of a mixture of variously toxic compounds because the TEQ method offers toxicity information about the mixture. In addition, it is a convenient method to compare dioxin/furans as a group throughout the estuary in various media. Within the TEQ method, each dioxin compound is assigned a Toxic Equivalency Factor, or TEF. This factor denotes a given dioxin compound's toxicity relative to 2,3,7,8-TCDD, which is assigned the maximum toxicity designation of one. Other dioxin compounds are given equal or lower numbers, with each number roughly proportional to its toxicity relative to that of 2,3,7,8-TCDD.

Metals
Group 1A shellfish tissue samples collected and analyzed for metal constituents identified several COPCs above detection limits. The most frequently detected metals were arsenic, copper, lead, mercury, methyl mercury, nickel, selenium, and zinc.

Exhibit 11-5 Summary Statistics for Metals (mg/Kg) Detected in Group 1A Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	22/39	0.18	0.63	0.32	0.10
Copper	25/39	0.86	163	13.64	36.61
Lead	17/39	0.14	1.2	0.22	0.212
Mercury	36/39	.002	0.314	0.0395	0.062
Methyl Mercury	36/39	.0038	0.0797	0.0140	0.0217
Nickel	38/39	0.25	2.6	**0.902**	0.497
Selenium	18/39	0.22	1.6	**0.427**	0.352
Zinc	24/39	4.4	2080	121.304	427.504

Bold = similar to reference area

Arsenic was detected at a higher mean concentration in the reference area of 0.763 mg/Kg. Copper was detected significantly lower in the reference area at a range of 0.82 mg/Kg to 1.7 mg/Kg. Lead was not detected in the reference area samples. Mercury was detected in all three reference area samples at a mean concentration of 0.009 mg/Kg, significantly lower than the estuary. Zinc was detected at a much higher mean concentration in the estuary than the reference area (5.6 mg/Kg). Nickel and selenium were detected at a similar mean concentration as reference area for Group 1A shellfish at 0.463 mg/Kg and 0.46 mg/Kg.

11.2.1.1.2 Group 1B
Group 1B shellfish tissue analytical results were obtained from small (<7.5 cm) sedentary crustaceans (e.g., fiddler crabs, hermit crabs, and juvenile blue crabs). Exhibits 11-6 and 11-7 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1B shellfish. Group 1B shellfish tissues were not collected from the reference area.

SVOCs and PAHs
SVOCs were not detected in Group 1B shellfish tissues. A total of 18 PAHs were detected in Group 1B samples. PAHs detected most frequently included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, phenanthrene, and pyrene.

Pesticides
The pesticide analysis of Group 1B shellfish tissue samples identified 12 analytes. These analytes were observed at relatively comparable concentrations to the other sampled areas at low concentrations and frequency.

Exhibit 11-6 Summary Statistics for Detects (µg/Kg) in Group 1B Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzo(a)pyrene	7/9	0.68	6.5	3.60	2.06
benzo(b)fluoranthene	7/9	0.62	8.8	4.29	2.73
Benzo(g,h,I)perylene	8/9	0.74	7.8	4.16	2.22
benzo(a)anthracene	8/9	0.68	6.5	3.60	2.06
Phenanthrene	7/9	0.79	7.8	3.94	2.31
Pyrene	7/9	1.2	15	6.92	4.6
Dieldrin	2/9	1.2	4.3	NA	NA
4,4-DDE	2/9	1.2	3.8	NA	NA
Gamma-BHC	2/9	0.96	1.2	NA	NA
Aroclor 1254	5/9	19	34	27	6.5
Aroclor 1260	5/9	18	35	26.7	6.89
2,3,7,8-TCDF pg/g	3/3	4.75	6.21	5.58	0.87
2,3,7,8-TCDD TEQ pg/g	3/3	5.48	85.83	32.84	61.96

PCBs (Aroclors) and PCB Congeners

PCBs Aroclor 1254 and Aroclor 1260 were the most frequently detected, as in other areas. The mean concentrations of Aroclor 1254 and 1260 were 27 and 26.7 µg/Kg, respectively. PCB congeners were analyzed in three samples from this group, with the highest concentrations associated with PCB-129, PCB-110/77, and PCB-118 (mean concentrations equal 11,463, 6,506, and 5,176 µg/Kg, respectively).

Dioxin/Furans

Three samples were analyzed from Group 1B shellfish for dioxin/furan analysis. Thirty-four analytes were detected, with 2,3,7,8-TCDF being the most frequently detected at a mean concentration of 5.58 pg/g.

Metals

The metals analysis of Group 1B shellfish tissue samples identified several COPCs above detection limits. The most frequently detected were arsenic, chromium, copper, lead, mercury, methyl mercury, and nickel.

Exhibit 11-7 Summary Statistics for Metals (mg/Kg) Detected in Group 1B Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	7/9	0.8	1	0.832	0.10
Chromium	3/9	0.73	1.3	0.64	0.57
Copper	9/9	0.64	33	24.22	11.15
Lead	7/9	0.47	2.2	1.04	0.71
Mercury	9/9	0.011	0.12	0.063	0.036
Methyl Mercury	7/7	0.024	0.095	0.051	0.025
Nickel	7/9	0.3	0.62	0.48	0.13

11.2.1.1.3 Group 2A

Group 2A shellfish tissue results were obtained from small (<12.5 cm) migratory crustaceans of low trophic level (e.g., shrimp). Exhibits 11-8 and 11-9 present the range,

mean, and standard deviation of the COPCs most frequently detected in the Group 2A shellfish.

SVOCs and PAHs
The SVOC analysis of Group 2A shellfish tissue samples identified the detection of nine SVOC analytes at low frequency of detection and concentration. Benzaldehyde was the most frequently detected analyte in shellfish tissue. The mean benzaldehyde concentration identified during analysis was 110.28 µg/Kg. Benzaldehyde was observed in the reference samples at a high frequency of detection (8/9), with a mean concentration of 105.63 µg/Kg. This concentration is similar to the concentration observed in the estuary Group 2A shellfish.

Pesticides
No pesticide analytes were detected in the Group 2A shellfish collected or observed in the reference area samples analyzed. A total of 10 samples were collected and analyzed.

Exhibit 11-8 Summary Statistics for Detects (µg/Kg) in Group 2A Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	42/51	16	310	110.28	75.23
2,3,7,8-TCDF (pg/g)	7/7	13.2	33.1	22.941	7.12
2,3,7,8- TCDD TEQ (pg/g)	7/7	1.14	2.79	2.35	0.67

PCBs (aroclors) and PCB Congeners
Group 2A shellfish tissue samples collected and analyzed for PCB aroclors and PCB congeners indicated very low frequency of detects of PCB aroclors and detections of 18 PCB congeners. Eleven PCB congeners were detected in the shellfish tissue samples. The PCB congeners that were observed with the highest frequency of detection and the greatest mean concentrations were PCB-118 (4,467 pg/g), PCB-105 (1,010 pg/g), and PCB-61/70 (1,402 pg/g). In the reference area Group 2A shellfish, PCB-118 and PCB 66 were frequently detected (3/3), with a mean concentration of 927.66 and 277.33 µg/Kg, respectively. The comparison to reference indicates the PCB-118 concentrations in the estuary are much higher than that detected in the reference area for Group 2A shellfish.

Dioxin/Furans
Group 2A shellfish tissue samples collected and analyzed for dioxin/furans identified 10 compounds above detection limits. The most frequently detected dioxin/furan was 2,3,7,8-TCDF, with a mean concentration of 22.941 pg/g. The highest concentration observed in reference area Group 2A shellfish was 0.265 pg/g.

Metals
Group 2A shellfish tissue samples collected and analyzed for metals identified several COPCs above detection limits. The most frequently detected metals in the shellfish tissue samples were arsenic, chromium, copper, lead, mercury, methyl mercury, selenium, and zinc. In comparison to reference area, a majority of the metals were similar to that observed in reference area Group 2A shellfish. Nickel was not detected in reference area samples, methyl mercury was not analyzed for in reference samples, and

selenium was observed at a higher mean concentration in the estuary than observed in the reference area (0.034 mg/Kg).

Exhibit 11-9 Summary Statistics for Metals (mg/Kg) Detected in Group 2A Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	50/52	0.13	0.6	**0.38**	0.098
Chromium	42/52	0.16	1.4	**0.415**	0.323
Copper	52/52	8.8	24.2	**14.84**	2.82
Lead	33/52	0.08	1.7	**0.207**	0.327
Mercury	52/52	0.006	0.049	**0.028**	0.009
Methyl Mercury	31/31	0.0094	0.0375	0.0251	0.007
Nickel	16/52	0.18	0.47	0.173	0.11
Selenium	52/52	0.17	0.96	0.535	0.174
Zinc	52/52	6.7	37.3	**11.75**	4.99

Bold = similar to reference area

11.2.1.1.4 Group 2B

Group 2B shellfish results were obtained from large (>12.5 cm) mobile crustaceans (e.g., blue crabs). Exhibits 11-10 and 11-11 present the range, mean, and standard deviation of the COPCs most frequently detected in the Group 2B shellfish.

SVOCs and PAHs

The SVOC analysis of Group 2B shellfish tissue samples identified the detection of three SVOC analytes. The most frequently detected SVOC compound was benzaldehyde. The mean concentration of benzaldehyde was 150 µg/Kg. Benzaldehyde was observed in the reference area samples at a high frequency (6/7), with a mean concentration of 233.09 µg/Kg. HCB was detected at a low frequency of detection in estuary samples and was not observed in reference area samples.

Pesticides

Pesticide analysis of the Group 2B shellfish tissue samples identified infrequent detections of several pesticides. 4,4-DDT and beta-BHC were the most frequently detected pesticides. There were no detections of pesticides in the Group 2B shellfish in the reference area samples.

Exhibit 11-10 Summary Statistics for Detects (µg/Kg) in Group 2B Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	21/21	38	660	150	150
HCB	3/15	20	28	24.79	4.87
4,4-DDT	5/22	14	43	9.75	13.24
Beta-BHC	8/22	10	56	14.37	14.98
Aroclor1254	19/22	13	330	77.85	84.71
2,3,7,8-TCDF (pg/g)	5/5	4.96	69.7	41.39	29.86
2,3,7,8-TCDD TEQ (pg/g)	5/5	2.72	24.7	14.7	10.1

PCBs (Aroclors) and PCB Congeners

Group 2B shellfish tissue samples collected and analyzed for PCB aroclors and PCB congeners indicated detections of PCB Aroclor 1254 and detections of PCB congeners.

Aroclor 1254 was observed at a high frequency of detection in estuary Group 2B shellfish but was not detected in reference area samples. PCB congeners observed with the highest concentration in the reference area were PCB-118, PCB-66, PCB-162, and PCB-105 at 4,660, 1,560, 607, and 851 pg/g, respectively.

Dioxin/Furans
Group 2B shellfish tissue samples collected and analyzed for dioxin/furans identified eight compounds above detection limits. The most frequently detected was 2,3,7,8-TCDF, which was detected in two reference area samples analyzed, with the highest concentration of 2.18 pg/g. The concentrations observed in the reference area samples are significantly lower than those observed in estuary Group 2B shellfish.

Metals
Group 2B tissue samples collected and analyzed for metals identified 19 analytes above detection limits. COPC metals detected included arsenic, copper, lead, mercury, nickel, selenium, and zinc in the Group 2B shellfish tissue samples. All concentrations of metals were similar to those of the reference area.

Exhibit 11-11 Summary Statistics for Metals (mg/Kg) Detected in Group 2B Shellfish

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	21/22	0.25	0.97	**0.53**	0.20
Copper	22/22	6.2	15.6	**8.97**	2.33
Lead	13/22	0.03	0.67	**0.09**	0.166
Mercury	22/22	0.04	0.302	**0.12**	0.077
Nickel	21/22	0.06	0.21	**0.099**	0.034
Selenium	22/22	0.36	1.6	**0.87**	0.295
Zinc	22/22	20.3	36.2	**28.51**	4.78

Bold = similar to reference area

11.2.1.2 Fish

11.2.1.2.1 Group 1

Group 1 fish tissue results were obtained from small (<15 cm) sedentary species of low trophic level (e.g., sheepshead minnows, blennies, gobies, and mollies). Exhibits 11-12 and 11-13 present the range, mean, and standard deviation of the COPCs most frequently detected in Group 1 fish.

SVOCs and PAHs
The SVOC analysis of Group 1 fish tissue samples indicated the detection of three analytes. Benzaldehyde and phenol were the most frequently detected. Benzaldehyde (12/12) and phenol (5/12) were the most frequently detected SVOCs in the reference area. Benzaldehyde had a mean concentration in the reference area of 2,899 µg/Kg and the mean phenol concentration was 335.5 µg/Kg.

Pesticides
The pesticide analysis of Group 1 fish tissue samples identified two analytes, 4,4'-DDT and endrin. These analytes were only detected in one sample and at a very low concentration. These compounds were observed at similar frequency and concentration in the reference area samples.

Exhibit 11-12 Summary Statistics for Detects (µg/Kg) in Group 1 Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	81/124	28	6400	640.19	1118.64
Phenol	77/124	110	8200	869.01	1155.86
Aroclor1254	80/128	12	820	84.82	144.72
Aroclor1260	32/127	12	90	13.92	13.67
2,3,7,8-TCDD TEQ (pg/g)	27/27	0.25	12.2	3.52	3.82

PCBs (Aroclors) and PCB Congeners

Group 1 fish tissue samples collected and analyzed for PCB aroclors and PCB congeners indicated detections of PCB Aroclor1254, Aroclor1260, and 18 PCB congeners. Aroclor1254 was the most frequently detected compound and was observed in the reference area at a similar frequency and at a mean concentration of 76.10 µg/Kg. PCB congeners observed with the highest frequencies and highest mean concentrations included PCB-118 (14,589 pg/g), PCB-105 (3,733 pg/g), PCB-162 (3,468 pg/g), and PCB-66 (3,275 pg/g). Similar frequency of detections and concentrations were observed in reference area samples for Group 1 fish tissue. The mean concentrations for reference samples are PCB-118 (19,900 pg/g), PCB-162 (3,600 pg/g), and PCB-66 (3,093 pg/g).

Dioxin/Furans

Group 1 fish tissue samples collected and analyzed for dioxin/furans identified six compounds above detection limits. The most frequently detected dioxin/furan was 2,3,7,8-TCDF.

Metals

Group 1 fish tissue samples collected and analyzed for metal constituents identified several COPCs above detection limits. The most frequently detected metals were arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc. Of these metals copper, mercury, selenium, and zinc were observed at lower concentrations in the reference area Group 1 fish tissue samples.

Exhibit 11-13 Summary Statistics for Metals (mg/Kg) Detected in Group 1 Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	115/129	0.08	0.91	**0.24**	0.106
Chromium	129/129	0.19	2.1	**0.36**	0.199
Copper	129/129	0.91	17.4	3.158	2.46
Lead	98/129	0.02	4.3	**0.278**	0.488
Mercury	129/129	0.011	0.65	0.146	0.146
Nickel	102/129	0.03	0.63	**0.079**	0.078
Selenium	127/129	0.13	2.9	0.49	0.29
Zinc	129/129	19	188	35.184	17.58

Bold = similar to reference area

11.2.1.2.2 Group 2A

Group 2A fish tissue results were obtained from small (<15 cm) migratory species of low trophic level (e.g., mullet, anchovies, sunfish, and menhaden). Exhibits 11-14 and 11-15 present the range, mean, and standard deviation of the COPCs frequently detected in the Group 2A fish.

SVOCs and PAHs

The SVOC analysis of Group 2A fish tissue samples identified the detection of two SVOC analytes. Benzaldehyde was also the most frequently detected analyte in the whole body analysis. Benzaldehyde was observed in the reference area at a similar frequency, with a mean concentration of 3,680 µg/Kg.

Pesticides

Pesticides were detected in one Group 2A fish at very low frequencies of detection and concentration. Pesticides were not detected in reference area samples.

Exhibit 11-14 Summary Statistics for Detects (µg/Kg) in Group 2A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	30/31	330	39000	9757.38	12635.67
Aroclor 1254	21/34	14	100	40.12	25.70
Aroclor 1260	7/34	12	90	10.87	21.21
2,3,7,8-TCDD TEQ (pg/g)	6/6	0.39	24.8	12.06	9.57

PCBs (Aroclors) and PCB Congeners

Group 2A fish tissue samples collected and analyzed for PCB aroclors and PCB congeners indicated detections of PCB Aroclors1254 and Aroclor1260 and detections of 18 PCB congeners. Aroclor 1254 was the most frequently detected and was not observed in reference area Group 2A fish tissue. PCB congeners observed most frequently included PCB-118 (20,275 pg/g), PCB-66 (8,158 pg/g), PCB-162 (4,605 pg/g), and PCB-61/70 (6,717 pg/g). The same PCB congeners were observed at a similar frequency in the reference area, with the highest concentrations of 3,790, 951, 733, and 1,050 pg/g.

Dioxin/Furans

Group 2A fish tissue samples collected and analyzed for dioxin/furans identified 18 compounds above detection limits. The most frequently detected dioxin/furan was 2,3,7,8-TCDF. 2,3,7,8-TCDF was detected with similar frequency in the reference area, with a maximum concentration of 1.33 pg/g.

Metals

Group 2A fish tissue samples collected and analyzed for metals identified several COPCs above detection limits. The most frequently detected metals in the fish tissue samples were arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc. These same metals were observed at similar frequency and range of concentrations as the reference area, with the exception of arsenic, chromium, and mercury. Arsenic was observed with greater range of detects in the reference area, chromium lower frequency and concentration in the reference area, and mercury similar frequency of detects but a lower mean concentration in the reference area.

Exhibit 11-15 Summary Statistics for Metals (mg/Kg) Detected in Group 2A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	33/34	0.15	0.81	0.423	0.123
Chromium	34/34	0.25	1.4	0.75	0.36
Copper	34/34	0.47	4.4	**1.85**	0.97

Lead	34/34	0.06	1.7	**0.707**	0.44
Mercury	34/34	0.013	0.275	0.86	0.069
Nickel	33/34	0.06	0.53	**0.256**	0.122
Selenium	34/34	0.23	1.1	**0.677**	0.146
Zinc	34/34	9.1	37.8	**23.57**	6.03

Bold = similar to reference area

11.2.1.2.3 Group 2B

Group 2B fish tissue results were obtained from small migratory or mobile species (< 15 cm) of high trophic level (e.g., pinfish, spotted trout, southern puffer, juvenile scianid, and Atlantic croaker). Exhibits 11-16 and 11-17 present the range, mean, and standard deviation of the COPCs most frequently detected in Group 2B fish. There were no Group 2B fish samples collected from the reference area for comparison.

SVOCs and PAHs

The SVOC analysis of Group 2B fish tissue samples identified the detection of six SVOC analytes. Benzaldehyde was also the most frequently detected analyte in the whole body analysis. HCB and HCBD were detected at a very low frequency, with maximum detected concentrations of 94 and 26 μg/Kg, respectively. Two PAHs were detected, with naphthalene most frequently detected.

Pesticides

Pesticides were detected at a low frequency of detection and concentration in the Group 2B fish tissue. The most frequently detected pesticide was beta-BHC, followed by 4,4-DDE.

Exhibit 11-16 Summary Statistics for Detects (μg/Kg) in Group 2B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	21/21	150	2200	462.38	508.14
Naphthalene	9/21	61	97	68.32	10.74
4,4-DDE	4/24	10	13	NA	NA
Beta-BHC	16/24	10	130	28.22	32.69
Aroclor 1254	23/24	22	180	65.43	48.97
Aroclor 1260	22/24	12	110	40.60	27.49
2,3,7,8-TCDF (pg/g)	4/4	0.881	4	2.68	1.577
2,3,7,8-TCDD TEQ (pg/g)	4/4	2.08	10.48	6.35	4.60

NA – Not available

PCBs (Aroclors) and PCB Congeners

Group 2B fish tissue samples collected and analyzed for PCB aroclors and PCB congeners indicated frequent detections of PCB Aroclors 1254 and 1260 and detections of 21 PCB congeners. Aroclor 1254 was the most frequently detected. The most frequently detected PCB congeners with the highest mean concentrations included PCB-118 (20,852 pg/g), PCB-66 (6,512 pg/g), and PCB-105 (4957 pg/g), respectively.

Dioxin/Furans
Group 2B fish tissue samples collected and analyzed for dioxin/furans identified 21 compounds above detection limits. The most frequently detected dioxin/furan was 2,3,7,8-TCDF.

Metals
Group 2B fish tissue samples were collected and analyzed for metals. The results of these analyses identified several COPCs above detection limits. The most frequently detected metals in the fish tissue samples were arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.

Exhibit 11-17 Summary Statistics for Metals (mg/Kg) Detected in Group 2B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	22/22	0.2	0.63	0.40	0.10
Chromium	22/22	0.22	0.62	0.33	0.11
Copper	22/22	0.55	9	1.22	2.34
Lead	21/22	0.1	0.78	0.18	0.17
Mercury	22/22	0.018	0.163	0.062	0.037
Nickel	18/22	0.05	0.31	0.11	0.06
Selenium	22/22	0.38	0.77	0.59	0.13
Zinc	22/22	10.4	31.1	17.11	4.96

11.2.1.2.4 Group 3A
Group 3A fish tissue results were obtained from medium (15 to <30 cm) migratory or mobile species of low trophic level (mullet, anchovies, menhaden, and herring). Exhibits 11-18 and 11-19 present the ranges, means, and standard deviations of the COPCs detected most frequently in Group 3A fish.

SVOCs and PAHs
The SVOC analysis of Group 3A fish tissue samples identified the detection of three SVOC analytes and two PAH analytes. Benzaldehyde and hexachloro-1,3-butadiene were the most frequently detected SVOC analytes. 2-Methylnaphthalene and naphthalene were the only detected PAHs. All four compounds were detected in tissue samples from the reference areas at similar frequencies of detection and at mean concentrations of 1,122.55, 613.08, 52.44, and 84.55 µg/Kg, respectively.

Pesticides
The pesticide analyses of Group 3A fish tissue samples indicated the presence of eight analytes. 4,4'-DDD and beta-BHC were the most frequently detected analytes and were observed in reference area samples at mean concentrations of 17 and 28.25 µg/Kg, respectively.

Exhibit 11-18 Summary Statistics for Detects (μg/Kg) in Group 3A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	34/36	66	3000	1077.96	830.02
HCBD	18/36	22	1800	263.41	370.74
2-Methylnaphthalene	7/35	26	100	45.025	22.60
Naphthalene	6/35	28	280	NA	NA
4,4-DDE	12/36	11	57	11.09	14.39
Beta-BHC	26/36	13	440	84.17	104.62
Aroclor 1254	34/36	25	2800	330.92	558.88
Aroclor 1260	34/36	19	1100	159.85	215.66
2,3,7,8-TCDF (pg/g)	6/6	1.78	118	47.96	50.18
2,3,7,8-TCDD TEQ (pg/g)	6/6	0.39	24.80	12.06	9.57

PCBs (Aroclors) and PCB Congeners

Group 3A fish tissue samples were analyzed for PCB aroclors and PCB congeners, and results indicated detections of PCB Aroclor 1254 and 1260 and 17 PCB congeners. Aroclor1254 and 1260 were detected at similar frequencies with Aroclor 1254 having the higher mean concentration. Aroclor 1254 and 1260 were both observed in the reference area at similar frequencies of detection but at lower mean concentrations (64.95 μg/Kg and 40.35 μg/Kg, respectively). PCB-118 (58,788 pg/g), PCB-162 (11,483 pg/g), PCB-61/70 (19,430 pg/g), PCB-105 (15,075 pg/g), and PCB-66 (21,375 pg/g) were the most frequently detected PCB congeners. PCB congeners PCB-118, PCB-162, and PCB-61/70 were the most frequently detected in the reference area at 15,800, 3,580, and 9,180 pg/g, respectively.

Dioxin/Furans

Group 3A fish tissue samples were analyzed for dioxin/furans, and results revealed 20 compounds above detection limits. 2,3,7,8-TCDF was the most frequently detected dioxin/furan. 2,3,7,8-TCDF was detected in both samples collected in the reference area, with the highest concentration of 7.5 pg/g. This concentration is significantly lower than that of the estuary Group 3A fish tissues for 2,3,7,8-TCDF.

Metals

Group 3A fish tissue samples collected and analyzed for metals identified several COPCs above detection limits. All detected metal analytes were frequently observed and included arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.

Exhibit 11-19 Summary Statistics for Metals (mg/Kg) Detected in Group 3A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	36/36	0.28	1.1	0.599	0.20
Chromium	35/36	0.21	1.9	**0.553**	0.335
Copper	36/36	0.86	14.2	**5.99**	3.47
Lead	36/36	0.04	1.5	**0.62**	0.404
Mercury	37/37	0.01	0.244	0.0765	0.060
Nickel	23/36	0.07	1.1	**0.23**	0.214
Selenium	36/36	0.3	0.89	**0.577**	0.14
Zinc	36/36	9.1	29.7	**18.83**	4.36

Bold = similar to reference area

The same metals were observed in the reference area and at similar concentrations, with the exception of arsenic, which was higher in the reference area, and mercury, which was lower in the reference area than in the Group 3A fish tissue.

11.2.1.2.5 Group 3B

Group 3B fish tissue results were obtained from medium (15 to <30 cm) migratory or mobile fish species assigned to a high trophic level (e.g., puffer, croaker, sea trout, black drum, and redfish). Exhibits 11-20 and 11-21 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 3B fish.

SVOCs and PAHs

The SVOC analysis of Group 3B fish tissue samples identified six SVOC analytes and one PAH. Benzaldehyde and hexachloro-1, 3-butadiene were the most frequently detected analytes. Benzaldehyde and HCBD were both detected at similar frequencies in the reference area at mean concentrations of 646.28 µg/Kg and 100.71 µg/Kg, respectively.

Pesticides

The pesticide analysis of Group 3B fish tissue samples indicated the presence of eight analytes, all at low concentrations and frequency of detection. Beta-BHC was the most frequently detected pesticide with a mean concentration of 16.04 µg/Kg. Beta-BHC was detected at a much lower frequency (3/23) in the reference area, with the highest concentration equal to 230 µg/Kg.

Exhibit 11-20 Summary Statistics for Detects (µg/Kg) in Group 3B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	53/58	170	1900	598.02	418.64
HCBD	29/71	27	880	81.83	127.80
Beta-BHC	27/60	10	150	16.04	23.80
Aroclor 1254	41/71	19	730	92.88	126.33
Aroclor 1260	46/71	12	360	56.148	72.73
2,3,7,8-TCDF (pg/g)	13/15	0.186	4.28	1.37	1.34
2,3,7,8-TCDD TEQ (pg/g)	15/15	0.22	4.08	1.74	1.28

PCBs (Aroclors) and PCB Congeners
Group 3B fish tissue samples were collected and analyzed for PCB aroclors and PCB congeners. These analyses indicated two detections of PCB Aroclors 1254 and 1260 and detections of 17 PCB congeners. Both aroclors were detected at similar frequency and concentration. The reference area results indicate Aroclor 1254 and 1260 at lower concentrations of 27 and 16 µg/Kg, respectively. PCB-105 (4,699 pg/g), PCB-118 (19,264 pg/g), and PCB-66 (4,578 pg/g) were the most frequently detected PCB congeners. Similar frequencies of detection were observed in the reference area for the same PCB congeners but at lower concentrations.

Dioxin/Furans
Group 3B fish tissue samples were analyzed for dioxin/furans. These analyses identified seven compounds above detection limits. 2,3,7,8-TCDF was the most frequently detected dioxin/furan. The frequency of detection was similar for 2,3,7,8-TCDF for the reference area sample, with the highest concentration of 0.668 pg/g.

Metals
Group 3B fish tissue samples collected and analyzed for metals identified several COPCs above detection limits. Arsenic, copper, chromium, lead, mercury, nickel, selenium, and zinc were the most frequently detected metals. All the metals were observed at similar concentrations as the reference area, with the exception of mercury. Mercury was detected at a mean concentration of 0.019 mg/Kg for Group 3B fish tissue in the reference area.

Exhibit 11-21 Summary Statistics for Metals (mg/Kg) Detected in Group 3B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	47/69	0.13	1.5	**0.346**	0.216
Chromium	61/69	0.08	0.78	**0.266**	0.128
Copper	62/69	0.28	7	**0.812**	0.97
Lead	34/69	0.05	0.52	**0.088**	0.09
Mercury	63/70	0.015	0.251	0.080	0.051
Nickel	47/69	0.03	0.98	**0.0855**	0.142
Selenium	62//69	0.25	2	**0.672**	0.354
Zinc	68/69	8.5	29.9	**14.52**	4.55

Bold = similar to reference area

11.2.1.2.6 Group 4A
Group 4A fish tissue sample results were obtained from large migratory or mobile species (30 to 90 cm) assigned to low trophic level (e.g., mullet and shad). Exhibit 11-22 and 11-23 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 4A fish.

SVOCs and PAHs
The SVOC analysis of Group 4A fish tissue samples identified four SVOC analytes. Benzaldehyde was the most frequently detected followed by HCBD.

Diethyl phthalate was the only SVOC detected in Group 4A reference area samples at a concentration of 58 µg/Kg.

Pesticides

The pesticide analyses of Group 4A fish tissue samples indicated the presence of several pesticides at a frequency of detection of less than 50 percent. 4,4'-DDE and beta-BHC were the most frequently detected pesticide analytes. 4,4-DDE was detected in the reference area at a maximum concentration of 18 µg/Kg.

Exhibit 11-22 Summary Statistics for Detects (µg/Kg) in Group 4A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	33/41	140	4200	600.35	773.98
HCBD	27/44	26	1100	113.42	196.10
HCB	3/22	140	280	NA	NA
4,4-DDE	19/44	9.2	39	12.99	8.99
Beta-BHC	28/43	6	300	55.18	75.52
Aroclor 1254	37/43	12	2300	506.11	592.22
Aroclor 1260	36/43	14	2000	293.75	447.21
2,3,7,8-TCDF (pg/g)	9/9	2.28	158	43.80	57.72
2,3,7,8-TCDD TEQ (pg/g)	9/9	1.02	57.35	15.74	20.81

NA = Not available

PCBs (Aroclors) and PCB Congeners

Group 4A fish tissue samples were collected and analyzed for PCB aroclors and PCB congeners. These results revealed detection of PCB aroclors 1254 and 1260 as well as detections of 18 PCB congeners. Both aroclors were detected at similar frequencies of detection and concentrations. In the reference area samples, Aroclor1254 was detected in only one sample at a concentration of 1,800 µg/Kg. The PCB congeners that were most frequently detected include PCB-118 (41,214 pg/g), PCB-66 (14,493 pg/g), PCB-105 (9,573 pg/g), and PCB-162 (8,317 pg/g). In the reference area samples, PCB-118, PCB-66, and PCB-61/70 had the highest concentrations of 3,660, 1,330, and 1,048 pg/g, respectively. Aroclors were not observed at the same frequency as the estuary samples although concentrations were similar. PCB congeners were detected at a higher concentration in the estuary than the reference area.

Dioxin/Furans

Group 4A fish tissue samples were also analyzed for dioxin/furans, and these analyses identified several COPCs above detection limits. 2,3,7,8-TCDF was the most frequently detected in the estuary (158 pg/g) and the reference area (7.14 pg/g). Although frequency of detection was similar for the estuary and the reference area, the concentrations observed were significantly higher in the estuary.

Metals

The results of analyses of Group 4A fish tissue samples for metals identified several COPCs above detection limits. Arsenic, chromium, copper, iron, lead, mercury, nickel, and selenium were the most frequently detected metals. With the exception of lead, mercury, and zinc, all other metals were observed at similar mean concentrations. Lead was observed at a lower mean concentration in the reference area at 0.193 mg/Kg, and

mercury was observed at 0.02 mg/Kg. Zinc was not observed in the estuary samples but was detected in the reference area samples at a mean concentration of 18.4 mg/Kg.

Exhibit 11-23 Summary Statistics for Metals (mg/Kg) Detected in Group 4A Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	40/41	0.18	1	**0.39**	0.187
Chromium	40/41	0.1	1.5	**0.541**	0.389
Copper	41/41	0.35	25.5	**4.78**	6.17
Lead	40/41	0.05	37.2	1.36	8.11
Mercury	41/44	0.012	0.229	0.053	0.044
Nickel	38/41	0.04	0.76	**0.25**	0.182
Selenium	40/41	0.24	1.6	**0.563**	0.251

Bold = similar to reference area

11.2.1.2.7 Group 4B

Group 4B fish tissue samples results were obtained from large migratory or mobile species (30 to 90 cm) assigned to high trophic level (e.g., redfish, black drum, and flounder). Exhibits 11-24 and 11-25 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 4B fish.

SVOCs and PAHs

The SVOC analysis of Group 4B fish tissue samples identified several SVOCs. Benzaldehyde, bis (2-ethylhexyl) phthalate (BEHP), and diethyl phthalate were the most frequently identified SVOCs. In the reference area samples, HCBD was the most frequently observed SVOC, with a mean concentration of 83.51 µg/Kg. A single detection of diethyl phthalate equaled 32 µg/Kg. Benzaldehyde was not detected in the Group 4B tissue samples from the reference area.

Pesticides

The pesticide analysis of Group 4B fish tissue samples resulted in the detection of multiple pesticides but at low frequencies of detection and low concentrations. Beta-BHC was the most frequently (<20 percent) detected. No pesticides were detected in the reference area Group 4B tissue samples.

Exhibit 11-24 Summary Statistics for Detects (µg/Kg) in Group 4B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	12/50	26	1000	52.45	179.126
BEHP	15/51	230	7000	357.59	1265.68
Diethyl Phthalate	24/52	25	93	40.53	13
HCBD	9/52	30	220	NA	NA
Aroclor 1254	39/52	12	1100	78.27	187.08
Aroclor 1260	32/52	11	710	43.12	122.54
2,3,7,8-TCDF (pg/g)	9/9	0.194	30.8	4.24	13.62
2,3,7,8-TCDD TEQ (pg/g)	9/9	0.27	10.5	1.88	4.25

NA – Not available

PCBs (Aroclors) and PCB Congeners
Group 4B fish tissue samples revealed detections of Aroclor 1254 and 1260 as well as detections of 19 PCB congeners. Aroclors 1254 and 1260 were both detected in the reference area samples at similar frequencies of detection and lower mean concentrations of (25.25 µg/Kg and 8.33 µg/Kg, respectively). PCB-118 (17,862 pg/g), PCB-105 (4,391 pg/g), PCB-162 (3,796 pg/g), and PCB-66 (4,834 pg/g) were associated with the highest mean concentrations of detected PCB congeners in Group 4B tissue samples. PCB-118, PCB-105, and PCB-162 were associated with the highest concentrations observed in the Group 4B reference area samples (1,227 pg/g, 299 pg/g, and 427 pg/g, respectively).

Dioxin/Furans
Group 4B fish tissue samples revealed 10 compounds measured above detection limits. 2,3,7,8-TCDF was the most frequently detected dioxin/furan analyte in the Group 4B tissue analysis. 2,3,7,8-TCDF was detected at 0.627 pg/g in the reference area sample.

Metals
Analysis of samples of Group 4B fish identified several COPCs above detection limits. Of these, arsenic, chromium, copper, lead, nickel, mercury, selenium, and zinc were most often observed above detection limits. Arsenic and copper were observed at higher mean concentrations in the reference area at 0.66 mg/Kg and 10.025 mg/Kg, respectively while lead was not detected in reference area Group 4B tissue samples. All other metals were observed at similar concentrations in reference and test areas.

Exhibit 11-25 Summary Statistics for Metals (mg/Kg) Detected in Group 4B Fish Tissue

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	52/52	0.11	1.5	0.328	0.23
Chromium	50/52	0.08	0.63	**0.215**	0.132
Copper	52/52	0.24	4.1	0.765	0.62
Lead	20/52	0.004	0.49	0.043	0.083
Mercury	51/52	0.016	0.71	**0.153**	0.122
Nickel	47/52	0.03	0.58	**0.089**	0.089
Selenium	52/52	0.15	1.6	**0.615**	0.255
Zinc	52/52	3.1	22.3	**8.95**	4.23

Bold = similar to reference area

11.2.2 Upper Calcasieu Extent of Tissue Contamination
This section discusses Group 1 shellfish and sedentary fish of the Upper Calcasieu. These results are compared to reference samples. Group 2, 3, and 4 samples were discussed in the previous sections and are not further discussed because of their migratory behavior in the estuary.

11.2.2.1 Shellfish
11.2.2.1.1 Group 1A
Group 1A shellfish tissue analytical results were obtained from small (<7.5 cm) bivalves (e.g., clams, mussels, oysters). Figure 11-1 illustrates the areas within Upper Calcasieu from which the Group 1A samples were collected, as well as their corresponding

sediment sample locations. Exhibits 11-26 and 11-27 present the ranges, means, and standard deviations of the COPCs detected most frequently in Group 1A shellfish in Upper Calcasieu. There were no Group 1A shellfish collected from the reference area.

SVOCs and PAHs

The SVOC analysis of Group 1A shellfish revealed detections of five analytes at low concentrations. Eighteen PAHs were detected in the Group 1A tissue samples. The most frequently detected compounds (10/12) include benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, with mean concentrations of 1.066 µg/Kg, 1.48 µg/Kg, 1.10 µg/Kg, 1.25 µg/Kg, and 0.47 µg/Kg, respectively. Benzaldehyde was the only SVOC detected in reference area samples at a mean concentration of 1,500 µg/Kg. No PAHs were detected in the reference area Group 1A shellfish.

Pesticides

The pesticide analysis of Group 1A shellfish indicated the presence of 14 analytes associated with low frequencies of detection and low concentrations. 4,4'-DDE was the most frequently detected pesticide (3 of 22 samples or 14 percent), at concentrations ranging from1.8 to 2.7 µg/Kg. No pesticides were detected in the reference area Group 1A shellfish.

Exhibit 11-26 Summary Statistics for Detects (µg/Kg) in Group 1A Shellfish – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	11/11	31	320	131.45	86.691
Benzo(a)pyrene	10/12	0.84	1.4	1.066	1.68
Benzo(b)fluoranthene	10/12	0.99	2.2	1.48	0.44
Benzo(g,h,I)perylene	10/12	1	1.6	1.25	0.16
Benzo(k)fluoranthene	10/12	0.5	2.1	1.10	0.567
Indeno(1,2,3-cd)pyrene	10/12	0.34	0.68	0.47	0.114
2,3,7,8-TCDD TEQ (pg/g)	1/1	2.26	2.26	-	-

PCBs (Aroclors) and PCB Congeners

Group 1A shellfish were analyzed for PCB aroclors. Aroclors 1254 and 1260 were detected in less than 10 percent of the samples analyzed and at low concentrations. PCB congeners were not analyzed. Concentrations in the reference area were at a lower concentration than Upper Calcasieu.

Dioxin/Furans

One Group 1A shellfish tissue sample was collected and analyzed for dioxin/furans, and this resulted in the identification of 13 compounds above detection limits.

Metals

Group 1A shellfish tissue samples collected and analyzed for metal constituents identified several COPCs above detection limits. Arsenic, chromium, copper, mercury, methyl mercury, nickel, selenium, and zinc were the most frequently detected analytes.

Exhibit 11-27 Summary Statistics for Metals (mg/Kg) Detected in Group 1A Shellfish – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	12/22	0.18	0.63	0.296	0.111
Chromium	10/22	0.091	0.22	0.117	0.036
Copper	12/22	0.86	2.9	**1.357**	0.731
Lead	7/22	0.14	0.25	0.16	0.045
Mercury	20/22	0.002	0.0056	0.0194	0.0148
Methyl Mercury	11/11	0.0038	0.0068	0.0049	0.00105
Nickel	22/22	0.37	1.2	**0.82**	0.25
Selenium	8/22	0.22	0.66	**0.264**	0.142
Zinc	12/22	4.9	11.5	**6.08**	1.74

Bold – Similar to reference area

Arsenic (0.763 mg/Kg) was detected at a higher mean concentration in the reference area than Upper Calcasieu. Chromium and Lead were not detected in the reference area Group 1A shellfish and mercury was detected significantly higher in Upper Calcasieu than in reference area (0.009 mg/Kg) samples. All other metals were detected at similar mean concentrations.

11.2.2.1.2 Group 1B

Group 1B shellfish tissue analytical results were obtained from small (<7.5 cm) sedentary crustaceans (e.g., fiddler crabs, hermit crabs, and juvenile blue crabs). Exhibits 11-28 and 11-29 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1B shellfish. Group 1B shellfish tissues were not collected from the reference area.

SVOCs and PAHs

SVOCs were not detected in Group 1B shellfish tissues. 18 PAHs were detected in Group 1B samples. PAHs detected most frequently included benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(a)anthracene, and pyrene.

Pesticides

The pesticide analysis of Group 1B shellfish tissue samples identified three analytes. These analytes were alpha-chlordane, dieldrin, and heptachlor epoxide at maximum concentrations of 0.43 µg/Kg, 1.2 µg/Kg, and 0.83 µg/Kg, respectively. These analytes were observed at relatively comparable concentrations to the other sampled areas.

Exhibit 11-28 Summary Statistics for Detects (μg/Kg) in Group 1B Shellfish – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzo(a)anthracene	3/3	2.3	6.5	4.96	2.99
Benzo(a)pyrene	3/3	2.9	6.1	4.47	1.79
Benxo(b)fluoranthene	3/3	3.2	8.8	6.27	3.23
Benzo(g,h,I)perylene	3/3	2.8	5.2	4	1.34
Phenanthrene	3/3	1.9	7.8	4.5	3.47
Pyrene	3/3	3.6	15	9.87	6.60

PCBs (Aroclors) and PCB Congeners

PCBs Aroclor 1254 and Aroclor 1260 were detected in one of three samples analyzed at maximum concentrations of 20 and 26 μg/Kg, respectively. PCB congeners were not analyzed in three samples from the Group 1B shellfish from Upper Calcasieu.

Metals

The metals analysis of Group 1B shellfish tissue samples identified several COPCs above detection limits. The most frequently detected were arsenic, copper, lead, mercury, methyl mercury, and nickel.

Exhibit 11-29 Summary Statistics for Metals (mg/Kg) Detected in Group 1B Shellfish – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	3/3	0.8	0.93	0.86	0.077
Copper	3/3	22	29	25	4.22
Lead	1/3	0.72	0.77	NA	NA
Mercury	3/3	0.025	0.052	0.041	0.015
Methyl Mercury	3/3	0.024	0.041	0.035	0.012
Nickel	3/3	0.3	0.38	0.34	0.044

11.2.2.2 Fish

11.2.2.2.1 Group 1

Group 1 fish tissue analytical results were derived from small (<15 cm) sedentary species (e.g., killifish, sheepshead minnows, blennies, and gobies). Exhibits 11-30 and 11-31 present the ranges, means, and standard deviations of the COPCs detected in greater than 5 percent of the Group 1 fish.

SVOCs and PAHs

The SVOC analysis of Group 1 whole body fish tissue identified four analytes, and 2-Methylphenol, 4-methylphenol, benzaldehyde, and phenol were most frequently detected. 2-Methylphenol and 4-methylphenol were not identified in the reference area Group 1 samples. While benzaldehyde was detected at the same frequency in the Upper Calcasieu Group 1 tissues as the reference area Group 1 tissues, the mean concentration identified in Upper area was lower than that observed in the reference area (2,899

µg/Kg). Phenol was detected more frequently in the Upper Calcasieu Group 1 tissue analysis than in the reference area Group 1 tissues. Additionally, the mean phenol concentration observed in the Upper Calcasieu was greater than that observed in the reference area (335 µg/Kg).

Pesticides
Pesticides were not detected in the Group 1 fish tissue analysis.

Exhibit 11-30 Summary Statistics for Detects (µg/Kg) in Group 1 Fish Tissue – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
2-Methylphenol	7/29	64	340	54.50	85.71
4-Methylphenol	10/29	56	300	72.23	73.78
Benzaldehyde	18/29	140	6400	831.87	1702.55
Phenol	16/29	240	4900	675.21	1072.08
Arolcor 1254	6/33	12	35	NA	NA
2,3,7,8-TCDF (pg/g)	6/6	0.139	0.57	0.307	0.185
2,3,7,8-TCDD TEQ (pg/g)	6/6	0.25	1.21	0.52	0.42

NA – Not available

PCBs (Aroclors) and PCB Congeners
PCB Aroclor 1254 was the only detected aroclor in the Group 1 tissue analysis for Upper Calcasieu. PCB congeners were analyzed in only six samples within this group. The PCB congeners with the highest mean concentration included PCB-118, PCB-162, and PCB-105 at 4,481 pg/g, 1,103 pg/g, and 1,023 pg/g, respectively. PCB Aroclor 1254 was detected in both the Upper Calcasieu sample and the reference area Group 1 sample. However, the concentrations of Aroclor 1254 were higher in the reference area, with a mean concentration of 76 µg/Kg. When concentrations of PCB congeners identified in the reference area Group 1 tissue samples are compared to the concentrations of PCB congeners identified in the Upper Calcasieu Group 1 tissues, those present in Upper Calcasieu were lower.

Dioxin/Furans
The results of Group 1 fish tissue samples collected and analyzed for dioxin/furans identified 18 compounds above detection limits but at low frequencies and low concentrations. The most frequently detected compound was 2,3,7,8-TCDF, with a mean concentration of 0.307 pg/g. Group 1 tissue analysis of the Upper Calcasieu samples identified more dioxin/furan analytes than in the reference area Group 1 tissue samples. 2,3,7,8-TCDF in the Group 1 tissue reference area samples was detected in all three samples, with a mean concentration of 0.424 pg/g. The concentrations of 2,3,7,8-TCDF appear to be similar or slightly lower in the Upper Calcasieu tissue sample group compared to those from the reference area.

Metals
Group 1 fish tissue samples were collected and analyzed for several metal parameters. The results identified several COPCs above detection limits. Arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc were the most frequently detected

and, when compared to Group 1 tissue reference area samples. Arsenic, mercury, and selenium in the Upper Calcasieu data was lower than that observed in the reference area, and zinc in the Upper Calcasieu data was greater than that observed in the reference area.

Exhibit 11-31 Summary Statistics for Metals (mg/Kg) Detected in Group 1 Fish Tissue – Upper Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	30/34	0.27	0.46	0.3166	0.043
Chromium	34/34	0.26	0.51	**0.341**	0.0614
Copper	34/34	1.1	3.3	**1.756**	0.637
Lead	26/34	0.03	0.88	**0.141**	0.22
Mercury	34/34	0.011	0.127	0.048	0.029
Nickel	22/34	0.03	0.11	**0.0467**	0.022
Selenium	34/34	0.23	0.89	0.403	0.127
Zinc	34/34	31.2	45.7	35.80	3.30

Bold = similar to reference area

11.2.3 Lower Calcasieu Extent of Tissue Contamination

This section only discusses the Group 1 shellfish and fish that are sedentary within the Lower Calcasieu and compares these data to data from reference samples. The migratory groups 2, 3, and 4 were discussed in previous sections and are not discussed further.

11.2.3.1 Shellfish

11.2.3.1.1 Group 1A

Group 1A shellfish tissue results were obtained from small (<7.5 cm) bivalves (e.g., clams, mussels, and oysters). Exhibits 11-32 and 11-33 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1A shellfish in Lower Calcasieu.

SVOCs and PAHs

The SVOC analysis of Group 1A shellfish tissue samples identified three SVOC analytes and three PAH analytes. Benzaldehyde was the most commonly detected SVOC, at a mean concentration of 430 µg/Kg. Benzo(a)pyrene was the most frequently detected PAH, at a mean concentration of 110.37 µg/Kg. Benzaldehyde was the only SVOC detected in reference area samples at a mean concentration of 1,500 µg/Kg. No PAHs were detected in the reference area Group 1A shellfish.

Pesticides

Pesticides were not detected in the Group 1A tissue analysis.

Exhibit 11-32 Summary Statistics for Detects (µg/Kg) in Group 1A Shellfish – Lower Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	7/7	37	2000	430	921.64
Benzo(a)pyrene	3/5	27	240	110.37	132.27
2,3,7,8-TCDD TEQ (pg/g)	3/3	1.41	2.38	1.85	0.56

PCBs (Aroclors) and PCB Congeners

Group 1A shellfish tissue samples were collected and analyzed for PCBs and PCB congeners. No PCB aroclors were detected. PCB congeners were detected in two samples analyzed within the Group 1A shellfish. The highest detected congeners were PCB-118, PCB-66, and PCB-61/70 at 3,650 pg/g, 1,230 pg/g and 1,200 pg/g, respectively. Concentrations of similar congeners in the reference area were significantly at a much lower detection of frequency and concentration PCB-118 at 73 pg/g.

Dioxin/Furans

The results of Group 1A tissue samples collected and analyzed for dioxin/furans identified 21 compounds above detection limits.

Metals

Arsenic, copper, lead, mercury, methyl mercury, nickel, selenium, and zinc were the most frequently detected metals.

Exhibit 11-33 Summary Statistics for Metals (mg/Kg) Detected in Group 1A Shellfish – Lower Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	7/8	0.21	0.45	0.32	0.083
Copper	8/8	1.7	163	60.475	60.79
Lead	7/8	0.17	1.2	0.42	0.40
Mercury	8/8	0.01	0.039	0.019	0.012
Methyl Mercury	7/7	0.0061	0.0104	0.008	0.001
Nickel	7/8	0.25	0.72	**0.41**	0.18
Selenium	7/8	0.25	1.6	**0.89**	0.49
Zinc	8/8	5.3	2000	569.81	790.36

Bold = Similar to reference area

With the exception of nickel and selenium all metals detected in Group 1A shellfish in Lower Calcasieu were higher than that detected in reference area. Copper (0.82 mg/Kg to 1.7 mg/Kg) and zinc (5.6 mg/Kg) were significantly higher than the reference area.

11.2.3.1.2 Group 1B

Group 1B shellfish tissue results were obtained from the analysis of small (<7.5 cm) sedentary crustaceans (e.g., fiddler crabs, juvenile blue crabs, and hermit crabs). Exhibit 11-34 presents the range, mean, and standard deviation of the COPCs detected most frequently in the Group 1B shellfish. There was only one Group 1B shellfish sample collected in Lower Calcasieu.

SVOCs and PAHs
SVOCs and PAHs were not detected in the Group 1B tissue analysis.

Pesticides
The pesticide analysis of Group 1B tissue samples identified three analytes in the single shellfish tissue sample at very low concentrations.

Exhibit 11-34 Summary Statistics for Metals (mg/Kg) Detected in Group 1B Shellfish – Lower Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Copper	1/1	20.3	20.3	NA	NA
Lead	1/1	0.98	0.98	NA	NA
Mercury	1/1	0.011	0.011	NA	NA
Selenium	1/1	0.83	0.83	NA	NA
Zinc	1/1	19.1	19.1	NA	NA

NA – Not available

PCBs (Aroclors) and PCB Congeners
PCBs were not detected in the Group 1B tissue analysis.

Dioxin/Furans
Dioxin/furan analysis was not performed on Group 1B tissue.

Metals
One group 1B tissue sample was collected and analyzed for metal constituents. Metals detected included copper, lead, mercury, selenium, and zinc.

11.2.3.2 Fish

11.2.3.2.1 Group 1

Group 1 fish results were obtained from the analysis of small (<15 cm) sedentary species (e.g., killifish, sheepshead minnows, and blennies) assigned to a low trophic level. Exhibits 11-35 and 11-36 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1 fish.

SVOCs and PAHs
The SVOC analysis of Group 1 samples resulted in the detection of nine analytes. Benzaldehyde and phenol were most frequently detected. Benzaldehyde was detected at a slightly lower frequency in the whole body tissues from the Lower Calcasieu Group 1 than in the reference area. The mean concentration of benzaldehyde and phenol in the reference area was 2,899 µg/Kg and 335 µg/Kg, respectively. HCBD was detected in one sample, at a concentration of 29 µg/Kg, and was not detected in any reference area samples.

Pesticides
The pesticide analysis of Group 1 samples identified endosulfan sulfate in one sample at a concentration of 30 µg/Kg. No pesticides were observed in the Group 1 reference area samples.

Exhibit 11-35 Summary Statistics for Detects (µg/Kg) in Group 1 Fish Tissue – Lower Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	14/17	170	5000	1036.20	1704.24
Phenol	6/17	330	800	328.31	182.49
Aroclor-1254	6/17	25	140	23.41	39.67
2,3,7,8-TCDF (pg/g)	3/3	1.54	1.91	1.71	0.21
2,3,7,8-TCDD TEQ (pg/g)	3/3	1.58	2.01	1.74	0.30

PCBs (Aroclors) and PCB Congeners
The results of Group 1 tissue analyses for PCBs and PCB congeners indicated the presence of one PCB aroclor and 18 PCB congeners. PCB Aroclor 1254 was the only detected analyte identified during the analysis, with a mean concentration of 23.41 µg/Kg. PCB analyses for the Lower Calcasieu Group 1 whole body tissues revealed approximately the same detection frequency when compared to the reference area Group 1 data. PCB Aroclor 1254 was detected at a lower mean concentration in Lower Calcasieu compared to the reference area mean of 76 µg/Kg.

PCB-118, PCB-105, and PCB-162 were detected, with mean concentrations of 22,100 pg/g; 7,780 pg/g; and 6,110 pg/g, respectively, and were the most frequently detected. All PCB congeners detected in the Lower Calcasieu data were also identified in the reference area and at concentrations comparable to those of the reference area.

Dioxin/Furans
Three group 1-tissue samples were collected and analyzed for dioxin/furans. 2,3,7,8-TCDF was detected at a mean concentration of 1.71 pg/g. Dioxin/furan analysis of the Lower Calcasieu Group 1 tissues identified analytes at approximately the same frequency as in the reference area. Mean concentrations of analytes detected in both the Lower Calcasieu data and the reference group data were similar. The greatest difference between the Lower Calcasieu data and the reference group data was the finding of 21 analytes identified in the Lower Calcasieu and only six analytes detected in the reference group.

Metals
Arsenic was detected less frequently in the Lower Calcasieu Group 1 samples than in the reference area samples. In addition to the detection frequency being higher in the reference area, the mean of the Lower Calcasieu data (0.24 mg/Kg) is similar to the range of the reference area data (0.38 mg/Kg).

Chromium was detected at the same frequency in the Lower Calcasieu Group 1 tissue analysis as in the reference area. The mean concentration of the Lower Calcasieu results (0.32 mg/Kg) was similar to that of the reference area (0.33 mg/Kg).

Copper was detected at the same frequency in the Lower Calcasieu Group 1 samples as in the reference area samples. The means of the two groups are similar, with the mean of the Lower Calcasieu data (2.5 mg/Kg) slightly exceeding that of the mean for the reference area data (2.02 mg/Kg).

Exhibit 11-36 Summary Statistics for Metals Detects (mg/Kg) in Group 1 Fish Tissue – Lower Calcasieu

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	8/17	0.24	0.43	**0,24**	0.092
Chromium	17/17	0.26	0.51	**0.32**	0.07
Copper	17/17	1.0	7.3	**2.5**	2.1
Lead	8/17	0.04	0.59	0.142	0.20
Mercury	17/17	0.029	0.134	0.067	0.31
Nickel	8/17	0.04	0.24	0.054	0.064
Selenium	15/17	0.13	0.63	**0.33**	0.17
Zinc	17/17	27.8	37.2	**31.94**	2.66

Bold = similar mean value to reference area.

Nickel was detected at a higher frequency in the reference area than in Lower Calcasieu for group 1 tissue analyses. The mean nickel concentration of Lower Calcasieu data (0.054 mg/Kg) is lower than that of the reference area (0.085 mg/Kg).

Mercury was detected at the same frequency in the Lower Calcasieu Group 1 tissue as in the reference area. The mean concentration of the Lower Calcasieu data (0.067 mg/Kg) exceeds that of the reference area (0.022 mg/Kg).

Selenium was also detected at a similar frequency in both the Lower Calcasieu and the reference area. The mean concentration of selenium was higher in the Lower Calcasieu (0.33 mg/Kg) than the mean for the reference area (0.017 mg/Kg).

Zinc was detected at a similar frequency in the Lower Calcasieu and reference area samples collected for Group 1 tissue analyses. The mean concentration for the Lower Calcasieu (31.94 mg/Kg) slightly exceeds the mean for the reference area (29.26 mg/Kg).

11.2.4 Bayou d'Inde Extent of Tissue Contamination

This section only discusses the Group 1 shellfish and fish that are sedentary residents of Bayou d'Inde, and compares the results of analyses of these data to results from reference area samples. The more mobile or migratory groups 2, 3, and 4 were discussed in previous sections.

11.2.4.1 Shellfish

11.2.4.1.1 Group 1A

Group 1A shellfish tissue sample results were obtained from small (<7.5 cm) sedentary bivalves (e.g., clams, mussels, and oysters). Exhibits 11-37 and 11-38 present the ranges,

means, and standard deviations of the COPCs detected most frequently in Group 1A shellfish.

SVOCs and PAHs

The SVOC analysis of Group 1A shellfish tissue samples identified one SVOC analyte and 18 PAH analytes. Benzaldehyde was detected at an equal frequency in the shellfish analysis of both Bayou d'Inde Group 1A and the reference area. Most frequently detected PAHs in the Bayou d'Inde Group 1A shellfish include benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene. No PAHs were detected in the Group 1A shellfish tissue samples.

Pesticides

The pesticide analysis of Group 1A shellfish tissue samples indicated the presence of 12 analytes. Beta-BHC was the most frequently detected, at a mean concentration of 30.34 µg/Kg. Other detected pesticides include 4,4-DDD, 4,4-DDT, and endrin, at mean concentrations of 13.76 µg/Kg, 32.13 µg/Kg, and 10.76 µg/Kg, respectively. These same pesticides were not identified in the single sample taken from the reference area.

Exhibit 11-37 Summary Statistics for Detects (µg/Kg) in Group 1A Shellfish – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldeyde	3/3	1300	1600	1466.66	175.41
Benzo(a)pyrene	5/6	1.6	2.2	1.92	0.23
Benzo(b)fluoranthene	5/6	1.7	2.6	2.04	0.37
Benzo(g,h,I)perylene	5/6	2	3.3	2.39	0.58
Benzo(k)fluoranthene	5/6	0.84	1.6	1.19	0.36
Benzo(a,h)anthracene	5/6	0.52	0.93	0.71	0.15
Ideno(1,2,3-cd)pyrene	5/6	0.71	1.1	0.88	0.15
1-Methylnaptthalene	5/5	0.33	0.59	0.448	0.132
Beta-BHC	6/8	25	56	30.34	13.83
Aroclor1254	6/9	17	74	29.80	24.61
2,3,7,8-TCDF (pg/g)	3/3	3.28	46.2	30.83	31.26
2,3,7,8-TCDD TEQ (pg/g)	3/3	1.40	20.25	13.07	12.81

PCBs (Aroclors) and PCB Congeners

Group 1A shellfish tissue samples collected and analyzed for PCBs and PCB congeners indicated detections of PCB Aroclor 1254 and Aroclor 1260, with Aroclor 1254 being the most frequently detected. The mean concentrations of Aroclor 1254 and Aroclor 1260 were 29.80 µg/Kg and 13.85 µg/Kg, respectively. Aroclor 1254 was not identified in reference area sample. Only one sample from this group was analyzed for PCB congeners, and those with the highest frequency of detection were PCB-118, PCB-61/70, and PCB-129 (detected at 12,600 pg/g, 5,980 pg/g, and 6,020 pg/g, respectively). PCB congener analytes detected in both Bayou d'Inde Group 1A shellfish tissue and reference area Group 1A shellfish tissue was observed at the same frequency but at a much lower concentrations in the reference area samples.

Dioxin/Furans
Group 1A shellfish tissue samples collected and analyzed for dioxin/furans identified 24 compounds above detection limits. Detected dioxins/furans in the Bayou d'Inde Group 1A shellfish were identified at approximately the same frequency as the reference area samples. However, the mean concentration of the Bayou d'Inde results exceeded the mean of the reference samples. The most frequently detected compound in the Bayou was 2,3,7,8-TCDF, with a mean of 30.83 pg/g.

Metals
Group 1A shellfish tissue samples were collected and analyzed for metal constituents of which 18 metals were identified above detection limits.

Arsenic was detected at a lower frequency in the Bayou d'Inde shellfish Group 1A data than in the reference area data. The mean concentration of the reference area data was greater than the mean of the Bayou d'Inde data. The mean arsenic concentration in the reference area data was 0.76 mg/Kg.

Copper was detected at an equal frequency in the Bayou d'Inde Group 1A tissue analysis as in the reference area. The mean concentration for the Bayou d'Inde results exceeded the range of the reference area (0.82 mg/Kg to 1.7 mg/Kg).

Mercury was also detected at an equal frequency in both the Bayou d'Inde and reference area. The mean of the Bayou d'Inde results exceeded that of the reference area (0.009 mg/Kg).

Exhibit 11-38 Summary Statistics for Metals (mg/Kg) Detected in Group 1A Shellfish – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	3/9	0.27	0.61	0.425	0.135
Chromium	5/9	0.1	0.23	0.154	0.054
Copper	5/9	1.8	6.1	**2.72**	1.89
Lead	3/9	0.16	0.33	0.185	0.089
Mercury	9/9	0.031	0.314	0.108	0.1
Methyl Mercury	3/3	0.05	0.08	0.062	0.019
Nickel	9/9	0.49	2.6	1.49	0.61
Selenium	3/9	0.36	0.82	**0.46**	0.25
Zinc	4/9	4.4	8.5	**5.6**	1.41

Bold = similar to reference area

Nickel was detected as frequently in the Bayou d'Inde Group 1A tissue analysis as in the reference area. The mean concentration of the Bayou d'Inde results was greater than that of the reference area (0.463 mg/Kg).

Selenium was detected at a lower frequency in the Bayou d'Inde Group 1A tissue analysis than in the reference area. The mean concentrations for the Bayou d'Inde results were similar to that of the reference area (0.46 mg/Kg).

Zinc was detected with equal frequency in both the Bayou and the reference area. The mean concentration of Bayou d'Inde data was marginally greater than that of the reference area data set (5.6 mg/Kg).

Chromium and lead were not detected in the Group 1A shellfish from the reference area.

11.2.4.1.2 Group 1B

Group 1B shellfish tissue analytical results were obtained from small (<7.5 cm) sedentary crustaceans (e.g., fiddler crabs, hermit crabs, and juvenile blue crabs). Exhibits 11-39 and 11-40 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1B shellfish. Group 1B shellfish tissues were not collected from the reference area.

SVOCs and PAHs

SVOCs were not detected in Group 1B shellfish tissues. 18 PAHs were detected in Group 1B samples. PAHs detected most frequently included benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzo(a,h)anthracene, ideno(1,2,3-cd)pyrene, and pyrene.

Pesticides

The pesticide analysis of Group 1B shellfish tissue samples identified 12 analytes. These analytes were observed at relatively comparable concentrations to the other sampled areas. As in the other areas, the pesticide beta-BHC was the most frequently detected compound, with a mean concentration of 30.34 µg/Kg.

Exhibit 11-39 Summary Statistics for Detects (µg/Kg) in Group 1B Shellfish – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzo(a)pyrene	4/5	0.81	6.5	3.42	2.4
Benzo(b)fluoranthene	4/5	0.62	5.3	2.92	1.97
Benzo(g,h,I)perylene	4/5	0.74	7.8	4.2	3.01
Benzo(k)fluoranthene	4/5	0.39	2.7	1.42	0.97
Benzo(a)anthracene	4/5	0.68	4.4	2.64	1.61
Ideno(1,2,3-cd)pyrene	4/5	0.36	3.1	1.57	1.16
Pyrene	4/5	1.2	7.5	4.9	2.97
1-Methylnapthalene	4/4	0.28	0.64	0.475	0.165
Beta-BHC	6/8	25	56	30.34	13.83
Aroclor 1254	4/5	19	34	28.86	7.72
2,3,7,8-TCDF (pg/g)	3/3	4.75	6.21	5.58	0.87
2,3,7,8-TCDD TEQ (pg/g)	3/3	5.48	85.83	32.84	61.96

PCBs (Aroclors) and PCB Congeners

PCBs Aroclor 1254 and Aroclor 1260 were the most frequently detected, as in other areas. The mean concentrations of Aroclors 1254 and 1260 were 28.8 µg/Kg and 27.04 µg/Kg, respectively. PCB congeners were analyzed in three samples from this group, with the highest concentrations associated with PCB-129, PCB-110/77, and PCB-118 (mean concentrations equal 11,463 pg/g, 6,506 pg/g, and 5,176 pg/g, respectively).

Dioxin/Furans
Three samples were analyzed from Group 1B shellfish for dioxin/furan analysis. Thirty-four analytes were detected, with 2,3,7,8-TCDF being the most frequently detected at a mean concentration of 5.58 pg/g.

Metals
The metals analysis of Group 1B shellfish tissue samples identified several COPCs above detection limits. The most frequently detected were arsenic, copper, lead, mercury, and nickel.

Exhibit 11-40 Summary Statistics for Metals (mg/Kg) Detected in Group 1B Shellfish – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	4/5	0.8	1	0.832	0.130
Copper	5/5	0.64	33	24.53	17.82
Lead	4/5	0.47	2.2	1.32	0.95
Mercury	5/5	0.062	0.12	0.09	0.026
Nickel	4/5	0.54	0.62	0.58	0.033

11.2.4.2 Fish

11.2.4.2.1 Group 1

Group 1 fish tissue results were obtained from small (<15 cm) sedentary species assigned to a low trophic level (e.g., killifish, blennies, gobies, and mollies). Exhibits 11-41 and 11-42 present the ranges, means, and standard deviations of the COPCs detected most frequently in the Group 1 fish.

SVOCs and PAHs
The SVOC analysis of Group 1 fish samples indicated the presence of nine analytes. Additionally, one PAH was identified in these samples. 4-Methylphenol, Benzaldehyde, and phenol were the most frequently detected SVOCs.

Benzaldehyde was detected less frequently in the whole body tissue analysis of Bayou d'Inde Group 1 than in the reference area samples. The reference area Group mean concentration of 2,899 μg/Kg exceeds the mean observed in Bayou d'Inde (484 μg/Kg). The mean concentration of benzaldehyde was an order of magnitude lower than the mean of the reference area for Group 1 whole body fish samples.

Pesticides
The pesticide analysis of Group 1 fish samples identified three analytes at low frequency of detection and low concentrations. Beta-BHC was the most frequently detected (6/78) pesticide identified.

Exhibit 11-41 Summary Statistics for Detects (μg/Kg) in Group 1 Fish Tissue – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Benzaldehyde	49/78	28	3300	484.30	599.82
Phenol	56/78	110	8200	1071.23	1287.66

Aroclor 1254	68/78	12	820	129.24	170.38
2,3,7,8-TCDF (pg/g)	18/18	0.735	17.6	6.96	6.203
2,3,7,8-TCDD TEQ (pg/g)	18/18	0.40	12.22	4.82	4.07

PCBs (Aroclors) and PCB Congeners

Group 1 fish tissue samples collected and analyzed for PCBs and PCB congeners indicated the presence of Aroclor 1254 and 19 PCB congeners. PCB aroclor analysis for the Bayou d'Inde Group 1 samples was associated with much greater detection frequencies compared to the reference area. PCB Aroclor 1254 was detected at a mean concentration of 76.1 µg/Kg in the reference area. All PCB congeners detected in the Bayou d'Inde Group 1 tissue data were identified at similar frequencies when compared to the reference area results. The congeners detected with the highest concentration in Bayou d'Inde Group 1 tissue samples included PCB-118, PCB-162, PCB-105, and PCB-66, with mean concentrations of 16,773 pg/g, 3,875 pg/g, 3,975 pg/g, and 4,062 pg/g, respectively.

Dioxin/Furans

Group 1 fish tissue samples collected and analyzed for dioxin/furans identified 25 compounds above detection limits. 2,3,7,8-TCDF was the most total frequently detected, with a mean concentration of 0.424 pg/g in the reference area.

Dioxin/furan analysis of the Bayou d'Inde Group 1 tissue samples identified analytes at similar detection frequencies as in the reference Group Area Group 1 tissue samples. Mean concentrations of analytes detected in both the Bayou d'Inde data and the reference group data were higher in the Bayou d'Inde samples. Also, 25 analytes were identified in the Bayou d'Inde and only 6 analytes were detected in the reference area samples.

Metals

Group 1 fish tissue samples were collected and analyzed for metal constituents of which 11 metals were identified above detection limits.

Arsenic was detected more frequently in Bayou d'Inde than in the reference area. Even though the detection frequency was greater in the bayou, the mean concentration of the Bayou d'Inde data was lower than that of the reference area data (0.43 mg/Kg).

Chromium was detected more frequently in the Bayou d'Inde Group 1 tissue analysis than in the reference area Group 1 tissue analysis. The mean concentration of the Bayou d'Inde results was slightly higher than that of the reference area data (0.31 mg/Kg).

Exhibit 11-42 Summary Statistics for Metals (mg/Kg) Detected in Group 1 Fish Tissue – Bayou d'Inde

Parameter	Frequency of Detects	Minimum Detected Value	Maximum Detected Value	Mean	Standard Deviation
Arsenic	77/78	0.08	0.91	**0.21**	0.11
Chromium	78/78	0.19	2.1	**0.38**	0.25
Copper	78/78	0.91	17.4	3.92	2.7

Lead	64/78	0.02	4.3	0.37	0.60
Mercury	78/78	0.013	0.65	**0.205**	0.16
Nickel	75/78	0.03	0.63	**0.097**	0.093
Selenium	78/78	0.23	2.9	0.56	0.35
Zinc	78/78	19	188	35.62	22.82

Bold = Similar to reference area.

Copper was detected more frequently in the Bayou d'Inde Group 1 tissue analysis than in the reference area Group 1 tissue analysis. The mean concentration of the Bayou d'Inde data was greater than that of the reference area data (1.6 mg/Kg).

Lead was also detected more frequently in the Bayou d'Inde samples than in the reference area samples. The mean lead concentration of the Bayou d'Inde data exceeded that of the reference area (0.10 mg/Kg).

Mercury was detected more frequently in the Bayou d'Inde Group 1 tissue analysis than in the reference area Group 1 tissues. The mean concentration in the Bayou d'Inde was greater than that of the reference area (0.024 mg/Kg).

Nickel was detected more frequently in the Bayou d'Inde than in the reference area. Mean concentrations of this analyte were virtually identical in both data sets.

Selenium was detected more frequency in Bayou d'Inde than in the reference area. The mean concentration of selenium was higher in the Bayou d'Inde.

Zinc was detected more frequently in Bayou d'Inde than in the reference area. The mean concentration of the Bayou d'Inde samples was greater than that of the reference area (28.8 mg/Kg).

11.2.5 Summary

Tissue samples from a variety of aquatic biota were collected and analyzed for chemicals of concern. These data were used to assess risks to fish, wildlife resources, and human health. These data also support the feasibility study and potential future remedial actions.

This summary section discusses the tissue data by AOC and by biota group. The four AOCs in the estuary are Upper Calcasieu, Bayou d'Inde, Lower Calcasieu, and the reference area. Biota groups, presented previously as Exhibit 11-2, are repeated below as Exhibit 11-43.

Exhibit 11-43 Description of Biota Groups for the Calcasieu Estuary

Type	Group	Description of Group	Size Class (cm)
Fish	1	Small sedentary species – low trophic level (<2.5)	<15 cm
Invertebrates	1A	Small sedentary bivalves	<7.5 cm
Invertebrates	1B	Small sedentary crustaceans	<7.5 cm
Invertebrates	2A	Small migratory crustaceans	<12.5 cm
Invertebrates	2B	Large migratory crustaceans	>12.5 cm

Fish	2A	Small migratory species - low trophic level (<2.5)	<15 cm
Fish	2B	Small migratory species - high trophic level (>2.5)	<15 cm
Fish	3A	Medium migratory species - low trophic level (<2.5)	15 to <30 cm
Fish	3B	Medium migratory species – high trophic level (>2.5)	15 to <30 cm
Fish	4A	Large migratory species - low trophic level (>2.5)	30 to 90 cm
Fish	4B	Large migratory species - high trophic level (>2.5)	30 to 90 cm

Finally, the relationships between COPCs concentrations in sediment and in biological tissues are evaluated for small sedentary bivalves (Group 1A biota) that are directly and continuously exposed to potentially contaminated sediments. These relationships are expressed as biota-sediment accumulation factors (BSAFs) that are based on the following equation:

BSAF = COPCs concentration in biota / COPCs concentration in sediment

COPCs concentrations are expressed as mg/Kg dry weight sediment and mg/Kg wet weight biota. The BSAFs presented in this section are not normalized for biota lipids or for sediment organic carbon content. BSAFs are not calculated for other biota groups because of more limited and less direct contact with potentially contaminated sediments. For example, most fish are expected to accumulate contaminants primarily as a result of water rather than sediment exposure. Also, other types of invertebrates (e.g., crustaceans) that are more mobile will be exposed to sediments over a wider spatial area. The mobility of these types of organisms precludes an accurate determination of relationships between COPCs concentrations in sediment and those in biota.

Sitewide Results for Biota Groups 2A – 4B

Sitewide results include the results of sampling of migratory/mobile biota throughout the site. This approach is appropriate because little difference was observed in the tissue COPCs concentrations of Groups 2, 3, and 4 migratory/mobile fish and crustaceans. The sitewide results are presented by COPCs class and by mobile/migratory biota group.

As presented in Exhibit 11-44, and in general, there is little difference in the types of analytes detected and the most frequently detected analytes from one biota group to another. These summary data encompass all the data from the three areas and, where available, the reference area.

In a few cases, comparisons of the summary data from the three areas to reference area data indicate significant differences. Two types of differences are observed. Contamination of reference areas by unknown sources can be concluded where reference area COPCs concentrations exceed the area concentrations in similar biota. This situation is observed occasionally with benzaldehyde and infrequently with 2,3,7,8-TCDF. On the other hand, significant AOC contamination can be interpreted where the concentrations of COPCs in AOC biota substantially exceed those of

reference area biota. This case is observed more commonly with the PCB congener PCB-118 and 2,3,7,8-TCDF. These COPCs were commonly detected in AOC biota at concentrations that substantially exceeded those of the reference area. These are important findings because of the high toxicity and bioaccumulation potential of these COPCs. In general, the frequencies of detection and the concentrations of other COPCs such as metals were similar in both the reference area biota and the AOC biota, based on the overall data for all three AOCs.

Exhibit 11-44 Sitewide Summary of Biota Tissue Data, Groups 2A to 4B

Biota Group	Metals	SVOCs/ PAHs	PCBs	Pesticides	Dioxins/Furans
2A Invertebrates	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	9 DET, MFD = benzaldehyde at conc ~RA	MFD = PCB-118 at conc >> RA	ND, and ND in RA	10 DET, MFD = 2,3,7,8-TCDF at conc >>RA
2B Invertebrates	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	3 DET, MFD = benzaldehyde at conc< RA	MFD = Aroclor 1254 (ND in RA) and PCB-118	MFD = DDT and beta-BHC	8 DET, MFD = 2,3,7,8-TCDF at conc > RA
2A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	2 DET, MFD = benzaldehyde at FD and conc~RA	MFD = Aroclor 1254 (ND in RA) and PCB-118 at conc ~ to RA	Few DET at low FD and conc	18 DET, MFD = 2,3,7,8-TCDF at conc ~ RA
2B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	6 DET, MFD = benzaldehyde	MFD = Aroclor 1254 and PCB-118	MFD = beta-BHC and DDE	21 DET, MFD = 2,3,7,8-TCDF
3A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	5 DET, MFD = benzaldehyde at conc ~RA	MFD = Aroclors 1254 and 1260 at conc ~ RA and PCB-118 at conc > RA	8 DET, MFD = DDD and beta-BHC	20 DET, MFD = 2,3,7,8-TCDF at conc < RA
3B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	7 DET, MFD = benzaldehyde at conc ~RA	MFD = Aroclors 1254 and 1260 at conc > RA and PCB-118 at conc ~ to RA	8 DET, MFD = beta-BHC	7 DET, MFD = 2,3,7,8-TCDF at conc ~ RA

Exhibit 11-44 (cont'd) Sitewide Summary of Biota Tissue Data, Groups 2A to 4B

Biota Group	Metals	SVOCs/ PAHs	PCBs	Pesticides	Dioxins/Furans
4A Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	4 DET, MFD = benzaldehyde. Only 1 SVOC detected in RA	MFD = Aroclors 1254 and 1260 (only 1254 DET in RA) and PCB-118 at conc > RA	Few DET at FD<50%, MFD = DDE and beta-BHC	FD ~ RA, but at conc > RA
4B Fish	MFD = As, Cr, Cu, Hg, Ni, Zn, in general at conc ~ RA	Several DET, MFD = benzaldehyde, BEHP, and diethylphthalate	MFD = Aroclors 1254 and 1260 at FD and conc ~ RA and PCB-118 at conc > RA	Few DET at low FD and conc, MFD = beta-BHC, pesticides ND in RA	10 DET, MFD = 2,3,7,8-TCDF at conc > RA

MFD = Most frequently detected "X", DET = Number of analytes detected, RA = reference area
Conc = concentrations, FD = frequency of detection, < = less than,
> = greater than, >> = much greater than, and ~ = Similar to

In summary, only relatively minor differences are observed in the COPCs concentrations in tissues taken from the AOCs and the reference area for the migratory or mobile biota. Therefore, area-specific data for these more mobile organisms are unlikely to provide useful information with regard to the identification of source areas or areas in need of remediation. Instead, area-specific data are best evaluated for less mobile organisms, primarily biota from Groups 1, 1A, and 1B. These data are summarized below.

AOC-Specific Results for Biota Groups 1, 1A, and 1B

The results summarized in this section are based on sedentary or less mobile organisms. These organisms, especially the invertebrates in Groups 1A and 1B, have more constant and direct contact with potentially contaminated sediments. Tissue COPCs concentrations for these organisms are therefore more likely to be better linked to sediment quality, as indicated by COPCs concentrations. Because the sediment quality and tissue COPCs concentrations have direct association, these data are presented on a by-area as well as a by-COPCs and by-biota group basis.

As shown in the summary presented below (Exhibit 11-45), there are some important findings based on location-specific data. Results for Group 1 sedentary fish reveal several locations where the frequency of detection and/or the mean concentration of metals COPCs exceed that of the reference area. This is true for Lower Calcasieu, Bayou d'Inde, and Upper Calcasieu. The most important finding within this group is the high mean concentration of mercury in Upper Calcasieu relative to the mean for the reference area. A second important finding is revealed by the comparison of the number of dioxin/furan compounds detected in each area. Twenty-one of these compounds were found in Lower Calcasieu while 25 and 18 were detected in the Bayou d'Inde and Upper Calcasieu, respectively. In contrast, only six dioxin/furan compounds were detected in the reference area. Comparisons of location-specific data for SVOCs/PAHs, PCBs, and pesticides reveal only relatively minor differences between reference area results and results from other AOCs.

Exhibit 11-45 Site-wide Summary of Biota Tissue Data, Groups 1, 1A, and 1B

Biota Group	Areas of Concern	Metals	SVOCs/ PAHs	PCBs	Pesticides	Dioxins/ Furans
1 Fish	LC	FD>RA (Ni) Conc>RA (Hg, Se, Zn)	9 DET, MFD = benzaldehyde (FD and conc<RA) and phenol. HCBD DET but not in RA.	Aroclor 1254 (FD~RA, conc<RA) and 18 congeners (FD and conc ~RA) DET.	endosulfan sulfate DET but not in RA. None DET in LC also found in RA.	21 DET, MFD = 2,3,7,8-TCDF.
	BI	FD>RA (As, Cr, Cu, Pb, Hg, Ni, Se, Zn). Conc >RA (Cr, Cu, Pb, Hg, Se, Zn).	9 SVOCs/1 PAH DET. Benzaldehyde MFD, but conc <RA.	Aroclor 1254 and 19 congeners DET. Aroclor 1254 FD >>RA, conc > RA. Congeners FD~RA.	3 DET at low FD and conc.	25 DET. Of 6 also DET in RA, FD~RA, conc >RA.
	UC	FD>RA (none), conc >RA (As, Pb, Zn). Mean conc Hg 2X RA mean.	5 SVOCs DET, MFD = 2- and 4-methylphenol (neither DET in RA). Phenol FD and conc>RA	Aroclor 1254 only Aroclor DET, at conc>RA. MFD congener = PCB-118, conc of congeners <RA	Not Detected	18 DET at low FD and conc. MFD=2,3,7,8-TCDF (mean=0.307 pg/g), ~RA
	RA	Similar elements DET	See above	See above	Few DET	6 DET
1A Bivalves	LC	FD >RA (none), conc >RA (Cu, Se, Zn).	3 SVOCs/3 PAHs DET. MFD = benzaldehyde and BAP	No Aroclors DET. MFD congener = PCB-118.	Not Detected	21 DET, FD~RA, conc>RA
	BI	FD>RA (none), conc >RA(Cu, Hg, mHg, Ni, Se, Zn).	1 SVOC/18 PAHs DET	Aroclor 1254 and 1260 DET, MFD congener = PCB-118. Congener FD~RA, conc >RA.	12 DET, MFD = beta-BHC. None DET in BI were DET in RA.	24 DET, FD~RA, mean conc >RA.
	UC	MFD=As, Cr, Cu, Hg, mHg, Ni, Se, Zn	5 SVOCs/18 PAHs DET, MFD = BAP (mean=1.066 ug/Kg)	Aroclors 1254 and 1260 FD<10%. Congeners not analyzed	14 DET, MFD=DDE (max=2.7 ug/Kg)	13 DET, compounds ~ RA
	RA	No sample collected	NS	6 DET	4 DET	11 DET
1B Crustaceans	LC	DET = Cu, Pb, Hg, Se, Zn.	Not Detected	Not Detected	3 DET	Not Analyzed
	BI	MFD = As, Cu, Pb, Hg, Ni.	No SVOCs DET, 18 PAHs DET	Aroclors 1254 and 1260 DET, MFD congener = PCB-129.	12 DET, MFD = beta-BHC.	34 DET, MFD = 2,3,7,8-TCDF.

	UC	MFD = As, Cu, Hg, Ni	No SVOCs, 18 PAHs	Aroclor 1254 and 1260, No congeners analyzed	3 DET	13 DET
	RA	NS	NS	NS	NS	NS

MFD = Most frequently detected analytes detected
Upper Calcasieu
FD = frequency of detection
> = greater than

LC = Lower Calcasieu
BI = Bayou d'Inde
Conc = concentrations
NS = Not sampled
>> = much greater than

"X" DET = Number of
RA = reference areaUC =
RA = reference area
< = less than
~ = similar to

Biota-Sediment Relationships for Group 1A Biota
Geometric mean biota-sediment relationships for Group 1A shellfish (Bayou d'Inde and Upper and Lower Calcasieu) and Group 2A crustaceans (reference area), expressed as BSAFs rounded in most cases to two significant digits, are presented for each area in Appendix H. The ranges of these BSAFs are presented below for each class of COPCs (e.g., metals, PAHs) or for an individual PAH where only one PAH was detected in both sediment and biota. The number of samples refers to paired (co-located) samples of both sediment and biota. Appendix H presents all COPCs-specific and AOC-specific BSAFs for Group 1A biota based by sample.

Lower Calcasieu (Group 1A shellfish - one sample)
Geometric mean BSAFs for metals other than mercury range from 0.0006 (lead) to 1.5 (zinc). Geometric mean BSAFs for mercury and methyl mercury are 0.013 and 0.4, respectively. Geometric mean BSAFs for PAHs range from 0.0023 (benzo(k)fluoranthene) to 0.0045 (benzo(a)pyrene).

Bayou d'Inde (Group 1A shellfish - one sample)
Geometric mean BSAFs for metals other than mercury range from 0.0002 (lead) to 0.05 (cadmium). Geometric mean BSAFs for mercury and methyl mercury are 0.060 and 9.3, respectively. The geometric mean BSAF for phenanthrene is 0.098.

Upper Calcasieu (Group 1A shellfish - 5 samples)
Geometric mean BSAFs for metals other than mercury range from 0.0056 (lead) to 1.0 (silver). Geometric mean BSAFs for mercury range from 0.007 to 0.28 in the five samples. Geometric mean BSAFs for PAHs range from 0.01 (benzo(a)pyrene and indeno(1,2,3-cd)pyrene) to 0.06 (anthracene).

Reference area (Group 2A crustaceans - one sample)
Group 1A shellfish were not sampled in the reference area. Data on Group 2A crustaceans, which are more mobile than Group 1A shellfish, are used to generally describe the sediment/biota relationships within the reference area. PAHs were not detected in the reference area. Geometric mean BSAFs for metals other than mercury range from 0.02 (lead) to 1.09 (cadmium). The geometric mean BSAF for mercury is 0.105. These data probably do not describe the sediment/biota relationships as well as the data based on Group 1A shellfish because of crustacean mobility. However, most of the Group 2A crustaceans sampled in the reference area are not expected to range widely over the estuary and are in fact likely to remain within the described reference

area. These biota are therefore considered reasonable representatives of benthic biota having direct contact with reference area sediments.

BSAF Summary

COPCs that are easily bioaccumulated and not easily or rapidly depurated are expected to accumulate to the highest concentrations in exposed biota. Such COPCs include mercury and, for Group 1A bivalves, PAHs. Mercury can be converted to methyl mercury in sediment and in biological tissues, so mercury BSAFs can be viewed somewhat similarly to methyl mercury BSAFs. It is noted, however, that methyl mercury is more rapidly accumulated and accumulates to a higher degree than inorganic mercury. The highest overall BSAF was determined for methyl mercury in Bayou d'Inde (9.3). With a very few exceptions, geometric mean BSAFs for most other metals remained below 1.0. In most cases, the lowest geometric mean BSAFs were for lead, which is not unexpected given the low solubility and bioavailability of lead in sediments. BSAFs for PAHs generally remained low, in all cases less than 0.1. Other than the single high geometric mean BSAF for methyl mercury in Bayou d'Inde (9.3), the BSAFs determined for this site appear to be similar to those determined for other contaminated sites where BSAFs commonly approximate unity (1.0) for most COPCs.

The BSAFs presented here can be used to evaluate in a general sense the bioavailability of site COPCs. The identification of COPCs that occur in forms that are accumulated in biological tissues is reflected in the BSAF data presented. Also, these BSAFs can be used as input parameters to food chain modeling to derive predicted COPCs doses via ingestion of food items. This use is relevant only if it is determined that food chain modeling is indicated for this site.

Figure 11-1
Group 1 Tissue and Associated Sediment Samples

Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

Legend

Group 1 Tissue and Associated Sediment Sample Location

- Tissue
- Sediment
- Interstate
- Bayou Verdine AOC Boundary
- Bayou dTnde AOC Boundary
- Lower Calcasieu AOC Boundary
- Upper Calcasieu AOC Boundary

N
W E
S

Kilometers
0 0.5 1 2

Region 6

Prepared by CDM

Map Filename: Figure11-1Group1TissueandSediment.mxd 09/30/2002

Section 12
Toxicity Testing and Benthic Community Survey

This section summarizes the data generated from sediment and porewater toxicity tests in support of a remedial investigation of the Calcasieu Estuary in Lake Charles, Louisiana. Analyses conducted on sediments included:

- Whole sediment toxicity tests:
    - 10-d and 28-d whole-sediment toxicity tests with the amphipod *Hyalella azteca*
    - 10-d whole-sediment toxicity tests with the amphipod *Ampelisca abdita*
    - 28-d sediment bioaccumulation tests with the polychaete *Nereis virens*
    - Solid-phase Microtox® toxicity tests with *Vibrio fisheri*
- Porewater toxicity tests:
    - Sea lettuce or macroalga *Ulva fasciata thalli*
    - Sea urchin Arbacia punctulata
    - Redfish embryos Sciaenops ocellatus
- Benthic community assessments
- Toxicity Identification Evaluation

A total of 100 sediment samples were collected from the Calcasieu Estuary in November and December of 2000 (Figures 4-7 through 4-9). A more comprehensive interpretation of these tests can be found in the *Calcasieu Estuary Baseline Ecological Risk Assessment* (CDM 2002c).

Sediment is a major repository for many of the more persistent chemicals that are introduced into surface waters and provides habitat for many aquatic organisms. In the aquatic environment, most anthropogenic chemicals and waste materials, including toxic organic and inorganic chemicals, eventually accumulate in sediment. Mounting evidence exists of environmental degradation in areas where EPA water quality criteria are not exceeded, yet organisms in or near sediments are adversely affected (EPA 2000). Although certain chemicals are highly sorbed to sediment, these compounds may still be available to the biota. Contaminated sediments may be directly toxic to aquatic life or can be a source of contaminants for bioaccumulation in the food chain.

Concentrations of contaminants in sediment may be several orders of magnitude higher than in the overlying water. However, bulk sediment concentrations may not always be strongly correlated to bioavailability. Because relationships between concentrations of contaminants in sediment and their bioavailability are poorly understood, determining effects of contaminants in sediment on aquatic organisms requires controlled toxicity and bioaccumulation tests and measures of effects on benthic communities inhabiting sediments (Ingersoll et al 1997).

The testing was explicitly designed to provide the information that is required to evaluate the risks to sediment-dwelling organisms that are associated with exposure to contaminated sediments. These goals were supported in two ways. First, the results will provide information of whole-sediment and porewater toxicity on benthic invertebrate community status, both of which support direct evaluations of the effects of contaminated sediments on benthic organisms. In addition, they will provide the information needed to evaluate the ability of the SQGs to correctly classify sediments in the study area as toxic or not toxic. This evaluation of predictive ability is essential to the overall ERA process because sediment chemistry will be used as a primary indicator of the potential for adverse effects on sediment-dwelling organisms. Therefore, demonstrating the site-specific applicability of the SQGs is of critical importance to the overall ecological risk assessment.

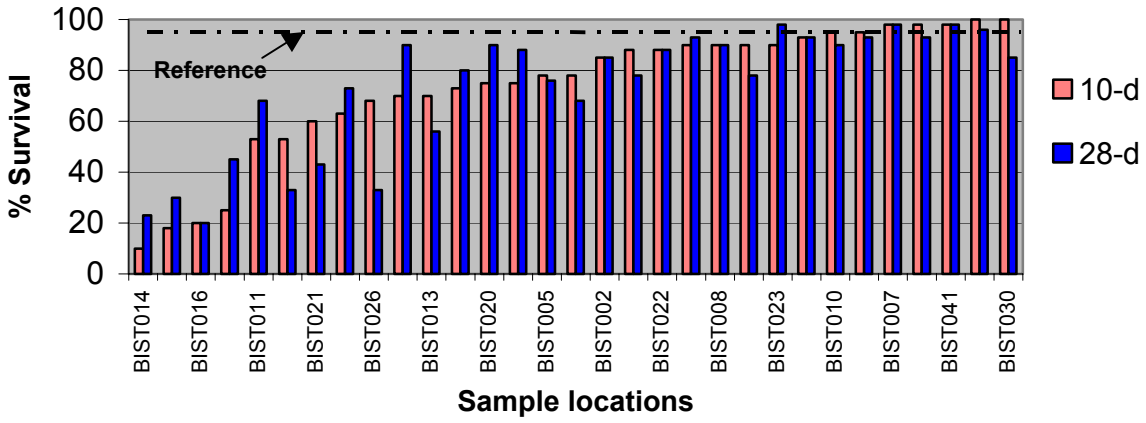
12.1 Whole-Sediment Hyalella Azteca Toxicity Tests

Whole-sediment toxicity tests were conducted on 100 samples with the amphipod *Hyalella azteca* following procedures outlined in ASTM (2000), EPA (2000), and Ingersoll *et al.* (1997). Exposures were conducted for 10 and 28 days, and endpoints measured at the end of these exposures included survival and length of amphipods.

Mean survival of amphipods in the control sediment for both the 10- and 28-d tests was at or above 92 percent for the first and second batches of samples. Therefore, these tests met the acceptability criteria recommended in ASTM (2000) and EPA (2000).

Wide ranges in mean survival and length of amphipods were observed with exposure to the Calcasieu sediments in the 10- and 28-d tests. In both the 10- and 28-d tests, survival of amphipods exposed to Calcasieu sediments ranged from 0 to 100 percent. Survival was reduced in comparison to reference by 20 percent of the control response in 29 percent of the Calcasieu sediments in the 10-d test and in 22 percent of the Calcasieu sediments in the 28-d test. Exhibit 12-1 illustrates a comparison of the 10-d and 28-d tests for Bayou d'Inde sediments.

Exhibit 12-1 10-d and 28-d Bayou d'Inde whole-sediment toxicity test with Hyalella azteca in comparison to reference



12.2 Whole-Sediment Toxicity Test Using *Ampelisca Abdita*

Amphipods were exposed to test sediments for 10 days under static conditions, following ASTM procedures. Exhibit 12-2 illustrates the observed magnitude of toxicity for the 10-d test for *Ampelisca abdita*. The results were then put into three categories, low risk, indeterminate risk, and high risk.

Exhibit 12-2 Summary of Observed Magnitude on the Survival of *Ampelisca abdita*

Area (No. of tests)	Low Risk Survival > 55.5 percent	Indeterminate Risk Survival 49.4 – 55.5 percent	High Risk Survival < 49.4 percent
Bayou d'Inde (31)	3	7	21
Upper Calcasieu (29)	16	4	9
Lower Calcasieu (15)	8	3	4
Reference Areas (14)	14	0	0
Totals (89)	41	14	34

These categories are defined as:

- **Low Risk** – Survival > 55 percent – effects that were observed or predicted to occur within a sample, reach, or an area that were similar to those of the reference areas
- **Indeterminate Risk** – Survival 49.4 percent – 55.5 percent– effects that were observed or predicted to occur within a sample, a reach, or area that were indeterminately higher in frequency or magnitude than those of the reference areas

- **High Risk** – Survival < 49.4 percent – effects that were observed or predicted to occur within a sample, a reach, or areas that were substantially higher than those for the selected reference area

The exhibit shows that out of 100 percent of the samples tested, 46 percent of the samples tested had a survival rate of greater than 55 percent, with a majority of the survival occurring in the reference area and Upper Calcasieu; 16 percent had a survival of 49.4 to 55 percent, and 38 percent of the samples demonstrated a survival rate of less than 49.4 percent, with a majority of this occurring in Bayou d'Inde (21 out of 31). A summary of the test organism survival data is presented in Appendix I.

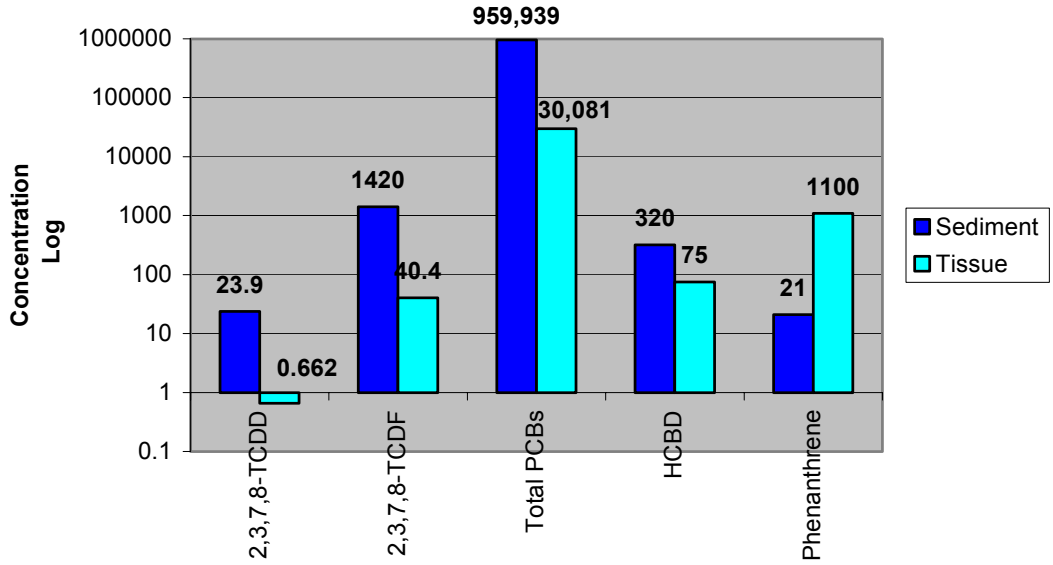
12.3 Bioaccumulation Tests Using *Nereis Virens*

Bioaccumulation is the net accumulation of a substance by an organism as a result of uptake from an environmental source. A 28-d bioaccumulation test was conducted with site sediment from 12 locations (Figures 4-7 through 4-9) within the Calcasieu Estuary and the reference areas using the polychaete *Nereis virens* as the test organism. The polychates were allowed to live in 2 cms of sediment for 28 days. After 28 days of exposure, the test organisms were removed from the sediment and allowed to depurate in clean seawater for 24 hours. After depuration, organisms from each replicate were rinsed in deionized water, placed into glass sample jars, and stored in a freezer at -10 ± 2°C. Frozen *Nereis virens* tissues were shipped to American Analytical and Technical Services, Inc., for chemical analyses.

Survival data for the *Nereis virens* in the bioaccumulation tests in the laboratory control sediment were 99 percent. Survival of *Nereis virens* in the site sediments ranged from 87 percent (sample station 00BI2-ST030-NSD-010) to 98 percent. Exhibits 12-3 through 12-7 show a summary of COPCs detected from the chemical analysis of the test organisms and their associated sediment and porewater sample analysis.

Bioaccumulation tests were conducted at six whole sediment sample locations in Bayou d'Inde. COPCs detected in the test organisms and sediments from Bayou d'Inde were total PCB congeners, dioxin/furans, and SVOCs. Sample location BI027 had the highest detections in test organisms for total PCB congeners (30,081 ng/kg); dioxin/furans; 2,3,7,8-TCDD (0.662 pg/g); and 2,3,7,8-TCDF (40.4 pg/g). Sediment analyzed for the same location had detects for total PCB congeners (959,939 ng/kg); 2,3,7,8-TCDD (23.9 pg/g); and 2,3,7,8-TCDF (1420 pg/g). Location BIST030 detected phenanthrene in tissue and sediment of 1,100 and 21 µg/kg, respectively. Sample location BIST011 detected HCBD 75 µg/kg in tissue and 320 µg/kg in sediments. Exhibit 12-3 illustrates a comparison of the COPCs detected in tissue and sediment from the same locations.

Exhibit 12-3 COPCs Detected in Bayou d'Inde Bioaccumulation Test Organisms



Metals detected in test organism were all within the range of metals detected in tissue from the reference areas. Summary tables showing all results by sample location can be found in Appendix I.

Exhibit 12-4 COPCs Detected in Bayou Verdine Bioaccumulation Test Organisms

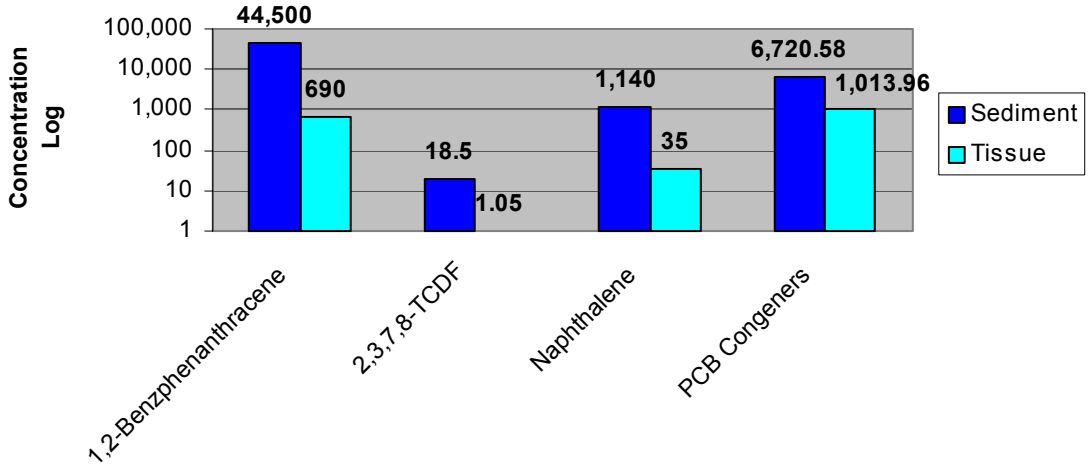


Exhibit 12-4 shows the COPCs detected in the test organisms from Bayou Verdine at sample location BV005. The bioaccumulation test was only performed at one whole sediment sample location for Bayou Verdine but with four replicate analyses. Results from these four replicates were averaged and are illustrated in Exhibit 12-4. COPCs

detected in the test organism tissue and sediment includes PCB congeners (1,013.956 and 6,720 ng/kg); 2,3,7,8-TCDF (1.05 and 18.5 pg/g); naphthalene (35 and 1,140 µg/kg); 1,2-benzphenanthracene (690 and 44,500 µg/kg); and HCDB (90 µg/kg) in tissue only. Metals detected in test organism tissue were all within the range of metals detected in the test organisms from the reference area.

Exhibit 12-5 COPCs Detected in Lower Calcasieu Bioaccumulation Test Organisms

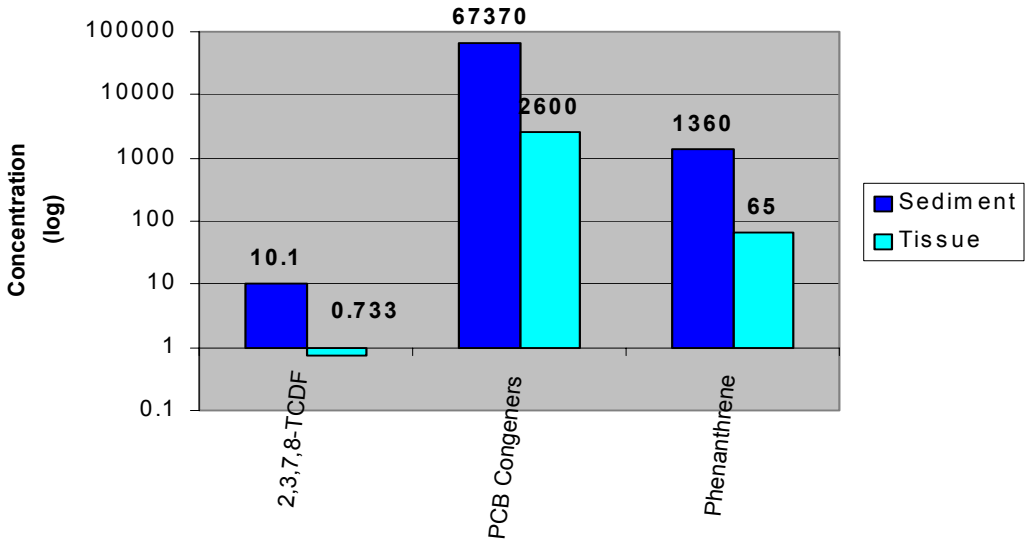
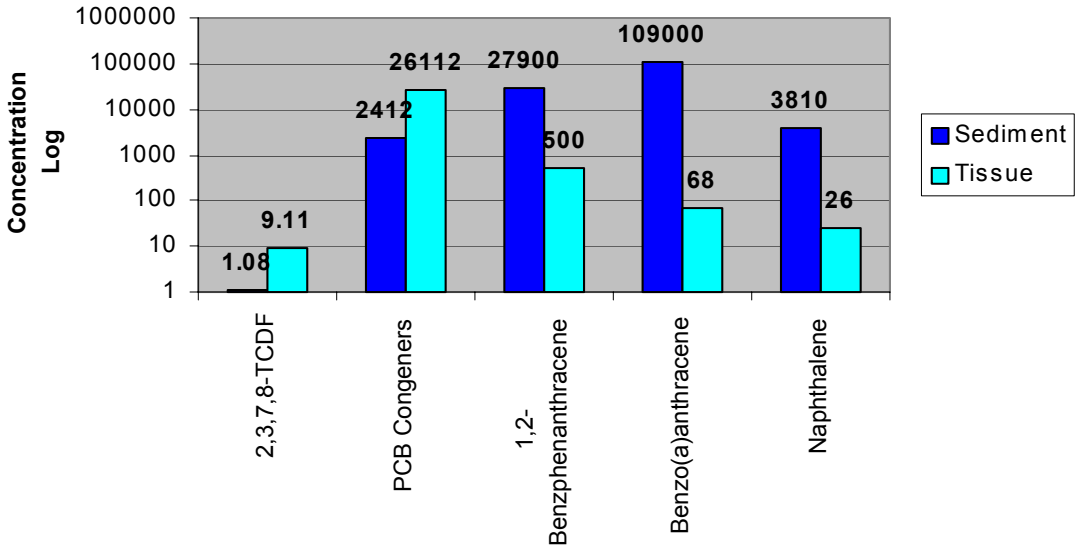


Exhibit 12-5 shows the COPCs detected in the test organism and whole sediments collected from Lower Calcasieu. The bioaccumulation test was conducted at only one whole sediment sample location in Lower Calcasieu, LC006, with four replicate analyses. The four replicates were averaged and are illustrated in Exhibit 12-5. COPCs detected in the test organism tissue and sediment includes total PCB congeners (2,600 and 67,370 ng/kg); 2,3,7,8-TCDF (0.733 and 10.1 pg/g); phenanthrene (65 and 1360 µg/kg); and HCBD (140 µg/kg). HCBD was detected in the tissue sample only due to higher detection limits for the sediment sample. Metals detected were all within the range of metals detected in the reference area test organisms.

Exhibit 12-6 shows the COPCs detected in whole sediment collected from Upper Calcasieu. The bioaccumulation tests were conducted from two whole sediment locations, UC011 and UC028, with four replicate analyses from each sample. COPCs detected in the test organism and sediment included total PCB congeners (2,412 and 26,112 ng/kg); 2,3,7,8-TCDF (1.08 and 9.11 pg/g); naphthalene (26 and 3,810 µg/kg); benzo(a)anthracene (68 and 109,000 µg/kg); 1,2 benzphenanthracene (500 and 27,900 µg/kg); and HCBD (84 µg/kg) in tissue only. Metals detected were all within the range of metals detected in the reference area test organisms.

Exhibit 12-6 COPCs Detected in Upper Calcasieu Bioaccumulation Test Organisms



COPCs detected in whole sediment from two whole sediment sample locations in the reference areas are at locations SN006 and SN011. COPCs detected at these locations in tissue included total PCB congeners (3,009 ng/kg) and 2,3,7,8-TCDF (0.388 pg/g) and in sediment at these locations 162,498 ng/kg and 5.91 pg/g.

The detections in tissue of our test organisms, with a 28-d test of COPCs, demonstrate the ability of these compounds to bioaccumulate.

12.4 Solid-Phase Microtox® Toxicity Tests

The Microtox® Solid-Phase Toxicity test (SPT test) was conducted on 100 whole sediment samples collected during the Phase II sampling. The SPT test determines the bioavailability of chemicals in sediment by exposing bioluminescent bacteria (*Vibrio fisheri*; B-NRL 1117, Azur Environmental, Carlsbad, CA) directly to sediment suspended in solution for a period of 25 minutes (Johnson 1998; Johnson and Long 1998). A log-linear model was then used to calculate EC-50 values.

The bioluminescence of bacteria at the start of the exposures was always within the acceptability limits for the test (90 to 110 percent in the control). Therefore, the Microtox® tests met the acceptability criteria recommended in Johnson and Long (1998).

A wide range in the EC50 values was observed with exposure to the Calcasieu sediments in the Microtox® test (0.15 to 37). The results were put into three

categories, low risk, indeterminate risk, and high risk. These categories are defined as:

- **Low Risk** – EC-50 less than 1.12 – effects that were observed or predicted to occur within a sample, reach, or an area that were similar to those of the reference areas
- **Indeterminate Risk** – EC-50 between 1.12 and 1.26 – effects that were observed or predicted to occur within a sample, a reach, or area that were moderately higher in frequency or magnitude than those of the reference areas
- **High Risk** – EC-50 greater than 1.26 – effects that were observed or predicted to occur within a sample, a reach, or areas that were substantially higher than those for the selected reference area

Exhibit 12-7 Microtox® EC-50 Data Summary

Area (No. of Samples)	Low < 1.12	Indeterminate 1.12 – 1.26	High > 1.26
Bayou d'Inde (32)	26	0	5
Bayou Verdine (10)	6	0	4
Upper Calcasieu (29)	26	0	3
Lower Calcasieu (15)	12	0	3
Reference (15)	14	0	0

As illustrated in Exhibit 12-7, the results indicate that exposure to whole sediments from the Calcasieu estuary poses variable risks to the microbial community, with the highest posed to the microbial community in Bayou Verdine, followed by Bayou d'Inde, and Lower Calcasieu. (CDM 2002c)

12.5 Porewater Toxicity Testing

Fifty of the 100 stations were selected for porewater toxicity evaluation to determine if there were adverse effects to survival, growth, and reproduction of aquatic plants, benthic invertebrate, and benthic or pelagic fish associated with porewater from contaminated sediments from the Calcasieu Estuary. The three tests that were conducted and their endpoints included:

- **Porewater toxicity testing with Algal zoospores** – 96-hour (h) porewater toxicity test determined with Algal zoospore using sea lettuce, *Ulva fasciata, thalli*; endpoint: germination or growth
- **Porewater toxicity testing with sea urchins** – 30-minute or 48-h toxicity test determined using the sea urchin *Arbacia punctulata*; endpoint: fertilization test and the embryological development
- **Porewater toxicity testing with redfish embryos** – 48-h porewater toxicity tests with redfish (*Sciaenops ocellatus*) embryos; endpoint: hatching success and survival

Exhibit 12-8 - Observed incidence of toxicity (IOT) summary to benthic invertebrates, aquatic plants, and fish to porewater from contaminated sediments

Area of Concern	N	IOT Benthic (percent)	IOT Aquatic Plants (percent)	IOT Fish (percent)	Risk
Bayou d'Inde	15	13	27	0	Low
Bayou Verdine	5	NA	NA	NA	NA
Upper Calcasieu	15	7	20	0	Low
Lower Calcasieu	8	25	13	0	Low
Reference	7	0	14	0	Low

NA – Not Available

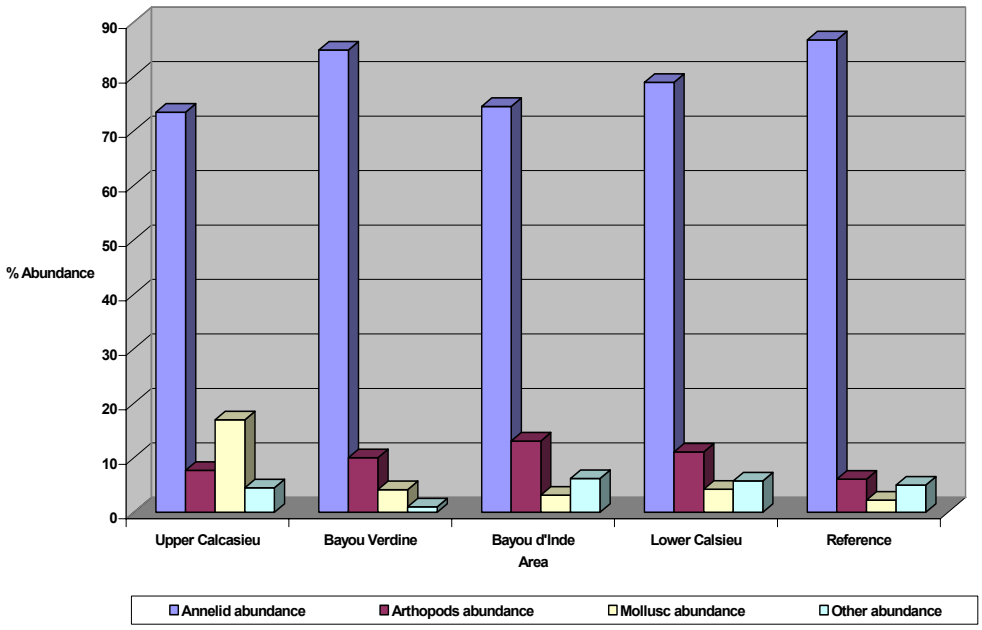
Based on the results from these tests, Exhibit 12-8 illustrates that when considered together the three lines of evidence indicate that exposure to porewater is generally not adversely affecting the survival, growth, and reproduction of aquatic plants, benthic invertebrate, and benthic or pelagic fish.

12.6 Benthic Community Survey

Estuaries of southwestern Louisiana may be characterized as vertically well mixed, with wide annual salinity fluctuations, weak tidal flushing, fine sediments (often approaching 100 percent silt/clay content), and widespread low oxygen of bottom waters during warm months (Gaston and Nasci 1988). Macrofaunal density of the region is typically modest by comparison with U.S. East-coast estuaries (e.g., Chesapeake Bay, Delaware Bay, Raritan Bay) and larger estuaries of the Gulf of Mexico (e.g., Mobile Bay, Galveston Bay). As is characteristic of macrobenthos, diversity and density values vary with numerous metrics, particularly natural environmental gradients and sediment contamination.

There were 3,408 macrobenthic organisms identified during the present study, distributed among 62 taxa. Exhibit 12-9 shows that most of the organisms were annelids (26 taxa; 77.8 percent of the specimens) and arthropods (22 taxa; 11.3 percent of the specimens). Only 11 taxa of molluscs were collected (7.7 percent of the specimens). No echinoderms were collected. Nemerteans, hydroids, and urochordates made up the remaining organisms (3.3 percent).

Exhibit 12-9 Benthic Community Survey Comparison by AOC



The species list closely resembled one reported for the region by Gaston and Nasci (1988), following their study 15 years earlier, and is characteristic of the fauna that inhabit upper reaches of Louisiana estuaries.

Abundance data for this study were comparable to values reported for the region by previous investigators (Gaston and Nasci 1988, Gaston and Young 1992). Data by station, however, ranged widely in the current study. For instance, many of the samples from Bayou d'Inde had very few organisms or very low mean total abundance per site while one station on that bayou supported 4,258 organisms/0.5 m^2). Gaston and Young (1992) also reported that many sites in Bayou d'Inde were devoid of macrofauna and attributed this paucity to contaminant effects. They also collected fewer organisms in Bayou d'Inde than elsewhere (Bayou Verdine and Contraband Bayou).

Densities of macrobenthos on Contraband Bayou in this study averaged 377 organisms/0.5 m^2. Previous studies (Gaston and Nasci 1988; Gaston and Young 1992) reported 270-macrobenthic organisms/ 0.5 m^2 in Contraband Bayou. Values for middle and lower Bayou d'Inde averaged 472/ 0.5 m^2 (previous study = 156/ 0.5 m^2). Macrobenthos of lower Bayou Verdine averaged 738/ 0.5 m^2 (previous study = 226/ 0.5 m^2). It should be mentioned that these data (current and previous studies) were not collected at the same sites.

Highest densities of macrobenthos occurred at reference sites (Choupique Bayou = 2,267/0.5 m^2; Johnson Bayou = 2,651/0.5 m^2) and Moss Lake (3,140/0.5 m^2), Prien Lake (2,207/0.5 m^2), upper Calcasieu River – Clooney Island to Coon Lake (2,059/0.5 m^2), and lower Bayou d'Inde – (2,049/0.5 m^2). Previous investigations of Choupique Bayou reported densities of 1,326/0.5 m^2 (Gaston and Nasci 1988). Gaston and Nasci sampled primarily in the salt-marsh creeks of lower Choupique Bayou, whereas the current study had more sites along intermediate marshes and adjacent to upland areas. The previous study did not sample in Johnsons Bayou, Prien Lake, or Moss Lake.

Lowest densities of macrobenthos occurred in upper Bayou d'Inde (56/0.5 m^2), lower Bayou d'Inde (123 organisms/0.5 m^2), lower Bayou d'Inde – lower PPG canal (130/0.5 m^2), and a reference site in Grand Bayou (141/0.5 m^2).

The Index of Biotic Integrity was assessed by region to make predictions of likelihood of contaminant effect on macrobenthic communities. Lowest values for the index (indicating a likelihood of contaminant effect) occurred at sites in upper Bayou d'Inde, middle Bayou d'Inde, and lower Bayou d'Inde; Bayou Olsen; and Coon Island Loop. Most of these sites supported very few organisms; and nearly all of the specimens collected were indicators of the highest levels of contamination.

Highest values for the Index of Biotic Integrity (indicative of low levels of contamination) occurred at reference sites on Johnson's Bayou, two sites in Clooney Island Loop and single sites in Moss Lake, Prien Lake, upper Calcasieu River, lower Bayou d'Inde, and Coon Island Loop. Most of these sites supported a moderate diversity of species and relatively high abundances of macrobenthos.

Values for the Index of Biotic Integrity indicated that much of the region might be contaminated with metals and organic compounds. Most of the organisms collected were indicative of high metal and organic-contaminated sediments. Few of the organisms collected were indicators of uncontaminated conditions. The low index values for stations in close proximity to industrial development were particularly distressing. They are indicative of low abundance, low species diversity, and presence of macrobenthic species known to inhabit sediments contaminated with metals, petroleum products, and other organic pollutants.

12.7 Toxicity Identification Evaluation

Phase II sediment samples were collected from seven locations in support of EPA Region 6 TMDL study as part of the current 303(d) listing. Based on the 303(d) list, a draft TMDL is to be developed for the Calcasieu Estuary.

The purpose of the TMDL is to determine the pollutant loading that a water body can assimilate without exceeding the water quality standard for that pollutant. In support of the TMDL, a TIE was performed. The TIE method aids the TMDL determination by identifying which compound or compound groups result in toxicity to test organisms. A draft report for the TMDL study can be found in Appendix I.

The TIE methodology involved manipulation of the physical/chemical properties of sediment porewater samples to target each of the major classes of contaminant compounds. The process entails stepwise removal of each class of compounds and subsequent toxicity testing. This approach provides evidence to correlate contaminant classes with observed changes in toxic effects.

Toxicity results indicate that six of the seven sediments exhibited toxicity to both species. TIE findings for amphipods and mysids are in generally good agreement, and the results are consistent with sediment toxicity results. Exhibit 12-10 summarizes the findings from the TIE for the primary COPCs for sediment, particulate, and/or porewater.

Exhibit 12-10 Summary of Findings from the Toxicity Identification Evaluation (TIE)

Areas of Concern	COPCs
Middle Bayou d'Inde	Cu, Zn, Ni
Lower Bayou d'Inde	Cu, Zn, Ni
Lower Bayou Verdine	Cu, Zn, Ni, Pb, Cr
Prien Lake	Cu, Zn, Ni, NH_4
Citgo Pond (Indian Marais Lagoon)	Cu, Zn, Ni. Pb, NH_4
Bayou Olsen	Cu, Zn
Coon Island Loop (NE)	Cu, Zn, Ni, NH_4

TIE results also indicate that specific contaminant classes caused acute toxicity and that sediment loads (via porewater flux) may be considered sources that may contribute to toxicity in the water column. The TIE study provides evidence relating site-specific contaminants and contaminant classes to observed adverse effects in benthic species. The TIE results may be applied to determine load limit requirements for protection of benthic habitat.

Section 13
Baseline Ecological Risk Assessment Summary

13.1 Introduction

This section summarizes the evaluation of the risks to ecological receptors (i.e., aquatic organisms and aquatic-dependent wildlife) posed by exposure to environmental media (i.e., water, sediment, or biota) in the Calcasieu Estuary (Figure 13-1). More specifically, risks to the microbial community associated with exposure to COPCs in whole sediments were evaluated. In addition, risks to the aquatic plant community associated with exposure to COPCs in surface water or porewater from Calcasieu Estuary sediments were assessed. The risks to the benthic invertebrate community associated with exposure to COPCs in whole sediments and porewater were also evaluated. Furthermore, risks to benthic and pelagic fish associated with exposure to COPCs in surface water, porewater, whole sediments, and prey organisms were assessed. Finally, risks to aquatic-dependent wildlife (i.e., birds and mammals) were evaluated based on their potential exposure to COPCs in prey organisms. More details can be found in the *Calcasieu Estuary Remedial Investigation/Feasibility Study: Baseline Ecological Risk Assessment*, September 2002, MESL/CDM (CDM 2002c), and the BERA for Bayou Verdine that was conducted for Conoco, Inc. and Condea Vista which is presented in a separate document (Entrix 2001).

13.2 Study Objectives

The goal of this study was to assess the risks to aquatic organisms and aquatic-dependent wildlife exposed to environmental media in the Calcasieu Estuary. The primary objectives of this study were to:

- Determine if adverse effects on ecological receptors are occurring, or are likely to be occurring, within the Calcasieu Estuary
- Evaluate the nature, severity, and area extent of any such effects
- Identify the substances that are causing or substantially contributing to effects on aquatic receptors (i.e., contaminants of concern; COCs)

13.3 Study Approach

A step-wise approach was used to assess the risks to aquatic organisms (i.e., microorganisms, aquatic plants, benthic invertebrates, and/or fish) and aquatic-dependent wildlife associated with exposure to COPCs in the Calcasieu Estuary. The five main steps in this process include:

- Identification of assessment endpoints, risk questions and testable hypotheses, and measurement endpoints
- Collection, evaluation, and compilation of the relevant information on environmental conditions in the Calcasieu Estuary
- Assessment of the exposure of aquatic organisms and aquatic-dependent wildlife to COPCs (i.e., exposure assessment; Figure 13-2)
- Assessment of the effects of COPCs on aquatic organisms and aquatic-dependent wildlife (i.e., effects assessment; Figure 13-3)
- Characterization of risks to the aquatic organisms and aquatic-dependent wildlife (i.e., risk characterization; Figure 13-4)

The procedures used in this BERA to evaluate the nature, severity, and areal extent of risks to ecological receptors in the Calcasieu Estuary are briefly described below and can be found in more detail in *Calcasieu Estuary Remedial Investigation/Feasibility Study: Baseline Ecological Risk Assessment*, September 2002, MESL/CDM (CDM 2002c).

As a first step, assessment endpoints, risk questions and testable hypotheses, and measurement endpoints were identified. In this context, an assessment endpoint was defined as an explicit expression of the environmental value that is to be protected, whereas, a measurement endpoint is defined as a measurable ecological characteristic that is related to the valued characteristic that is selected as the assessment endpoint (USEPA 1997). To facilitate this process, a BERA workshop was convened in Lake Charles, LA in September 2000. The results of this workshop provided a basis for identifying preliminary assessment endpoints and priority measurement endpoints to support the BERA (MacDonald *et al.* 2000a). Subsequently, additional information on the sources, fate and transport, and ecological effects, of COPCs was compiled in a baseline problem formulation (BPF) report (CDM 2001). Potential exposure pathways and ecological receptors potentially at risk were also identified in the BPF. Integration of this information in the conceptual model for the site provided a base for linking assessment endpoints to measurement endpoints with a series of risk questions and testable hypotheses (Figure 13-5). The assessment endpoints that were considered in the BERA included:

- Activity of the aquatic microbial community
- Survival, growth, and reproduction of aquatic plants
- Survival, growth, and reproduction of benthic invertebrates
- Survival, growth, and reproduction of benthic and pelagic fish
- Survival and reproduction of aquatic-dependent birds

- Survival, growth, and reproduction of aquatic-dependent mammals

In the second step of the process, the relevant information on environmental conditions in the Calcasieu Estuary generated in Phase I and Phase II of the RI was collected, evaluated, and compiled. The data on surface-water quality consisted primarily of information on the levels of conventional variables (e.g., ammonia), metals, and organic substances [e.g., PAHs, PCBs, organochlorine pesticides (OC pesticides)]. The data on sediment quality conditions included whole-sediment chemistry, whole-sediment toxicity, porewater chemistry, porewater toxicity, and benthic invertebrate community structure. In addition, data were compiled on the concentrations of COPCs in fish and shellfish from the study area. All of the relevant information was compiled in relational database format.

In the third step of the process, the exposure of ecological receptors to COPCs was evaluated. Exposure is the contact or co-occurrence of a contaminant and a receptor (Suter *et al.* 2000). The exposure assessment was intended to provide an estimate of the magnitude of exposure of receptors to COPCs over time and space. Exposure of the microbial community to COPCs was evaluated using the data on whole-sediment chemistry. By comparison, data on surface-water and porewater chemistry were used to assess exposure of aquatic plants to COPCs. For benthic invertebrates, exposure was evaluated using data on whole-sediment and porewater chemistry. Exposure of the fish community to COPCs was assessed using data on surface-water, porewater, whole-sediment, and tissue chemistry. Finally, data on the concentrations of COPCs in the tissues of fish and shellfish were used to assess exposure of aquatic-dependent birds and mammals to COPCs.

In the analysis of effects, risk assessors determine the nature of toxic effects that are associated with exposure to contaminants and their magnitude as a function of exposure (Suter *et al.* 2000). Information on the effects of environmental contaminants may be acquired from the results of single chemical toxicity tests (e.g., spiked sediment toxicity tests), ambient media toxicity tests (e.g., the results of toxicity tests conducted using sediments collected from the site under investigation), and/or biological surveys (e.g., benthic invertebrate community assessments). In this investigation, the effects of COPCs were evaluated using toxicity thresholds for surface water (i.e., for aquatic plants and fish), toxicity thresholds for whole-sediment chemistry (i.e., for microorganisms, benthic invertebrates, and fish), toxicity thresholds for porewater chemistry (i.e., for aquatic plants, benthic invertebrates, and fish), and toxicity reference values (i.e., for birds and mammals). The toxicity thresholds for whole sediments were evaluated to determine their relevance for assessing sediment quality conditions in the Calcasieu Estuary. The results of this evaluation indicated that site-specific concentration-response models were needed to assess the effects on benthic invertebrates associated with exposure to contaminated sediments. The resultant models were used to assess the effects of sediment-associated COPCs on the benthic invertebrate community.

In the final step of the process, the exposure and effects assessments were integrated to determine if significant effects are occurring or are likely to occur at the site under investigation. In addition, the nature, magnitude, and areal extent of effects on the selected assessment endpoints were described. The substances that are causing or substantially contributing to such effects (termed COC) were then identified from COPCs. Initially, the results that were obtained for each line of evidence (e.g., whole-sediment chemistry) were compiled and interpreted separately. Subsequently, an evaluation of the uncertainty in the analyses was conducted to determine the level of confidence that could be placed on the results for the individual lines of evidence and for integrating multiple lines of evidence into an overall assessment of risks to a particular receptor group (e.g., benthic invertebrates). Finally, the various lines of evidence were considered together to establish a weight of evidence for assessing risks to the assessment endpoint under consideration. In this latter assessment, the available data were integrated by calculating a final risk score for each location based on multiple lines of evidence. The final risk scores were then used to classify risks at each location into one of three categories including:

- Low (i.e., risks similar to those for reference conditions)
- Indeterminate (i.e., elevated risks relative to reference conditions, decisions on remedial actions should consider multiple factors)
- High (i.e., risks substantially elevated relative to reference conditions, remedial actions likely required to mitigate risks)

13.4 Assessment of Risks to Aquatic Receptors

In this investigation, the risks to four groups of aquatic organisms posed by exposure to COPCs in the Calcasieu Estuary were assessed. The receptors groups that were considered in this evaluation included the microbial community, aquatic plant community, the benthic invertebrate community, and the fish community. For each receptor group, an assessment was conducted to determine if adverse effects are occurring, or are likely to be occurring, within the Calcasieu Estuary. In addition, the nature, severity, and areal extent of such effects were evaluated. Finally, the substances that are causing or substantially-contributing to such effects (i.e., COCs) were identified.

13.4.1 Microbial Community

The risks posed to microbial communities by exposure to whole sediments were assessed in the Calcasieu Estuary. In total, information on two lines of evidence was used to determine if the activity of the aquatic microbial community (i.e., the assessment endpoint) has been adversely affected or is likely to have been adversely affected by exposure to sediments in the estuary relative to reference conditions. The two lines of evidence that were considered in the assessment included whole-sediment chemistry and whole-sediment toxicity. The measurement endpoints for

this assessment included the concentrations of COPCs in whole sediments and bioluminescence of the baterium, *Vibrio fisheri*, in solid phase tests.

The results of this assessment indicated that exposure to whole sediments from the Calcasieu Estuary posed variable risks to microbial communities (i.e., risks were classified as low for 51 percent and indeterminate for 49 percent of the 624 sediment samples collected within the three AOCs investigated; Table 13-1). Of the three AOCs considered, the risks to the microbial community were highest in Bayou d'Inde (Figures 13-6 to 13-10). Within this AOC, sediment samples from the lower portions of upper Bayou d'Inde, middle Bayou d'Inde, lower Bayou d'Inde mainstem, and Lockport Marsh posed the highest risks to the microbial community (Figure 13-7). Although risks to the microbial community were generally lower in the UCR AOC and MCR AOC, sediments posing indeterminate risks were identified in the northern portions of Clooney Island Loop; Clooney Island barge slip; the northern, central, and southern portions of Coon Island Loop; the western shoreline of middle Calcasieu River mainstem from Bayou d'Inde to Moss Lake; Moss Lake; Prien Lake; Indian Wells Lagoon; and portions of the old river channel within the Middle Calcasieu River Mainstem reach (Figures 13-6 to 13-9). Risks to the microbial community are generally low throughout the reference areas, with the exception of certain portions of Bayou Choupique (Figure 13-10).

The results of the biological investigations conducted during the RI indicate that the magnitude of effects tends to increase with increasing risk to the microbial community. The average EC_{50}-bioluminescence was 11.1$\pm$8.4 percent sediment wet weight/mL (n=84) for the whole-sediment samples that were classified into the low risk category. For the samples that were classified into the indeterminate risk category, a mean EC_{50}-bioluminescence of 0.5$\pm$0.3 percent sediment wet weight/mL (n=5) was calculated. Together, these results demonstrated that the metabolism of microorganisms is impaired in response to exposure to contaminated sediments at certain locations in the Calcasieu Estuary.

The results of this assessment indicated that a number of substances are causing or substantially contributing to adverse effects on the microbial community in the Calcasieu Estuary (i.e., relative to reference conditions). More specifically, the COCs were considered to include:

- PAHs [1,1-biphenyl, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, total low molecular weight-PAHs (LMW-PAHs), benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, total high molecular weight-PAHs (HMW-PAHs), and total PAHs]

- PCBs (total PCBs)

- Phthalates [bis(2-ethylhexyl)phthalate; BEHP]

13.4.2 Aquatic Plant Community

The risks posed to aquatic plant communities by exposure to surface water and porewater were assessed in the Calcasieu Estuary. In total, information on three lines of evidence was used to determine if the survival, growth, or reproduction of aquatic plants (i.e., assessment endpoints) was being adversely affected or was likely to be adversely affected by exposure to COPCs in the estuary (i.e., relative to reference conditions). The three lines of evidence that were considered in the assessment included: surface-water chemistry, porewater chemistry and porewater toxicity. The measurement endpoints for this assessment included concentrations of COPCs in surface water, the concentrations of COPCs in porewater, and germination rate of algae zoospores, germling length, and cell number of the macrophyte, *Ulva fasciata*, in porewater toxicity tests.

The results of this BERA indicated that exposure to surface water and/or porewater from the Calcasieu Estuary generally posed low risks to aquatic plant communities (i.e., risks were classified as low for 72 percent of the 130 samples collected within the three AOCs investigated; Table 13-2; Figures 13-6 to 13-10). However, indeterminate and high risks to the aquatic plant community were indicated for 5 percent (6 of 130) and 24 percent (31 of 130) of the samples, respectively (Table 13-2). Of the three AOCs considered, the risks to the aquatic plant community were highest in Bayou d'Inde (Figure 13-7). Within this AOC, samples from the upper and lower portions of upper Bayou d'Inde, Maple Fork, PPG Canal, and the central and southeastern portions of Lockport Marsh posed the highest risks. Although risks to the aquatic plant community were generally lower in the UCR AOC and MCR AOC, samples posing high risk are present in the eastern and southwestern portions of Clooney Island Loop, Clooney Island Barge Slip, the southeastern and southwestern portions of Coon Island Loop, the mouth of Bayou Verdine, old river channel downstream of Prien Lake, west-central portion of Moss Lake, southern side of Contraband Bayou in the vicinity of Charvais Drive, southeastern portion of Lake Charles, and Indian Wells Lagoon (Table 13-2; Figures 13-6 to 13-9). Risks to the aquatic plant community are generally low at the locations sampled in the reference areas, with the exception at lower Bayou Boise Connine and the central portion of Grand Bayou (Figure 13-10).

The results of the biological investigations conducted during the RI indicate that the magnitude of effects tends to increase with increasing risk to the aquatic plant community. For example, the germination of algal zoospores was lower in the samples that were designated as indeterminate (60±32 percent; n=3) and high (37±20 percent; n=6) risk than was the case for the low risk samples (88±7 percent; n=36). Likewise, growth rates tended to be highest for the samples that were designated as posing low risks to the aquatic plant communities. These results demonstrate that the survival, growth, and reproduction of aquatic plants are impaired in response to exposure to surface water or porewater at certain locations in the Calcasieu Estuary.

The results of this assessment indicated that a number of substances are causing or substantially contributing to adverse effects on the aquatic plant community in the

Calcasieu Estuary (i.e., relative to reference conditions). More specifically, the COCs that were considered to include:

- Total ammonia
- Metals (dissolved copper and total and dissolved nickel)
- Benz(a)anthracene

13.4.3 Benthic Invertebrate Community

The risks to benthic invertebrate communities posed by exposure to whole sediments and porewater were assessed in the Calcasieu Estuary. In total, information on five lines of evidence was used to determine if the survival, growth, or reproduction of benthic invertebrates (i.e., the assessment endpoints) has been adversely affected or is likely to have been adversely affected by exposure to contaminated sediments in the estuary relative to reference conditions. The five lines of evidence that were considered in the assessment included whole-sediment chemistry, whole-sediment toxicity, porewater chemistry, porewater toxicity, and benthic invertebrate community structure. The measurement endpoints in this assessment included the concentrations of COPCs in whole sediment; the concentrations of COPCs in porewater; the survival and growth of amphipods, *Hyalella azteca*, in whole-sediment toxicity tests; the survival of amphipods, *Ampelisca abdita*, in whole-sediment toxicity tests; gamete fertilization and embryo development in sea urchins, *Arbacia punctulata*, in porewater toxicity tests; the abundance of pollution sensitive species; the abundance of pollution tolerant species; total abundance of benthic macroinvertebrates; species richness; and macrobenthic index of biotic integrity.

The results of this assessment indicated that exposure to whole sediment and/or porewater from the Calcasieu Estuary generally posed low risks to benthic invertebrate communities (i.e., risks were classified as low for 68 percent of the locations sampled (423 of 624) within the three AOCs investigated (Figures 13-6 to 13-10). However, indeterminate and high risks to the benthic invertebrate community were indicated for 9 percent (58 of 624) and 23 percent (143 of 624) of the locations sampled, respectively (Table 13-3). Of the three AOCs considered, the risks to the benthic invertebrate community were highest in Bayou d'Inde based both on the incidence and magnitude of toxicity (i.e., observed and predicted; Figure 13-7). Within this AOC, samples from the lower portions of upper Bayou d'Inde, middle Bayou d'Inde, PPG Canal, and the inner portions of Lockport Marsh posed the highest risks. Although risks to the benthic invertebrate community were generally lower in the UCR AOC and MCR AOC, samples posing a high risk to benthic invertebrates were collected from the northern portions of Clooney Island Loop, the northern portions of Coon Island Loop, the middle Calcasieu River in the vicinity of the Citgo property, and Indian Wells Lagoon (Table 13-3; Figures 13-6 to 13-9). Risks to the benthic invertebrate community are generally low throughout the reference areas (Figure 13-10).

The results of the biological investigations conducted during the RI indicate that the magnitude of effects tends to increase with increasing risk to the benthic invertebrate community. For example, the survival and/or growth of freshwater and marine amphipods was lower for the locations that were designated as posing indeterminate and high risks than was the case for the locations that were classified as posing low risk to benthic invertebrates (Table 13-4). Likewise, the fertilization of sea urchin gametes was reduced in the samples from locations that were designated as posing indeterminate or high risks to the benthic community (Table 13-4). Importantly, the density of pollution indicator (i.e., tolerant) species, the density of pollution sensitive species, species richness, and total abundance of benthic invertebrates were generally lower for the sampling locations that were classified as posing indeterminate and high risks, as compared to the sampling locations that posed low risks to benthic invertebrates (Table 13-4). Together, these results demonstrate that the survival, growth, and reproduction of benthic invertebrates have been impaired in response to exposure to contaminated sediments in the Calcasieu Estuary.

The results of this assessment indicated that a number of substances are causing or substantially contributing to adverse effects on the benthic invertebrate community in the Calcasieu Estuary (i.e., relative to reference conditions). More specifically, the COCs included:

- Hydrogen sulfide
- Metals (chromium, copper, lead, mercury, nickel, and zinc)
- PAHs (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, phenanthrene, total LMW-PAHs, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, total HMW-PAHs, and total PAHs)
- PCBs (total PCBs)
- Chlorinated benzenes [hexachlorobenzene (HCB), hexachloro-1,3-butadiene (HCBD)]
- Phthalates (BEHP)
- OC pesticides (aldrin and dieldrin)
- Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) [(total 2,3,7,8-tetrachlorodibenzo-*p*-dioxin toxic equivalents (total 2,3,7,8-TCDD TEQs)]

13.4.4 Fish Community

The risks posed to fish communities by exposure to surface water, whole sediments, and porewater, and all exposure routes (i.e., based on tissue chemistry) combined

were assessed in the Calcasieu Estuary. In total, information on four lines of evidence was used to determine if the survival, growth, or reproduction of fish was being adversely affected or was likely to be adversely affected by exposure to surface water or sediments in the estuary relative to reference conditions. The four lines of evidence that were considered in the assessment included: surface-water chemistry, porewater chemistry, whole-sediment chemistry, and porewater toxicity. In addition, tissue chemistry was also used to assess the effects of bioaccumulative COPCs (i.e., total PCBs) that accumulate in fish tissues from all exposure routes. In this assessment, the measurement endpoints included the concentrations of COPCs in surface water; the concentrations of COPCs in whole sediment; the concentrations of COPCs in porewater; the concentrations of COPCs in the tissues of carnivorous fish; and the hatching success and survival of redfish, *Sciaenops ocellatus*, eggs, and larvae in porewater toxicity tests.

The results of this BERA indicated that exposure to surface water, whole sediments, or porewater from the Calcasieu Estuary generally poses low risks to fish communities. Risks to fish were classified as low for 58 percent of the sediment samples (i.e., 367 of 634) collected within the three AOCs investigated; Figures 13-6 to 13-10). However, indeterminate and high risks to the fish community were indicated for 5 percent (33 of 634) and 37 percent (234 of 634) of the samples, respectively (Table 13-5). Of the three AOCs considered, the risks to the fish community were highest in Bayou d'Inde. Within this AOC, samples from the lower portions of upper Bayou d'Inde, middle Bayou d'Inde, the central portions of Lockport Marsh, and lower Bayou d'Inde mainstem posed the highest risks. Although risks to the fish community were generally lower in the UCR AOC and MCR AOC, sediments posing high risk are present in portions of Clooney Island Loop, portions of Coon Island Loop, the middle Calcasieu River in the vicinity of the Citgo and WR Grace properties, Indian Wells Lagoon, Moss Lake and west-central portion of Prien Lake (Table 13-5; Figures 13-6 to 13-9). Risks to the fish community are generally low throughout the reference areas (Figure 13-10).

Of the exposure routes examined, exposure to COPCs in whole sediments and porewater represents the most important routes for benthic and pelagic fish. Accordingly, the fish that are closely associated with sediments, such as flounder (i.e., benthic species), are the most likely to be adversely affected by COPCs in the Calcasieu Estuary. As risks to carnivorous fish associated with the accumulation of PCBs in their tissues are considered to be low, dietary exposure to COPCs may be of lesser importance.

The results of this assessment indicated that a number of substances are causing or substantially contributing to adverse effects on the fish community in the Calcasieu Estuary (i.e., relative to reference conditions). More specifically, the COCs were considered to include:

- Hydrogen sulfide

- Metals (chromium, copper, lead, mercury, nickel, and zinc)
- PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, total LMW-PAHs, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, total HMW-PAHs, and total PAHs)
- PCBs (total PCBs)
- OC pesticides (dieldrin)
- PCDDs and PCDFs (total 2,3,7,8-TCDD TEQs)

13.4.5 Integrated Risks to Aquatic Receptors

The results of this investigation indicated that exposure to COPCs is adversely affecting a variety of ecological receptors in the Calcasieu Estuary. More specifically, activity of the microbial community has been impaired in portions of the Calcasieu Estuary due to exposure to sediment-associated COPCs. In addition, the survival, growth, and/or reproduction of aquatic plants have also been adversely affected in portions of the estuary through exposure to COPCs in surface water and porewater. Furthermore, exposure to whole sediments or porewater have been adversely affected the survival, growth, and/or reproduction of benthic invertebrates. Finally, the survival, growth, and/or reproduction of benthic fish have been impaired due to exposure to COPCs in whole sediments and/or porewater (Figures 13-11 to 13-15 summarize the risks to each receptor group throughout the Calcasieu Estuary).

For each of the four aquatic receptor groups, the information for various measurement endpoints and lines of evidence were integrated by calculating a final risk score for each location sampled. Subsequently, the final risk scores that were calculated for the various receptor groups for each location were averaged to obtain an overall risk score for the four-receptor groups for each location. Then, risks to microorganisms, plants, benthic invertebrates, and fish were classified into three categories for each location, based on the overall risk score that was calculated. Locations with overall risk scores of <2, 2 to 3, and >3 were classified as posing low, indeterminate, and high risks to aquatic receptors, respectively. In this way, it was possible to integrate information on the risks posed to multiple aquatic receptors by exposure to COPCs in the Calcasieu Estuary.

The results of this assessment indicated that risks to aquatic receptors are generally low throughout the Calcasieu Estuary. Of the 634 locations that were sampled within the three AOCs, 377 (59 percent) were classified as posing low risks to microorganisms, aquatic plants, benthic invertebrates, and/or fish (Table 13-6). By comparison, 11 percent (69 of 634) and 30 percent (188 of 634) of the locations sampled were classified as posing indeterminate and high risks, respectively (Table 13-6). Among the three AOCs, the highest risks to aquatic receptors were evident in Bayou

d'Inde (Table 13-6). Risks to aquatic receptors were classified as low throughout the reference areas.

In general, there was good correspondence among the risk classifications for the four groups of aquatic receptors. For example, risks were classified as low within the three AOCs for 58 percent of the locations sampled for fish (Table 13-5) to 72 percent of the locations sampled for aquatic plants (Table 13-2). With the exception of microorganisms, the frequency of classification of indeterminate risks was generally low (i.e., 5 to 9 percent) for the various receptor groups. Similarly, the frequency of classification of high risks was comparable for three of the four aquatic receptor groups (i.e., 23 to 37 percent, with microorganisms being the exception). Risks to the microbial community were generally classified as being lower than those for the other three aquatic receptor groups because confidence in the information on the selected measurement endpoints tended to be lower for microorganisms. The degree of correspondence among the risk classifications for the various receptor groups is illustrated in Figures 13-6 to 13-10. These figures also show that correspondence was lower in certain locations, particularly within the more contaminated areas within the estuary (e.g., Clooney Island barge slip, Lockport Marsh).

Upper Calcasieu River AOC – In general, risks to aquatic receptors were low throughout the UCR AOC, as indicated by the average overall risk score of 0.81 that was calculated for this AOC. Of the 155 locations that were sampled within this AOC, 131 (85 percent) were classified as posing a low risk to microorganisms, aquatic plants, benthic invertebrates, and/or fish (Table 13-6). Nevertheless, 15 percent (i.e., 24 of 155) of the locations within this AOC were classified as posing indeterminate (5 percent; 7 of 155) or high (11 percent; 17 of 155) risks to aquatic receptors (Table 13-6). All of the locations that posed a high risk to aquatic receptors were encountered in the Clooney Island Loop (n=7) or the Coon Island Loop (n=10). The locations that posed the highest risk to aquatic receptors included the Clooney Island barge slip, the northern and north eastern portions of Clooney Island Loop, the northern and central portions of Coon Island Loop, and the mouth of Bayou Verdine (Figure 13-11).

Bayou d'Inde AOC – Risks to aquatic receptors were generally as high within the BI AOC. The average overall risk score that was calculated for this reach was 2.4 (n= 316). Forty-nine percent of the locations sampled within the BI AOC (i.e., 156 of 316) were classified as posing a high risk to microorganisms, aquatic plants, benthic invertebrates, and/or fish (Table 13-6). By comparison, 33 percent (i.e., 104 of 316) and 18 percent (i.e., 56 of 316) of the locations sampled were classified as posing low or indeterminate risks to aquatic receptors, respectively (Table 13-6). The locations that posed the highest risk to aquatic receptors (i.e., overall risk score >3) were collected in the lower portion of upper Bayou d'Inde (i.e., between the CitCon facility and the Highway 108 bridge), the mainstem and wetland areas within middle Bayou d'Inde, throughout Lockport Marsh, the lower and middle portion of PPG Canal, and lower Bayou d'Inde mainstem in the vicinity of the confluence with PPG Canal and throughout the mainstem (Figure 13-13).

Middle Calcasieu River AOC – Risks to aquatic receptors were generally classified as low with the MCR AOC. An average overall risk score of 0.73 was calculated for this portion of the study area. Based on the results that were obtained for microorganisms, aquatic plants, benthic invertebrates, and/or fish, 87 percent of the locations sampled (i.e., 142 of 163) within this AOC were classified as posing a low risk to aquatic receptors (Table 13-6). Nevertheless, 13 percent (i.e., 21 of 163) samples from this AOC were classified as posing indeterminate (4 percent; 6 of 163) or high (9 percent; 15 of 163) risks to aquatic receptors (Table 13-6). The samples that posed the highest risk to aquatic receptors were collected along the western shoreline of the middle Calcasieu River in the vicinity of the Citgo property, in Indian Wells Lagoon, Prien Lake and the central portions of Moss Lake (Figures 13-13 and 13-14).

Reference Areas – Risks to aquatic receptors were classified as low for all of the locations sampled within the reference areas. An average overall risk score of 0.55 was calculated for this portion of the study area (Table 13-6). All of the locations sampled were classified as posing low risks to aquatic receptors (Figure 13-15).

Contaminants of Concern – In this report, the COPCs that were considered to be causing or substantially contributing to adverse effects on aquatic receptors were termed COCs. The results of this assessment indicated that there are a number of substances that are adversely affecting microorganisms, aquatic plants, benthic invertebrate and/or fish (Table 13-7). In surface water, ammonia, dissolved copper, and total and dissolved nickel are considered to be COCs. In whole sediments, the COCs are considered to include metals (chromium, copper, lead, mercury, nickel, and zinc); 18 individual PAHs; total LMW-PAHs; total HMW-PAHs; total PAHs; total PCBs; aldrin; dieldrin; BEHP; HCB; HCBD; and, TCDD TEQs. The porewater COCs are considered to include hydrogen sulfide, total nickel, total zinc, 1-methlynaphthalene, benz(a)anthracene, and benzo(a)pyrene.

All of these substances occurred in whole-sediment, surface-water, and/or porewater samples from the Calcasieu Estuary at concentrations in excess of those observed in samples from reference areas and in excess of the selected benchmarks. In addition, the concentrations in the effects distribution (i.e., toxic samples) were generally higher than the concentrations in the no effects distribution (i.e., non-toxic samples) for one or more of the measurement endpoints (e.g., survival of *Ampelisca abdita* in 10-d toxicity tests). This latter evaluation was conducted to assess concordance between the chemistry and biological effects data. Many of these substances or groups of substances also accumulated in the tissues of polychaetes (*Nereis virens*) in 28-d bioaccumulation tests and were shown to be associated with toxicity to amphipods (*Ampelisca abdita)* in toxicity identification evaluations.

13.5 Assessment of Risks to Aquatic-Dependent Wildlife

The risks to five groups of aquatic-dependent wildlife posed by exposure to COPCs in the Calcasieu Estuary were assessed. The receptor groups included sediment probing birds, carnivorous wading birds, piscivorus birds, piscivorus mammals, and omnivorous mammals. For each receptor group, an assessment was conducted to

determine if adverse effects are occurring, or are likely to be occurring, in the Calcasieu Estuary. To the extent possible, the nature, severity and areal extent of such effects were evaluated, and the COPCs contributing to such effects were identified (i.e., COCs).

13.5.1 Avian Community

The risks to sediment probing, carnivorous wading, and piscivorus birds from exposure to contaminated aquatic prey were assessed for the Calcasieu Estuary. A conservative, deterministic screening ERA identified AOCs and COCs in the Calcasieu Estuary (Appendix G). The COCs identified in the deterministic assessment for birds included TCDD-TEQs, selenium, mercury, total PCBs, and lead.

For each group of aquatic-dependent birds, local receptors of concern were identified. The life history and foraging behaviors of these receptors of concern were blended to create hypothetical receptors possessing the qualities characteristic of each bird group. For example, the hypothetical receptor for piscivorus birds was based on the characteristics of the belted kingfisher, osprey, brown pelican, and Caspian, least and Forster's terns, all of which occur in the Calcasieu Estuary area. In addition to the average-sized hypothetical receptor, a small hypothetical receptor was created to account for the higher metabolic rate, and, therefore, higher exposure of smaller birds.

The probabilistic risk assessment was carried out in four steps: (1) collection, evaluation, and compilation of data, (2) exposure assessment, (3) effects assessment, and (4) risk characterization. In the first step, relevant data on COC concentrations in prey items and sediments from the Calcasieu Estuary were collected, evaluated, and compiled. These data were then incorporated into a probabilistic exposure model, calculating total daily intake of COCs for each group of aquatic-dependent birds. Monte Carlo analysis was applied to this model to account for the distribution of possible exposures. The effects characterization began with a review of the literature on effects of COCs on the survival, growth, and reproduction of aquatic-dependent birds. An appropriate effects metric was selected for each COC to be used with the results of the exposure assessment to estimate risks. The effects metrics in this assessment were expressed as a threshold range spanning sensitive and tolerant species. This range is likely to include the threshold for the receptor groups of interest. In the risk characterization step, the results of the exposure and effects characterizations were integrated to estimate the risks of each COC to each aquatic-dependent bird group in each AOC. High-indeterminate, and low-risk categories were used to express the level of risk to each group of aquatic-dependent birds.

The results of the assessment for aquatic-dependent birds indicated that there is a high risk that small hypothetical sediment probing birds will be adversely affected by exposure to selenium in the middle Calcasieu River. The risk of adverse effects are indeterminate for average-sized and small sediment probing, carnivorous wading, and piscivorus birds exposed to lead and TCDD-TEQs in all AOCs and selenium in AOCs other than the middle Calcasieu River. Mercury poses a low risk to average-sized and small sediment probing, carnivorous wading, and piscivorus birds, except

for Bayou d'Inde where it poses indeterminate risks to small piscivorus birds. Accordingly, selenium, lead, mercury, and TCDD-TEQs were identified as COCs in the Calcasieu Estuary for aquatic-dependent birds.

13.5.2 Mammalian Community

The risks to piscivorus and omnivorous mammals from exposure to contaminated aquatic prey were assessed for the Calcasieu Estuary. A conservative, deterministic screening ERA identified AOCs and COCs in the Calcasieu Estuary. The COCs identified in the deterministic assessment for mammals included TCDD-TEQs, selenium, mercury, and PCBs.

For each group of aquatic-dependent mammals, local receptors of concern were identified. The life history and foraging behaviors of these receptors of concern were blended to create hypothetical receptors possessing the qualities characteristic of each mammal group. For example, the hypothetical receptor for omnivorous mammals was based on the characteristics of the raccoon, marsh rice rat and muskrat, all of which occur in the Calcasieu Estuary area. In addition to the average-sized hypothetical receptor, a small hypothetical receptor was created to account for the higher metabolic rate, and, therefore, higher exposure of smaller mammals.

The probabilistic risk assessment was carried out in four steps: (1) collection, evaluation, and compilation of data, (2) exposure assessment, (3) effects assessment, and (4) risk characterization. In the first step, relevant data on COC concentrations in prey items from the Calcasieu Estuary were collected, evaluated, and compiled. These data were then incorporated into a probabilistic exposure model, calculating total daily intake of COCs for each group of aquatic-dependent mammals. Monte Carlo analysis was applied to this model to account for the distribution of possible exposures. The effects characterization began with a review of the literature on effects of COCs on the survival, growth, and reproduction of aquatic-dependent mammals. An appropriate effects metric was selected for each COC to be used with the results of the exposure assessment to estimate risks. The effects metrics in this assessment were expressed as benchmarks and as dose-response curves. In the risk characterization step, the results of the exposure and effects characterizations were integrated to estimate the risks of each COC to each aquatic-dependent mammal group in each AOC. High-indeterminate, and low-risk categories were used to express the level of risk to each group of aquatic-dependent mammals.

The risk characterization results showed that there is a low probability that exposure to methylmercury, TCDD-TEQs, and selenium will cause adverse effects to piscivorus and omnivorous mammals foraging in the Calcasieu Estuary. There is also a low probability of adverse effects to omnivorous mammals exposed to total PCBs. However, there is a high risk that total PCBs are causing adverse effects to average-sized and small piscivorus mammals inhabiting the Bayou d'Inde AOC of the Calcasieu Estuary. Based on the deterministic ecological risk assessment, total PCBs pose low risks to piscivorus mammals in other parts of the estuary. Accordingly, total

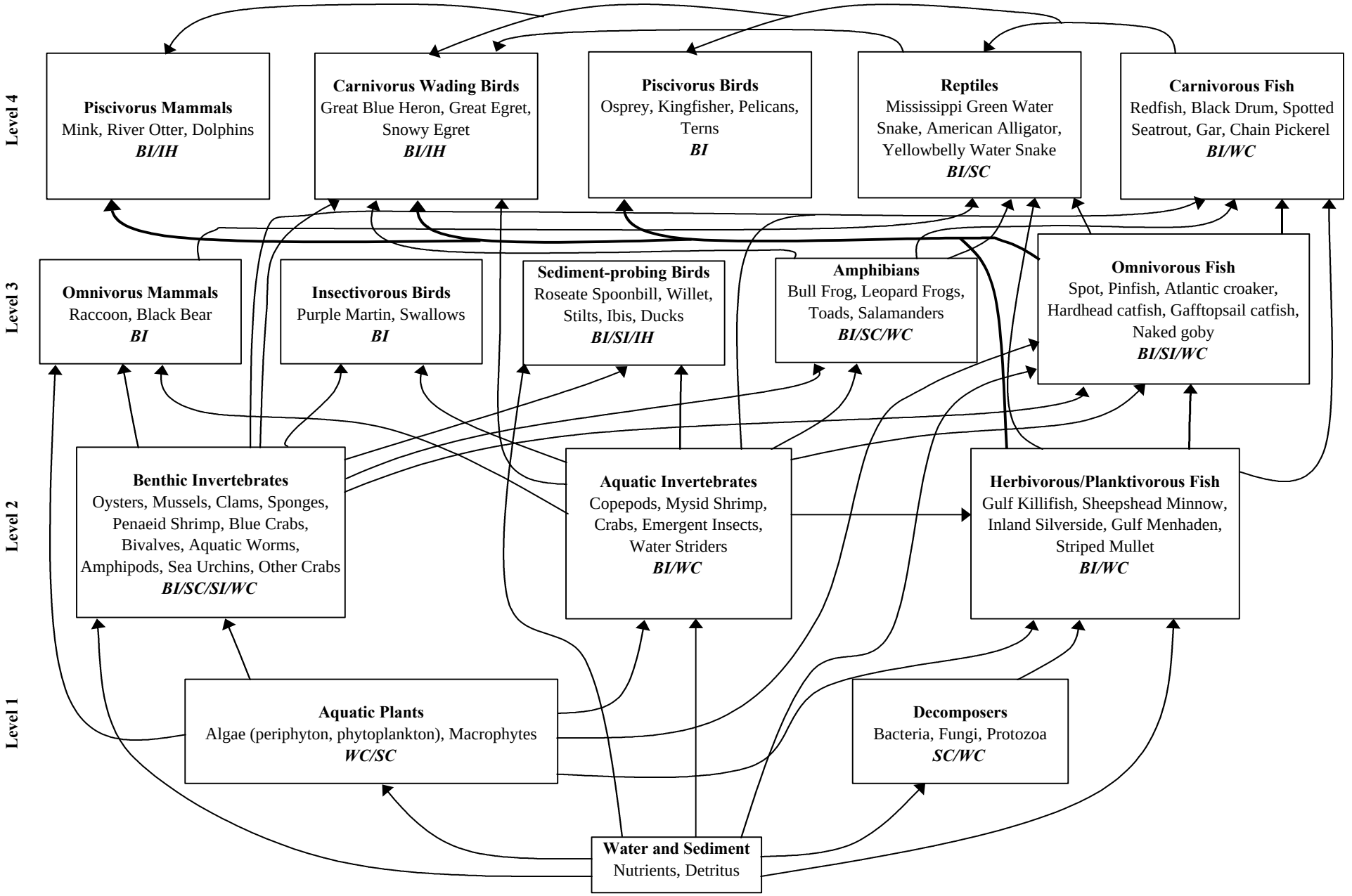
PCBs were identified as COCs in the Calcasieu Estuary for aquatic-dependent mammals.

13.6 Conclusions

In accordance with EPA (1997) guidance, the BERA of the Calcasieu Estuary was conducted following an eight-step process (see Appendix A1). The first two of these steps (i.e., the SERA) was completed in 1999 (CDM 1999). The results of the final six steps of the process are described in this document. A companion document describes the risks to human health associated with exposure to COPCs in the Calcasieu Estuary (CDM 2002b).

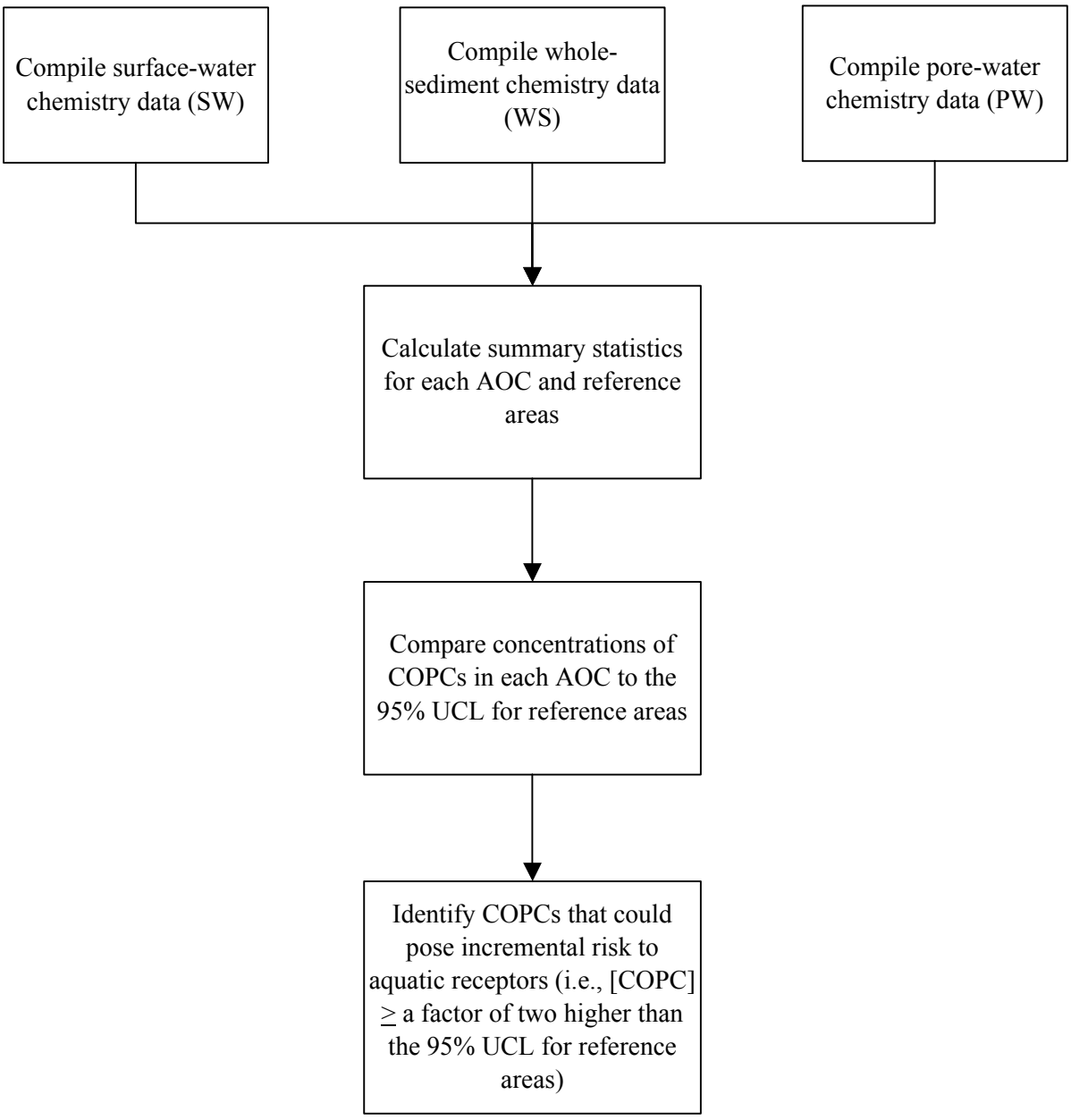
The results of this assessment indicated that the presence of COCs in surface water, whole sediments, porewater, and/or the tissues of aquatic organisms poses a risk to ecological receptors. Exposure to contaminated sediment and porewater pose risks to microorganisms, aquatic plants, benthic invertebrates, and/or fish throughout portions of the Calcasieu Estuary. Consumption of contaminated fish and shellfish also poses risks to aquatic dependent wildlife, including sediment-probing birds, carnivorous wading birds, piscivorus birds, omnivorous mammals, and/or piscivorus mammals. Collectively, the information compiled, evaluated, and analyzed to support the BERA provides a weight-of-evidence that clearly demonstrates that the presence of ammonia; hydrogen sulfide; metals (chromium, copper, lead, mercury, nickel, and zinc); PAHs (1,1-biphenyl, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, total LMW-PAHs, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, total HMW-PAHs, and total PAHs); PCBs (total PCBs), chlorinated benzenes (HCB and HCBD); phthalates (BEHP); OC pesticides (aldrin and dieldrin) and PCDDs and, PCDFs (total 2,3,7,8-TCDD TEQs) in environmental media pose unacceptable risks to ecological receptors. The information contained in this BERA and companion documents (i.e., CDM 2002b; 2002c) is intended to support decisions regarding the need for remedial actions within the Calcasieu Estuary.

Figure 13-1. The Calcasieu Estuary food web showing the principal routes of exposure to contaminated water, sediment and biota.



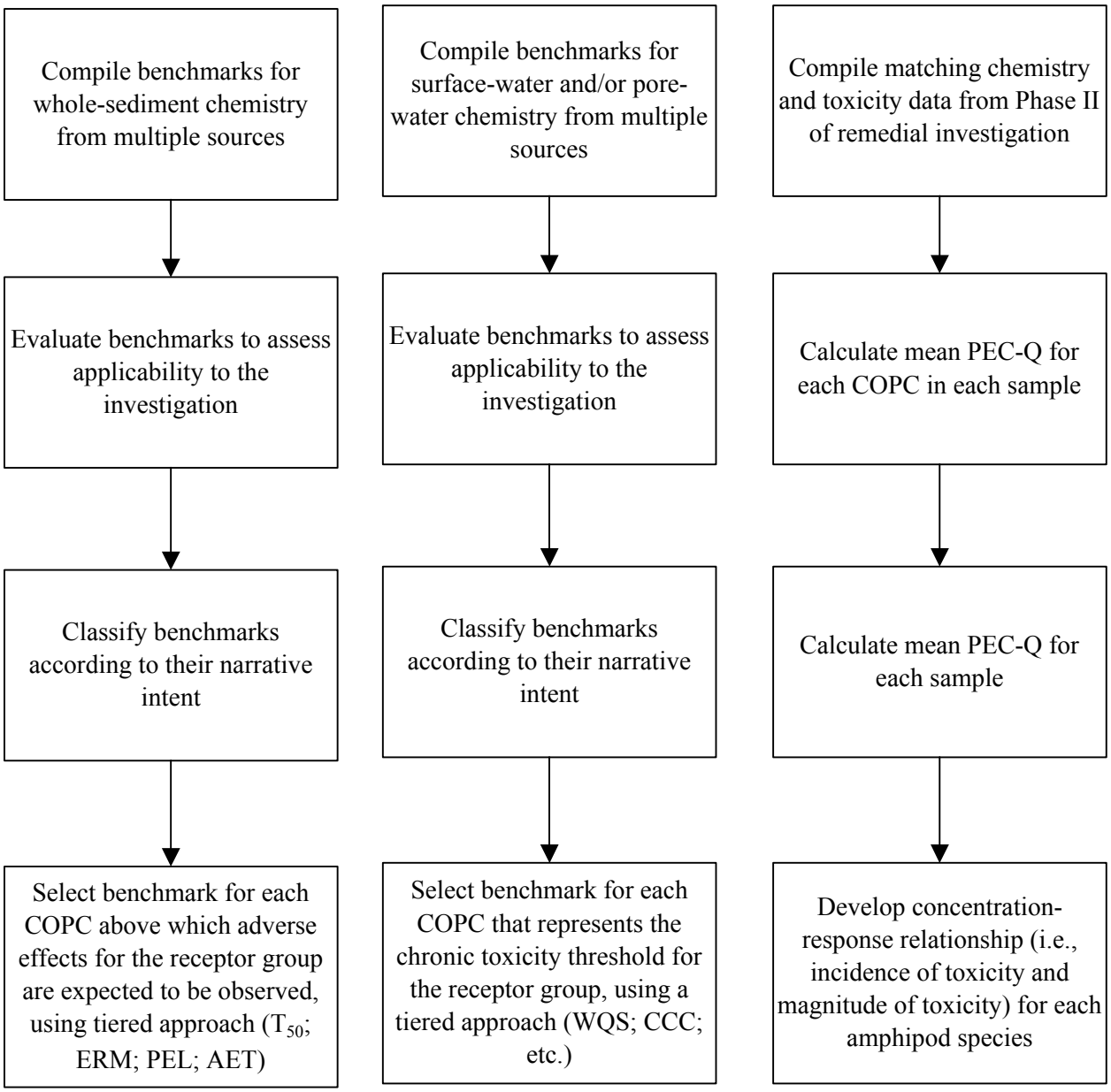
Principal Exposure Routes: BI = Biota Ingestion; WC = Water Contact; SC = Sediment Contact; SI = Sediment Ingestion; IH = Inhalation
(Note: surface waters tend to have high salinity, reducing the potential for water ingestion by ecological receptors).

Figure 13-2. Overview of the approach that was used to assess exposure of aquatic receptors to chemicals of potential concern in the Calcasieu Estuary.



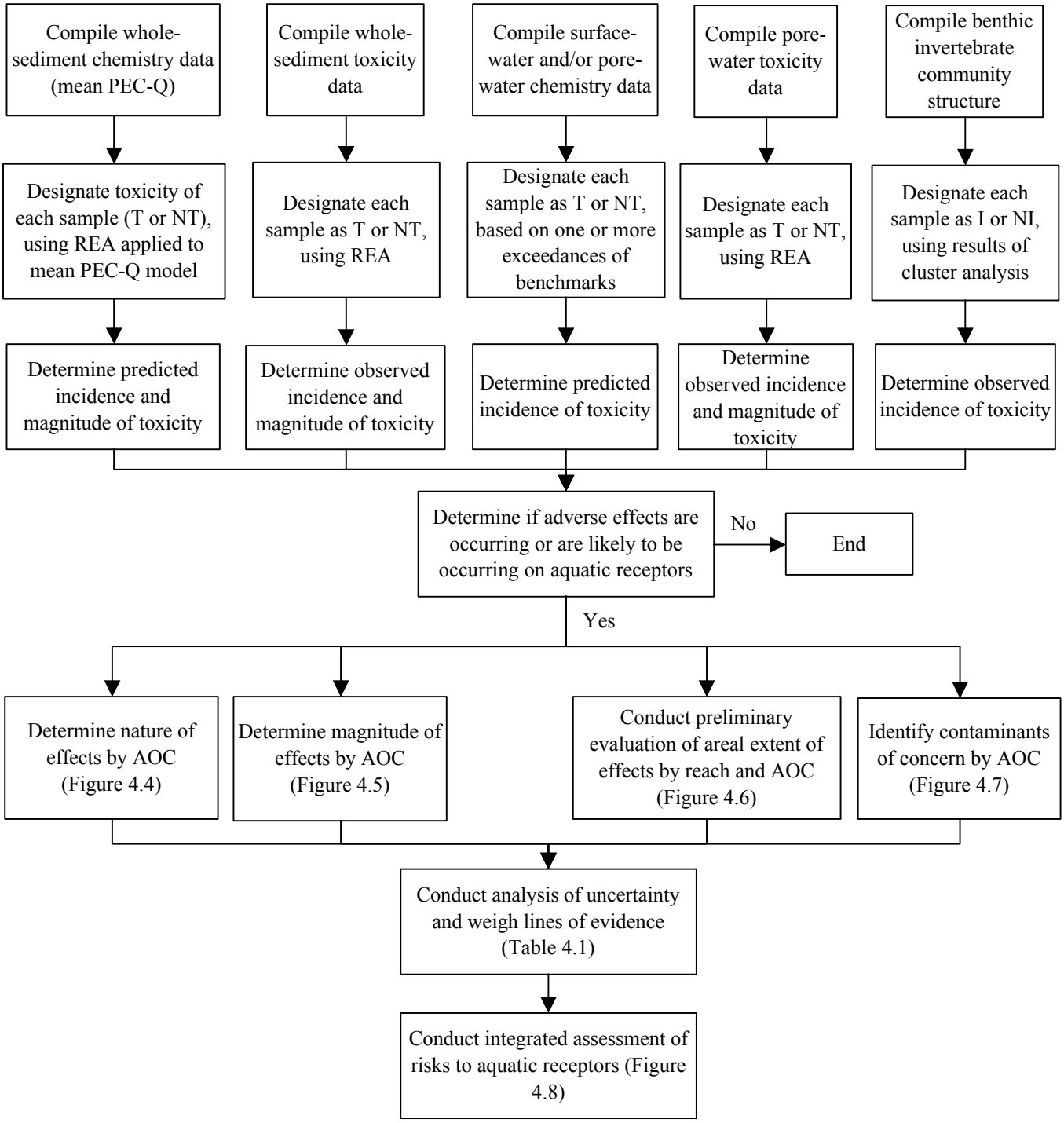
AOC = area of concern; UCL = upper confidence limit; COPCs = chemicals of potential concern.
For microbial community, exposure assessment included WS chemistry data.
For aquatic plant community, exposure assessment included SW and PW chemistry data.
For benthic invertebrate community, exposure assessment included WS and PW chemistry data.
For fish community, exposure assessment included SW, WS, and PW chemistry data.

Figure 13-3. Overview of the approach that was used to assess the effects on aquatic receptors associated with exposure to chemicals of potential concern in the Calcasieu Estuary.



AOC = area of concern; UCL = upper confidence limit; COPCs = chemicals of potential concern; PEC = probable effect concentration; ERM = effects range median; PEL = probable effect level; AET = apparent effects threshold; WQS = water quality standard; CCC = criteria continuous concentration.

Figure 13-4. Overview of the approach that was used to characterize risks to aquatic receptors associated with exposure to chemicals of potential concern in the Calcasieu Estuary.



AOC = area of concern; PEC-Q = probable effect concentration-quotient; T = toxic; NT = not toxic; REA = reference envelope approach; I = impacted; NI = not impacted.

Figure 13-5. Conceptual model diagram illustrating exposure pathways and potential effects for all categories of COPCs.

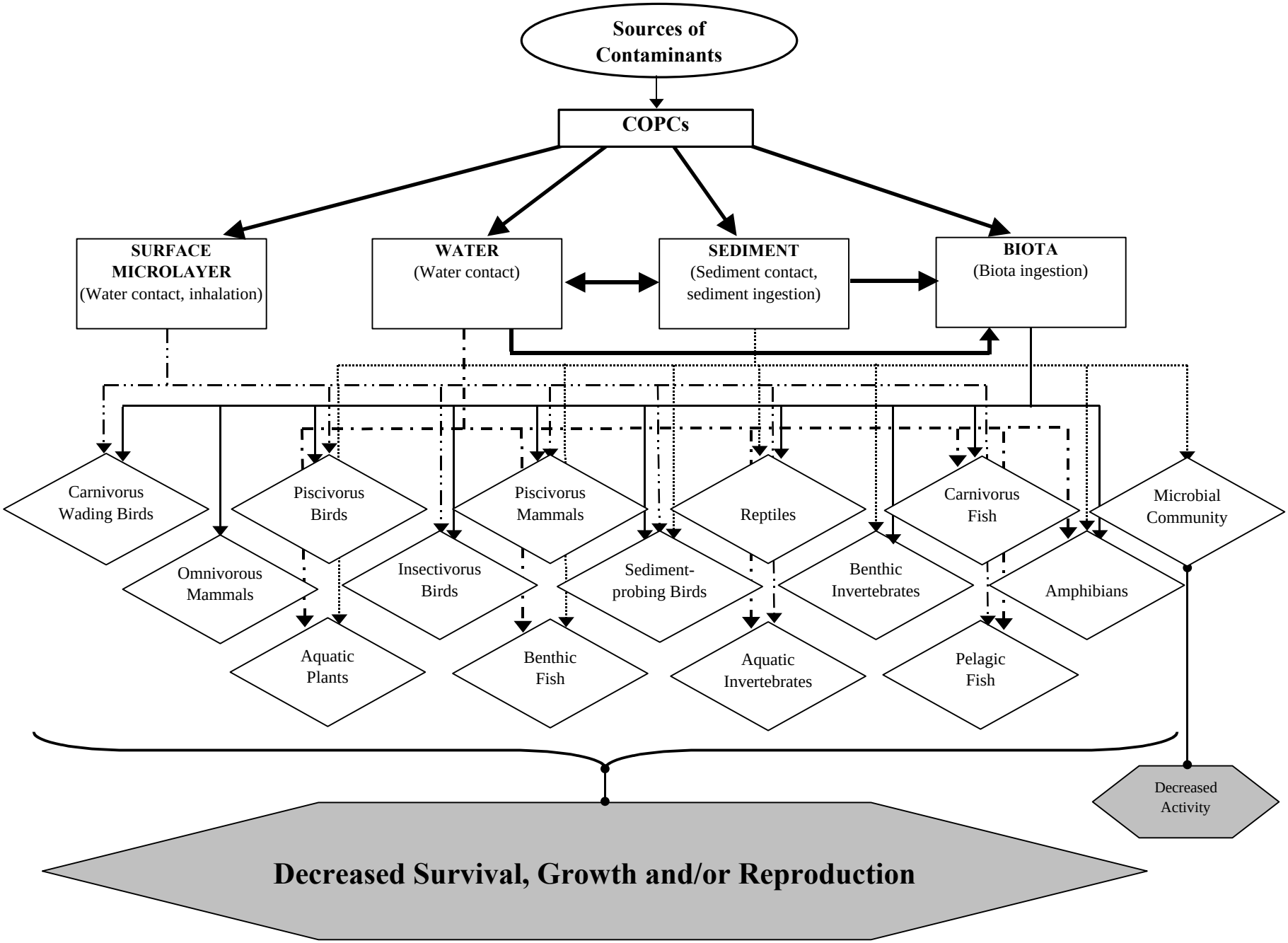


Figure 13-6. **Map of the Upper Calcasieu River AOC, showing the reach boundaries and locations of samples (surface water and surface sediments) that pose low, indeterminate or high risk to the microbial, aquatic plant, benthic invertebrate, and fish communities considering multiple lines of evidence.**

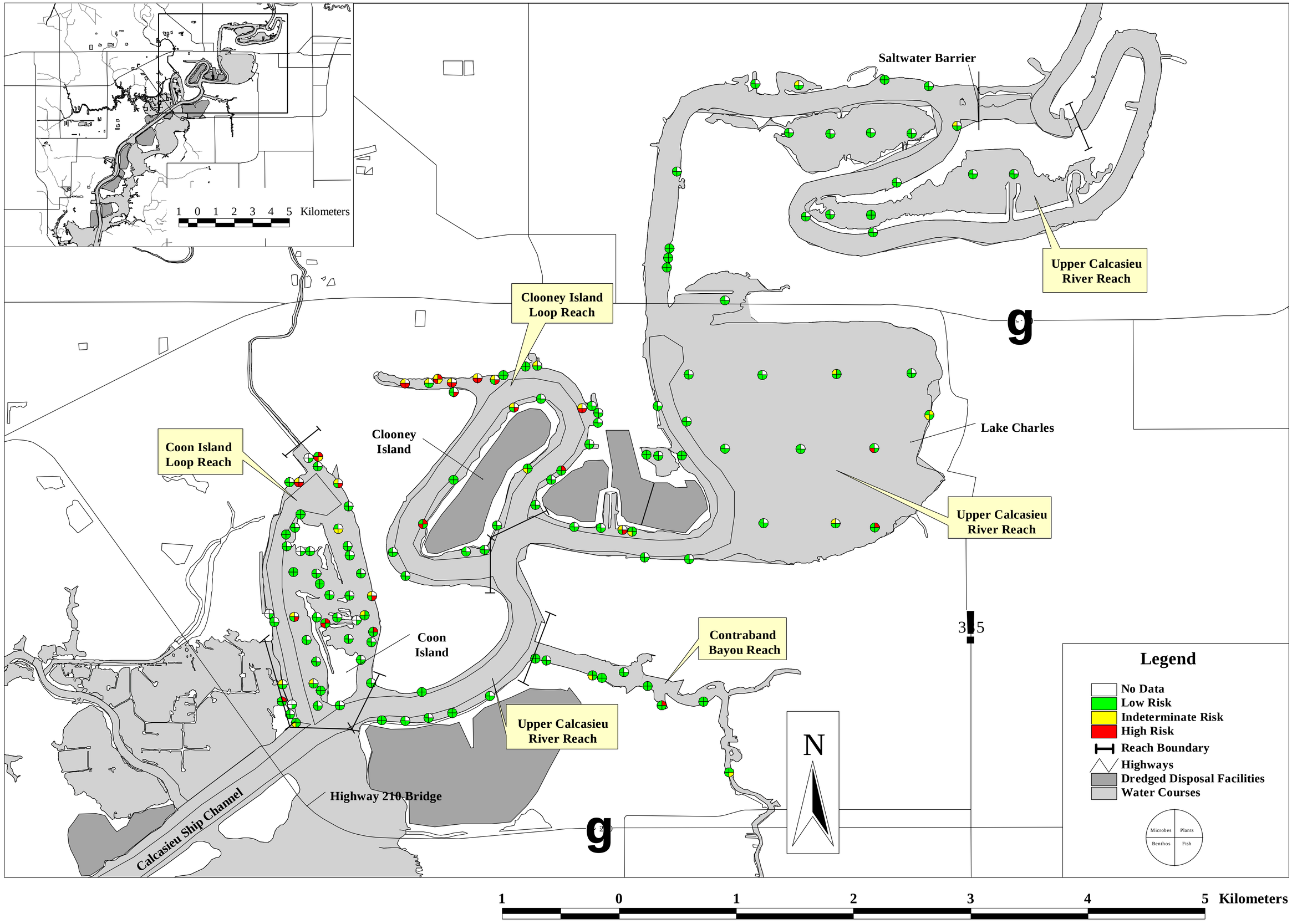


Figure 13-7. **Map of the Bayou d'Inde AOC, showing the reach boundaries and locations of samples (surface water and surface sediments) that pose low, indeterminate or high risk to the microbial, aquatic plant, benthic invertebrate, and fish communities considering multiple lines of evidence.**

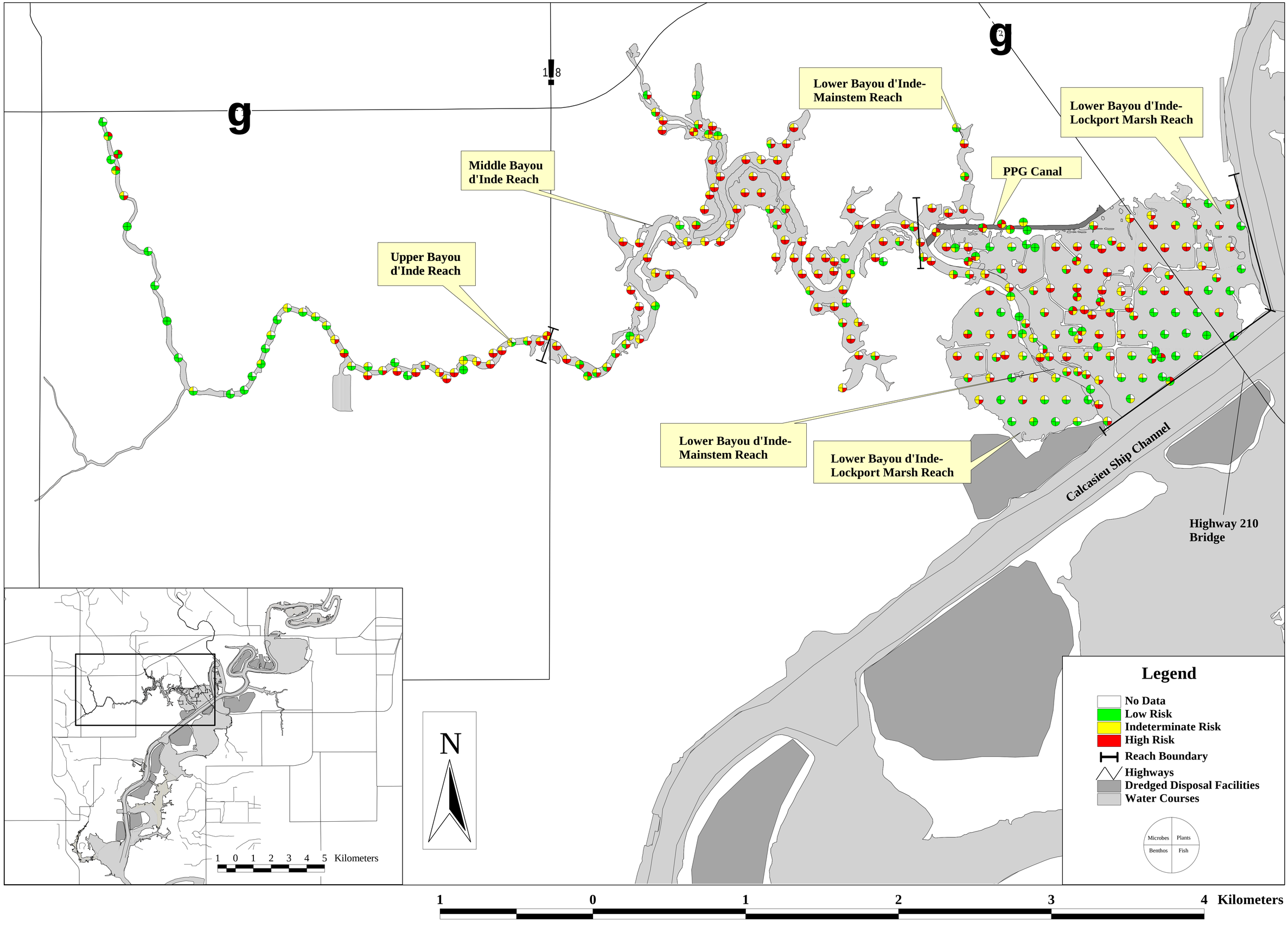


Figure 13-8. **Map of the upper Middle Calcasieu River AOC, showing the reach boundaries and locations of samples (surface water and surface sediments) that pose low, indeterminate or high risk to the microbial, aquatic plant, benthic invertebrate, and fish communities considering multiple lines of evidence.**

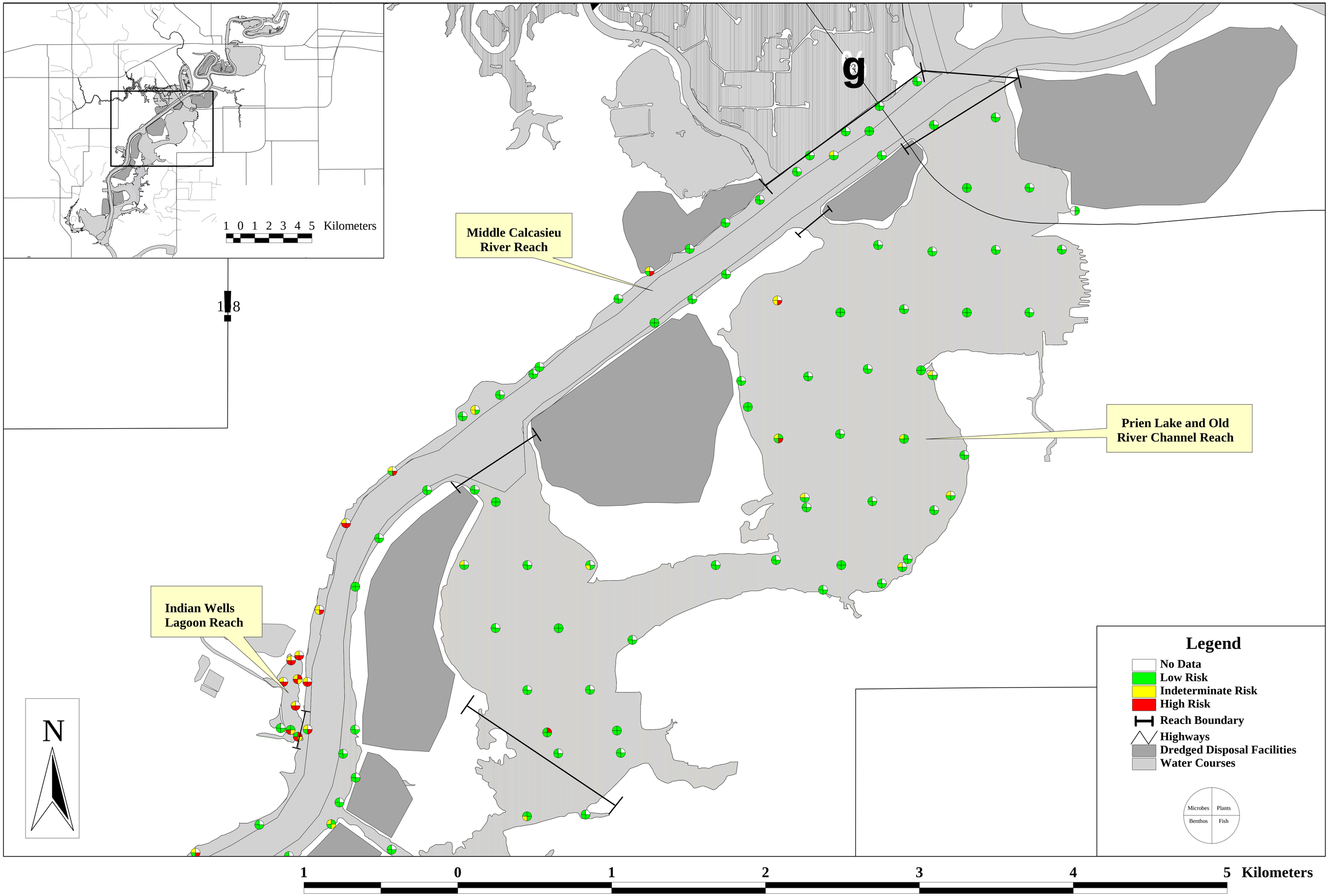


Figure 13-9. **Map of the lower Middle Calcasieu River AOC, showing the reach boundaries and locations of samples (surface water and surface sediments) that pose low, indeterminate or high risk to the microbial, aquatic plant, benthic invertebrate, and fish communities considering multiple lines of evidence.**

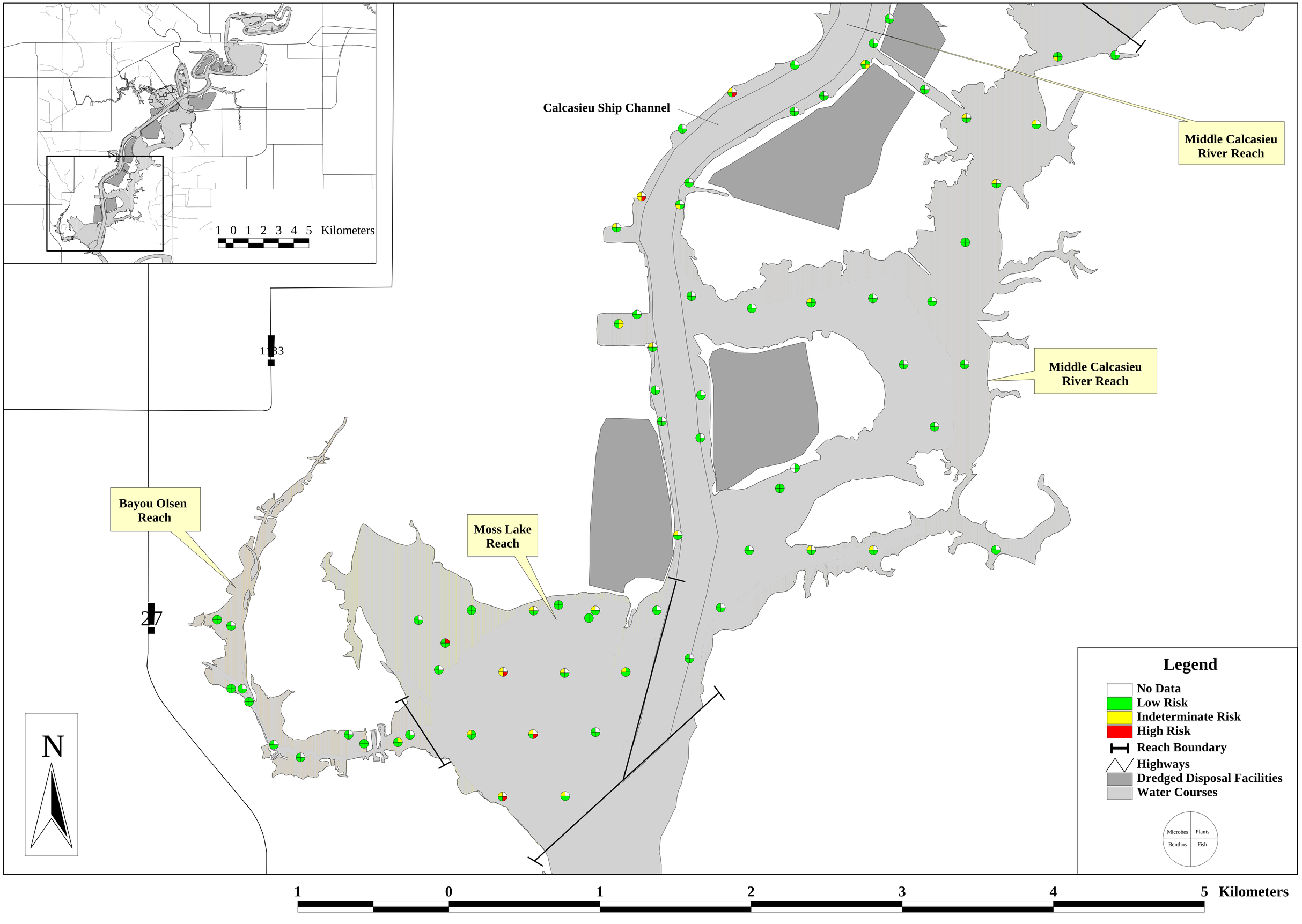
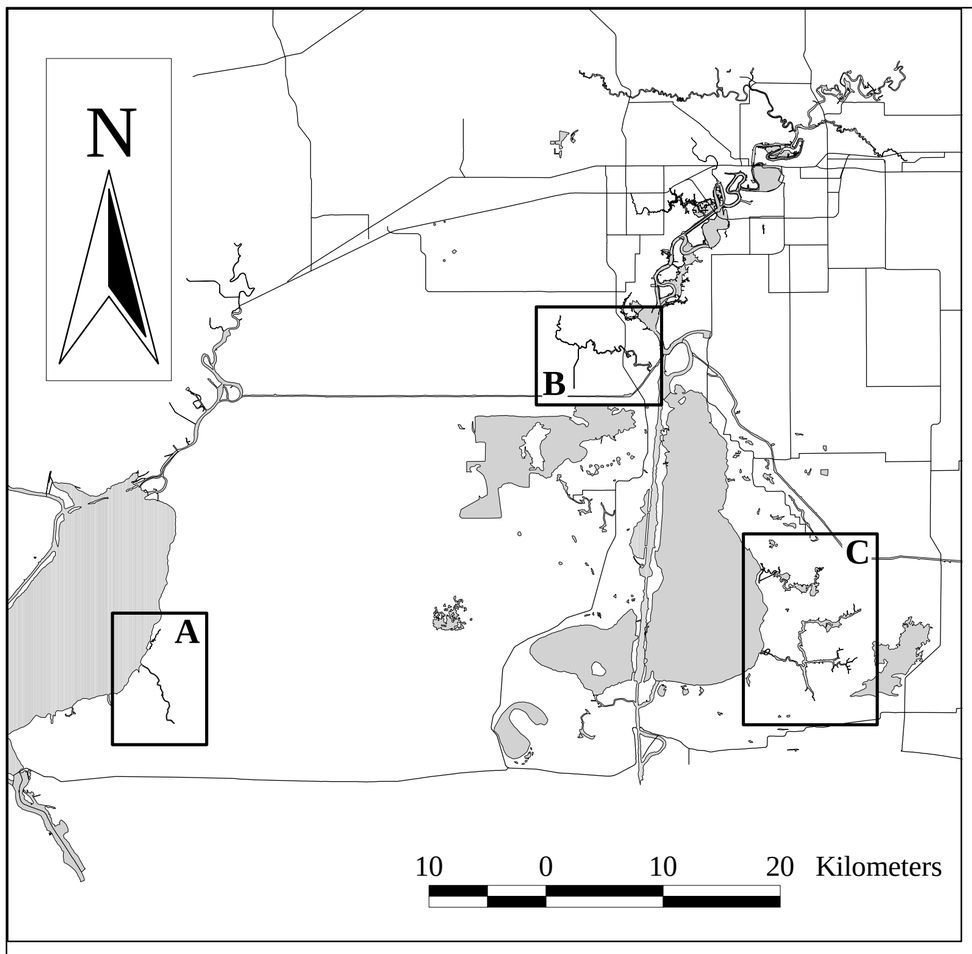
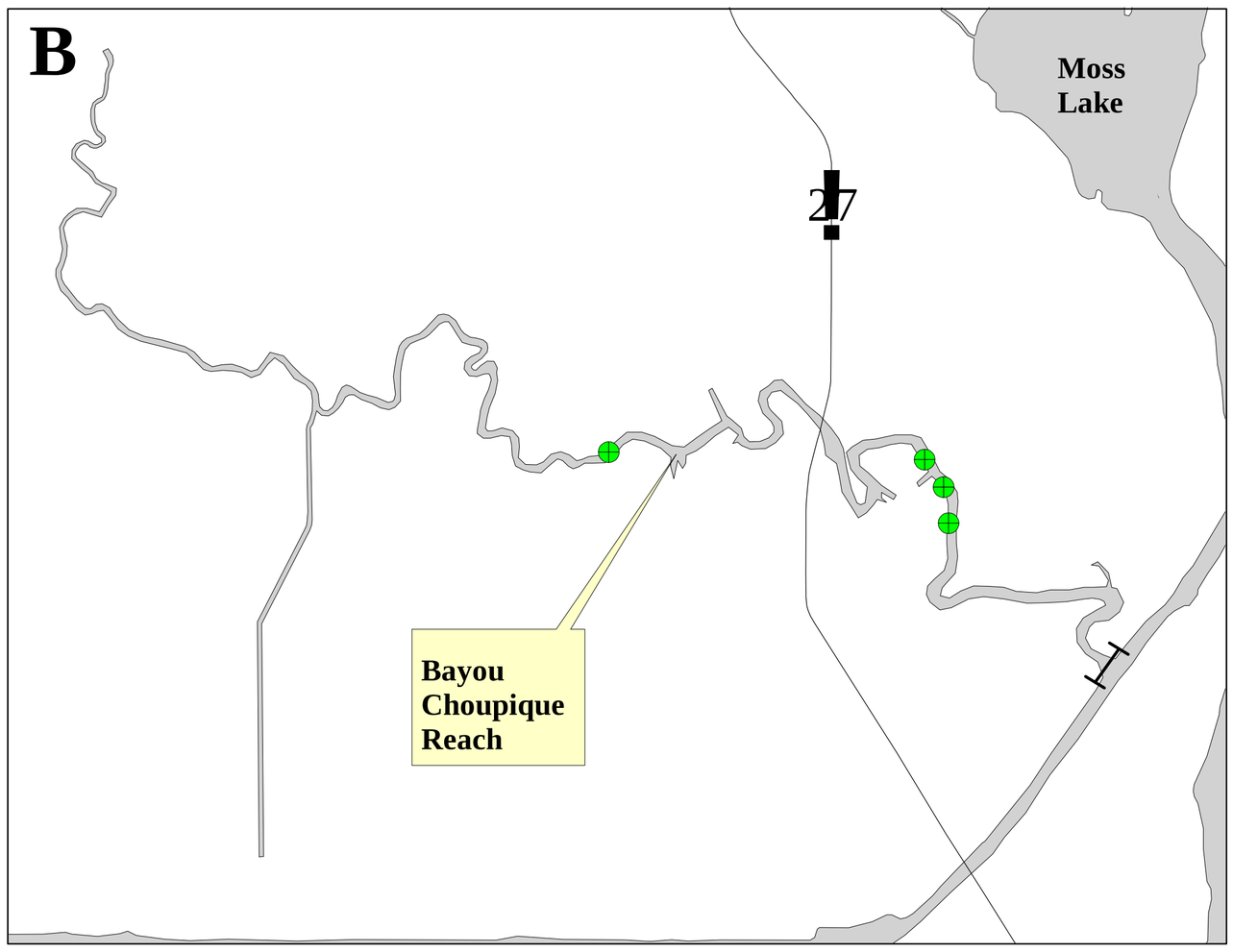
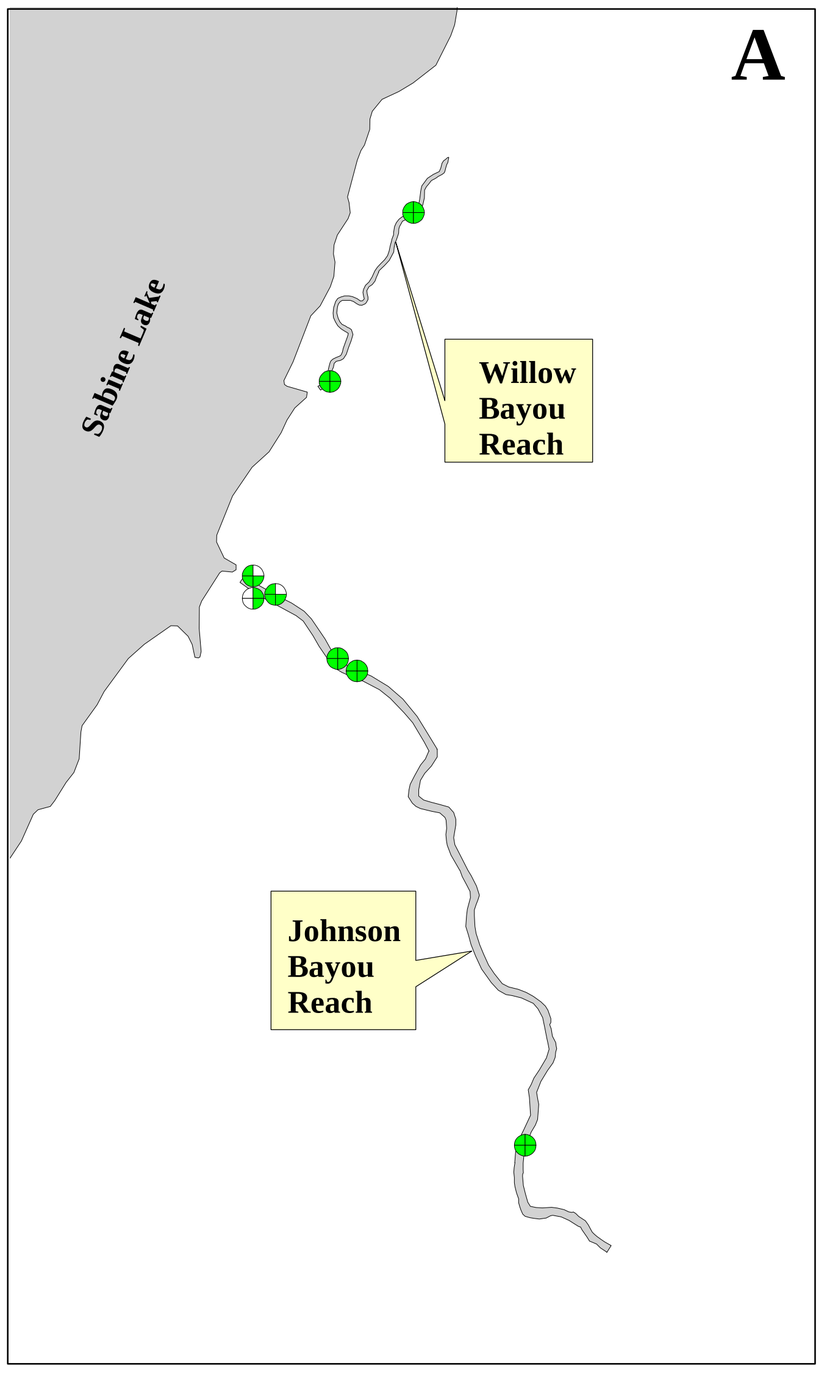
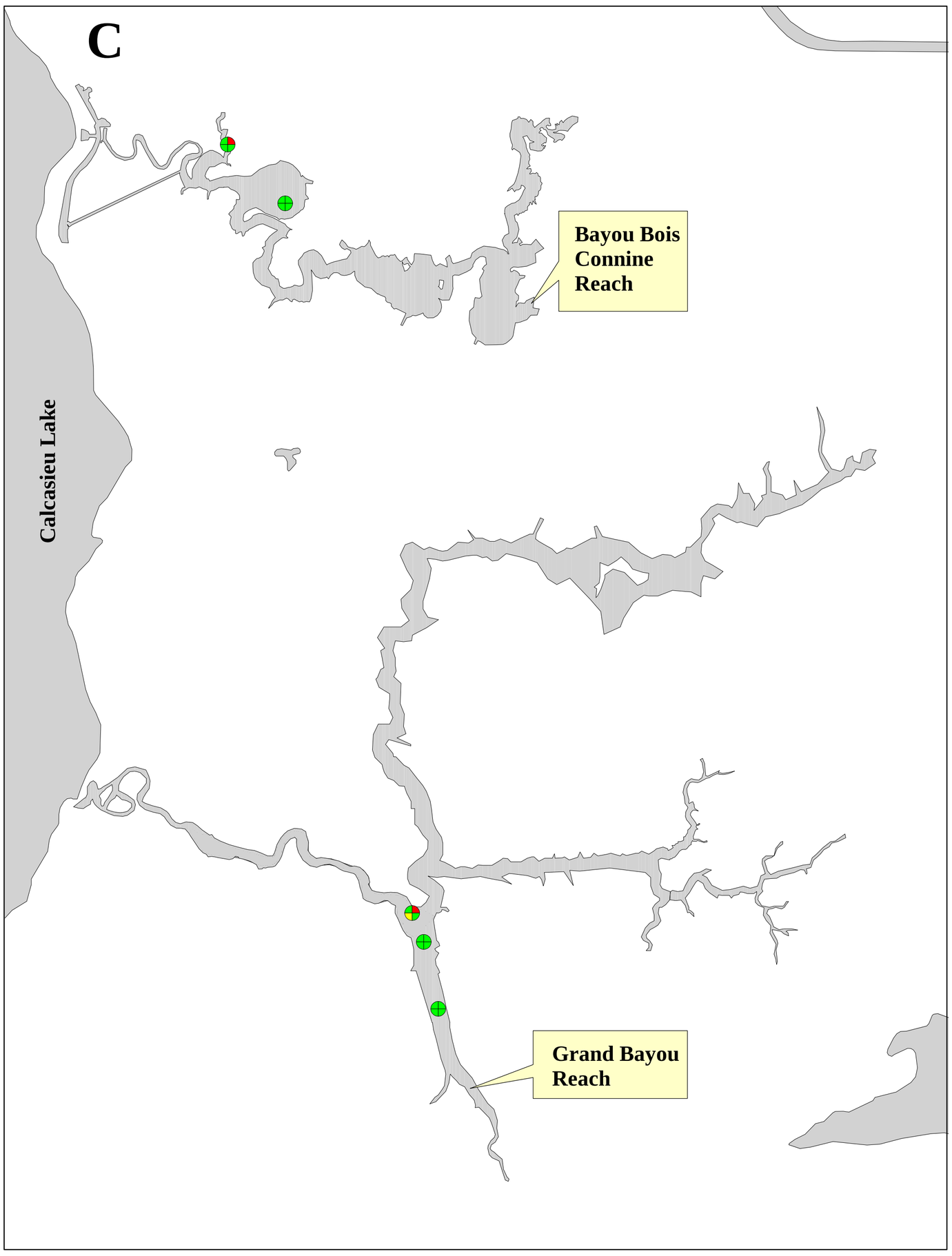


Figure 13-10. Map of the Reference Areas, showing the reach boundaries and locations of samples (surface water and surface sediments) that pose low, indeterminate or high risk to the microbial, aquatic plant, benthic invertebrate, and fish communities considering multiple lines of evidence.



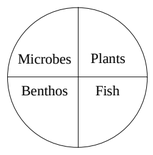






Legend

- No Data
- Low Risk
- Indeterminate Risk
- High Risk
- Reach Boundary
- Highways
- Water Courses



1 0 1 2 3 4 5 Kilometers

Figure 13-11. Map of the Upper Calcasieu River AOC, showing the reach boundaries and locations that pose low, indeterminate or high risk to aquatic receptors (i.e., microbial, aquatic plant, benthic invertebrate, and fish communities) considering multiple lines of evidence.

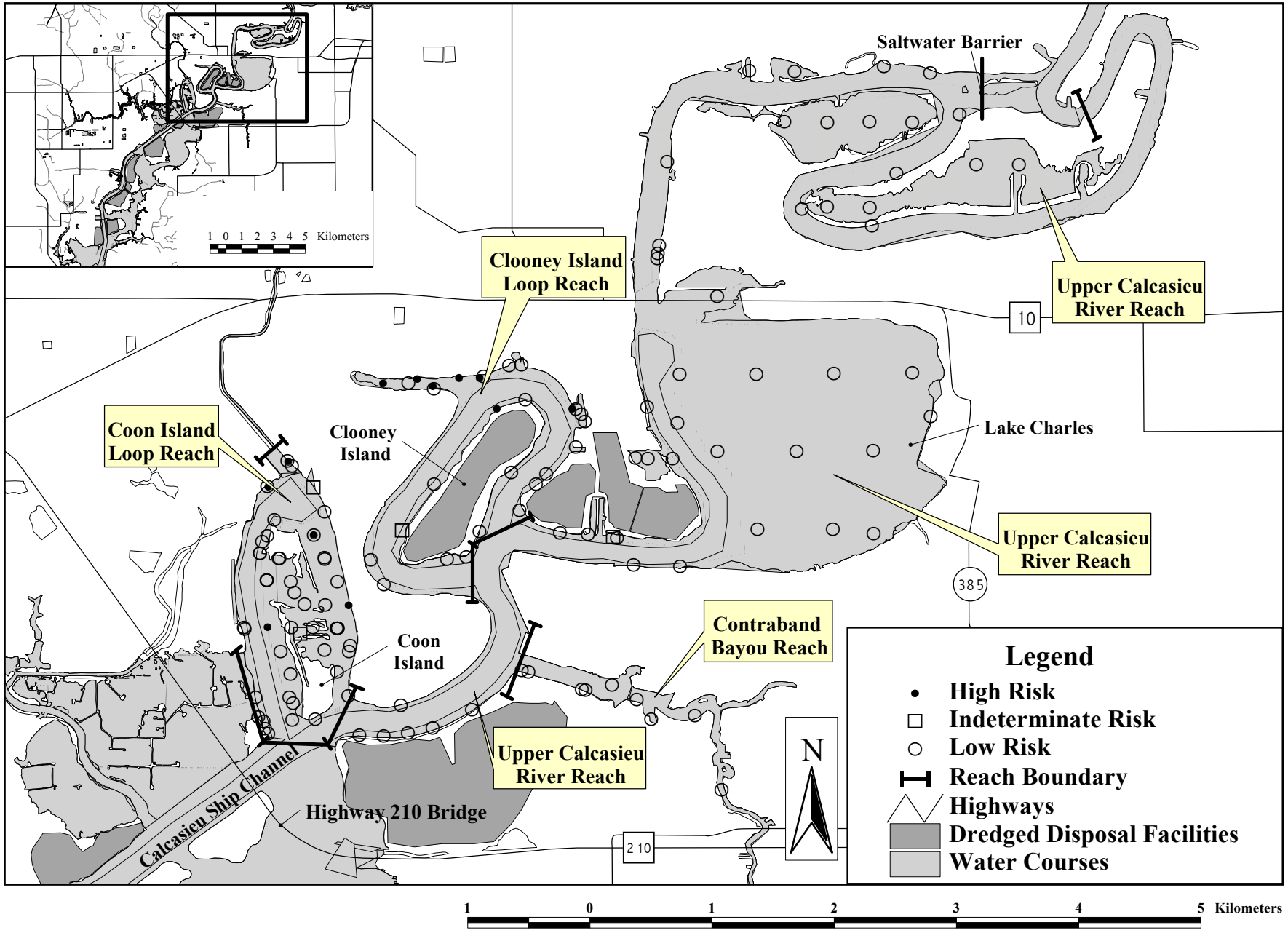


Figure 13-12. **Map of the Bayou d'Inde AOC, showing the reach boundaries and locations that pose low, indeterminate or high risk to aquatic receptors (i.e., microbial, aquatic plant, benthic invertebrate, and fish communities) considering multiple lines of evidence.**

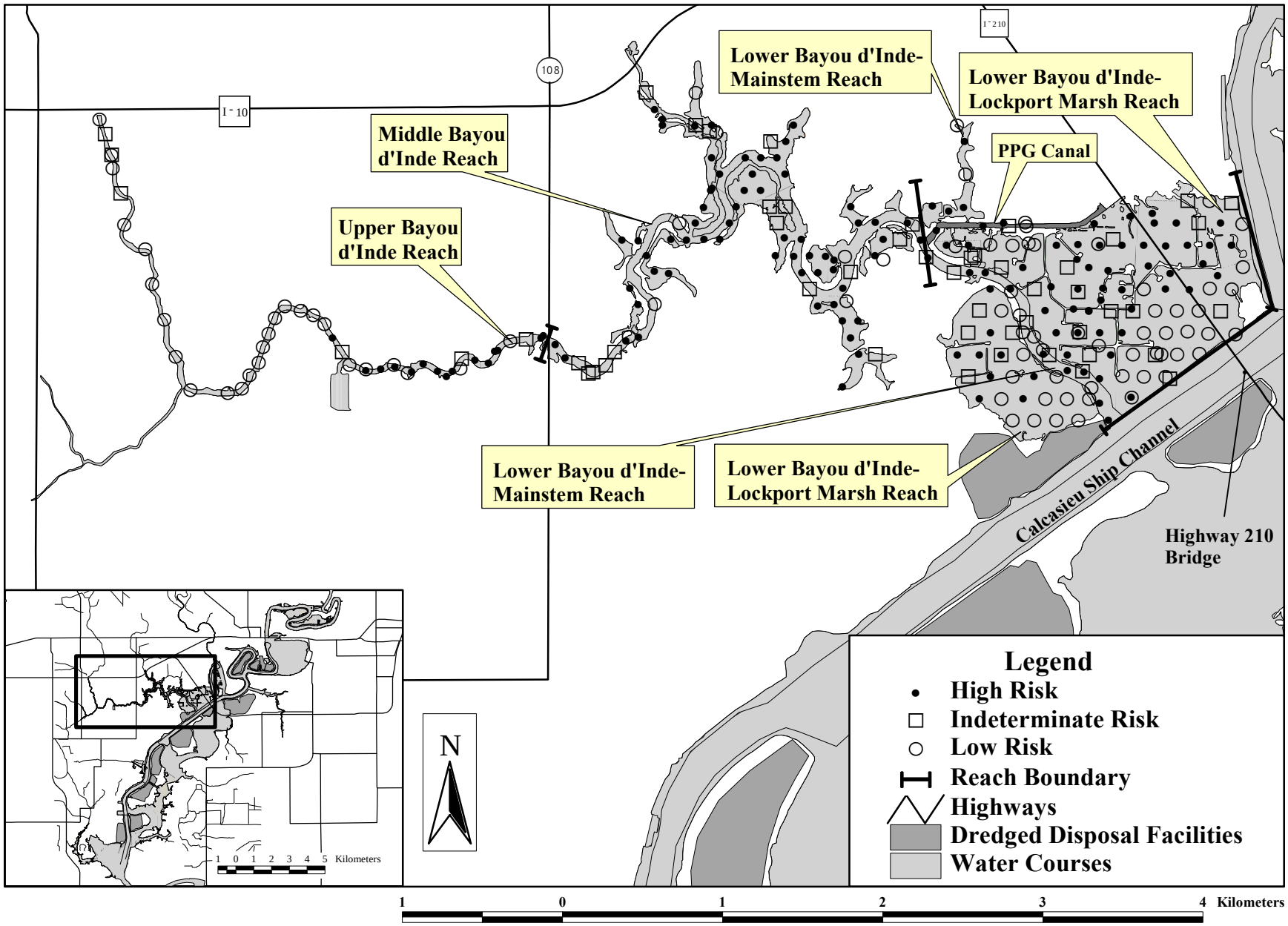


Figure 13-13. **Map of the upper Middle Calcasieu River AOC, showing the reach boundaries and locations that pose low, indeterminate or high risk to aquatic receptors (i.e., microbial, aquatic plant, benthic invertebrate, and fish communities) considering multiple lines of evidence.**

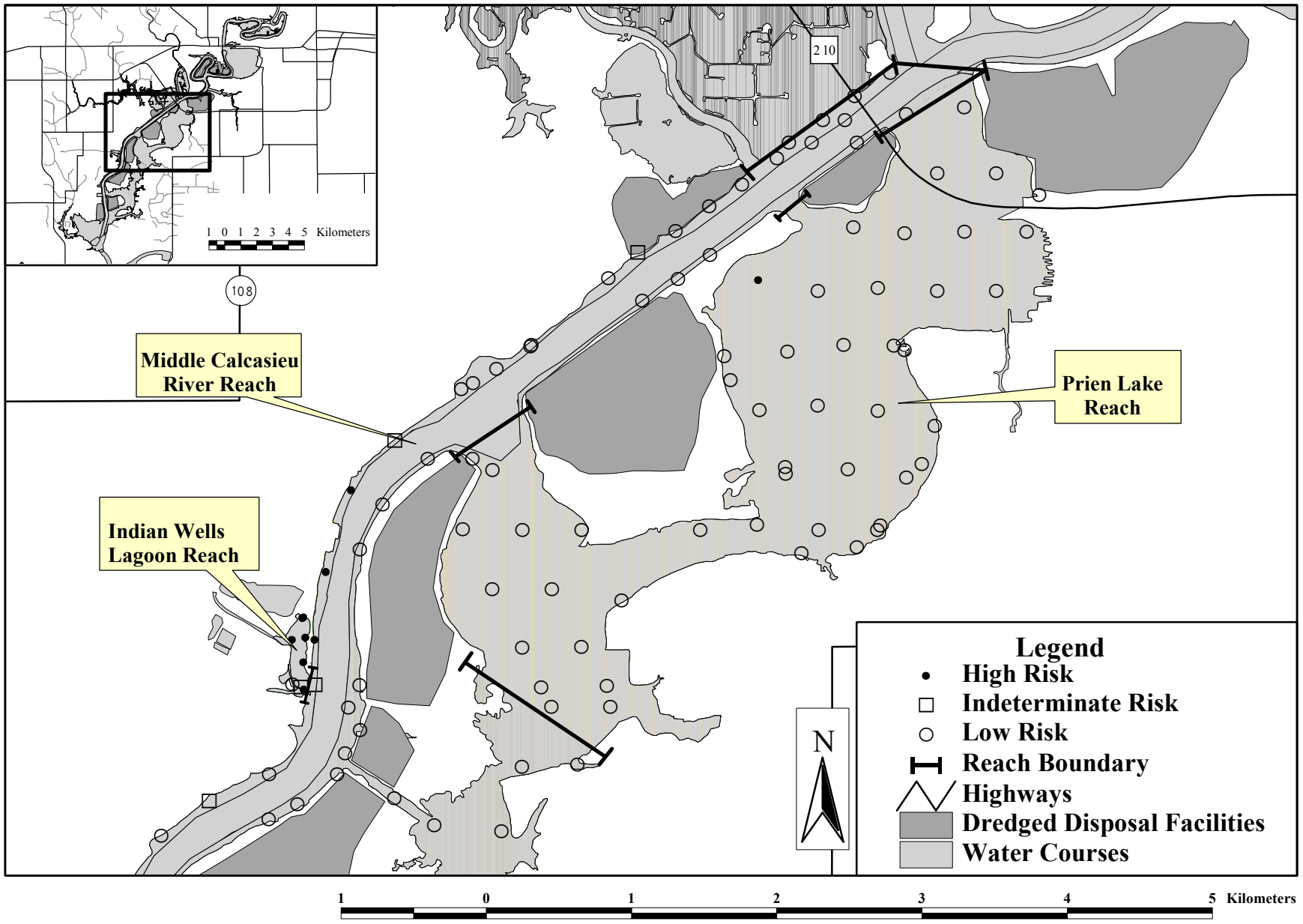


Figure 13-14. **Map of the lower Middle Calcasieu River AOC, showing the reach boundaries and locations that pose low, indeterminate or high risk to aquatic receptors (i.e., microbial, aquatic plant, benthic invertebrate, and fish communities) considering multiple lines of evidence.**

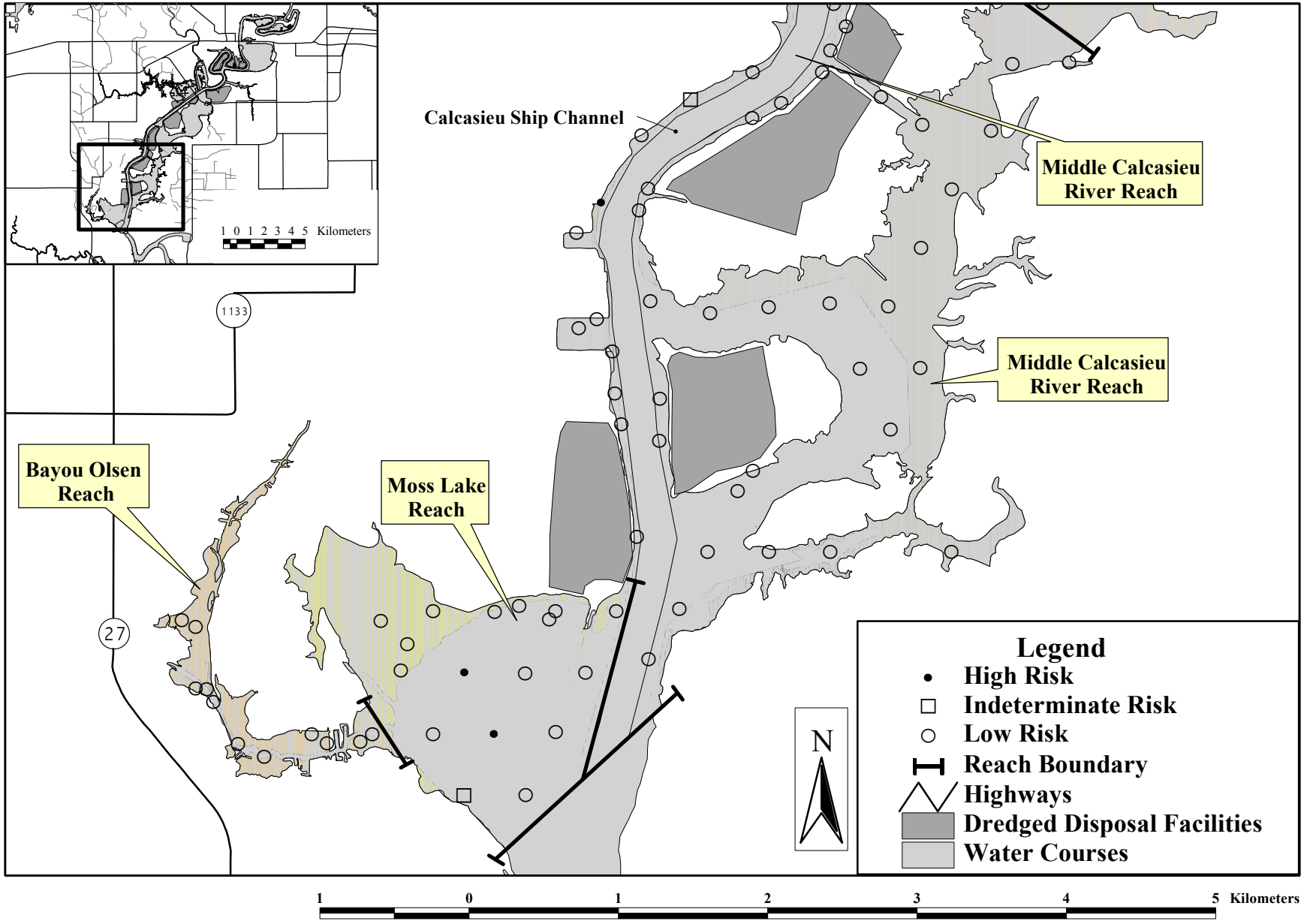


Figure 13-15. **Map of the Reference Areas, showing the reach boundaries and locations that pose low, indeterminate or high risk to aquatic receptors (i.e., microbial, aquatic plant, benthic invertebrate, and fish communities) considering multiple lines of evidence.**

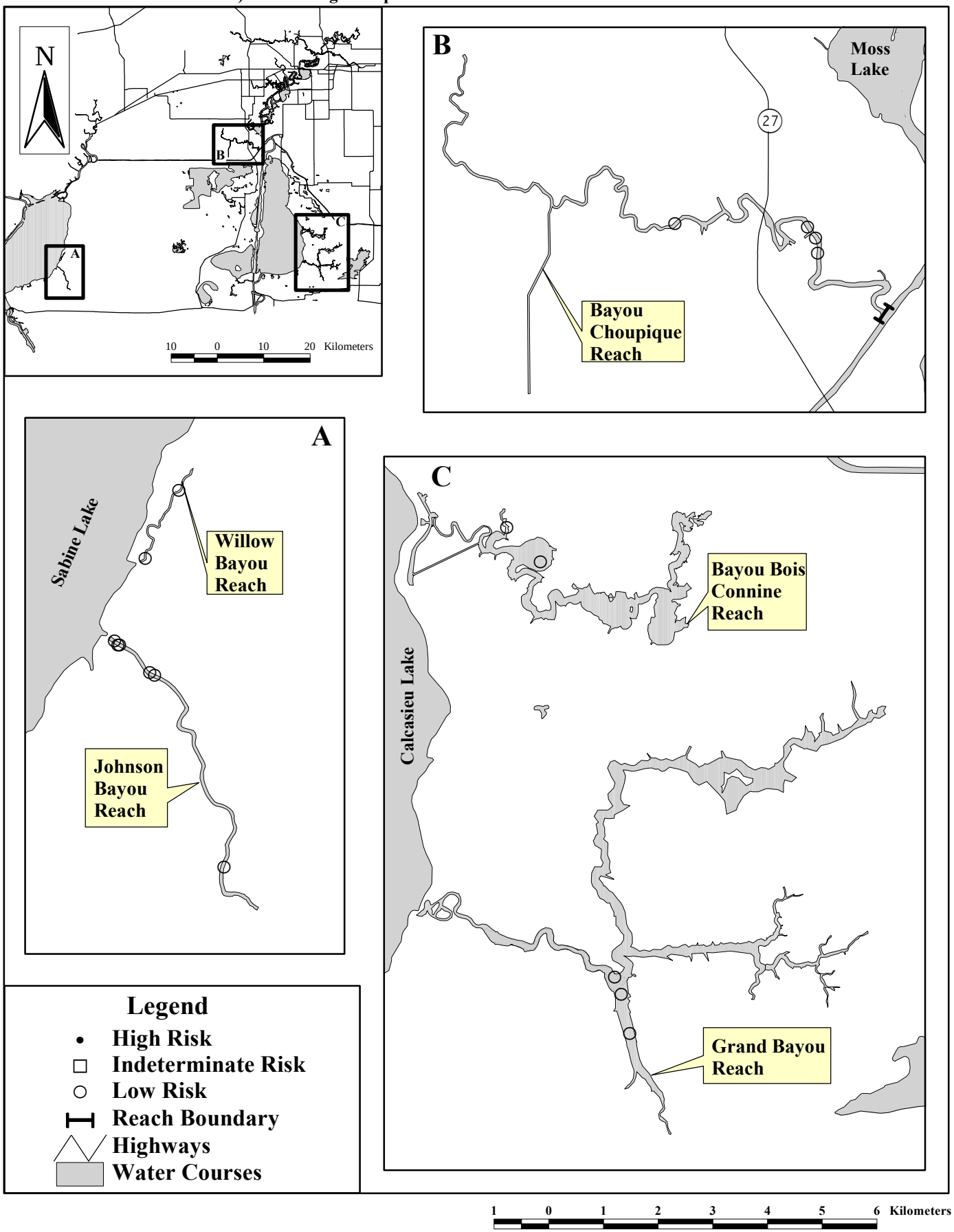


Table 13-1. Summary of risks to the microbial community estimated from multiple lines of evidence in the Calcasieu Estuary.

Area of Concern (AOC)/Reach	n	Average mean Risk Score	Predicted Risk *Percent (n) of Samples/Risk Category* Low	Indeterminate	High
Upper Calcasieu River AOC					
Upper Calcasieu River - Mainstem	49	0.335	90% (44)	10% (5)	0% (0)
Clooney Island Loop	32	1.12	66% (21)	34% (11)	0% (0)
Contraband Bayou	9	0.167	100% (9)	0% (0)	0% (0)
Coon Island Loop	56	0.936	71% (40)	29% (16)	0% (0)
Overall UCR AOC	146	0.727	78% (114)	22% (32)	0% (0)
Bayou d'Inde AOC					
Upper Bayou d'Inde	53	1.92	38% (20)	62% (33)	0% (0)
Middle Bayou d'Inde	93	2.85	6% (6)	94% (87)	0% (0)
Lower Bayou d'Inde - Mainstem	38	2.49	21% (8)	79% (30)	0% (0)
Lower Bayou d'Inde - Lockport Marsh	125	2.08	35% (44)	65% (81)	0% (0)
PPG Canal	6	1.73	83% (5)	17% (1)	0% (0)
Overall BI AOC	315	2.32	26% (83)	74% (232)	0% (0)
Middle Calcasieu River AOC					
Middle Calcaiseu River - Mainstem	76	0.789	74% (56)	26% (20)	0% (0)
Prien Lake and upper old river channel	49	0.490	84% (41)	16% (8)	0% (0)
Indian Wells Lagoon	10	2.39	30% (3)	70% (7)	0% (0)
Bayou Olsen	11	0	100% (11)	0% (0)	0% (0)
Moss Lake	17	1.75	47% (8)	53% (9)	0% (0)
Overall MCR AOC	163	0.845	73% (119)	27% (44)	0% (0)
AOC Subtotal	***624***	***1.56***	***51% (316)***	***49% (308)***	***0% (0)***
Reference					
Bayou Choupique	4	0.750	100% (4)	0% (0)	0% (0)
Grand Bayou	3	0	100% (3)	0% (0)	0% (0)
Bayou Bois Connine	2	0	100% (2)	0% (0)	0% (0)
Johnson Bayou	6	0	100% (6)	0% (0)	0% (0)
Willow Bayou	2	0	100% (2)	0% (0)	0% (0)
Overall Reference Areas	17	0.176	100% (17)	0% (0)	0% (0)
Entire Estuary	***641***	***1.53***	***52% (333)***	***48% (308)***	***0% (0)***

n = number of samples.
Overall risk of High assigned for samples with a final risk score of >3; overall risk of Indeterminate assigned for samples with a final risk score of 2 - 3; overall risk of Low assigned for samples with a final risk score of 0 to < 2

Table 13-2. Summary of risks to aquatic plants estimated from multiple line of evidence in the Calcasieu Estuary.

Area of Concern (AOC)/Reach	n	Average mean Risk Score	Predicted Risk *Percent (n) of Samples/Risk Category*		
			Low	Indeterminate	High
Upper Calcasieu River AOC					
Upper Calcasieu River - Mainstem	14	0.732	86% (12)	7% (1)	7% (1)
Clooney Island Loop	7	2.10	57% (4)	0% (0)	43% (3)
Contraband Bayou	7	0.893	86% (6)	0% (0)	14% (1)
Coon Island Loop	13	1.61	69% (9)	0% (0)	31% (4)
Overall UCR AOC	41	1.27	76% (31)	2% (1)	22% (9)
Bayou d'Inde AOC					
Upper Bayou d'Inde	10	1.83	60% (6)	0% (0)	40% (4)
Middle Bayou d'Inde	11	1.60	64% (7)	9% (1)	27% (3)
Lower Bayou d'Inde - Mainstem	7	0.857	86% (6)	14% (1)	0% (0)
Lower Bayou d'Inde - Lockport Marsh	18	1.99	56% (10)	6% (1)	39% (7)
PPG Canal	6	3.11	33% (2)	0% (0)	67% (4)
Overall BI AOC	52	1.85	60% (31)	6% (3)	35% (18)
Middle Calcasieu River AOC					
Middle Calcasieu River - Mainstem	10	0.200	90% (9)	10% (1)	0% (0)
Prien Lake and upper old river channel	13	0.410	92% (12)	0% (0)	8% (1)
Indian Wells Lagoon	3	3.19	33% (1)	0% (0)	67% (2)
Bayou Olsen	5	0.533	80% (4)	20% (1)	0% (0)
Moss Lake	6	1.00	83% (5)	0% (0)	17% (1)
Overall MCR AOC	37	0.691	84% (31)	5% (2)	11% (4)
AOC Subtotal	***130***	***1.34***	***72% (93)***	***5% (6)***	***24% (31)***
Reference					
Bayou Choupique	4	0.333	100% (4)	0% (0)	0% (0)
Grand Bayou	3	1.78	67% (2)	0% (0)	33% (1)
Bayou Bois Connine	2	2.67	50% (1)	0% (0)	50% (1)
Johnson Bayou	4	0.480	100% (4)	0% (0)	0% (0)
Willow Bayou	2	0.333	100% (2)	0% (0)	0% (0)
Overall Reference Areas	15	0.972	87% (13)	0% (0)	13% (2)
Entire Estuary	***145***	***1.30***	***73% (106)***	***4% (6)***	***23% (33)***

n = number of samples.
Overall risk of High assigned for samples with a final risk score of >3; overall risk of Indeterminate assigned for samples with a final risk score of 2 - 3; overall risk of Low assigned for samples with a final risk score of 0 to < 2

Table 13-3. Summary of risks to the benthic invertebrate community estimated from multiple lines of evidence in the Calcasieu Estuary.

Area of Concern (AOC)/Reach	n	Average mean Risk Score	Predicted Risk *Percent (n) of Samples/Risk* Low	Indeterminate
Upper Calcasieu River AOC				
Upper Calcasieu River - Mainstem	49	0.519	94% (46)	4% (2)
Clooney Island Loop	32	1.25	78% (25)	3% (1)
Contraband Bayou	9	1.23	89% (8)	11% (1)
Coon Island Loop	56	0.816	84% (47)	4% (2)
Overall UCR AOC	146	0.838	86% (126)	4% (6)
Bayou d'Inde AOC				
Upper Bayou d'Inde	53	1.86	58% (31)	15% (8)
Middle Bayou d'Inde	93	3.01	26% (24)	13% (12)
Lower Bayou d'Inde - Mainstem	38	1.53	68% (26)	13% (5)
Lower Bayou d'Inde - Lockport Marsh	125	1.90	57% (71)	14% (17)
PPG Canal	6	3.24	17% (1)	33% (2)
Overall BI AOC	315	2.20	49% (153)	14% (44)
Middle Calcasieu River AOC				
Middle Calcasieu River - Mainstem	76	0.475	91% (69)	7% (5)
Prien Lake and upper old river channel	49	0.270	96% (47)	4% (2)
Indian Wells Lagoon	10	4.33	10% (1)	0% (0)
Bayou Olsen	11	0.512	100% (11)	0% (0)
Moss Lake	17	0.691	94% (16)	6% (1)
Overall MCR AOC	163	0.674	88% (144)	5% (8)
AOC Subtotal	***624***	***1.48***	***68% (423)***	***9% (58)***
Reference				
Bayou Choupique	4	0.515	100% (4)	0% (0)
Grand Bayou	3	1.63	67% (2)	33% (1)
Bayou Bois Connine	2	1.36	100% (2)	0% (0)
Johnson Bayou	6	0.051	100% (6)	0% (0)
Willow Bayou	2	0.153	100% (2)	0% (0)
Overall Reference Areas	17	0.605	94% (16)	6% (1)
Entire Estuary	***641***	***1.46***	***68% (439)***	***9% (59)***

n = number of samples.
Overall risk of High assigned for samples with a final risk score of >3; overall risk of Indeterminate assigned for samples with a final risk score of 2 - 3; overall risk of Low assigned for samples with a final final risk score of 0 to < 2

Category High
2% (1)
19% (6)
0% (0)
13% (7)
10% (14)
26% (14)
61% (57)
18% (7)
30% (37)
50% (3)
37% (118)
3% (2)
0% (0)
90% (9)
0% (0)
0% (0)
7% (11)
23% (143)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
22% (143)

Table 13-4. Biological conditions that occur within the three categories of risk to the benthic invertebrate community in the Calcasieu Estuary, identified using the risk designations assigned to each sample.

Benthic Metric/Toxicity Test	Endpoint Measured	Low mean ± SD (n)	Indeterminate mean ± SD (n)	High mean ± SD (n)
Sediment Toxicity				
28-d *Hyalella azteca*	% survival	91.6 ± 7.03 (54)	80.5 ± 19.5 (15)	53.6 ± 28.6 (20)
28-d *Hyalella azteca*	length (mm)	3.82 ± 0.487 (54)	3.80 ± 0.625 (15)	3.76 ± 0.555 (19)
10-d *Ampelisca abdita*	% survival	62.4 ± 17.3 (54)	43.1 ± 23.6 (15)	15.5 ± 17.6 (20)
30-m *Arbacia punctulata*	% fertilization	68.4 ± 25.8 (30)	56.2 ± 36.2 (10)	23.0 ± 29.1 (5)
Benthic Invertebrate Community Structure				
Mean total abundance (H/H)	#/35.4 cm sq.	3.94 ± 3.38 (54)	1.48 ± 1.54 (15)	1.52 ± 2.63 (20)
Mean total abundance (H/M)	#/35.4 cm sq.	3.53 ± 5.04 (54)	0.787 ± 0.955 (15)	0.420 ± 0.908 (20)
Mean total abundance (L/L)	#/35.4 cm sq.	0.300 ± 1.18 (54)	0.760 ± 2.94 (15)	0 ± 0 (20)
Mean total abundance (M/H)	#/35.4 cm sq.	0.0667 ± 0.145 (54)	0.0667 ± 0.209 (15)	0.0200 ± 0.0894 (20)
Mean total abundance (M/L)	#/35.4 cm sq.	0.633 ± 1.78 (54)	0.587 ± 2.27 (15)	0 ± 0 (20)
Mean total abundance (M/M)	#/35.4 cm sq.	0.548 ± 0.734 (54)	0.293 ± 0.506 (15)	0.0800 ± 0.151 (20)
Nonnormalized mIBI	no units	9.15 ± 8.59 (54)	6.88 ± 14.0 (15)	2.56 ± 2.07 (20)
Normalized mIBI	no units	0.495 ± 0.177 (54)	0.354 ± 0.136 (15)	0.299 ± 0.058 (20)
Pollution Indicator Spp. (H/H + H/M + M/H)	#/35.4 cm sq.	7.54 ± 7.65 (54)	2.33 ± 2.00 (15)	1.96 ± 3.03 (20)
Pollution Sensitive (L/L + M/L)	#/35.4 cm sq.	0.933 ± 2.32 (54)	1.35 ± 5.22 (15)	0 ± 0 (20)
Richness = total # sp.	# species/35.4 cm sq.	6.72 ± 4.38 (54)	3.87 ± 3.64 (15)	2.45 ± 1.93 (20)
Total Abundance	#/35.4 cm sq.	9.03 ± 8.38 (54)	4.00 ± 7.35 (15)	2.07 ± 3.14 (20)

SD = standard deviation; n = number of samples; d = day; m = minute; H = high; M = medium; L = low; sp. = species; mIBI = macroinvertebrate index of biotic integrity.

Table 13-5. Summary of risks to fish estimated from multiple lines of evidence in the Caclasieu Estuary

Area of Concern (AOC)/Reach	n	Average mean Risk Score	Predicted Risk *Percent (n) of Samples/Ris*	
			Low	Indeterminate
Upper Calcasieu River AOC				
Upper Calcasieu River - Mainstem	49	0.250	98% (48)	0% (0)
Clooney Island Loop	32	1.26	75% (24)	3% (1)
Contraband Bayou	9	0.574	89% (8)	11% (1)
Coon Island Loop	65	1.13	72% (47)	8% (5)
Overall UCR AOC	155	0.846	82% (127)	5% (7)
Bayou d'Inde AOC				
Upper Bayou d'Inde	53	1.71	60% (32)	4% (2)
Middle Bayou d'Inde	93	3.81	8% (7)	5% (5)
Lower Bayou d'Inde - Mainstem	38	3.07	24% (9)	5% (2)
Lower Bayou d'Inde - Lockport Marsh	126	2.45	40% (51)	6% (8)
PPG Canal	6	2.12	33% (2)	67% (4)
Overall BI AOC	316	2.79	32% (101)	7% (21)
Middle Calcasieu River AOC				
Middle Calcasieu River - Mainstem	76	0.605	87% (66)	3% (2)
Prien Lake and upper old river channel	49	0.324	96% (47)	0% (0)
Indian Wells Lagoon	10	3.30	10% (1)	30% (3)
Bayou Olsen	11	0.162	100% (11)	0% (0)
Moss Lake	17	1.01	82% (14)	0% (0)
Overall MCR AOC	163	0.697	85% (139)	3% (5)
AOC Subtotal	***634***	***1.78***	***58% (367)***	***5% (33)***
Reference				
Bayou Choupique	4	0.572	100% (4)	0% (0)
Grand Bayou	3	0.741	100% (3)	0% (0)
Bayou Bois Connine	2	1.11	100% (2)	0% (0)
Johnson Bayou	6	0.257	100% (6)	0% (0)
Willow Bayou	2	0.222	100% (2)	0% (0)
Overall Reference Areas	17	0.513	100% (17)	0% (0)
Entire Estuary	***651***	***1.74***	***59% (384)***	***5% (33)***

n = number of samples.
Overall risk of High assigned for samples with a final risk score of >3; overall risk of Indeterminate assigned for samples with a final risk score of 2 - 3; overall risk of Low assigned for samples with a final score of 0 > 2.

k Category
High
2% (1)
22% (7)
0% (0)
20% (13)
14% (21)
36% (19)
87% (81)
71% (27)
53% (67)
0% (0)
61% (194)
11% (8)
4% (2)
60% (6)
0% (0)
18% (3)
12% (19)
37% (234)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
36% (234)

Table 13-6. Summary of integrated risks to aquatic receptors (i.e., microorganisms, aquatic plants, benthic invertebrates, and fish) estimated from multiple lines of evidence in the Calcasieu Estuary.

Area of Concern (AOC)/Reach	n	Average Overall Risk Score	Predicted Risk *Percent (n) of Samples/Risk* Low	Indeterminate
Upper Calcasieu River AOC				
Upper Calcasieu River - Mainstem	49	0.380	98% (48)	2% (1)
Clooney Island Loop	32	1.25	75% (24)	3% (1)
Contraband Bayou	9	0.660	100% (9)	0% (0)
Coon Island Loop	65	0.942	77% (50)	8% (5)
Overall UCR AOC	155	0.811	85% (131)	5% (7)
Bayou d'Inde AOC				
Upper Bayou d'Inde	53	1.84	57% (30)	11% (6)
Middle Bayou d'Inde	93	3.20	9% (8)	18% (17)
Lower Bayou d'Inde - Mainstem	38	2.30	37% (14)	26% (10)
Lower Bayou d'Inde - Lockport Marsh	126	2.15	40% (50)	17% (22)
PPG Canal	6	2.55	33% (2)	17% (1)
Overall BI AOC	316	2.43	33% (104)	18% (56)
Middle Calcasieu River AOC				
Middle Calcasieu River - Mainstem	76	0.608	89% (68)	5% (4)
Prein Lake and upper old river channel	49	0.355	98% (48)	0% (0)
Indian Wells Lagoon	10	3.35	10% (1)	10% (1)
Bayou Olsen	11	0.229	100% (11)	0% (0)
Moss Lake	17	1.15	82% (14)	6% (1)
Overall MCR AOC	163	0.732	87% (142)	4% (6)
AOC Subtotal	***634***	***1.60***	***59% (377)***	***11% (69)***
Reference				
Bayou Choupique	4	0.543	100% (4)	0% (0)
Grand Bayou	3	1.04	100% (3)	0% (0)
Bayou Bois Connine	2	1.28	100% (2)	0% (0)
Johnson Bayou	6	0.192	100% (6)	0% (0)
Willow Bayou	2	0.177	100% (2)	0% (0)
Overall Reference Areas	17	0.550	100% (17)	0% (0)
Entire Estuary	***651***	***1.57***	***61% (394)***	***11% (69)***

n = number of samples.
Overall risk of High assigned for samples with a final risk score of >3; overall risk of Indeterminate assigned for samples with a final risk score of 2 - 3; overall risk of Low assigned for samples with a final risk score of 0 < 2.

,

Category
High
0% (0)
22% (7)
0% (0)
15% (10)
11% (17)
32% (17)
73% (68)
37% (14)
43% (54)
50% (3)
49% (156)
5% (4)
2% (1)
80% (8)
0% (0)
12% (2)
9% (15)
30% (188)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
0% (0)
29% (188)

Table 13-7. Summary of Contaminants of Concern (COCs) in the Calcasieu Estuary.

Chemicals of Potential Concern (COPCs)	Microbial Community	Aquatic Plant Community		Benthic Invertebrate Community		Fish Community		
	WS	SW	PW	WS	PW	SW	WS	PW
Conventionals								
Hydrogen sulfide					*			*
Nitrogen, as Ammonia		*						
Total dissolved sulfide								
Ammonia - Toxic Units								
Metals								
Chromium, total				*			*	
Chromium, filtered								
Copper, total				*			*	
Copper, filtered		*				*		
Lead, total				*			*	
Lead, filtered								
Mercury, total				*			*	
Mercury, filtered								
Methyl mercury								
Nickel, total		*			*	*	*	
Nickel, filtered		*				*		
Zinc, total				*	*		*	
Zinc, filtered								
PAHs								
1,1'-Biphenyl	*							
1-Methylnaphthalene					*			
1-Methylphenanthrene								
2,6-Dimethylnaphthalene								
2-Methylnaphthalene	*			*			*	
Acenaphthene	*			*			*	
Acenaphthylene	*			*			*	
Anthracene	*			*			*	
Fluorene	*			*			*	
Naphthalene	*						*	
Phenanthrene	*			*			*	
Total LMW-PAHs	*			*			*	
Benz(a)anthracene	*		*	*	*		*	
Benzo(a)pyrene	*			*	*		*	
Benzo(b)fluoranthene	*			*				
Benzo(g,h,i)perylene	*			*				
Benzo(k)fluoranthene	*			*				
Chrysene	*			*			*	
Dibenz(a,h)anthracene	*			*			*	

Table 13-7. Summary of Contaminants of Concern (COCs) in the Calcasieu Estuary.

Chemicals of Potential Concern (COPCs)	Microbial Community	Aquatic Plant Community		Benthic Invertebrate Community		Fish Community		
	WS	SW	PW	WS	PW	SW	WS	PW
PAHs (cont.)								
Fluoranthene	*			*			*	
Indeno(1,2,3-cd)pyrene	*			*				
Perylene								
Pyrene	*			*			*	
Total HMW-PAHs	*			*			*	
TOTAL PAHs	*			*			*	
PCB Aroclors								
Aroclor-1016								
Aroclor-1221								
Aroclor-1232								
Aroclor-1242								
Aroclor-1248								
Aroclor-1254								
Aroclor-1260								
Total PCBs	*			*			*	
PCB Congeners								
PCB 105								
PCB 108								
PCB 114								
PCB 118								
PCB 126								
PCB 127								
PCB 128								
PCB 132/153								
PCB 138/160								
PCB 15								
PCB 156								
PCB 157								
PCB 162								
PCB 167								
PCB 169								
PCB 170/190								
PCB 18/17								
PCB 180								
PCB 187								
PCB 189								
PCB 195/208								
PCB 206								
PCB 209								

Table 13-7. Summary of Contaminants of Concern (COCs) in the Calcasieu Estuary.

Chemicals of Potential Concern (COPCs)	Microbial Community	Aquatic Plant Community		Benthic Invertebrate Community		Fish Community		
	WS	SW	PW	WS	PW	SW	WS	PW
PCB Congeners (cont.)								
PCB 28								
PCB 29								
PCB 37								
PCB 44								
PCB 5/8								
PCB 52								
PCB 58								
PCB 60								
PCB 61/70								
PCB 66								
PCB 77								
PCB 77/110								
PCB 79								
PCB 80								
PCB 81								
PCB 87/115								
PCB 90/101								
PCB 201/157/173								
Organochlorine Pesticides								
Aldrin				*				
Dieldrin				*			*	
Phthalates								
Benzylbutylphthalate								
Bis(2-ethylhexyl)phthalate	*			*				
Diethylphthalate								
Dimethylphthalate								
Di-n-butylphthalate								
Di-n-octylphthalate								
Chlorinated Benzenes								
1,2,3,4-Tetrachlorobenzene								
1,2,3-Trichlorobenzene								
1,2,4,5-Tetrachlorobenzene								
1,2,4-Trichlorobenzene								
1,2-Dichlorobenzene								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
Hexachloro-1,3-butadiene				*				
Hexachlorobenzene				*				
Pentachlorobenzene								

Table 13-7. Summary of Contaminants of Concern (COCs) in the Calcasieu Estuary.

Chemicals of Potential Concern (COPCs)	Microbial Community	Aquatic Plant Community		Benthic Invertebrate Community		Fish Community		
	WS	SW	PW	WS	PW	SW	WS	PW
Chlorinated Ethanes								
1,1,1-Trichloroethane								
1,2-Dichloroethane								
PCDDs and PCDFs								
1,2,3,4,6,7,8-HpCDD								
1,2,3,4,7,8-HxCDD								
1,2,3,6,7,8-HxCDD								
1,2,3,7,8,9-HxCDD								
1,2,3,7,8-PeCDD								
2,3,7,8-TCDD								
OCDD								
Total HpCDD								
Total HxCDD								
Total PeCDD								
Total TCDD								
1,2,3,4,6,7,8-HpCDF								
1,2,3,4,7,8,9-HpCDF								
1,2,3,4,7,8-HxCDF								
1,2,3,6,7,8-HxCDF								
1,2,3,7,8,9-HxCDF								
1,2,3,7,8-PeCDF								
2,3,4,6,7,8-HxCDF								
2,3,4,7,8-PeCDF								
2,3,7,8-TCDF								
OCDF								
Total HpCDF								
Total HxCDF								
Total PeCDF								
Total TCDF								
Total Toxic Equivalents (TEQs)				*			*	
Other COPCs								
Acetone								
Carbon Disulfide								

WS = whole sediment; PW = pore water; SW = surface water; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls

Section 14
Human Health Risk Assessment Summary

This section is a summary of the HHRA (CDM 2002b) portion of the RI/FS for the Calcasieu Estuary in Calcasieu Parish, Louisiana (Figure 1-1). The study area includes Bayou d'Inde, Bayou Verdine, and the Upper Calcasieu and Lower Calcasieu, extending from the saltwater barrier near Lake Charles down to Moss Lake (Figure 2-2). This assessment quantifies potential carcinogenic and noncarcinogenic health risks from exposure to contaminants in the Calcasieu Estuary, following EPA risk assessment policies and guidance. This assessment evaluates both current and future risks to individuals living and working near the estuary based on the assumption of no remediation or institutional controls (i.e., baseline conditions).

The baseline HHRA estimates current and future risks to humans resulting from direct exposure to contaminated sediments, surface water, fish, and shellfish from the Calcasieu Estuary in the absence of any remediation. The baseline risk estimates, developed using conservative or health protective assumptions, are used to determine which contaminants and exposure pathways pose the greatest risk, and whether remediation is likely to be required, and to provide a baseline against which any future remedial action can be evaluated.

14.1 Scope of Risk Assessment

The goal of the HHRA process is to provide a framework for developing the risk information necessary to assist in the determination of possible remedial actions at a site. EPA uses risk assessment as a tool to characterize the contaminants, evaluate the toxicity of the chemicals, assess the potential ways in which an individual may be exposed to the contaminants, and characterize the cancer risks and noncancer health hazards at a site (EPA 1989a). In accordance with EPA guidance, actions at Superfund sites are based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future conditions at the site. EPA guidance also recommends estimation of risks based on central tendency (CT), or typical, exposures at a site (EPA 1995).

The following are the components of the HHRA used to evaluate the potential human health risks associated with the site:

Conceptual Site Model

The first step of the risk assessment is development of the conceptual site model. This section identifies current and potential land uses and receptors associated with the site. Based on this information, the site is broken down into several exposure areas for evaluation in the HHRA. The pathways through which chemical contaminants migrate from potential sources to existing receptors were identified. Receptor groups (i.e., human populations) that might potentially be exposed as a result of the presence of one or more chemicals in the environment were also identified.

Data Evaluation And Selection Of Chemicals Of Potential Concern
In this step, chemical concentration data are summarized and evaluated to identify COPCs for further analysis in the HHRA. The primary selection criteria for these chemicals include a comparison of the chemical concentrations to site-specific risk-based screening levels. The frequency of detection and toxicity of the chemicals were also considered.

Exposure Assessment
In the exposure assessment, qualitative or quantitative estimates of the magnitude, frequency, and duration of exposure are made. Exposure point concentrations for COPCs are estimated based on the 95 percent upper confidence level (UCL) on the arithmetic mean or the maximum concentration, whichever is lower. Exposure point concentrations are summarized for COPCs in each exposure area and medium. It should be noted that the risk assessment assumes that no reduction in exposure concentrations occurs due to natural physical/chemical processes, site remediation, or institutional controls.

Daily chemical intakes via the exposure route are quantitatively evaluated based on the concentration and the site-specific, medium-specific, and receptor-specific intake variables. Intake variables are estimated for both an RME scenario and a CT exposure scenario.

Toxicity Assessment
The toxicity assessment provides weight-of-evidence information regarding the potential for a particular chemical contaminant to cause adverse health effects in exposed individuals and provides, where possible, an estimate of the relationship between the extent of exposure to a chemical contaminant and the increased likelihood and/or severity of adverse health effects (EPA 1989a).

EPA has evaluated the toxicity of numerous chemicals and has made available the resulting toxicity information and toxicity values, which have undergone extensive peer review. These established toxicity values are obtained from EPA's Integrated Risk Information System (IRIS) database (EPA 2001) or from the Health Effects Assessment Summary Tables (EPA 1997a), if no value is available in IRIS. The Superfund National Center for Environmental Assessment (NCEA) is consulted for other specific chemical toxicity values, as directed by HEAST, when no value is shown in IRIS or HEAST.

Risk Characterization
The last step of the risk assessment process is risk characterization. This process consists of comparing the chronic daily intake for each chemical to which the receptor group might be exposed with concentrations known or suspected to present some health risk or hazard. Quantitative estimates of the carcinogenic risks and noncarcinogenic health effects associated with each exposure pathway are presented for current and potential future land uses of the site.

Because of the number of assumptions required during the risk assessment process, some degree of uncertainty is inevitably associated with the risk and hazard estimates. These uncertainties are discussed in the risk characterization section of the HHRA (CDM 2002b).

14.2 Overview of Risk Assessment Approach

In the HHRA for the Calcasieu Estuary, contaminants in sediment, surface water, fish tissue, and shellfish tissue at the Calcasieu Estuary site were quantitatively evaluated for potential health threats to human receptors via the ingestion and dermal pathways. Recreational users, commercial fishers, and residential fish and shellfish consumers were evaluated under present and potential future land use conditions. The estimates of risk and hazard and the greatest chemical contributors to these estimates have been presented and discussed.

Chemicals of potential concern were selected based on criteria outlined in RAGS (EPA 1989a), including screening levels that are presented in the HHRA (CDM 2002b). The chemicals of potential concern included SVOCs, pesticides, PCBs, dioxins/furans, and inorganics. The essential nutrients (i.e., calcium, magnesium, potassium, and sodium) were not quantitatively addressed as their potential toxicity is significantly lower than other inorganics at the site, and most existing toxicological data pertain to dietary intake.

Exposure routes and human receptor groups were identified, and quantitative estimates of the magnitude, frequency, and duration of exposure were made. Exposure points were estimated using the minimum of the 95 percent UCL and the maximum concentration. Chronic daily intakes for the ingestion route were calculated for reasonable maximum exposures.

In the toxicity assessment, current toxicological human health data (i.e., reference doses and slope factors) were obtained from various sources and were utilized in the order as specified by Risk Assessment Guidance for Superfund (RAGS) (EPA 1989a). Risk characterization involved integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. Specifically, chronic daily intakes were compared with concentrations known or suspected to present health risks or hazards. The carcinogenic risks and noncarcinogenic hazard index values calculated for the site are based on the reasonable maximum exposure (the highest exposure reasonably expected to occur at a site). The intent is to estimate a conservative exposure case that is still within the range of possible exposures.

In accordance with NCP Section 300.430 (e)(2) for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-6} and 10^{-4}. Per RAGS Part B: Development of Risk-Based Preliminary Remediation Goals (EPA 1991c), for noncarcinogenic effects, the NCP does not specify a range, but it is generally appropriate to assume a hazard index equal to 1.

In general, the EPA recommends target values or ranges (i.e., risk of 10^{-6} to 10^{-4} or hazard index of one) as threshold values for potential human health impacts (EPA 1989a). These target values aid in determining whether additional response action is necessary at the site. In cases where remedial action is warranted, the values also provide a basis for determining residual chemical levels that are adequately protective of human health, as well as a basis for comparing potential health impacts of various remedial alternatives.

14.3 Summary of Site Risks

In summary, a review of the carcinogenic risks and noncarcinogenic hazards for sediment and surface water exposures in the Calcasieu Estuary showed values that fell within EPA's target risk range of 10^{-4} to 10^{-6} and below a hazard index of 1. However the carcinogenic risks and noncarcinogenic hazards for fish and shellfish consumption exceeded EPA's target risk range and hazard index. A summary of excess lifetime cancer risks and of noncancer hazard indices is presented in Tables 14-1 and 14-2, respectively.

Risk Drivers

Shellfish Tissue
- PCBs
- Dioxin/Furans
- Arsenic
- Pesticides

Fish Tissue
- Dioxin/Furans
- Arsenic

Total excess lifetime cancer risks from consumption of fish and shellfish from the Calcasieu Estuary were above the range of 10^{-6} to 10^{-4}. The cancer risks associated with fish and shellfish ingestion from the areas of Bayou d'Inde, Upper Calcasieu, and Lower Calcasieu were all above 1×10^{-4} (1 in 10,000) for residential exposure and 1×10^{-3} (1 in 1,000) for subsistence exposure. The highest cancer risks were associated with ingestion of fish and shellfish ingestion from Bayou d'Inde. The chemicals that contributed most significantly to risk estimates include PCBs, dioxins/furans, arsenic, and pesticides in shellfish tissue and dioxins/furans and arsenic in fish tissue. Several pesticides, including aldrin, dieldrin, heptachlor epoxide, heptachlor, and BHCs, also contributed to the total cancer risk estimate.

Total excess lifetime cancer risks from ingestion of dioxins/furans in fish and shellfish from Bayou Verdine were also above the range of 10^{-6} to 10^{-4}. The cancer risk estimates were 1×10^{-4} (1 in 10,000) for residential exposure and 6×10^{-4} (6 in 10,000) for subsistence exposure. The estimated risks for residential fish/shellfish consumption were dominated by fish ingestion (1×10^{-4} for fish ingestion, 2×10^{-6} for shellfish ingestion). Similarly, for subsistence fish/shellfish ingestion, the estimated risks were due primarily to fish ingestion (5×10^{-4} for fish ingestion, 7×10^{-5} for shellfish ingestion). Only dioxin/furan concentrations were used to estimate these risks. Risks associated with other chemicals present in fish and shellfish were estimated in ENTRIX (2001). When the risks associated with dioxin/furan are added to the risks from the ENTRIX report, the total cancer risks for all chemicals in fish/shellfish are 4×10^{-4} for residential consumption and 2×10^{-3} for subsistence consumption.

The total hazard indices for both residential and subsistence fish/shellfish consumption from Bayou d'Inde, Upper Calcasieu, and Lower Calcasieu were all

greater than the threshold of one for noncancer effects. These hazard indices indicate that there is a potential for noncancer health effects to occur from ingestion of fish and shellfish from the Calcasieu Estuary. The chemicals that contributed most significantly to the noncancer hazard index include PCBs and manganese in shellfish tissue and PCBs in fish tissue. PCBs may adversely affect the eyes, skin, and nails of individuals consuming fish and shellfish from the Calcasieu Estuary at the rates assumed in this risk assessment. In addition, elevated levels of PCBs may cause immunological and developmental effects. Manganese may impact the nervous system of shellfish consumers.

As in any risk assessment, the estimates of potential health threats (carcinogenic risks and noncarcinogenic health effects) for the Calcasieu Estuary have associated uncertainties. The key uncertainties in this assessment that could influence the risk estimates are the following:

- Chemical concentrations in the estuary are likely to fluctuate and decrease over time. The risk estimates assume long-term (i.e., up to 30 years) exposure to a constant concentration and therefore may overestimate risks.

- Some of the risks noted in the assessment were based on limited data. For example, a limited number of tissue samples were analyzed for dioxins/furans, and an even smaller set were analyzed for barium and manganese. Additional data may need to be collected to provide technical support for any cleanup decisions that are based primarily on these chemicals in fish/shellfish tissue.

- For several COPCs, concentrations measured in reference area samples were similar to or higher than concentrations measured in the Calcasieu Estuary. Cancer risks estimated for dioxins/furans in reference area biota represent 5 to 44 percent of the risks estimated for dioxins/furans in the estuary, depending on the AOC. Cancer risks estimated for arsenic in reference area biota were higher than those estimated for the estuary.

- There is some uncertainty in the toxicity value for dioxin/furans. EPA has proposed a cancer slope factor for dioxins/furans that is seven times higher than the value applied here to 2,3,7,8-TCDD equivalents. Risks associated with these chemicals could be almost an order of magnitude higher.

As a result of these uncertainties, this risk assessment should not be construed as presenting absolute risks or hazards. Rather, it is a conservative analysis intended to indicate the potential for adverse impacts to occur based on a reasonable maximum exposure.

Table 14-1
Summary of Excess Lifetime Cancer Risks by Receptor and Exposure Area
Reasonable Maximum and Central Tendency Exposures

Area of Concern (AOC)	Exposure Area	Receptor					Risk Driver Chemicals for Fish/Shellfish
		Commercial Fisher	Recreational Fisher	Recreational Swimmer	Resident - Fish/Shellfish Ingestion	Resident - Subsistence Fish/Shellfish Ingestion	
Bayou d'Inde	Bayou d'Inde	NA	9E-06 (6E-07)	NA	1E-03 (1E-04)	3E-03 (4E-04)	Shellfish:dioxins/furans, Aroclor 1254, aldrin, bis2EHP, arsenic, beta-BHC; Fish: arsenic, dioxins/furans, aldrin, dieldrin, Aroclor 1254
Upper Calcasieu	Above Lake Charles	NA	2E-06 (2E-07)	2E-06 (9E-08)	4E-04 (4E-05)	1E-03 (1E-04)	Shellfish: dioxins/furans, Aroclor 1254, arsenic; Fish:arsenic, dioxins/furans, aldrin, dieldrin, Aroclor 1254
	Lake Charles	NA	1E-05 (9E-07)	2E-05 (5E-07)			
	Clooney Island Loop	NA	3E-06 (2E-07)	NA			
	Below Clooney Island Loop	1E-05 (8E-07)	4E-06 (3E-07)	NA			
Lower Calcasieu	Prien Lake	1E-05 (1E-06)	3E-06 (2E-07)	5E-06 (1E-07)	5E-04 (4E-05)	1E-03 (2E-04)	Shellfish: benzo(a)pyrene, dioxins/furans, arsenic, Aroclor 1254; Fish: arsenic, dioxins/furans, aldrin, dieldrin, Aroclor 1254
	Remainder of Lower Calcasieu	1E-05 (1E-06)	4E-06 (2E-07)	NA			
Bayou Verdine	Bayou Verdine	NA	NA	NA	1E-04 (5E-06)	6E-04 (7E-05)	Shellfish/Fish: dioxins/ furans

NA = Not applicable. Receptor is not expected to be present in this exposure area.
() Numbers in parenthesis are central tendency results.
1E-06 = One in one million
1E-05 = One in one hundred thousand
1E-04 = One in ten thousand
1E-03 = One in one thousand

The table provides the total excess lifetime cancer risk for each receptor by exposure area. These estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about exposure to sediment, surface water, fish, and shellfish.

An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 1E-06 to 1E-04 (one in one million to one in ten thousand).

The estimated risks for fish/shellfish ingestion and subsistence fish/shellfish ingestion are higher than EPA's generally acceptable risk range primarily due to the presence of dioxins/furans, PCBs, pesticides, and arsenic in shellfish and fish. Benzo(a)pyrene in shellfish also contributed significantly to the cancer risk in the lower Calcasieu. Details of the cancer risks for fish/shellfish ingestion are provided in CDM 2002b.

Table 14-2
Summary of Noncancer Hazard Indices by Receptor and Exposure Area
Reasonable Maximum and Central Tendency Exposures

Area of Concern (AOC)	Exposure Area	Receptor					Risk Driver Chemicals for Fish/Shellfish
		Commercial Fisher	Recreational Fisher	Recreational Swimmer	Resident - Fish/Shellfish Ingestion	Resident - Subsistence Fish/Shellfish Ingestion	
Bayou d'Inde	Bayou d'Inde	NA	0.016 (0.0038)	NA	12 (4.0)	33 (14)	Shellfish: manganese, Aroclor 1254, barium; Fish: Aroclor 1254
Upper Calcasieu	Above Lake Charles	NA	0.0045 (0.0011)	0.0056 (0.00053)	5.1 (1.6)	14 (5.8)	Shellfish: Aroclor 1254; Fish: Aroclor 1254
	Lake Charles	NA	0.059 (0.014)	0.12 (0.0082)			
	Clooney Island Loop	NA	0.037 (0.0089)	NA			
	Below Clooney Island Loop	0.087 (0.014)	0.068 (0.015)	NA			
Lower Calcasieu	Prien Lake	0.032 (0.0086)	0.011 (0.0025)	0.018 (0.0014)	3.8 (1.2)	10 (4.3)	Shellfish: Aroclor 1254, copper; Fish: Aroclor 1254
	Remainder of Lower Calcasieu	0.030 (0.0077)	0.0079 (0.0018)	NA			
Bayou Verdine	Bayou Verdine	NA	NA	NA	--	--	--

NA = Not applicable. Receptor is not expected to be present in this exposure area.

() Numbers in parenthesis are central tendency results.

-- = For Bayou Verdine, only dioxins/furans in fish and shellfish were evaluated in this risk assessment. Noncancer toxicity values are not available for dioxins/furans. See ENTRIX (2001) for noncancer HIs from other chemicals.

The table provides the total hazard index for each receptor by exposure area. These estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about exposure to sediment, surface water, fish, and shellfish. EPA Risk Assessment Guidance for Superfund (EPA 1989) states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.

The estimated HIs for fish/shellfish ingestion and subsistence fish/shellfish ingestion indicate that potential adverse noncancer effects could occur primarily due to the presence of PCBs and inorganics in shellfish and PCBs in fish. Details of the noncancer HIs for fish/shellfish ingestion are provided in CDM 2002b.

Section 15
Summary and Conclusions

15.1 Introduction and Background

Calcasieu Estuary is a complex estuarine system consisting of numerous perennial wetland bayous and tributaries in a heavy industrial setting (Section 2). The term estuary is used to describe, "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage" (Pritchard 1967).

Calcasieu Estuary is a drowned river valley system. Pritchard's description of the drowned river valley system is "a wide coastal plain; only a portion of the area affected by tides [e.g.] is estuarine, based on salinity diluted by freshwater"(Pritchard 1967).

The nature of Calcasieu Estuary is best described by total energy contributed by the various regions of the estuary. Specific regions of the estuary have been grouped into 1 of 5 energy system classes, including bayous, marshes, shallow lakes, shipping channels, and river (Figure 3-3). A small area that does not fit these broad energy system classes has been categorized as "other". The energy of this "other" area will influence surface water variability and sediment nature and stability. Each system influences the nature and behavior of surface water and sediment differently.

Industrial development, including chemical manufacturing and distribution, and petroleum refining has been prevalent in the Lake Charles area since the early 1920s and has impacted the estuary through the release of hazardous chemicals (Curry et al. 1997). Additionally, facility discharges, urban and agricultural activities, dredging, stormwater runoff, and accidental releases have contributed to contaminated groundwater and surface water in and around the industrial areas. These same activities also have resulted in contaminated sediments within the various surface waters in the estuary. Further, fish and shellfish within the estuary have been impacted by industrial contaminants, prompting the State of Louisiana to issue health advisories for the Calcasieu Estuary (Louisiana Department of Environmental Quality [LDEQ] 1999 and Louisiana Department of Health and Hospitals [LDHH] 2000). In January 1999, EPA decided, in the interest of the public health, welfare, and the environment, to implement a government-lead RI/FS under CERCLA.

The purpose of the RI was to gather sufficient information to define the nature and extent of chemical contamination in sediment, surface water, and biota within the Calcasieu Estuary and to support ecological and human risk assessments. The RI was conducted in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). Two phases of the RI were completed during November 2000 and November 2001.

15.2 Summary

The RI for the Calcasieu Estuary has been demonstrated through the chemical and statistical analysis of sediments, water, and biota, as a result, the Calcasieu Estuary COPCs-fall into three categories:

- ***Background*** is ambient concentrations of chemicals or compounds present in the environment that are not the result of human activities (e.g., aluminum, magnesium).
- ***Anthropogenic*** are conditions generated or created by, or a result of, human and/or human activities. Usually used in the content of emissions or non-point source run-off that is produced as a result of human activity.
- ***Industrial*** are spills, releases, or point source releases (NPDES) that are the result of human activities and processes in the production of man made or man induced materials that are have been altered chemically, physically, or biologically.

Exhibit 15-1 presents constituents detected in the RI and the three categories the constituents fit within.

Exhibit 15-1 Example Background, Anthropogenic, and Industrial Constituents

Background	Anthropogenic	Industrial
Potassium, Silver, Beryllium, Iron, Aluminum, Magnesium, Manganese, Cobalt, Vanadium, Selenium, Arsenic, Sodium, (low level metals)	4,4-DDT, 4,4-DDD, 4,4-DDE, Endrin, Dieldrin, Ethylbenzene, Acetone, Delta-BHC, Aldrin, Benzaldehyde, Alpha Chlordane, Phenanthrene, PCBs, dioxin/furans, nickel, mercury	PAHs, dioxin/furans, copper, chromium, PCBs, nickel, Aroclor 1254, alpha-BHC, Benzaldehyde, mercury, zinc

The three categories and their associated constituents are the result of the evaluation of the RI data through statistical analysis and a variety of published literature. It should be noted that analytes listed as background and anthropogenic also occur as industrial contaminants when generated in or released from a process (or non-point source) to the environment. From these categories, the RI focuses on areas within the Calcasieu Estuary that have been affected by industrial constituents that are related to historical releases and spills, ongoing releases, and to a lesser extent industrial anthropogenic effects. The discussion will begin in the northern portion of the study area (Upper Calcasieu) and conclude with the southern most area (Lower Calcasieu).

Upper Calcasieu

The areas that define the Upper Calcasieu portion of the estuary represent a mixture of land-uses and energy systems. Upper Calcasieu is divided into five energy systems: river, marsh, shallow lake, ship channel, and bayou. Contraband Bayou represents the bayou energy system in Upper Calcasieu and is a moderately saline low flow bayou. It receives effluent from the Lake Charles POTW. The river energy system consists of low salinity marsh areas above Lake Charles. The shallow lake area includes Lake Charles, the West Slip of Clooney Island Loop, and the eastern portion of Coon Island Loop; they are characterized by confined and shallow low-flow systems with generally limited circulation. The ship channel energy system includes the main ship channel from I-210 to Lake Charles and the slightly smaller limbs of Clooney Island Loop and western Coon Island Loop.

The portions of the river above Lake Charles are considerably less saline and are protected somewhat from storm surge and tidal influence. Lake Charles and the natural river segment between Lake Charles and the saltwater barrier experience seasonal salinity shifts, and the installation of the saltwater barrier was in response to saltwater intrusion in the region.

Upper Calcasieu in Coon Island Loop and Clooney Island Loop, receives surface runoff and wastewater discharge from industrial facilities (Lyondell, Conoco, and PPG), see Figure 9-2. These sources appear to define most of the COPC occurrences. However, isolated and discontinuous detections also occur for which associated releases are not discernable (e.g., oil field operations, railroad or highway associated runoff). Contraband Bayou receives effluent from the Lake Charles municipal wastewater treatment facility. Additional non-point sources (rural, residential, and light industrial areas) are also present throughout this system. Primary introduction of contaminants to this system appears to occur in Clooney Island Loop and Coon Island Loop.

The most extensive set of contaminants, and generally the greatest concentrations, are found in the shallow lake system portion within the Coon Island Loop and the Clooney Island Loop West Slip area.

The West Slip, (see Figure 9-2) has the highest levels of industrial contaminants in Upper Calcasieu and appears to be related to discharge from Lyondell. Contaminants in this area include PAHs, dioxins, PCBs, and metals. Similar contaminants can also be found in the northeast corner of Clooney Island Loop adjacent to the Conoco dock and at the southwest corner of Clooney Island Loop. Contaminants within the Clooney Island Loop are associated with outfalls from Lyondell and Conoco. Bayou Verdine is also a documented source to Upper Calcasieu.

Coon Island Loop is located in the southwest corner of Upper Calcasieu. Within Coon Island Loop, there are areas that have been identified to have high localized PAH and PCB contamination. The PAHs are located along the turning basin and in the northeast portion of Coon Island Loop (the shallow lake portion adjacent to the turning basin) at the mouth of Bayou Verdine. A linear pattern of PAHs is noted, but upon examination a shift from the LPAHs to HPAHs is seen. The PAHs detected in eastern Coon Island Loop are HPAHs, and those prevalent in the lower 100 m of Bayou Verdine are LPAHs. The HPAHs may be attributed to Lyondell/Olin NPDES outfalls or surface run-off within this area. PCBs, copper and lead were detected at elevated concentrations across Coon Island into the western portion of the loop and ecologic risks are noted for this area in the BERA.

Upper Calcasieu most Contaminated Areas

- West Slip
- Bayou Verdine Confluence
- Coon Island Loop (East)
- Clooney Island (East)

The Calcasieu Estuary BERA (CDM 2002c) has identified this area as a high risk to benthic invertebrate and fish communities based on multiple lines of evidence. The multiple lines of evidence are based on sediment and porewater toxicity tests, along with laboratory data. Similar contaminant driven risk can also be found in the northeast corner of Clooney Island Loop adjacent to the Conoco dock and at the southwest corner of Clooney Island Loop.

Fish and shellfish samples used to calculate human health consumption risk for Upper Calcasieu were collected from 9 locations. The sample locations were in Lake Charles, Clooney Island Loop and Coon Island Loop and represent popular public fishing spots. The locations are not necessarily in areas with impacted sediment.

The Reasonable Maximum Exposure (RME) calculated excess cancer risk for shellfish (only) consumption in Upper Calcasieu was driven by dioxin/furans (risk of 2×10^{-4}), Aroclor 1254 (5×10^{-5}) and arsenic (5×10^{-5}). Total excess risk for residential fish and shellfish consumption was 4×10^{-4}, total excess risk for subsistence fish and shellfish consumption was 1×10^{-3}. The residential and subsistence RME derived Hazard Indices (HI) are elevated for Upper Calcasieu, driven by Aroclor 1254 in shellfish.

Bayou Verdine

As noted earlier, Bayou Verdine is a source of contaminants to Upper Calcasieu. Bayou Verdine is a single energy system that was divided into five geographic reaches to facilitate data presentation and discussion. The reaches are defined in Section 8.1.2 and Figure 8-1. Bayou Verdine can be characterized as a moderately saline, channelized, moderately low-flow system with significant industrial discharge in the lower three reaches (Reaches 1 through 3). The upper reaches (Reaches 4 and 5) are generally a less-saline, shallow, and narrow vegetated low-flow system.

Bayou Verdine most Contaminated Areas
- Below west ditch to I-10
- Middle reach 1 to the mouth of bayou

The greatest extent and concentration of contaminants for this energy system are seen in Reaches 1 and 2, generally from the Vista West Ditch to below I-10 and from middle Reach 1 to the mouth of Bayou Verdine. The primary contaminant group is PAHs (predominantly LPAHs), however, Reach 2 is also impacted by dioxin/furans and various VOCs, primarily EDC. The maximum concentration of EDC was 19,000,000 µg/Kg. Concentrations of HPAHs were elevated throughout Reach 2, while dioxin/furans were moderately low.

Contaminant occurrence indicates that several sources are present throughout Bayou Verdine. The upstream reaches are relatively un-impacted by industry. The Conoco Lube Tank Farm area appears to be the primary source of LPAHs and minor HPAHs in Reach 3.

Reach 2 is primarily impacted by release through the Vista West Ditch and Vinyl Chloride Monomer (VCM) wastewater treatment unit discharge, Fabaucher Ditch, releases via Conoco Outfalls 001 and 004, and release through KCSRR Ditch. Reach 2 appears to be the most heavily impacted segment of Bayou Verdine.

Reach 1 appears to be impacted by release through outfalls that discharged to the upper third of the reach from I-10 through the PPG Derivatives Area (Plant B). Potential sources include the former Conoco, Olin, and Lyondell outfalls that discharge into Bayou Verdine below I-10. Releases to the lower reaches (Reaches 1 and 2) appear to come from PPG outfall 004 and activities (barge operations, periodic spills and associated releases) at the PPG North Dock area.

A high mortality rate for benthic invertebrates were identified within these reaches in the Conoco BERA prepared by Entrix, Inc. (Entrix 2001). Shellfish samples used to calculate human health consumption risks for Bayou Verdine were collected by Conoco. Biota samples were collected from 31 locations located in Reaches 1 through 3 in Bayou Verdine. Public access is limited although not restricted in Bayou Verdine. CDM staff collected fish filets for dioxin/furan analysis, as Conoco did not analyze dioxin/furans. Alligator gar was used as the representative fish as it was the only fish observed in Bayou Verdine during the sampling period.

The Total Reasonable Maximum Exposure (RME) calculated excess cancer risk for fish and shellfish consumption in Bayou Verdine was driven by arsenic and bis(2ethylhexyl)phthalate in fish. Total subsistence excess cancer risk for consumption was 1×10^{-3}.

Bayou d'Inde

The single largest bayou and most industrially impacted area the estuary is Bayou d'Inde. Bayou d'Inde is split into two energy systems, marsh and bayou. The bayou was divided into four geographic reaches to facilitate data presentation and discussion. The reaches are defined in Section 7.1.2 and Figure 7-1. The most

extensive set of contaminants, and generally the greatest concentrations are found in Reach 1 of Bayou d'Inde and Lockport Marsh. Contaminants found throughout Bayou d'Inde include PAHs, SVOCs, PCBs, dioxin/furans, and metals. Contaminants are widespread throughout the bayou and marsh energy systems.

PCBs are extensive throughout Reaches 1, 2 and 3. Dioxin/furans are predominant in Reaches 1 and 2, Lockport Marsh, and the Reach 2 marshes. Concentrations are often comparable where bayou and marsh locations are present. Overall, the primary impacted areas are lower Reach, Reach 1 and Lockport Marsh.

PCBs tend to occur in two primary PCB congener groupings, those grouped with PCB-118 and those with PCB-15. The PCB-118 group appears to originate in lower Reach 3 and extend through to the middle Reach 2 marsh area. The PCB-15 impacted areas begin at PPG Canal and are prevalent up to the middle of Reach 2 marsh and extend downstream through Reach 1 to the ship channel. Lockport Marsh contains the highest detections of PCBs. No documented PCB releases were noted in the regulatory record, however it is important to note that industrial processes, which combine carbon and chlorine at elevated temperatures, may generate PCBs as a by-product.

Bayou d'Inde most Contaminated Areas

- Lockport Marsh
- Citgo to LA-108
- PPG canal to the ship channel

Elevated concentrations of mercury tend to be found from Maple Fork Bayou through Reach 1 to the ship channel. Minor concentrations extend into upper Reach 3. Mercury concentrations are highest in the marshes, Lockport Marsh in particular. A potential source includes the former PPG mercury cell-settling pond that was operated in the late 1960s. The pond was an unlined impoundment within the PPG Canal drainage area. Additionally, localized elevated mercury detections within Lockport Marsh may be due to manometer use in by the oil field industry, however elevated mercury was not noted in Coon Island Loop where oil and gas drilling has also occurred.

HPAHs are found in the highest concentration in Reach 1, Lockport Marsh, and reach 2 marshes (near Maple Fork Bayou and marshes to the east). PPG Canal, Maple Fork Bayou and lower Reach 3 appear to be the sources of these PAHs. Elevated concentrations are noted in the marshes upstream of PPG Canal and may indicate PPG Canal overflow to these marshes. No known sources exist on Maple Fork Bayou, although industrial pipelines and a highway and a railroad spur cross Maple Fork near the highest detections. Urban runoff (anthropogenic) from the nearby highways may be a source of contaminants.

Documented releases from these features are unknown.

LPAH distribution is not as widespread in Bayou d'Inde as HPAHs. The LPAHs tend to be found in Lockport Marsh. Concentrations are generally higher than HPAHs. Additional LPAHs are noted in Maple Fork Bayou, lower Reach 3 and near LA-108 in upper Reach 2. In general, LPAHs tend to increase with depth, indicating historic release. Potential LPAH sources include processes at Citgo.

BEHP is found throughout Bayou d'Inde, however highest concentrations are noted in Reaches 1 and 2. BEHP appears to accumulate in the Reach 2 marshes and Reach 1. However, in Reach 1 where significant levels of BEHP were detected, the bayou rather than the marsh contains the majority of the contaminant. The concentrations in the bayou are greater than the Lockport Marsh by an order of magnitude in Reach 1. The overall distribution of BEHP suggests that the compound is greatly influenced by the presence of suspended or colloidal phase material in the water column. The distribution of BEHP indicates the greatest degree of transport of any COPC in Bayou d'Inde and suggests that its concentration in sediment is an indicator of low surface water flow velocity (high settling rate) and high organic or detritus material, either particulate or suspended.

The Calcasieu Estuary BERA (CDM 2002c) has identified this area as a high risk to benthic invertebrate and fish communities based on multiple lines of evidence. Fish and shellfish samples used to calculate human health consumption risk for Bayou d'Inde were collected from 6 areas. The sample locations were located in Reach 1 and the mouth of Bayou d'Inde, and lower Maple Fork Bayou. The locations represent popular public fishing spots.

The Reasonable Maximum Exposure (RME) calculated excess cancer risk for shellfish (only) consumption in Bayou d'Inde was driven by dioxin/furans (risk of 8×10^{-4}), Aroclor 1254 (6×10^{-5}) and Bis(2 ethylhexyl)phthalate (4×10^{-5}). Total excess risk for residential fish and shellfish consumption was 1×10^{-3}, total excess risk for subsistence fish and shellfish consumption was 3×10^{-3}. The residential and subsistence RME derived Hazard Indices (HI) are elevated for Bayou d'Inde, driven primarily by Manganese and Aroclor 1254 in shellfish.

Lower Calcasieu

South of Bayou d'Inde is Lower Calcasieu, which is divided into four energy areas: bayou, shallow lake, other (Indian Marais Lagoon), and ship channel. The energy areas are defined in Section 10.1.2 and Figure 10-1.

Bayous Olsen and Guy represent the bayou energy area in Lower Calcasieu. Both bayous are saline, low-flow systems. Bayou Guy receives predominantly rural residential flow. Bayou Olsen receives industrial discharge from W. R. Grace Inc., and rural residential run-off. Both bayous are net sediment exporters and receiving bodies are Moss Lake for Bayou Olsen and the Old Calcasieu River channel below Prien Lake for Bayou Guy.

The shallow lake areas include Prien Lake and Moss Lake; they are semi-confined shallow low-flow systems with limited circulation. Moss Lake tends to have the larger opening to the ship channel. The ship channel system includes the main ship channel from I-210 south to the southern end of Moss Lake.

The areas that define Lower Calcasieu represent a mixture of land-uses and point and non-point contaminant sources. Additional input to the Lower Calcasieu area includes flow from Upper Calcasieu, Bayou Verdine, and Bayou d'Inde sources. The most significant introduction of contaminants to the system appears to occur near the Citgo facility. The accumulation of low-level sediments in the bend of the ship channel south of Indian Marais Lagoon may come from any of the various sources upstream. Presence of material in this area appears to be the result of velocity drops and sediment particle settling.

Lower Calcasieu most Contaminated Area
- Indian Marais Lagoon

The most impacted area within Lower Calcasieu is the Indian Marais Lagoon. The most extensive set of contaminants and highest concentrations are located in the lagoon. Former discharges have impacted lagoon sediments. Primary COPCs include PAHs and various metals, primarily lead, copper, chromium, and zinc.

The shallow lake areas, specifically Prien Lake, tend to have broad distribution of moderate to low-level concentrations of dioxin/furans, PAHs, and some metals. Copper, lead, mercury, nickel, and zinc were present in elevated concentrations in Prien Lake in the surface water. Copper concentrations exceed the ambient water quality criteria set for acute and chronic marine exposure and chronic freshwater exposure limits. Mercury concentrations exceed the chronic ambient water quality criteria for freshwater systems.

Data from the ship channel portion of Lower Calcasieu indicated limited detections of dioxin/furans, PAHs, BEHP, and mercury. The distribution of COPCs is primarily associated with the Citgo facility and the Indian Marais Lagoon. Distribution appears to represent some degree of sediment transport downstream of the potential sources, e.g., the Citgo Outfalls 004 and 006 or the Indian Marais Lagoon, to a shallow shelf on the eastern side of the ship channel where velocities appear to decrease and settling occurs.

The Calcasieu Estuary BERA (CDM 2002c) has identified this area as a high risk to benthic invertebrate and fish communities based on multiple lines of evidence. Fish and shellfish samples used to calculate human health consumption risk for Lower Calcasieu were collected from 5 areas. The sample locations were located in Prien Lake, Indian Marais and Moss Lake. The locations represent accessible and popular public fishing spots.

The Reasonable Maximum Exposure (RME) calculated excess cancer risk for shellfish (only) consumption in Lower Calcasieu was driven by benzo (a) pyrene (risk of 2×10^{-4}), dioxin/furans (9×10^{-5}) Aroclor 1254 (2×10^{-5}) and arsenic (5×10^{-5}). Total excess risk for residential fish and shellfish consumption was 5×10^{-4}, total excess risk for subsistence fish and shellfish consumption was 1×10^{-3}. The residential and subsistence RME derived Hazard Index (HI) are elevated for Lower Calcasieu, driven primarily by copper and zinc.

15.3 Discussion

Localized hot spots occur throughout the study area and are the result of historical spills, releases, and/or current activities attributed, primarily to industries surrounding the Calcasieu Estuary. The RI has attempted to narrow the original study area, which started at the saltwater barrier and extended south to Moss Lake to more focused Areas of Interest (AOI). The AOI are based on the frequency of detects and the elevated concentration of COPCs and the result of the PCA as discussed in Sections 7 through 10.

Exhibit 15-2 summarizes the most significant AOI by geographic location in the estuary followed by COPC concentration compared to estuary-wide data population 95 percent Upper Confidence Limit (UCL) concentration, a general sediment stability ranking, potential contaminant sources to the study area, a ranking of ecological risk (from the BERA) posed by sediment to the benthic invertebrate community and a ranking of human health risk (RME) to potential subsistence and residential consumption of shellfish from each area (shellfish samples were collected for Bayou Verdine, Bayou d'Inde, Upper and Lower Calcasieu). Use of the 95 percent UCL is a standard statistical approach to identify the maximum values in a population. The data from all of the AOC and individual energy areas were combined to generate the estuary-wide population statistics provided in Appendix J. The statistical output is provided for all compounds, summation data is provided for total HPAHs, total LPAHs, and 2,3,7,8-TCDD TEQ.

This summary organic data is shown graphically on Figure 15-1. Inorganic data is shown on Figure 15-2. Each figure shows the data points where the 95 percent UCL was exceeded for the select group of compounds. The figures illustrate the primary areas impacted by the highest concentrations. They show correlation to physical conditions that influence contaminant occurrence and transport with the estuary as a whole. The COPC list is based on those compounds that are most prevalent, most concentrated and/or are a concern from a human health or ecological risk perspective.

Figures 15-1 and 15-2 and Exhibit 15-2 are intended to provide a summary of the most prevalent and/or significant contaminants. The figures illustrate distribution and a number of the physical conditions that influence chemical fate and transport. The presentation is not based on clean-up standards (site-specific standards have not been established in this report) but on standard statistical approaches to enable stakeholders and risk managers to evaluate the status of the estuary.

The following paragraphs discuss Exhibit 15-2 and provide the stakeholders and risk managers an overall understanding of the impacted areas and the risks associated.

Clooney Island West Slip

The Clooney Island West Slip area sediments are impacted by PAHs (high [HPAHs] and low [LPAHs] molecular weight), BEHP, mercury, zinc, and Aroclor-1254. Each of these compounds exceeds the estuary-wide population 95 percent UCL. The highest

concentrations are located in the West Slip area from UCR2028, and UCR2026 at the Conoco Dock. This AOI has also been identified as a high risk to benthic invertebrate and fish (CDM 2002c). Overall, sediment stability tends to be moderate, however, there is potential for the sediments to mobilize, particularly under heavy storm conditions. The sources of contaminants within this AOI are potentially attributed to Lyondell/Olin and Conoco storage, transfer, and transport activities. Elevated concentrations appear to be associated with current and historical outfalls releases as well as various non-point source releases associated with these operations.

Clooney Island Loop East
Sources of contaminants within this area potentially include Lyondell/Olin and Conoco, however the highest concentrations do not exceed the 95 percent UCL. Low-level contaminants include BEHP, dioxin/furans, copper, and Aroclor-1254. This distribution appears to be due to the physical transport and settling of adsorbed particulate matter. Overall, sediment stability tends to be moderate. It appears that re-suspension of fine grained material facilitates physical transport occurs throughout the Clooney Island Loop. Elevated concentrations appear to be associated with release from current and historical outfalls as well as various non-point source releases associated with these operations.

Coon Island Loop East
The primary contaminants in the eastern Coon Island Loop shallow lake include chromium, lead, and copper. It should be noted that significant HPAH concentrations are detected at the mouth of Bayou Verdine adjacent to this area. However, distribution gradients indicate salting-out of these PAHs as the enter Coon Island Loop. Lateral extent of PAHs is limited as distance increases from the mouth of Bayou Verdine. The extent of elevated metals within this area is greater than their PAHs. The highest lead and chromium concentrations are detected mid-way through the loop to station UCR 1-23-SD.

Overall, sediment stability tends to be moderate, however, there is potential for the sediments to mobilize, particularly under heavy storm conditions. The data suggests that moderate fine or suspended particle inorganic transport occurs. The BERA (CDM 2002c) indicates this is a high-risk area for benthic invertebrates and fish. The source of these contaminants is not fully understood, but is most likely Bayou Verdine. Limited surface run-off from adjacent industrial properties is possible, however, the distribution of contaminants indicates that deposition is from the mouth of Bayou Verdine not Coon Island.

Coon Island Loop (PPG North Dock Area and western portion of the Loop)
Limited various PAHs, BEHP, metals,, and PCBs were noted in the upper Coon Island Loop area near the confluence of Bayou Verdine and the Coon Island Loop turning basin. Lateral distribution extends approximately 1200 m upstream along the western Coon Island Loop from the mouth of Bayou Verdine. A metal that exceeds the 95 percent UCL is lead, which is detected mid-way through the loop to station UCR 1-13-SD.

Overall, sediment stability appears to have potential to mobilize. These contaminants suite appears to be from release to the mouth of Bayou Verdine and the lateral extent of PAHs, metals, PCBs, and dioxin/furans indicates that impacted sediments have been covered approximately 1,000 to 1,200 m along the ship channel from the PPG North Dock Area.

Discharges from outfalls 002 and 003 enter Coon Island Loop in this region, however, release histories and the contaminant levels indicate that material from the north dock area has also impacted sediments away from the North Dock Area. Potential for the sediments to be drawn further downstream exists, particularly under heavy storm conditions.

The BERA (CDM 2002c) indicates this is a high-risk area for benthic invertebrates and fish. Potential sources are the distribution, storage, and transportation of products and waste locally by PPG. Releases through the PPG Outfalls 002 through 004 are documented and appear to have contributed to current sediment quality. Additionally, oil field activities on Coon Island may be a potential source of PAHs and lead. The BERA (CDM 2002c) indicates this is a high-risk area for benthic invertebrates and fish.

Bayou Verdine Reach 1

The primary contaminants in the lower portion of Bayou Verdine include HPAHs, BEHP, PCBs, dioxin/furans, and metals. Contaminant extent is concentrated around I-10 and PPG Outfall 004 located upstream of the North Dock Area.

Reach 1 has received discharge from multiple industrial outfalls. It may be impacted by release associated with the KCSRR drainage ditch and/or runoff from I-10. Release from these process areas mix with the saline waters of Bayou Verdine contaminants noted in overlapping areas. PAH distribution appears to be due primarily to "salting-out". The PAH concentrations tend to indicate that localized areas with higher concentrations are present along Reach 1. The NPDES compliance data does not indicate significant release to these areas; therefore, other sources are suspect to have impacted this area.

Sediment stability in Reach 1 of Bayou Verdine is susceptible to tidal surge or storm scouring. Localized impact from surface drainage ditches is noted in the reaches upstream in Bayou Verdine and similar effects are likely to occur in Reach 1. While multiple sources exist, the broad distribution along the length of Reach 1 is indicative of contaminant transport and sediment movement. Based on this assumption, the sediment stability for this portion of Bayou Verdine is considered low. In addition, ecological risk evaluations conducted for Conoco (Entrix 2001) indicate that this area is a high-risk area for benthic invertebrates and fish.

Possible industrial sources of contaminants to Bayou Verdine Reach 1 include Condea Vista, Conoco, Tetra Technologies, Lyondell, and PPG. Additional potential sources likely include KCSRR railroad activities and run-off from I-10. Reach 1 sediments

contamination may be related to spills, release by impacted soils or groundwater or outfall discharge.

Bayou Verdine Reach 2
The contaminants that exceed the 95 percent UCL in Reach 2 of Bayou Verdine include LPAHs, EDC, and zinc. PCBs and PAHs were detected in previous studies and in the RI throughout Reach 2; however, the concentrations do not exceed the 95 percent UCL. The data indicates that most contaminant concentrations are higher in shallow surface sediments indicative of recent deposition. Reach 1 has received discharge from multiple industrial (i.e., CONDEA Vista and Conoco) outfalls. Surface run-off flow from industrial ditches and the distribution of contaminants indicate that the in-flow alters distribution locally. Release may also be impacted in lower Reach 2 by release associated with the KCSRR drainage ditch and/or runoff from I-10.

Tidal surge or high freshwater inflows tend to facilitate sediment transport in Reach 1. Based on this transport mechanism and shallow sediment concentrations, the sediment stability within this area is moderate. In addition, ecological risk evaluations conducted for Conoco (Entrix 2001) indicate that this area is a high-risk area for benthic invertebrates and fish.

Bayou Verdine Reach 3
The primary contaminants that exceed the 95 percent UCL in Reach 3 of Bayou Verdine are PAHs, PCBs, zinc, and VOCs (EDC). LPAHs in Reach 3 tend to be more concentrated than other areas throughout the estuary. Vertically, the concentrations of PAHs consisting of LPAHs and HPAHs tend to be highest in the subsurface in Reach 3. Sediment transport is evidenced by the broad distribution of PAHs from New Trousdale Road downstream in Reach 3. Primary contaminant sources to Reach 3 appear to be the Conoco Lube Tank Farm and the CONDEA Vista via the Vista West Ditch. While multiple sources exist, the broad distribution along the length of the bayou is indicative of moderate contaminant transport and sediment movement. Potential sources include CONDEA Vista and Conoco.

Bayou d'Inde - Lockport Marsh
The primary contaminants that exceed the 95 percent UCL in Lockport Marsh include dioxin/furans, PCBs, BEHP, HPAHs, LPAHs, copper, mercury, lead, and zinc. The potential responsible industries discharging these contaminants include PPG and the oil industry. The BERA (CDM 2002c) identifies areas throughout Lockport Marsh as high-risk to benthic invertebrates and fish. The distribution of contaminants throughout Lockport Marsh indicates a similar pattern. The areas with significant contamination are generally within the upper, bermed portion of Lockport Marsh. Sediment stability is poor in the lower portion of the area, outside of the levees. Circulation through the area can be substantial and contaminant distribution indicates that impacted sediments have been transported out of the area.

The potential source of contaminants within this AOI is PPG. Overall, Lockport Marsh is not considered a significant sink for contaminated sediments exported by

upper reaches. The upper portions of Lockport Marsh appear to receive contaminant input from PPG Canal and sediment stability in these areas is moderate. Protection by the levees however, would be compromised by high storm surges or flooding. Release to Lockport Marsh appears to be primarily from waste storage or discharge activities and/or impacted groundwater in-flow.

Bayou d'Inde Reach 1
Reach 1 was the Bayou d'Inde area with the greatest number of detections and the highest COPC concentrations. Reach 1 contaminants that exceed the 95 percent UCL include dioxin/furans, PCBs, BEHP, mercury, lead, and zinc. The HPAHs, LPAHs, HCB, and HCBD concentrations are also elevated, however, they are not shown on Figure 15-1. The contaminant concentrations and distribution in this reach warrant further evaluation. The BERA (CDM 2002c) identified areas throughout Reach 1 as high-risk to benthic invertebrate and fish.

The major potential source of contaminants within Reach 1 is PPG. Reach 1 also appears to receive minor amounts of impacted sediment (primarily BEHP and possibly Aroclor-1254) from upper reaches. Reach 1 may, under specific flow conditions, act as a sink for contaminated sediments exported by upper reaches. The primary contaminant source to Reach 1 is the PPG Canal. Sediment stability in Reach 1 is generally considered low and storm surges or wind forcing would likely mobilize sediments.

Bayou d'Inde Reach 2 Bayou and Marshes
The Reach 2 COPCs that exceed the 95 percent UCL include metals, PCBs, and dioxin/furans. The contaminant concentrations of metals are highest for copper, chromium, mercury, lead, and zinc. Reach 2 marshes tend to exhibit the highest concentrations for metals, dioxin/furans, and most HPAHs. Lead and zinc do not exceed the 95 percent UCL for the marshes; however, they are present in Reach 2 of the bayou at elevated concentrations.

Similarly, the HPAH compound 1,2-BPA is absent from Reach 2 marshes even though 1,2-BPA is present in the bayou, possibly indicating rapid chemical precipitation when it was released. The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrate and fish.

Potential sources of contaminants within Reach 2 include Citgo, Westlake Polymers, Equistar, and PPG. Reach 2 appears to receive impacted sediment from Reach 3 industrial releases. Reach 2 bayou is a net sediment exporter and its marshes act as sinks for contaminated sediments exported by Reaches 2 and 3. Evidence of flow both up and down stream is noted for Reach 2, specifically from contaminant gradient and compound presence. Sediment stability in Reach 2 is low to moderate as supported by contaminant distribution. Sediments may be mobilized by storm surges or wind forcing throughout lower Reach 2.

Bayou d'Inde Reach 3
Reach 3 contained a limited number of COPCs that exceed the 95 percent UCL, specifically PCBs, copper, zinc, and lead. However, concentrations of PAHs, BEHP, mercury, and dioxin/furans in Reach 3 tend to be the second highest of all detections observed in Bayou d'Inde. Two areas of possible contaminant sources are observed; the area between the uppermost Cit-Con Outfall and the Firestone outfall, and the area between OxyChem outfall 001 and Westlake outfall 002B near the LA-108 Bridge. The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrates and fish.

Reach 3 is a net sediment exporter. Reach 2 marshes appear to receive contaminated sediments exported by Reach 3. Sediment stability in Reach 2 is low to moderate as supported by contaminant distribution, and is likely mobilized by barge traffic near the docks at LA-108. Further, it appears likely that the shallow depth of Reach 3 makes the area susceptible to turbulence driven mixing due to strong winds or tidal forces.

Maple Fork Bayou
Contaminants that exceed the 95 percent UCL in Maple Fork Bayou include Aroclor-1254, chromium, and zinc. Mercury and dioxin/furans are also present at elevated levels. The BERA (CDM 2002c) identified both bayou and marsh areas throughout Reach 2 as high-risk to benthic invertebrates and fish.

No major contaminant sources are known to exist for Maple Fork Bayou. Anthropogenic releases from the railroad and industrial pipelines that cross Maple Fork Bayou appear to be a possible contaminant source. Contaminant concentrations indicate local release within the bayou.

Maple Fork Bayou appears to be a net sediment exporter. Sediment stability in Maple Fork Bayou is moderate given the limited temporal data available to evaluate the contaminant entry into Maple Fork Bayou. Storm surge or wind forcing may mobilize sediments.

Indian Marais Lagoon
The primary contaminants in Indian Marais Lagoon that exceed the 95 percent UCL include PAHs (HPAH and LPAH), PCBs, lead and zinc. Vertical core data indicate that sediment scouring has occurred in Indian Marais Lagoon.

The leading potential source of contaminants appears to be the former waste handling activities in the Indian Marais Lagoon with some addition from outfalls within the area (e.g., Citgo or upstream industrial releases to Upper Calcasieu, Bayou Verdine or Bayou d'Inde. The BERA (CDM 2002c) has indicated that Indian Marais is a high risk for benthic invertebrate and fish. Overall, sediment stability appears to be low. Current conditions have led to sediment accumulation, however, historically the site has been susceptible to storm scouring. It appears that material moves out of the lagoon into the ship channel during periods of high flow.

15.4 Conclusions

Calcasieu estuary represents a mixture of land-uses and energy systems. It is a complex system consisting of numerous perennial wetland bayous and tributaries in a heavy industrial setting. Development along the banks of the estuary has culminated in point and non-point discharge to the system that has resulted in impacted sediments than pose a risk to ecological biota.

The estuary can be characterized in many ways, and for the purpose of evaluating sediment stability; an energy-based approach was been chosen for the RI. By grouping areas into energy systems trends in contaminant behavior became apparent. The overall findings of the investigation indicate that the multiple lines of evidence approach yield a comprehensive evaluation of sediment quality within Calcasieu Estuary.

The figures in this section illustrate the primary areas impacted by the highest concentrations. They show correlation to physical conditions that influence contaminant occurrence and transport with the estuary as a whole. The summary is based on those compounds that are most prevalent; most concentrated and/or are a concern from a human health or ecological risk perspective.

Exhibit 15-2 Areas of Interest and Chemicals of Concern for the Calcasieu Estuary - Conclusions

Areas of Interest	PAHs	SVOCs[1]	VOCs	Metals[2]	PCBs	2,3,7,8-TCDD TEQ	Sediment Stability	Potential Sources	Human Health Risk Subsistence/Residential	BERA RISK
Upper Calcasieu										
▪ Clooney Island West Slip	A	A	B	A (Hg, Zn)	A	B	2	Lyondell/Olin, Conoco	High/Indeterminate	High
▪ Clooney Island Loop (East)	C	B	B	B	B	B	2	Conoco, Lyondell		High
▪ Coon Island Loop (East, shallow lake)	B	B	B	A (Cr, Pb); C (Cu)	B	B	2	PPG, Conoco, CONDEA Vista, Oil field Activities		High
▪ Coon Island Loop (PPG North Dock Area and west loop)	A	A	B	A (Pb); C (Cu)	A	C	1	PPG, Conoco, CONDEA Vista, Oil field Activities		High
Bayou Verdine										
▪ Reach 1	A	A	B	A (Zn)	B	B	1	Conoco, CONDEA Vista	High/Indeterminate	High[3]
▪ Reach 2	C	B	A	A (Zn)	B	B	2	Conoco, CONDEA Vista		High[3]
▪ Reach 3	A	B	A	A (Zn)	B	B	1	Conoco, CONDEA Vista		High[3]
Bayou d'Inde										
▪ Lockport Marsh	A	A	B	A (Cu, Hg, Pb, Zn)	A	A	1	PPG, Oil Field Activities	High/High	High
▪ Reach 1	C	A	B	A (Hg, Pb, Zn)	A	A	1	PPG		High
▪ Reach 2	B	B	B	A (Cu, Cr, Hg, Pb, Zn)	A	A	2	Citgo, Equistar, Westlake Polymers		High
▪ Reach 3	C	C	B	A (Cu, Zn)	A	C	2	Citgo, Equistar, Westlake Polymers		High
▪ Maple Fork Bayou	C	B	B	A (Cr, Zn)	A	C	2	Unknown (incl. Railroad activities, interstate runoff, industrial pipelines)		High
▪ Reach 2 Marshes	C	A	B	A (Cr, Cu, Hg)	A	A	3	Citgo, Equistar, Westlake Polymers, PPG		High
Lower Calcasieu										
▪ Indian Marais Lagoon	A	B	B	A (Pb, Zn)	A	B	1	Citgo	High/Indeterminate	High

Concentration Level Classes and Footnotes

A = Area Mean Exceeds the Estuary-wide 95 percent UCL

B = Area Mean does not exceed the Estuary-wide 95 percent UCL

C = Area Mean does not exceed the Estuary-wide 95 percent UCL but area remains AOI due to distribution or compound nature.

[1] - BEHP

[2] - Cr, Cu, Hg, Pb, Zn

[3] - Ecologic Risk for Bayou Verdine performed by Entrix, Inc., 2001 for Conoco

Stability

1 – High potential to re-mobilize

2 – Moderate potential to re-mobilize

3 – Low potential to re-mobilize

BERA (CDM 2002a)

Low Risk = Low

Indeterminate Risk = Ind.

High Risk = High

HHRA (CDM 2002b)

Low risk = excess risk > $1X\ 10^{-6}$

Indeterminate risk = $1\ X\ 10^{-4}$ to $1\ X\ 10^{-6}$

High risk = $<1\ X\ 10^{-4}$

Exhibit 15-2
Areas of Interest and Chemicals of Concern for the Calcasieu Estuary - Conclusions

Section 16
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Calcasieu Estuary Remedial Investigation
Lake Charles, Louisiana

Draft Remedial Investigation Report

November 2002







Appendices A - I

U. S. EPA Contract No. 68-W5-0022
Work Assignment No.: 941-RICO-06ZZ

3282-941-RTZ-RIRTZ-13707

DISCLOSURE

This disc contains Appendices A through I of the Calcasieu Estuary Draft Final RI Report. The links in the table of contents are accessible only to the sections included on the disc. Sections one through six with associated tables and figures are on Disc One. Sections seven through sixteen are on Disc Two. As with Disc One, Discs Two and Three links are only accessible to the sections included on that disc.

Calcasieu Estuary Remedial Investigation
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Appendices A - I

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Appendix A
Previous Investigations/Site Reference Documents

Numerous reference documents have been cited in the development of this RI report. Appendix A is a summary of ten previous investigation reports from properties within the investigation area. The reports are publicly available through LDEQ or USEPA Region 6. An overview of the scope and findings is presented below.

Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report, Prepared by McNeese State University for the Louisiana Department of Wildlife and Fisheries, June 1987.

The Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO) study was prepared for the Louisiana Department of Wildlife and Fisheries to understand the basic ecology of the Calcasieu River/Lake Complex and to evaluate the effects of human activities on that ecology. The study involved surveying in the Calcasieu Estuary, from the saltwater barrier to the mouth of the Calcasieu River (near Cameron at Monkey Island), for the presence of anthropogenic substances (i.e., SVOCs, VOCs, pesticides, PCBs, PAHs, and metals) as well as analyses of the effects of human activities (e.g., conventional and biological parameters) on the biotic communities within the estuary (Figure A1).

The study concluded that the influence from the urban environment was significant in Contraband Bayou and Bayou d'Inde with the latter bayou showing greater alterations to water quality compared to other water systems through out the Calcasieu Estuary. The investigation pointed out that bayous make poor receptacles for discharge of either domestic wastewater or industrial effluents. Likewise, evidence was established to a reasonable extent that urban runoff adversely affected the ecological balance of bayous. Because of the movement of water through the Calcasieu Estuary (the flow rate is not sufficient to flush pollutants downstream) anthropogenic substances tend to stay undiluted, in the small bayous that comprises the upper portion of the Calcasieu Estuary. Table A1-1 summarizes the investigation and findings of the CALECO study.

Table A1-1 Summary of Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Calcasieu River/Lake Complex (Upper and Lower Calcasieu)	▪ Conventional parameters (pH, temperature salinity, etc.) ▪ (SVOCs ▪ VOCs ▪ Pesticides ▪ PCBs ▪ PAH ▪ Inorganic compounds	▪ 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane (DDT) ▪ 1,1-dichloro-2,2-bis(chlorophenyl) ethylene (DDE) ▪ 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD) ▪ Benzo(a)pyrene ▪ Hexachlorobenzene ▪ Copper ▪ Chromium ▪ Lead ▪ Zinc	Discharges of domestic wastewater and industrial effluent, as well as runoff from an urban environment, can be expected to adversely affect the ecological balance of a bayou.

Calcasieu Estuary Water Sampling Program, Louisiana Department of Environmental Quality, 1987-1996.

The Louisiana Department of Environmental Quality (LDEQ) has measured ambient water conditions in the Calcasieu Estuary on a monthly basis since 1987. LDEQ collects water samples from 23 discrete sampling locations within the estuary. Stations range from the saltwater barrier near Lake Charles to the southern end of Calcasieu Lake, and include Bayou d'Inde, Prien Lake, and portions of the Calcasieu River and ship channel (Figure A2). Over the history of the program, LDEQ has collected more than 2,000 water samples. These samples were analyzed for VOCs and conventional parameters such as dissolved oxygen and salinity. LDEQ did not analyze the data for SVOCs, PCBs, or inorganic compounds.

Since the LDEQ water data include more than eight years of monitoring information, they provide insight into the estuary's historical contamination trends. LDEQ limits its analysis to volatile organic compounds, whereas other studies measure a wide range of chemical groups. Although some of the VOCs were found very infrequently, LDEQ detected 18 compounds in at least 10 percent of the 91 samples. Furthermore, eight compounds were detected in over 50percent of the samples. These eight compounds include bromodichloromethane, bromoform, chloroform, 1,2-dichloroethane, 1,1,2,2-tetrachloromethane, tetrachloromethane, 1,1,1-trichloroethane, and trichloroethane. The two most frequently detected compounds were chloroform and 1,2-dichloroethane (79 percent and 77 percent of the samples, respectively). LDEQ measured concentrations for three VOCs at greater than 0.1 mg/L. These

VOCs include bromoform, chlorobenzene, and trans-1,3-dichloropropene. The maximum concentration measured for any of the compounds was 0.185 mg/L for bromoform. Table A1-2 summarizes the sampling and results of the LDEQ sampling.

Table A1-2 Summary of the Calcasieu Estuary Water Sampling Program, (LDEQ), 1987-1996

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Calcasieu Basin (Upper and Lower Calcasieu Estuary)	▪ VOCs ▪ Conventional parameters (dissolved oxygen, pH, salinity, etc)	Major VOCs: ▪ Bromodichloromethane ▪ Bromoform ▪ Chloroform ▪ 1,2-dichloroethane ▪ 1,1,2,2-tetrachloromethane ▪ Tetrachloromethane ▪ 1,1,1-trichloroethane ▪ Trichloroethane	Eighteen compounds were detected in at least 10% of the 91 samples. Eight VOCs were detected in over 50% of the samples.

Toxics Study of the Lower Calcasieu River, Prepared by Research Triangle Institute for the U.S. Environmental Protection Agency-Region VI, Louisiana Department Environmental Quality and U.S. Geological Survey, March 1990.

The Toxics Study of the Lower Calcasieu River summarizes the results of a toxics study conducted by USEPA Region VI, LDEQ, and the USGS. The study area included the Lower Calcasieu River, Bayou d'Inde, Bayou Verdine, Prien Lake, Lake Charles, Moss Lake, and Calcasieu Lake (Figure A3). Water and sediment samples were collected in June and July of 1988 and April 1989. Water samples were mid-channel, mid-depth grab samples. Sediment samples were composite samples, consisting of three grab samples (river locations). Grab samples were also taken from wastewater effluent from industrial facilities.

Samples were tested for VOCs, SVOCs, PCBs, pesticides, inorganic elements, anions, and conventional chemical and physical parameters (e.g., salinity, pH, temperature). Toxicity testing of effluent, water, and sediment samples was performed using six different bioassay species and methods. The report concluded that a variety of organic and inorganic constituents exist in the various media, which resulted in high mortality rates of benthic species within the estuary. Table A1-3 summarizes the investigation and findings of the EPA Toxics study.

Table A1-3 Summary of Toxics Study of the Lower Calcasieu River

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Lower Calcasieu River (including; Bayou Verdine, Bayou d'Inde, Prien Lake, Lake Charles, Moss Lake, Calcasieu Lake)	▪ VOCs ▪ SVOCs ▪ PCBs ▪ Pesticides ▪ Inorganic compounds ▪ Anions ▪ Conventional parameters (pH, temperature, salinity, etc)	Major constituents: ▪ 1,2-dichloroethane ▪ Tetrachloroethene ▪ Benzo(a)anthracene ▪ Bis(2-ethylhexyl) phthalate ▪ Chrysene ▪ Fluorene ▪ Acenaphthene ▪ 2-methylnaphthalene ▪ Phenathrene ▪ Endrin ▪ Mercury ▪ Nickel ▪ Copper ▪ Total PCBs	Inorganic and organic compounds in the sediment and surface water were toxic to several bioassay species.

Bayou d'Inde Expanded Site Inspection - Final Report, Prepared by PRC Environmental Management, Inc. for the U.S. Environmental Protection Agency-Region VI, September 1993.

The Bayou d'Inde Expanded Site Inspection was prepared for the USEPA as part of the CERCLA Hazard Ranking System screening process. The objectives of this study were to document contamination in Bayou d'Inde and to build on previously collected data by further defining site waste characteristics, contaminant sources, and exposure pathways. PRC Environmental Management, Inc. collected samples from November 30 through December 4, 1992. Sediment samples were collected from near-shore and deeper channel locations (Figure A4).

Samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and inorganic elements. Sediment used for the VOC analyses was taken as a grab from a discrete sample interval; the remaining sample interval was homogenized for the SVOC, PCB, pesticide, and inorganic analyses. Numerous inorganic and organic contaminants were documented in Bayou d'Inde specifically concentrated from the industrial areas to its confluence with the Calcasieu River. Similar contaminants were also documented in the PPG Canal. Table A1-4 summarizes the Bayou d'Inde Expanded Site Investigation analyses and results.

Table A1-4 Summary of Bayou d'Inde Expanded Site Inspection – Final Report

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Bayou d'Inde	▪ VOCs ▪ SVOCs ▪ PCBs ▪ Pesticides ▪ Inorganic compounds	Major constituents: ▪ Tetrachloroethane ▪ Dibromochloromethane ▪ Bis(2-ethylhexyl) phthalate ▪ Fluorene ▪ Phenanthrene ▪ 2-methylnaphthalene ▪ Naphthalene ▪ Total PCB ▪ Endrin ▪ DDE ▪ Mercury ▪ Nickel	Numerous inorganic and organic analytes from industrial facilities were concentrated in Bayou d'Inde to its confluence with the Calcasieu River.

Site Inspection for Bayou Verdine, Prepared by PRC Environmental Management, Inc., for U.S. Environmental Protection Agency - Region VI, May 1994.

The Site Inspection for Bayou Verdine was focused on areas of elevated contaminant concentrations. Background information presented in this report was prepared from a comprehensive file review. The study objective was to document the presence of hazardous substances in surface water and sediments from PPG's North Dock, a section of Coon Island Loop, and Bayou Verdine (including Kansas City Southern Railroad West Ditch, the Vista West Ditch, and the Faubacher Ditch; Figure A5). A total of 27 sediment and 23 surface water samples were collected from 27 stations within the study area from July 19 through July 22, 1993. Sediment samples were collected from near-shore and center channel areas with dedicated aluminum push tubes.

Sediment samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and inorganic compounds. Sediment for the VOC analyses was discrete depth grab samples; the remaining sample interval was homogenized for the SVOC, PCB, pesticide, and inorganic elemental analyses. Surface water samples were collocated with the sediment samples; however, they were only analyzed for VOCs. The primary chemicals of potential concern (COPCs) identified were benzo(a)pyrene; dibenz(a,h)anthracene; 1,2-dichloroethane; 1,1,2-trichloroethane; vinyl chloride; benzene; chromium; lead; and mercury. Table A1-5 summarizes the Bayou Verdine site inspection findings.

Table A1-5 Summary of Site Inspection for Bayou Verdine

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Bayou Verdine	▪ VOCs ▪ SVOCs ▪ PCBs ▪ Pesticides ▪ Inorganic compounds	▪ Benzo(a)pyrene ▪ Dibenz(a,h)anthracene ▪ 1,2-dichloroethane ▪ 1,1,2-trichloroethane ▪ Vinyl chloride ▪ Benzene ▪ Chromium ▪ Lead ▪ Mercury	Hazardous substances were present in the surface water and sediment in portions of Coon Island Loop and Bayou Verdine.

Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River, Prepared by McLaren/Hart Environmental Engineering - ChemRisk Division for PPG Industries, Inc., 1994.

The study objective was to characterize the nature and extent of chemical contamination in Coon Island Loop (including the PPG North Dock facilities) and a section of Bayou Verdine (from Interstate Highway 10 to the Coon Island Loop) for PPG. ChemRisk established 58 sampling stations within the study area. Twelve stations were located in Bayou Verdine; 16 were located in the PPG dock area and turning basin (including two transects); 18 stations (comprising six transects) were located in the west arm of Coon Island Loop; and 12 stations (including five transects) were located in the east arm and south end of Coon Island Loop (Figure A6).

ChemRisk collected 33 surface water samples from 25 stations from October 1 to October 15, 1993. Bayou Verdine, the dock area and turning basin, and the east and southern Coon Island Loop locations (17 stations) were sampled at one depth, at approximately two-thirds the depth of the surface water. Coon Island Loop locations from the western arm (eight stations) were collected from the center of the dredged ship channel at two depths. All samples were collected with a Van Dorn water sampler. ChemRisk completed multi-depth (4 inches to 9 feet) sediment boring at the 58 different locations, from which 141 sediment samples were collected. Sediment samples from Bayou Verdine reached a maximum depth of 2 feet. Samples were collected using a vibratory corer and a 2-inch, split barrel, PVC sampler.

All surface water and sediment samples were analyzed for VOCs, SVOCs, total petroleum hydrocarbons (TPHs; i.e., diesel and gasoline fractions), PCBs, chlorinated pesticides, inorganic compounds, anions, ammonia, and conventional physical and chemical parameters (e.g., salinity, pH, temperature). A grain-size analysis also was performed on the sediment samples. Analytical results showed elevated

concentrations of organic and inorganic contaminants in the areas sampled. Table A1-6 summarizes results of the 1993 PPG study.

Table A1-6 Summary of Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Bayou Verdine and the Coon Island Loop	▪ VOCs ▪ SVOCs ▪ TPHs ▪ PCBs ▪ Chlorinated pesticides ▪ Inorganic compounds ▪ Anions ▪ Ammonia ▪ Conventional parameters (pH, temperature, salinity, etc.)	Major constituents: ▪ 1,2-dichloroethane ▪ Anthracene ▪ Benzo(b)fluoranthene ▪ Benzo(g,h,I)perylene ▪ Dibenzo(a,h)anthrancene ▪ Fluorene ▪ Indeno(1,2,3-cd)pyrene ▪ 2-methylnaphthalene ▪ Naphthalene ▪ Phenanthrene ▪ Pyrene ▪ Nickel	Analytical results showed elevated concentrations of organic and inorganic contaminants in the areas sampled.

Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report, Prepared by McLaren/Hart Environmental Engineering - ChemRisk Division for PPG Industries, Inc., June 1995.

The ChemRisk Sediment Sampling Report was prepared for PPG Industries, Inc. The objective of the study was to assess sediment and water quality in Bayou d'Inde, the Lower PPG Canal, and a portion of the Calcasieu ship channel (Figure A7). Surface water sample locations that exhibited salinity stratification were sampled 3 feet above the sediment and in the middle of the freshwater layer. At non-stratified sample locations, one surface water sample was collected at two-thirds the depth of the water. Five-foot-long sediment cores were collected from the main channel of Bayou d'Inde, and 10-foot cores were collected from the shallow sample locations within the bayou.

Water and sediment samples were tested for VOCs, SVOCs, PCBs, chlorinated pesticides, TPHs, total and dissolved inorganic compounds, ammonia, major anions, and conventional chemical and physical parameters (e.g., salinity, pH, temperature). Conclusions state that, although many constituents were detected in surface water, there were no organic or inorganic contaminants that warranted additional characterization. However, for sediment, most organic and inorganic constituents were detected and warranted additional investigations to fully characterize the area. Table A1-7 summarizes the results presented in the 1995 PPG report.

Table A1-7 Summary of Bayou d'Inde, Lower PPG Canal, Calcasieu River Ship Channel Water and Sediment Sampling Report

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Upper Calcasieu Estuary (Bayou d'Inde, Lower PPG Canal, and Lower Calcasieu River Ship Channel)	▪ VOCs ▪ SVOCs ▪ TPHs ▪ PCBs ▪ Chlorinated pesticides ▪ Inorganic compounds (total and dissolved) ▪ Anions ▪ Ammonia ▪ Conventional parameters (pH, temperature, salinity, etc.)	Major constituents: ▪ 1,2-dichloroethane ▪ Tetrachloroethene ▪ Bis(2-ethylhexyl) phthalate ▪ 1,2,4-trichlorobenzene ▪ Total PCBs ▪ Hexachlorobenzene ▪ Hexachlorobutadiene ▪ 2-methylnaphthalene ▪ Napthalene ▪ Copper ▪ Lead ▪ Mercury ▪ Nickel	Many inorganic and organic compounds were detected in the surface water and sediment; no further characterization was needed for surface water.

Findings Report for the Focused Site Assessment - Bayou d'Inde, Prepared by Fluor Daniel, Inc. for U.S. Environmental Protection Agency - Region VI, August 1997.

Fluor Daniel, Inc. conducted the Bayou d'Inde Focused Site Investigation for the USEPA Region VI as part of the CERCLA site investigation process. The sampling was initiated in response to a proposed dredging permit within the lower 1,000 feet of Bayou d'Inde. The purpose of the study was to determine the area extent of contamination within lower Bayou d'Inde. Water samples were collected from locations established at the confluence of Bayou d'Inde and the Calcasieu River and at 500; 1,000; and 5,000 feet upstream and downstream (Figure A8). Samples were collected from the surface and at near-bottom depth. Sediment core samples were collected from the lower 1,250 feet of Bayou d'Inde to depths of 10 to 20 feet.

All samples were analyzed for VOCs, SVOCs, inorganic compounds, PCBs, and pesticides. Five sediment samples were also analyzed for dioxin. The findings suggest contaminated sediment to a maximum depth of 16.5 feet; however, the majority of the contaminants occurred in the upper 4 feet. Elevated concentrations of three dioxins were reported. In addition, approximately 65,000 cubic yards of contaminated sediment reportedly exist in an area proposed for dredging. Table A1-8 summarizes the findings of the 1997 Bayou d'Inde Focused Site Assessment.

Table A1-8 Summary of Findings Report for the Focused Site Assessment – Bayou d'Inde

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Bayou d'Inde	▪ VOCs ▪ SVOCs ▪ PCBs ▪ Pesticides ▪ Inorganic compounds ▪ Dioxins	Major constituents: ▪ 1,2-dichloroethane ▪ 1,1,2,2-tetrachloroethane ▪ Benzo(a)anthracene ▪ Benzo(b)fluoranthene ▪ Bis(2-ethylhexyl) phthalate ▪ Chrysene ▪ Fluorene ▪ Hexachlorobenzene ▪ 2-methylnaphthalene ▪ Phenanthrene ▪ Total PCBs	Contaminated sediments extended to a maximum depth of 16.5 feet, with the majority of contaminants occurring in the upper 4 feet. Elevated concentrations of three dioxins were reported.

Calcasieu River Estuary Biological Monitoring Program: Annual Report April 1997 – January 1998 (Year 9) Prepared by QST Environmental Inc. for PPG Industries, Inc., Louisiana Department of Health and Hospitals and Louisiana Department of Environmental Quality, July 1998.

QST Environmental Inc. (QST) conducted quarterly field sampling and chemical analyses for. Aquatic organisms where collected from 11 stations throughout the Calcasieu Estuary. Stations were located in the estuary from the upper Calcasieu River to the Gulf of Mexico (Figure A9). PPG has sampled fish and shellfish on a quarterly basis since 1989. The study targeted seven species of fin fish (i.e., spotted sea trout, sand sea trout, southern flounder, red drum, black drum, blue catfish, and channel catfish) and four species of shellfish (i.e., blue crab, white shrimp, brown shrimp and oyster). Fish and shellfish samples were analyzed for twelve chlorinated hydrocarbon compounds (e.g., hexachlorobenzene and hexachlorobutadiene) and PCBs (as seven Aroclor mixtures 1016, 1221, 1232, 1242, 1248, 1254, 1260). Collections were made using trawl, gill net, crab trap, oyster tongs, and hook-and-line sampling. During each quarterly survey, physio-chemical measurements (i.e., water temperature, conductivity, salinity, pH, and DO) were made at 1-meter intervals from the surface to near-bottom of the water column.

The principal findings of the study indicated that Bayou d'Inde and the PPG Canal contained the most contaminated fish and shellfish in the Calcasieu Estuary. Of the 13 contaminants, 12 were found at the highest concentrations in the PPG Canal or in the lower portion of Bayou d'Inde. The contaminants with the highest concentration

included hexachlorobenzene, hexachlorobutadiene, PCB Aroclor 1254 and pentachlorobenzene, all of which were measured in excess of 1 ppm. Hexachlorobenzene, hexachlorobutadiene, and 1,2-dichlorobenzene, were measured at or above 100 ppb as far south as Calcasieu Lake and the Gulf of Mexico. Two contaminants (Aroclor 1254 and 1,2,3,4-tetrachlorobenzene) also were measured at or above 100 ppb level upstream of Bayou d'Inde. The results were consistent with presumptions regarding fish mobility and bioaccumulation.

Species analysis indicated that blue catfish and channel catfish were the most contaminated species within the estuary. Out of the 13 contaminants measured, catfish had the highest concentration for 8 contaminants. Brown shrimp, black drum, blue crab and spotted sea trout samples contained the highest measured concentrations for the five remaining contaminants (hexachlorobenzene and hexachlorobutadiene, 1,2-dichlorobenzene, 1,2,3-trichlorobenzene, and 1,2,4-trichlorobenzene, respectfully). Other species that exhibited high levels of contamination with less frequently include red drum, southern flounder, and oyster. Tissue concentrations of hexachlorobenzene, hexachlorobutadiene, and several additional chlorinated hydrocarbons monitored have been highest in the vicinity of the PPG Canal and Bayou d'Inde and have decreased at upstream and downstream locations within the estuary. Table A1-9 summarizes the results of the Biological Monitoring (Year 9) study.

Table A1-9 Summary of the Calcasieu River Estuary Biological Monitoring Program: Annual Report April 1997 – January 1998 (Year 9)

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Upper and Lower Calcasieu Estuary	▪ Conventional parameters ▪ Chlorinated hydrocarbons ▪ PCBs	▪ Hexachlorobenzene ▪ Hexachlorobutadiene ▪ Pentachloroethane ▪ Hexachloroethane ▪ 1,2-dichlorobenzene ▪ 1,3-dichlorobenzene ▪ 1,2,3-trichlorobenzene ▪ 1,2,4-trichlorobenzene ▪ 1,3,5-trichlorobenzene ▪ 1,2,3,4-tetrachlorobenzene ▪ 1,2,4,5-tetrachlorobenzene ▪ PCB Aroclor 1254	Tissue concentrations of hexachlorobenzene, hexachlorobutadiene, and several additional chlorinated hydrocarbons monitored were highest in the vicinity of the PPG Canal and its confluence with Bayou d'Inde. Concentrations at locations upstream and downstream of these areas decreased.

Bayou Verdine Investigation, Nature and Extent Investigation, Lake Charles, Louisiana, prepared by Entrix, Inc., for Conoco, Inc., October 1999.

The Bayou Verdine Investigation, Nature and Extent Investigation was completed on the behalf of Conoco to characterize the nature of chemical constituents in Bayou Verdine as well delineate the extent of those constituents in the lower 4.5 kilometers (km) portion of the bayou near the Conoco refinery in Westlake, Louisiana (Figure A10). The investigation also included a biological inventory evaluation to identify representative plant and wildlife species inhabiting the area.

A total of 134 chemicals; these include VOCs, pesticides, inorganic compounds, PAHs, SVOCs, dioxins/furans, and PCBs, were analyzed in 12 surface water samples and 96 sediment samples. In surface water, four chemicals were detected; however, none of these exceeded water quality criteria benchmarks. In sediment, 58 chemicals were detected of which 47 were found to exceed sediment quality benchmarks. These 47 chemicals included, VOCs, pesticides, inorganic compounds, PAHs, and SVOCs. The data collected indicated the highest concentrations of many of the chemical constituents were found in the lower reaches with decreasing concentrations in the upper reaches. Table A1-10 summarizes the results of Bayou Verdine Investigation, Nature and Extent Investigation.

Table A1-10 Bayou Verdine Investigation, Nature and Extent Investigation

Study Area	Analytes Investigated	Analytes Detected	Results of Study
Bayou Verdine	▪ VOCs ▪ SVOCs ▪ PCBs ▪ Pesticides ▪ Inorganic compounds ▪ Conventional parameters (pH, temperature, salinity, etc.)	▪ PAHs ▪ VOCs ▪ SVOCs ▪ Pesticides ▪ Inorganic compounds	The analysis of chemicals in sediments indicated that a number of chemical groups, including inorganic compounds and PAHs, were present in sediments at concentrations that may elicit adverse effects in aquatic organisms.

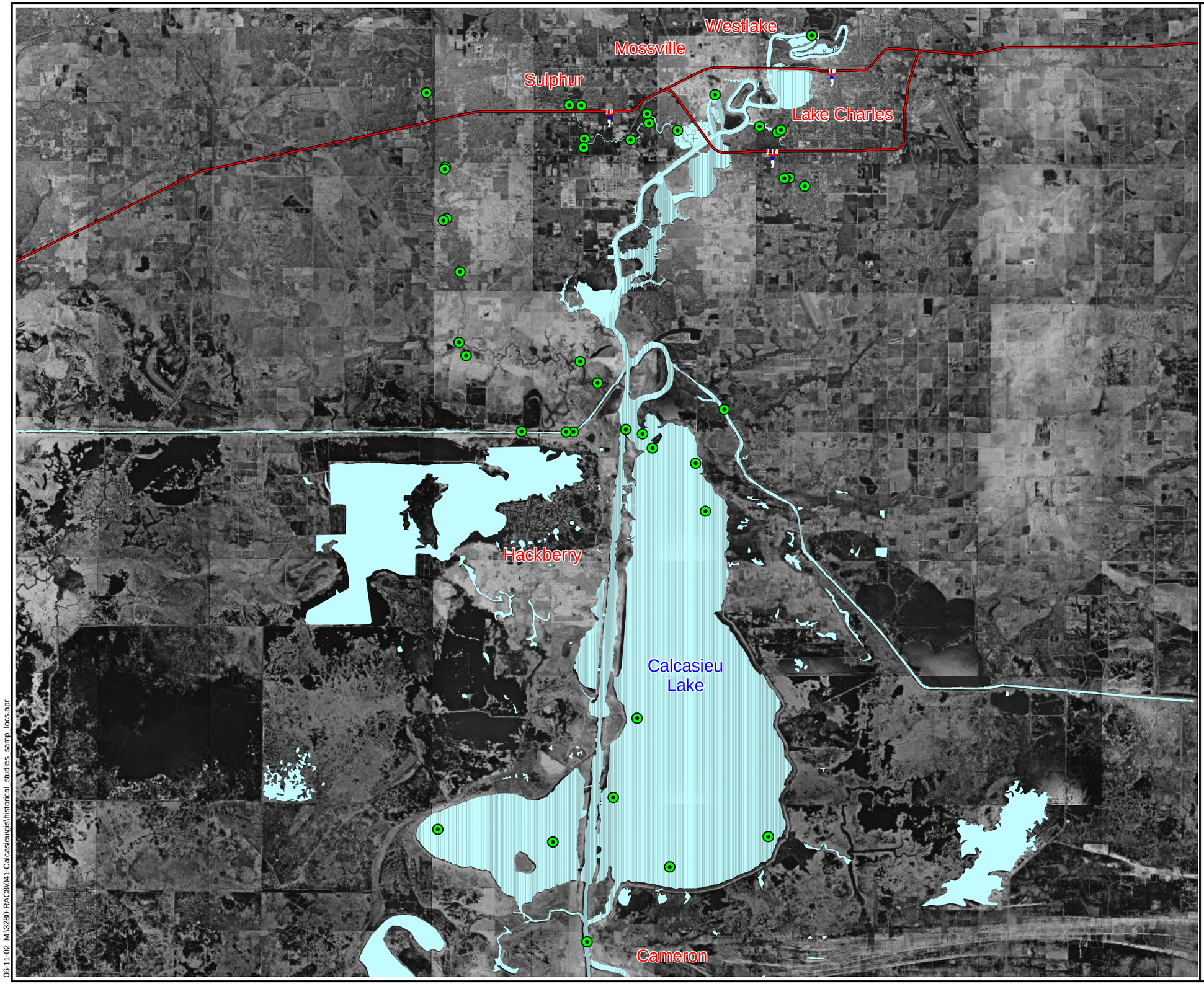

Figure A1
Sample Location Map
Ecosystem Analysis of the Calcasieu River/Lake Complex (CALECO), Final Report
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Sulphur — City
- Water
- Interstate

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Figure A2
Sample Location Map
Calcasieu Estuary Water Sampling Program,
Louisiana Department of Environmental
Quality, 1987-1996
Calcasieu Parish, Louisiana

Westlake
Mossville
Sulphur
Lake Charles
Hackberry
Calcasieu
Lake

Legend

- Sample Location
- Sulphur City
- Water
- Interstate

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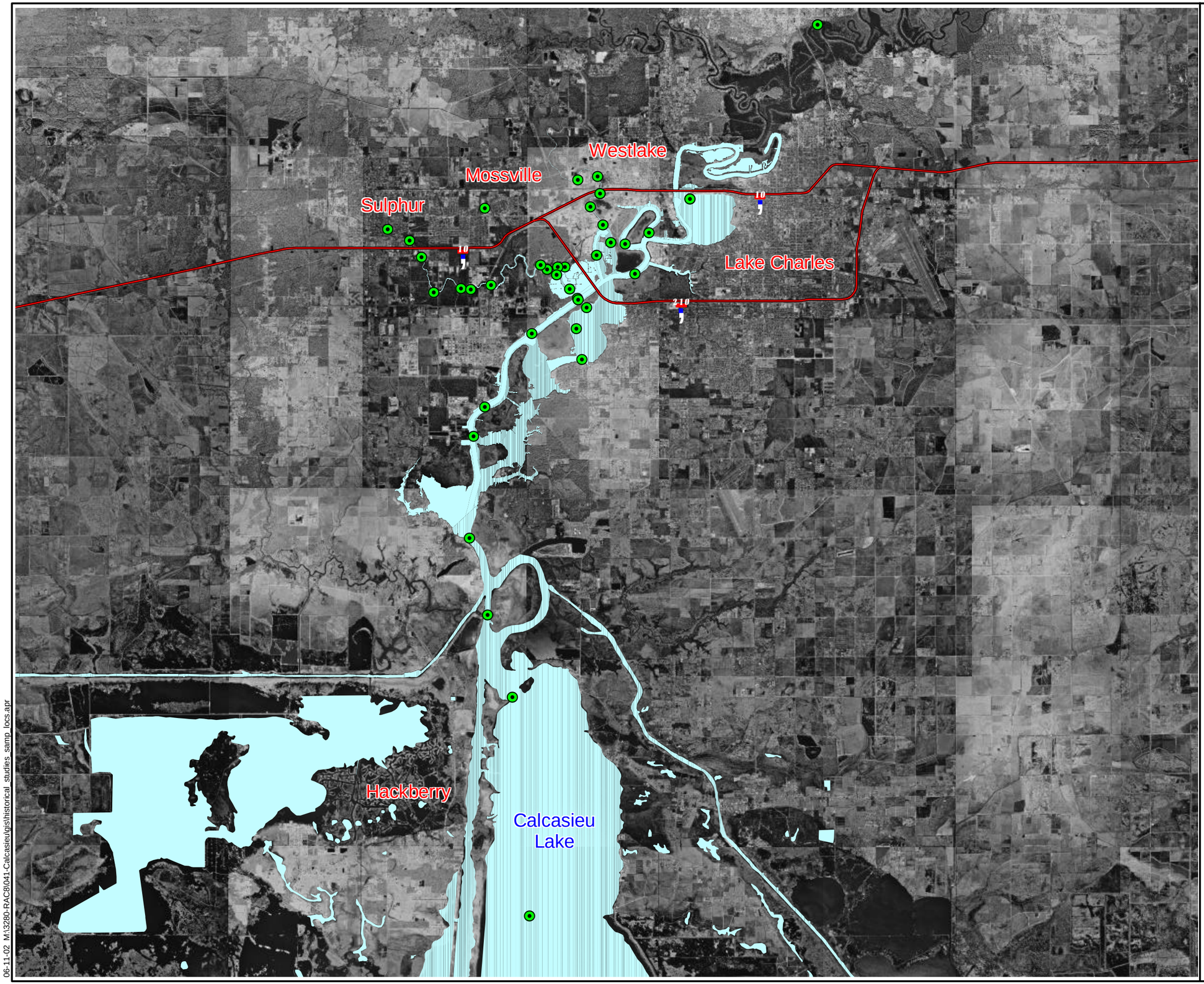

Figure A3
Sample Location Map
Toxics Study of the Lower Calcasieu River
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Sulphur City
- Water
- Interstate

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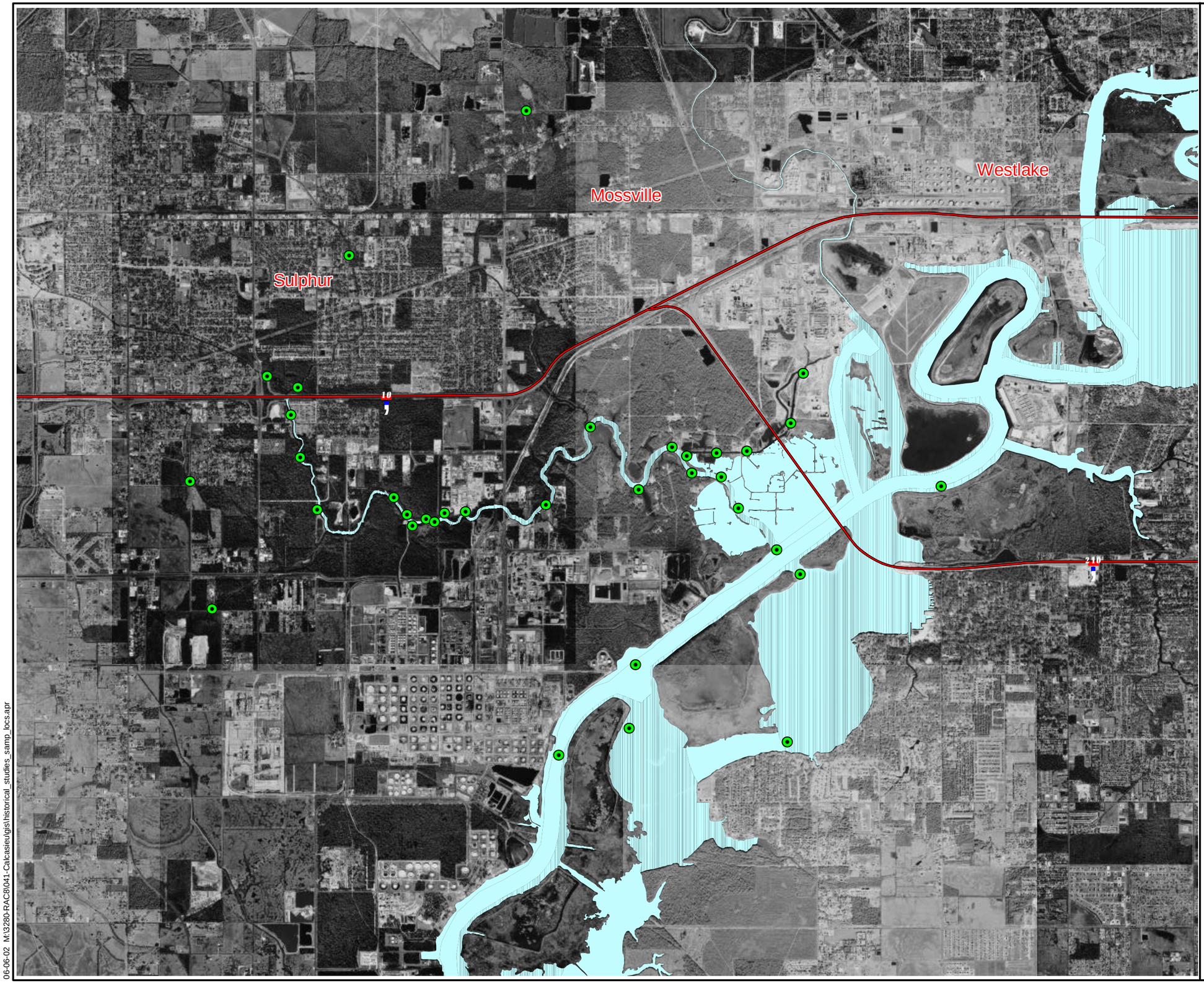

Figure A4
Sample Location Map
Bayou d'Inde Expanded Site Inspection - Final Report
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Sulphur — City
- Water
- Interstate

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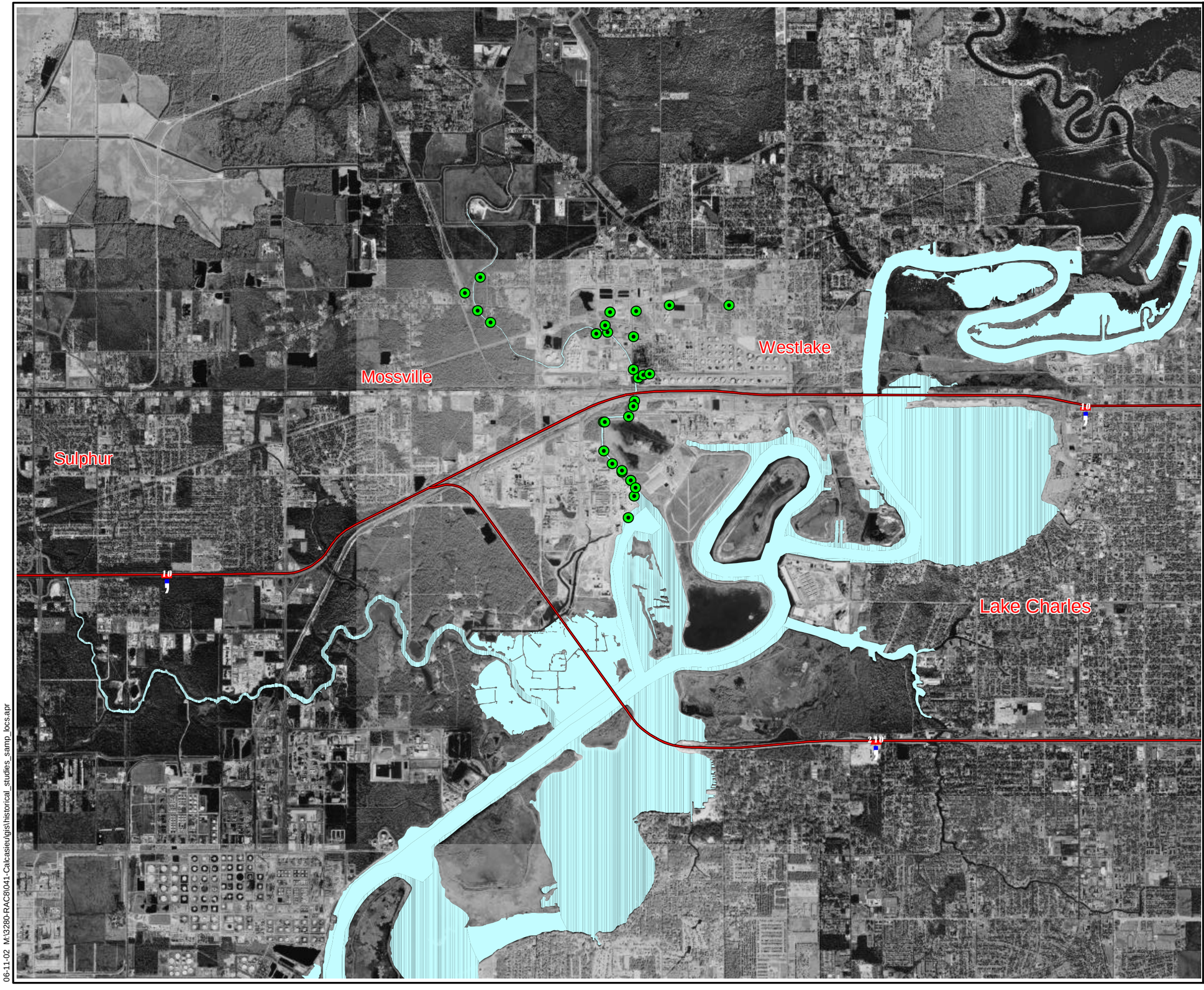
Figure A5
Sample Location Map
Site Inspection for Bayou Verdine
Calcasieu Parish, Louisiana



Legend

- Sample Location
- Sulphur — City
- Water
- Interstate

N
W E
S

1 0 1 Kilometers

CDM

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Figure A6
Sample Location Map
Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Sulphur City
- Water
- Interstate

N
W E
S

600 0 600 Meters

CDM

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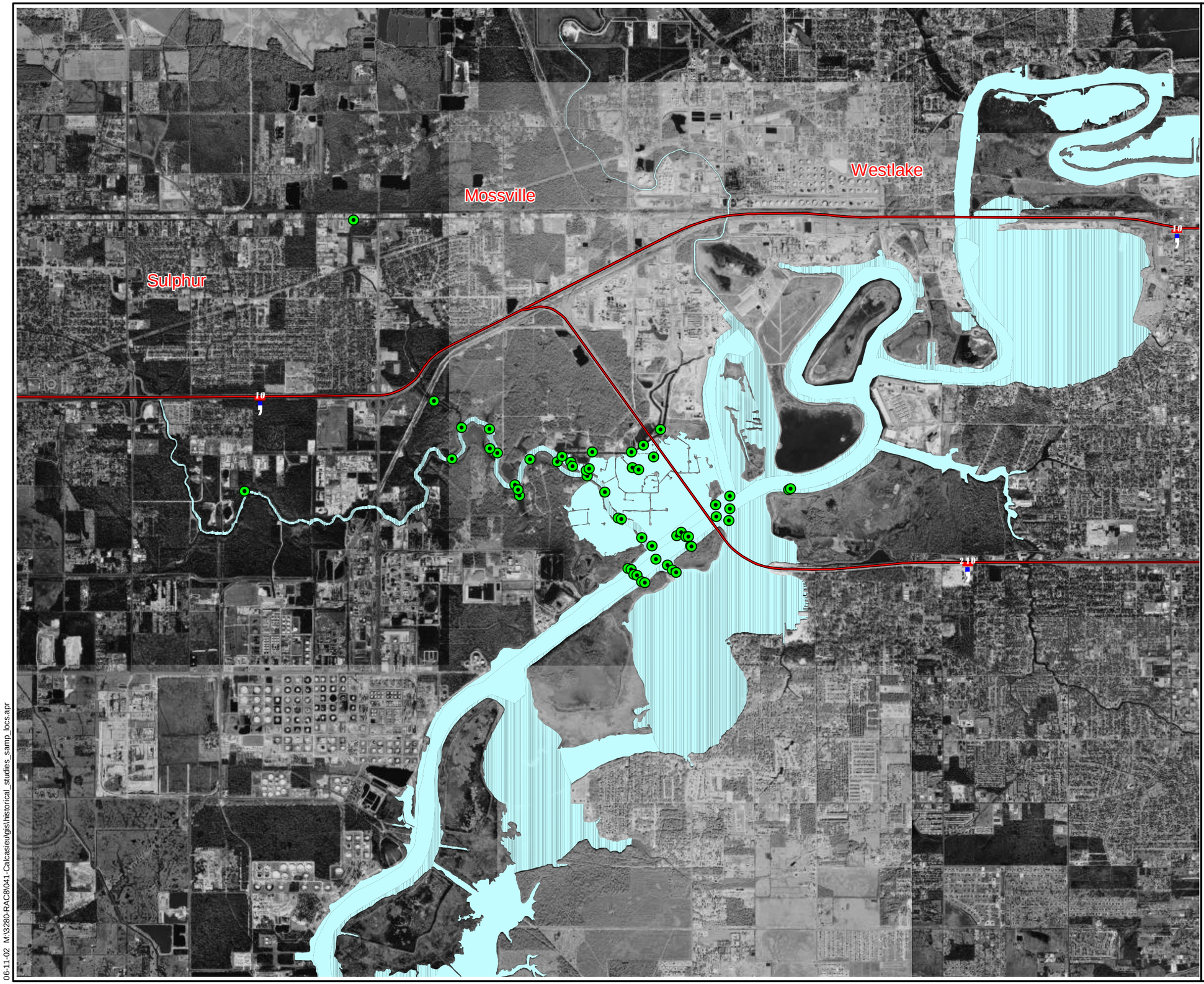

Figure A7
Sample Location Map
Bayou d'Inde, Lower PPG Canal, and Calcasieu
River Ship Channel Water and
Sediment Sampling Report
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Sulphur City
- Water
- Interstate

N
W E
S

1 0 1 Kilometers

CDM

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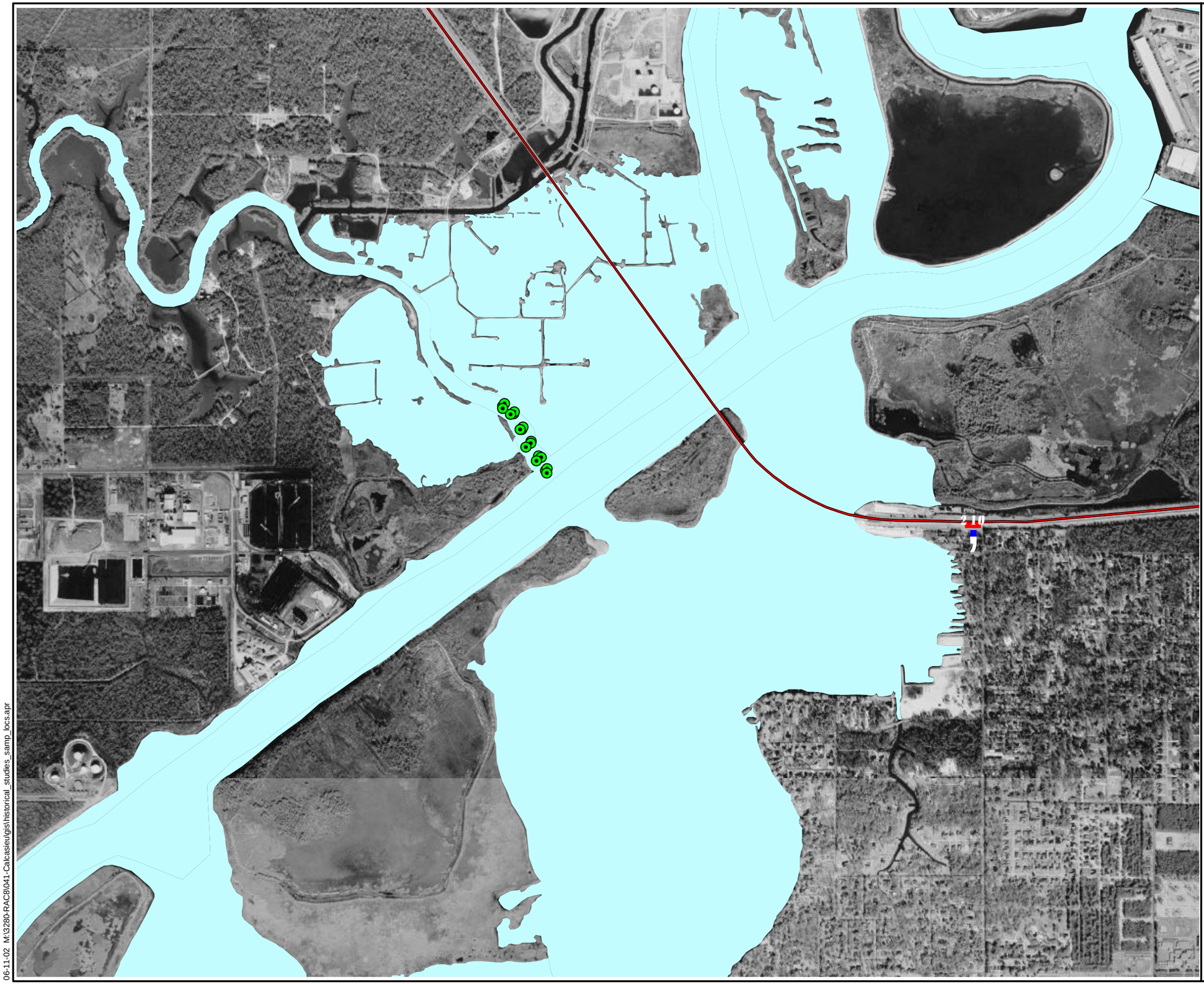

Figure A8
Sample Location Map
Findings Report for the Focused Site
Assessment - Bayou d'Inde
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Water
- Interstate

N
W E
S

400 0 400 Meters

CDM

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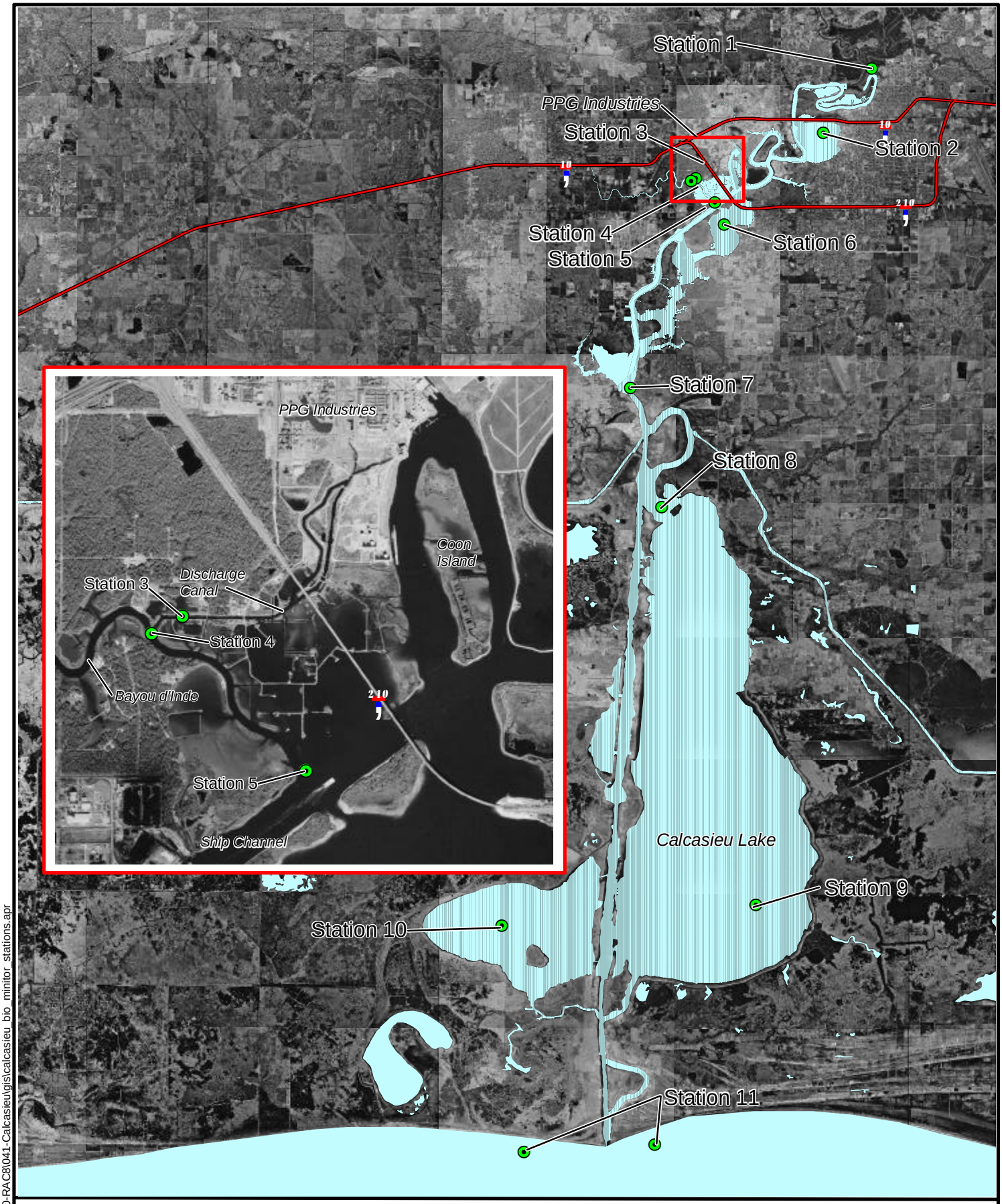

CDM

N

2 0 2 Kilometers

Figure A-9
Biological Monitoring Stations
Calcasieu Estuary Remedial Investigation
Calcasieu Parish, Louisiana

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Figure A10
Sample Location Map
Bayou Verdine Investigation: Nature and Extent Investigation
Calcasieu Parish, Louisiana

Legend

- Sample Location
- Water
- Interstate

N
W E
S

0.4 0 0.4 Kilometers

CDM

06-11-02 M:\3280-RAC8\041-Calcasieu\gis\historical_studies_samp_locs.apr

Table B-1
Inorganic Duplicate and MS/MSD Criteria

	Duplicate and MS/MSD Criteria			
	Sediment:		Surface Water:	
	Laboratory Duplicate	**MS/MSD Criteria**	**Laboratory Duplicate**	**MS/MSD Criteria**
TAL METALS (SW-846 Methods 6010B/7000/9010B or CLP)	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125% (post digestion spike not required for silver and mercury)	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125% (post digestion spike not required for silver and mercury)

Verified against Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-3).

Table B-2
Matrix Spike/Matrix Spike Duplicate Criteria (Percent Recovery/Relative Percent Difference)

	MS/MSD Criteria (from Form III's of USEPA CLP Statement of Work)			
	Sediment:		Surface Water:	
	% recovery	RPD	% recovery	RPD
VOCs (SW-846 and CLP Methods)				
1,1-Dichloroethene	59 - 172%	22	61 - 145%	14
Trichloroethene	62 - 137%	24	71 - 120%	14
Benzene	66 - 142%	21	76 - 127%	11
Toluene	59 - 139%	21	76 - 125%	13
Chlorobenzene	60 - 133%	21	75 - 130%	13
SVOCs (SW-846 and CLP Methods)				
Phenol	26 - 90%	35	12 - 110%	42
2-Chlorophenol	25 - 102%	50	27 - 123%	40
1,4-Dichlorobenzene	28 - 104%	27	36 - 97%	28
N-Nitroso-di-n-propylamine	41 - 126%	38	41 - 116%	38
1,2,4-Trichlorobenzene	38 - 107%	23	39 - 98%	28
4-Chloro-3-methylphenol	26 - 103%	33	23 - 97%	42
Acenaphthene	31 - 137%	19	46 - 118%	31
4-Nitrophenol	11 - 114%	50	10 - 80%	50
2,4-Dinitrotoluene	28 - 89%	47	24 - 96%	38
Pentachlorophenol	17 - 109%	47	9 - 103%	50
Pyrene	35 - 142%	36	26 - 127%	31
Pesticides (SW-846 and CLP Methods)				
gamma-BHC	46 - 127%	50	56 - 123%	15
Heptachlor	35 - 130%	31	40 - 131%	20
Aldrin	34 - 132%	43	40 - 120%	22
Dieldrin	31 - 134%	38	52 - 126%	18
Endrin	42 - 139%	45	56 - 121%	21
4-4'-DDT	23 - 134%	50	38 - 127%	27

Verified against Calcasieu Estuary Phase II Sampling and Analyis Plan (Table 5-3). Could not find relevant EPA documents to support.

Table B-3
Ion Ratio Limits for Dioxins and Furans

	Control Criteria				Lab Duplicate Criteria
	Sediment:		Surface Water:		Sediment and Surface Water
	Ion Ratio Limits	RPD	Ion Ratio Limits	RPD	
Dioxins/Furans (SW-846 and CLP Methods)					
2,3,7,8-Tetrachlorodibenzofuran	0.65 - 0.89	25 - 150%	0.65 - 0.89	25 - 150%	<50%
2,3,7,8-Tetrachlorodibenzodioxin	0.65 - 0.89	25 - 150%	0.65 - 0.89	25 - 150%	<50%
1,2,3,6,7,8-Hexachlorodibenzodioxin	1.05 - 1.43	25 - 150%	1.05 - 1.43	25 - 150%	<50%
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.88 - 1.20	25 - 150%	0.88 - 1.20	25 - 150%	<50%
Octachlorodibenzodioxin	0.76 - 1.01	25 - 150%	0.76 - 1.01	25 - 150%	<50%

Verified against Calcasieu Estuary Phase II Sampling and Analysis Plan (Table 5-3) and against USEPA CLP SOW for Analysis of CDDs and CDFs.

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Other Inorganic Parameters				
Ancillary	Cation Exchange Capacity	--	--	--
Ancillary	pH	--	--	--
Ancillary	Total Organic Carbon	--	--	--
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	< 50%	50 - 150%	*3.3%*
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	< 50%	50 - 150%	*6.2%*
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	< 50%	50 - 150%	*2.4%*
Dioxin/Furans	1,2,3,4,7,8-HxCDD	< 50%	50 - 150%	*0.47%*
Dioxin/Furans	1,2,3,4,7,8-HxCDF	< 50%	50 - 150%	*4.6%*
Dioxin/Furans	1,2,3,6,7,8-HxCDD	< 50%	50 - 150%	*7.6%*
Dioxin/Furans	1,2,3,6,7,8-HxCDF	< 50%	50 - 150%	*6.8%*
Dioxin/Furans	1,2,3,7,8,9-HxCDD	< 50%	50 - 150%	*0.66%*
Dioxin/Furans	1,2,3,7,8,9-HxCDF	< 50%	50 - 150%	*6.5%*
Dioxin/Furans	1,2,3,7,8-PeCDD	< 50%	50 - 150%	*2.2%*
Dioxin/Furans	1,2,3,7,8-PeCDF	< 50%	50 - 150%	*1.3%*
Dioxin/Furans	2,3,4,6,7,8-HxCDF	< 50%	50 - 150%	*0.35%*
Dioxin/Furans	2,3,4,7,8-PeCDF	< 50%	50 - 150%	*6.1%*
Dioxin/Furans	2,3,7,8-TCDD	< 50%	50 - 150%	*0.55%*
Dioxin/Furans	2,3,7,8-TCDF	< 50%	50 - 150%	*1.4%*
Dioxin/Furans	OCDD	< 50%	50 - 150%	*6.4%*
Dioxin/Furans	OCDF	< 50%	50 - 150%	*11%*
Dioxin/Furans	Total HpCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDF	< 50%	50 - 150%	--
Herbicides				
Herbicide	2,2-Dichloropropionic Acid	--	--	--
Herbicide	2,4,5-T	--	*38-92%*	*21%*
Herbicide	2,4,5-TP (Silvex)	--	*45-87%*	*6.7%*

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Herbicides				
Herbicide	2,4-D	--	*28-104%*	*1.9%*
Herbicide	2,4-DB	--	--	--
Herbicide	Dicamba	--	--	--
Herbicide	Dichlorprop	--	--	--
Herbicide	Dinitrobutyl Phenol	--	--	--
Herbicide	MCPA (2-Methyl-4-Chlorophenoxyacetic Acid)	--	--	--
Herbicide	Mecoprop	--	--	--
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Aluminum (Fume Or Dust)	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Antimony	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Arsenic	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	-- *2.6%*
Metal	Barium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Beryllium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cadmium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Calcium Metal	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Chromium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cobalt	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Copper	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cyanide	--	--	--
Metal	Iron	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Lead	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Magnesium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Manganese	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Mercury	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Nickel	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Potassium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Selenium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Silver	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Sodium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Thallium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Vanadium (Fume Or Dust)	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Zinc	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Pesticides & PCBs (SW-846 Methods 8081A/8082 or CLP)				
PCB	Aroclor-1016	--	--	--
PCB	Aroclor-1221	--	--	--
PCB	Aroclor-1232	--	--	--
PCB	Aroclor-1242	--	--	--
PCB	Aroclor-1248	--	--	--
PCB	Aroclor-1254	--	--	--
PCB	Aroclor-1260	--	--	--
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--	--	--
Pesticide	4,4'-DDD	--	--	--
Pesticide	4,4'-DDE	--	--	--
Pesticide	4,4'-DDT	--	23-134%	50%
Pesticide	Aldrin	--	34-132%	43%
Pesticide	alpha-BHC	--	--	--
Pesticide	alpha-Chlordane	--	--	--
Pesticide	beta-BHC	--	--	--
Pesticide	Camphechlor	--	--	--
Pesticide	delta-BHC	--	--	--
Pesticide	Dieldrin	--	31-134%	38%
Pesticide	Endosulfan I	--	--	--
Pesticide	Endosulfan II	--	--	--
Pesticide	Endosulfan Sulfate	--	--	--
Pesticide	Endrin	--	42-139%	45%
Pesticide	Endrin Aldehyde	--	--	--
Pesticide	Endrin Ketone	--	--	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Pesticides & PCBs (SW-846 Methods 8081A/8082 or CLP)				
Pesticide	gamma-BHC (Lindane)	--	46-127%	50%
Pesticide	gamma-Chlordane	--	--	--
Pesticide	Heptachlor	--	35-130%	31%
Pesticide	Heptachlor Epoxide	--	--	--
SVOCs (SW-846 Method 8270C or CLP)				
PAH	1,1'-Biphenyl	--	--	--
Semivolatile	1,2,4-Trichlorobenzene	--	--	--
PAH	1,2-Benzphenanthracene	--	--	--
Semivolatile	1,2-Dichlorobenzene	--	--	--
Semivolatile	1,4-Dichlorobenzene	--	--	--
Semivolatile	2,2'-oxybis(1-Chloropropane)	--	--	--
Semivolatile	2,4,5-Trichlorophenol	--	--	--
Semivolatile	2,4,6-Trichlorophenol	--	--	--
Semivolatile	2,4-Dichlorophenol	--	--	--
Semivolatile	2,4-Dimethylphenol	--	--	--
Semivolatile	2,4-Dinitrophenol	--	--	--
Semivolatile	2,4-Dinitrotoluene	--	28-89%	47%
Semivolatile	2,6-Dinitrotoluene	--	--	--
Semivolatile	2-Chloronaphthalene	--	--	--
Semivolatile	2-Chlorophenol	--	25-102%	50%
PAH	2-Methylnaphthalene	--	--	--
Semivolatile	2-Methylphenol	--	--	--
Semivolatile	2-Nitroaniline	--	--	--
Semivolatile	2-Nitrophenol	--	--	--
Semivolatile	3,3'-Dichlorobenzidine	--	--	--
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--	--	--
Semivolatile	3-Methylphenol & 4-Methylphenol	--	--	--
Semivolatile	3-Nitroaniline	--	--	--
Semivolatile	4,6-Dinitro-2-methylphenol	--	--	--
Semivolatile	4-Bromophenyl Phenyl Ether	--	--	--
Semivolatile	4-Chloro-3-methylphenol	--	26-103%	33%
Semivolatile	4-Chlorophenyl Phenyl Ether	--	--	--
Semivolatile	4-Methylphenol	--	--	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	4-Nitrophenol	--	11-114%	50%
PAH	Acenaphthene	--	31-137%	19%
PAH	Acenaphthylene	--	--	--
Semivolatile	Acetophenone	--	--	--
PAH	Anthracene	--	--	--
Semivolatile	Atrazine	--	--	--
Semivolatile	Benzaldehyde	--	--	--
PAH	Benzo(a)anthracene	--	--	--
PAH	Benzo(a)pyrene	--	--	--
PAH	Benzo(b)fluoranthene	--	--	--
PAH	Benzo(g,h,i)perylene	--	--	--
PAH	Benzo(k)fluoranthene	--	--	--
Semivolatile	Benzoic Acid	--	--	--
Semivolatile	Benzyl Alcohol	--	--	--
Semivolatile	Benzyl Butyl Phthalate	--	--	--
Semivolatile	bis(2-Chloroethoxy)methane	--	--	--
Semivolatile	bis(2-Chloroethyl)ether	--	--	--
Semivolatile	bis(2-Ethylhexyl)phthalate	--	--	--
Semivolatile	Caprolactam	--	--	--
Semivolatile	Carbazole	--	--	--
PAH	Dibenzo(a,h)anthracene	--	--	--
Semivolatile	Dibenzofuran	--	--	--
Semivolatile	Diethyl Phthalate	--	--	--
Semivolatile	Dimethyl Phthalate	--	--	--
Semivolatile	Di-n-butylphthalate	--	--	--
Semivolatile	Di-n-octylphthalate	--	--	--
PAH	Fluoranthene	--	--	--
PAH	Fluorene	--	--	--
Semivolatile	Hexachloro-1,3-butadiene	--	--	--
Semivolatile	Hexachlorobenzene	--	--	--
Semivolatile	Hexachlorocyclopentadiene	--	--	--
Semivolatile	Hexachloroethane	--	--	--
PAH	Indeno(1,2,3-cd)pyrene	--	--	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	M-Dichlorobenzene	--	--	--
PAH	Naphthalene	--	--	--
Semivolatile	Nitrobenzene	--	--	--
Semivolatile	N-Nitroso-di-n-propylamine	--	41-126%	38%
Semivolatile	N-Nitrosodiphenylamine	--	--	--
Semivolatile	P-Chloroaniline	--	--	--
Semivolatile	Pentachlorophenol	--	17-109%	47%
PAH	Phenanthrene	--	--	--
Semivolatile	Phenol	--	26-90%	35%
Semivolatile	P-Nitroaniline	--	--	--
PAH	Pyrene	--	35-142%	36%
Total Petroleum Hydrocarbons (Non-halogenated organics using GC/FID) (SW-846 8015B Modified)				
TPH	Diesel Range Organics	--	57-134%	*12%*
VOCs (SW-846 Method 8260B or CLP)				
Volatile	1,1,1-Trichloroethane	--	59-172%	--
Volatile	1,1,2,2-Tetrachloroethane	--	59-172%	--
Volatile	1,1,2-Trichloroethane	--	59-172%	--
Volatile	1,1-Dichloroethane	--	59-172%	--
Volatile	1,1-Dichloroethylene	--	59-172%	22%
Volatile	1,2-Dibromo-3-chloropropane (DBCP)	--	59-172%	--
Volatile	1,2-Dibromoethane	--	59-172%	--
Volatile	1,2-Dichloroethane	--	59-172%	--
Volatile	1,2-Dichloropropane	--	59-172%	--
Volatile	2-Butanone	--	59-172%	--
Volatile	4-Methyl-2-pentanone	--	59-172%	--
Volatile	Acetone	--	59-172%	--
Volatile	Benzene	--	66-142%	21%
Volatile	Bromodichloromethane	--	59-172%	--
Volatile	Bromomethane	--	59-172%	--
Volatile	Carbon Disulfide	--	59-172%	--
Volatile	Carbon Tetrachloride	--	59-172%	--
Volatile	CFC-11	--	59-172%	--
Volatile	CFC-12	--	59-172%	--

Table B-4
Phase I Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
VOCs (SW-846 Method 8260B or CLP)				
Volatile	Chlorinated Fluorocarbon (Freon 113)	--	59-172%	--
Volatile	Chlorobenzene	--	60-133%	21%
Volatile	Chlorodibromomethane	--	59-172%	--
Volatile	Chloroethane	--	59-172%	--
Volatile	Chloroform	--	59-172%	--
Volatile	Chloromethane	--	59-172%	--
Volatile	cis-1,2-Dichloroethene	--	59-172%	--
Volatile	cis-1,3-Dichloropropene	--	59-172%	--
Volatile	Cyclohexane	--	59-172%	--
Volatile	Dichloromethane	--	59-172%	--
Volatile	Ethylbenzene	--	59-172%	--
Volatile	Isopropylbenzene	--	59-172%	--
Volatile	Methyl Acetate	--	59-172%	--
Volatile	Methyl N-Butyl Ketone	--	59-172%	--
Volatile	Methyl tert-Butyl Ether	--	59-172%	--
Volatile	Methylbenzene	--	59-172%	--
Volatile	Methylcyclohexane	--	59-172%	--
Volatile	Styrene (monomer)	--	59-172%	--
Volatile	Tetrachloroethene	--	59-172%	--
Volatile	trans-1,2-Dichloroethene	--	59-172%	--
Volatile	trans-1,3-Dichloropropene	--	59-172%	--
Volatile	Tribromomethane	--	59-172%	--
Volatile	Trichloroethylene	--	62-137%	24%
Volatile	Vinyl Chloride	--	59-172%	--
Volatile	Xylenes (total)	--	59-172%	--

[a] Derived from Calcasieu Estuary Phase I Sampling and Analysis Plan.

[b] Derived from Form IIIs and Form Vs from CLP and Quanterra hard copy data packages.

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Other Inorganic Parameters				
Ancillary	Ammonia as N	--	--	--
Ancillary	Bicarbonate Alkalinity	--	--	--
Ancillary	Biochemical Oxygen Demand	--	--	--
Ancillary	Bromide	--	--	--
Ancillary	Carbonate Alkalinity	--	--	--
Ancillary	Chemical Oxygen Demand (COD)	--	--	--
Ancillary	Chloride	--	--	--
Ancillary	Fluoride	--	--	--
Ancillary	Hardness, as CaCO3	--	--	--
Ancillary	Hydroxide Alkalinity	--	--	--
Ancillary	Nitrate-Nitrite	--	--	--
Ancillary	Phosphate as P, Ortho	--	--	--
Ancillary	Sulfate	--	--	--
Ancillary	Total Alkalinity	--	--	--
Ancillary	Total Kjeldahl Nitrogen	--	--	--
Ancillary	Total Organic Carbon	--	*91-111%*	*1.3%*
Ancillary	Total Suspended Solids	--	--	--
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	< 50%	*78-134%*	*107%*
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	< 50%	*80-115%*	*102%*
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	< 50%	*68-151%*	*128%*
Dioxin/Furans	1,2,3,4,7,8-HxCDD	< 50%	*58-146%*	*101%*
Dioxin/Furans	1,2,3,4,7,8-HxCDF	< 50%	*77-124%*	*109%*
Dioxin/Furans	1,2,3,6,7,8-HxCDD	< 50%	*80-131%*	*109%*
Dioxin/Furans	1,2,3,6,7,8-HxCDF	< 50%	*69-135%*	*115%*
Dioxin/Furans	1,2,3,7,8,9-HxCDD	< 50%	*60-154%*	*114%*
Dioxin/Furans	1,2,3,7,8,9-HxCDF	< 50%	*58-141%*	*114%*
Dioxin/Furans	1,2,3,7,8-PeCDD	< 50%	*85-131%*	*105%*
Dioxin/Furans	1,2,3,7,8-PeCDF	< 50%	*79-136%*	*102%*
Dioxin/Furans	2,3,4,6,7,8-HxCDF	< 50%	*58-140%*	*114%*
Dioxin/Furans	2,3,4,7,8-PeCDF	< 50%	*56-164%*	*101%*
Dioxin/Furans	2,3,7,8-TCDD	< 50%	*73-144%*	*100%*
Dioxin/Furans	2,3,7,8-TCDF	< 50%	*70-135%*	*99%*
Dioxin/Furans	OCDD	< 50%	*73-144%*	*108%*

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	OCDF	< 50%	*64-152%*	*107%*
Dioxin/Furans	Total HpCDD	< 50%	--	--
Dioxin/Furans	Total HpCDF	< 50%	--	--
Dioxin/Furans	Total HxCDD	< 50%	--	--
Dioxin/Furans	Total HxCDF	< 50%	--	--
Dioxin/Furans	Total PeCDD	< 50%	--	--
Dioxin/Furans	Total PeCDF	< 50%	--	--
Dioxin/Furans	Total TCDD	< 50%	--	--
Dioxin/Furans	Total TCDF	< 50%	--	--
Herbicide				
Herbicide	2,2-Dichloropropionic Acid	--	--	--
Herbicide	2,4,5-T	--	--	--
Herbicide	2,4,5-TP (Silvex)	--	--	--
Herbicide	2,4-D	--	--	--
Herbicide	2,4-DB	--	--	--
Herbicide	Dicamba	--	--	--
Herbicide	Dichlorprop	--	--	--
Herbicide	Dinitrobutyl Phenol	--	--	--
Herbicide	MCPA (2-Methyl-4-Chlorophenoxyacetic Acid)	--	--	--
Herbicide	Mecoprop	--	--	--
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Aluminum (Fume Or Dust) Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*36%*
	Aluminum (Fume Or Dust) Dissolved			*3.4%*
Metal	Antimony	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Arsenic Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*9.1%*
	Arsenic Dissolved			*0.40%*

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Barium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Beryllium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cadmium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Calcium Metal	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Chromium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cobalt	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Copper Total Copper Dissolved	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*6.7%* *0.30%*
Metal	Cyanide Total	--	72-118%	1.5%

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Iron	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Lead Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*8.8%*
	Lead Dissolved			*1.9%*
Metal	Magnesium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Manganese	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Mercury Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*2%*
	Mercury Dissolved			
Metal	Nickel Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*5.5%*
	Nickel Dissolved			*1.2%*
Metal	Potassium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Selenium Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*14%*
	Selenium Dissolved			*0.06%*

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Silver Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*8.5%*
	Silver Dissolved			*0.02%*
Metal	Sodium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Thallium Total	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%/*80-120%*	*8%*
	Thallium Dissolved			*3%*
Metal	Vanadium (Fume Or Dust)	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Zinc	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Pesticides & PCBs (SW-846 Methods 8081A/8082 or CLP)				
PCB	Aroclor-1016	--	--	--
PCB	Aroclor-1221	--	--	--
PCB	Aroclor-1232	--	--	--
PCB	Aroclor-1242	--	--	--
PCB	Aroclor-1248	--	--	--
PCB	Aroclor-1254	--	--	--
PCB	Aroclor-1260	--	--	--
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--	--	--
Pesticide	4,4'-DDD	--	--	--
Pesticide	4,4'-DDE	--	--	--
Pesticide	4,4'-DDT	--	38-127%	27%
Pesticide	Aldrin	--	40-120%	22%
Pesticide	alpha-BHC	--	--	--
Pesticide	alpha-Chlordane	--	--	--

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
Pesticides & PCBs (SW-846 Methods 8081A/8082 or CLP)				
Pesticide	beta-BHC	--	--	--
Pesticide	Camphechlor	--	--	--
Pesticide	delta-BHC	--	--	--
Pesticide	Dieldrin	--	52-126%	18%
Pesticide	Endosulfan I	--	--	--
Pesticide	Endosulfan II	--	--	--
Pesticide	Endosulfan Sulfate	--	--	--
Pesticide	Endrin	--	56-121%	21%
Pesticide	Endrin Aldehyde	--	--	--
Pesticide	Endrin Ketone	--	--	--
Pesticide	gamma-BHC (Lindane)	--	56-123%	15%
Pesticide	gamma-Chlordane	--	--	--
Pesticide	Heptachlor	--	40-131%	20%
Pesticide	Heptachlor Epoxide	--	--	--
SVOCs (SW-846 Method 8270C or CLP)				
PAH	1,1'-Biphenyl	--	--	--
Semivolatile	1,2,4-Trichlorobenzene	--	--	--
PAH	1,2-Benzphenanthracene	--	--	--
Semivolatile	1,2-Dichlorobenzene	--	--	--
Semivolatile	1,4-Dichlorobenzene	--	--	--
Semivolatile	2,2'-oxybis(1-Chloropropane)	--	--	--
Semivolatile	2,4,5-Trichlorophenol	--	--	--
Semivolatile	2,4,6-Trichlorophenol	--	--	--
Semivolatile	2,4-Dichlorophenol	--	--	--
Semivolatile	2,4-Dimethylphenol	--	--	--
Semivolatile	2,4-Dinitrophenol	--	--	--
Semivolatile	2,4-Dinitrotoluene	--	24-96%	38%
Semivolatile	2,6-Dinitrotoluene	--	--	--
Semivolatile	2-Chloronaphthalene	--	--	--
Semivolatile	2-Chlorophenol	--	27-123%	40%
PAH	2-Methylnaphthalene	--	--	--
Semivolatile	2-Methylphenol	--	--	--
Semivolatile	2-Nitroaniline	--	--	--
Semivolatile	2-Nitrophenol	--	--	--
Semivolatile	3,3'-Dichlorobenzidine	--	--	--

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--	--	--
Semivolatile	3-Nitroaniline	--	--	--
Semivolatile	4,6-Dinitro-2-methylphenol	--	--	--
Semivolatile	4-Bromophenyl Phenyl Ether	--	--	--
Semivolatile	4-Chloro-3-methylphenol	--	23-97%	42%
Semivolatile	4-Chlorophenyl Phenyl Ether	--	--	--
Semivolatile	4-Methylphenol	--	--	--
Semivolatile	4-Nitrophenol	--	10-80%	50%
PAH	Acenaphthene	--	46-118%	31%
PAH	Acenaphthylene	--	--	--
Semivolatile	Acetophenone	--	--	--
PAH	Anthracene	--	--	--
Semivolatile	Atrazine	--	--	--
Semivolatile	Benzaldehyde	--	--	--
PAH	Benzo(a)anthracene	--	--	--
PAH	Benzo(a)pyrene	--	--	--
PAH	Benzo(b)fluoranthene	--	--	--
PAH	Benzo(g,h,i)perylene	--	--	--
PAH	Benzo(k)fluoranthene	--	--	--
Semivolatile	Benzyl Butyl Phthalate	--	--	--
Semivolatile	bis(2-Chloroethoxy)methane	--	--	--
Semivolatile	bis(2-Chloroethyl)ether	--	--	--
Semivolatile	bis(2-Ethylhexyl)phthalate	--	--	--
Semivolatile	Caprolactam	--	--	--
Semivolatile	Carbazole	--	--	--
PAH	Dibenzo(a,h)anthracene	--	--	--
Semivolatile	Dibenzofuran	--	--	--
Semivolatile	Diethyl Phthalate	--	--	--
Semivolatile	Dimethyl Phthalate	--	--	--
Semivolatile	Di-n-butylphthalate	--	--	--
Semivolatile	Di-n-octylphthalate	--	--	--
PAH	Fluoranthene	--	--	--
PAH	Fluorene	--	--	--
Semivolatile	Hexachloro-1,3-butadiene	--	--	--
Semivolatile	Hexachlorobenzene	--	--	--

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	Hexachlorocyclopentadiene	--	--	--
Semivolatile	Hexachloroethane	--	--	--
PAH	Indeno(1,2,3-cd)pyrene	--	--	--
Semivolatile	M-Dichlorobenzene	--	--	--
PAH	Naphthalene	--	--	--
Semivolatile	Nitrobenzene	--	--	--
Semivolatile	N-Nitroso-di-n-propylamine	--	41-116%	38%
Semivolatile	N-Nitrosodiphenylamine	--	--	--
Semivolatile	P-Chloroaniline	--	--	--
Semivolatile	Pentachlorophenol	--	9-103%	50%
PAH	Phenanthrene	--	--	--
Semivolatile	Phenol	--	12-110%	42%
Semivolatile	P-Nitroaniline	--	--	--
PAH	Pyrene	--	26-127%	31%
Total Petroleum Hydrocarbons (Non-halogenated organics using GC/FID) (SW-846 8015B Modified)				
TPH	C5-C8 Aliphatics	--	--	--
TPH	C9-C10 Aromatics	--	--	--
TPH	C9-C12 Aliphatics	--	--	--
TPH	Diesel Range Organics	--	--	--
TPH	Unadjusted C5-C8 Aliphatics	--	--	--
TPH	Unadjusted C9-C12 Aliphatics	--	--	--
VOCs (SW-846 Method 8260B or CLP)				
Volatile	1,1,1-Trichloroethane	--	--	--
Volatile	1,1,2,2-Tetrachloroethane	--	--	--
Volatile	1,1,2-Trichloroethane	--	--	--
Volatile	1,1-Dichloroethane	--	--	--
Volatile	1,1-Dichloroethylene	--	61-145%	14%
Volatile	1,2-Dibromo-3-chloropropane (DBCP)	--	--	--
Volatile	1,2-Dibromoethane	--	--	--
Volatile	1,2-Dichloroethane	--	--	--
Volatile	1,2-Dichloropropane	--	--	--
Volatile	2-Butanone	--	--	--
Volatile	4-Methyl-2-pentanone	--	--	--
Volatile	Acetone	--	--	--

Table B-5
Phase I Surface Water Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (CLP/*Quanterra*)[b]	MS/MSD RPD (CLP/*Quanterra*)[b]
VOCs (SW-846 Method 8260B or CLP)				
Volatile	Benzene	--	76-127%	11%
Volatile	Bromodichloromethane	--	--	--
Volatile	Bromomethane	--	--	--
Volatile	Carbon Disulfide	--	--	--
Volatile	Carbon Tetrachloride	--	--	--
Volatile	CFC-11	--	--	--
Volatile	CFC-12	--	--	--
Volatile	Chlorinated Fluorocarbon (Freon 113)	--	--	--
Volatile	Chlorobenzene	--	75-130%	13%
Volatile	Chlorodibromomethane	--	--	--
Volatile	Chloroethane	--	--	--
Volatile	Chloroform	--	--	--
Volatile	Chloromethane	--	--	--
Volatile	cis-1,2-Dichloroethene	--	--	--
Volatile	cis-1,3-Dichloropropene	--	--	--
Volatile	Cyclohexane	--	--	--
Volatile	Dichloromethane	--	--	--
Volatile	Ethylbenzene	--	--	--
Volatile	Isopropylbenzene	--	--	--
Volatile	Methyl Acetate	--	--	--
Volatile	Methyl N-Butyl Ketone	--	--	--
Volatile	Methyl tert-Butyl Ether	--	--	--
Volatile	Methylbenzene	--	--	--
Volatile	Methylcyclohexane	--	--	--
Volatile	Styrene (monomer)	--	--	--
Volatile	Tetrachloroethene	--	--	--
Volatile	trans-1,2-Dichloroethene	--	--	--
Volatile	trans-1,3-Dichloropropene	--	--	--
Volatile	Tribromomethane	--	--	--
Volatile	Trichloroethylene	--	71-120%	14%
Volatile	Vinyl Chloride	--	--	--
Volatile	Xylenes (total)	--	--	--

[a] Derived from Calcasieu Estuary Phase I Sampling and Analysis Plan.

[b] Derived from Form IIIs and Form Vs in the CLP and Quanterra hard copy data packages.

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Other Inorganic Parameters				
Ancillary	Total Organic Carbon	--	--	--
AVS/SEM	Acid Volatile Sulfide	--	--	--
AVS/SEM	Loss on Ignition	--	--	--
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,6,7,8-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,6,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8,9-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8,9-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8-PeCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8-PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,4,6,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,4,7,8-PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,7,8-TCDD	< 50%	50 - 150%	--
Dioxin/Furans	2,3,7,8-TCDF	< 50%	50 - 150%	--
Dioxin/Furans	OCDD	< 50%	50 - 150%	--
Dioxin/Furans	OCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total HpCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDF	< 50%	50 - 150%	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Aluminum (Fume Or Dust)	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Antimony	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Arsenic	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Barium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Beryllium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Cadmium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Calcium Metal	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Chromium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Cobalt	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Copper	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Iron	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Lead	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Magnesium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Manganese	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Mercury	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Methyl Mercury	--	--	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Nickel	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Potassium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Selenium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Silver	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Sodium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Thallium	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Vanadium (Fume Or Dust)	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Zinc	If both results >5 x CRDL: Sediment: < 35% If either result < 5 x CRDL: Sediment: < 2 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	Aroclor-1016	--	--	--
PCB	Aroclor-1221	--	--	--
PCB	Aroclor-1232	--	--	--
PCB	Aroclor-1242	--	--	--
PCB	Aroclor-1248	--	--	--
PCB	Aroclor-1254	--	--	--
PCB	Aroclor-1260	--	--	--
PCB	PCB-105	--	--	--
PCB	PCB-108	--	--	--
PCB	PCB-114	--	--	--
PCB	PCB-118	--	--	--
PCB	PCB-126	--	--	--
PCB	PCB-127	--	--	--
PCB	PCB-15	--	--	--
PCB	PCB-156	--	--	--
PCB	PCB-157	--	--	--
PCB	PCB-162	--	--	--
PCB	PCB-167	--	--	--
PCB	PCB-169	--	--	--
PCB	PCB-189	--	--	--
PCB	PCB-37	--	--	--
PCB	PCB-58	--	--	--
PCB	PCB-60	--	--	--
PCB	PCB-61/70	--	--	--
PCB	PCB-66	--	--	--
PCB	PCB-77	--	--	--
PCB	PCB-79	--	--	--
PCB	PCB-80	--	--	--
PCB	PCB-81	--	--	--
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--	--	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
Pesticide	4,4'-DDD	--	--	--
Pesticide	4,4'-DDE	--	--	--
Pesticide	4,4'-DDT	--	50-150%	--
Pesticide	Aldrin	--	50-150%	--
Pesticide	alpha-BHC	--	--	--
Pesticide	alpha-Chlordane	--	--	--
Pesticide	beta-BHC	--	--	--
Pesticide	Camphechlor	--	--	--
Pesticide	delta-BHC	--	--	--
Pesticide	Dieldrin		50-150%	--
Pesticide	Endosulfan I	--	--	--
Pesticide	Endosulfan II	--	--	--
Pesticide	Endosulfan Sulfate	--	--	--
Pesticide	Endrin		50-150%	--
Pesticide	Endrin Aldehyde	--	--	--
Pesticide	Endrin Ketone	--	--	--
Pesticide	gamma-BHC (Lindane)		50-150%	--
Pesticide	gamma-Chlordane	--	--	--
Pesticide	Heptachlor		50-150%	--
Pesticide	Heptachlor Epoxide	--	--	--
Pesticide	Technical Chlordane	--	--	--
SVOCs (SW-846 Method 8270C or CLP)				
PAH	1,1'-Biphenyl	--	--	--
Semivolatile	1,2,4-Trichlorobenzene	--	--	--
PAH	1,2-Benzphenanthracene	--	--	--
Semivolatile	1,2-Dichlorobenzene	--	--	--
Semivolatile	1,4-Dichlorobenzene	--	--	--
Semivolatile	2,2'-oxybis(1-Chloropropane)	--	--	--
Semivolatile	2,4,5-Trichlorophenol	--	--	--
Semivolatile	2,4,6-Trichlorophenol	--	--	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	2,4-Dichlorophenol	--	--	--
Semivolatile	2,4-Dimethylphenol	--	--	--
Semivolatile	2,4-Dinitrophenol	--	--	--
Semivolatile	2,4-Dinitrotoluene	--	44-111%	47%
Semivolatile	2,6-Dinitrotoluene	--	--	--
Semivolatile	2-Chloronaphthalene	--	--	--
Semivolatile	2-Chlorophenol	--	33-95%	50%
PAH	2-Methylnaphthalene	--	--	--
Semivolatile	2-Methylphenol	--	--	--
Semivolatile	2-Nitroaniline	--	--	--
Semivolatile	2-Nitrophenol	--	--	--
Semivolatile	3,3'-Dichlorobenzidine	--	--	--
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--	--	--
Semivolatile	3-Methylphenol & 4-Methylphenol	--	--	--
Semivolatile	3-Nitroaniline	--	--	--
Semivolatile	4,6-Dinitro-2-methylphenol	--	--	--
Semivolatile	4-Bromophenyl Phenyl Ether	--	--	--
Semivolatile	4-Chloro-3-methylphenol	--	43-106%	33%
Semivolatile	4-Chlorophenyl Phenyl Ether	--	--	--
Semivolatile	4-Methylphenol	--	--	--
Semivolatile	4-Nitrophenol	--	9-147%	50%
PAH	Acenaphthene	--	47-102%	19%
PAH	Acenaphthylene	--	--	--
Semivolatile	Acetophenone	--	--	--
PAH	Anthracene	--	--	--
Semivolatile	Atrazine	--	--	--
Semivolatile	Benzaldehyde	--	--	--
PAH	Benzo(a)anthracene	--	--	--
PAH	Benzo(a)pyrene	--	--	--
PAH	Benzo(b)fluoranthene	--	--	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
SVOCs (SW-846 Method 8270C or CLP)				
PAH	Benzo(g,h,i)perylene	--	--	--
PAH	Benzo(k)fluoranthene	--	--	--
Semivolatile	Benzoic Acid	--	--	--
Semivolatile	Benzyl Alcohol	--	--	--
Semivolatile	Benzyl Butyl Phthalate	--	--	--
Semivolatile	bis(2-Chloroethoxy)methane	--	--	--
Semivolatile	bis(2-Chloroethyl)ether	--	--	--
Semivolatile	bis(2-chloroisopropyl)ether	--	--	--
Semivolatile	bis(2-Ethylhexyl)phthalate	--	--	--
Semivolatile	Caprolactam	--	--	--
Semivolatile	Carbazole	--	--	--
PAH	Dibenzo(a,h)anthracene	--	--	--
Semivolatile	Dibenzofuran	--	--	--
Semivolatile	Diethyl Phthalate	--	--	--
Semivolatile	Dimethyl Phthalate	--	--	--
Semivolatile	Di-n-butylphthalate	--	--	--
Semivolatile	Di-n-octylphthalate	--	--	--
PAH	Fluoranthene	--	--	--
PAH	Fluorene	--	--	--
Semivolatile	Hexachloro-1,3-butadiene	--	--	--
Semivolatile	Hexachlorobenzene	--	--	--
Semivolatile	Hexachlorocyclopentadiene	--	--	--
Semivolatile	Hexachloroethane	--	--	--
PAH	Indeno(1,2,3-cd)pyrene	--	--	--
Semivolatile	M-Dichlorobenzene	--	--	--
PAH	Naphthalene	--	--	--
Semivolatile	Nitrobenzene	--	--	--
Semivolatile	N-Nitroso-di-n-propylamine	--	26-119%	38%
Semivolatile	N-Nitrosodiphenylamine	--	--	--

Table B-6
Phase II Sediment Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	P-Chloroaniline	--	--	--
Semivolatile	Pentachlorophenol	--	1-146%	47%
PAH	Phenanthrene	--	--	--
Semivolatile	Phenol	--	18-101%	35%
Semivolatile	P-Nitroaniline	--	--	--
PAH	Pyrene	--	24-143%	36%
Semivolatile	Pyridine	--	--	--

[a] Derived from Calcasieu Estuary Phase II Sampling and Analysis Plan.

[b] Derived from Form III's from ALTA and AATS hard copy data packages.

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Other Inorganic Parameters				
%Lipid	Percent Lipids	--	--	--
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	1,2,3,4,6,7,8-HpCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,6,7,8-HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8,9-HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,4,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,6,7,8-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,6,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8,9-HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8,9-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8-PeCDD	< 50%	50 - 150%	--
Dioxin/Furans	1,2,3,7,8-PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,4,6,7,8-HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,4,7,8-PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	2,3,7,8-TCDD	< 50%	50 - 150%	--
Dioxin/Furans	2,3,7,8-TCDF	< 50%	50 - 150%	--
Dioxin/Furans	OCDD	< 50%	50 - 150%	--
Dioxin/Furans	OCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total HpCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HpCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total HxCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total PeCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDD	< 50%	50 - 150%	--
Dioxin/Furans	Total TCDF	< 50%	50 - 150%	--
Dioxin/Furans	Total Dichloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Hepta-Dioxins	< 50%	50 - 150%	--
Dioxin/Furans	Total Hepta-Furans	< 50%	50 - 150%	--
Dioxin/Furans	Total Heptachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Hexa-Dioxins	< 50%	50 - 150%	--
Dioxin/Furans	Total Hexa-Furans	< 50%	50 - 150%	--
Dioxin/Furans	Total Hexachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Monochloro Biphenyls	< 50%	50 - 150%	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Dioxin/Furans (SW-846, SW-8290 or CLP)				
Dioxin/Furans	Total Nonachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Octachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Penta-Dioxins	< 50%	50 - 150%	--
Dioxin/Furans	Total Penta-Furans	< 50%	50 - 150%	--
Dioxin/Furans	Total Pentachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Tetra-Dioxins	< 50%	50 - 150%	--
Dioxin/Furans	Total Tetra-Furans	< 50%	50 - 150%	--
Dioxin/Furans	Total Tetrachloro Biphenyls	< 50%	50 - 150%	--
Dioxin/Furans	Total Trichloro Biphenyls	< 50%	50 - 150%	--
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Aluminum (Fume Or Dust)	--	75-125%/*61-114%*	--
Metal	Antimony	--	75-125%	--
Metal	Arsenic	--	75-125%/*56-109%*	--
Metal	Barium	--	75-125%/*57-112%*	--
Metal	Beryllium	--	75-125%/*57-110%*	--
Metal	Cadmium	--	75-125%/*55-110%*	--
Metal	Calcium Metal	--	75-125%	--
Metal	Chromium	--	75-125%/*55-108%*	--
Metal	Cobalt	--	75-125%/*59-110%*	--
Metal	Copper	--	75-125%/*55-108%*	--
Metal	Iron	--	75-125%	--
Metal	Lead	--	75-125%/*52-111%*	--
Metal	Magnesium	--	75-125%/*57-112%*	--
Metal	Manganese	--	75-125%/*57-110%*	--
Metal	Mercury	--	75-125% (AATS & ACZ)/*64-126%*	--
Metal	Methyl Mercury	--	--	--
Metal	Nickel	--	75-125%/*53-115%*	--
Metal	Potassium	--	75-125%	--
Metal	Selenium	--	75-125%/*54-117%*	--
Metal	Silver	--	75-125%	--
Metal	Sodium	--	75-125%/*31-132%*	--
Metal	Thallium	--	75-125%	--
Metal	Vanadium (Fume Or Dust)	--	75-125%/*55-111%*	--
Metal	Zinc	--	75-125%/*55-115%*	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	Aroclor-1016	--	--	--
PCB	Aroclor-1221	--	--	--
PCB	Aroclor-1232	--	--	--
PCB	Aroclor-1242	--	--	--
PCB	Aroclor-1248	--	--	--
PCB	Aroclor-1254	--	--	--
PCB	Aroclor-1260	--	--	--
PCB	PCB-1	--	--	--
PCB	PCB-10	--	--	--
PCB	PCB-100/93	--	--	--
PCB	PCB-101/90	--	--	--
PCB	PCB-102/93	--	--	--
PCB	PCB-103	--	--	--
PCB	PCB-104	--	--	--
PCB	PCB-105	--	--	--
PCB	PCB-106	--	--	--
PCB	PCB-107	--	--	--
PCB	PCB-108	--	--	--
PCB	PCB-109	--	--	--
PCB	PCB-11	--	--	--
PCB	PCB-110/77	--	--	--
PCB	PCB-111	--	--	--
PCB	PCB-112	--	--	--
PCB	PCB-113/90	--	--	--
PCB	PCB-114	--	--	--
PCB	PCB-115/110	--	--	--
PCB	PCB-116/85	--	--	--
PCB	PCB-117/85	--	--	--
PCB	PCB-118	--	--	--
PCB	PCB-119/86	--	--	--
PCB	PCB-12	--	--	--
PCB	PCB-120	--	--	--
PCB	PCB-121	--	--	--
PCB	PCB-122	--	--	--
PCB	PCB-123	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-124/107	--	--	--
PCB	PCB-125/86	--	--	--
PCB	PCB-126	--	--	--
PCB	PCB-127	--	--	--
PCB	PCB-128	--	--	--
PCB	PCB-129	--	--	--
PCB	PCB-13/12	--	--	--
PCB	PCB-130	--	--	--
PCB	PCB-131	--	--	--
PCB	PCB-132	--	--	--
PCB	PCB-133	--	--	--
PCB	PCB-134	--	--	--
PCB	PCB-135	--	--	--
PCB	PCB-136	--	--	--
PCB	PCB-137	--	--	--
PCB	PCB-138 /160	--	--	--
PCB	PCB-139	--	--	--
PCB	PCB-14	--	--	--
PCB	PCB-140/139	--	--	--
PCB	PCB-141	--	--	--
PCB	PCB-142	--	--	--
PCB	PCB-143/134	--	--	--
PCB	PCB-144	--	--	--
PCB	PCB-145	--	--	--
PCB	PCB-146	--	--	--
PCB	PCB-147	--	--	--
PCB	PCB-148	--	--	--
PCB	PCB-149/147	--	--	--
PCB	PCB-15	--	--	--
PCB	PCB-150	--	--	--
PCB	PCB-151/135	--	--	--
PCB	PCB-152	--	--	--
PCB	PCB-153/132	--	--	--
PCB	PCB-154/135	--	--	--
PCB	PCB-155	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-156	--	--	--
PCB	PCB-157	--	--	--
PCB	PCB-158	--	--	--
PCB	PCB-159	--	--	--
PCB	PCB-16	--	--	--
PCB	PCB-160/129	--	--	--
PCB	PCB-161	--	--	--
PCB	PCB-162	--	--	--
PCB	PCB-163/129	--	--	--
PCB	PCB-164	--	--	--
PCB	PCB-165	--	--	--
PCB	PCB-166/128	--	--	--
PCB	PCB-167	--	--	--
PCB	PCB-168/153	--	--	--
PCB	PCB-169	--	--	--
PCB	PCB-17	--	--	--
PCB	PCB-170/190	--	--	--
PCB	PCB-171	--	--	--
PCB	PCB-172	--	--	--
PCB	PCB-173/171	--	--	--
PCB	PCB-174	--	--	--
PCB	PCB-175	--	--	--
PCB	PCB-176	--	--	--
PCB	PCB-177	--	--	--
PCB	PCB-178	--	--	--
PCB	PCB-179	--	--	--
PCB	PCB-18/17	--	--	--
PCB	PCB-180	--	--	--
PCB	PCB-181	--	--	--
PCB	PCB-182	--	--	--
PCB	PCB-183	--	--	--
PCB	PCB-184	--	--	--
PCB	PCB-185/183	--	--	--
PCB	PCB-186	--	--	--
PCB	PCB-187	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-188	--	--	--
PCB	PCB-189	--	--	--
PCB	PCB-19	--	--	--
PCB	PCB-190	--	--	--
PCB	PCB-191	--	--	--
PCB	PCB-192	--	--	--
PCB	PCB-193/180	--	--	--
PCB	PCB-194	--	--	--
PCB	PCB-195/208	--	--	--
PCB	PCB-196	--	--	--
PCB	PCB-197	--	--	--
PCB	PCB-198	--	--	--
PCB	PCB-199/198	--	--	--
PCB	PCB-2	--	--	--
PCB	PCB-20	--	--	--
PCB	PCB-200/197	--	--	--
PCB	PCB-201/157/173	--	--	--
PCB	PCB-202	--	--	--
PCB	PCB-203	--	--	--
PCB	PCB-204	--	--	--
PCB	PCB-205	--	--	--
PCB	PCB-206	--	--	--
PCB	PCB-207	--	--	--
PCB	PCB-208	--	--	--
PCB	PCB-209	--	--	--
PCB	PCB-21	--	--	--
PCB	PCB-22	--	--	--
PCB	PCB-23	--	--	--
PCB	PCB-24	--	--	--
PCB	PCB-25	--	--	--
PCB	PCB-26	--	--	--
PCB	PCB-27	--	--	--
PCB	PCB-28/20	--	--	--
PCB	PCB-29/26	--	--	--
PCB	PCB-3	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-30/18	--	--	--
PCB	PCB-31	--	--	--
PCB	PCB-32	--	--	--
PCB	PCB-33/21	--	--	--
PCB	PCB-34	--	--	--
PCB	PCB-35	--	--	--
PCB	PCB-36	--	--	--
PCB	PCB-37	--	--	--
PCB	PCB-38	--	--	--
PCB	PCB-39	--	--	--
PCB	PCB-4	--	--	--
PCB	PCB-40	--	--	--
PCB	PCB-41/40	--	--	--
PCB	PCB-42	--	--	--
PCB	PCB-43	--	--	--
PCB	PCB-44	--	--	--
PCB	PCB-45	--	--	--
PCB	PCB-46	--	--	--
PCB	PCB-47/44	--	--	--
PCB	PCB-48	--	--	--
PCB	PCB-49	--	--	--
PCB	PCB-5	--	--	--
PCB	PCB-50	--	--	--
PCB	PCB-51/45	--	--	--
PCB	PCB-52	--	--	--
PCB	PCB-53/50	--	--	--
PCB	PCB-54	--	--	--
PCB	PCB-55	--	--	--
PCB	PCB-56	--	--	--
PCB	PCB-57	--	--	--
PCB	PCB-58	--	--	--
PCB	PCB-59	--	--	--
PCB	PCB-6	--	--	--
PCB	PCB-60	--	--	--
PCB	PCB-61/70	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-62/59	--	--	--
PCB	PCB-63	--	--	--
PCB	PCB-64	--	--	--
PCB	PCB-65/44	--	--	--
PCB	PCB-66	--	--	--
PCB	PCB-67	--	--	--
PCB	PCB-68	--	--	--
PCB	PCB-69/49	--	--	--
PCB	PCB-7	--	--	--
PCB	PCB-70/61	--	--	--
PCB	PCB-71/40	--	--	--
PCB	PCB-72	--	--	--
PCB	PCB-73	--	--	--
PCB	PCB-74/61	--	--	--
PCB	PCB-75/59	--	--	--
PCB	PCB-76/61	--	--	--
PCB	PCB-77	--	--	--
PCB	PCB-78	--	--	--
PCB	PCB-79	--	--	--
PCB	PCB-8/5	--	--	--
PCB	PCB-80	--	--	--
PCB	PCB-81	--	--	--
PCB	PCB-82	--	--	--
PCB	PCB-83	--	--	--
PCB	PCB-84	--	--	--
PCB	PCB-85	--	--	--
PCB	PCB-86	--	--	--
PCB	PCB-87/115	--	--	--
PCB	PCB-88	--	--	--
PCB	PCB-89	--	--	--
PCB	PCB-9	--	--	--
PCB	PCB-90	--	--	--
PCB	PCB-91/88	--	--	--
PCB	PCB-92	--	--	--
PCB	PCB-93	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-94	--	--	--
PCB	PCB-95/93	--	--	--
PCB	PCB-96	--	--	--
PCB	PCB-97/86	--	--	--
PCB	PCB-98/93	--	--	--
PCB	PCB-99/83	--	--	--
PCB	TOTAL PCBs	--	--	--
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--	--	--
Pesticide	4,4'-DDD	--	--	--
Pesticide	4,4'-DDE	--	--	--
Pesticide	4,4'-DDT	--	50-150%	--
Pesticide	Aldrin	--	50-150%	--
Pesticide	alpha-BHC	--	--	--
Pesticide	alpha-Chlordane	--	--	--
Pesticide	beta-BHC	--	--	--
Pesticide	Camphechlor	--	--	--
Pesticide	delta-BHC	--	--	--
Pesticide	Dieldrin	--	50-150%	--
Pesticide	Endosulfan I	--	--	--
Pesticide	Endosulfan II	--	--	--
Pesticide	Endosulfan Sulfate	--	--	--
Pesticide	Endrin	--	50-150%	--
Pesticide	Endrin Aldehyde	--	--	--
Pesticide	Endrin Ketone	--	--	--
Pesticide	gamma-BHC (Lindane)	--	50-150%	--
Pesticide	gamma-Chlordane	--	--	--
Pesticide	Heptachlor	--	50-150%	--
Pesticide	Heptachlor Epoxide	--	--	--
SVOCs (SW-846 Method 8270C or CLP)				
PAH	1,1'-Biphenyl	--	--	--
Semivolatile	1,2,4-Trichlorobenzene	--	--	--
PAH	1,2-Benzphenanthracene	--	*50-140%*	--
Semivolatile	1,2-Dichlorobenzene	--	--	--
Semivolatile	1,4-Dichlorobenzene	--	--	--
PAH	1-Methylnaphthalene	--	*50-140%*	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	2,2'-oxybis(1-Chloropropane)	--	--	--
Semivolatile	2,4,5-Trichlorophenol	--	--	--
Semivolatile	2,4,6-Trichlorophenol	--	--	--
Semivolatile	2,4-Dichlorophenol	--	--	--
Semivolatile	2,4-Dimethylphenol	--	--	--
Semivolatile	2,4-Dinitrophenol	--	--	--
Semivolatile	2,4-Dinitrotoluene	--	44-111%	47%
Semivolatile	2,6-Dinitrotoluene	--	--	--
Semivolatile	2-Chloronaphthalene	--	--	--
Semivolatile	2-Chlorophenol	--	33-95%	50%
PAH	2-Methylnaphthalene	--	*50-140%*	--
Semivolatile	2-Methylphenol	--	--	--
Semivolatile	2-Nitroaniline	--	--	--
Semivolatile	2-Nitrophenol	--	--	--
Semivolatile	3,3'-Dichlorobenzidine	--	--	--
Semivolatile	3,5,5-Trimethyl-2-cyclohexene-1-one	--	--	--
Semivolatile	3-Nitroaniline	--	--	--
Semivolatile	4,6-Dinitro-2-methylphenol	--	--	--
Semivolatile	4-Bromophenyl Phenyl Ether	--	--	--
Semivolatile	4-Chloro-3-methylphenol	--	43-106%	33%
Semivolatile	4-Chlorophenyl Phenyl Ether	--	--	--
Semivolatile	4-Methylphenol	--	--	--
Semivolatile	4-Nitrophenol	--	9-147%	50%
PAH	Acenaphthene	--	47-102%/*50-140%*	19%
PAH	Acenaphthylene	--	*50-140%*	--
Semivolatile	Acetophenone	--	--	--
PAH	Anthracene	--	*50-140%*	--
Semivolatile	Atrazine	--	--	--
Semivolatile	Benzaldehyde	--	--	--
PAH	Benzo(a)anthracene	--	*50-140%*	--
PAH	Benzo(a)pyrene	--	*50-140%*	--
PAH	Benzo(b)fluoranthene	--	*50-140%*	--
PAH	Benzo(g,h,i)perylene	--	*50-140%*	--
PAH	Benzo(k)fluoranthene	--	*50-140%*	--
Semivolatile	Benzyl Butyl Phthalate	--	--	--

Table B-7
Phase II Tissue Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery (AATS/*EnChem*)[b]	MS/MSD RPD (AATS)[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	bis(2-Chloroethoxy)methane	--	--	--
Semivolatile	bis(2-Chloroethyl)ether	--	--	--
Semivolatile	bis(2-Ethylhexyl)phthalate	--	--	--
Semivolatile	Caprolactam	--	--	--
Semivolatile	Carbazole	--	--	--
PAH	Dibenzo(a,h)anthracene	--	*50-140%*	--
Semivolatile	Dibenzofuran	--	--	--
Semivolatile	Diethyl Phthalate	--	--	--
Semivolatile	Dimethyl Phthalate	--	--	--
Semivolatile	Di-n-butylphthalate	--	--	--
Semivolatile	Di-n-octylphthalate	--	--	--
PAH	Fluoranthene	--	*50-140%*	--
PAH	Fluorene	--	*50-140%*	--
Semivolatile	Hexachloro-1,3-butadiene	--	--	--
Semivolatile	Hexachlorobenzene	--	--	--
Semivolatile	Hexachlorocyclopentadiene	--	--	--
Semivolatile	Hexachloroethane	--	--	--
PAH	Indeno(1,2,3-cd)pyrene	--	*50-140%*	--
Semivolatile	M-Dichlorobenzene	--	--	--
PAH	Naphthalene	--	*50-140%*	--
Semivolatile	Nitrobenzene	--	--	--
Semivolatile	N-Nitroso-di-n-propylamine	--	26-119%	38%
Semivolatile	N-Nitrosodiphenylamine	--	--	--
Semivolatile	P-Chloroaniline	--	--	--
Semivolatile	Pentachlorophenol	--	1-146%	47%
PAH	Phenanthrene	--	*50-140%*	--
Semivolatile	Phenol	--	18-101%	35%
Semivolatile	P-Nitroaniline	--	--	--
PAH	Pyrene	--	24-143%/*50-140%*	36%

[a] Derived from Calcasieu Estuary Phase II Sampling and Analysis Plan.

[b] Derived from Form IIIs from AATS and EnChem hard copy data packages.

Table B-8
Phase II Porewater Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Other Inorganic Parameters				
Ancillary	Ammonia as N	--	--	--
Ancillary	Conductivity	--	--	--
Ancillary	Dissolved Oxygen	--	--	--
Ancillary	Hardness, as CaCO3	--	--	--
Ancillary	Hydrogen Sulfide	--	--	--
Ancillary	Mean Dissolved Organic Carbon	--	--	--
Ancillary	pH	--	--	--
Ancillary	Salinity	--	--	--
Ancillary	Total Alkalinity	--	--	--
Ancillary	Unionized Ammonia	--	--	--
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Cadmium	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Copper	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Lead	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Nickel	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Metal	Silver	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--

Table B-8
Phase II Porewater Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
TAL Metals (SW-846 Methods 6010B/7000/9010B or CLP)				
Metal	Zinc	If both results >5 x CRDL: Surface Water: < 20% If either result < 5 x CRDL: Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125%	--
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	Aroclor-1016	--	--	--
PCB	Aroclor-1221	--	--	--
PCB	Aroclor-1232	--	--	--
PCB	Aroclor-1242	--	--	--
PCB	Aroclor-1248	--	--	--
PCB	Aroclor-1254	--	--	--
PCB	Aroclor-1260	--	--	--
PCB	PCB-101/90	--	--	--
PCB	PCB-105	--	--	--
PCB	PCB-110/77	--	--	--
PCB	PCB-118	--	--	--
PCB	PCB-128	--	--	--
PCB	PCB-138 /160	--	--	--
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-153/132	--	--	--
PCB	PCB-170/190	--	--	--
PCB	PCB-18/17	--	--	--
PCB	PCB-180	--	--	--
PCB	PCB-187	--	--	--
PCB	PCB-195/208	--	--	--
PCB	PCB-201/157/173	--	--	--
PCB	PCB-206	--	--	--
PCB	PCB-209	--	--	--
PCB	PCB-28/20	--	--	--
PCB	PCB-29/26	--	--	--
PCB	PCB-44	--	--	--

Table B-8
Phase II Porewater Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
PCB	PCB-52	--	--	--
PCB	PCB-66	--	--	--
PCB	PCB-8/5	--	--	--
PCB	PCB-87/115	--	--	--
Pesticide	1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	--	--	--
Pesticide	2,4' DDD	--	--	--
Pesticide	2,4' DDE	--	--	--
Pesticide	2,4' DDT	--	--	--
Pesticide	4,4'-DDD	--	--	--
Pesticide	4,4'-DDE	--	--	--
Pesticide	4,4'-DDT	--	50-150%	--
Pesticide	Aldrin	--	50-150%	--
Pesticide	alpha-BHC	--	--	--
Pesticide	alpha-Chlordane	--	--	--
Pesticide	beta-BHC	--	--	--
Pesticide	Camphechlor	--	--	--
Pesticide	Chlorpyrifos	--	--	--
Pesticide	Cis-Nonachlor	--	--	--
Pesticide	delta-BHC	--	--	--
Pesticide	Dieldrin	--	50-150%	--
Pesticide	Endosulfan I	--	--	--
Pesticide	Endosulfan II	--	--	--
Pesticide	Endosulfan Sulfate	--	--	--
Pesticide	Endrin	--	50-150%	--
Pesticide	Endrin Aldehyde	--	--	--
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
Pesticide	Endrin Ketone	--	--	--
Pesticide	gamma-BHC (Lindane)	--	50-150%	--
Pesticide	gamma-Chlordane	--	--	--
Pesticide	Heptachlor	--	50-150%	--

Table B-8
Phase II Porewater Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
Pesticides & PCBs (SW-846 Methods 8081A & 8082 or CLP)				
Pesticide	Heptachlor Epoxide	--	--	--
Pesticide	Mirex	--	--	--
Pesticide	Oxychlordane	--	--	--
Pesticide	Pentachloroanisole	--	--	--
Pesticide	Pentachlorobenzene	--	--	--
Pesticide	Tetrachlorobenzene 1,2,3,4	--	--	--
Pesticide	Trans-Nonachlor	--	--	--
SVOCs (SW-846 Method 8270C or CLP)				
PAH	1,1'-Biphenyl	--	--	--
Semivolatile	1,2,4,5-Tetrachlorobenzene	--	--	--
PAH	1,2-Benzphenanthracene	--	--	--
PAH	1,6,7-Trimethylnaphthalene	--	--	--
PAH	1-Methylnaphthalene	--	--	--
PAH	1-Methylphenanthrene	--	--	--
PAH	2,6-Dimethylnaphthalene	--	--	--
PAH	2-Methylnaphthalene	--	--	--
PAH	Acenaphthene	--	47-102%	19%
PAH	Acenaphthylene	--	--	--
PAH	Anthracene	--	--	--
PAH	Benzo(a)anthracene	--	--	--
PAH	Benzo(a)pyrene	--	--	--
PAH	Benzo(b)fluoranthene	--	--	--
PAH	Benzo(e)pyrene	--	--	--
PAH	Benzo(g,h,i)perylene	--	--	--
PAH	Benzo(k)fluoranthene	--	--	--
PAH	Dibenzo(a,h)anthracene	--	--	--
PAH	Dibenzothiophene	--	--	--
PAH	Fluoranthene	--	--	--
PAH	Fluorene	--	--	--
Semivolatile	Hexachloro-1,3-butadiene	--	--	--

Table B-8
Phase II Porewater Percent Recoveries

Method Group	Analyte	Laboratory Duplicate Percent Recovery[a]	MS/MSD Percent Recovery[b]	MS/MSD RPD[b]
SVOCs (SW-846 Method 8270C or CLP)				
Semivolatile	Hexachlorobenzene	--	--	--
PAH	Indeno(1,2,3-cd)pyrene	--	--	--
PAH	Naphthalene	--	--	--
PAH	Perylene	--	--	--
PAH	Phenanthrene	--	--	--
PAH	Pyrene	--	24-143%	36%

[a] Derived from Calcasieu Estuary Phase II Sampling and Analysis Plan.

[b] Derived from Form III in AATS and EnChem hard copy data packages.

Table C-1
Calcasieu Estuary Reference Area
Summary Statistics -Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	5/5	70.74	32.9837429	0.46626722	41.8284747	99.6515253	42.15	82	93.7	51.55	23.3	98			ln(y) = 4.14882692657185 + 0.69321510962786*Z
1,2,3,4,6,7,8-HpCDF PG/G	2/5										1.59	8.1	0.099	0	
1,2,3,4,7,8-HxCDD PG/G	1/5										1.59	1.59	0.52	0	
1,2,3,4,7,8-HxCDF PG/G	1/5										3.04	3.04	0.18	0	
1,2,3,6,7,8-HxCDD PG/G	1/5										3.25	3.25	0.96	0	
1,2,3,6,7,8-HxCDF PG/G	1/5										1.39	1.39	0.049	0	
1,2,3,7,8,9-HxCDD PG/G	3/5	4.13977162	1.60384834	0.38742435	2.73393657	5.54560667	2.9252194	3.9251007	5.2667556	2.3415362	4.26	6.3	1.53	4	ln(y) = 1.36739201617981 + 0.436112822525884*Z
1,2,3,7,8-PeCDF PG/G	2/5										1.71	1.78	0.34	4	
1,2-Benzphenanthracene ug/Kg	2/5										37.3	46.4	275	4	
2,3,4,6,7,8-HxCDF PG/G	1/5										1.14	1.14	0.044	4	
2,3,4,7,8-PeCDF PG/G	2/5										1.58	3.22	0.21	4	
2,3,7,8-TCDD PG/G	1/5										1.5	1.5	0.223	4	
2,3,7,8-TCDF PG/G	5/5	3.184	2.34026751	0.73500864	1.13266508	5.23533492	1.45	1.6	5.71	4.26	1.3	5.91			ln(y) = 0.937116395508358 + 0.890742521882871*Z
2,4-D ug/Kg	2/3										35	47	170	0	
alpha-BHC ug/Kg	1/18										0.079	0.079	1.4	0	
Aluminum (Fume Or Dust) MG/KG	3/3	6506.66667	1231.94627	0.189336	5112.58823	7900.74511	5390	6530	7600	2210	5390	7600			ln(y) = 8.77078880414931 + 0.254826755552087*Z
Aroclor-1254 ug/Kg	3/18										100	1000	17	0	
Arsenic MG/KG	3/3	7.83333333	3.46246585	0.44201692	3.91518437	11.7514823	4.8	9.2	9.5	4.7	4.8	9.5			ln(y) = 2.01303706685845 + 0.506294035416225*Z
Barium MG/KG	3/3	35.3	6.97992097	0.19773147	27.4014759	43.1985241	28.7	37.1	40.1	11.4	28.7	40.1			ln(y) = 3.55396347556383 + 0.248060367395905*Z
Benzo(a)anthracene ug/Kg	1/4										37	37	275	0	
Benzo(a)pyrene ug/Kg	1/4										42.5	42.5	275	0	
Benzo(b)fluoranthene ug/Kg	1/4										42	42	275	0	
Benzo(g,h,i)perylene ug/Kg	1/4										35.9	35.9	275	0	
bis(2-Ethylhexyl)phthalate ug/Kg	5/18	71.4182798	16.368612	0.22919359	63.8563669	78.9801927	55.408707	69.591549	87.404741	31.996034	55	110	67	380	ln(y) = 4.24264313809253 + 0.338045176343363*Z
Cadmium MG/KG	15/18	0.12891586	0.06946028	0.5388032	0.09682685	0.16100488	0.0696386	0.1087656	0.1698766	0.100238	0.047	0.24	0.1	0.12	ln(y) = -2.21855991015574 + 0.661352557387265*Z
Calcium Metal MG/KG	3/3	1856.66667	214.276984	0.11540951	1614.18943	2099.1439	1690	1820	2060	370	1690	2060			ln(y) = 7.52317894992386 + 0.146826344498658*Z
Chromium MG/KG	3/3	9.26666667	1.46405088	0.1579911	7.60993713	10.9233962	7.9	9.4	10.5	2.6	7.9	10.5			ln(y) = 2.21964923530414 + 0.211003471275303*Z
Cobalt MG/KG	3/3	4.33333333	0.59667139	0.1376934	3.65813609	5.00853057	3.9	4.2	4.9	1	3.9	4.9			ln(y) = 1.46176542784717 + 0.169283839225232*Z
Copper MG/KG	18/18	12.7033333	3.48050278	0.27398343	11.0954231	14.3112436	11.7275	13.25	15	3.2725	4.87	18.1			ln(y) = 2.49624355168622 + 0.338940849627823*Z
Diethyl Phthalate ug/Kg	1/18										730	730	67	0	
Fluoranthene ug/Kg	1/4										59.4	59.4	110	0	
Iron MG/KG	3/3	10090	1606.69415	0.15923629	8271.85441	11908.1456	8570	10500	11200	2630	8570	11200			ln(y) = 9.21294086834021 + 0.198494776758168*Z
Lead MG/KG	18/18	19.1966667	6.0666215	0.31602473	16.3940305	21.9993028	13.1	21.75	23.35	10.25	8.64	29.1			ln(y) = 2.90195541906062 + 0.37589074160583*Z
Magnesium MG/KG	3/3	3833.33333	569.242545	0.14849806	3189.17475	4477.49191	3370	3760	4370	1000	3370	4370			ln(y) = 8.24578684927333 + 0.192713178920779*Z
Manganese MG/KG	3/3	90.8	45.6504936	0.50275874	39.1416034	142.458397	68.4	73	131	62.6	68.4	131			ln(y) = 4.46367652965935 + 0.481930410901379*Z
Mercury MG/KG	15/18	0.0632653	0.0233338	0.36882453	0.05248564	0.07404497	0.0416117	0.0578122	0.0803201	0.0387084	0.0203	0.0927	0.09	0.11	ln(y) = -2.85055498095598 + 0.487726251915661*Z
Methyl Mercury MG/KG	3/15	0.00070597	0.00065834	0.93252838	0.00037281	0.00103914	0.0003501	0.0005817	0.0009663	0.0006162	0.00117	0.0019	0.00065	0.00101	ln(y) = -7.44962563645172 + 0.752915632162923*Z
Nickel MG/KG	18/18	16.0255556	4.64533502	0.28987045	13.8795203	18.1715908	11.35	17.95	19.575	8.225	8.5	21.5			ln(y) = 2.72763058367119 + 0.346050110614534*Z
OCDD PG/G	5/5	1502.2	900.71283	0.59959581	712.690394	2291.70961	740.5	1600	2215	1474.5	281	2530			ln(y) = 7.09835483204276 + 1.03646244610415*Z
OCDF PG/G	2/5										1.51	26	0.21	0	
PCB-105 NG/KG	2/2										48.2	22600			
PCB-108 NG/KG	2/2										10.4	4780			
PCB-114 NG/KG	2/2										2.3	1820			
PCB-118 NG/KG	2/2										130	63100			
PCB-126 NG/KG	1/2										299	299	5	0	
PCB-15 NG/KG	2/2										73.3	501			
PCB-156 ng/kg	2/2										13.8	10800			
PCB-157 NG/KG	2/2										3.79	2700			
PCB-162 NG/KG	2/2										21.7	15200			
PCB-167 NG/KG	2/2										7.43	4280			
PCB-169 NG/KG	1/2										8.28	8.28	5	0	

Table C-1
Calcasieu Estuary Reference Area
Summary Statistics -Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-189 NG/KG	**2/2**										**12.4**	**579**			
PCB-37 ng/kg	**2/2**										**46.3**	**384**			
PCB-58 NG/KG	**2/2**										**4.84**	**390**			
PCB-60 NG/KG	**1/2**										**2470**	**2470**	**56.4**	**0**	
PCB-61/70 NG/KG	**1/2**										**20200**	**20200**	**125**	**0**	
PCB-66 NG/KG	**2/2**										**121**	**12400**			
PCB-77 NG/KG	**2/2**										**17.9**	**933**		**0**	
PCB-79 NG/KG	**1/2**										**540**	**540**	**5**		
PCB-81 NG/KG	**1/2**										**733**	**733**	**5**	**0**	
Potassium MG/KG	**3/3**	**2360**	**454.055329**	**0.19239633**	**1846.18803**	**2873.81197**	**1930**	**2430**	**2720**	**790**	**1930**	**2720**			ln(y) = 7.75643632584119 + 0.254462625554207*Z
Pyrene ug/Kg	**3/6**	42.343415	28.9740442	0.68426328	19.1593511	65.5274789	22.115314	39.48683	70.503622	48.388307	**25**	**79.7**	**110**	**380**	ln(y) = 3.67596719818936 + 0.85984310044914*Z
Silver MG/KG	**15/18**	0.1827603	0.1061071	0.58058068	0.13374132	0.23177928	0.1192575	0.1652905	0.2290921	0.1098346	**0.08**	**0.51**	**0.41**	**0.5**	ln(y) = -1.80005089631601 + 0.484166198586113*Z
Sodium MG/KG	**3/3**	**5110**	**493.012017**	**0.09647985**	**4552.10438**	**5667.89562**	**4800**	**4960**	**5570**	**770**	**4800**	**5570**			ln(y) = 8.53689418317876 + 0.110339315177776*Z
Total HpCDD PG/G	**5/5**	**277.12**	**134.888802**	**0.48675232**	**158.884752**	**395.355248**	**192.8**	**310**	**345**	**152.2**	**86.6**	**370**			ln(y) = 5.51602793757406 + 0.639647001236188*Z
Total HpCDF PG/G	**2/5**										**1.59**	**17.3**	**0.099**	**0**	
Total HxCDD PG/G	**5/5**	**108**	**46.3980305**	**0.42961139**	**67.3303331**	**148.669667**	**73.5**	**103**	**145**	**71.5**	**52**	**170**			ln(y) = 4.61262795564878 + 0.555968388655873*Z
Total HxCDF PG/G	**2/5**										**1.45**	**13.9**	**0.19**	**0**	
Total Organic Carbon MG/KG	**15/15**	**43456.6394**	**24874.007**	**0.57238681**	**30868.655**	**56044.6238**	**33030.391**	**40451.107**	**49682.52**	**16652.129**	**10082.91133**	**111832.4802**			ln(y) = 10.5575089815982 + 0.57533516087616*Z
Total PeCDD PG/G	**5/5**	**21.98**	**9.14185579**	**0.41591701**	**13.9668101**	**29.9931899**	**15.45**	**20**	**29.5**	**14.05**	**13.1**	**35**			ln(y) = 3.0361889705793 + 0.48140626661182*Z
Total PeCDF PG/G	**2/5**										**14.5**	**28.3**	**0.92**	**0**	
Total TCDD PG/G	**5/5**	**23.04**	**5.25792027**	**0.22820835**	**18.4312297**	**27.6487703**	**19**	**20**	**28.6**	**9.6**	**19**	**29.7**			ln(y) = 3.11798865647361 + 0.263719170317724*Z
Total TCDF PG/G	**5/5**	**49.58**	**46.5859199**	**0.93961113**	**8.74564082**	**90.4143592**	**17**	**20**	**96.95**	**79.95**	**15**	**113**			ln(y) = 3.55376461931989 + 1.14940276228532*Z
Vanadium (Fume Or Dust) MG/KG	**3/3**	**15.9666667**	**3.34481226**	**0.2094872**	**12.1816553**	**19.7516781**	**13**	**15.9**	**19**	**6**	**13**	**19**			ln(y) = 2.75856914861805 + 0.281441511858617*Z
Zinc MG/KG	**18/18**	**59.6166667**	**15.4129794**	**0.25853474**	**52.4962335**	**66.7370999**	**46.925**	**59.15**	**73.1**	**26.175**	**36**	**86**			ln(y) = 4.05455135822942 + 0.30046904098748*Z
Acid Volatile Sulfide umol/g	**15/15**	**7.81533333**	**9.35996924**	**1.19764172**	**3.07853535**	**12.5521313**	**1.59**	**6.88**	**10.3**	**8.71**	**0.54**	**34.2**			ln(y) = 1.54966391866427 + 1.27665892199646*Z
Percent Clay %	**15/15**	**23.944**	**11.6970441**	**0.48851671**	**18.024479**	**29.863521**	**15.96**	**22.01**	**38.17**	**22.21**	**4.7**	**40.34**			ln(y) = 3.02820763416998 + 0.675563018374045*Z
Percent Sand %	**15/15**	**35.8586667**	**16.3389299**	**0.455648**	**27.5900273**	**44.127306**	**23.66**	**33.44**	**42.06**	**18.4**	**10.83**	**68.3**			ln(y) = 3.48334232427613 + 0.524963133663656*Z
Percent Silt %	**15/15**	**40.2**	**11.0120172**	**0.27393078**	**34.6271504**	**45.7728496**	**32.17**	**38.17**	**48.83**	**16.66**	**20.38**	**59.02**			ln(y) = 3.6554847299915 + 0.328018305834483*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table C-2
Calcasieu Estuary Reference Area
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean Lower	Upper	Percentiles 25th	Median	75th	IQR	Range of Detected Values Minimum	Maximum	Reporting Limit Minimum	Maximum	Regression Equation
Aluminum (Fume Or Dust) mg/L Dissolved	1/1										0.1	0.1			
Aluminum (Fume Or Dust) mg/L Total	1/1										0.98	0.98			
Ammonia as N mg/L	1/1										0.33	0.33			
Arsenic mg/L Dissolved	1/1										0.0064	0.0064			
Arsenic mg/L Total	1/1										0.0054	0.0054			
Barium mg/L Dissolved	1/1										0.0606	0.0606			
Barium mg/L Total	1/1										0.0641	0.0641			
beta-BHC ug/L	1/1										0.053	0.053			
Bromide mg/L	1/1										13.9	13.9			
Calcium Metal mg/L Dissolved	1/1										76.2	76.2			
Calcium Metal mg/L Total	1/1										81.3	81.3			
Copper mg/L Dissolved	1/1										0.0091	0.0091			
Copper mg/L Total	1/1										0.009	0.009			
delta-BHC ug/L	1/1										0.053	0.053			
Iron mg/L Total	1/1										0.111	0.111			
Lead mg/L Total	1/1										0.0144	0.0144			
Magnesium mg/L Dissolved	1/1										245	245			
Magnesium mg/L Total	1/1										260	260			
Manganese mg/L Dissolved	1/1										0.0434	0.0434			
Manganese mg/L Total	1/1										0.0615	0.0615			
Nickel mg/L Dissolved	1/1										0.0024	0.0024			
Nickel mg/L Total	1/1										0.0049	0.0049			
Potassium mg/L Dissolved	1/1										149	149			
Potassium mg/L Total	1/1										161	161			
Selenium mg/L Total	1/1										0.01	0.01			
Sodium mg/L Dissolved	1/1										1850	1850			
Sodium mg/L Total	1/1										1910	1910			
Thallium mg/L Dissolved	1/1										0.012	0.012			
Thallium mg/L Total	1/1										0.0095	0.0095			
Total Organic Carbon mg/L	1/1										6.9	6.9			
Vanadium (Fume Or Dust) mg/L Dissolved	1/1										0.0016	0.0016			
Vanadium (Fume Or Dust) mg/L Total	1/1										0.0022	0.0022			
Zinc mg/L Dissolved	1/1										0.0194	0.0194			
Zinc mg/L Total	1/1										0.0142	0.0142			
Bicarbonate Alkalinity mg/L	1/1										42.1	42.1			
Chloride mg/L	1/1										3835	3835			
Diesel Range Organics ug/L	1/1										250	250			
Dissolved Oxygen %	13/13	10.364615	1.5500996	0.14955689	9.52197163	11.2072591	9.26	10.55	11.365	2.105	7.495	12.76			ln(y) = 2.32805577497841 + 0.174104053345536*Z
Field Conductivity ms/cm	13/13	21363.077	18966.562	0.88781977	11052.7364	31673.4174	11025	15150	35225	24200	1350	53800			ln(y) = 9.50636104884689 + 1.25857063935141*Z
Field pH standard units	13/13	7.3330769	0.4266412	0.05818038	7.10115211	7.56500174	7.1125	7.27	7.5525	0.44	6.67	8.135			ln(y) = 1.99093446438294 + 6.28819581578223E-02*Z
Field Specific Gravity NO UNITS	10/10	5.7	1.6535484	0.29009621	4.67512009	6.72487991	4	6	7.25	3.25	4	8			ln(y) = 1.70252490845787 + 0.327343138970797*Z
Field Temperature deg c	13/13	15.884615	3.5045952	0.22062827	13.9794958	17.789735	14.4225	15.67	18.4275	4.005	9.6	21.145			ln(y) = 2.74228417174071 + 0.253662114066156*Z
Field Total Dissolved Solids mg/L	14/14	13466.786	10243.792	0.76067091	8100.75927	18832.8122	7000	8500	16750	9750	6000	32000			ln(y) = 9.31127273338025 + 0.624999180518189*Z
Field Turbidity NTU	12/12	6.9875	6.3791011	0.91293038	3.3781838	10.5968162	2.6875	4.75	10.5	7.8125	1	21.4			ln(y) = 1.61205582391047 + 1.01317679493726*Z
Hardness, as CaCO3 mg/L	1/1										1295	1295			
Nitrate-Nitrite mg/L	1/1										0.06	0.06			
Salinity ppt	13/13	14.423077	12.039392	0.83473119	7.87838882	20.967765	7	9	22.75	15.75	6	36			ln(y) = 2.42567038146116 + 0.711176149931114*Z
Sulfate mg/L	1/1										597.5	597.5			

CDM

Table C-2
Calcasieu Estuary Reference Area
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean Lower	95% Confidence Limit about the Mean Upper	Percentiles 25th	Percentiles Median	Percentiles 75th	Percentiles IQR	Range of Detected Values Minimum	Range of Detected Values Maximum	Reporting Limit Minimum	Reporting Limit Maximum	Regression Equation
Total Alkalinity mg/L	**1/1**										**42.1**	**42.1**			
Total Kjeldahl Nitrogen mg/L	**1/1**										**0.95**	**0.95**			
Total Suspended Solids mg/L	**1/1**										**13.25**	**13.25**			

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table C-3
Calcasieu Estuary Reference Area
Summary Statistics - Pore Water Results

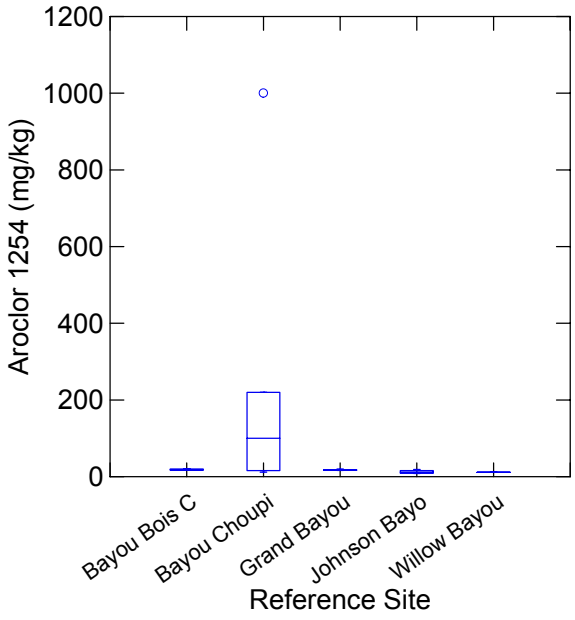
Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1'-Biphenyl	7/7	0.0000025	0.0000004	0.1450642	0.0000022	0.0000028	0.0000022	0.0000023	0.0000030	0.0000008	0.0000022	0.0000030			ln(y) = -12.9018721309696 + 0.160946486994291*Z
1,2,4,5-Tetrachlorobenzene	5/7	0.0000028	0.0000033	1.1742835	0.0000004	0.0000052	0.0000003	0.0000011	0.0000044	0.0000041	0.0000001	0.0000071	0.0000002	0.0000002	ln(y) = -13.7160603369701 + 2.03965347544636*Z
1,2-Benzphenanthracene	7/7	0.0000037	0.0000113	3.0596518	-0.0000047	0.0000121	0.0000005	0.0000007	0.0000009	0.0000004	0.0000005	0.0000217			ln(y) = -13.7059467036452 + 1.28078506385881*Z
1,6,7-Trimethylnaphthalene	7/7	0.0000022	0.0000011	0.4849519	0.0000014	0.0000030	0.0000012	0.0000020	0.0000029	0.0000017	0.0000011	0.0000038			ln(y) = -13.1338428873219 + 0.599379024249822*Z
1-Methylnaphthalene	7/7	0.0000073	0.0000039	0.5442269	0.0000043	0.0000102	0.0000044	0.0000055	0.0000114	0.0000070	0.0000038	0.0000136			ln(y) = -11.9420706498266 + 0.599471564940698*Z
1-Methylphenanthrene	7/7	0.0000012	0.0000004	0.2960815	0.0000010	0.0000015	0.0000009	0.0000014	0.0000015	0.0000006	0.0000008	0.0000017			ln(y) = -13.63777254064 + 0.365592284774204*Z
2,4' DDE	1/7										0.0000001	0.0000001	0.0000001	0	
2,6-Dimethylnaphthalene	7/7	0.0000030	0.0000018	0.6031903	0.0000017	0.0000044	0.0000014	0.0000030	0.0000041	0.0000027	0.0000013	0.0000061			ln(y) = -12.8504126143416 + 0.731762169192141*Z
2-Methylnaphthalene	7/7	0.0000094	0.0000045	0.4816484	0.0000061	0.0000128	0.0000056	0.0000094	0.0000141	0.0000085	0.0000046	0.0000162			ln(y) = -11.6690800546486 + 0.595069424913948*Z
4,4'-DDD	1/7										0.0000003	0.0000003	0.0000001	0	
Acenaphthene	7/7	0.0000038	0.0000018	0.4833164	0.0000024	0.0000051	0.0000030	0.0000038	0.0000055	0.0000025	0.0000006	0.0000056			ln(y) = -12.6624251508977 + 0.796733042119329*Z
Acenaphthylene	7/7	0.0000011	0.0000006	0.6047206	0.0000006	0.0000015	0.0000005	0.0000010	0.0000016	0.0000011	0.0000004	0.0000020			ln(y) = -13.9302194217596 + 0.788428644525154*Z
Aldrin	1/7										0.0000003	0.0000003	0.0000001	0	
alpha-BHC	7/7	0.0000021	0.0000016	0.7943698	0.0000008	0.0000033	0.0000006	0.0000016	0.0000040	0.0000033	0.0000006	0.0000044			ln(y) = -13.4040006004209 + 1.06786690169845*Z
Ammonia as N	15/15	0.6226667	0.3517040	0.5648351	0.4446799	0.8006534	0.42	0.5	0.7	0.28	0.31	1.56			ln(y) = -0.571532281950146 + 0.469310024780544*Z
Anthracene	7/7	0.0000014	0.0000006	0.4122521	0.0000010	0.0000019	0.0000011	0.0000013	0.0000019	0.0000008	0.0000007	0.0000024			ln(y) = -13.5244939983536 + 0.488224842951357*Z
Benzo(a)anthracene	7/7	0.0000004	0.0000001	0.3620487	0.0000003	0.0000005	0.0000003	0.0000004	0.0000005	0.0000002	0.0000002	0.0000006			ln(y) = -14.8232159564157 + 0.452250949745343*Z
Benzo(a)pyrene	7/7	0.0000005	0.0000005	0.9332583	0.0000001	0.0000008	0.0000001	0.0000004	0.0000006	0.0000005	0.0000001	0.0000013			ln(y) = -14.8697048707635 + 1.12537474778637*Z
Benzo(b)fluoranthene	7/7	0.0000031	0.0000094	3.0738071	-0.0000039	0.0000101	0.0000004	0.0000006	0.0000009	0.0000005	0.0000002	0.0000182			ln(y) = -13.9998413171283 + 1.55464484819194*Z
Benzo(e)pyrene	7/7	0.0000019	0.0000049	2.6485162	-0.0000018	0.0000055	0.0000003	0.0000006	0.0000009	0.0000006	0.0000002	0.0000099			ln(y) = -14.1598002400866 + 1.43876862391979*Z
Benzo(g,h,i)perylene	7/7	0.0000006	0.0000015	2.3678749	-0.0000005	0.0000018	0.0000001	0.0000003	0.0000003	0.0000002	0.0000000	0.0000032			ln(y) = -15.1261107473015 + 1.53832820662228*Z
Benzo(k)fluoranthene	7/7	0.0000008	0.0000021	2.5536912	-0.0000007	0.0000024	0.0000001	0.0000003	0.0000005	0.0000004	0.0000000	0.0000043			ln(y) = -15.0688500717941 + 1.75472031808434*Z
beta-BHC	4/7	0.0000014	0.0000009	0.6653109	0.0000007	0.0000021	0.0000008	0.0000012	0.0000019	0.0000012	0.0000011	0.0000024	0.0000001	0.0000001	ln(y) = -13.6047716614694 + 0.670945422130836*Z
Cadmium	5/7	0.0000646	0.0000408	0.6326211	0.0000343	0.0000948	0.0000333	0.0000542	0.0000882	0.0000550	0.00003	0.00012	0.000051	0.000063	ln(y) = -9.82351715436692 + 0.72341317235355*Z
Chlorpyrifos	2/7										0.0000002	0.0000003	0.0000002	0.000063	
Cis-Nonachlor	1/7										0.0000002	0.0000002	0.0000001	0.000063	
Conductivity	15/15	18.1066667	0.2966174	0.0163817	17.9565576	18.2567758	17.8	18.1	18.3	0.5	17.7	18.7			ln(y) = 2.8961599139648 + 1.79598999312587E-02*Z
Copper	7/7	0.0074657	0.0036025	0.4825385	0.0047969	0.0101345	0.0037500	0.0068900	0.0111000	0.0073500	0.0030700	0.0118000			ln(y) = -5.01134349641036 + 0.657461151030017*Z
delta-BHC	3/7	0.0000023	0.0000027	1.1650425	0.0000003	0.0000043	0.0000008	0.0000016	0.0000033	0.0000024	0.0000029	0.0000062	0.0000001	0.0000001	ln(y) = -13.3192782983318 + 1.01604505410756*Z
Dibenzo(a,h)anthracene	7/7	0.0000002	0.0000001	0.6574491	0.0000001	0.0000003	0.0000001	0.0000002	0.0000003	0.0000002	0.0000000	0.0000004			ln(y) = -15.6380420242238 + 0.994853923420163*Z
Dibenzothiophene	7/7	0.0000018	0.0000016	0.9016816	0.0000006	0.0000030	0.0000003	0.0000017	0.0000033	0.0000030	0.0000002	0.0000041			ln(y) = -13.7944000452014 + 1.54371750704123*Z
Dissolved Oxygen	15/15	6	0.4784853	0.0797475	5.7578530	6.2421470	5.6	5.8	6.5	0.9	5.5	6.8			ln(y) = 1.78890715668186 + 8.34664487691527E-02*Z
Endrin	3/7	0.0000002	0.0000005	2.2580651	-0.0000002	0.0000006	0.0000000	0.0000001	0.0000003	0.0000002	0.0000002	0.0000011	0.0000001	0.0000002	ln(y) = -16.7278410373397 + 2.31713919976689*Z
Fluoranthene	7/7	0.0000069	0.0000057	0.8380642	0.0000026	0.0000111	0.0000041	0.0000056	0.0000068	0.0000027	0.0000029	0.0000171			ln(y) = -12.0378428946615 + 0.650101711335877*Z
Fluorene	7/7	0.0000097	0.0000035	0.3592413	0.0000071	0.0000123	0.0000069	0.0000104	0.0000117	0.0000048	0.0000049	0.0000150			ln(y) = -11.5983733007857 + 0.463080829702517*Z
gamma-BHC (Lindane)	7/7	0.0000006	0.0000004	0.6850806	0.0000003	0.0000009	0.0000002	0.0000008	0.0000009	0.0000007	0.0000001	0.0000012			ln(y) = -14.5714012878505 + 1.07321930814192*Z
gamma-Chlordane	2/7										0.0000005	0.0000007	0.0000001	0	
Hardness, as CaCO3	11/11	2159.0909	284.3739	0.1317100	1991.0367	2327.1451	1920	2190	2360	440	1700	2680			ln(y) = 7.66988070610141 + 0.15214970689817*Z
Heptachlor	3/7	0.0000010	0.0000005	0.5007200	0.0000006	0.0000013	0.0000006	0.0000009	0.0000013	0.0000006	0.0000011	0.0000016	0.0000001	0.0000001	ln(y) = -13.9186825227573 + 0.50232279055529*Z
Heptachlor Epoxide	4/7	0.0000019	0.0000051	2.7000831	-0.0000019	0.0000057	0.0000000	0.0000003	0.0000018	0.0000017	0.0000005	0.0000105	0.0000001	0.0000001	ln(y) = -15.1461356159657 + 2.82630464971316*Z
Hexachlorobenzene	7/7	0.0000009	0.0000010	1.0618810	0.0000002	0.0000016	0.0000001	0.0000009	0.0000015	0.0000014	0.0000000	0.0000025			ln(y) = -14.7805044381721 + 2.13755347304352*Z
Hydrogen Sulfide	15/15	0.0242667	0.0192595	0.7936599	0.0145200	0.0340133	0.014	0.021	0.028	0.014	0.01	0.079			ln(y) = -3.8571858284115 + 0.548871591470944*Z
Indeno(1,2,3-cd)pyrene	7/7	0.0000009	0.0000023	2.5052427	-0.0000008	0.0000026	0.0000002	0.0000003	0.0000005	0.0000003	0.0000001	0.0000046			ln(y) = -14.7713723144601 + 1.33624241389521*Z
Lead	6/7	0.0001639	0.0000681	0.4152303	0.0001135	0.0002144	-0.00015	-0.00015	0.00024	0.00039	0.0001	0.00027	0.00015	0.00015	ln(y) = -8.78409721521191 + 0.446826832806601*Z
Mean Dissolved Organic Carbon	15/15	4.7777800	3.4115348	0.7140418	3.0513052	6.5042548	3.0616	3.8263	4.6573	1.5957	2.2918	13.5204			ln(y) = 1.41963916794404 + 0.543666780118722*Z
Naphthalene	7/7	0.0000161	0.0000049	0.3027817	0.0000125	0.0000197	0.0000116	0.0000177	0.0000195	0.0000079	0.0000091	0.0000226			ln(y) = -11.079150706924 + 0.394423704711024*Z
Nickel	7/7	0.0043471	0.0016450	0.3784167	0.0031285	0.0055658	0.00285	0.00371	0.00608	0.00323	0.00245	0.0067			ln(y) = -5.49814824059906 + 0.468304415725036*Z
PCB-101/90	1/7										0.0000033	0.0000033	0.0000001	0	
PCB-110/77	2/7										0.0000005	0.0000013	0.0000001	0	
PCB-138 /160	7/7	0.0000036	0.0000012	0.3375142	0.0000027	0.0000045	0.0000023	0.0000033	0.0000045	0.0000022	0.0000022	0.0000054			ln(y) = -12.5921965553099 + 0.410337926728869*Z
PCB-180	5/7	0.0000005	0.0000004	0.8056852	0.0000002	0.0000008	0.0000002	0.0000004	0.0000008	0.0000006	0.0000004	0.0000013	0.0000001	0.0000001	ln(y) = -14.686470850778 + 0.895535745874798*Z

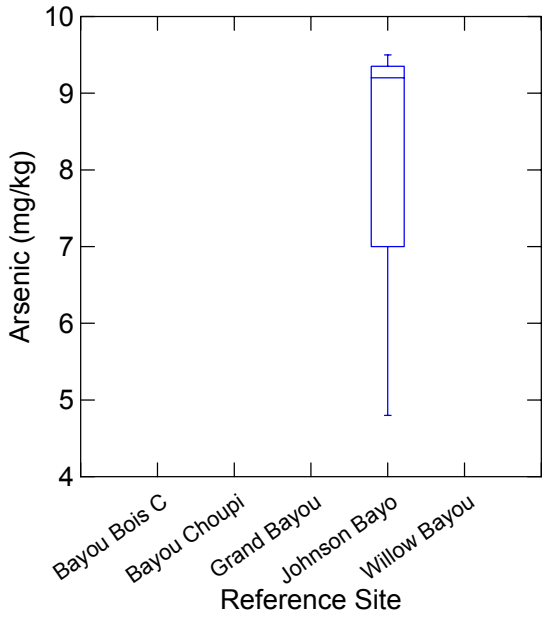
Table C-3
Calcasieu Estuary Reference Area
Summary Statistics - Pore Water Results

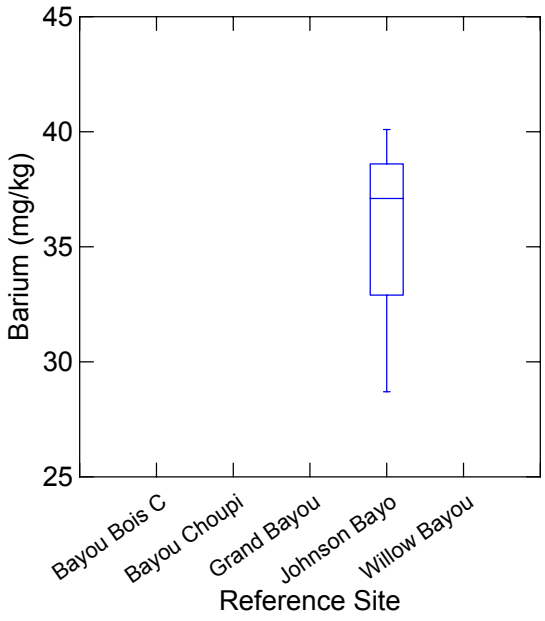
Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-206	**1/7**										**0.0000002**	**0.0000002**	**0.0000001**	**0.0000001**	
PCB-209	**1/7**										**0.0000002**	**0.0000002**	**0.0000001**	**0.0000001**	
PCB-28/20	**4/7**	0.0000023	0.0000020	0.85188239	0.0000008	0.0000038	0.0000010	0.0000018	0.0000033	0.0000023	**0.0000016**	**0.0000044**	**0.0000001**	**0.0000001**	ln(y) = -13.2229578752625 + 0.881175076367077*Z
PCB-44	**1/7**										**0.0000007**	**0.0000007**	**0.0000001**	**0.0000001**	
PCB-52	**3/7**	0.0000008	0.0000014	1.7247597	-0.0000002	0.0000018	0.0000001	0.0000003	0.0000010	0.0000010	**0.0000007**	**0.0000032**	**0.0000001**	**0.0000001**	ln(y) = -15.1012048484984 + 1.96143585743635*Z
PCB-66	**1/7**										**0.0000006**	**0.0000006**	**0.0000001**	**0.0000001**	
PCB-8/5	**5/7**	0.0000061	0.0000070	1.14704979	0.0000009	0.0000112	0.0000007	0.0000026	0.0000092	0.0000084	**0.0000006**	**0.0000142**	**0.0000001**	**0.0000001**	ln(y) = -12.8667142172086 + 1.87782624542036*Z
Pentachloroanisole	**7/7**	**0.00000035**	**0.0000004**	**1.02659669**	**0.0000001**	**0.0000006**	**0.0000001**	**0.0000002**	**0.0000007**	**0.0000006**	**0.0000001**	**0.0000010**			ln(y) = -15.2574824791349 + 1.16722488595516*Z
Pentachlorobenzene	**5/7**	0.0000009	0.0000011	1.22607242	0.0000001	0.0000017	0.0000001	0.0000003	0.0000014	0.0000013	**0.0000000**	**0.0000027**	**0.0000002**	**0.0000002**	ln(y) = -14.9685472489164 + 2.18499162581145*Z
Perylene	**7/7**	**0.0000006**	**0.0000002**	**0.37771994**	**0.0000004**	**0.0000008**	**0.0000005**	**0.0000007**	**0.0000008**	**0.0000003**	**0.0000002**	**0.0000008**			ln(y) = -14.3830888018594 + 0.521678521701333*Z
pH	**15/15**	**8.28**	**0.10457615**	**0.01262997**	**8.22707717**	**8.33292283**	**8.2**	**8.3**	**8.3**	**0.1**	**8.2**	**8.5**			ln(y) = 2.11377363304662 + 1.20252633107844E-02*Z
Phenanthrene	**7/7**	**0.0000298**	**0.0000169**	**0.56658031**	**0.0000173**	**0.0000423**	**0.0000232**	**0.0000299**	**0.0000309**	**0.0000077**	**0.0000111**	**0.00006**			ln(y) = -10.5257976983159 + 0.588929009507952*Z
Pyrene	**7/7**	**0.0000037**	**0.0000048**	**1.30686221**	**0.0000001**	**0.0000073**	**0.0000018**	**0.0000026**	**0.0000029**	**0.0000011**	**0.0000017**	**0.0000118**			ln(y) = -12.7536680543355 + 0.692150212149909*Z
Salinity	**15/15**	**108.4**	**2.01447827**	**0.01858375**	**107.380533**	**109.419467**	**106**	**109**	**110**	**4**	**105**	**111**			ln(y) = 4.68566913464996 + 2.00063083686178E-02*Z
Silver	**4/7**	0.00048428	0.00068319	1.4107152	-0.0000218	0.0009904	0.0000340	**0.00019**	**0.00131**	0.001276	**0.00019**	**0.00156**	**0.000025**	**0.000025**	ln(y) = -8.83083713299172 + 2.16305933243534*Z
Tetrachlorobenzene 1,2,3,4	**6/7**	0.0000065	0.0000059	0.90847925	0.0000021	0.0000108	**-0.0000002**	**0.0000098**	**0.0000115**	**0.0000117**	**0.0000001**	**0.0000119**	**0.0000002**	**0.0000002**	ln(y) = -12.9964731122542 + 2.20580105110513*Z
Total Alkalinity	**8/8**	**164.125**	**94.0715952**	**0.57317042**	**98.9367104**	**229.31329**	**136.5**	**140.5**	**147.5**	**11**	**132**	**332**			ln(y) = 5.04987066857507 + 0.267148577708275*Z
Trans-Nonachlor	**4/7**	0.0000070	0.0000230	3.30408879	-0.0000101	0.0000240	0.0000001	0.0000005	0.0000043	0.0000042	**0.0000011**	**0.0000439**	**0.0000001**	**0.0000001**	ln(y) = -14.584238401238 + 3.29482629990368*Z
Unionized Ammonia	**15/15**	**0.00473333**	**0.00234018**	**0.4944033**	**0.00354904**	**0.00591763**	**0.003**	**0.004**	**0.005**	**0.002**	**0.002**	**0.01**			ln(y) = -5.45055413416678 + 0.497699427953934*Z
Zinc	**7/7**	**0.358**	**0.18840944**	**0.52628335**	**0.21842433**	**0.49757567**	**0.207**	**0.325**	**0.584**	**0.377**	**0.151**	**0.632**			ln(y) = -1.14126815341981 + 0.646965538536792*Z

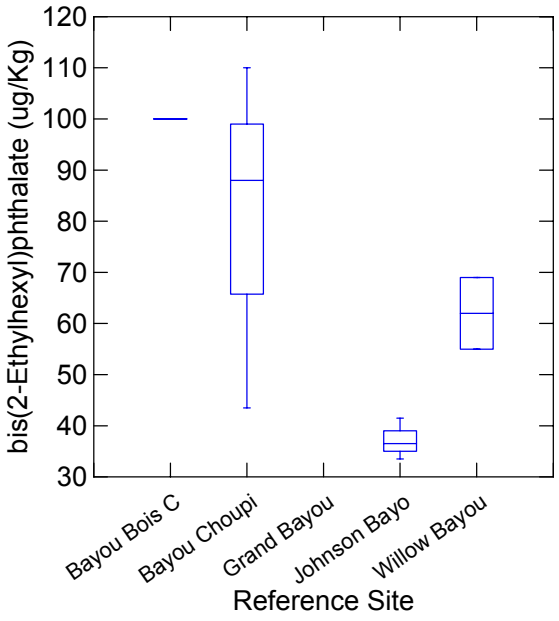
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

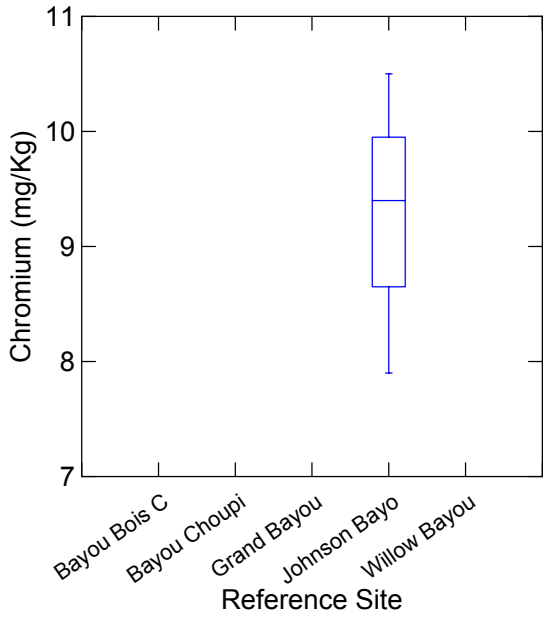
Appendix C-4
Kruskal-Wallis Test Results

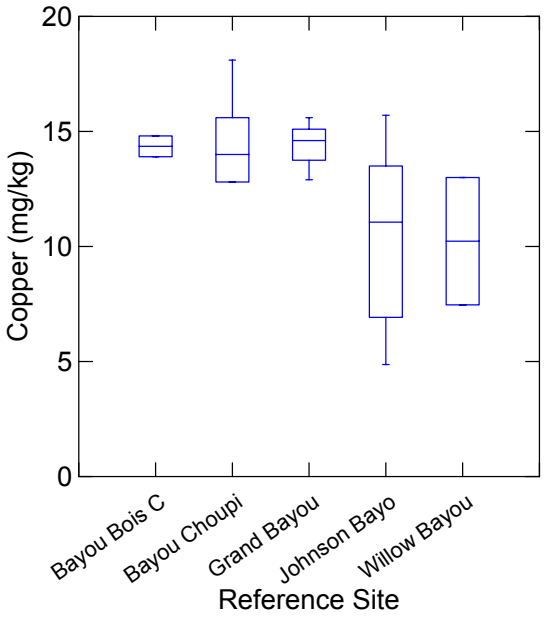


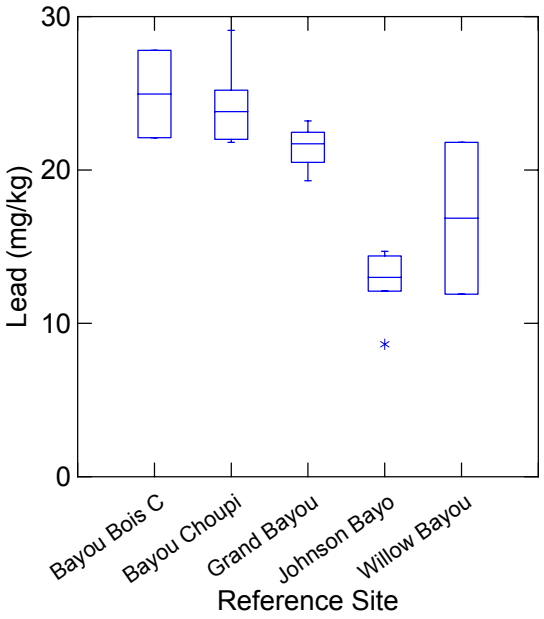


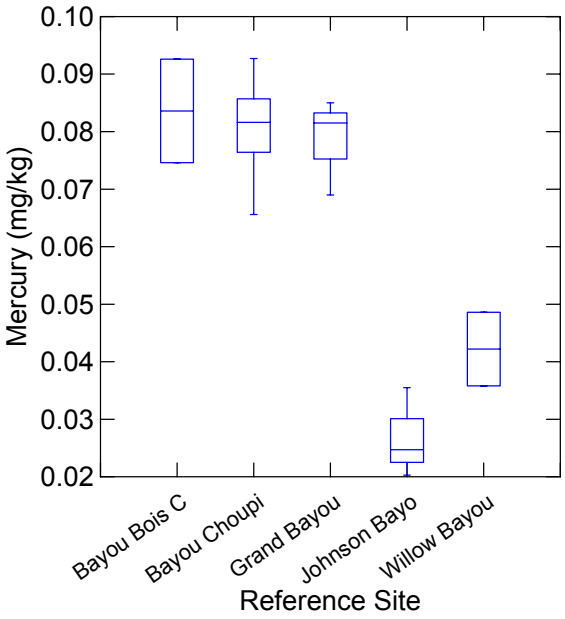


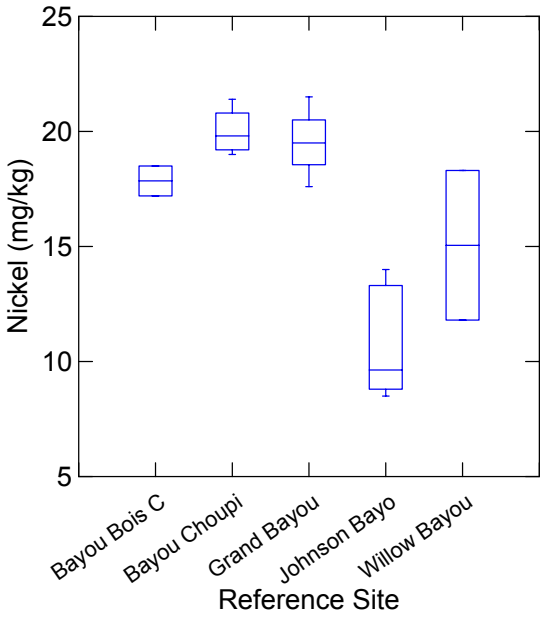


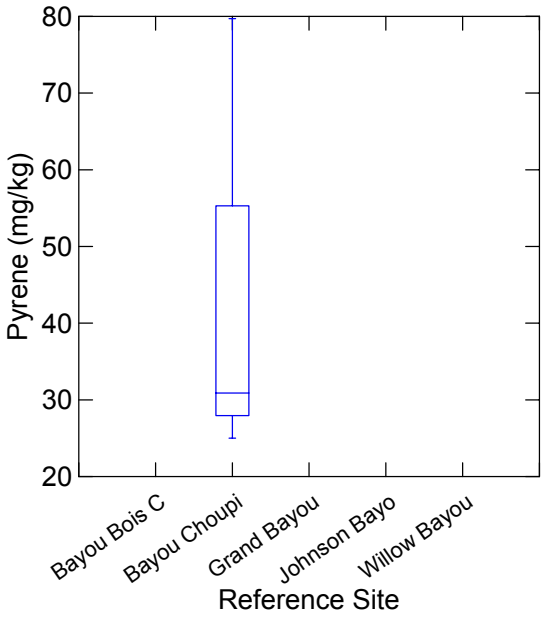

Chromium (mg/Kg)
11
10
9
8
7
Bayou Bois C
Bayou Choupi
Grand Bayou
Johnson Bayo
Willow Bayou
Reference Site

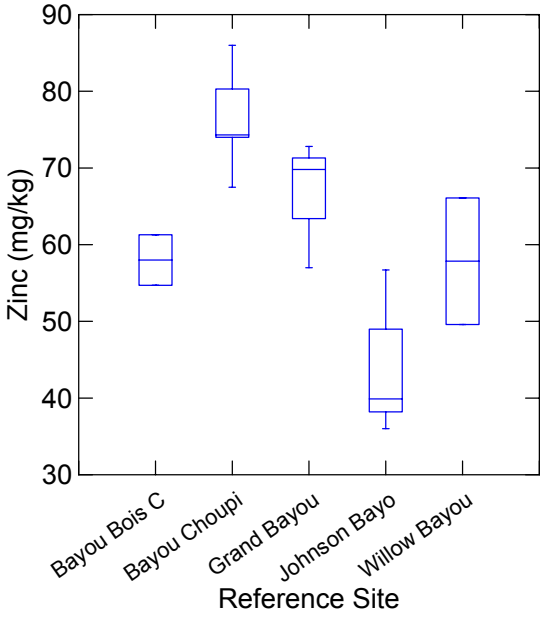

Copper (mg/kg)
20
15
10
5
0
Bayou Bois C
Bayou Choupi
Grand Bayou
Johnson Bayo
Willow Bayou
Reference Site

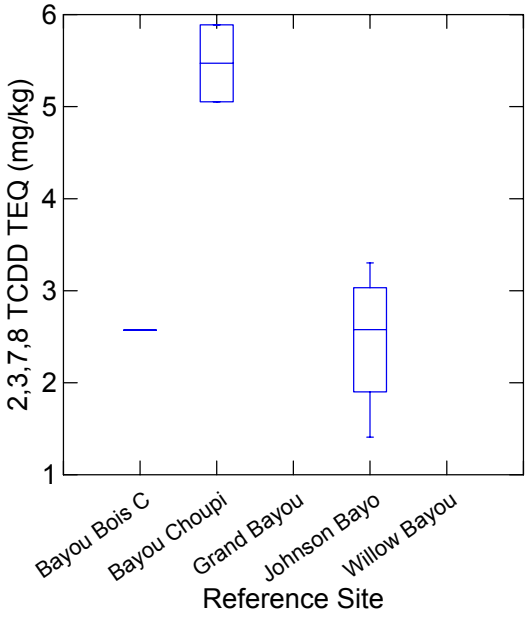

Lead (mg/kg)
30
20
10
0
Bayou Bois C
Bayou Choupi
Grand Bayou
Johnson Bayo
Willow Bayou
Reference Site


Mercury (mg/kg)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
Bayou Bois C
Bayou Choupi
Grand Bayou
Johnson Bayo
Willow Bayou
Reference Site









Categorical values encountered during processing are:
REFERENCESI$ (5 levels)
Bayou Bois C, Bayou Choupi, Grand Bayou, Johnson Bayo, Willow Bayou

Kruskal-Wallis One-Way Analysis of Variance for 18 cases
Dependent variable is AROCL1254
Grouping variable is REFERENCESI$

Group	Count	Rank Sum

Bayou Bois C	2	26.000
Bayou Choupi	5	65.500
Grand Bayou	3	36.000
Johnson Bayo	6	34.500
Willow Bayou	2	9.000

Kruskal-Wallis Test Statistic = 8.541
Probability is 0.074 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 3 cases
Dependent variable is ARSENIC
Grouping variable is REFERENCESI$

Group	Count	Rank Sum

Not enough groups for analysis

Kruskal-Wallis One-Way Analysis of Variance for 3 cases
Dependent variable is BARIUM
Grouping variable is REFERENCESI$

Group	Count	Rank Sum

Not enough groups for analysis

Kruskal-Wallis One-Way Analysis of Variance for 9 cases
Dependent variable is BIS2EHP
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	1	8.000
Bayou Choupi	3	20.000
Johnson Bayo	3	6.000
Willow Bayou	2	11.000

Kruskal-Wallis Test Statistic = 5.978
Probability is 0.113 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 3 cases
Dependent variable is CHROMIUM
Grouping variable is REFERENCESI$

Group	Count	Rank Sum

Not enough groups for analysis

Kruskal-Wallis One-Way Analysis of Variance for 18 cases
Dependent variable is COPPER
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	2	25.000
Bayou Choupi	5	58.500
Grand Bayou	3	36.500
Johnson Bayo	6	39.000
Willow Bayou	2	12.000

Kruskal-Wallis Test Statistic = 4.994
Probability is 0.288 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 18 cases

Appendix C-4
Kruskal-Wallis Test Results

Dependent variable is LEAD
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	2	30.000
Bayou Choupi	5	71.500
Grand Bayou	3	31.000
Johnson Bayo	6	26.000
Willow Bayou	2	12.500

Kruskal-Wallis Test Statistic = 12.612
Probability is 0.013 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 15 cases
Dependent variable is MERCURY
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	2	22.000
Bayou Choupi	5	54.000
Grand Bayou	3	29.000
Johnson Bayo	3	6.000
Willow Bayou	2	9.000

Kruskal-Wallis Test Statistic = 9.902
Probability is 0.042 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 18 cases
Dependent variable is NICKEL
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	2	19.000
Bayou Choupi	5	73.000
Grand Bayou	3	41.000
Johnson Bayo	6	23.000
Willow Bayou	2	15.000

Kruskal-Wallis Test Statistic = 13.432
Probability is 0.009 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 3 cases
Dependent variable is PYRENE
Grouping variable is REFERENCESI$

Group	Count	Rank Sum

Not enough groups for analysis

Kruskal-Wallis One-Way Analysis of Variance for 18 cases
Dependent variable is ZINC
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	2	17.000
Bayou Choupi	5	78.000
Grand Bayou	3	36.000
Johnson Bayo	6	23.000
Willow Bayou	2	17.000

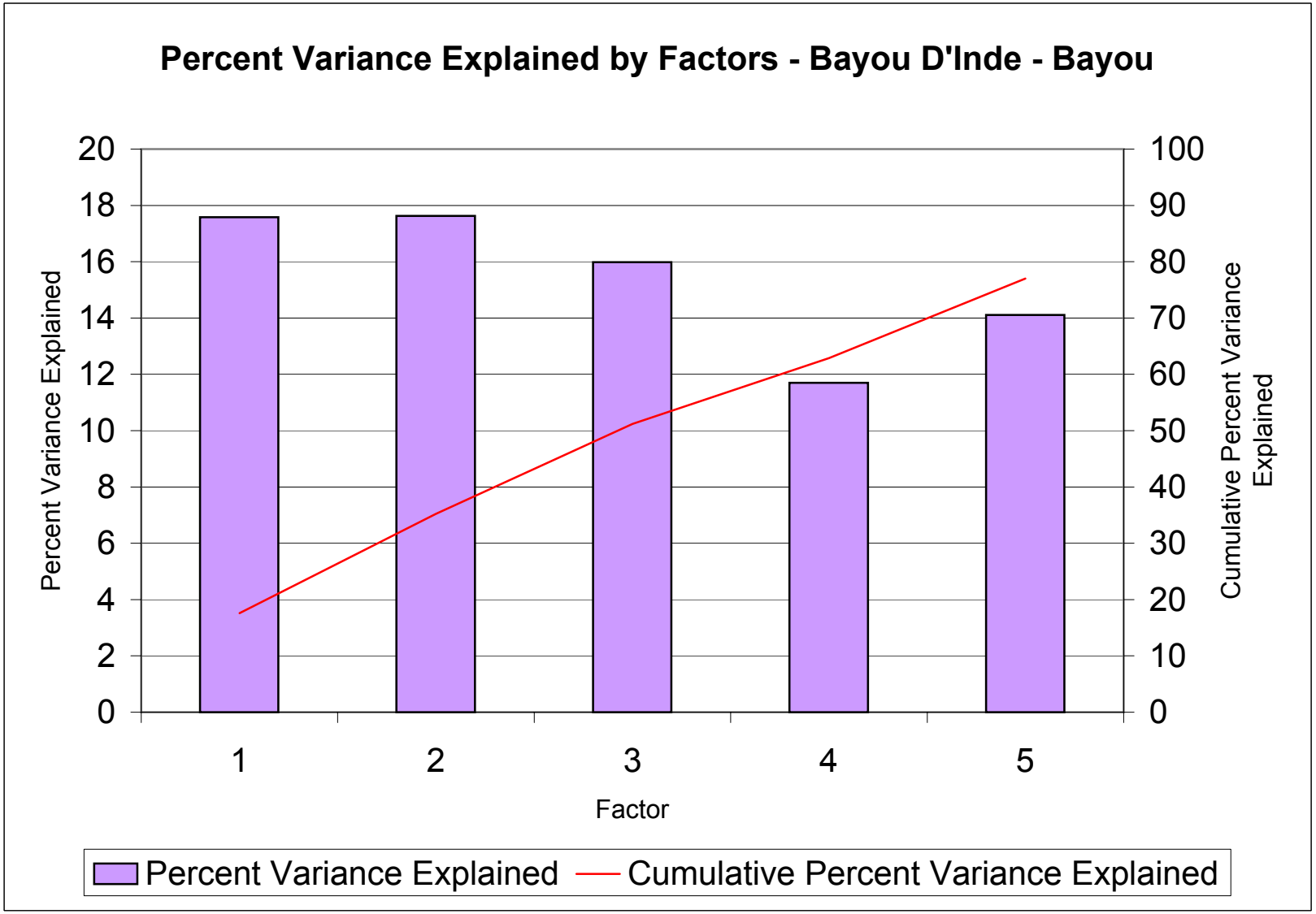
Kruskal-Wallis Test Statistic = 14.087
Probability is 0.007 assuming Chi-square distribution with 4 df

Kruskal-Wallis One-Way Analysis of Variance for 7 cases
Dependent variable is V2378TEQ
Grouping variable is REFERENCESI$

Group	Count	Rank Sum
Bayou Bois C	1	3.000
Bayou Choupi	2	13.000
Johnson Bayo	4	12.000

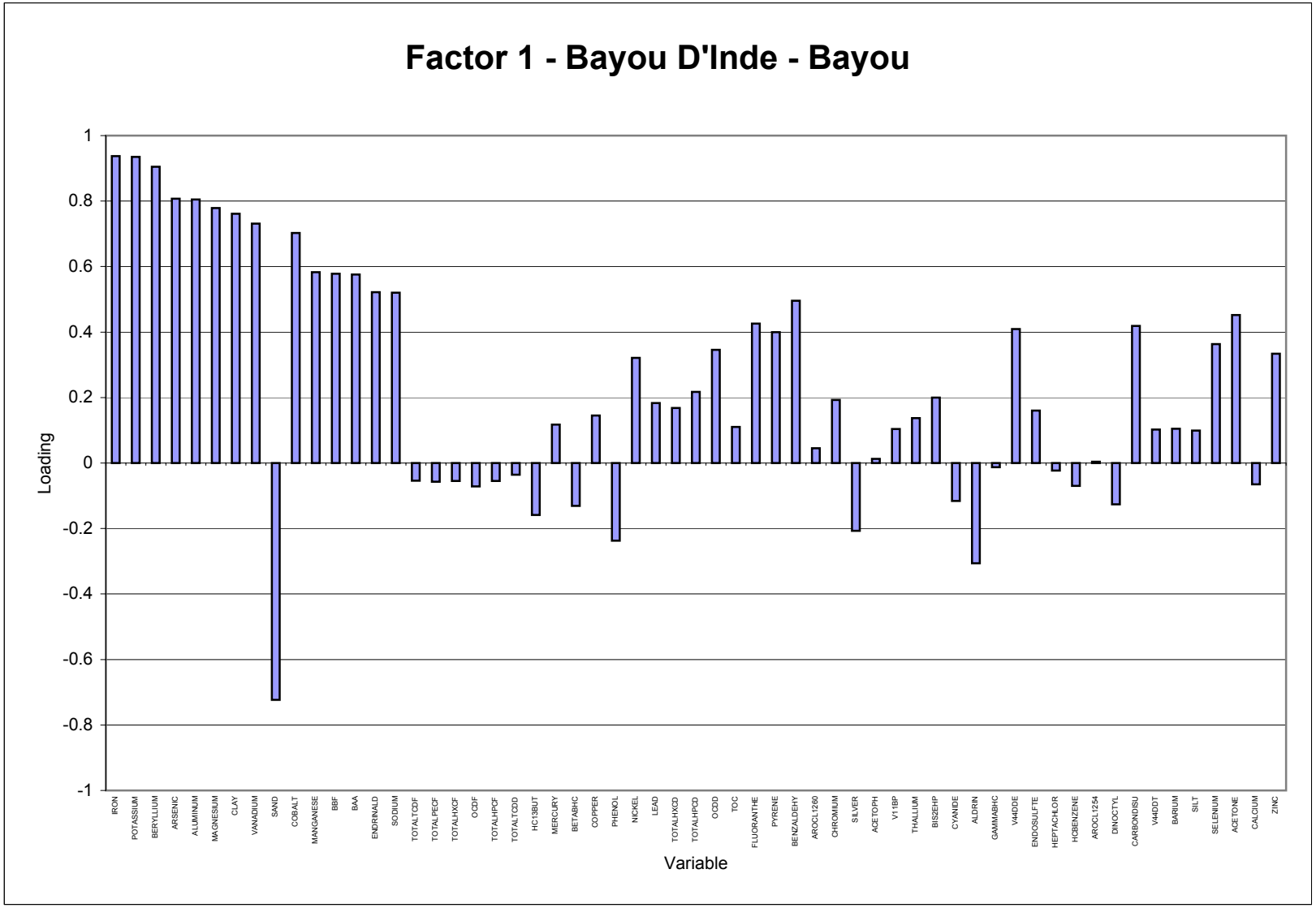
Kruskal-Wallis Test Statistic = 3.750
Probability is 0.153 assuming Chi-square distribution with 2 df

Table D-1
Principal Component Analysis Results



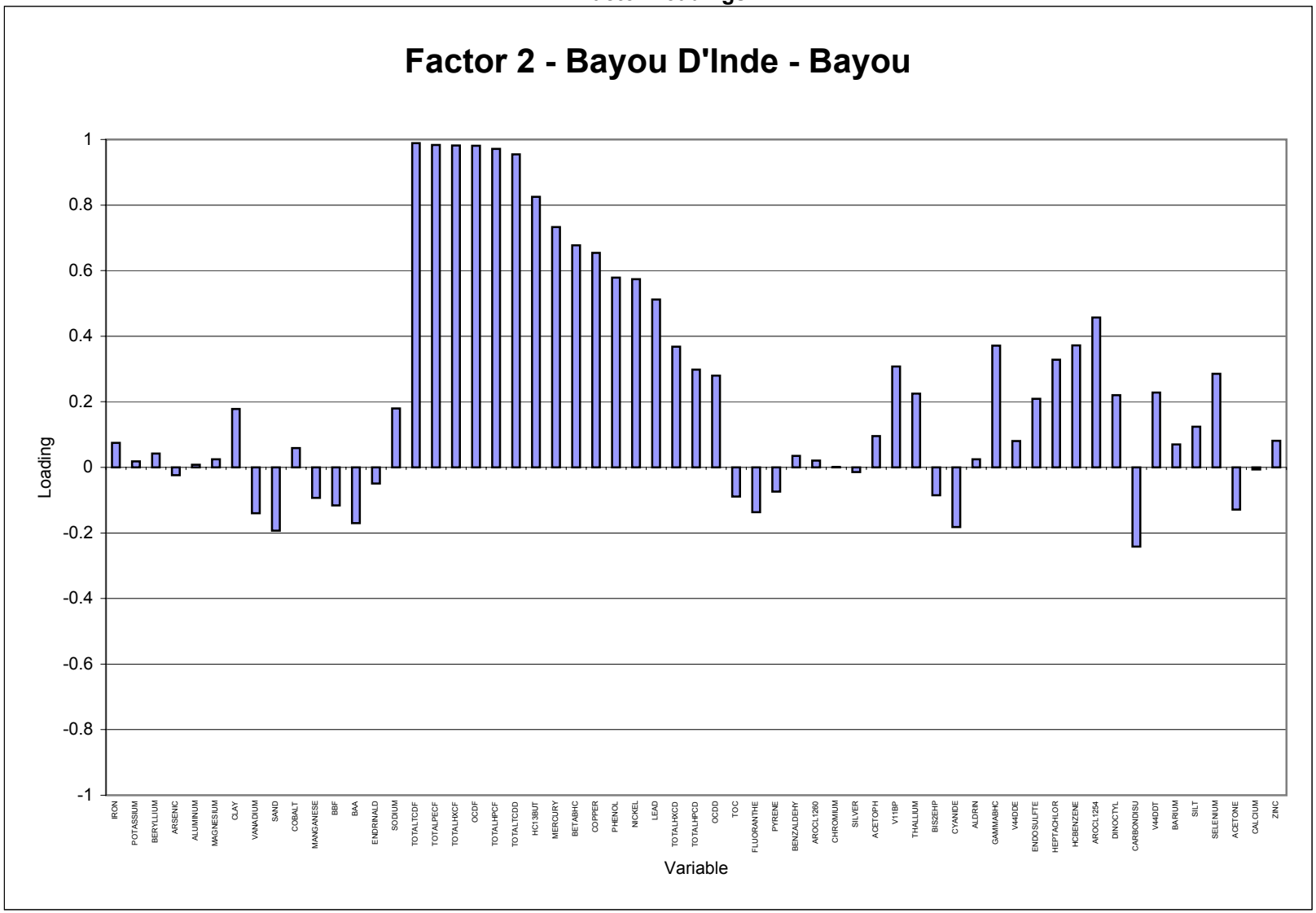
CDM

Table D-2
Bayou D'Inde-Bayou
Factor Loadings



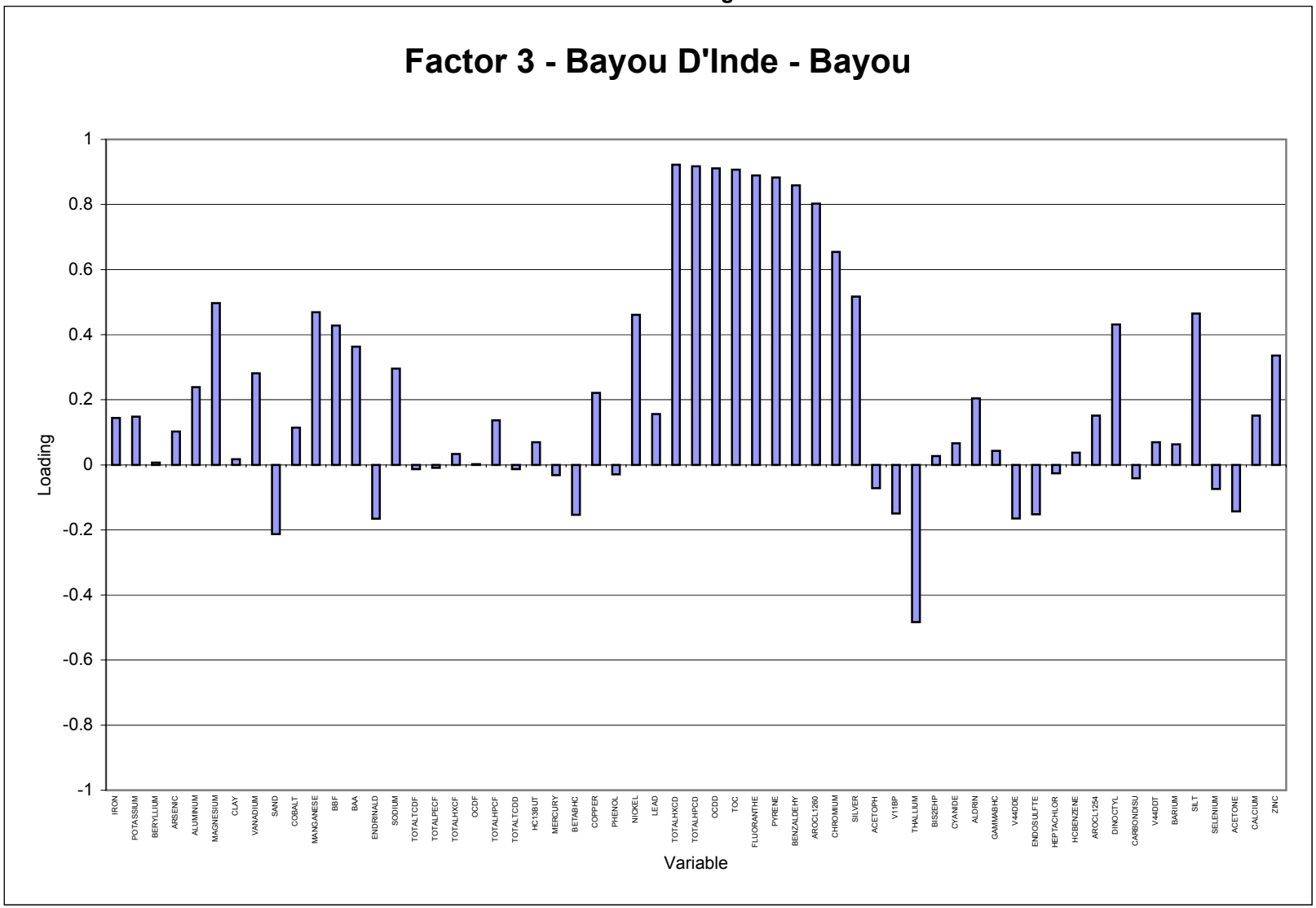
CDM

Table D-2
Bayou D'Inde-Bayou
Factor Loadings



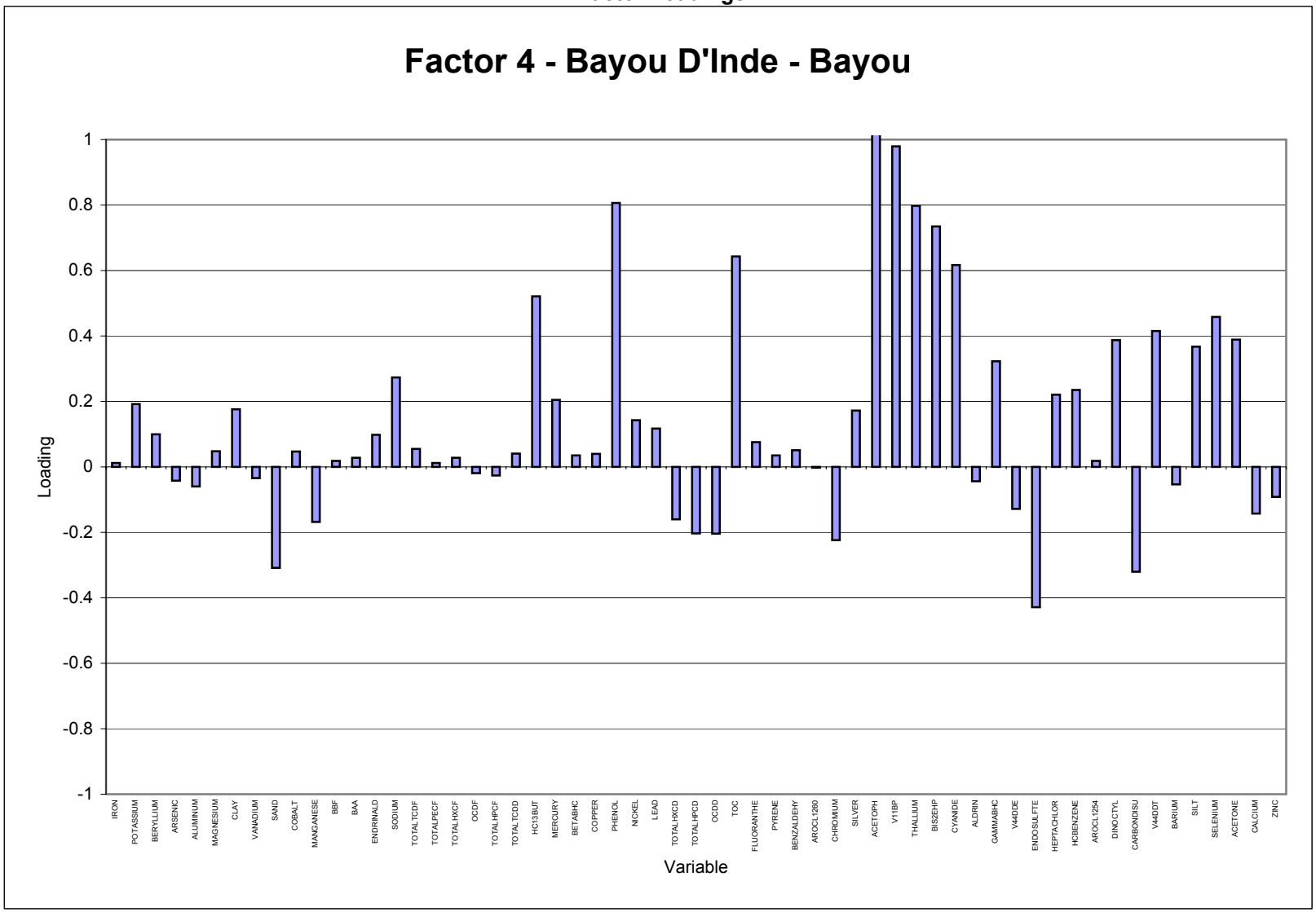
CDM

Table D-2
Bayou D'Inde-Bayou
Factor Loadings



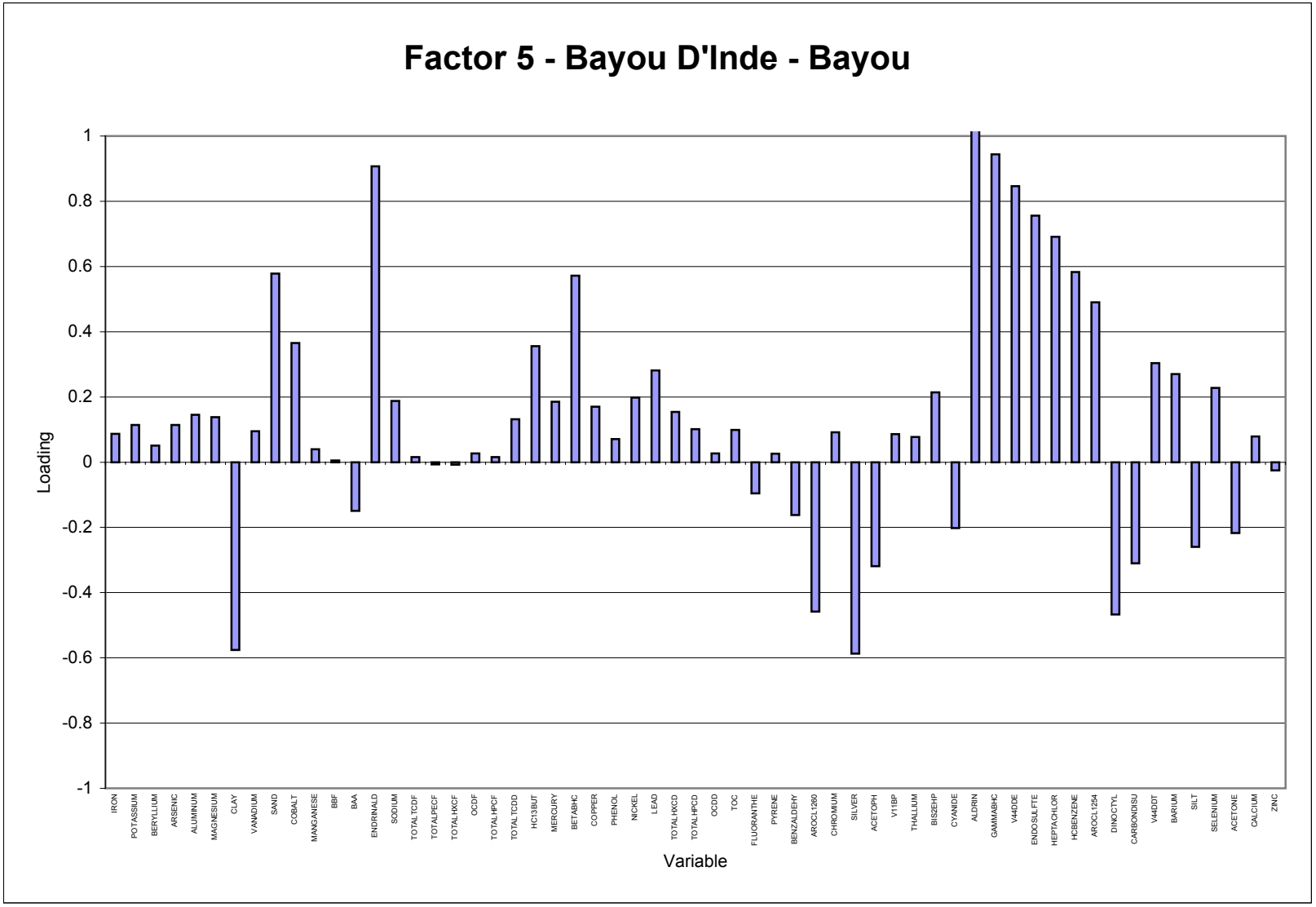
CDM

Table D-2
Bayou D'Inde-Bayou
Factor Loadings



CDM

Table D-2
Bayou D'Inde-Bayou
Factor Loadings



CDM

Table D-3
Bayou d'Inde - Bayou Energy System
Principal Components Analysis Results

Variable	Sum Ranking		Variable	Sum Ranking
NICKEL	0.276		ACETONE	0.081
BETABHC	0.224		ENDOSULFTE	0.080
MAGNESIUM	0.216		OCDD	0.077
COPPER	0.203		FLUORANTHE	0.077
POTASSIUM	0.202		TOTALHXCD	0.077
SODIUM	0.201		TOTALHPCD	0.075
MANGANESE	0.193		BARIUM	0.075
LEAD	0.191		SELENIUM	0.075
VANADIUM	0.189		THALLIUM	0.072
IRON	0.189		PHENOL	0.069
HEPTACHLOR	0.187		HC13BUT	0.069
COBALT	0.184		ENDRINALD	0.067
ALUMINUM	0.183		V44DDE	0.065
MERCURY	0.180		DINOCTYL	0.063
AROCL1260	0.174		SILT	0.061
HCBENZENE	0.162		V44DDT	0.057
ARSENIC	0.161		TOTALHPCF	0.057
BERYLLIUM	0.158		CALCIUM	0.057
CHROMIUM	0.156		BENZALDEHY	0.055
CYANIDE	0.131		TOTALTCDF	0.053
ZINC	0.125		TOTALTCDD	0.053
AROCL1254	0.123		TOTALHXCF	0.052
CARBONDISU	0.122		OCDF	0.052
BIS2EHP	0.121		TOTALPECF	0.051
SAND	0.098		ALDRIN	0.050
PYRENE	0.089		V11BP	0.050
SILVER	0.088		BAA	0.045
CLAY	0.084		BBF	0.043
GAMMABHC	0.084		ACETOPH	0.042
TOC	0.084			

Table D-4
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**1/98**										**0.5**	**0.5**	**0.79**	**0**	
1,1'-Biphenyl ug/Kg	**6/98**										**86**	**620**	**53**	**0**	
1,2,3,4,6,7,8-HpCDD PG/G	**27/27**	**344.08148**	**476.41454**	**1.38459804**	**164.376879**	**523.786084**	**150**	**243**	**330**	**180**	**51.2**	**2200**			ln(y) = 5.48111247787173 + 0.844742111057271*Z
1,2,3,4,6,7,8-HpCDF PG/G	**27/27**	**1903.437**	**6936.5241**	**3.6442099**	**-713.03494**	**4519.90901**	**80**	**190**	**720**	**640**	**14**	**29000**			ln(y) = 5.60231198224178 + 1.82576401081907*Z
1,2,3,4,7,8,9-HpCDF PG/G	**24/27**	416.97783	1721.9749	4.12965587	-232.55487	1066.51053	6.7090449	32.191581	154.4628	147.75376	**4.95**	**7100**	**1.4**	**3.3**	ln(y) = 3.47170494961733 + 2.3261252008744*Z
1,2,3,4,7,8-HxCDD PG/G	**12/27**	7.5393923	18.312633	2.42892697	0.63182717	14.4469575	0.6607193	2.1158919	6.7759456	6.1152262	**2.36**	**73**	**0.901**	**79**	ln(y) = 0.749476404814573 + 1.726373877021186*Z
1,2,3,4,7,8-HxCDF PG/G	**25/27**	521.23968	1786.3771	3.42717009	-152.58563	1195.06499	14.841433	64.45639	279.93431	265.09288	**8.14**	**7500**	**2.1**	**3.3**	ln(y) = 4.16598887870105 + 2.17827018395658*Z
1,2,3,6,7,8-HxCDD PG/G	**23/27**	20.503349	32.134663	1.56728845	8.38208473	32.624614	5.5464629	11.642101	24.436929	18.890466	**3.11**	**140**	**1.04**	**6.1**	ln(y) = 2.45462793350293 + 1.09979156203317*Z
1,2,3,6,7,8-HxCDF PG/G	**21/27**	171.55948	622.54477	3.62874021	-63.265766	406.384721	3.7445641	18.080441	87.300505	83.555941	**4.51**	**2600**	**1.8**	**8.6**	ln(y) = 2.89483073334364 + 2.33543588411124*Z
1,2,3,7,8,9-HxCDD PG/G	**23/27**	11.090936	12.810306	1.15502478	6.25886081	15.9230114	4.6422017	8.086165	14.085141	9.442939	**1.63**	**59**	**1.5**	**63**	ln(y) = 2.09015457934706 + 0.823160414177198*Z
1,2,3,7,8,9-HxCDF PG/G	**13/27**	25.73383	65.90819	2.56114968	0.87311718	50.5945428	0.4289362	2.6304154	16.130801	15.701865	**1.86**	**280**	**0.61**	**4.9**	ln(y) = 0.967141779448366 + 2.69002962282207*Z
1,2,3,7,8-PeCDD PG/G	**9/27**	2.785762	6.5916829	2.36620459	0.29936489	5.27215913	0.4941884	1.2432361	3.1276255	2.6334371	**1.27**	**28**	**0.657**	**67**	ln(y) = 0.217717778358639 + 1.368393901292*Z
1,2,3,7,8-PeCDF PG/G	**20/27**	144.80427	474.90362	3.27962439	-34.330408	323.938953	2.4469449	14.012203	80.239577	77.792632	**2.86**	**2000**	**0.84**	**6.1**	ln(y) = 2.63992856678349 + 2.58842541431178*Z
1,2-Benzphenanthracene ug/Kg	**26/98**	186.81343	229.64884	1.22929513	141.345276	232.281575	82.16502	144.68529	254.77792	172.6129	**57.3**	**1790**	**91**	**4900**	ln(y) = 4.97456096431393 + 0.839276802155053*Z
1,4-Dichlorobenzene ug/Kg	**17/87**										**2**	**32**	**11**	**4900**	
2,2-Dichloropropionic Acid ug/Kg	**1/86**										**120**	**120**	**63**	**4900**	
2,3,4,6,7,8-HxCDF PG/G	**16/27**	48.896941	159.20264	3.25588146	-11.154642	108.948524	1.139883	5.8834999	30.367653	29.22777	**2.4**	**670**	**1.3**	**5.3**	ln(y) = 1.77215181143939 + 2.43437055397722*Z
2,3,4,7,8-PeCDF PG/G	**19/27**	93.217314	308.88561	3.31360773	-23.295011	209.729639	1.9088742	10.193129	54.42993	52.521055	**2.94**	**1300**	**0.73**	**4.5**	ln(y) = 2.32171390850539 + 2.4847630604257*Z
2,3,7,8-TCDD PG/G	**11/27**	2.1095096	6.8898031	3.26606856	-0.4893391	4.70835836	0.129495	0.4361412	1.4689306	1.3394356	**0.57**	**29**	**0.196**	**1.6**	ln(y) = -0.829789341150314 + 1.80116219622211*Z
2,3,7,8-TCDD TEQ (pg/g)	**25/25**	**183.52447**	**567.85163**	**3.0941467**	**-39.07337**	**406.12231**	**8.10775**	**24.6891**	**118.955**	**110.84725**	**1.7779**	**2313.5**			ln(y) = 3.51085043924786 + 1.98376031848608*Z
2,3,7,8-TCDF PG/G	**26/27**	58.833827	138.34876	2.35151725	6.64837407	111.01928	**7.9**	**13**	**77**	**69.1**	**1.1**	**600**	**1.4**	**1.4**	ln(y) = 2.89361719262266 + 1.70191749435335*Z
2,4,5-TP (Silvex) ug/Kg	**1/86**										**42**	**42**	**32**	**1.4**	
2-Butanone ug/Kg	**25/86**	19.615459	30.030147	1.53094282	13.2685208	25.9623982	6.4373912	12.279793	23.4246	16.987208	**5**	**160**	**11**	**90**	ln(y) = 2.5079550498382 + 0.95793842730937*Z
2-Methylnaphthalene ug/Kg	**6/90**										**14.8**	**94**	**78**	**90**	
4,4'-DDD ug/Kg	**15/99**										**1.3**	**100**	**4.1**	**90**	
4,4'-DDE ug/Kg	**26/99**	4.8487823	15.211415	3.13716201	1.85232489	7.84523963	0.852626	1.9912879	4.6506059	3.7979798	**0.63**	**120**	**4.1**	**32**	ln(y) = 0.688781627435607 + 1.25812746927097*Z
4,4'-DDT ug/Kg	**3/98**										**4.3**	**9.8**	**3.7**	**32**	
4-Bromophenyl Phenyl Ether ug/Kg	**1/98**										**100**	**100**	**53**	**32**	
4-Methyl-2-pentanone ug/Kg	**1/86**										**3**	**3**	**11**	**32**	
4-Methylphenol ug/Kg	**2/98**										**430**	**820**	**53**	**32**	
Acenaphthene ug/Kg	**6/89**										**10.8**	**141**	**78**	**32**	
Acenaphthylene ug/Kg	**11/94**										**18.3**	**295**	**78**	**32**	
Acetone ug/Kg	**31/86**	84.20178	150.07757	1.78235624	52.4825506	115.921009	12.686751	34.362524	93.07214	80.385389	**11**	**820**	**15**	**540**	ln(y) = 3.53696655381969 + 1.47793589885673*Z
Acetophenone ug/Kg	**3/98**										**48**	**390**	**53**	**540**	
Aldrin ug/Kg	**20/99**	9.6669335	48.18434	4.98444932	0.17522506	19.1586419	0.6454093	1.9056291	5.6265414	4.9811321	**0.65**	**370**	**1.9**	**32**	ln(y) = 0.64481219396868 + 1.60590356160674*Z
alpha-BHC ug/Kg	**12/98**										**0.54**	**75**	**1.9**	**32**	
alpha-Chlordane ug/Kg	**18/98**										**0.17**	**77**	**2.1**	**32**	
Aluminum (Fume Or Dust) MG/KG	**87/87**	**13398.506**	**5003.054**	**0.37340388**	**12347.1937**	**14449.8178**	**9720**	**13200**	**16100**	**6380**	**4390**	**28100**			ln(y) = 9.4317018732503 + 0.401425495788625*Z
Anthracene ug/Kg	**10/94**										**15.8**	**739**	**78**	**0**	
Aroclor-1254 ug/Kg	**52/99**	80.000386	91.910248	1.14887256	61.8952237	98.1055474	33.474125	57.540909	98.910911	65.436786	**33**	**590**	**13**	**940**	ln(y) = 4.05249615593031 + 0.803518432317907*Z
Aroclor-1260 ug/Kg	**4/98**										**59**	**190**	**13**	**940**	
Arsenic MG/KG	**87/87**	**3.9542529**	**1.318985**	**0.33356111**	**3.67708921**	**4.23141654**	**3.1**	**3.8**	**4.7**	**1.6**	**1.3**	**8.4**			ln(y) = 1.31435526319216 + 0.370630297859747*Z
Barium MG/KG	**87/87**	**326.80575**	**453.66554**	**1.38818102**	**231.475168**	**422.136327**	**180**	**242**	**433**	**253**	**70**	**3580**			ln(y) = 5.52868070254278 + 0.659113509905211*Z
Benzaldehyde ug/Kg	**6/97**										**41**	**290**	**53**	**0**	
Benzene ug/Kg	**1/86**										**6**	**6**	**11**	**0**	

Table D-4
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Benzo(a)anthracene ug/Kg	**21/97**	127.90053	244.03664	1.90801893	79.3353269	176.46574	50.265923	93.442818	173.70735	123.44142	**33.7**	**1950**	**91**	**4900**	ln(y) = 4.53734967888914 + 0.919656309713055*Z
Benzo(a)pyrene ug/Kg	**17/97**										**25**	**1470**	**78**	**4900**	
Benzo(b)fluoranthene ug/Kg	**21/98**	169.29661	254.62718	1.50403002	118.882996	219.710215	75.422347	130.24274	224.90909	149.48674	**54.1**	**1990**	**91**	**4900**	ln(y) = 4.86939993784597 + 0.810301290339698*Z
Benzo(g,h,i)perylene ug/Kg	**15/96**										**17.6**	**670**	**78**	**4900**	
Benzo(k)fluoranthene ug/Kg	**15/96**										**19.9**	**612**	**78**	**4900**	
Beryllium MG/KG	**83/87**	0.796632	0.2357456	0.29592781	0.74709387	0.84617022	0.5987965	0.755089	0.9521756	0.3533791	**0.27**	**1.2**	**0.52**	**1.7**	ln(y) = -0.280919688706482 + 0.343989306500815*Z
beta-BHC ug/Kg	**28/98**	28.00441	69.55114	2.48357811	14.233987	41.7748334	0.3250045	1.9802584	12.065752	11.740747	**5.2**	**300**	**2.1**	**32**	ln(y) = 0.683227320975387 + 2.68046987013983*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**64/98**	1459.9006	10329.287	7.07533581	-585.19388	3504.99502	108.20222	230.31385	490.23461	382.0324	**66**	**80000**	**66**	**6500**	ln(y) = 5.43944295989323 + 1.12051807141145*Z
Cadmium MG/KG	**17/99**										**0.06**	**1.03**	**0.11**	**6500**	
Calcium Metal MG/KG	**87/87**	**4273.3333**	**3869.8659**	**0.90558485**	**3460.1427**	**5086.52396**	**2670**	**3270**	**3970**	**1300**	**1050**	**27900**			ln(y) = 8.17457878454992 + 0.531676677090629*Z
Carbazole ug/Kg	**3/87**										**64**	**693**	**180**	**0**	
Carbon Disulfide ug/Kg	**59/86**	15.771459	21.714231	1.37680547	11.1821079	20.3608105	3.8593306	8.3058032	17.875216	14.015885	**2**	**99**	**11**	**40**	ln(y) = 2.11695445520806 + 1.13686303597968*Z
Chlorobenzene ug/Kg	**16/86**										**3**	**150**	**11**	**40**	
Chloromethane ug/Kg	**2/86**										**4**	**8**	**11**	**40**	
Chromium MG/KG	**87/87**	**46.490805**	**33.869263**	**0.72851532**	**39.3737189**	**53.6078903**	**26.5**	**44**	**60.8**	**34.3**	**7.1**	**231**			ln(y) = 3.64113306035907 + 0.658797375590689*Z
Cobalt MG/KG	**87/87**	**6.0252874**	**1.8963808**	**0.31473699**	**5.62679316**	**6.42378155**	**5**	**6**	**6.8**	**1.8**	**2.6**	**16.1**			ln(y) = 1.75346848544821 + 0.296934760505415*Z
Copper MG/KG	**98/99**	60.165686	46.618173	0.77482992	50.9824923	69.348879	**26**	**49.2**	**80.3**	**54.3**	**8.27**	**280**	**18.5**	**18.5**	ln(y) = 3.83381508332702 + 0.764703579705116*Z
Cyanide MG/KG	**20/86**	0.1350059	0.1761894	1.30504904	0.09776791	0.17224394	0.0477347	0.0900627	0.1699241	0.1221893	**0.15**	**1.2**	**0.07**	**3.1**	ln(y) = -2.4072496978164 + 0.941643816046425*Z
Cyclohexane ug/Kg	**2/86**										**3**	**4**	**11**	**3.1**	
delta-BHC ug/Kg	**15/98**										**1.2**	**83**	**1.9**	**3.1**	
Dibenzo(a,h)anthracene ug/Kg	**10/95**										**15.4**	**288**	**78**	**3.1**	
Dibenzofuran ug/Kg	**2/98**										**80.3**	**92.8**	**53**	**3.1**	
Dichloromethane ug/Kg	**10/86**										**1**	**36**	**3**	**3.1**	
Dichlorprop ug/Kg	**4/86**										**81**	**640**	**130**	**3.1**	
Dieldrin ug/Kg	**13/98**										**1**	**33**	**4.1**	**3.1**	
Dimethyl Phthalate ug/Kg	**1/98**										**77**	**77**	**53**	**3.1**	
Di-n-butylphthalate ug/Kg	**4/98**										**73**	**130**	**53**	**3.1**	
Di-n-octylphthalate ug/Kg	**3/98**										**250**	**470**	**53**	**3.1**	
Endosulfan I ug/Kg	**4/98**										**0.23**	**83**	**2.1**	**3.1**	
Endosulfan II ug/Kg	**9/98**										**1.1**	**170**	**3.7**	**3.1**	
Endosulfan Sulfate ug/Kg	**32/99**	6.1933965	15.65884	2.52831217	3.10880218	9.27799082	1.4354501	3.0507505	6.4837355	5.0482855	**0.93**	**110**	**3.7**	**32**	ln(y) = 1.11538762086939 + 1.11824582964089*Z
Endrin Aldehyde ug/Kg	**25/99**	5.3219565	11.920381	2.23984937	2.97379151	7.67012149	1.3268934	2.8085686	5.9447562	4.6178628	**0.86**	**77**	**4.1**	**32**	ln(y) = 1.03267497585766 + 1.11220205107408*Z
Endrin Ketone ug/Kg	**4/98**										**1.1**	**24**	**4.1**	**32**	
Endrin ug/Kg	**14/98**										**1**	**60**	**3.7**	**32**	
Ethylbenzene ug/Kg	**2/86**										**5**	**7**	**11**	**32**	
Fluoranthene ug/Kg	**28/98**	236.18947	453.03972	1.91811992	146.492178	325.886753	87.650336	158.66269	287.20769	199.55735	**76**	**3560**	**91**	**4900**	ln(y) = 5.06678052269085 + 0.880205625502482*Z
Fluorene ug/Kg	**7/91**										**10.3**	**285**	**78**	**4900**	
gamma-BHC (Lindane) ug/Kg	**9/98**										**1.9**	**23**	**1.9**	**4900**	
gamma-Chlordane ug/Kg	**19/99**										**0.4**	**200**	**1.9**	**4900**	
Heptachlor Epoxide ug/Kg	**3/98**										**1.3**	**19**	**2.1**	**4900**	
Heptachlor ug/Kg	**5/98**										**50**	**240**	**1.9**	**4900**	
Hexachloro-1,3-butadiene ug/Kg	**8/98**										**100**	**1600**	**39**	**4900**	
Hexachlorobenzene ug/Kg	**11/98**										**630**	**24000**	**39**	**4900**	
Indeno(1,2,3-cd)pyrene ug/Kg	**14/95**										**34.9**	**667**	**78**	**4900**	
HPAH ug/Kg	**41/41**	**1324.9829**	**2991.8186**	**2.25800543**	**409.185523**	**2240.78033**	**140**	**571.9**	**953.7**	**813.7**	**85**	**15547**			ln(y) = 6.20820978873376 + 1.37063235896165*Z
Iron MG/KG	**87/87**	**13469.425**	**4310.5248**	**0.32002292**	**12563.6372**	**14375.2134**	**10500**	**13500**	**16100**	**5600**	**4240**	**25200**			ln(y) = 9.45068000814332 + 0.361986905813497*Z
Isopropylbenzene ug/Kg	**6/86**										**1**	**9**	**11**	**0**	
Lead MG/KG	**94/99**	38.133146	25.448887	0.6673692	33.1200356	43.1462564	23.917059	33.496558	46.912932	22.995872	**7.45**	**218**	**17.4**	**44.3**	ln(y) = 3.51144267668956 + 0.499638255687164*Z

Table D-4
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
LPAH ug/Kg	**24/24**	**427.6875**	**901.32838**	**2.10744616**	**67.0810458**	**788.293954**	**90.775**	**140**	**557.3**	**466.525**	**25**	**3737.8**			ln(y) = 5.29220703074901 + 1.2591865530779*Z
Magnesium MG/KG	**87/87**	**3925.7471**	**1327.5142**	**0.33815581**	**3646.79119**	**4204.70307**	**3400**	**3880**	**4530**	**1130**	**1520**	**11100**			ln(y) = 8.22324873273867 + 0.330936860214977*Z
Manganese MG/KG	**87/87**	**210.8092**	**127.15366**	**0.60316942**	**184.089881**	**237.52851**	**134**	**185**	**264**	**130**	**59.4**	**1020**			ln(y) = 5.23587469045999 + 0.481676212433298*Z
M-Dichlorobenzene ug/Kg	**18/87**	9.0558427	7.2515995	0.80076474	7.53203472	10.5796508	4.4092205	7.4057838	12.43885	8.0296297	**3**	**48**	**11**	**970**	ln(y) = 2.00226128698221 + 0.769166004537692*Z
Mercury MG/KG	**73/99**	0.6479557	0.7598586	1.17270148	0.49827315	0.79763832	0.1258605	0.3106417	0.7667082	0.6408478	**0.0698**	**3**	**0.08**	**0.22**	ln(y) = -1.16911516289436 + 1.34007829367218*Z
Methyl Acetate ug/Kg	**8/86**										**4**	**21**	**5**	**0.22**	
Methyl Mercury MG/KG	**8/13**	0.0016896	0.0018883	1.11763228	0.00066307	0.00271609	0.0004576	0.0010244	0.0022931	0.0018355	**0.00068**	**0.00602**	**0.00065**	**0.00094**	ln(y) = -6.88366525286049 + 1.19522023949624*Z
Methylbenzene ug/Kg	**7/86**										**1**	**7**	**11**	**0.00094**	
Naphthalene ug/Kg	**4/89**										**21.3**	**146**	**78**	**0.00094**	
Nickel MG/KG	**99/99**	**19.452828**	**9.3942688**	**0.4829256**	**17.6022756**	**21.303381**	**13.5**	**17.5**	**23.5**	**10**	**4.64**	**53.8**			ln(y) = 2.86014721509878 + 0.485936636677623*Z
OCDD PG/G	**27/27**	**5406.4074**	**4732.3491**	**0.87532232**	**3621.35504**	**7191.45978**	**2850**	**4400**	**7300**	**4450**	**593**	**23000**			ln(y) = 8.33038100277033 + 0.824313666352447*Z
OCDF PG/G	**27/27**	**17546.519**	**69754.949**	**3.9754296**	**-8765.2**	**43858.2371**	**270**	**610**	**5270**	**5000**	**39**	**290000**			ln(y) = 7.00224601340048 + 2.24552727760139*Z
PCB-105 NG/KG	**10/10**	**7253**	**6619.4217**	**0.91264603**	**3150.23994**	**11355.7601**	**2425**	**5365**	**11950**	**9525**	**1100**	**21000**			ln(y) = 8.50734307655777 + 1.16626148610456*Z
PCB-108 NG/KG	**10/10**	**2290.6**	**1886.4339**	**0.82355449**	**1121.37615**	**3459.82385**	**685.25**	**1900**	**3292.5**	**2607.25**	**439**	**6150**			ln(y) = 7.41543364777753 + 1.0656465525259*Z
PCB-114 NG/KG	**10/10**	**502.48**	**383.41155**	**0.76303843**	**264.839058**	**740.120942**	**188.75**	**524**	**678.75**	**490**	**36.8**	**1290**			ln(y) = 5.86323791143526 + 1.18722344253209*Z
PCB-118 NG/KG	**10/10**	**25240**	**21393.835**	**0.84761627**	**11979.9639**	**38500.0361**	**8242.5**	**19900**	**42025**	**33782.5**	**3910**	**68400**			ln(y) = 9.78753609891365 + 1.12171225393604*Z
PCB-126 NG/KG	**10/10**	**271.23**	**196.19625**	**0.72335747**	**149.626307**	**392.833693**	**71.925**	**248.5**	**421**	**349.075**	**48.4**	**642**			ln(y) = 5.30920967559313 + 1.02628584069222*Z
PCB-127 NG/KG	**6/10**	18.401148	14.80884	0.80477803	9.22253436	27.5797624	7.0479704	13.548015	26.042776	18.994806	**13.7**	**46**	**4.92**	**4.98**	ln(y) = 2.60624005407223 + 0.96931310038204*Z
PCB-15 NG/KG	**10/10**	**8514.2**	**13143.828**	**1.54375374**	**367.570968**	**16660.829**	**423.25**	**3220**	**15675**	**15251.75**	**327**	**37700**			ln(y) = 7.99781981104021 + 1.99322081680395*Z
PCB-156 ng/kg	**10/10**	**3321.9**	**2458.2298**	**0.74000716**	**1798.2734**	**4845.5266**	**1059.25**	**2800**	**4730**	**3670.75**	**622**	**7650**			ln(y) = 7.81392321759787 + 1.02117211653613*Z
PCB-157 NG/KG	**10/10**	**1016.1**	**908.6948**	**0.89429662**	**452.88513**	**1579.31487**	**317**	**775**	**1465**	**1148**	**176**	**2840**			ln(y) = 6.56881912137397 + 1.10820625096121*Z
PCB-162 NG/KG	**10/10**	**7152.4**	**7017.5375**	**0.98114444**	**2802.88519**	**11501.9148**	**2432.5**	**4600**	**12600**	**10167.5**	**874**	**21100**			ln(y) = 8.42849052782661 + 1.24655454485314*Z
PCB-167 NG/KG	**10/10**	**2137.1**	**1571.9507**	**0.73555319**	**1162.79484**	**3111.40516**	**674.5**	**1955**	**3407.5**	**2733**	**323**	**5010**			ln(y) = 7.36597533275216 + 1.0559496884722*Z
PCB-169 NG/KG	**8/10**	59.411511	100.09044	1.68469784	-2.6251891	121.44821	8.4239249	25.160837	75.151161	66.727236	**9.93**	**284**	**4.92**	**4.97**	ln(y) = 3.22528871722655 + 1.62300575113502*Z
PCB-189 NG/KG	**10/10**	**670.69**	**851.39324**	**1.26942886**	**142.991001**	**1198.389**	**234**	**393.5**	**879.25**	**645.25**	**59.9**	**2580**			ln(y) = 6.01711100428583 + 1.26961925773014*Z
PCB-37 ng/kg	**10/10**	**1160.3**	**1348.481**	**1.16218304**	**324.502829**	**1996.09717**	**150**	**679**	**1967.5**	**1817.5**	**108**	**3830**			ln(y) = 6.42540417947983 + 1.49121778591658*Z
PCB-58 NG/KG	**10/10**	**380.95**	**364.90864**	**0.95789116**	**154.777284**	**607.122716**	**41.775**	**268.5**	**836**	**794.225**	**23.2**	**880**			ln(y) = 5.2549314732504 + 1.65706887210064*Z
PCB-60 NG/KG	**10/10**	**1750.8**	**1259.414**	**0.71933631**	**970.207109**	**2531.39289**	**650.75**	**1375**	**3062.5**	**2411.75**	**278**	**3590**			ln(y) = 7.16444153456212 + 1.04092623209673*Z
PCB-61/70 NG/KG	**10/10**	**12233**	**9251.5439**	**0.75627761**	**6498.83366**	**17967.1663**	**3402.5**	**10050**	**20650**	**17247.5**	**1860**	**29000**			ln(y) = 9.09298834518429 + 1.07973015751381*Z
PCB-66 NG/KG	**10/10**	**8543**	**5972.4747**	**0.69910742**	**4841.22184**	**12244.7782**	**3487.5**	**7105**	**14450**	**10962.5**	**1450**	**18000**			ln(y) = 8.76900860913575 + 1.00869390112528*Z
PCB-77 NG/KG	**10/10**	**1073.7**	**787.31221**	**0.7332702**	**585.718836**	**1561.68116**	**284**	**1060**	**1485**	**1201**	**186**	**2380**			ln(y) = 6.68002214189642 + 1.02309253385018*Z
PCB-79 NG/KG	**10/10**	**382.94**	**272.26652**	**0.71099002**	**214.187463**	**551.692537**	**111**	**376**	**543.25**	**432.25**	**55.4**	**882**			ln(y) = 5.65184205612801 + 1.04664408869324*Z
PCB-80 ng/kg	**4/10**	40.959545	64.298278	1.56979961	1.10705953	80.8120307	3.4690861	12.926312	48.165294	44.696208	**29.9**	**158**	**4.86**	**5**	ln(y) = 2.55926495035406 + 1.95104561479489*Z
PCB-81 NG/KG	**10/10**	**410.86**	**346.45645**	**0.84324696**	**196.124071**	**625.595929**	**128**	**354.5**	**594.5**	**466.5**	**46.6**	**1050**			ln(y) = 5.66031858227217 + 1.14465248530647*Z
Phenanthrene ug/Kg	**18/98**										**20.6**	**2500**	**78**	**0**	
Phenol ug/Kg	**9/98**										**49**	**400**	**53**	**0**	
Potassium MG/KG	**87/87**	**2182.9885**	**687.52041**	**0.31494459**	**2038.51705**	**2327.45996**	**1870**	**2160**	**2570**	**700**	**886**	**4150**			ln(y) = 7.63466167750196 + 0.34623938889734*Z
Pyrene ug/Kg	**38/98**	247.50645	346.38167	1.39948543	178.926376	316.086518	108.74807	182.29555	305.58399	196.83592	**85**	**2550**	**180**	**4900**	ln(y) = 5.20562929329822 + 0.766246941689707*Z
Selenium MG/KG	**11/87**										**0.3**	**2.2**	**0.07**	**4900**	
Silver MG/KG	**39/99**	0.5507371	0.5263188	0.95566258	0.44705892	0.65441529	0.1642662	0.3409222	0.7075586	0.5432924	**0.03**	**1.9**	**0.38**	**1.9**	ln(y) = -1.07610089877253 + 1.08302860906724*Z
Sodium MG/KG	**87/87**	**9388.9655**	**3903.2943**	**0.41573209**	**8568.75045**	**10209.1806**	**6310**	**9240**	**11900**	**5590**	**3380**	**21100**			ln(y) = 9.06129902169659 + 0.439185042388754*Z
Styrene (monomer) ug/Kg	**2/86**										**3**	**29**	**11**	**0**	
Thallium MG/KG	**3/87**										**0.05**	**0.31**	**0.05**	**0**	
Total HpCDD PG/G	**27/27**	**820.31111**	**1001.0716**	**1.22035597**	**442.70474**	**1197.91748**	**351**	**622**	**859**	**508**	**92.4**	**4700**			ln(y) = 6.37006191324488 + 0.868307795808278*Z
Total HpCDF PG/G	**27/27**	**3637.1519**	**12892.204**	**3.54458775**	**-1225.8155**	**8500.11922**	**190**	**420**	**1500**	**1310**	**46**	**54000**			ln(y) = 6.38396244164289 + 1.74799336333555*Z
Total HxCDD PG/G	**27/27**	**199.17407**	**259.14015**	**1.30107368**	**101.425847**	**296.922301**	**82**	**130**	**210**	**128**	**25.5**	**1200**			ln(y) = 4.91277455191632 + 0.914680036697895*Z
Total HxCDF PG/G	**27/27**	**2353.8593**	**8638.8567**	**3.67008208**	**-904.73628**	**5612.4548**	**82**	**200**	**1240**	**1158**	**21**	**36000**			ln(y) = 5.81543785550794 + 1.95004150010696*Z
Total Organic Carbon MG/KG	**31/31**	**49082.514**	**58020.457**	**1.18210033**	**28657.7824**	**69507.2465**	**20350**	**36050**	**64350**	**44000**	**5510**	**287500**			ln(y) = 10.4584644112034 + 0.869018656230776*Z
Total PeCDD PG/G	**15/27**	14.080163	27.292383	1.93835698	3.78541709	24.3749093	2.1636711	5.7656348	15.363955	13.200283	**1.31**	**120**	**1.9**	**93**	ln(y) = 1.75191526352556 + 1.45375953033996*Z

Table D-4
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total PeCDF PG/G	**26/27**	1575.6818	6018.7126	3.81975142	-694.58974	3845.95326	**41.9**	**94**	**760**	**718.1**	**12**	**25000**	**4.6**	**4.6**	ln(y) = 5.11023813798479 + 2.19349758364651*Z
Total TCDD PG/G	**25/27**	17.61206	27.730502	1.5745178	7.15205432	28.0720655	4.1976372	9.4457764	21.255456	17.057819	**1.29**	**120**	**0.394**	**2.8**	ln(y) = 2.24556770180796 + 1.20299463201279*Z
Total TCDF PG/G	**27/27**	**806.26296**	**2609.173**	**3.23613155**	**-177.92278**	**1790.4487**	**58**	**110**	**554**	**496**	**12**	**11000**			ln(y) = 5.09999154108205 + 1.7788177665752*Z
TPAH ug/Kg	**42/42**	**1537.8286**	**3649.5535**	**2.3731862**	**434.077432**	**2641.57971**	**135**	**672.65**	**1190.375**	**1055.375**	**85**	**19284.8**			ln(y) = 6.30046902834905 + 1.43197012490911*Z
Vanadium (Fume Or Dust) MG/KG	**87/87**	**24.129885**	**9.1202775**	**0.37796606**	**22.2134041**	**26.046366**	**19.3**	**22.7**	**27.8**	**8.5**	**9.3**	**59.2**			ln(y) = 3.11870539175705 + 0.373227188041057*Z
Xylenes (total) ug/Kg	**4/86**										**3**	**20**	**11**	**0**	
Zinc MG/KG	**87/99**	172.27909	107.78352	0.62563322	151.047095	193.51109	97.992499	146.00727	217.5485	119.55601	**25.7**	**700**	**63.4**	**342**	ln(y) = 4.98365638611163 + 0.591474150027365*Z
Acid Volatile Sulfide umol/g	**13/13**	**16.179615**	**15.14783**	**0.93622929**	**7.94516133**	**24.4140694**	**5.64**	**13.4**	**20.95**	**15.31**	**0.19**	**52.7**			ln(y) = 2.27048799823218 + 1.42918073259386*Z
Cation Exchange Capacity meq/100g	**18/18**	**30.025**	**9.3814204**	**0.31245364**	**25.6910049**	**34.3589951**	**21.55**	**31.275**	**38.425**	**16.875**	**14.2**	**41.4**			ln(y) = 3.34683823298779 + 0.384946610924169*Z
Diesel Range Organics ug/Kg	**18/18**	**297222.22**	**387331.41**	**1.30317111**	**118284.239**	**476160.206**	**86750**	**167500**	**340000**	**253250**	**34000**	**1300000**			ln(y) = 12.0822457661835 + 1.1026832483607*Z
Field Photoionization Detector ppm	**20/20**	**5.01**	**7.4848997**	**1.49399196**	**1.72959806**	**8.29040194**	**0.825**	**2.1**	**5.85**	**5.025**	**0.3**	**26.6**			ln(y) = 0.773708481399052 + 1.5082180513402*Z
pH standard units	**18/18**	**7.6777778**	**0.3339322**	**0.04349334**	**7.52350899**	**7.83204657**	**7.4875**	**7.65**	**7.825**	**0.3375**	**6.9**	**8.2**			ln(y) = 2.03746792357969 + 4.64593695673632E-02*Z
Percent Clay %	**31/31**	**35.696129**	**16.966016**	**0.47529008**	**29.7236437**	**41.6686144**	**23.3**	**33.9**	**47**	**23.7**	**1.74**	**66.2**			ln(y) = 3.39956007184107 + 0.703432343126366*Z
Percent Sand %	**31/31**	**29.8**	**20.884562**	**0.70082423**	**22.448083**	**37.151917**	**13.1**	**29**	**41.94**	**28.84**	**1.7**	**74.88**			ln(y) = 3.04406758798327 + 1.03095505888058*Z
Percent Silt %	**31/31**	**34.750968**	**9.3679733**	**0.26957446**	**31.4531939**	**38.0487416**	**26.67**	**35**	**42.2**	**15.53**	**16.2**	**53**			ln(y) = 3.51003081309006 + 0.309341667939402*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-5
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Acetone ug/L	**2/13**										**9**	**13**	**10**	**0**	
Aluminum (Fume Or Dust) mg/L Dissolved	**10/13**	0.0751186	0.0570278	0.7591698	0.04411794	0.10611923	0.0374421	0.0613731	0.1005995	0.0631574	**0.0474**	**0.216**	**0.0305**	**0.0496**	ln(y) = -2.79078381211303 + 0.732993168873268*Z
Aluminum (Fume Or Dust) mg/L Total	**13/13**	**0.4403846**	**0.2551282**	**0.57933041**	**0.30169535**	**0.57907389**	**0.2865**	**0.411**	**0.5465**	**0.26**	**0.1**	**0.92**			ln(y) = -0.997667329017335 + 0.745947910281283*Z
Ammonia as N mg/L	**4/4**	**1.875**	**0.6564169**	**0.35008902**	**1.23171143**	**2.51828857**	**1.25**	**1.95**	**2.425**	**1.175**	**1.1**	**2.5**			ln(y) = 0.58267163077623 + 0.489643150810089*Z
Arsenic mg/L Dissolved	**4/13**	0.0022957	0.0008861	0.38597941	0.00181399	0.00277735	0.0016794	0.0021668	0.0027955	0.0011161	**0.0029**	**0.004**	**0.0017**	**0.002**	ln(y) = -6.13452297483774 + 0.377911733755006*Z
Arsenic mg/L Total	**5/13**	0.0021967	0.0020624	0.93886273	0.00107556	0.0033178	0.0010702	0.0017681	0.002921	0.0018509	**0.0029**	**0.0066**	**0.0017**	**0.002**	ln(y) = -6.33787288565758 + 0.744679115703029*Z
Barium mg/L Dissolved	**13/13**	**0.1378462**	**0.0435112**	**0.31565037**	**0.1141932**	**0.16149911**	**0.1065**	**0.141**	**0.178**	**0.0715**	**0.054**	**0.193**			ln(y) = -2.03808728279818 + 0.408101335310057*Z
Barium mg/L Total	**13/13**	**0.1399154**	**0.0449187**	**0.32104216**	**0.11549728**	**0.16433349**	**0.10395**	**0.146**	**0.168**	**0.06405**	**0.0509**	**0.206**			ln(y) = -2.02545710899416 + 0.418010792869135*Z
Bromide mg/L	**4/4**	**29.65**	**4.4818189**	**0.15115747**	**25.2578174**	**34.0421826**	**25.65**	**30.15**	**33.15**	**7.5**	**24.3**	**34**			ln(y) = 3.38224598243241 + 0.187936229780523*Z
Cadmium mg/L Dissolved	**9/13**	0.0016992	0.0025898	1.52413597	0.00029136	0.00310705	0.0007394	0.0012395	0.0020778	0.0013384	**0.0011**	**0.008**	**0.0003**	**0.0046**	ln(y) = -6.69306948827857 + 0.766290225020485*Z
Cadmium mg/L Total	**9/13**	0.001368	0.0003137	0.22930816	0.00119746	0.0015385	0.0011221	0.0013412	0.001603	0.000481	**0.0011**	**0.002**	**0.0003**	**0.0046**	ln(y) = -6.61421602543162 + 0.264556690708334*Z
Calcium Metal mg/L Dissolved	**13/13**	**164.53846**	**39.111823**	**0.23770626**	**143.277033**	**185.799891**	**138.5**	**171**	**191.5**	**53**	**78**	**208**			ln(y) = 5.07239442731902 + 0.291477225351423*Z
Calcium Metal mg/L Total	**13/13**	**161.3**	**41.841275**	**0.25940034**	**138.554824**	**184.045176**	**148**	**170**	**191**	**43**	**72.8**	**202**			ln(y) = 5.04377983102539 + 0.318804513088833*Z
Caprolactam ug/L	**5/13**	5.5024397	5.3999448	0.98137283	2.56699625	8.43788307	2.0717308	3.9431121	7.5049003	5.4331695	**2**	**17**	**9.1**	**10**	ln(y) = 1.37197028475253 + 0.954607323777208*Z
Carbon Disulfide ug/L	**3/13**										**1**	**2**	**10**	**10**	
Chloroform ug/L	**2/13**										**2**	**3**	**1**	**10**	
Chromium mg/L Dissolved	**5/13**	0.0034227	0.0047257	1.38068074	0.00085381	0.0059916	0.0005529	0.001546	0.0043233	0.0037704	**0.0024**	**0.0142**	**0.0007**	**0.0043**	ln(y) = -6.47208019541096 + 1.52529653401176*Z
Chromium mg/L Total	**9/13**	0.0057113	0.0163372	2.86049404	-0.0031697	0.01459232	0.0008355	0.0021404	0.0054832	0.0046477	**0.0012**	**0.0456**	**0.0007**	**0.0043**	ln(y) = -6.14677495971214 + 1.3953264260504*Z
Copper mg/L Dissolved	**11/13**	0.0082356	0.0070758	0.85917273	0.00438912	0.01208198	**0.00485**	**0.0065**	**0.0074**	**0.00255**	**0.0047**	**0.0231**	**0.003**	**0.003**	ln(y) = -5.01947121045754 + 0.695136787784591*Z
Copper mg/L Total	**11/13**	0.0082227	0.003289	0.39998485	0.00643482	0.01001063	0.0056885	0.0076735	0.010351	0.0046625	**0.0053**	**0.0137**	**0.003**	**0.006**	ln(y) = -4.86998628594151 + 0.443966473783699*Z
delta-BHC ug/L	**1/13**										**0.0025**	**0.0025**	**0.045**	**0.006**	
Di-n-butylphthalate ug/L	**1/13**										**1**	**1**	**9.1**	**0.006**	
Iron mg/L Dissolved	**12/13**	1.0875954	1.1920574	1.09604858	0.43958561	1.73560515	**0.06215**	**1.2**	**1.625**	**1.56285**	**0.0098**	**3.89**	**0.0217**	**0.0217**	ln(y) = -0.99878052987536 + 2.15475899886326*Z
Iron mg/L Total	**12/13**	1.2559654	1.2848214	1.02297517	0.55752851	1.95440225	**0.318**	**0.655**	**2.115**	**1.797**	**0.245**	**4.33**	**0.0217**	**0.0217**	ln(y) = -0.249883837857788 + 1.2289621427016*Z
Lead mg/L Dissolved	**2/13**										**0.0018**	**0.0021**	**0.00043**	**0.0217**	
Lead mg/L Total	**11/13**	0.0021686	0.00054	0.24899435	0.00187509	0.00246216	0.0018491	0.002127	0.0024466	0.0005974	**0.0018**	**0.0034**	**0.00035**	**0.0021**	ln(y) = -6.15304927712456 + 0.207636805736993*Z
Magnesium mg/L Dissolved	**13/13**	**490.15385**	**127.74075**	**0.26061359**	**420.713183**	**559.594509**	**378**	**521**	**588**	**210**	**256**	**652**			ln(y) = 6.15918227621344 + 0.322769302654435*Z
Magnesium mg/L Total	**13/13**	**477.30769**	**135.18267**	**0.28321913**	**403.821555**	**550.79383**	**411**	**507**	**577.5**	**166.5**	**201**	**622**			ln(y) = 6.12039027908789 + 0.360170841288179*Z
Manganese mg/L Dissolved	**13/13**	**0.261**	**0.173746**	**0.66569359**	**0.16655058**	**0.35544942**	**0.124**	**0.197**	**0.3905**	**0.2665**	**0.087**	**0.637**			ln(y) = -1.53007813118233 + 0.733439660816699*Z
Manganese mg/L Total	**13/13**	**0.262**	**0.1695059**	**0.646969**	**0.16985555**	**0.35414445**	**0.128**	**0.19**	**0.401**	**0.273**	**0.098**	**0.596**			ln(y) = -1.51531582111521 + 0.696682880443316*Z
Mercury mg/L Dissolved	**1/13**										**0.0001**	**0.0001**	**0.00006**	**0**	
Mercury mg/L Total	**4/13**	0.0001127	5.034E-05	0.44665196	8.5341E-05	0.00014007	7.561E-05	0.0001034	0.0001415	6.591E-05	**0.00013**	**0.0002**	**0.000073**	**0.0001**	ln(y) = -9.17650292317184 + 0.464887854664545*Z
Nickel mg/L Dissolved	**12/13**	0.0103432	0.0118336	1.14409217	0.0039104	0.01677603	**0.0037**	**0.0054**	**0.0118**	**0.0081**	**0.0029**	**0.0348**	**0.0021**	**0.0021**	ln(y) = -4.99958984964794 + 1.04463040601552*Z
Nickel mg/L Total	**13/13**	**0.0112154**	**0.0122854**	**1.09540376**	**0.00453698**	**0.01789379**	**0.00405**	**0.0058**	**0.01645**	**0.0124**	**0.0033**	**0.0348**			ln(y) = -4.88749696681297 + 0.878604891103594*Z
Potassium mg/L Dissolved	**13/13**	**170.07692**	**30.683347**	**0.18040864**	**153.397266**	**186.75658**	**149.5**	**168**	**193**	**43.5**	**118**	**217**			ln(y) = 5.1210544679945 + 0.211810244887614*Z
Potassium mg/L Total	**13/13**	**166.00769**	**36.028168**	**0.2170271**	**146.422557**	**185.592827**	**149.5**	**170**	**189**	**39.5**	**77.1**	**207**			ln(y) = 5.08681833710811 + 0.251337518967634*Z
Selenium mg/L Dissolved	**12/13**	0.00865	0.0032219	0.3724766	0.00689854	0.01040146	**0.007**	**0.0093**	**0.011**	**0.004**	**0.0026**	**0.012**	**0.0026**	**0.0026**	ln(y) = -4.82512074299472 + 0.445343484333006*Z
Selenium mg/L Total	**12/13**	0.0088572	0.0032363	0.36538004	0.007098	0.0106165	**0.00735**	**0.01**	**0.011**	**0.00365**	**0.0026**	**0.012**	**0.0026**	**0.0026**	ln(y) = -4.79815278983762 + 0.431279011452514*Z
Silver mg/L Total	**1/13**										**0.0019**	**0.0019**	**0.001**	**0.0026**	
Sodium mg/L Dissolved	**13/13**	**5039.2308**	**1937.3958**	**0.38446261**	**3986.0504**	**6092.41114**	**3965**	**4720**	**6960**	**2995**	**1930**	**7930**			ln(y) = 8.45087584440646 + 0.469453809006348*Z
Sodium mg/L Total	**13/13**	**5810**	**3742.3215**	**0.6441173**	**3775.65087**	**7844.34913**	**4055**	**5260**	**6880**	**2825**	**1620**	**15400**			ln(y) = 8.51933996998636 + 0.642701151168656*Z
Thallium mg/L Dissolved	**3/13**										**0.0042**	**0.0045**	**0.001**	**0**	
Thallium mg/L Total	**4/13**	0.0029424	0.0030244	1.02787305	0.00129832	0.00458653	0.001278	0.0022381	0.0039193	0.0026413	**0.0042**	**0.0096**	**0.00019**	**0.0045**	ln(y) = -6.10214095333543 + 0.831078228322384*Z
Total Organic Carbon mg/L	**4/4**	**5.3625**	**0.5043472**	**0.09405076**	**4.86823975**	**5.85676025**	**4.875**	**5.425**	**5.7875**	**0.9125**	**4.8**	**5.8**			ln(y) = 1.67622855750144 + 0.122781477612423*Z
Tribromomethane ug/L	**2/13**										**2**	**8**	**10**	**0**	
Vanadium (Fume Or Dust) mg/L Dissolved	**11/13**	0.0044658	0.0014887	0.33335316	0.00365652	0.00527503	**-0.0059**	**-0.0059**	**0.00595**	**0.01185**	**0.0021**	**0.0074**	**0.0059**	**0.0059**	ln(y) = -5.46926180872412 + 0.378868474527379*Z

Table D-5
Bayou d'Inde - Bayou Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Vanadium (Fume Or Dust) mg/L Total	**11/13**	0.0047514	0.0023692	0.49863519	0.00346346	0.00603928	**-0.0059**	**-0.0059**	**0.00655**	**0.01245**	**0.0015**	**0.0096**	**0.0059**	**0.0059**	ln(y) = -5.46597222893672 + 0.542338845029676*Z
Zinc mg/L Dissolved	**2/13**										**0.011**	**0.0158**	**0.0098**	**0.0059**	
Zinc mg/L Total	**3/13**	0.0091149	0.0035972	0.39465515	0.0071594	0.01107035	0.0062436	0.0084297	0.0113812	0.0051376	**0.0121**	**0.0182**	**0.0098**	**0.0192**	ln(y) = -4.77599991336486 + 0.445284443785387*Z
Bicarbonate Alkalinity mg/L	**4/4**	**104.525**	**4.9358158**	**0.04722139**	**99.6879005**	**109.3621**	**99.825**	**105.25**	**108.5**	**8.675**	**98.6**	**109**			ln(y) = 4.64870489775127 + 6.00954220664045E-02*Z
Biochemical Oxygen Demand mg/L	**4/4**	**6.3875**	**3.6282471**	**0.56802303**	**2.83181781**	**9.94318219**	**3.1625**	**6.15**	**9.85**	**6.6875**	**2.85**	**10.4**			ln(y) = 1.72606148210209 + 0.81899885759639*Z
Chemical Oxygen Demand (COD) mg/L	**4/4**	**76.425**	**5.8932261**	**0.07711123**	**70.6496384**	**82.2003616**	**71.4**	**75.75**	**82.125**	**10.725**	**71**	**83.2**			ln(y) = 4.33426834363776 + 0.100045922519791*Z
Chloride mg/L	**4/4**	**8532.5**	**1521.1724**	**0.1782798**	**7041.75107**	**10023.2489**	**7380**	**8360**	**9857.5**	**2477.5**	**7060**	**10350**			ln(y) = 9.04234095450243 + 0.209256465741422*Z
Fluoride mg/L	**2/4**										**6**	**10**	**20**	**0**	
Hardness, as CaCO3 mg/L	**4/4**	**2808.75**	**471.96164**	**0.16803263**	**2346.22759**	**3271.27241**	**2412.5**	**2950**	**3063.75**	**651.25**	**2250**	**3085**			ln(y) = 7.93295650379069 + 0.177556904277335*Z
Nitrate-Nitrite mg/L	**4/4**	**0.2245**	**0.1292406**	**0.57568198**	**0.09784421**	**0.35115579**	**0.116**	**0.2225**	**0.335**	**0.219**	**0.083**	**0.37**			ln(y) = -1.62249004136071 + 0.825590132633462*Z
Sulfate mg/L	**4/4**	**1206.25**	**178.62882**	**0.14808607**	**1031.19376**	**1381.30624**	**1052.5**	**1215**	**1351.25**	**298.75**	**1000**	**1395**			ln(y) = 7.08834668738892 + 0.182764896635812*Z
Total Alkalinity mg/L	**4/4**	**104.525**	**4.9358158**	**0.04722139**	**99.6879005**	**109.3621**	**99.825**	**105.25**	**108.5**	**8.675**	**98.6**	**109**			ln(y) = 4.64870489775127 + 6.00954220664045E-02*Z
Total Kjeldahl Nitrogen mg/L	**4/4**	**2.3875**	**0.6045603**	**0.25321899**	**1.79503087**	**2.97996913**	**1.8**	**2.475**	**2.8875**	**1.0875**	**1.7**	**2.9**			ln(y) = 0.846148831766134 + 0.341082682572347*Z
Total Suspended Solids mg/L	**4/4**	**43.3875**	**35.12501**	**0.8095652**	**8.96499002**	**77.81001**	**18.6875**	**37.275**	**74.2**	**55.5125**	**13**	**86**			ln(y) = 3.56356679237107 + 1.04307177135053*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-6
Bayou d'Inde - Bayou Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N	**5/5**	**1.692**	**0.6850354**	**0.40486724**	**1.09154003**	**2.29245997**	**1.03**	**1.7**	**2.35**	**1.32**	**0.96**	**2.5**			ln(y) = 0.457972905716933 + 0.546027635865078*Z
Dissolved Oxygen	**105/105**	**10.619688**	**3.0927786**	**0.29123064**	**10.0281127**	**11.2112639**	**8.55**	**10**	**12.7**	**4.15**	**5**	**19.5**			ln(y) = 2.32062421066605 + 0.303044349080781*Z
Field Conductivity	**105/105**	**12718.918**	**11937.982**	**0.93860044**	**10435.4634**	**15002.3721**	**2750**	**3600**	**23600**	**20850**	**1500**	**36600**			ln(y) = 8.892439007884 + 1.07900787817744*Z
Field pH	**105/105**	**8.0067638**	**0.6385476**	**0.07975102**	**7.88462473**	**8.12890292**	**7.5638889**	**7.95**	**8.495**	**0.9311111**	**6.58**	**9.42**			ln(y) = 2.07711354232245 + 8.26212073510069E-02*Z
Field Redox Potential	**100/105**	126.28076	46.602612	0.36903968	117.366781	135.194743	81.918416	113.57221	157.45724	75.538825	**11**	**200**	**7**	**64**	ln(y) = 4.73243888005013 + 0.484604447590905*Z
Field Specific Gravity	**105/105**	**10.738629**	**4.0092**	**0.37334374**	**9.97176376**	**11.5054945**	**8**	**11**	**14**	**6**	**2**	**17.5**			ln(y) = 2.28036729893935 + 0.464458223906724*Z
Field Temperature	**105/105**	**16.973478**	**3.238784**	**0.1908144**	**16.3539751**	**17.5929811**	**14.8**	**16.85**	**18.6**	**3.8**	**9.8**	**25.7**			ln(y) = 2.81329795890932 + 0.199085678503876*Z
Field Total Dissolved Solids	**105/105**	**15597.807**	**4923.568**	**0.3156577**	**14656.045**	**16539.5699**	**12000**	**17000**	**19750**	**7750**	**3000**	**24000**			ln(y) = 9.58748895171359 + 0.386160447011901*Z
Field Turbidity	**88/88**	**121.21016**	**263.74047**	**2.17589414**	**66.1050936**	**176.315223**	**11**	**21**	**60.75**	**49.75**	**0.1**	**990**			ln(y) = 3.37642426450484 + 1.65048995337747*Z
Hardness, as CaCO3	**5/5**	**2857**	**435.45077**	**0.15241539**	**2475.31057**	**3238.68943**	**2575**	**3000**	**3067.5**	**492.5**	**2250**	**3085**			ln(y) = 7.95094457695284 + 0.145868565239969*Z
Salinity	**105/105**	**15.702496**	**5.492393**	**0.34977833**	**14.6519311**	**16.7530616**	**11**	**17**	**20**	**9**	**3**	**25.5**			ln(y) = 2.67081441373856 + 0.433692989124901*Z
Total Alkalinity	**5/5**	**102.72**	**5.812674**	**0.05658756**	**97.6249666**	**107.815033**	**97.05**	**103.5**	**108**	**10.95**	**95.5**	**109**			ln(y) = 4.63078916769835 + 7.27450138953603E-02*Z
Total Kjeldahl Nitrogen	**5/5**	**2.37**	**0.526676**	**0.22222615**	**1.90834815**	**2.83165185**	**1.9**	**2.3**	**2.875**	**0.975**	**1.7**	**2.9**			ln(y) = 0.843500889999928 + 0.289066993597562*Z

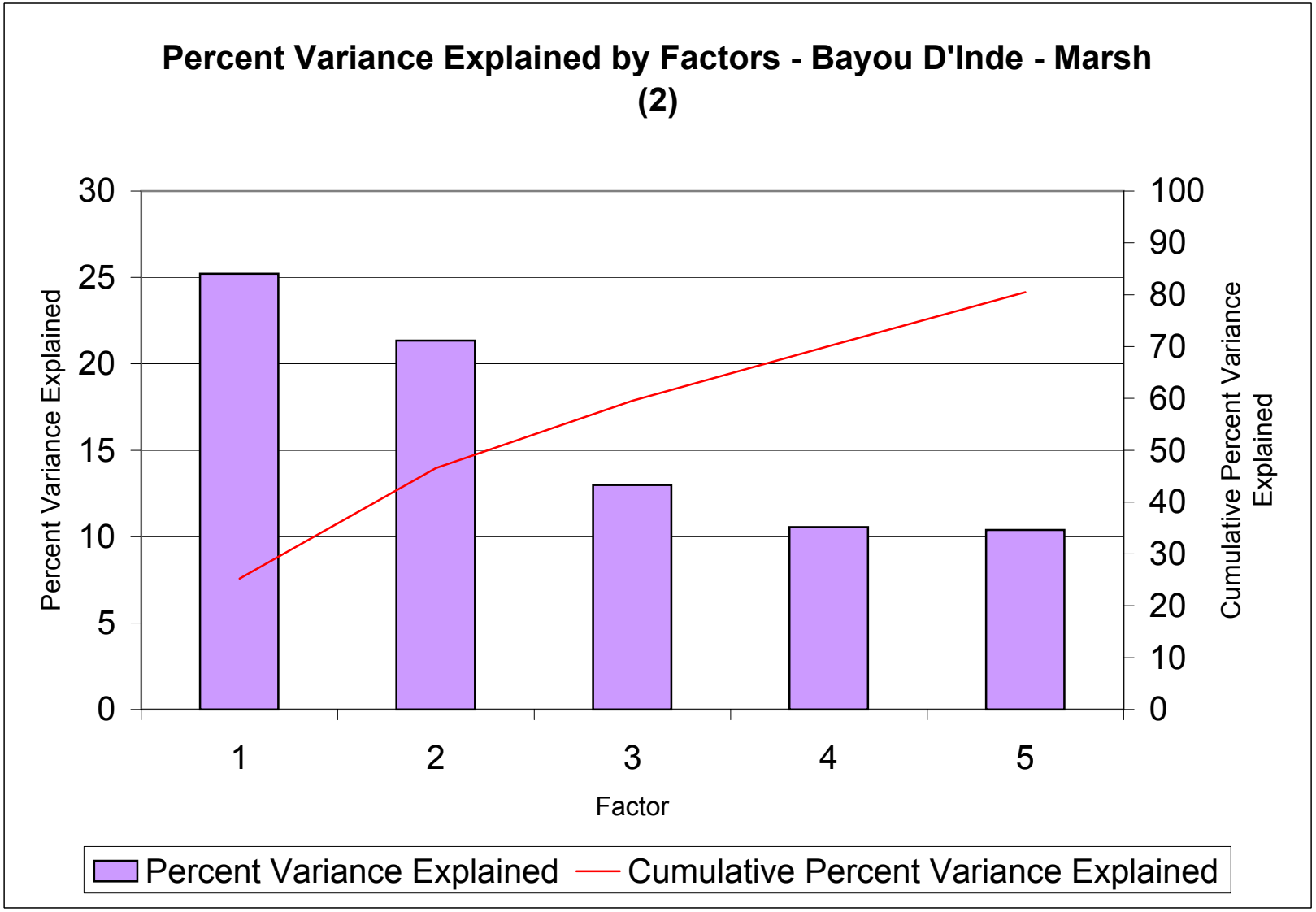
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-7
Bayou d'Inde - Bayou Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen	**21/21**	**6.8392857**	**2.6030956**	**0.38060928**	**5.72592332**	**7.95264811**	**5.24**	**6.5**	**8.24**	**3**	**3.02**	**11.75**			ln(y) = 1.85067047120742 + 0.439057723216093*Z
Field Conductivity	**21/21**	**17781.238**	**34299.091**	**1.92894839**	**3111.27469**	**32451.2015**	**1875**	**3140**	**26975**	**25100**	**242**	**135000**			ln(y) = 8.64740378864521 + 1.81792475998275*Z
Field pH	**21/21**	**7.1692857**	**0.285295**	**0.03979406**	**7.04726303**	**7.2913084**	**7.005**	**7.185**	**7.32**	**0.315**	**6.56**	**7.83**			ln(y) = 1.96907779908945 + 4.27756034540191E-02*Z
Field Redox Potential	**17/21**	159.24394	117.72142	0.73925208	108.893662	209.594225	54.558956	109.86408	221.23069	166.67173	**16.5**	**357**	**22**	**117.92**	ln(y) = 4.69924394368856 + 1.03822803118613*Z
Field Specific Gravity	**9/9**	**6.9444444**	**4.2148765**	**0.60694222**	**4.19072513**	**9.69816375**	**3**	**7**	**11.25**	**8.25**	**1**	**12**			ln(y) = 1.64136859083951 + 1.05101382378178*Z
Field Temperature	**21/21**	**20.57619**	**4.8422057**	**0.23533052**	**18.5051449**	**22.6472361**	**15.8**	**21.7**	**25.0325**	**9.2325**	**13.28**	**27.78**			ln(y) = 2.99593610222391 + 0.262963585227165*Z
Field Total Dissolved Solids	**21/21**	**12723.81**	**7256.3246**	**0.57029497**	**9620.22823**	**15827.3908**	**5550**	**15000**	**18500**	**12950**	**800**	**24500**			ln(y) = 9.11659888075846 + 1.02665865777918*Z
Field Turbidity	**21/21**	**6.3071429**	**6.5668223**	**1.04117228**	**3.49846657**	**9.11581914**	**2.45**	**3.5**	**5.45**	**3**	**1.8**	**22.5**			ln(y) = 1.49078823849442 + 0.809050049677841*Z
Salinity	**21/21**	**12.595238**	**7.8321697**	**0.62183578**	**9.24536379**	**15.9451124**	**5.5**	**13.5**	**19**	**13.5**	**1**	**26.5**			ln(y) = 2.13019616471455 + 1.13295062360206*Z

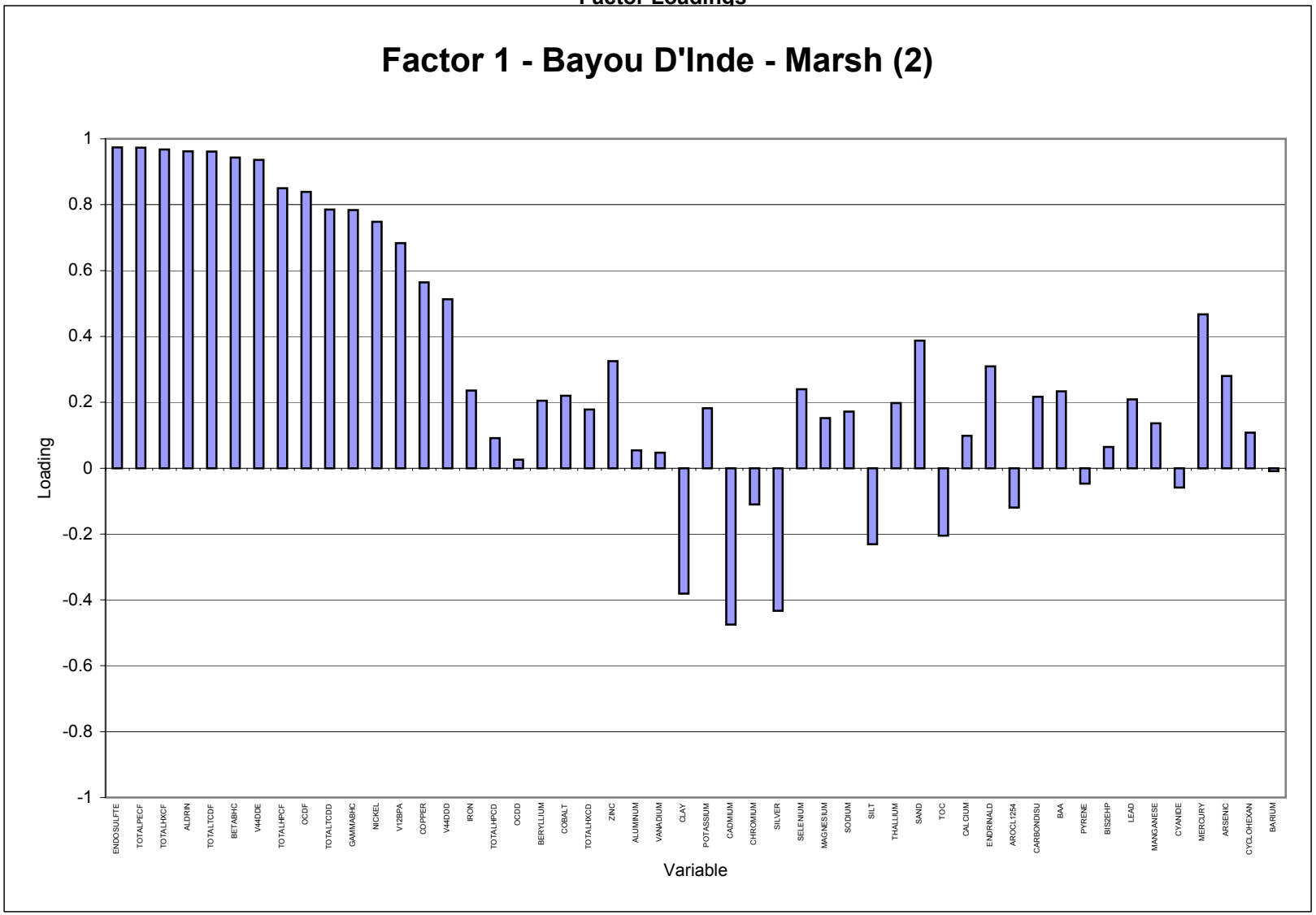
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-8
Principal Component Analysis Results



CDM

Table D-9
Bayou D'Inde-Marsh
Factor Loadings



CDM

Table D-9
Bayou D'Inde-Marsh
Factor Loadings

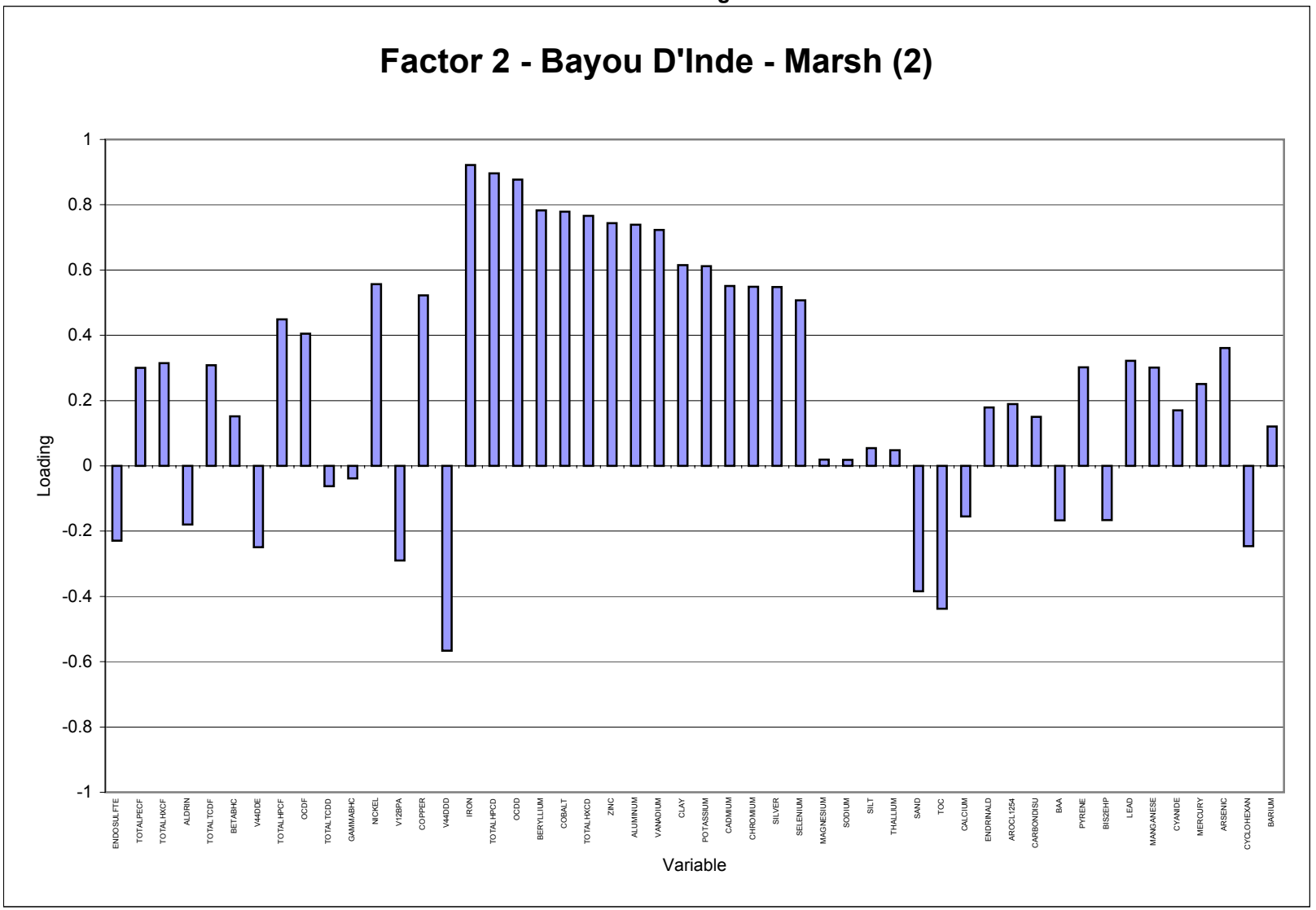
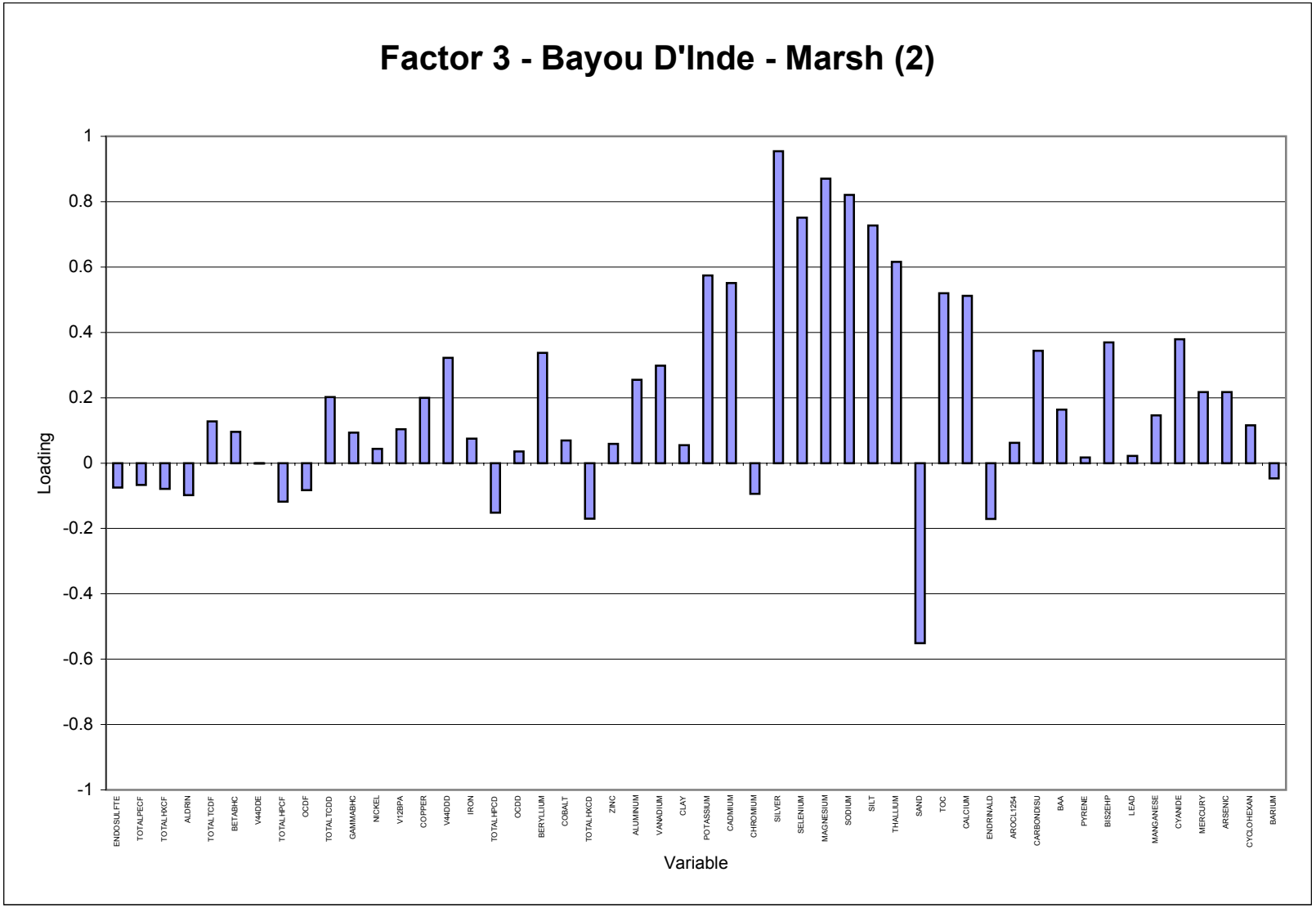
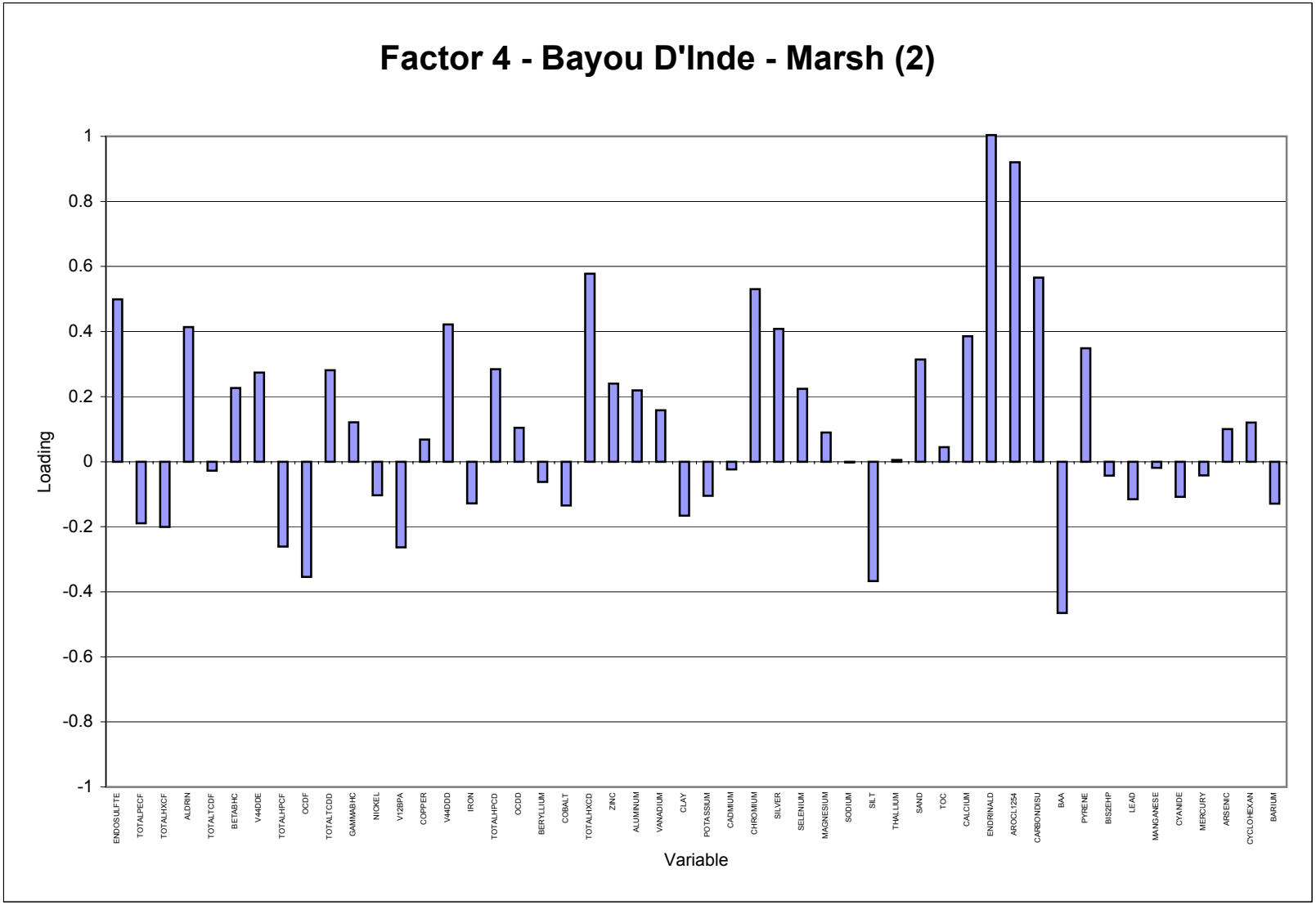


Table D-9
Bayou D'Inde-Marsh
Factor Loadings



CDM

Table D-9
Bayou D'Inde-Marsh
Factor Loadings



CDM

Table D-9
Bayou D'Inde-Marsh
Factor Loadings

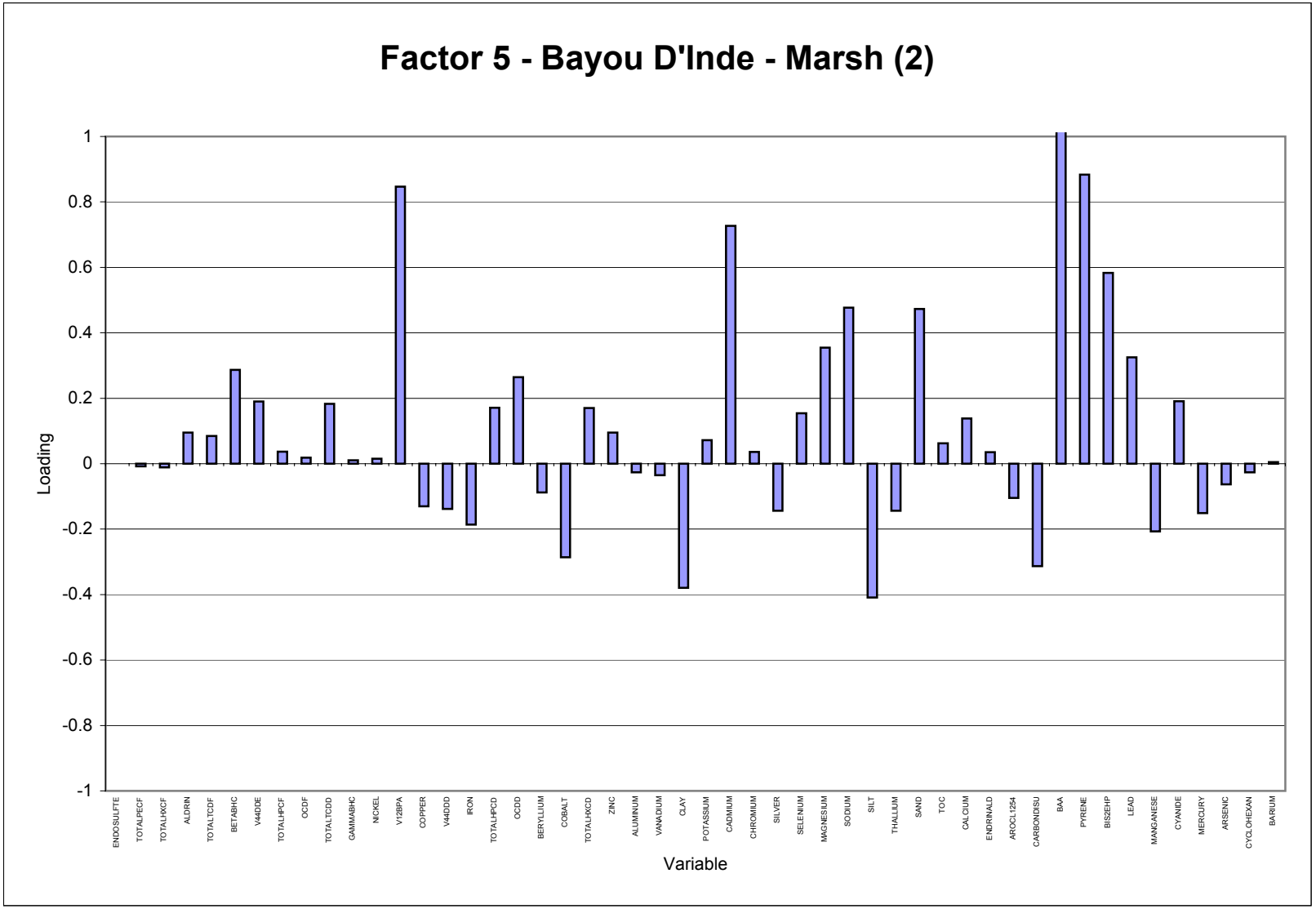


Table D-10
Bayou d'Inde - Bayou Energy System
Principal Components Analysis Results

Variable	Sum Ranking
NICKEL	0.305
COPPER	0.300
IRON	0.275
ZINC	0.266
POTASSIUM	0.239
COBALT	0.225
BERYLLIUM	0.219
ALUMINUM	0.213
VANADIUM	0.208
MERCURY	0.207
CHROMIUM	0.201
MAGNESIUM	0.187
SODIUM	0.172
ARSENIC	0.166
LEAD	0.162
CALCIUM	0.161
GAMMABHC	0.140
MANGANESE	0.130
SELENIUM	0.119
THALLIUM	0.106
ENDOSULFTE	0.100
BETABHC	0.095
CYANIDE	0.088
BIS2EHP	0.087
CARBONDISU	0.080
V12BPA	0.073
CADMIUM	0.073
CYCLOHEXAN	0.069
SAND	0.063
SILVER	0.061
PYRENE	0.061
AROCL1254	0.057
V44DDE	0.055
CLAY	0.055
ALDRIN	0.054
TOTALHPCF	0.051
TOTALHXCF	0.049
TOTALPECF	0.049
TOTALTCDF	0.048
V44DDD	0.048
ENDRINALD	0.048
OCDF	0.048
SILT	0.046
BARIUM	0.0447
TOTALHXCD	0.044
TOC	0.043
TOTALTCDD	0.041
BAA	0.041
TOTALHPCD	0.041
OCDD	0.034

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**6/109**										**4.5**	**23**	**0.9**	**0**
1,1'-Biphenyl ug/Kg	**1/162**										**110**	**110**	**91**	**0**
1,2,3,4,6,7,8-HpCDD PG/G	**23/23**	**398.3913**	**362.84117**	**0.9107658**	**250.102379**	**546.68023**	**142**	**340**	**489**	**347**	**47**	**1400**		
1,2,3,4,6,7,8-HpCDF PG/G	**22/23**	1267.6809	1959.1448	1.54545582	467.001422	2068.36034	**190**	**530**	**1600**	**1410**	**55**	**7600**	**110**	**110**
1,2,3,4,7,8,9-HpCDF PG/G	**23/23**	**292.10435**	**613.13337**	**2.0990217**	**41.5239447**	**542.684751**	**26**	**57.8**	**290**	**264**	**8.6**	**2420**		
1,2,3,4,7,8-HxCDD PG/G	**9/23**	11.77986	27.541599	2.33802439	0.52393162	23.0357878	1.2809034	3.9067838	11.915777	10.634874	**3.18**	**110**	**0.45**	**71.2**
1,2,3,4,7,8-HxCDF PG/G	**22/23**	578.15436	1020.4721	1.76505136	161.099386	995.209341	**56**	**141**	**640**	**584**	**21**	**3720**	**45**	**45**
1,2,3,6,7,8-HxCDD PG/G	**18/23**	31.848416	40.605907	1.27497415	15.2532587	48.4435728	8.1710861	18.343212	41.178544	33.007458	**7.86**	**170**	**0.82**	**9.9**
1,2,3,6,7,8-HxCDF PG/G	**21/23**	155.87691	298.1299	1.91259824	34.0347207	277.719095	17.882792	54.82247	168.06677	150.18398	**7.4**	**1210**	**7.4**	**12**
1,2,3,7,8,9-HxCDD PG/G	**15/23**	17.29453	21.162501	1.22365285	8.64566458	25.9433958	5.0337058	10.449502	21.692186	16.65848	**5.57**	**82**	**1.3**	**39.6**
1,2,3,7,8,9-HxCDF PG/G	**11/23**	60.294022	264.65473	4.38940246	-47.867256	168.4553	0.7441471	4.6284964	28.788636	28.044489	**4.55**	**951**	**0.41**	**6.8**
1,2,3,7,8-PeCDD PG/G	**8/23**	10.094746	20.515514	2.03229631	1.71029597	18.4791953	0.5603969	2.3051672	9.4822	8.9218031	**2.62**	**79.2**	**0.33**	**11**
1,2,3,7,8-PeCDF PG/G	**22/23**	176.88409	324.58158	1.83499595	44.2314075	309.536768	**18**	**37**	**200**	**182**	**8.9**	**1290**	**11**	**11**
1,2,4-Trichlorobenzene ug/Kg	**1/100**										**8**	**8**	**13**	**11**
1,2-Benzphenanthracene ug/Kg	**28/160**										**110**	**10400**	**100**	**11**
1,4-Dichlorobenzene ug/Kg	**14/100**										**1**	**22**	**13**	**11**
2,3,4,6,7,8-HxCDF PG/G	**17/23**	68.699814	168.47317	2.45230905	-0.1531934	137.552821	5.6181756	19.476915	67.521956	61.90378	**9.6**	**672**	**0.61**	**6.3**
2,3,4,7,8-PeCDF PG/G	**21/23**	136.32654	327.05509	2.39905665	2.6629664	269.990115	11.852386	39.561789	132.05233	120.19994	**6.6**	**1310**	**5.9**	**8.8**
2,3,7,8-TCDD PG/G	**11/23**	2.7335819	3.6766953	1.34501011	1.23095973	4.23620407	0.5352182	1.3468111	3.389085	2.8538668	**0.538**	**13.9**	**0.55**	**2.9**
2,3,7,8-TCDD TEQ PG/G	**24/25**	201.84532	397.16661	1.96767811	46.1560057	357.534631	**25.7085**	**50.141**	**213.4535**	**187.745**	**1.155**	**1645.648**	**4.8475**	**4.8475**
2,3,7,8-TCDF PG/G	**23/23**	**172.8**	**258.68676**	**1.49702987**	**67.0777596**	**278.52224**	**22**	**53**	**268**	**246**	**5.7**	**886**		
2,4,5-T ug/Kg	**6/100**										**5.4**	**20**	**25**	**0**
2,4,5-TP (Silvex) ug/Kg	**1/100**										**5.5**	**5.5**	**25**	**0**
2,4-DB ug/Kg	**7/100**										**23**	**120**	**100**	**0**
2-Butanone ug/Kg	**21/100**	10.317091	4.602667	0.44612063	9.41496789	11.2192134	6.8662427	9.641522	13.538547	6.6723038	**3**	**35**	**13**	**210**
2-Methylnaphthalene ug/Kg	**6/152**										**78**	**128**	**100**	**210**
4,4'-DDD ug/Kg	**22/109**	4.817743	14.473344	3.00417527	2.10060485	7.5348811	1.3890053	2.8329967	5.7781421	4.3891368	**0.61**	**120**	**4.3**	**62**
4,4'-DDE ug/Kg	**26/110**	3.4699661	15.887909	4.57869289	0.50085482	6.43907737	1.2193944	2.1784025	3.8916345	2.6722401	**0.67**	**120**	**4.3**	**62**
4,4'-DDT ug/Kg	**13/109**										**0.66**	**65**	**4.3**	**62**
4-Chloro-3-methylphenol ug/Kg	**1/162**										**110**	**110**	**91**	**62**
4-Methylphenol ug/Kg	**1/162**										**180**	**180**	**91**	**62**
Acenaphthene ug/Kg	**4/152**										**57.4**	**1460**	**100**	**62**
Acenaphthylene ug/Kg	**10/157**										**64.1**	**901**	**100**	**62**
Acetone ug/Kg	**25/100**	835.62313	12069.561	14.4437856	-1530.0109	3201.25715	1.5361344	6.9236553	31.206256	29.670122	**4**	**81000**	**13**	**120**
Aldrin ug/Kg	**25/109**	5.7948532	40.986852	7.0729749	-1.8997704	13.4894769	0.6066699	1.5452464	3.9358905	3.3292206	**0.35**	**320**	**0.74**	**62**
alpha-BHC ug/Kg	**11/109**										**1.7**	**13**	**2.2**	**62**
alpha-Chlordane ug/Kg	**13/110**										**0.61**	**84**	**0.23**	**62**
Aluminum (Fume Or Dust) mg/Kg	**149/149**	**11158.899**	**4899.7974**	**0.43909325**	**10372.1415**	**11945.6571**	**7215**	**10400**	**14600**	**7385**	**956**	**25200**		
Anthracene ug/Kg	**9/155**										**52.5**	**1320**	**100**	**0**
Antimony MG/KG	**2/82**										**2.7**	**5.9**	**0.03**	**0**
Aroclor-1254 ug/Kg	**49/111**	115.50781	235.1143	2.03548399	71.7683288	159.24729	18.518727	46.172696	115.12227	96.603539	**4.9**	**1300**	**26**	**330**
Aroclor-1260 ug/Kg	**2/109**										**120**	**140**	**26**	**330**
Arsenic MG/KG	**133/149**	3.6720653	1.449907	0.39484783	3.4392545	3.90487606	2.5913221	3.3987062	4.4576487	1.8663266	**1.2**	**10.7**	**0.51**	**4.9**
Barium MG/KG	**149/149**	**1220.094**	**2814.132**	**2.30648793**	**768.230316**	**1671.9576**	**239**	**510**	**1100**	**861**	**56.3**	**23200**		
Benzaldehyde ug/Kg	**3/162**										**59**	**330**	**91**	**0**
Benzene ug/Kg	**1/100**										**29**	**29**	**13**	**0**
Benzo(a)anthracene ug/Kg	**21/158**										**71**	**4850**	**100**	**0**
Benzo(a)pyrene ug/Kg	**19/159**										**76.5**	**2620**	**100**	**0**

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
Benzo(b)fluoranthene ug/Kg	**19/159**										**103**	**7390**	**100**	**0**
Benzo(g,h,i)perylene ug/Kg	**11/157**										**62**	**651**	**100**	**0**
Benzo(k)fluoranthene ug/Kg	**13/155**										**55.8**	**2620**	**100**	**0**
Benzyl Butyl Phthalate ug/Kg	**3/162**										**130**	**360**	**91**	**0**
Beryllium MG/KG	**126/149**	0.7593816	0.2666492	0.35113994	0.71656587	0.80219731	0.5660294	0.7171775	0.9086869	0.3426574	**0.24**	**2.4**	**0.08**	**2.6**
beta-BHC ug/Kg	**40/109**	13.728317	58.037904	4.22760505	2.83263231	24.6240024	1.3250593	3.7867905	10.821993	9.4969334	**1.5**	**480**	**1.9**	**62**
bis(2-Ethylhexyl)phthalate ug/Kg	**83/162**	393.42853	864.73836	2.1979554	260.265614	526.59144	109.39682	218.33431	435.75187	326.35505	**58**	**8000**	**91**	**15000**
Cadmium MG/KG	**23/162**										**0.074**	**3.8**	**0.08**	**15000**
Calcium Metal MG/KG	**143/149**	3522.6188	3917.5266	1.11210631	2893.58365	4151.65387	1736.6861	2694.5409	4180.6925	2444.0064	**597**	**32300**	**669**	**3700**
Carbazole ug/Kg	**2/151**										**271**	**607**	**420**	**3700**
Carbon Disulfide ug/Kg	**57/100**	5.9319741	3.9729444	0.66975081	5.15327698	6.7106712	2.9528819	4.939064	8.2612018	5.30832	**1**	**19**	**13**	**210**
CFC-11 ug/Kg	**1/100**										**1**	**1**	**13**	**210**
Chlorobenzene ug/Kg	**1/100**										**1**	**1**	**13**	**210**
Chloromethane ug/Kg	**1/100**										**6**	**6**	**13**	**210**
Chromium MG/KG	**149/149**	**102.08389**	**128.93209**	**1.26300128**	**81.3813374**	**122.786448**	**22.45**	**56.1**	**150**	**127.55**	**2.8**	**774**		
Cobalt MG/KG	**123/149**	5.4770416	1.8194341	0.33219287	5.18489605	5.76918715	3.9880783	5.1326321	6.6056657	2.6175874	**1.6**	**10.2**	**0.62**	**11.9**
Copper MG/KG	**161/162**	125.87432	155.44669	1.23493573	101.93675	149.81189	**43.75**	**79.25**	**149**	**105.25**	**7.1**	**943**	**21.9**	**21.9**
Cyanide MG/KG	**34/134**	0.1936852	0.4203807	2.17043309	0.12250707	0.26486331	0.0261175	0.0712588	0.1944223	0.1683048	**0.14**	**2.9**	**0.06**	**2.3**
Cyclohexane ug/Kg	**3/100**										**130**	**9000**	**13**	**2.3**
delta-BHC ug/Kg	**23/109**	2.1131885	4.9235054	2.32989407	1.1888794	3.03749767	0.6169948	1.263427	2.5871331	1.9701382	**0.39**	**39**	**2.5**	**62**
Dibenzo(a,h)anthracene ug/Kg	**7/155**										**45.4**	**503**	**100**	**62**
Dibenzofuran ug/Kg	**3/162**										**109**	**150**	**91**	**62**
Dichloromethane ug/Kg	**13/100**										**1**	**23000**	**4**	**62**
Dichlorprop ug/Kg	**1/100**										**25**	**25**	**100**	**62**
Dieldrin ug/Kg	**14/109**										**0.78**	**45**	**4.3**	**62**
Di-n-butylphthalate ug/Kg	**5/162**										**97**	**460**	**63**	**62**
Dinitrobutyl Phenol ug/Kg	**3/100**										**2**	**24**	**15**	**62**
Di-n-octylphthalate ug/Kg	**5/162**										**210**	**930**	**91**	**62**
Endosulfan I ug/Kg	**5/109**										**0.55**	**0.94**	**2.2**	**62**
Endosulfan II ug/Kg	**6/109**										**1**	**25**	**4.3**	**62**
Endosulfan Sulfate ug/Kg	**45/110**	5.034868	18.749187	3.72386864	1.53104491	8.53869114	1.8206378	3.141513	5.4206849	3.6000471	**0.86**	**150**	**4.3**	**62**
Endrin Aldehyde ug/Kg	**31/110**	4.7015943	9.5250804	2.02592561	2.92156001	6.48162867	1.8781012	3.300551	5.8003463	3.9222451	**0.97**	**81**	**4.3**	**62**
Endrin Ketone ug/Kg	**9/109**										**0.77**	**3.4**	**4.3**	**62**
Endrin ug/Kg	**13/109**										**0.93**	**25**	**4.3**	**62**
Ethylbenzene ug/Kg	**5/100**										**1**	**770**	**13**	**62**
Fluoranthene ug/Kg	**22/159**										**70.9**	**19100**	**100**	**62**
Fluorene ug/Kg	**4/151**										**160**	**14800**	**100**	**62**
gamma-BHC (Lindane) ug/Kg	**4/109**										**8**	**30**	**2.2**	**62**
gamma-Chlordane ug/Kg	**23/109**	2.3114808	5.2438375	2.26860521	1.32703451	3.29592717	0.7555017	1.4645212	2.8389378	2.0834362	**0.55**	**42**	**2.2**	**62**
Heptachlor Epoxide ug/Kg	**6/109**										**0.73**	**14**	**2.2**	**62**
Heptachlor ug/Kg	**7/109**										**1.2**	**38**	**2.2**	**62**
Hexachloro-1,3-butadiene ug/Kg	**4/162**										**110**	**860**	**91**	**62**
Hexachlorobenzene ug/Kg	**10/162**										**130**	**790**	**91**	**62**
HPAH ug/Kg	**50/50**	**2917.74**	**12089.652**	**4.14349874**	**-433.34057**	**6268.82057**	**141.5**	**580**	**1493.65**	**1352.15**	**61**	**66884**		
Indeno(1,2,3-cd)pyrene ug/Kg	**14/158**										**58.4**	**1450**	**100**	**62**
Iron MG/KG	**148/149**	11625.846	4959.6926	0.42660917	10829.4709	12422.2212	**-11800**	**-11800**	**14950**	**26750**	**772**	**28300**	**11800**	**11800**
Isopropylbenzene ug/Kg	**1/100**										**7**	**7**	**13**	**11800**
Lead MG/KG	**153/162**	86.988454	117.03982	1.34546381	68.9652418	105.011666	30.206658	55.515395	102.02913	71.822473	**4.6**	**902**	**29.1**	**74.9**
LPAH ug/Kg	**21/21**	**6511.3095**	**20106.542**	**3.08794132**	**-2088.4004**	**15111.0195**	**174**	**615**	**2346**	**2172**	**26**	**73800**		

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
Magnesium MG/KG	**148/149**	4405.6101	1827.4878	0.41480925	4112.17137	4699.04883	**3160**	**4110**	**5165**	**2005**	**1220**	**10700**	**389**	**389**
Manganese MG/KG	**148/149**	161.20592	99.692031	0.61841422	145.198421	177.213411	**-108**	**149**	**194.5**	**302.5**	**5.4**	**934**	**108**	**108**
MCPA (2-Methyl-4-Chlorophenoxyacetic Acid) ug/Kg	**6/100**										**1900**	**6800**	**10000**	**108**
M-Dichlorobenzene ug/Kg	**25/100**	4.7726187	4.8395208	1.0140179	3.82407264	5.72116479	1.9374387	3.6930858	7.0396461	5.1022074	**1**	**32**	**13**	**4260**
Mecoprop ug/Kg	**1/100**										**7900**	**7900**	**10000**	**4260**
Mercury mg/Kg	**145/162**	2.6918706	9.339923	3.46967756	1.25359583	4.13014534	0.4301299	1.0743321	2.6833508	2.2532209	**0.11**	**93.9**	**0.07**	**0.71**
Methyl Acetate ug/Kg	**7/100**										**5**	**22**	**13**	**0.71**
Methyl Mercury MG/KG	**13/13**	**0.0081446**	**0.0051817**	**0.63621716**	**0.00532779**	**0.01096144**	**0.004825**	**0.00718**	**0.01079**	**0.005965**	**0.00174**	**0.0198**		
Methylbenzene ug/Kg	**12/100**										**1**	**300**	**13**	**0**
Methylcyclohexane ug/Kg	**6/100**										**1**	**160**	**13**	**0**
Naphthalene ug/Kg	**2/150**										**59.4**	**220**	**100**	**0**
Nickel MG/KG	**150/162**	21.73289	16.123914	0.74191304	19.2499334	24.2158456	11.594732	17.720409	27.082376	15.487645	**5.1**	**110**	**1.4**	**29.5**
OCDD PG/G	**23/23**	**4393.913**	**2591.1404**	**0.58971136**	**3334.94439**	**5452.8817**	**2500**	**3600**	**6100**	**3600**	**1200**	**12000**		
OCDF PG/G	**22/23**	7361.5164	12292.755	1.66986727	2337.61171	12385.421	**-760**	**2160**	**8500**	**9260**	**310**	**41700**	**760**	**760**
PCB-105 NG/KG	**6/6**	**14643.333**	**11165.391**	**0.76248974**	**5709.15946**	**23577.5072**	**4140**	**13250**	**24825**	**20685**	**3210**	**30900**		
PCB-108 NG/KG	**6/6**	**5808.8333**	**5848.7137**	**1.00686547**	**1128.88769**	**10488.779**	**927.25**	**5195**	**9387.5**	**8460.25**	**865**	**15200**		
PCB-114 NG/KG	**6/6**	**1621**	**2796.8682**	**1.72539676**	**-616.96062**	**3858.96062**	**303.75**	**881.5**	**2567.5**	**2263.75**	**162**	**6040**		
PCB-118 NG/KG	**6/6**	**47856.667**	**35206.161**	**0.73565844**	**19685.8709**	**76027.4624**	**11410**	**46500**	**85375**	**73965**	**9940**	**87700**		
PCB-126 NG/KG	**6/6**	**695.9**	**565.69645**	**0.81289905**	**243.248565**	**1148.55143**	**252.35**	**623.5**	**1119.25**	**866.9**	**79.4**	**1570**		
PCB-127 NG/KG	**4/6**	104.81614	268.39075	2.56058602	-109.94119	319.573474	10.335397	33.610968	109.30371	98.968311	**28.1**	**498**	**5**	**49.8**
PCB-15 NG/KG	**6/6**	**61694.167**	**113588.29**	**1.84115128**	**-29195.398**	**152583.731**	**2941.25**	**25850**	**113075**	**110133.75**	**665**	**245000**		
PCB-156 ng/kg	**6/6**	**7631.6667**	**9445.5549**	**1.23767917**	**73.6486914**	**15189.6846**	**1575**	**4960**	**13147.5**	**11572.5**	**1260**	**23100**		
PCB-157 NG/KG	**6/6**	**1958.5**	**2082.1756**	**1.06314813**	**292.412519**	**3624.58748**	**403.25**	**1505**	**3317.5**	**2914.25**	**320**	**5350**		
PCB-162 NG/KG	**6/6**	**9180**	**6541.4588**	**0.71257722**	**3945.7428**	**14414.2572**	**2377.5**	**9585**	**14550**	**12172.5**	**2010**	**18000**		
PCB-167 NG/KG	**6/6**	**5486.8333**	**9145.3457**	**1.66678031**	**-1830.9673**	**12804.634**	**1072.75**	**3370**	**8282.5**	**7209.75**	**661**	**19900**		
PCB-169 NG/KG	**5/6**	237.32994	481.92984	2.03063226	-148.29424	622.954127	**24.2**	**115.15**	**375.75**	**351.55**	**30.6**	**984**	**5**	**5**
PCB-189 NG/KG	**6/6**	**2669.5**	**6420.5248**	**2.40514134**	**-2467.9898**	**7806.98982**	**488.5**	**974.5**	**3867.5**	**3379**	**190**	**12200**		
PCB-37 ng/kg	**6/6**	**6688**	**14761.509**	**2.20716337**	**-5123.6669**	**18499.6669**	**734.5**	**3010**	**9990**	**9255.5**	**613**	**29100**		
PCB-58 NG/KG	**6/6**	**1141.6667**	**2166.838**	**1.89796027**	**-592.16482**	**2875.49815**	**374.75**	**516.5**	**1679**	**1304.25**	**188**	**4430**		
PCB-60 NG/KG	**6/6**	**6076.6667**	**3621.3191**	**0.59593841**	**3179.00791**	**8974.32542**	**3795**	**5475**	**8867.5**	**5072.5**	**1440**	**11500**		
PCB-61/70 NG/KG	**6/6**	**26626.667**	**17441.614**	**0.65504308**	**12670.4691**	**40582.8643**	**11340**	**26650**	**39525**	**28185**	**6660**	**51300**		
PCB-66 NG/KG	**6/6**	**26883.333**	**34907.676**	**1.29848765**	**-1048.6251**	**54815.2917**	**12925**	**17800**	**37700**	**24775**	**5200**	**82100**		
PCB-77 NG/KG	**6/6**	**2849.5**	**1722.2989**	**0.60442145**	**1471.37384**	**4227.62616**	**1639.25**	**2785**	**4107.5**	**2468.25**	**557**	**5240**		
PCB-79 NG/KG	**6/6**	**1070**	**1380.9646**	**1.2906211**	**-35.001798**	**2175.0018**	**140.25**	**815.5**	**1725**	**1584.75**	**123**	**3330**		
PCB-80 ng/kg	**4/6**	169.16932	438.58448	2.59257699	-181.77135	520.109987	2.1127027	19.267532	175.71701	173.60431	**13.1**	**836**	**4.95**	**5.07**
PCB-81 NG/KG	**6/6**	**961.66667**	**801.82846**	**0.83379043**	**320.070271**	**1603.26306**	**300.5**	**805**	**1645**	**1344.5**	**149**	**2200**		
Phenanthrene ug/Kg	**17/159**										**69.9**	**59000**	**100**	**0**
Phenol ug/Kg	**4/162**										**95**	**1700**	**91**	**0**
Potassium MG/KG	**142/149**	2201.1659	611.61517	0.27785964	2102.9592	2299.37263	1712.5772	2105.9613	2589.707	877.12983	**818**	**3680**	**273**	**2690**
Pyrene ug/Kg	**46/160**	400.75798	1784.1831	4.45202145	124.29594	677.220014	111.13212	215.53642	418.02452	306.8924	**61**	**17300**	**130**	**15000**
Selenium MG/KG	**29/149**										**0.26**	**3.4**	**0.46**	**15000**
Silver MG/KG	**21/162**										**0.04**	**1.8**	**0.1**	**15000**
Sodium MG/KG	**124/149**	15461.516	9602.4849	0.62105713	13919.6505	17003.382	8471.6655	12891.81	19618.193	11146.527	**4900**	**53300**	**1990**	**19400**
Styrene (monomer) ug/Kg	**2/100**										**5**	**11**	**13**	**19400**
Tetrachloroethene ug/Kg	**4/100**										**2**	**14**	**13**	**19400**
Thallium MG/KG	**8/149**										**0.14**	**4.4**	**0.07**	**19400**

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
Total HpCDD PG/G	**23/23**	**850.13043**	**724.61151**	**0.85235334**	**553.990223**	**1146.27065**	**300**	**680**	**1100**	**800**	**110**	**2700**		
Total HpCDF PG/G	**23/23**	**2517.6522**	**4120.9781**	**1.63683377**	**833.456842**	**4201.84751**	**340**	**1200**	**2860**	**2520**	**98**	**14900**		
Total HxCDD PG/G	**23/23**	**305.69565**	**357.28644**	**1.1687652**	**159.676882**	**451.714422**	**106**	**200**	**406**	**300**	**17**	**1500**		
Total HxCDF PG/G	**23/23**	**2089.1739**	**4606.139**	**2.20476571**	**206.699018**	**3971.64881**	**220**	**640**	**2050**	**1830**	**34**	**18600**		
Total Organic Carbon MG/KG	**31/31**	**108684.44**	**73347.953**	**0.6748708**	**82864.0228**	**134504.853**	**48819.969**	**82153.402**	**160347.32**	**111527.36**	**25189.3519**	**284000**		
Total PeCDD PG/G	**14/23**	43.829526	56.93724	1.29906126	20.5599455	67.0991074	7.6305151	20.437911	54.74181	47.111295	**7.9**	**200**	**1.5**	**28**
Total PeCDF PG/G	**23/23**	**1486.7391**	**3512.8455**	**2.36278542**	**51.080428**	**2922.39783**	**120**	**350**	**1480**	**1360**	**40**	**14100**		
Total TCDD PG/G	**22/23**	34.487639	45.31956	1.31408127	15.9660672	53.009211	**8.1**	**20**	**38**	**29.9**	**4**	**163**	**1.8**	**1.8**
Total TCDF PG/G	**23/23**	**1372.0435**	**1931.3166**	**1.40762055**	**582.737076**	**2161.34988**	**290**	**940**	**1700**	**1410**	**77**	**8150**		
TPAH ug/Kg	**53/53**	**5332.5377**	**15699.186**	**2.94403654**	**1105.89762**	**9559.17785**	**150**	**640**	**2262**	**2112**	**26**	**73800**		
Vanadium (Fume Or Dust) mg/Kg	**149/149**	**18.137584**	**5.9019507**	**0.32539895**	**17.1899109**	**19.0852569**	**14.2**	**17.9**	**21.75**	**7.55**	**1.8**	**34.1**		
Xylenes (total) ug/Kg	**5/100**										**2**	**12**	**13**	**0**
Zinc MG/KG	**151/162**	147.45346	99.333843	0.67366235	132.156827	162.75009	67.181079	113.69752	192.42212	125.24104	**9.9**	**468**	**89.5**	**274**
Acid Volatile Sulfide umol/g	**13/13**	**17.236538**	**17.295872**	**1.00344233**	**7.83439514**	**26.6386818**	**4.9925**	**10.2**	**30.85**	**25.8575**	**0.95**	**53.2**		
Cation Exchange Capacity meq/100g	**19/19**	**36.963158**	**15.470735**	**0.41854473**	**30.0066671**	**43.9196487**	**27.4**	**37.8**	**42.4**	**15**	**11.9**	**73.3**		
Diesel Range Organics ug/Kg	**19/19**	**1842105.3**	**4374750.4**	**2.37486451**	**-125022.43**	**3809232.95**	**150000**	**460000**	**1600000**	**1450000**	**71000**	**16000000**		
Field Photoionization Detector ppm	**32/32**	**12.75125**	**15.241195**	**1.19527065**	**7.4704454**	**18.0320546**	**0.625**	**3.57**	**27.875**	**27.25**	**0.1**	**50**		
pH standard units	**19/19**	**7.3710526**	**0.3887098**	**0.05273464**	**7.19626738**	**7.54583789**	**7.2**	**7.3**	**7.6**	**0.4**	**6.6**	**8.3**		
Percent Clay %	**30/30**	**24.172333**	**13.054217**	**0.54004786**	**19.5009418**	**28.8437249**	**14.2**	**26.9**	**33.45**	**19.25**	**2.18**	**47.3**		
Percent Sand %	**30/30**	**32.424**	**22.614436**	**0.6974598**	**24.3315278**	**40.5164722**	**13**	**23.45**	**53.985**	**40.985**	**3.1**	**74.41**		
Percent Silt %	**30/30**	**43.810333**	**14.425507**	**0.32927179**	**38.648232**	**48.9724347**	**29.195**	**44.8**	**55.15**	**25.955**	**22.85**	**76**		

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Regression Equation
ln(y) = 5.6328937661901 + 0.981306658349988*Z
ln(y) = 6.28074124095549 + 1.51933780382071*Z
ln(y) = 4.48938571767664 + 1.67500330583684*Z
ln(y) = 1.36271447629924 + 1.65405934580006*Z
ln(y) = 5.21603411780993 + 1.68794722162732*Z
ln(y) = 2.90925959756418 + 1.19945236031753*Z
ln(y) = 4.00410013734152 + 1.66164231829535*Z
ln(y) = 2.34655428334337 + 1.08337228494137*Z
ln(y) = 1.53223207349939 + 2.71103247775309*Z
ln(y) = 0.835153206660004 + 2.09772460943124*Z
ln(y) = 4.07724375972673 + 1.66087683200434*Z
ln(y) = 2.96922989731046 + 1.844026915701*Z
ln(y) = 3.67786372110407 + 1.78782848312933*Z
ln(y) = 0.297739622414343 + 1.36878553969193*Z
ln(y) = 4.12648101281789 + 1.84264924958434*Z
ln(y) = 4.26591621140744 + 1.55587852681153*Z
ln(y) = 2.26607898454192 + 0.503511425882572*Z
ln(y) = 1.04133505364593 + 1.05719167563875*Z
ln(y) = 0.778591797606986 + 0.860644901141382*Z
ln(y) = 1.9349438527167 + 2.23331206898*Z
ln(y) = 0.435183373912233 + 1.38678262287667*Z
ln(y) = 9.21098957153983 + 0.498756100993452*Z
ln(y) = 3.8323886357612 + 1.35511841498102*Z
ln(y) = 1.22339482666106 + 0.4023004607616*Z
ln(y) = 6.28058343070841 + 1.17283682318046*Z

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Regression Equation
ln(y) = -0.332431957787142 + 0.351054645784649*Z
ln(y) = 1.33151883814235 + 1.55751780302754*Z
ln(y) = 5.3860273975202 + 1.02500252928388*Z
ln(y) = 7.89898312279757 + 0.651522008237112*Z
ln(y) = 1.59717583375347 + 0.762982093453103*Z
ln(y) = 4.00544659247223 + 1.17432348537262*Z
ln(y) = 1.63561860287125 + 0.374240850837913*Z
ln(y) = 4.33588457010163 + 1.03376764879102*Z
ln(y) = -2.64143688994401 + 1.48877227649094*Z
ln(y) = 0.233827865755538 + 1.0630881307342*Z
ln(y) = 1.14470453211389 + 0.809146292922535*Z
ln(y) = 1.19408943226393 + 0.836305645209001*Z
ln(y) = 0.381528336372591 + 0.981774398512903*Z
ln(y) = 6.45307997565527 + 1.64252415639991*Z
ln(y) = 9.24484271686784 + 0.518158944051176*Z
ln(y) = 4.01666037435419 + 0.902711073244488*Z
ln(y) = 6.56155013621451 + 2.14351663366899*Z

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Regression Equation
ln(y) = 8.30916932136992 + 0.418453290559489*Z
ln(y) = 4.94482963990435 + 0.535869374692183*Z
ln(y) = 1.30646237150211 + 0.956846510962935*Z
ln(y) = 7.16991344482702E-02 + 1.35773050950922*Z
ln(y) = -4.99316826950018 + 0.751498315388827*Z
ln(y) = 2.87471702029388 + 0.629150120178633*Z
ln(y) = 8.24588891226726 + 0.598295417015782*Z
ln(y) = 7.84456530662103 + 1.615596595629*Z
ln(y) = 9.30032645396676 + 1.14056353239335*Z
ln(y) = 8.19673361297963 + 1.4532582591274*Z
ln(y) = 6.73618300211473 + 1.58587029742854*Z
ln(y) = 10.4534959599969 + 1.18710334247361*Z
ln(y) = 6.19437693709826 + 1.31100802651008*Z
ln(y) = 3.51485244390219 + 1.74917957288366*Z
ln(y) = 9.71481213935488 + 2.7366929934359*Z
ln(y) = 8.46891136956038 + 1.3882598736107*Z
ln(y) = 7.14990276768248 + 1.37270818483197*Z
ln(y) = 8.83356598284842 + 1.13362324789599*Z
ln(y) = 8.01889699497246 + 1.47768604141936*Z
ln(y) = 4.50306433631717 + 1.95058718361454*Z
ln(y) = 6.96475697851597 + 1.61181882938455*Z
ln(y) = 7.92616059962902 + 1.68291845779504*Z
ln(y) = 6.47376978659576 + 1.23626986612491*Z
ln(y) = 8.54218241380626 + 0.85206348270561*Z
ln(y) = 9.97690456547232 + 0.963935606338245*Z
ln(y) = 9.85515706603559 + 1.06732994454165*Z
ln(y) = 7.75024437103132 + 0.953155753774896*Z
ln(y) = 6.37926323337175 + 1.62007045159056*Z
ln(y) = 2.95842141292247 + 3.2786843650898*Z
ln(y) = 6.53766067915644 + 1.23989961341808*Z
ln(y) = 7.6525273238864 + 0.306698345647079*Z
ln(y) = 5.37312991663542 + 0.982528682015333*Z
ln(y) = 9.46434751388331 + 0.622770497114229*Z

Table D-11
Bayou d'Inde - Marsh Energy System
Summary Statistics - Surface Sediment Results

Regression Equation
ln(y) = 6.43413317749206 + 0.91475375258668*Z
ln(y) = 6.92496305684267 + 1.53534419495595*Z
ln(y) = 5.22511961019091 + 1.1898677683111*Z
ln(y) = 6.50391120039014 + 1.75005642381143*Z
ln(y) = 11.3731838379534 + 0.749019015300326*Z
ln(y) = 3.01739156641016 + 1.46136469966447*Z
ln(y) = 6.1521766323818 + 1.68348640970532*Z
ln(y) = 2.94566243821655 + 1.25266494903793*Z
ln(y) = 6.63582063746584 + 1.2635109671072*Z
ln(y) = 6.65276990515827 + 1.91760304857869*Z
ln(y) = 2.83694426693577 + 0.367448661960417*Z
ln(y) = 4.7335415736112 + 0.780418868048037*Z
ln(y) = 2.31309817429276 + 1.36571092230773*Z
ln(y) = 3.52232121414464 + 0.487167844395198*Z
ln(y) = 13.2797255657019 + 1.6281769797495*Z
ln(y) = 1.19427593407207 + 2.18705051372836*Z
ln(y) = 1.99631976154102 + 5.53641537058388E-02*Z
ln(y) = 2.92537562395931 + 0.867822682013559*Z
ln(y) = 3.14134201400153 + 0.988511477028769*Z
ln(y) = 3.72405895863226 + 0.370197301147731*Z

v a 40% detection threshold.

Table D-12
Bayou d'Inde - Marsh Energy System
Summary Statistics - Phase I Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Acetone ug/L	4/8	15.136446	19.85523	1.31174978	1.3774738	28.8954186	4.40713	-10	19.25	14.84287	6	55	10	10	ln(y) = 2.25231467662547 + 1.14076441775927*Z
Aldrin ug/L	1/8										0.033	0.033	0.0079	10	
alpha-BHC ug/L	1/8										0.0066	0.0066	0.045	10	
Aluminum (Fume Or Dust) mg/L Dissolved	1/8										0.05	0.05	0.0222	10	
Aluminum (Fume Or Dust) mg/L Total	7/8	0.8588872	0.9419472	1.0967066	0.20615104	1.51162329	0.39	0.564	1.115	0.725	0.36	2.7	0.173	0.173	ln(y) = -0.457178068685139 + 0.969120553565805*Z
Ammonia as N mg/L	3/3	2.02	1.9750345	0.97773985	-0.2149619	4.25496192	0.96	1.3	3.8	2.84	0.96	3.8			ln(y) = 0.518847778893192 + 1.02035391816323*Z
Aroclor-1254 ug/L	1/8										0.21	0.21	0.91	0	
Arsenic mg/L Dissolved	1/8										0.0041	0.0041	0.002	0	
Barium mg/L Dissolved	8/8	0.133	0.0205676	0.15464337	0.1187474	0.1472526	0.1185	0.13	0.13925	0.02075	0.116	0.173			ln(y) = -2.02530303490334 + 0.151038247846387*Z
Barium mg/L Total	8/8	0.22575	0.2558269	1.133231	0.048471	0.403029	0.1305	0.146	0.23325	0.10275	0.123	0.712			ln(y) = -1.6928016844612 + 0.603150332947471*Z
beta-BHC ug/L	1/8										0.046	0.046	0.045	0	
Bromide mg/L	3/3	40.633333	10.631635	0.26164811	28.602506	52.6641607	31.5	45	45.4	13.9	31.5	45.4			ln(y) = 3.69072071354974 + 0.271084579612355*Z
Cadmium mg/L Dissolved	2/8										0.0016	0.0018	0.0011	0	
Cadmium mg/L Total	2/8										0.0016	0.002	0.0011	0	
Calcium Metal mg/L Dissolved	8/8	200.25	23.137278	0.11554196	184.216684	216.283316	192.5	206	213.75	21.25	155	222			ln(y) = 5.29438469400005 + 0.122087584230456*Z
Calcium Metal mg/L Total	8/8	205	21.326602	0.1040322	190.221419	219.778581	196.5	206	212.75	16.25	169	240			ln(y) = 5.31877162458628 + 0.115511778765937*Z
Caprolactam ug/L	1/8										84	84	9	0	
Chromium mg/L Total	4/8	0.0035907	0.0113557	3.16253089	-0.0042784	0.01145979	0.0001844	0.0007773	0.0032769	0.0030926	0.001	0.0234	0.001	0.05	ln(y) = -7.1597076959655 + 2.13421504204552*Z
Cobalt mg/L Total	1/8										0.014	0.014	0.0023	0.05	
Copper mg/L Dissolved	7/8	0.0055932	0.0013362	0.23889699	0.00466723	0.00651909	0.0049	0.00535	0.0065	0.0016	0.0049	0.0079	0.003	0.003	ln(y) = -5.20280257839857 + 0.250555069267433*Z
Copper mg/L Total	8/8	0.0159	0.0138098	0.86854089	0.0063303	0.0254697	0.01025	0.012	0.015825	0.005575	0.0089	0.0422			ln(y) = -4.272050949452 + 0.52592784824092*Z
delta-BHC ug/L	1/8										0.018	0.018	0.0071	0	
Dichloromethane ug/L	1/8										1	1	10	0	
Ethylbenzene ug/L	1/8										1	1	10	0	
Heptachlor ug/L	1/8										0.039	0.039	0.045	0	
Iron mg/L Total	6/8	0.6792732	0.9938719	1.46314006	-0.0094448	1.36799133	0.1630618	0.3853573	0.9106994	0.7476376	0.0796	2.61	0.31	1.01	ln(y) = -0.953584313458377 + 1.27566854768928*Z
Lead mg/L Dissolved	3/8										0.00016	0.0021	0.001	1.01	
Lead mg/L Total	7/8	0.0030078	0.0011192	0.37209499	0.00223225	0.00378337	0.002125	0.00305	0.004025	0.0019	0.0021	0.0043	0.00038	0.00038	ln(y) = -5.86316576871893 + 0.433031936994597*Z
Magnesium mg/L Dissolved	8/8	627.25	91.561972	0.14597365	563.800791	690.699209	609	656	669.25	60.25	448	677			ln(y) = 6.43361850299908 + 0.133294518299043*Z
Magnesium mg/L Total	8/8	641.875	65.531818	0.10209436	596.463767	687.286233	585.5	636.5	683	97.5	559	755			ln(y) = 6.46026981770651 + 0.11737154405466*Z
Manganese mg/L Dissolved	7/8	0.1584799	0.0926332	0.58451101	0.09428833	0.22267144	-0.13	0.162	0.225	0.355	0.0677	0.314	0.13	0.13	ln(y) = -1.99822102530482 + 0.683133213713896*Z
Manganese mg/L Total	8/8	0.1889	0.104436	0.55286404	0.11652953	0.26127047	0.09925	0.175	0.302	0.20275	0.0762	0.338			ln(y) = -1.80203464364298 + 0.683909474742984*Z
Mercury mg/L Dissolved	1/8										0.000078	0.000078	0.000052	0	
Mercury mg/L Total	8/8	0.0001658	8.876E-05	0.53553289	0.00010424	0.00022726	0.0001025	0.00017	0.0001975	0.000095	0.000056	0.00033			ln(y) = -8.82256468273818 + 0.646430105974465*Z
Methyl tert-Butyl Ether ug/L	1/8										12	12	10	0	
Methylbenzene ug/L	1/8										4	4	10	0	
Nickel mg/L Dissolved	7/8	0.0064193	0.0011416	0.17784302	0.0056282	0.00721042	-0.2	-0.2	-0.2	0	0.0054	0.0086	0.2	0.2	ln(y) = -5.05859075009218 + 0.192272424222859*Z
Nickel mg/L Total	6/8	0.0074196	0.0010568	0.14243854	0.00668728	0.00815199	0.0065935	0.0073848	0.0082709	0.0016774	0.0066	0.009	0.0021	0.2	ln(y) = -4.90833788659188 + 0.168093508732053*Z
Potassium mg/L Dissolved	8/8	207	22.856126	0.11041607	191.161513	222.838487	201.5	215.5	219.5	18	162	221			ln(y) = 5.32828323769435 + 0.105469949405873*Z
Potassium mg/L Total	8/8	211.5	19.012977	0.08989587	198.324679	224.675321	194	211	222	28	189	245			ln(y) = 5.35105555011519 + 0.102633230039552*Z
Selenium mg/L Dissolved	7/8	0.0065327	0.0030195	0.46220705	0.00444034	0.00862512	0.003675	0.0071	0.00805	0.004375	0.0026	0.01	0.002	0.002	ln(y) = -5.11483515287083 + 0.506384230603736*Z
Selenium mg/L Total	7/8	0.0077711	0.002607	0.33547411	0.00596457	0.00957771	0.0065	0.00705	0.010175	0.003675	0.0065	0.012	0.0022	0.0022	ln(y) = -4.89477307573589 + 0.350895816712622*Z
Sodium mg/L Dissolved	7/7	5844.2857	1734.1331	0.29672285	4559.62194	7128.94949	5400	5630	6070	670	3730	8920			ln(y) = 8.64497814264114 + 0.291188184200829*Z
Sodium mg/L Total	7/7	6001.4286	2047.0468	0.34109326	4484.95506	7517.90209	4750	5590	6080	1330	4490	9690			ln(y) = 8.67024605480455 + 0.287900521313293*Z
Thallium mg/L Dissolved	4/8										0.0045	0.0045	0.00031	0	
Total Organic Carbon mg/L	3/3	4.9333333	0.393599	0.07978359	4.48793408	5.37873258	4.6	4.9	5.3	0.7	4.6	5.3			ln(y) = 1.5943327763899 + 0.105052505780445*Z
Tribromomethane ug/L	1/8										2	2	10	0	

Table D-12
Bayou d'Inde - Marsh Energy System
Summary Statistics - Phase I Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Vanadium (Fume Or Dust) mg/L Dissolved	**5/8**	0.0022367	0.0011183	0.49996058	0.00146177	0.0030116	0.0014432	0.0020719	0.0029746	0.0015314	**0.002**	**0.0043**	**0.002**	**0.25**	ln(y) = -6.17928721967824 + 0.536391951405457*Z
Vanadium (Fume Or Dust) mg/L Total	**7/8**	0.0037381	0.002876	0.76938146	0.0017451	0.00573104	**-0.25**	**-0.25**	**-0.25**	**0**	**0.0023**	**0.009**	**0.25**	**0.25**	ln(y) = -5.68263674180405 + 0.460975932316925*Z
Xylenes (total) ug/L	**1/8**										**5**	**5**	**10**	**0.25**	
Zinc mg/L Dissolved	**1/8**										**0.01**	**0.01**	**0.0098**	**0.25**	
Bicarbonate Alkalinity mg/L	**3/3**	**90.966667**	**15.540991**	**0.1708427**	**73.3803797**	**108.552954**	**76.4**	**95.5**	**101**	**24.6**	**76.4**	**101**			ln(y) = 4.50340982016681 + 0.207017440722087*Z
Biochemical Oxygen Demand mg/L	**2/3**										**3.5**	**7.3**	**4**	**0**	
Chemical Oxygen Demand (COD) mg/L	**3/3**	**144.8**	**100.52618**	**0.6942416**	**31.0439147**	**258.556085**	**55.4**	**183**	**196**	**140.6**	**55.4**	**196**			ln(y) = 4.83406013527506 + 0.93707758730443*Z
Chloride mg/L	**3/3**	**9606.6667**	**680.98811**	**0.07088703**	**8836.05607**	**10377.2773**	**8960**	**9760**	**10100**	**1140**	**8960**	**10100**			ln(y) = 9.16895462940182 + 8.88216597887343E-02*Z
Dissolved Oxygen %	**110/110**	**10.459045**	**3.4868956**	**0.33338565**	**9.80741905**	**11.1106719**	**8.2**	**9.975**	**12.3**	**4.1**	**3.29**	**19.9**			ln(y) = 2.29172950652721 + 0.350287267354794*Z
Field Conductivity ms/cm	**111/111**	**21845.562**	**13312.091**	**0.60937281**	**19369.0471**	**24322.076**	**3300**	**27800**	**32200**	**28900**	**499**	**39200**			ln(y) = 9.57195981566774 + 1.0081290029755*Z
Field pH standard units	**111/111**	**7.8739489**	**0.638655**	**0.08110987**	**7.75513679**	**7.99276111**	**7.39**	**7.82**	**8.3**	**0.91**	**6.56**	**9.42**			ln(y) = 2.06031900717817 + 8.33323749466006E-02*Z
Field Specific Gravity NO UNITS	**110/110**	**12.671212**	**2.9587424**	**0.23350113**	**12.1182863**	**13.224138**	**12**	**13**	**14**	**2**	**1**	**19**			ln(y) = 2.49164223018694 + 0.294308681435034*Z
Field Temperature deg c	**111/111**	**17.718483**	**4.5055482**	**0.2542852**	**16.880294**	**18.556673**	**14.6**	**17**	**20.8**	**6.2**	**2**	**32.7**			ln(y) = 2.83252447865342 + 0.292393916835173*Z
Field Total Dissolved Solids mg/L	**110/110**	**18316.667**	**4095.6507**	**0.2236024**	**17551.2772**	**19082.0566**	**17000**	**18000**	**20000**	**3000**	**3100**	**43000**			ln(y) = 9.78873831677326 + 0.220093564503354*Z
Field Turbidity NTU	**106/106**	**169.08019**	**280.9788**	**1.66180794**	**115.589684**	**222.570693**	**21.75**	**52.5**	**145**	**123.25**	**0.3**	**990**			ln(y) = 4.04142842556618 + 1.57336280566986*Z
Fluoride mg/L	**1/3**										**5.2**	**5.2**	**20**	**0**	
Hardness, as CaCO3 mg/L	**3/3**	**3203.3333**	**314.80042**	**0.09827276**	**2847.10313**	**3559.56354**	**3050**	**3080**	**3480**	**430**	**3050**	**3480**			ln(y) = 8.07012310611253 + 9.78143189599506E-02*Z
Nitrate-Nitrite mg/L	**3/3**	**0.1813333**	**0.1674855**	**0.92363346**	**-0.0081944**	**0.37086106**	**0.064**	**0.14**	**0.34**	**0.276**	**0.064**	**0.34**			ln(y) = -1.93126490445574 + 1.23857122212265*Z
Salinity ppt	**110/110**	**18.448485**	**3.9455105**	**0.21386637**	**17.7111531**	**19.1858166**	**17**	**19**	**21**	**4**	**2**	**25**			ln(y) = 2.87772879296135 + 0.263597321669273*Z
Sulfate mg/L	**3/3**	**1280**	**126.64787**	**0.09894365**	**1136.68444**	**1423.31556**	**1160**	**1300**	**1380**	**220**	**1160**	**1380**			ln(y) = 7.15204453523376 + 0.128794342519135*Z
Total Alkalinity mg/L	**3/3**	**90.966667**	**15.540991**	**0.1708427**	**73.3803797**	**108.552954**	**76.4**	**95.5**	**101**	**24.6**	**76.4**	**101**			ln(y) = 4.50340982016681 + 0.207017440722087*Z
Total Kjeldahl Nitrogen mg/L	**2/3**										**2.3**	**3.9**	**1.2**	**0**	
Total Suspended Solids mg/L	**3/3**	**100**	**183.27999**	**1.83279992**	**-107.40084**	**307.400836**	**8.8**	**29.2**	**262**	**253.2**	**8.8**	**262**			ln(y) = 3.70575497817316 + 2.51679579269024*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-13
Bayou d'Inde - Marsh Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen	**21/21**	**6.8392857**	**2.6030956**	**0.38060928**	**5.72592332**	**7.95264811**	**5.24**	**6.5**	**8.24**	**3**	**3.02**	**11.75**			ln(y) = 1.85067047120742 + 0.439057723216093*Z
Field Conductivity	**21/21**	**17781.238**	**34299.091**	**1.92894839**	**3111.27469**	**32451.2015**	**1875**	**3140**	**26975**	**25100**	**242**	**135000**			ln(y) = 8.64740378864521 + 1.81792475998275*Z
Field pH	**21/21**	**7.1692857**	**0.285295**	**0.03979406**	**7.04726303**	**7.2913084**	**7.005**	**7.185**	**7.32**	**0.315**	**6.56**	**7.83**			ln(y) = 1.96907779908945 + 4.27756034540191E-02*Z
Field Redox Potential	**17/21**	159.24394	117.72142	0.73925208	108.893662	209.594225	54.558956	109.86408	221.23069	166.67173	**16.5**	**357**	**22**	**117.92**	ln(y) = 4.69924394368856 + 1.03822803118613*Z
Field Specific Gravity	**9/9**	**6.9444444**	**4.2148765**	**0.60694222**	**4.19072513**	**9.69816375**	**3**	**7**	**11.25**	**8.25**	**1**	**12**			ln(y) = 1.64136859083951 + 1.05101382378178*Z
Field Temperature	**21/21**	**20.57619**	**4.8422057**	**0.23533052**	**18.5051449**	**22.6472361**	**15.8**	**21.7**	**25.0325**	**9.2325**	**13.28**	**27.78**			ln(y) = 2.99593610222391 + 0.262963585227165*Z
Field Total Dissolved Solids	**21/21**	**12723.81**	**7256.3246**	**0.57029497**	**9620.22823**	**15827.3908**	**5550**	**15000**	**18500**	**12950**	**800**	**24500**			ln(y) = 9.11659888075846 + 1.02665865777918*Z
Field Turbidity	**21/21**	**6.3071429**	**6.5668223**	**1.04117228**	**3.49846657**	**9.11581914**	**2.45**	**3.5**	**5.45**	**3**	**1.8**	**22.5**			ln(y) = 1.49078823849442 + 0.809050049677841*Z
Salinity	**21/21**	**12.595238**	**7.8321697**	**0.62183578**	**9.24536379**	**15.9451124**	**5.5**	**13.5**	**19**	**13.5**	**1**	**26.5**			ln(y) = 2.13019616471455 + 1.13295062360206*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-14
Bayou d'Inde - Marsh Energy System
Summary Statistics - Pore Water Results

Constituents	Detected Value	Mean	Standard Deviation	Coefficient of	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
	Frequency			Variation	Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1'-Biphenyl	7/7	0.0000038	0.0000016	0.4236337	0.0000026	0.0000050	0.0000025	0.0000035	0.0000047	0.0000022	0.0000023	0.0000066			ln(y) = -12.5423258877135 + 0.465210471782772*Z
1,2,4,5-Tetrachlorobenzene	5/7	0.0000027	0.0000016	0.5911183	0.0000015	0.0000040	0.0000014	0.0000023	0.0000039	0.0000024	0.0000019	0.0000050	0.0000001	0.0000006	ln(y) = -12.9636280378949 + 0.740781122627603*Z
1,2-Benzphenanthracene	7/7	0.0000019	0.0000007	0.3482437	0.0000014	0.0000024	0.0000012	0.000002	0.0000023	0.0000011	0.0000009	0.0000027			ln(y) = -13.248008680406 + 0.469954225478312*Z
1,6,7-Trimethylnaphthalene	7/7	0.0000067	0.0000052	0.7706595	0.0000029	0.0000105	0.0000026	0.000006	0.0000086	0.000006	0.000002	0.0000159			ln(y) = -12.1248242349 + 0.900455158078257*Z
1-Methylnaphthalene	7/7	0.0000066	0.0000013	0.1928231	0.0000057	0.0000076	0.0000063	0.0000064	0.0000077	0.0000014	0.0000044	0.0000078			ln(y) = -11.9399035749382 + 0.225994468452477*Z
1-Methylphenanthrene	7/7	0.0000095	0.0000159	1.6835558	-0.0000023	0.0000213	0.0000015	0.000002	0.0000189	0.0000174	0.0000004	0.0000383			ln(y) = -12.5900112048828 + 1.90459512425987*Z
2,4' DDD	1/7										0.0000008	0.0000008	0.0000001	0	
2,4' DDE	2/7										0.0000012	0.0000053	0.0000001	0	
2,4' DDT	4/7	0.0000044	0.0000078	1.7486031	-0.0000013	0.0000102	0.0000000	0.0000002	0.0000035	0.0000034	0.0000003	0.0000177	0.0000001	0.0000002	ln(y) = -15.3297308148633 + 4.08361579370823*Z
2,6-Dimethylnaphthalene	7/7	0.0000033	0.0000010	0.3085615	0.0000025	0.0000040	0.0000027	0.000003	0.0000042	0.0000015	0.0000023	0.000005			ln(y) = -12.6592320569874 + 0.328631665771747*Z
2-Methylnaphthalene	7/7	0.0000074	0.0000014	0.1950551	0.0000063	0.0000084	0.0000064	0.0000074	0.0000086	0.0000022	0.0000054	0.0000095			ln(y) = -11.8351607233448 + 0.237846614802252*Z
4,4'-DDD	4/7	0.0000117	0.0000171	1.4686739	-0.0000010	0.0000243	0.0000005	0.0000027	0.0000146	0.0000141	0.0000025	0.0000378	0.0000001	0.0000002	ln(y) = -12.8288289790523 + 2.51442435700869*Z
4,4'-DDT	1/7										0.0000001	0.0000001	0.0000001	0.0000002	
Acenaphthene	7/7	0.0000166	0.0000100	0.6020311	0.0000092	0.0000240	0.0000045	0.0000228	0.0000248	0.0000203	0.0000039	0.0000256			ln(y) = -11.247105188223 + 0.952419293391395*Z
Acenaphthylene	7/7	0.0000032	0.0000026	0.8146405	0.0000013	0.0000052	0.0000015	0.0000018	0.0000061	0.0000046	0.0000015	0.0000076			ln(y) = -12.863986418841 + 0.78940943782034*Z
Aldrin	1/7										0.0000077	0.0000077	0.0000000	0	
alpha-BHC	7/7	0.0000026	0.0000026	0.9962647	0.0000007	0.0000045	0.0000005	0.0000009	0.0000052	0.0000048	0.0000004	0.0000059			ln(y) = -13.4659499242215 + 1.46672111359835*Z
alpha-Chlordane	1/7										0.0000001	0.0000001	0.0000001	0	
Ammonia as N	13/13	1.0215385	0.4567123	0.4470828	0.7732668	1.2698101	0.75	0.85	1.375	0.625	0.27	1.8			ln(y) = -8.56399198230991E-02 + 0.575681316608147*Z
Anthracene	7/7	0.0000105	0.0000260	2.4673236	-0.0000087	0.0000298	0.0000032	0.0000034	0.0000049	0.0000017	0.0000026	0.0000524			ln(y) = -12.1776938056193 + 1.01669974140582*Z
Benzo(a)anthracene	7/7	0.0000009	0.0000003	0.3580602	0.0000006	0.0000011	0.0000006	0.0000009	0.000001	0.0000004	0.0000005	0.0000014			ln(y) = -14.0014198651549 + 0.416749746193307*Z
Benzo(a)pyrene	7/7	0.0000005	0.0000003	0.6190615	0.0000003	0.0000008	0.0000002	0.0000004	0.0000009	0.0000007	0.0000002	0.000001			ln(y) = -14.6251739048272 + 0.796741167419344*Z
Benzo(b)fluoranthene	7/7	0.0000010	0.0000002	0.2331614	0.0000008	0.0000012	0.0000007	0.000001	0.0000012	0.0000005	0.0000007	0.0000012			ln(y) = -13.8543313769862 + 0.286014939829064*Z
Benzo(e)pyrene	7/7	0.0000011	0.0000002	0.2323469	0.0000009	0.0000012	0.0000009	0.000001	0.0000013	0.0000004	0.0000007	0.0000014			ln(y) = -13.7823518120648 + 0.286190057048873*Z
Benzo(g,h,i)perylene	7/7	0.0000005	0.0000002	0.4466784	0.0000003	0.0000007	0.0000005	0.0000005	0.0000007	0.0000002	0.0000001	0.0000007			ln(y) = -14.6163965788668 + 0.671400546225207*Z
Benzo(k)fluoranthene	7/7	0.0000004	0.0000002	0.4847209	0.0000002	0.0000005	0.0000002	0.0000004	0.0000005	0.0000003	0.0000002	0.0000007			ln(y) = -14.8591180175987 + 0.572163783430808*Z
beta-BHC	5/7	0.0000057	0.0000071	1.2534699	0.0000004	0.0000109	0.0000003	0.0000015	0.0000082	0.0000080	0.0000001	0.0000137	0.0000001	0.0000002	ln(y) = -13.429079756992 + 2.55046497094268*Z
Cadmium	3/7	0.0000634	0.0000266	0.4189992	0.0000437	0.0000830	0.0000439	0.0000592	0.0000799	0.0000360	0.00007	0.0001	0.000051	0.000063	ln(y) = -9.73431189203389 + 0.444532697960515*Z
Chlorpyrifos	1/7										0.0000014	0.0000014	0.0000002	0.000063	
Cis-Nonachlor	2/7										0.0000135	0.0000168	0.0000001	0.000063	
Conductivity	13/13	17.9	0.3060467	0.0170976	17.733631	18.066369	17.65	17.9	18.05	0.4	17.5	18.6			ln(y) = 2.88467694567331 + 1.83984233078898E-02*Z
Copper	7/7	0.0066229	0.0010028	0.1514192	0.00588	0.0073658	0.00575	0.00644	0.00751	0.00176	0.00516	0.0078			ln(y) = -5.02696713317332 + 0.187495856180585*Z
delta-BHC	4/7	0.0000016	0.0000027	1.6308251	-0.0000003	0.0000036	0.0000001	0.0000003	0.0000015	0.0000014	0.0000001	0.0000057	0.0000001	0.0000003	ln(y) = -15.0155244607649 + 2.37505201466887*Z
Dibenzo(a,h)anthracene	7/7	0.0000003	0.0000003	0.8543673	0.0000001	0.0000005	0.0000001	0.0000002	0.0000006	0.0000005	0.0000000	0.0000006			ln(y) = -15.4810974115569 + 1.51413522030451*Z
Dibenzothiophene	7/7	0.0000004	0.0000001	0.2709495	0.0000003	0.0000005	0.0000003	0.0000004	0.0000005	0.0000002	0.0000003	0.0000006			ln(y) = -14.7241949306215 + 0.303789669130316*Z
Dieldrin	1/7										0.0000007	0.0000007	0.0000001	0	
Dissolved Oxygen	13/13	6.1769231	0.3557079	0.0575866	5.983558	6.3702881	6	6.1	6.4	0.4	5.5	6.8			ln(y) = 1.81936276655362 + 6.37985838758462E-02*Z
Endrin	6/7	0.0000066	0.0000074	1.1168122	0.0000011	0.0000121	0.0000028	0.0000048	0.0000092	0.0000063	0.0000028	0.0000199	0.0000001	0.0000001	ln(y) = -12.2625806624154 + 1.05996049242649*Z
Fluoranthene	7/7	0.0000091	0.0000035	0.3879094	0.0000065	0.0000117	0.0000045	0.0000107	0.0000113	0.0000068	0.0000041	0.0000127			ln(y) = -11.6903818403984 + 0.528795365171913*Z
Fluorene	7/7	0.0000192	0.0000119	0.6207695	0.0000104	0.0000280	0.000013	0.0000165	0.000024	0.000011	0.000006	0.0000403			ln(y) = -10.9985727939347 + 0.705760906488738*Z
gamma-BHC (Lindane)	4/7	0.0000012	0.0000013	1.1577517	0.0000002	0.0000021	0.0000003	0.0000007	0.0000017	0.0000014	0.0000006	0.0000026	0.0000001	0.0000002	ln(y) = -14.1042486998601 + 1.20344314096096*Z
gamma-Chlordane	2/7										0.0000000	0.0000002	0.0000001	0.0000002	
Hardness, as CaCO3	13/13	2137.6923	412.61233	0.1930176	1913.3937	2361.9909	2080	2280	2310	230	1060	2380			ln(y) = 7.65015554852723 + 0.174559519627087*Z
Heptachlor Epoxide	2/7										0.0000013	0.0000019	0.0000001	0	
Hexachlorobenzene	7/7	0.0000024	0.0000028	1.140165	0.0000004	0.0000045	0.0000002	0.0000004	0.0000052	0.0000050	0.0000001	0.0000063			ln(y) = -13.8935963811664 + 1.99690313257995*Z
Hydrogen Sulfide	13/13	0.0396154	0.0196710	0.496549	0.0289221	0.0503087	0.025	0.034	0.0505	0.0255	0.021	0.082			ln(y) = -3.32344667278838 + 0.497867726038911*Z
Indeno(1,2,3-cd)pyrene	7/7	0.0000005	0.0000002	0.4240882	0.0000003	0.0000006	0.0000003	0.0000006	0.0000006	0.0000003	0.0000002	0.0000007			ln(y) = -14.6593013202961 + 0.566464268574462*Z
Lead	7/7	0.0004043	0.0001839	0.4549951	0.000268	0.0005406	0.00029	0.00036	0.00065	0.00036	0.00021	0.00066			ln(y) = -7.89326932772469 + 0.515902202268981*Z
Mean Dissolved Organic Carbon	13/13	14.306062	6.005877	0.4198134	11.04123	17.570893	9.83285	13.9129	19.0177	9.18485	2.5210000	23.0873			ln(y) = 2.54178330394914 + 0.607311774303513*Z
Mirex	4/7	0.0000022	0.0000041	1.8515257	-0.0000008	0.0000052	0.0000001	0.0000004	0.0000020	0.0000020	0.0000001	0.0000095	0.0000002	0.0000004	ln(y) = -14.8494683674899 + 2.58757820426754*Z
Naphthalene	7/7	0.0000143	0.0000027	0.1882254	1.233E-05	1.633E-05	0.0000131	0.0000156	0.0000158	0.0000027	0.0000095	0.0000166			ln(y) = -11.1680125067308 + 0.215289481529949*Z

Table D-14
Bayou d'Inde - Marsh Energy System
Summary Statistics - Pore Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean Lower	95% Confidence Limit about the Mean Upper	Percentiles 25th	Percentiles Median	Percentiles 75th	Percentiles IQR	Range of Detected Values Minimum	Range of Detected Values Maximum	Reporting Limit Minimum	Reporting Limit Maximum	Regression Equation
Nickel	**7/7**	**0.0132786**	**0.0252639**	**1.9026093**	**-0.005437**	**0.0319944**	**0.0058**	**0.00613**	**0.00795**	**0.00215**	**0.00512**	**0.0543**			ln(y) = -4.75064521527094 + 0.798896749925331*Z
Oxychlordane	**2/7**										**0.0000004**	**0.0000027**	**0.0000001**	**0**	
PCB-101/90	**2/7**										**0.0000003**	**0.0000005**	**0.0000002**	**0**	
PCB-105	**5/7**	0.0000071	0.0000106	1.5019555	-0.0000008	0.0000149	0.0000002	0.0000012	0.0000089	0.0000087	**0.0000004**	**0.0000241**	**0.0000001**	**0.0000002**	ln(y) = -13.6466225078664 + 2.98744892229407*Z
PCB-110/77	**1/7**										**0.0000004**	**0.0000004**	**0.0000001**	**0.0000002**	
PCB-118	**3/7**	0.0000014	0.0000020	1.3903823	0.0000000	0.0000029	0.0000004	0.0000008	0.0000020	0.0000016	**0.0000006**	**0.0000052**	**0.0000007**	**0.0000015**	ln(y) = -13.9851969128977 + 1.24520274523993*Z
PCB-138 /160	**7/7**	**0.0000249**	**0.0000280**	**1.1235317**	**0.0000042**	**0.0000456**	**0.0000073**	**0.0000103**	**0.0000607**	**0.0000534**	**0.0000069**	**0.0000680**			ln(y) = -11.0613192589599 + 1.100657568749*Z
PCB-18/17	**3/7**	0.0000080	0.0000120	1.4957737	-0.0000009	0.0000169	0.0000013	0.0000039	0.0000113	0.0000100	**0.0000070**	**0.0000250**	**0.0000001**	**0.0000003**	ln(y) = -12.4615313736868 + 1.59020709953978*Z
PCB-180	**4/7**	0.0000006	0.0000013	2.1214424	-0.0000004	0.0000016	0.0000001	0.0000003	0.0000007	0.0000006	**0.0000002**	**0.0000029**	**0.0000002**	**0.0000003**	ln(y) = -15.0844044154117 + 1.43630477903083*Z
PCB-187	**4/7**	0.0000013	0.0000017	1.3181377	0.0000000	0.0000025	0.0000001	0.0000005	0.0000018	0.0000017	**0.0000005**	**0.0000038**	**0.0000002**	**0.0000004**	ln(y) = -14.5190709310955 + 1.92472695756315*Z
PCB-206	**2/7**										**0.0000000**	**0.0000000**	**0.0000001**	**0.0000004**	
PCB-29/26	**2/7**										**0.0000002**	**0.0000008**	**0.0000001**	**0.0000004**	
PCB-44	**3/7**	0.0000004	0.0000011	2.659809	-0.0000004	0.0000012	0.0000000	0.0000001	0.0000005	0.0000005	**0.0000002**	**0.0000013**	**0.0000001**	**0.0000004**	ln(y) = -15.9487462660951 + 2.08078564490472*Z
PCB-52	**3/7**	0.0000017	0.0000026	1.5267692	-0.0000002	0.0000037	0.0000002	0.0000008	0.0000024	0.0000022	**0.0000015**	**0.0000058**	**0.0000001**	**0.0000002**	ln(y) = -14.1003769346014 + 1.72410046737122*Z
PCB-8/5	**3/7**	0.0000058	0.0000102	1.7516293	-0.0000017	0.0000134	0.0000004	0.0000016	0.0000072	0.0000069	**0.0000039**	**0.0000227**	**0.0000001**	**0.0000002**	ln(y) = -13.3376145601617 + 2.22274383281005*Z
PCB-87/115	**1/7**										**0.0000015**	**0.0000015**	**0.0000001**	**0.0000002**	
Pentachloroanisole	**6/7**	0.0000012	0.0000013	1.1257863	0.0000002	0.0000022	**-0.0000003**	**0.0000004**	**0.0000023**	**0.0000026**	**0.0000001**	**0.0000034**	**0.0000003**	**0.0000003**	ln(y) = -14.3993909986435 + 1.68706857799348*Z
Pentachlorobenzene	**6/7**	0.0000012	0.0000015	1.1751241	0.0000002	0.0000023	**-0.0000001**	**0.0000003**	**0.0000028**	**0.0000030**	**0.0000001**	**0.0000035**	**0.0000001**	**0.0000001**	ln(y) = -14.5367899346369 + 1.92893770074296*Z
Perylene	**7/7**	**0.0000027**	**0.0000026**	**0.9807888**	**0.0000007**	**0.0000047**	**0.0000012**	**0.0000017**	**0.0000039**	**0.0000027**	**0.0000011**	**0.0000075**			ln(y) = -13.0589395469991 + 0.813524369957817*Z
pH	**13/13**	**8.3076923**	**0.1397377**	**0.0168203**	**8.23173**	**8.3836546**	**8.15**	**8.4**	**8.4**	**0.25**	**8.1**	**8.5**			ln(y) = 2.11705336673095 + 0.018002196848768*Z
Phenanthrene	**7/7**	**0.0000408**	**0.0000276**	**0.6757952**	**0.0000204**	**0.0000613**	**0.0000164**	**0.0000368**	**0.0000500**	**0.0000336**	**0.0000161**	**0.00009**			ln(y) = -10.2624340675612 + 0.74382279212406*Z
Pyrene	**7/7**	**0.0000050**	**0.0000025**	**0.4914796**	**0.0000032**	**0.0000068**	**0.0000027**	**0.0000051**	**0.0000063**	**0.0000036**	**0.0000027**	**0.0000091**			ln(y) = -12.298442213435 + 0.577099367347114*Z
Salinity	**13/13**	**107.61538**	**2.3014641**	**0.021386**	**106.36429**	**108.86647**	**106**	**107**	**109**	**3**	**104**	**112**			ln(y) = 4.6783620383284 8 + 2.33981578261361E-02*Z
Silver	**5/7**	0.000381	0.000841	2.2069926	-0.000242	0.001004	0.0000457	**0.00014**	**0.00029**	0.0002443	**0.00014**	**0.0018**	**0.000078**	**0.000078**	ln(y) = -8.82290709827462 + 1.73702140945672*Z
Tetrachlorobenzene 1,2,3,4	**7/7**	**0.0000074**	**0.0000088**	**1.1961368**	**0.0000008**	**0.0000139**	**0.0000004**	**0.0000008**	**0.0000181**	**0.0000177**	**0.0000003**	**0.0000184**			ln(y) = -13.0671220295954 + 2.2344955964091*Z
Total Alkalinity	**13/13**	**153.15385**	**14.760783**	**0.0963788**	**145.12979**	**161.1779**	**141**	**150**	**165**	**24**	**134**	**184**			ln(y) = 5.02748344606422 + 0.105105169066415*Z
Trans-Nonachlor	**3/7**	0.0000006	0.0000015	2.5157236	-0.0000005	0.0000017	0.0000000	0.0000001	0.0000006	0.0000005	**0.0000001**	**0.0000031**	**0.0000001**	**0.0000002**	ln(y) = -16.017704887721 + 2.38299713636647*Z
Unionized Ammonia	**13/13**	**0.0065385**	**0.0039626**	**0.6060466**	**0.0043844**	**0.0086926**	**0.004**	**0.005**	**0.0085**	**0.0045**	**0.003**	**0.014**			ln(y) = -5.16230832925793 + 0.550720763806792*Z
Zinc	**7/7**	**0.7515714**	**0.5346493**	**0.7113752**	**0.3554977**	**1.1476452**	**0.139**	**0.765**	**1.35**	**1.211**	**0.111**	**1.45**			ln(y) = -0.631838012466109 + 1.20796819082903*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table D-15
Bayou d'Inde - Marsh Energy System
Summary Statistics - Pore Water Results

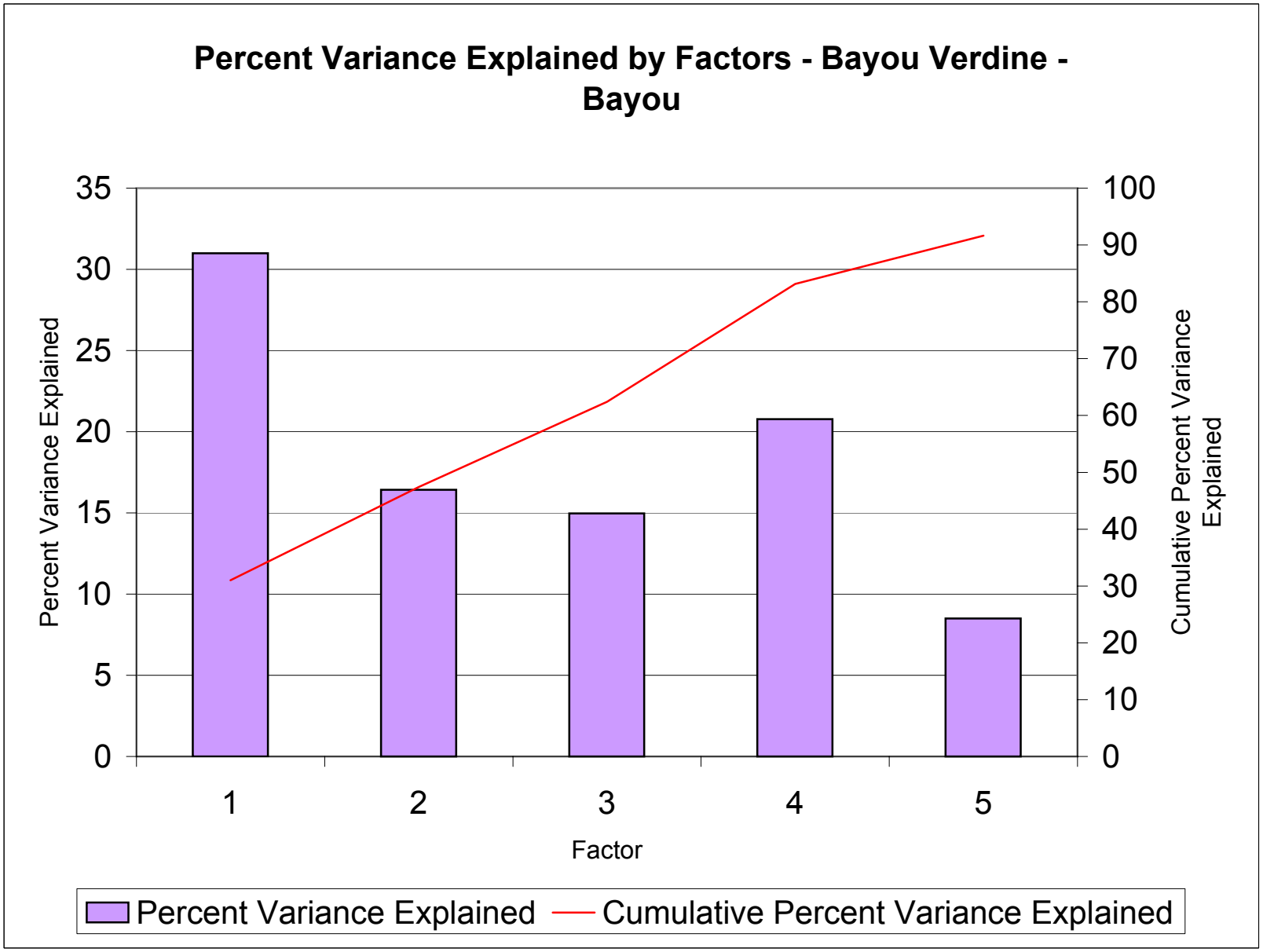
Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1'-Biphenyl	**6/6**	**0.0000042**	**0.0000040**	**0.9495780**	**0.0000010**	**0.0000074**	**0.0000015**	**0.0000029**	**0.0000071**	**0.0000056**	**0.0000013**	**0.0000108**			ln(y) = -12.6469238474215 + 1.0131846210889*Z
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane	**2/6**										**0.0000065**	**0.0000082**	**0.00005**	**0**	
1,2,4,5-Tetrachlorobenzene	**6/6**	**0.0000022**	**0.0000012**	**0.5488488**	**0.0000012**	**0.0000032**	**0.0000010**	**0.0000022**	**0.0000033**	**0.0000023**	**0.0000008**	**0.0000039**			ln(y) = -13.1620160112424 + 0.762419247998395*Z
1,2-Benzphenanthracene	**6/6**	**0.0000369**	**0.0000428**	**1.159169**	**0.0000027**	**0.0000711**	**0.0000040**	**0.0000201**	**8.155E-05**	**0.0000776**	**0.0000008**	**0.0001**			ln(y) = -11.1393782037819 + 2.3044640676934*Z
1,6,7-Trimethylnaphthalene	**6/6**	**0.0000445**	**0.0001016**	**2.2847894**	**-0.0000368**	**0.0001257**	**0.0000035**	**0.0000151**	**0.0000733**	**0.0000698**	**0.0000011**	**0.0002003**			ln(y) = -11.2004566907405 + 2.2516510650036*Z
1-Methylnaphthalene	**6/6**	**0.0000097**	**0.0000058**	**0.5950666**	**0.0000051**	**0.0000143**	**0.0000053**	**0.0000072**	**0.0000167**	**0.0000114**	**0.0000047**	**0.0000172**			ln(y) = -11.6793449380626 + 0.688518472121151*Z
1-Methylphenanthrene	**6/6**	**0.0000110**	**0.0000141**	**1.2773774**	**-0.0000002**	**0.0000223**	**0.0000047**	**0.0000082**	**0.0000154**	**0.0000107**	**0.0000009**	**0.0000336**			ln(y) = -11.8777378117674 + 1.38046380426578*Z
2,4' DDD	**3/6**	0.0000004	0.0000005	1.2978112	0.0000000	0.0000008	0.0000001	0.0000002	0.0000006	0.0000005	**0.0000004**	**0.0000012**	**0.0000001**	**0.0000003**	ln(y) = -15.3353751132854 + 1.45715469784886*Z
2,4' DDE	**3/6**	0.0000008	0.0000013	1.6899375	-0.0000003	0.0000018	0.0000001	0.0000002	0.0000009	0.0000009	**0.0000003**	**0.0000026**	**0.0000001**	**0.0000003**	ln(y) = -15.2829038813868 + 2.09414934897296*Z
2,4' DDT	**1/6**										**0.0000005**	**0.0000005**	**0.0000001**	**0.0000003**	
2,6-Dimethylnaphthalene	**6/6**	**0.0000044**	**0.0000053**	**1.1968773**	**0.0000002**	**0.0000087**	**0.0000014**	**0.0000028**	**0.0000073**	**0.0000059**	**0.0000009**	**0.0000131**			ln(y) = -12.7051315838768 + 1.20605124387645*Z
2-Methylnaphthalene	**6/6**	**0.0000094**	**0.0000066**	**0.7008315**	**0.0000041**	**0.0000146**	**0.0000059**	**0.0000074**	**0.0000129**	**0.000007**	**0.0000044**	**0.0000201**			ln(y) = -11.7025013420939 + 0.652091192304258*Z
4,4'-DDD	**3/6**	0.0000002	0.0000002	1.0242746	0.0000000	0.0000004	0.0000001	0.0000002	0.0000003	0.0000002	**0.0000002**	**0.0000006**	**0.0000001**	**0.0000002**	ln(y) = -15.6819634555572 + 1.0476619109112*Z
4,4'-DDE	**1/6**										**0.0000001**	**0.0000001**	**0.0000001**	**0.0000002**	
4,4'-DDT	**1/6**										**0.0000025**	**0.0000025**	**0.0000001**	**0.0000002**	
Acenaphthene	**6/6**	**0.0000135**	**0.0000121**	**0.8990146**	**0.0000038**	**0.0000231**	**0.0000045**	**0.0000086**	**0.0000269**	**0.0000224**	**0.000002**	**0.0000305**			ln(y) = -11.6015438754706 + 1.2996777767974*Z
Acenaphthylene	**6/6**	**0.0000076**	**0.0000072**	**0.9536022**	**0.0000018**	**0.0000133**	**0.0000012**	**0.0000063**	**0.0000145**	**0.0000134**	**0.0000005**	**0.0000173**			ln(y) = -12.4266893069595 + 1.78299696045338*Z
Aldrin	**4/6**	0.0000065	0.0000049	0.7451044	0.0000026	0.0000104	0.0000034	0.0000056	0.0000091	0.0000057	**0.0000058**	**0.000014**	**0.0000000**	**0.0000001**	ln(y) = -12.0984033415583 + 0.728499741922055*Z
alpha-BHC	**6/6**	**0.0000012**	**0.0000009**	**0.7560695**	**0.0000005**	**0.0000020**	**0.0000004**	**0.0000012**	**0.0000021**	**0.0000017**	**0.0000003**	**0.0000023**			ln(y) = -13.9297418800865 + 1.0994418489271*Z
alpha-Chlordane	**2/6**										**0.0000001**	**0.0000001**	**0.0000001**	**0**	
Ammonia as N	**13/13**	**0.7207692**	**0.2971977**	**0.4123341**	**0.5592107**	**0.8823278**	**0.515**	**0.64**	**0.925**	**0.41**	**0.45**	**1.42**			ln(y) = -0.389169737128333 + 0.398939942512542*Z
Anthracene	**6/6**	**0.0000136**	**0.0000141**	**1.037487**	**0.0000023**	**0.0000249**	**0.0000027**	**0.0000079**	**0.0000294**	**0.0000268**	**0.000001**	**0.0000334**			ln(y) = -11.8019075344588 + 1.69669855328811*Z
Benzo(a)anthracene	**6/6**	**0.0000131**	**0.0000235**	**1.7993799**	**-0.0000058**	**0.0000319**	**0.0000027**	**0.0000076**	**0.0000198**	**0.0000171**	**0.0000002**	**0.00005**			ln(y) = -12.173075598043 + 2.18400157904466*Z
Benzo(a)pyrene	**6/6**	**0.0000026**	**0.0000031**	**1.1731991**	**0.0000002**	**0.0000051**	**0.0000005**	**0.0000011**	**0.0000058**	**0.0000053**	**0.0000004**	**0.0000073**			ln(y) = -13.4440997557856 + 1.49756675602754*Z
Benzo(b)fluoranthene	**6/6**	**0.0000048**	**0.0000040**	**0.8291916**	**0.0000016**	**0.0000080**	**0.0000005**	**0.0000052**	**0.0000081**	**0.0000076**	**0.0000004**	**0.0000102**			ln(y) = -12.8186851768973 + 1.68245181228646*Z
Benzo(e)pyrene	**6/6**	**0.0000054**	**0.0000073**	**1.3445426**	**-0.0000004**	**0.0000113**	**0.0000005**	**0.0000012**	**0.0000145**	**0.0000141**	**0.0000004**	**0.0000149**			ln(y) = -13.1478419604591 + 1.97306279313944*Z
Benzo(g,h,i)perylene	**6/6**	**0.0000025**	**0.0000033**	**1.3171698**	**-0.0000001**	**0.0000052**	**0.0000004**	**0.0000005**	**0.0000067**	**0.0000064**	**0.0000003**	**0.0000068**			ln(y) = -13.7702355168411 + 1.67527380809974*Z
Benzo(k)fluoranthene	**6/6**	**0.0000009**	**0.0000005**	**0.50893**	**0.0000005**	**0.0000013**	**0.0000005**	**0.0000010**	**0.0000013**	**0.0000008**	**0.0000003**	**0.0000015**			ln(y) = -14.0512928639045 + 0.748135338001615*Z
beta-BHC	**6/6**	**0.0000125**	**0.0000206**	**1.6467108**	**-0.0000040**	**0.0000290**	**0.0000005**	**0.0000076**	**0.0000213**	**0.0000208**	**0.0000002**	**0.000046**			ln(y) = -12.5066298471909 + 2.62984498000438*Z
Cadmium	**1/6**										**0.00009**	**0.00009**	**0.0000630**	**0**	
Chlorpyrifos	**3/6**	0.0000009	0.0000015	1.6290171	-0.0000003	0.0000021	0.0000001	0.0000004	0.0000012	0.0000011	**0.0000005**	**0.0000026**	**0.0000002**	**0.0000007**	ln(y) = -14.7254206606694 + 1.66324333257656*Z
Conductivity	**13/13**	**18.138462**	**0.2677509**	**0.0147615**	**17.99291**	**18.284013**	**18**	**18.1**	**18.3**	**0.3**	**17.7**	**18.7**			ln(y) = 2.8979401341112 + 1.62961531825235E-02*Z
Copper	**6/6**	**0.0081367**	**0.007386**	**0.9077452**	**0.0022266**	**0.0140467**	**0.0039075**	**0.00595**	**0.0117775**	**0.00787**	**0.00381**	**0.0202**			ln(y) = -5.00942147503196 + 0.788154014967279*Z
delta-BHC	**2/6**										**0.0000039**	**0.0000043**	**0.0000001**	**0**	
Dibenzo(a,h)anthracene	**6/6**	**0.0000014**	**0.0000023**	**1.6246217**	**-0.0000004**	**0.0000032**	**0.0000005**	**0.0000006**	**0.0000023**	**0.0000019**	**0.0000003**	**0.000005**			ln(y) = -13.9823492180191 + 1.22204514262189*Z
Dibenzothiophene	**6/6**	**0.0000013**	**0.0000011**	**0.8099464**	**0.0000005**	**0.0000022**	**0.0000006**	**0.0000009**	**0.0000026**	**0.0000019**	**0.0000001**	**0.0000027**			ln(y) = -13.9533284197542 + 1.39521041165679*Z
Dieldrin	**2/6**										**0.0000042**	**0.0000068**	**0.0000001**	**0**	
Dissolved Oxygen	**13/13**	**6.4**	**0.4590452**	**0.0717258**	**6.1504602**	**6.6495398**	**6.2**	**6.5**	**6.7**	**0.5**	**5.5**	**7**			ln(y) = 1.85394489341548 + 7.88969153665662E-02*Z
Endosulfan II	**4/6**	0.0000019	0.0000044	2.2374588	-0.0000015	0.0000054	0.0000002	0.0000007	0.0000025	0.0000023	**0.0000008**	**0.0000084**	**0.0000001**	**0.0000002**	ln(y) = -14.1727817083264 + 1.87771570161795*Z
Endrin	**4/6**	0.0000005	0.0000005	0.9908069	0.0000001	0.0000008	0.0000001	0.0000003	0.0000007	0.0000005	**0.0000001**	**0.0000011**	**0.0000004**	**0.0000005**	ln(y) = -14.9627939679515 + 1.15473072944759*Z
Endrin Aldehyde	**2/6**										**0.000016**	**0.000018**	**0.00001**	**0.0000005**	
Endrin Ketone	**1/6**										**0.000005**	**0.000005**	**0.00001**	**0.0000005**	
Fluoranthene	**6/6**	**0.0000159**	**0.0000125**	**0.7876382**	**0.0000059**	**0.0000259**	**0.0000037**	**0.0000170**	**0.0000245**	**0.0000208**	**0.0000015**	**0.0000342**			ln(y) = -11.4617049022005 + 1.43245457711538*Z
Fluorene	**6/6**	**0.0000173**	**0.0000132**	**0.762126**	**0.0000068**	**0.0000279**	**0.0000077**	**0.0000143**	**0.0000287**	**0.0000210**	**0.000003**	**0.0000373**			ln(y) = -11.242891849327 + 1.12854957063305*Z
gamma-BHC (Lindane)	**6/6**	**0.0000028**	**0.0000062**	**2.2310785**	**-0.0000022**	**0.0000077**	**0.0000007**	**0.0000010**	**0.0000041**	**0.0000034**	**0.0000004**	**0.000012**			ln(y) = -13.5297175891531 + 1.33140277923395*Z
gamma-Chlordane	**1/6**										**0.0000036**	**0.0000036**	**0.0000001**	**0**	
Hardness, as CaCO3	**13/13**	**2213.0769**	**97.821975**	**0.0442018**	**2159.9003**	**2266.2536**	**2120**	**2220**	**2275**	**155**	**2100**	**2420**			ln(y) = 7.70129311075605 + 4.85756934143831E-02*Z
Heptachlor	**3/6**	0.0000015	0.0000048	3.1723402	-0.0000023	0.0000053	0.0000000	0.0000001	0.0000008	0.0000008	**0.0000001**	**0.0000084**	**0.0000001**	**0.0000004**	ln(y) = -16.005371277302 + 2.92954252566525*Z
Heptachlor Epoxide	**4/6**	0.0000012	0.0000019	1.6166908	-0.0000004	0.0000027	0.0000001	0.0000005	0.0000018	0.0000017	**0.0000004**	**0.0000043**	**0.0000002**	**0.0000002**	ln(y) = -14.5578907975012 + 1.95696769066043*Z
Hexachlorobenzene	**5/6**	0.0000013	0.0000014	1.0698293	0.0000002	0.0000025	**0.0000006**	**0.0000011**	**0.0000019**	**0.0000013**	**0.0000007**	**0.0000036**	**0.0000004**	**0.0000004**	ln(y) = -13.8313997305312 + 1.02568341337518*Z

Table D-15
Bayou d'Inde - Marsh Energy System
Summary Statistics - Pore Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Hydrogen Sulfide	**13/13**	**0.0313077**	**0.0227816**	**0.727667**	**0.0189235**	**0.0436919**	**0.017**	**0.028**	**0.037**	**0.02**	**0.01**	**0.09**			ln(y) = -3.6260657129276 + 0.664647550917597*Z
Indeno(1,2,3-cd)pyrene	**6/6**	**0.0000009**	**0.0000015**	**1.6965936**	**-0.0000003**	**0.0000021**	**0.0000003**	**0.0000005**	**0.0000014**	**0.0000012**	**0.0000001**	**0.0000033**			ln(y) = -14.5063800400636 + 1.45038203015531*Z
Lead	**6/6**	**0.00062**	**0.0010539**	**1.6997777**	**-0.000223**	**0.0014633**	**0.0001875**	**0.00025**	**0.0010025**	**0.000815**	**0.00018**	**0.00227**			ln(y) = -7.89092179283684 + 1.13782942897603*Z
Mean Dissolved Organic Carbon	**13/13**	**11.138908**	**2.6482728**	**0.2377498**	**9.6992902**	**12.578525**	**8.99725**	**10.8586**	**13.49055**	**4.4933**	**8.4318**	**16.6323**			ln(y) = 2.38685604417561 + 0.251159316538922*Z
Naphthalene	**6/6**	**0.0000573**	**0.0000377**	**0.6589807**	**0.0000271**	**0.0000875**	**0.0000137**	**0.0000634**	**0.0000925**	**0.0000789**	**0.0000132**	**0.0001**			ln(y) = -10.0487038586211 + 1.08956588575842*Z
Nickel	**6/6**	**0.0074167**	**0.0026815**	**0.3615485**	**0.005271**	**0.0095623**	**0.005525**	**0.006395**	**0.0100675**	**0.0045425**	**0.00488**	**0.0115**			ln(y) = -4.95002498045519 + 0.406155581875396*Z
PCB-101/90	**3/6**	0.0000005	0.0000004	0.6994607	0.0000002	0.0000008	0.0000003	0.0000005	0.0000007	0.0000004	**0.0000005**	**0.0000009**	**0.0000001**	**0.0000003**	ln(y) = -14.6067555646562 + 0.686758753378879*Z
PCB-105	**4/6**	0.0000007	0.0000007	0.9615987	0.0000002	0.0000012	0.0000002	0.0000004	0.0000011	0.0000009	**0.0000004**	**0.0000016**	**0.0000002**	**0.0000003**	ln(y) = -14.6252489345464 + 1.30790923724828*Z
PCB-110/77	**3/6**	0.0000007	0.0000008	1.1668633	0.0000000	0.0000013	0.0000002	0.0000004	0.0000010	0.0000008	**0.0000006**	**0.0000019**	**0.0000001**	**0.0000002**	ln(y) = -14.7235337068034 + 1.3038108576731*Z
PCB-118	**3/6**	0.0000006	0.0000008	1.3546388	-0.0000001	0.0000013	0.0000003	0.0000005	0.0000008	0.0000006	**0.0000004**	**0.0000018**	**0.0000005**	**0.0000015**	ln(y) = -14.5812031323343 + 0.888997555531527*Z
PCB-128	**1/6**										**0.0000006**	**0.0000006**	**0.0000001**	**0.0000015**	
PCB-138 /160	**6/6**	**0.0000055**	**0.0000020**	**0.360448**	**0.0000039**	**0.0000070**	**0.0000036**	**0.0000054**	**0.0000072**	**0.0000036**	**0.0000032**	**0.0000083**			ln(y) = -12.1688623695238 + 0.461450074258849*Z
PCB-153/132	**3/6**	0.0000003	0.0000003	0.958808	0.0000001	0.0000005	0.0000002	0.0000003	0.0000004	0.0000003	**0.0000003**	**0.0000007**	**0.0000001**	**0.0000005**	ln(y) = -15.1670788133255 + 0.722231900712003*Z
PCB-18/17	**2/6**										**0.0000004**	**0.0000124**	**0.0000001**	**0.0000005**	
PCB-180	**4/6**	0.0000009	0.0000004	0.4617562	0.0000006	0.0000012	0.0000006	0.0000008	0.0000012	0.0000006	**0.0000007**	**0.0000015**	**0.0000001**	**0.0000003**	ln(y) = -14.0154219650724 + 0.521166012906091*Z
PCB-187	**2/6**										**0.0000002**	**0.0000002**	**0.0000001**	**0.0000003**	
PCB-206	**3/6**	0.0000001	0.0000001	0.3762658	0.0000001	0.0000002	0.0000001	0.0000001	0.0000002	0.0000001	**0.0000001**	**0.0000002**	**0.0000001**	**0.0000004**	ln(y) = -15.8032083667599 + 0.495187091040977*Z
PCB-209	**3/6**	0.0000006	0.0000006	0.915513	0.0000002	0.0000011	0.0000002	0.0000005	0.0000009	0.0000007	**0.0000006**	**0.0000015**	**0.0000001**	**0.0000004**	ln(y) = -14.5581702317035 + 1.0192134978841*Z
PCB-28/20	**1/6**										**0.0000032**	**0.0000032**	**0.0000001**	**0.0000004**	
PCB-29/26	**2/6**										**0.0000002**	**0.0000003**	**0.0000000**	**0.0000004**	
PCB-44	**1/6**										**0.0000006**	**0.0000006**	**0.0000001**	**0.0000004**	
PCB-52	**2/6**										**0.0000013**	**0.0000018**	**0.0000000**	**0.0000004**	
PCB-66	**2/6**										**0.0000006**	**0.0000016**	**0.0000001**	**0.0000004**	
PCB-8/5	**3/6**	0.0000016	0.0000022	1.438131	-0.0000002	0.0000033	0.0000003	0.0000008	0.0000023	0.0000020	**0.0000014**	**0.0000051**	**0.0000001**	**0.0000002**	ln(y) = -14.0773281152578 + 1.61408169704994*Z
PCB-87/115	**1/6**										**0.0000012**	**0.0000012**	**0.0000001**	**0.0000002**	
Pentachloroanisole	**5/6**	0.0000006	0.0000004	0.6998083	0.0000002	0.0000009	**0.0000002**	**0.0000004**	**0.0000010**	**0.0000008**	**0.0000003**	**0.0000011**	**0.0000001**	**0.0000001**	ln(y) = -14.6036154095977 + 0.854271532155307*Z
Pentachlorobenzene	**5/6**	0.0000008	0.0000005	0.5745912	0.0000004	0.0000012	**-0.0000005**	**0.0000009**	**0.0000013**	**0.0000018**	**0.0000003**	**0.0000014**	**0.0000005**	**0.0000005**	ln(y) = -14.1523797462605 + 0.731644794890773*Z
Perylene	**6/6**	**0.0000045**	**0.0000043**	**0.9545668**	**0.0000011**	**0.0000079**	**0.0000013**	**0.0000040**	**0.0000069**	**0.0000055**	**0.0000008**	**0.0000115**			ln(y) = -12.6443867376075 + 1.20673237365755*Z
pH	**13/13**	**8.2230769**	**0.0975016**	**0.0118571**	**8.1700744**	**8.2760794**	**8.2**	**8.2**	**8.3**	**0.1**	**8**	**8.4**			ln(y) = 2.10688561739219 + 1.14657602982978E-02*Z
Phenanthrene	**6/6**	**0.0000418**	**0.0000294**	**0.7051243**	**0.0000182**	**0.0000653**	**0.0000174**	**0.0000367**	**0.0000724**	**5.503E-05**	**0.0000065**	**0.0000796**			ln(y) = -10.3696821788374 + 1.1571641258558*Z
Pyrene	**6/6**	**0.0000441**	**0.0000383**	**0.86796**	**0.0000135**	**0.0000748**	**0.0000095**	**0.0000459**	**7.875E-05**	**6.923E-05**	**0.0000009**	**0.0000819**			ln(y) = -10.7744766967307 + 2.05777900137755*Z
Salinity	**13/13**	**109.23077**	**1.5432375**	**0.0141282**	**108.39186**	**110.06968**	**108**	**109**	**111**	**3**	**107**	**111**			ln(y) = 4.69337167239253 + 1.49887587182514E-02*Z
Silver	**3/6**	0.0001614	0.0001306	0.8088948	0.0000569	0.0002659	0.0000688	**0.0001325**	**0.0002625**	0.0001937	**0.00017**	**0.00036**	**0.000095**	**0.000095**	ln(y) = -8.97433977527501 + 0.903699445751071*Z
Tetrachlorobenzene 1,2,3,4	**5/6**	0.0000025	0.0000073	2.8652429	-0.0000033	0.0000084	**-0.0000006**	**0.0000006**	**0.0000038**	**0.0000043**	**0.0000003**	**0.0000131**	**0.0000006**	**0.0000006**	ln(y) = -14.1459102440273 + 1.426727065472*Z
Total Alkalinity	**13/13**	**142.38462**	**7.4286771**	**0.0521733**	**138.34634**	**146.42289**	**137**	**142**	**149.5**	**12.5**	**130**	**152**			ln(y) = 4.9572942936808 4 + 5.96892268422788E-02*Z
Trans-Nonachlor	**2/6**										**0.0000004**	**0.0000051**	**0.0000000**	**0**	
Unionized Ammonia	**13/13**	**0.0040769**	**0.001131**	**0.2774266**	**0.0034621**	**0.0046918**	**0.003**	**0.004**	**0.005**	**0.002**	**0.003**	**0.006**			ln(y) = -5.53539884427872 + 0.290269272637917*Z
Zinc	**6/6**	**0.2371167**	**0.2354447**	**0.9929488**	**0.0487217**	**0.4255117**	**0.016975**	**0.2285**	**0.4055**	**0.388525**	**0.0136**	**0.59**			ln(y) = -2.17941766794779 + 1.96456740651476*Z

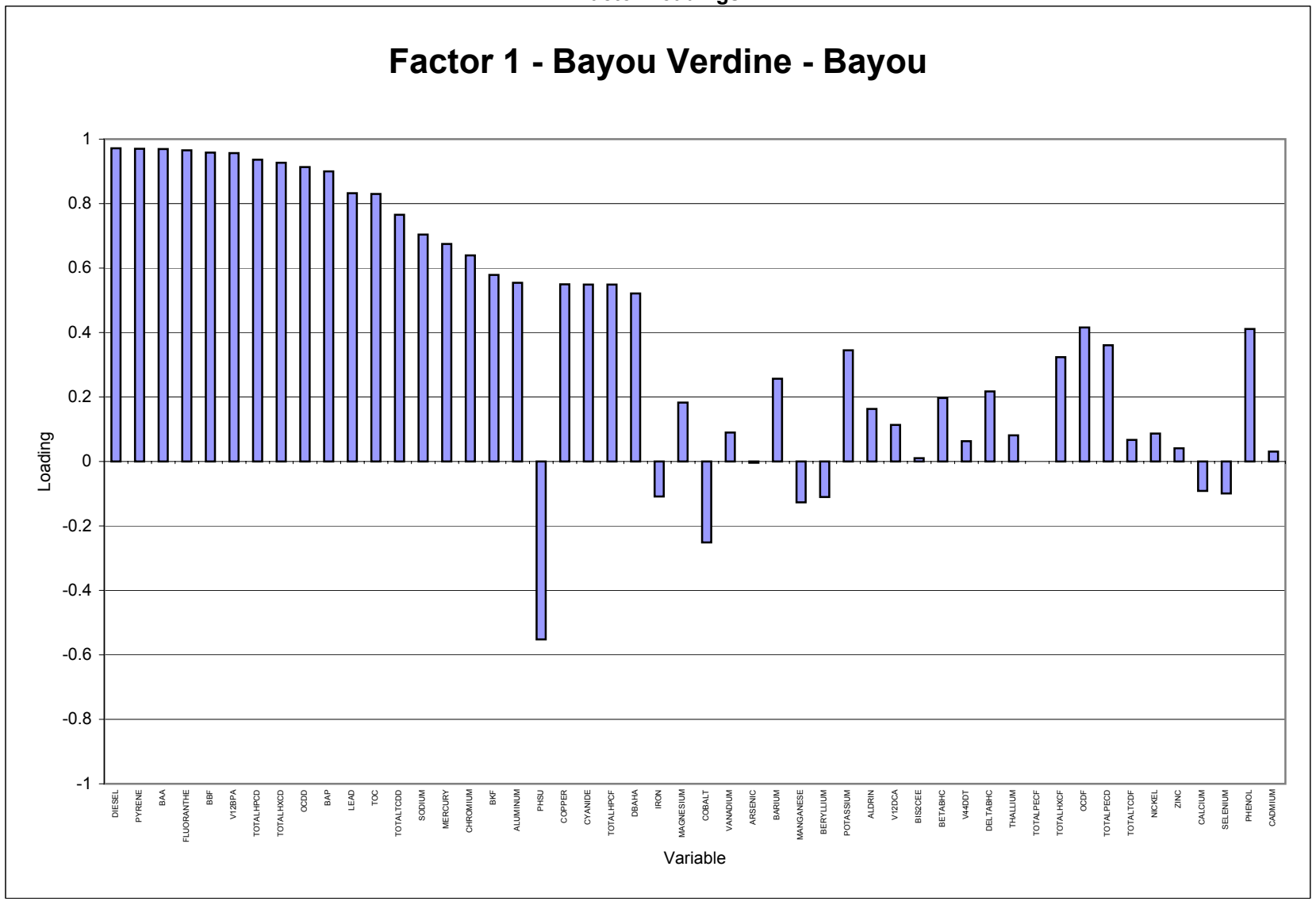
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table E-1
Principal Components Analysis Results



CDM

Table E-2
Bayou Verdine-Bayou
Factor Loadings



CDM

Table E-2
Bayou Verdine-Bayou
Factor Loadings

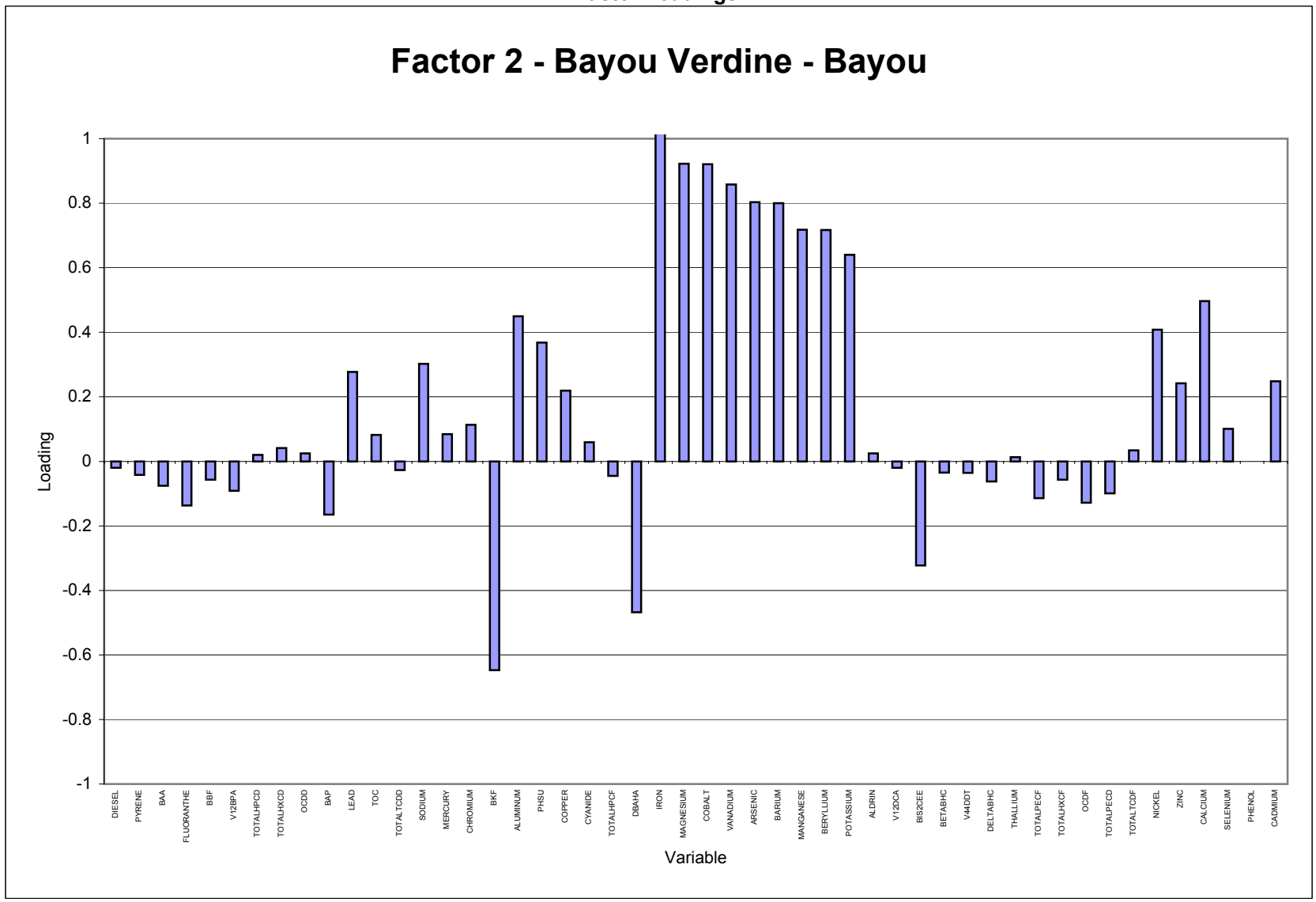


Table E-2
Bayou Verdine-Bayou
Factor Loadings

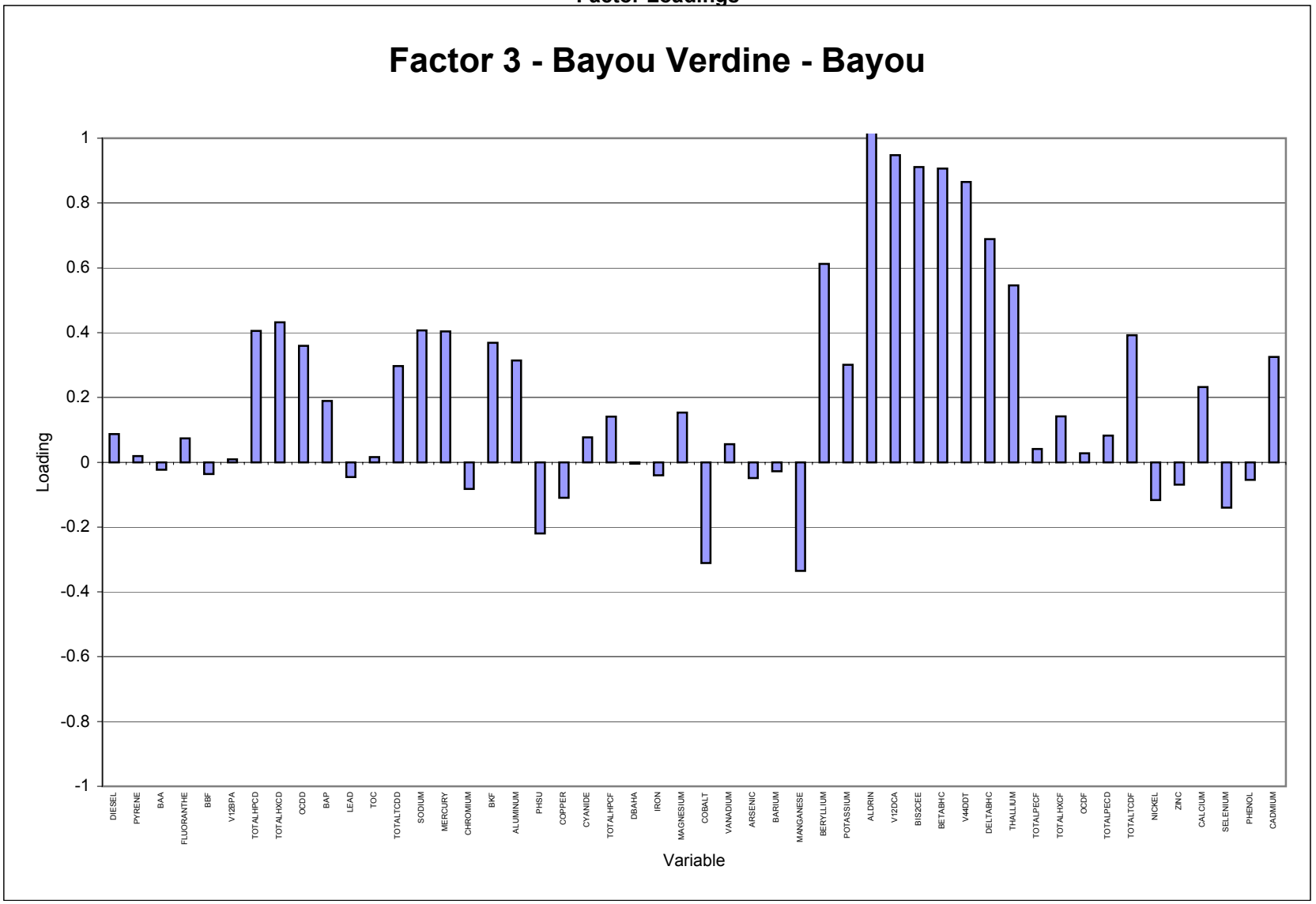


Table E-2
Bayou Verdine-Bayou
Factor Loadings

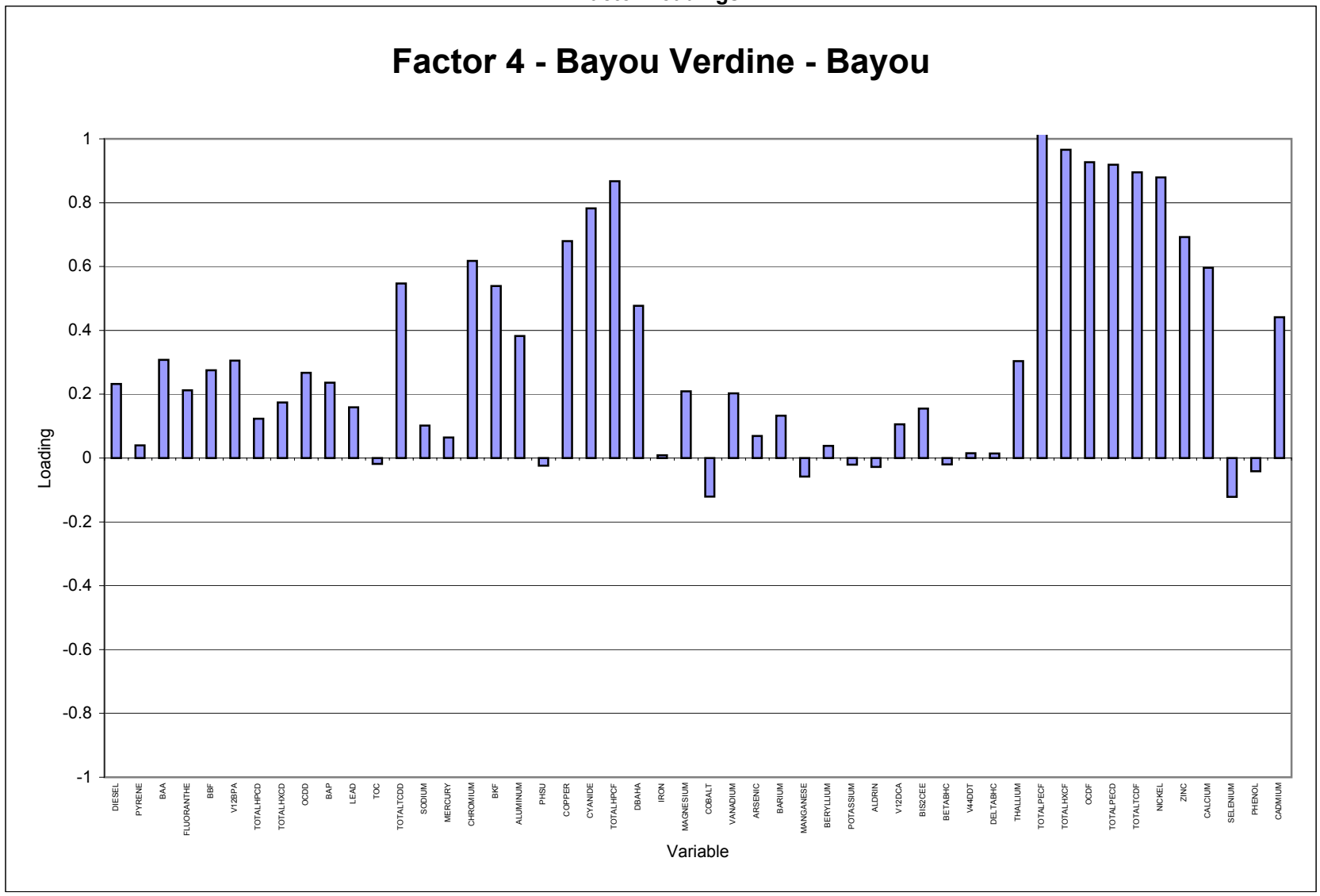


Table E-2
Bayou Verdine-Bayou
Factor Loadings

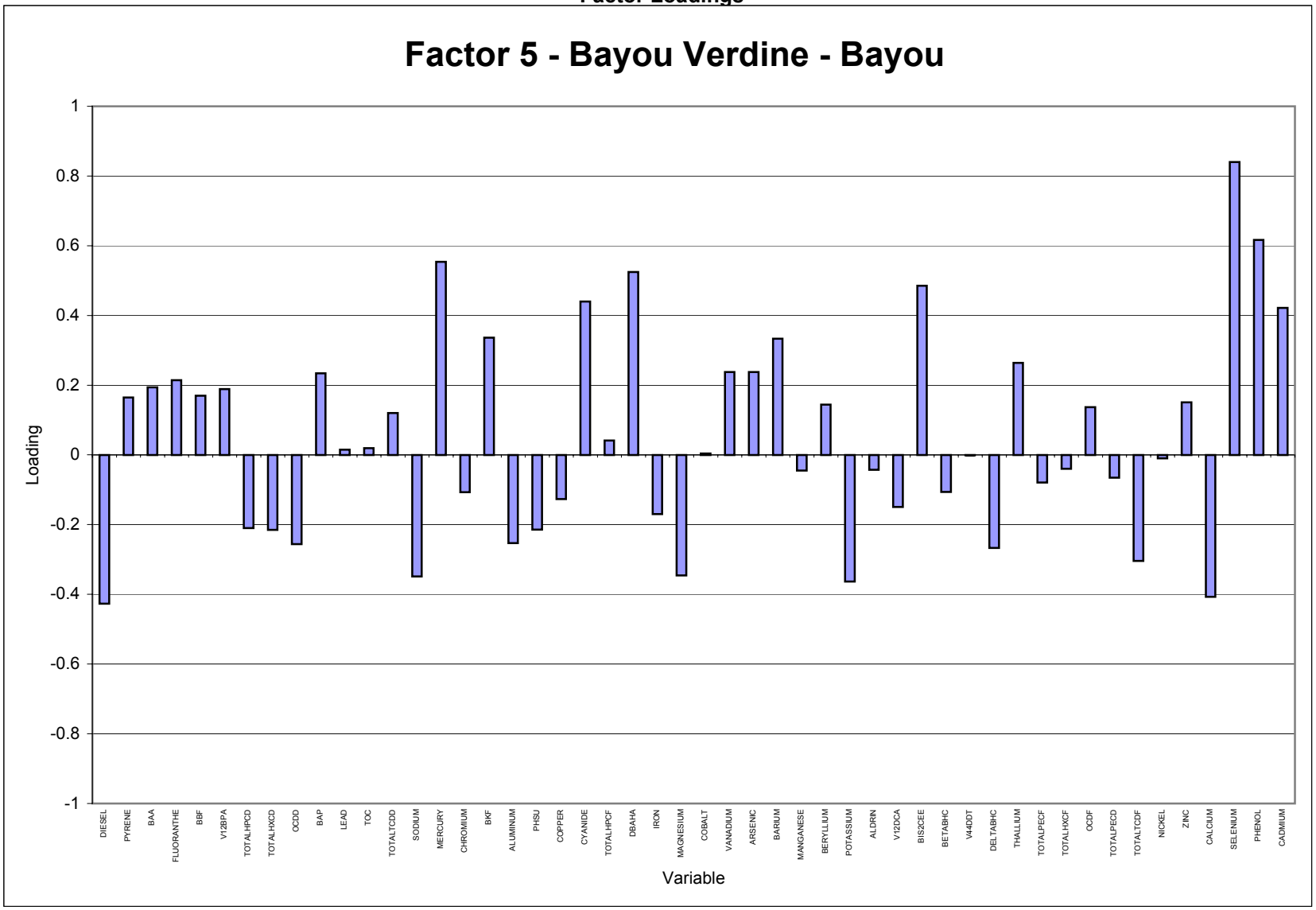


Table E-3
Bayou Verdine - Bayou Energy System
Prinicipal Components Analysis Results

Variable	Sum Ranking	Variable	Sum Ranking
COPPER	0.375	DELTABHC	0.122
LEAD	0.344	SELENIUM	0.109
DBAHA	0.341	ALUMINUM	0.097
CHROMIUM	0.330	CYANIDE	0.097
V12BPA	0.307	SODIUM	0.094
BBF	0.296	V44DDT	0.091
BAP	0.295	THALLIUM	0.087
FLUORANTHE	0.293	MAGNESIUM	0.075
BAA	0.287	CALCIUM	0.075
NICKEL	0.269	POTASSIUM	0.072
PYRENE	0.267	COBALT	0.066
BKF	0.257	IRON	0.056
BARIUM	0.244	MANGANESE	0.055
TOC	0.234	OCDD	0.046
ZINC	0.219	TOTALHXCD	0.045
BIS2CEE	0.216	TOTALTCDD	0.045
VANADIUM	0.216	TOTALHPCD	0.043
V12DCA	0.202	TOTALHPCF	0.042
PHENOL	0.191	TOTALPECD	0.037
MERCURY	0.170	TOTALHXCF	0.036
ARSENIC	0.154	DIESEL	0.036
CADMIUM	0.135	OCDF	0.035
BERYLLIUM	0.131	TOTALTCDF	0.032
ALDRIN	0.129	TOTALPECF	0.027
BETABHC	0.128	PHSU	0.026

Table E-4
Calcasieu Estuary Bayou Vedine AOC
Summary Statistics - Suface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**4/70**										**8.9**	**23**	**0.335**	**0**	
1,1,2,2-Tetrachloroethane ug/Kg	**1/91**										**70000**	**70000**	**0.65**	**0**	
1,1,2-Trichloroethane ug/Kg	**2/91**										**53000**	**3100000**	**0.6**	**0**	
1,1'-Biphenyl ug/Kg	**26/101**	1619.2722	13620.634	8.4115779	-1037.123	4275.6675	33.767634	143.06711	606.14842	572.38078	**44**	**100000**	**62**	**140000**	ln(y) = 4.96331381746602 + 2.14155192803946*Z
1,1-Dichloroethane ug/Kg	**1/91**										**39000**	**39000**	**0.405**	**140000**	
1,2,3,4,6,7,8-HpCDD PG/G	**11/11**	**393.45455**	**717.01104**	**1.82234784**	**-30.2719**	**817.18099**	**44**	**140**	**373**	**329**	**15**	**2100**			ln(y) = 4.96607974095031 + 1.80435917062343*Z
1,2,3,4,6,7,8-HpCDF PG/G	**8/11**	266.04148	441.08427	1.65795298	5.3773379	526.70563	19.656985	81.95962	341.72989	322.07291	**6.7**	**1300**	**1.2**	**9.1**	ln(y) = 4.40622668773565 + 2.11779434269901*Z
1,2,3,4,7,8,9-HpCDF PG/G	**7/11**	42.56181	67.687319	1.59032989	2.561161	82.56246	11.04609	24.765306	55.523755	44.477665	**26**	**200**	**0.37**	**2**	ln(y) = 3.20944372194908 + 1.1975381602512*Z
1,2,3,4,7,8-HxCDD PG/G	**4/11**	2.9950221	3.8887134	1.29839222	0.6969393	5.2931048	0.7487408	1.7270156	3.983465	3.2347242	**2.5**	**11**	**0.13**	**6.1**	ln(y) = 0.54639481312086 + 1.23964800495891*Z
1,2,3,4,7,8-HxCDF PG/G	**6/11**	49.722331	73.455796	1.47732005	6.3127291	93.131932	12.186215	28.501974	66.662413	54.476198	**39**	**220**	**0.6**	**25**	ln(y) = 3.34997333302726 + 1.26028126260958*Z
1,2,3,6,7,8-HxCDD PG/G	**6/11**	14.324293	18.126544	1.2654407	3.6121905	25.036396	3.1106687	7.8220413	19.669189	16.55852	**9.3**	**56**	**0.4**	**5.4**	ln(y) = 2.05694555428224 + 1.36772871696803*Z
1,2,3,6,7,8-HxCDF PG/G	**7/11**	26.345191	40.040688	1.51984809	2.6826563	50.007725	6.8079939	15.42662	34.956052	28.148059	**17**	**120**	**0.31**	**1.4**	ln(y) = 2.73609456232491 + 1.21330501854517*Z
1,2,3,7,8,9-HxCDD PG/G	**6/11**	8.4854176	7.0802534	0.83440247	4.3012552	12.66958	3.2148009	6.1801738	11.880844	8.6660435	**6.67**	**23**	**0.59**	**5.1**	ln(y) = 1.8213463994322 + 0.969432683720734*Z
1,2,3,7,8,9-HxCDF PG/G	**3/11**	3.2969994	6.0970188	1.84926293	-0.306108	6.9001073	0.4287739	1.3339111	4.1497833	3.7210094	**5.6**	**16.9**	**0.26**	**2.3**	ln(y) = 0.288115282730596 + 1.68341606284393*Z
1,2,3,7,8-PeCDD PG/G	**4/11**	2.4608811	2.8263874	1.14852662	0.7905928	4.1311693	0.7709616	1.5955557	3.3021072	2.5311455	**2.03**	**7.3**	**0.22**	**4.5**	ln(y) = 0.467222065920601 + 1.07883484268771*Z
1,2,3,7,8-PeCDF PG/G	**4/11**	7.3790219	15.038647	2.03802722	-1.508251	16.266295	0.9758405	2.879268	8.4954294	7.5195889	**6.1**	**42**	**0.68**	**9.2**	ln(y) = 1.05753609387927 + 1.6048793129984*Z
1,2-Benzphenanthracene ug/Kg	**67/98**	9510.2263	19213.626	2.02031215	5706.1225	13314.33	263.12146	1338.6088	6810.0626	6546.9412	**100**	**120000**	**8.9**	**27000**	ln(y) = 7.19938617167103 + 2.41292884714018*Z
1,2-Dichloroethane ug/Kg	**17/105**										**15**	**19000000**	**0.65**	**27000**	
2,3,4,6,7,8-HxCDF PG/G	**4/11**	7.8514446	9.0332479	1.15052049	2.5131362	13.189753	1.9533881	4.5963926	10.815477	8.8620893	**9.5**	**27**	**0.22**	**9.3**	ln(y) = 1.52527177555431 + 1.26923792890399*Z
2,3,4,7,8-PeCDF PG/G	**3/11**	4.417492	7.2038392	1.63075318	0.1602951	8.6746889	0.8312677	2.2203901	5.9308601	5.0995924	**6.6**	**18**	**0.7**	**6.4**	ln(y) = 0.797682910506261 + 1.45728589902642*Z
2,3,7,8-TCDD PG/G	**5/11**	1.022972	0.6077786	0.5941302	0.6637978	1.3821462	0.5904201	0.8819589	1.3174543	0.7270343	**0.985**	**2.4**	**0.11**	**1.8**	ln(y) = -0.125609813415037 + 0.595250117108864*Z
2,3,7,8-TCDD Equivalent PG/G	**11/11**	**24.68385**	**29.43905**	**1.1926446**	**7.286475**	**42.08121**	**2.5925**	**16.949**	**42.991**	**40.3985**	**0.726245**	**89.88**			ln(y) = 2.38459436105207 + 1.81813730861087*Z
2,3,7,8-TCDF PG/G	**8/11**	6.9123137	7.2013033	1.04180795	2.6566154	11.168012	1.1179198	3.3224266	9.8741593	8.7562395	**0.65**	**18.5**	**0.56**	**0.89**	ln(y) = 1.20069542910234 + 1.61560856260247*Z
2-Butanone ug/Kg	**14/91**										**3**	**53**	**12**	**0.89**	
2-Methylnaphthalene ug/Kg	**9/32**	2271.7271	8354.4276	3.6775666	-622.9344	5166.3885	51.188692	236.24278	1090.2926	1039.1039	**208**	**38000**	**460**	**27000**	ln(y) = 5.46486001947741 + 2.2684159145587*Z
4,4'-DDD ug/Kg	**1/70**										**12**	**12**	**0.335**	**27000**	
4,4'-DDE ug/Kg	**2/70**										**4.7**	**11**	**1.15**	**27000**	
4,4'-DDT ug/Kg	**4/70**										**4.5**	**48**	**0.335**	**27000**	
4-Bromofluorobenzene ug/Kg	**51/51**	**2127.9608**	**4519.3518**	**2.12379467**	**887.60256**	**3368.319**	**92**	**110**	**640**	**548**	**35**	**17000**			ln(y) = 5.65969671294681 + 1.71992859670079*Z
Acenaphthene ug/Kg	**15/97**										**73.3**	**5600**	**33**	**0**	
Acenaphthylene ug/Kg	**7/32**	219.22948	318.24525	1.45165357	108.96312	329.49583	76.713663	162.50234	344.22827	267.51461	**55.2**	**1560**	**460**	**140000**	ln(y) = 5.09069241864073 + 1.11335610598316*Z
Acetone ug/Kg	**35/91**	60.273891	136.72814	2.26844721	32.181204	88.366578	6.5803156	19.913655	60.263625	53.68331	**21**	**1000**	**7.5**	**110000**	ln(y) = 2.99140570036872 + 1.64245154417595*Z
Aldrin ug/Kg	**5/70**										**2.6**	**31**	**0.335**	**110000**	
alpha-BHC ug/Kg	**2/70**										**4.4**	**130**	**0.335**	**110000**	
Aluminum (Fume Or Dust) MG/KG	**25/25**	**7512.8**	**3188.5132**	**0.42441077**	**6262.9028**	**8762.6972**	**4675**	**6850**	**9850**	**5175**	**3390**	**13400**			ln(y) = 8.83591987680167 + 0.474678933457199*Z
Anthracene ug/Kg	**26/98**	1035.2429	3041.5793	2.93803455	433.04089	1637.4449	22.909516	112.70718	554.48179	531.57228	**225**	**18000**	**35**	**140000**	ln(y) = 4.72479316622921 + 2.36319559864262*Z
Aroclor-1248 ug/Kg	**1/70**										**96**	**96**	**16**	**140000**	
Aroclor-1254 ug/Kg	**1/70**										**460**	**460**	**16**	**140000**	
Aroclor-1260 ug/Kg	**1/70**										**48**	**48**	**16**	**140000**	
Arsenic MG/KG	**89/91**	3.8731389	2.5573846	0.66028733	3.3476889	4.3985889	2.199228	3.2832649	4.9016419	2.7024139	**0.86**	**18.7**	**2.2**	**2.6**	ln(y) = 1.18883831680295 + 0.594390940731333*Z
Barium MG/KG	**91/91**	**154.81648**	**64.147193**	**0.41434343**	**141.63656**	**167.99641**	**107**	**147**	**195**	**88**	**28.3**	**365**			ln(y) = 4.95421478667043 + 0.447711931999558*Z
Benzene ug/Kg	**3/92**										**5**	**135**	**3.35**	**0**	
Benzo(a)anthracene ug/Kg	**52/98**	3963.9952	8580.6135	2.16463773	2265.1204	5662.87	84.564311	452.12413	2417.2873	2332.723	**65**	**53000**	**8.9**	**27000**	ln(y) = 6.11395677473654 + 2.48660851393219*Z

Table E-4
Calcasieu Estuary Bayou Vedine AOC
Summary Statistics - Suface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Benzo(a)pyrene ug/Kg	**47/98**	5006.2186	12107.511	2.41849423	2609.0538	7403.3834	115.01447	581.10277	2935.982	2820.9676	**120**	**71000**	**8.9**	**27000**	ln(y) = 6.364927619714 + 2.40269318457761*Z
Benzo(b)fluoranthene ug/Kg	**58/98**	4118.3111	8701.7349	2.11293773	2395.4555	5841.1667	103.06316	535.21709	2779.4348	2676.3716	**43**	**58000**	**8.9**	**27000**	ln(y) = 6.28267244210723 + 2.44342472947019*Z
Benzo(g,h,i)perylene ug/Kg	**12/32**	1951.9856	8842.7647	4.53013826	-1111.876	5015.8472	72.931364	267.5261	981.33657	908.40521	**78**	**39000**	**460**	**27000**	ln(y) = 5.58921713540448 + 1.92779485194142*Z
Benzo(k)fluoranthene ug/Kg	**17/98**										**25**	**3600**	**8.9**	**27000**	
Benzyl Butyl Phthalate ug/Kg	**1/101**										**110**	**110**	**62**	**27000**	
Beryllium MG/KG	**26/91**	0.4036649	0.3200258	0.79280058	0.3379112	0.4694186	0.1873359	0.3145165	0.5280387	0.3407028	**0.23**	**1.5**	**0.065**	**1.3**	ln(y) = -1.15671881865147 + 0.76852787801451*Z
beta-BHC ug/Kg	**3/70**										**3.4**	**57**	**1.15**	**1.3**	
bis(2-Chloroethyl)ether ug/Kg	**3/101**										**630**	**49000**	**39.5**	**1.3**	
bis(2-Ethylhexyl)phthalate ug/Kg	**27/101**	175.76185	627.11819	3.56799951	53.456688	298.06701	37.833499	85.801018	194.58456	156.75106	**42**	**5000**	**60**	**140000**	ln(y) = 4.45203087046037 + 1.2145492772349*Z
Cadmium MG/KG	**49/101**	0.4350562	0.3369089	0.77440327	0.3693498	0.5007626	0.2022473	0.33614	0.5586729	0.3564256	**0.041**	**2.4**	**0.0335**	**1.5**	ln(y) = -1.09022758021778 + 0.753551799101803*Z
Calcium Metal MG/KG	**25/25**	**7054.4**	**9749.0286**	**1.38197843**	**3232.7808**	**10876.019**	**2230**	**2500**	**8290**	**6060**	**1870**	**39400**			ln(y) = 8.34461412850952 + 0.904190211905061*Z
Carbazole ug/Kg	**23/48**	511.864	434.81892	0.84948135	388.85302	634.87498	189.41168	363.82953	698.8583	509.44662	**89.4**	**1800**	**460**	**140000**	ln(y) = 5.89668542415003 + 0.968218762321041*Z
Carbon Disulfide ug/Kg	**2/91**										**9**	**12**	**3.35**	**140000**	
Chlorobenzene ug/Kg	**2/92**										**110**	**135**	**3.35**	**140000**	
Chloroform ug/Kg	**1/91**										**140000**	**140000**	**0.37**	**140000**	
Chloromethane ug/Kg	**1/91**										**6**	**6**	**6.5**	**140000**	
Chromium MG/KG	**91/91**	**108.85714**	**198.11239**	**1.81993008**	**68.152213**	**149.56207**	**9.2**	**26.8**	**110**	**100.8**	**3.2**	**1240**			ln(y) = 3.55816455759506 + 1.52254054582071*Z
cis-1,2-Dichloroethene ug/Kg	**1/91**										**26000**	**26000**	**0.315**	**0**	
Cobalt MG/KG	**22/25**	7.5983713	8.9423629	1.17687891	4.092965	11.103778	3.2839679	5.4672931	9.1021881	5.8182202	**2.1**	**38.4**	**4.7**	**5.4**	ln(y) = 1.69878362502681 + 0.756065587970883*Z
Copper MG/KG	**95/101**	41.533839	64.832884	1.56096539	28.889657	54.17802	8.2113941	19.41064	45.884161	37.672767	**2.8**	**317**	**0.42**	**3.8**	ln(y) = 2.96582135177422 + 1.27604938327215*Z
Cyanide MG/KG	**3/25**										**0.36**	**1.4**	**0.07**	**3.8**	
Cyclohexane ug/Kg	**1/25**										**18**	**18**	**11**	**3.8**	
delta-BHC ug/Kg	**6/70**										**4.6**	**55**	**1.15**	**3.8**	
Dibenzo(a,h)anthracene ug/Kg	**19/98**										**150**	**9800**	**8.9**	**3.8**	
Dibenzofuran ug/Kg	**7/101**										**47.2**	**4200**	**62**	**3.8**	
Dibromofluoromethane ug/Kg	**51/51**	**1953.902**	**4107.2235**	**2.10206223**	**826.65436**	**3081.1496**	**95**	**120**	**610**	**515**	**61**	**14000**			ln(y) = 5.66085440422189 + 1.62391862159919*Z
Dichloromethane ug/Kg	**21/91**	26.337037	133.00008	5.04992578	-0.989669	53.663744	0.6298923	2.8546002	12.936724	12.306831	**7.3**	**1000**	**6.3**	**26000**	ln(y) = 1.04893179538108 + 2.24141590646753*Z
Dieldrin ug/Kg	**1/70**										**20**	**20**	**1.15**	**26000**	
Diethyl Phthalate ug/Kg	**1/101**										**130**	**130**	**62**	**26000**	
Di-n-butylphthalate ug/Kg	**9/35**	72.762632	12.476383	0.17146691	68.629201	76.896064	59.803189	71.609169	85.745814	25.942625	**55**	**110**	**62**	**140000**	ln(y) = 4.27122312920089 + 0.267230852613486*Z
Dinitrobutyl Phenol ug/Kg	**23/75**	1623.0512	3196.664	1.96953983	899.57803	2346.5244	201.47718	575.10077	1641.58	1440.1028	**890**	**19000**	**17**	**8800**	ln(y) = 6.35454528491568 + 1.55574912973681*Z
Endosulfan I ug/Kg	**1/70**										**7.6**	**7.6**	**1.15**	**8800**	
Endrin Aldehyde ug/Kg	**1/70**										**5.3**	**5.3**	**0.335**	**8800**	
Endrin ug/Kg	**1/70**										**3.5**	**3.5**	**1.15**	**8800**	
Ethylbenzene ug/Kg	**1/48**										**29**	**29**	**3.35**	**8800**	
Fluoranthene ug/Kg	**53/98**	3152.4836	6915.3802	2.19362923	1783.3082	4521.659	108.0123	489.40473	2217.4973	2109.485	**69**	**40000**	**8.9**	**27000**	ln(y) = 6.19318981021996 + 2.24112876176988*Z
Fluorene ug/Kg	**21/98**	1132.737	4407.8219	3.89130213	260.03278	2005.4412	4.4395085	34.897563	274.31863	269.87912	**91.7**	**33000**	**39**	**140000**	ln(y) = 3.55241700295412 + 3.05830099802835*Z
gamma-BHC (Lindane) ug/Kg	**1/70**										**55**	**55**	**0.335**	**140000**	
Heptachlor Epoxide ug/Kg	**1/70**										**4.2**	**4.2**	**1.2**	**140000**	
Heptachlor ug/Kg	**1/70**										**2.7**	**2.7**	**1.15**	**140000**	
HPAH ug/Kg	**77/88**	**48207.247**	**91077.803**	**1.88929692**	**27863.86**	**68550.633**	**1935**	**11771**	**60600**	**58665**	**17**	**518000**			ln(y) = 9.11768752971357 + 2.35943910930371*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**28/98**	724.20336	2182.5378	3.01370847	292.08292	1156.3238	17.282715	83.406643	402.52171	385.23899	**74**	**16000**	**8.9**	**140000**	ln(y) = 4.4237279588436 + 2.33468767032268*Z
Iron MG/KG	**25/25**	**9324.4**	**5942.9851**	**0.63735845**	**6994.7498**	**11654.05**	**5500**	**6850**	**11050**	**5550**	**4030**	**26200**			ln(y) = 8.99017774047107 + 0.574241638994522*Z
Isopropylbenzene ug/Kg	**2/25**										**24**	**56**	**11**	**0**	
Lead MG/KG	**101/101**	**25.018812**	**20.717445**	**0.8280747**	**20.978345**	**29.059279**	**12.35**	**21.4**	**29.25**	**16.9**	**6.2**	**139**			ln(y) = 2.99675055804311 + 0.661064269656827*Z

Table E-4
Calcasieu Estuary Bayou Vedine AOC
Summary Statistics - Suface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
LPAH ug/Kg	**58.96/88**	**12234.236**	**24538.094**	**2.00569086**	**5972.8435**	**18495.628**	**810**	**2800**	**10300**	**9490**	**60**	**108300**			ln(y) = 7.984583416978 + 1.81575473911284*Z
Magnesium MG/KG	**25/25**	**1774.68**	**1155.1924**	**0.65092999**	**1321.8446**	**2227.5154**	**1025**	**1210**	**2440**	**1415**	**559**	**5000**			ln(y) = 7.30749302339701 + 0.63345975806353*Z
Manganese MG/KG	**25/25**	**347.88**	**408.39991**	**1.17396776**	**187.78724**	**507.97276**	**164.5**	**231**	**361.5**	**197**	**101**	**1860**			ln(y) = 5.57456448865746 + 0.702609935078612*Z
Mercury MG/KG	**37/101**	0.1391704	0.1503675	1.08045623	0.1098446	0.1684962	0.0349736	0.0771996	0.1704076	0.135434	**0.0239**	**0.57**	**0.022**	**0.27**	ln(y) = -2.56136133110015 + 1.17444711457258*Z
Methyl Acetate ug/Kg	**8/25**	6.0975004	2.6754313	0.43877509	5.0487314	7.1462695	4.060043	5.6839415	7.957352	3.897309	**4**	**14**	**11**	**140**	ln(y) = 1.73764492091288 + 0.499045948054181*Z
Methylbenzene ug/Kg	**3/92**										**3**	**135**	**0.35**	**140**	
Methylcyclohexane ug/Kg	**2/25**										**5**	**1100**	**11**	**140**	
Naphthalene ug/Kg	**22/98**	1611.4697	6319.5913	3.92163206	360.25448	2862.685	10.505887	71.815809	490.91624	480.41036	**197**	**48000**	**40.5**	**140000**	ln(y) = 4.27410463220743 + 2.851082560423*Z
Nickel MG/KG	**84/101**	19.205776	20.873759	1.08684798	15.134824	23.276729	7.2597853	13.161638	23.861411	16.601626	**3.3**	**117**	**0.42**	**12**	ln(y) = 2.57730640971734 + 0.882476628508978*Z
N-Nitrosodiphenylamine ug/Kg	**1/101**										**840**	**840**	**62**	**12**	
OCDD PG/G	**11/11**	**5440.9091**	**8221.5023**	**1.51105306**	**582.3117**	**10299.506**	**1000**	**2700**	**6500**	**5500**	**280**	**25000**			ln(y) = 7.90211625373906 + 1.53039934534258*Z
OCDF PG/G	**9/11**	805.1372	1512.8918	1.87904848	-88.92474	1699.1991	36.110273	189.27265	992.07605	955.96577	**10**	**4400**	**2.9**	**42**	ln(y) = 5.24318858060765 + 2.4571905510043*Z
PCB-105 NG/KG	**2/2**										**717**	**941**			
PCB-108 NG/KG	**2/2**										**136**	**167**			
PCB-114 NG/KG	**2/2**										**36.8**	**90.3**			
PCB-118 NG/KG	**2/2**										**1630**	**2050**			
PCB-126 NG/KG	**2/2**										**21.3**	**30.7**			
PCB-127 NG/KG	**1/2**										**4.58**	**4.58**	**4.96**	**42**	
PCB-15 NG/KG	**2/2**										**212**	**362**			
PCB-156 ng/kg	**2/2**										**231**	**287**			
PCB-157 NG/KG	**2/2**										**58.9**	**77.5**			
PCB-162 NG/KG	**2/2**										**412**	**510**			
PCB-167 NG/KG	**2/2**										**99.5**	**129**			
PCB-169 NG/KG	**1/2**										**17.5**	**17.5**	**4.96**	**42**	
PCB-189 NG/KG	**2/2**										**29.9**	**44.9**			
PCB-209 ug/Kg	**12/12**	**35.5**	**13.494376**	**0.38012326**	**27.864838**	**43.135162**	**25.25**	**33**	**49.25**	**24**	**17**	**55**			ln(y) = 3.50111769709513 + 0.456177503623049*Z
PCB-37 ng/kg	**2/2**										**249**	**289**			
PCB-58 NG/KG	**2/2**										**44.9**	**53**			
PCB-60 NG/KG	**2/2**										**415**	**932**			
PCB-61/70 NG/KG	**2/2**										**956**	**2060**			
PCB-66 NG/KG	**2/2**										**827**	**1590**			
PCB-77 NG/KG	**2/2**										**134**	**180**			
PCB-79 NG/KG	**2/2**										**24.5**	**30.6**			
PCB-81 NG/KG	**2/2**										**39.9**	**41.1**			
Phenanthrene ug/Kg	**13/32**	3105.8872	9498.185	3.05812295	-185.066	6396.8404	54.671327	282.03299	1454.9237	1400.2523	**60**	**42000**	**460**	**4900**	ln(y) = 5.64202405036166 + 2.43356733822167*Z
Phenol ug/Kg	**3/101**										**2500**	**5600**	**37.5**	**4900**	
Potassium MG/KG	**24/25**	716.78431	382.26046	0.53329915	566.9382	866.63041	**483.5**	**639**	**876**	**392.5**	**292**	**1720**	**259**	**259**	ln(y) = 6.45232669848946 + 0.555477445067389*Z
Pyrene ug/Kg	**72/98**	10369.774	23923.731	2.30706394	5633.1167	15106.431	232.87437	1290.1286	7147.3377	6914.4633	**17**	**160000**	**8.9**	**630**	ln(y) = 7.16249715831337 + 2.53934385730167*Z
Selenium MG/KG	**40/91**	1.8584808	3.7178881	2.00049856	1.0945893	2.6223723	0.2203594	0.6220995	1.7562572	1.5358977	**0.53**	**23.4**	**0.09**	**2.5**	ln(y) = -0.474655194123134 + 1.53939015260664*Z
Silver MG/KG	**12/101**										**0.077**	**1.8**	**0.29**	**2.5**	
Sodium MG/KG	**25/25**	**1418.48**	**2319.6474**	**1.63530499**	**509.17821**	**2327.7818**	**337**	**546**	**882**	**545**	**110**	**8660**			ln(y) = 6.43116218161315 + 1.30972444406645*Z
Tetrachloroethene ug/Kg	**1/91**										**38000**	**38000**	**0.9**	**0**	
Tetrachloro-m-xylene ug/Kg	**12/12**	**32.666667**	**12.520823**	**0.38329049**	**25.582344**	**39.750989**	**22**	**31**	**44.75**	**22.75**	**13**	**50**			ln(y) = 3.41059049651556 + 0.485511033442764*Z
Thallium MG/KG	**7/91**										**0.54**	**1.9**	**0.335**	**0**	
Total HpCDD PG/G	**11/11**	**1077.2727**	**2214.8504**	**2.05597923**	**-231.6202**	**2386.1656**	**140**	**340**	**1200**	**1060**	**41**	**6300**			ln(y) = 5.98986904898248 + 1.77312063920112*Z

Table E-4
Calcasieu Estuary Bayou Vedine AOC
Summary Statistics - Suface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total HpCDF PG/G	**11/11**	**607.87273**	**938.69155**	**1.54422383**	**53.14147**	**1162.604**	**15**	**344**	**869**	**854**	**5.1**	**2800**			ln(y) = 4.97550913601579 + 2.55704325588071*Z
Total HxCDD PG/G	**11/11**	**107.04545**	**160.7723**	**1.50190687**	**12.035095**	**202.05581**	**21**	**66**	**142**	**121**	**4.7**	**490**			ln(y) = 3.97637132223409 + 1.57939094911276*Z
Total HxCDF PG/G	**7/11**	259.19556	316.99407	1.2229919	71.864036	446.52709	70.683843	159.43096	359.60455	288.92071	**120**	**1000**	**1.3**	**3.3**	ln(y) = 5.07161098382829 + 1.20647741094863*Z
Total Organic Carbon MG/KG	**84/85**	24406.981	56629.618	2.32022213	12367.986	36445.976	**7570**	**15162.968**	**26700**	**19130**	**808**	**424500**	**119**	**119**	ln(y) = 9.56794323515344 + 1.01161063726109*Z
Total PeCDD PG/G	**4/11**	9.1794758	10.870301	1.18419629	2.7555383	15.603413	2.2220776	5.3037149	12.65905	10.436973	**9.92**	**32**	**0.5**	**8.1**	ln(y) = 1.66840749377257 + 1.29038699872627*Z
Total PeCDF PG/G	**8/11**	85.593186	137.87601	1.61082933	4.1136684	167.0727	6.4381444	26.661036	110.40617	103.96802	**3.6**	**410**	**1.3**	**2.4**	ln(y) = 3.28320318516018 + 2.10766199402741*Z
Total TCDD PG/G	**11/11**	**9.5081818**	**14.118509**	**1.48487995**	**1.1646764**	**17.851687**	**1.04**	**2.3**	**16**	**14.96**	**0.8**	**37**			ln(y) = 1.2828335312106 + 1.63701164163134*Z
Total TCDF PG/G	**11/11**	**54.318182**	**47.196825**	**0.86889553**	**26.42664**	**82.209723**	**8.1**	**57.8**	**100**	**91.9**	**3.2**	**140**			ln(y) = 3.42602098199301 + 1.47819709934679*Z
trans-1,2-Dichloroethene ug/Kg	**1/91**										**20000**	**20000**	**0.33**	**0**	
Trichloroethylene ug/Kg	**2/92**										**135**	**50000**	**0.465**	**0**	
Vanadium (Fume Or Dust) MG/KG	**91/91**	**19.141758**	**10.914093**	**0.57017193**	**16.899307**	**21.38421**	**12.2**	**17.4**	**22.1**	**9.9**	**7.7**	**85.4**			ln(y) = 2.84483506558679 + 0.45603041107599*Z
Xylenes (total) ug/Kg	**2/91**										**17**	**61**	**3.35**	**0**	
Zinc MG/KG	**101/101**	**450.85545**	**475.51941**	**1.05470482**	**358.11618**	**543.59471**	**48.2**	**296**	**831**	**782.8**	**8**	**1670**			ln(y) = 5.22769017418708 + 1.53137530100197*Z
Acid Volatile Sulfide umol/g	**10/10**	**28.701**	**16.942061**	**0.59029515**	**18.200202**	**39.201798**	**18.575**	**27.65**	**43.925**	**25.35**	**0.31**	**52.3**			ln(y) = 2.90594368494726 + 1.42360085452734*Z
Diesel Range Organics ug/Kg	**9/9**	**2905833.3**	**5260471.9**	**1.81031439**	**-531008.3**	**6342675**	**247000**	**610000**	**4875000**	**4628000**	**18500**	**14000000**			ln(y) = 13.4113143336534 + 2.55856167506765*Z
pH standard units	**9/9**	**7.4722222**	**0.2704712**	**0.03619689**	**7.2955144**	**7.6489301**	**7.325**	**7.5**	**7.7**	**0.375**	**6.95**	**7.75**			ln(y) = 2.01065325341128 + 3.96805173772958E-02*Z
Total Sulfide MG/KG	**7/9**	741.37855	595.81457	0.80365768	352.11304	1130.6441	269.75108	542.02001	1089.0992	819.34814	**304**	**1780**	**5.9**	**6.3**	ln(y) = 6.29530292167339 + 1.03502603001301*Z
Percent Clay %	**10/10**	**37.618**	**10.836108**	**0.28805646**	**30.901711**	**44.334289**	**28.21**	**35.95**	**47.5125**	**19.3025**	**24.58**	**55.06**			ln(y) = 3.59254753528807 + 0.328603593023194*Z
Percent Sand %	**10/10**	**31.852**	**18.046868**	**0.56658508**	**20.666435**	**43.037565**	**17.9375**	**35.165**	**47.06**	**29.1225**	**2.73**	**55.1**			ln(y) = 3.16067337879831 + 1.06836296500457*Z
Percent Silt %	**10/10**	**30.531**	**9.8242293**	**0.32177883**	**24.44188**	**36.62012**	**21.1325**	**28.785**	**41.5925**	**20.46**	**15.99**	**42.21**			ln(y) = 3.36882254724944 + 0.397935915476838*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

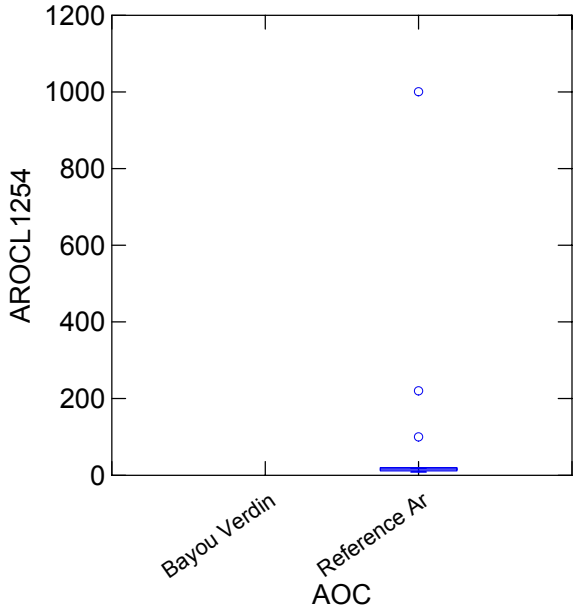
Table E-5
Calcasieu Estuary Bayou Vedine AOC
Summary Statistics - Surface Water Results

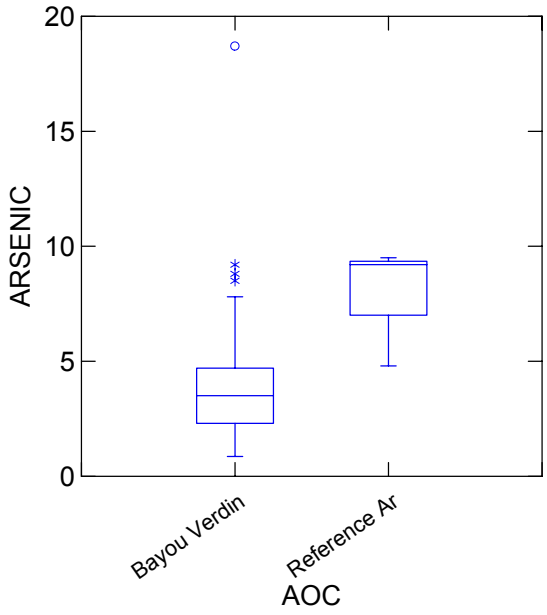
Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Lower	95% Confidence Limit about the Upper	Percentiles 25th	Percentiles Median	Percentiles 75th	Percentiles IQR	Range of Detected Values Minimum	Range of Detected Values Maximum	Reporting Limit Minimum	Reporting Limit Maximum	Regression Equation
Ammonia as N mg/L	**5/12**	0.108352	0.080501	0.74295734	0.0628	0.1539	0.048	0.08417	**0.155**	0.107	**0.11**	**0.26**	**0.1**	**0.1**	ln(y) = -2.47495354667399 + 0.833985687361657*Z
Chloroform ug/L	**7/12**	1.575047	0.894296	0.56779	1.06905	2.08104	0.8624	**1.3**	**2.45**	1.5876	**1.2**	**3.1**	**1**	**1**	ln(y) = 0.299633046158889 + 0.664048745402952*Z
Mercury mg/L Dissolved	**4/11**	0.000272	0.000169	0.62021136	0.00017	0.00037	0.0002	0.00023	**0.0004**	0.0002	**0.00033**	**0.0006**	**0.0002**	**0.0002**	ln(y) = -8.35640797394198 + 0.628759885857413*Z
Methyl tert-Butyl Ether ug/L	**2/25**										**1.1**	**1.7**	**1**	**0.0002**	
Zinc mg/L Dissolved	**3/11**	0.018209	0.016196	0.88945958	0.00864	0.02778	0.0074	0.01354	**0.028**	0.0206	**0.028**	**0.051**	**0.02**	**0.02**	ln(y) = -4.30217954028161 + 0.89633178614284*Z
Zinc mg/L Total	**1/1**										**0.028**	**0.028**			
Dissolved Oxygen %	**10/10**	**11.196**	**5.0909995**	**0.454715929**	**8.040566**	**14.35143**	**6.3225**	**10.4**	**16.1425**	**9.82**	**5.09**	**18.47**			ln(y) = 2.31604317758757 + 0.563871801452693*Z
Field Conductivity ms/cm	**10/10**	**9061.7**	**13356.537**	**1.473954927**	**783.2324**	**17340.17**	**2210**	**2730**	**13747.5**	**11537.5**	**547**	**33450**			ln(y) = 8.33415678744866 + 1.44611603124839*Z
Field pH standard units	**10/10**	**7.607**	**0.2893775**	**0.038040956**	**7.427642**	**7.786358**	**7.37125**	**7.5125**	**7.825**	**0.45375**	**7.26**	**8.15**			ln(y) = 2.02846017809114 + 4.29107111448588E-02*Z
Field Temperature deg c	**10/10**	**19.0075**	**3.3178404**	**0.174554275**	**16.95108**	**21.06392**	**16.37**	**18.27**	**22.7688**	**6.39875**	**14.61**	**23.22**			ln(y) = 2.93124301034812 + 0.203207248097195*Z
Field Total Dissolved Solids mg/L	**6/6**	**11966.667**	**7738.3502**	**0.64665879**	**5774.697**	**18158.64**	**3875**	**12150**	**20000**	**16125**	**3500**	**20000**			ln(y) = 9.16098296460973 + 0.968208862127122*Z
Field Turbidity NTU	**8/8**	**8.16875**	**15.198234**	**1.860533616**	**-2.36309**	**18.70059**	**1.95**	**3.375**	**9.175**	**7.225**	**1.7**	**37.3**			ln(y) = 1.49563814750626 + 1.19228558005663*Z
Hardness, as CaCO3 mg/L	**12/12**	**128.25**	**58.183818**	**0.453674992**	**95.32941**	**161.1706**	**88.5**	**110**	**144.5**	**56**	**80**	**246**			ln(y) = 4.78342873757663 + 0.406971509515527*Z
Salinity ppt	**6/6**	**13.333333**	**8.5854198**	**0.643906482**	**6.463567**	**20.2031**	**3.5**	**15.75**	**21.125**	**17.625**	**2**	**21.5**			ln(y) = 2.28424094345031 + 1.1659534470118*Z
Total Alkalinity mg/L	**12/12**	**126.14583**	**41.235478**	**0.32688736**	**102.8147**	**149.477**	**87.55**	**116.325**	**165**	**77.45**	**85**	**191**			ln(y) = 4.78976517300778 + 0.357428376503438*Z
Total Kjeldahl Nitrogen mg/L	**8/12**	0.559964	0.146938	0.26240595	0.47683	0.6431	0.4481	**0.555**	**0.6675**	0.2194	**0.51**	**0.85**	**0.5**	**0.5**	ln(y) = -0.608207273308276 + 0.288699457205132*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

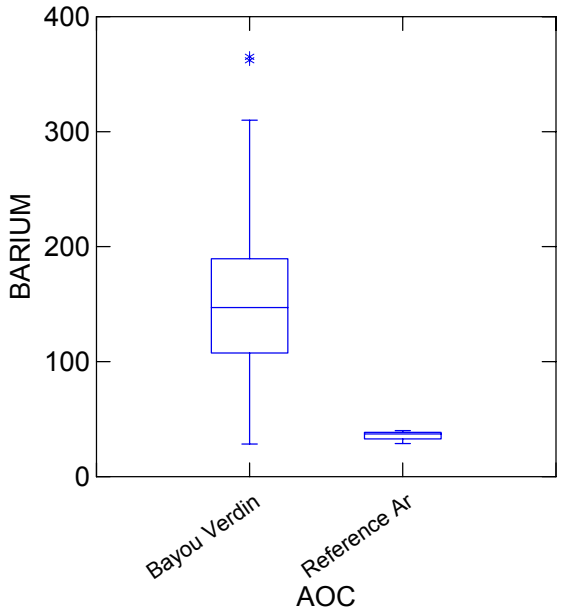
Only general summary statistics are provided for data at or below the 20% detection threshold.

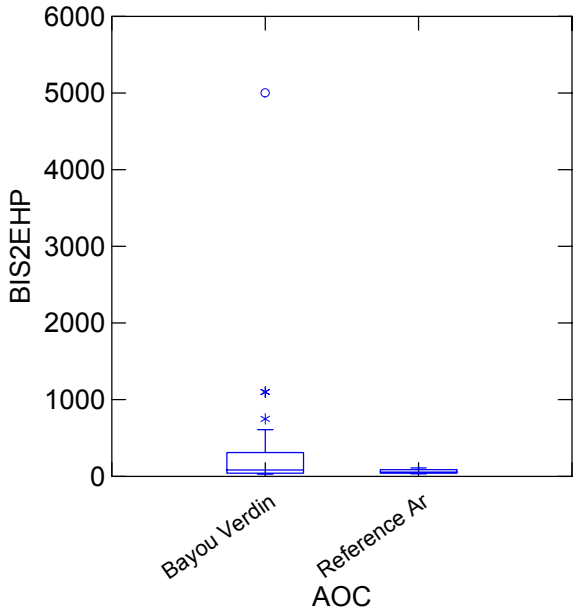
E-6 Box Plots
Bayou Verdine – Bayou Energy System



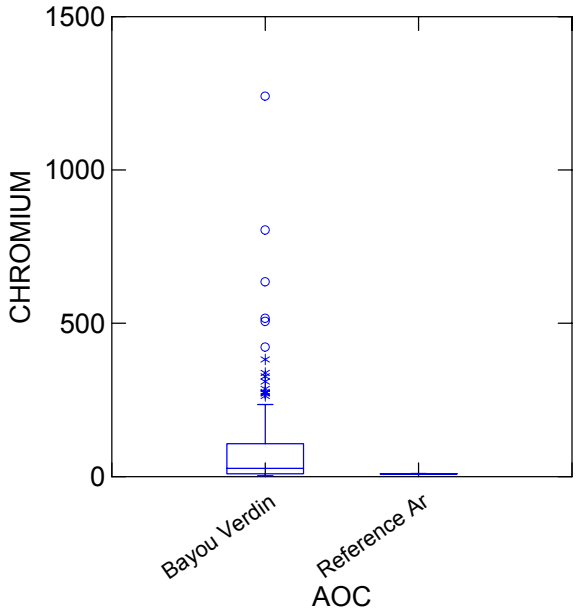


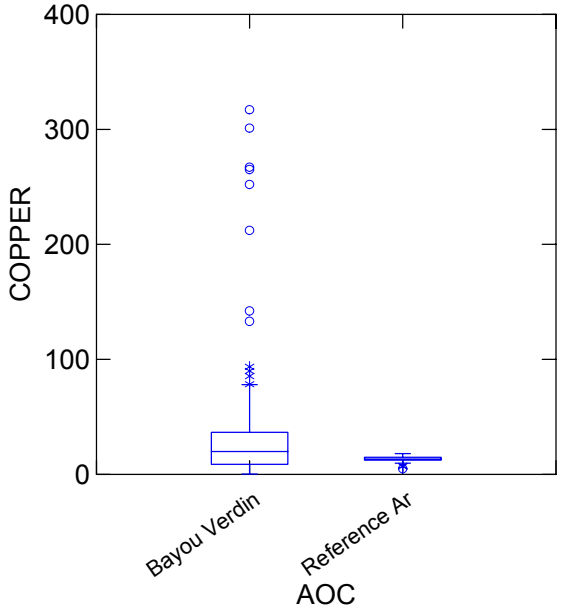
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ



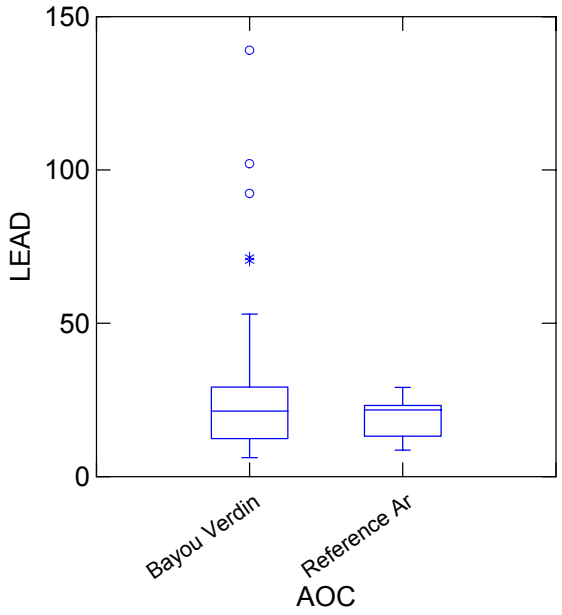


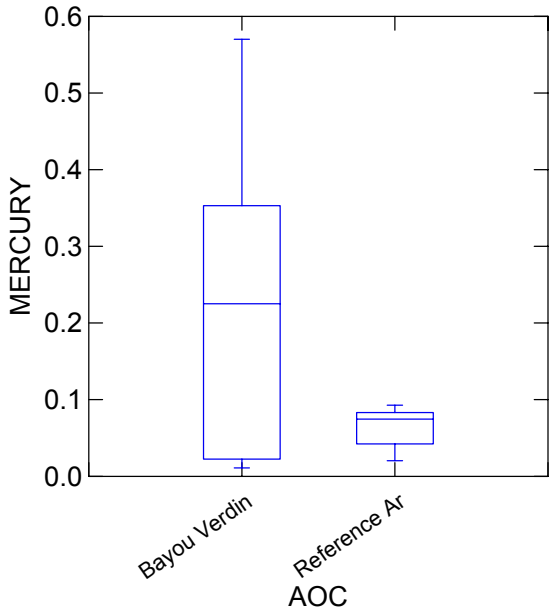
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ



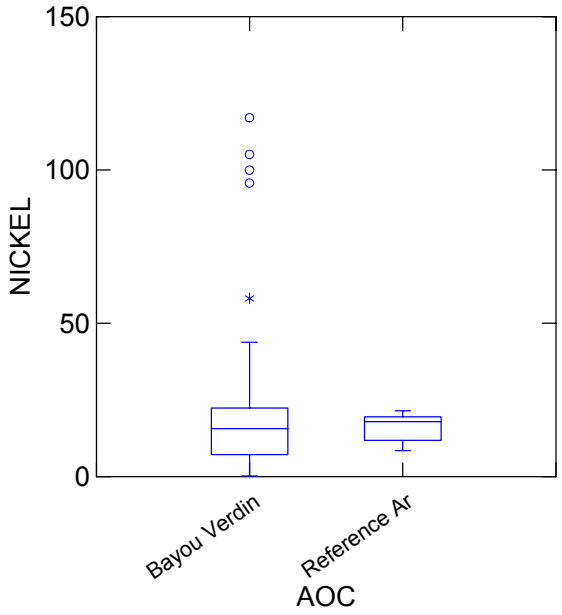


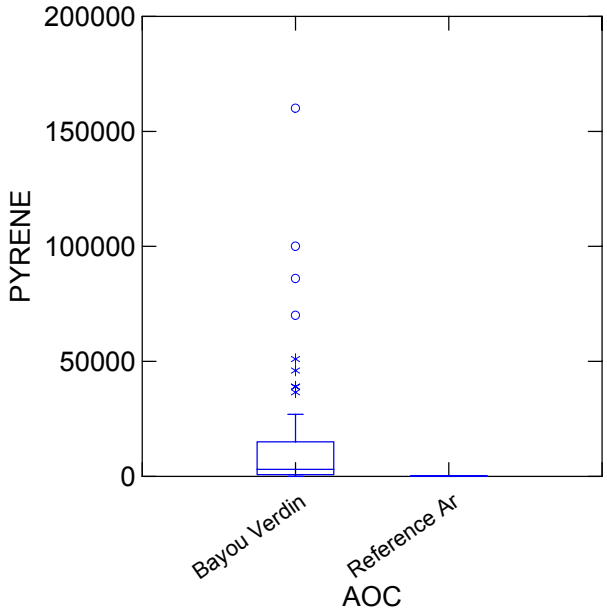
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ



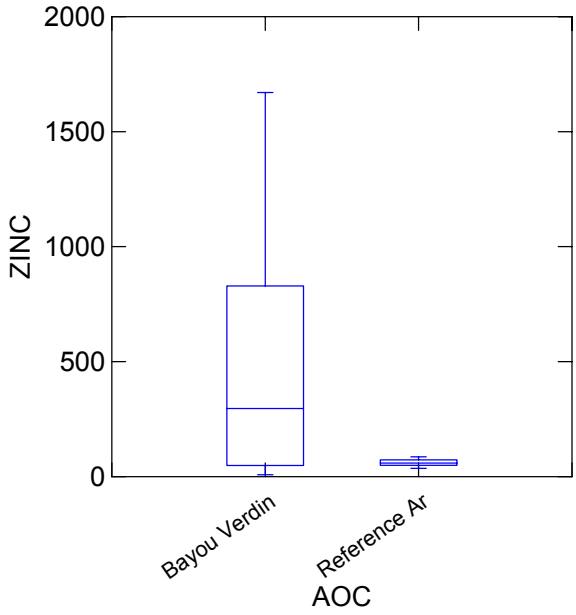


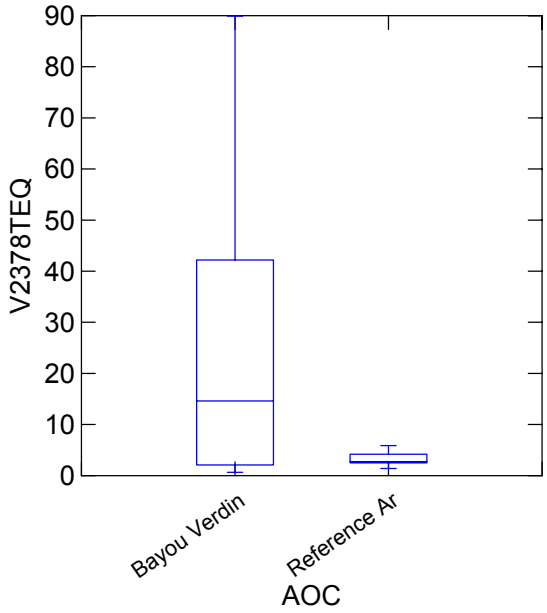
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ





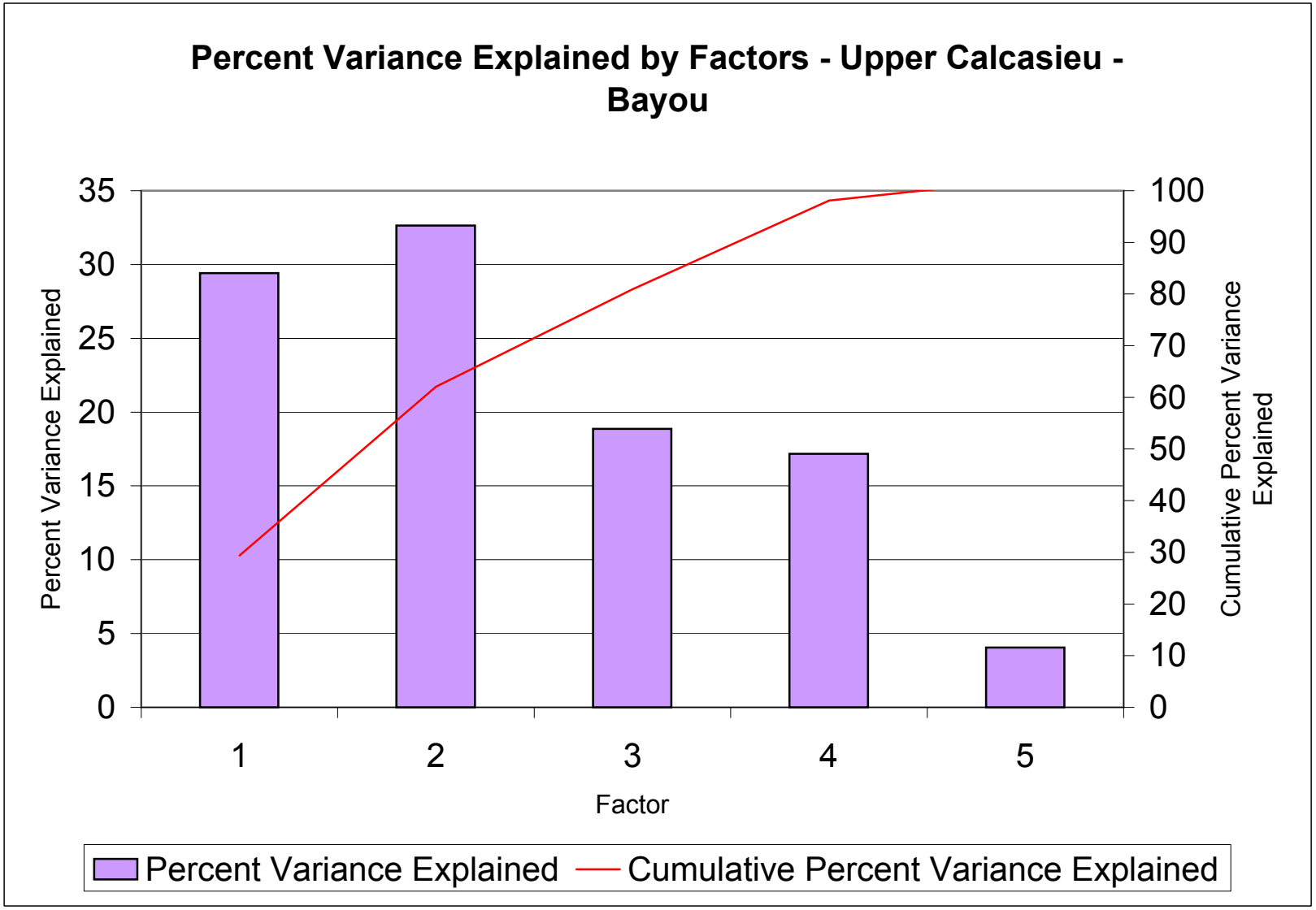
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ





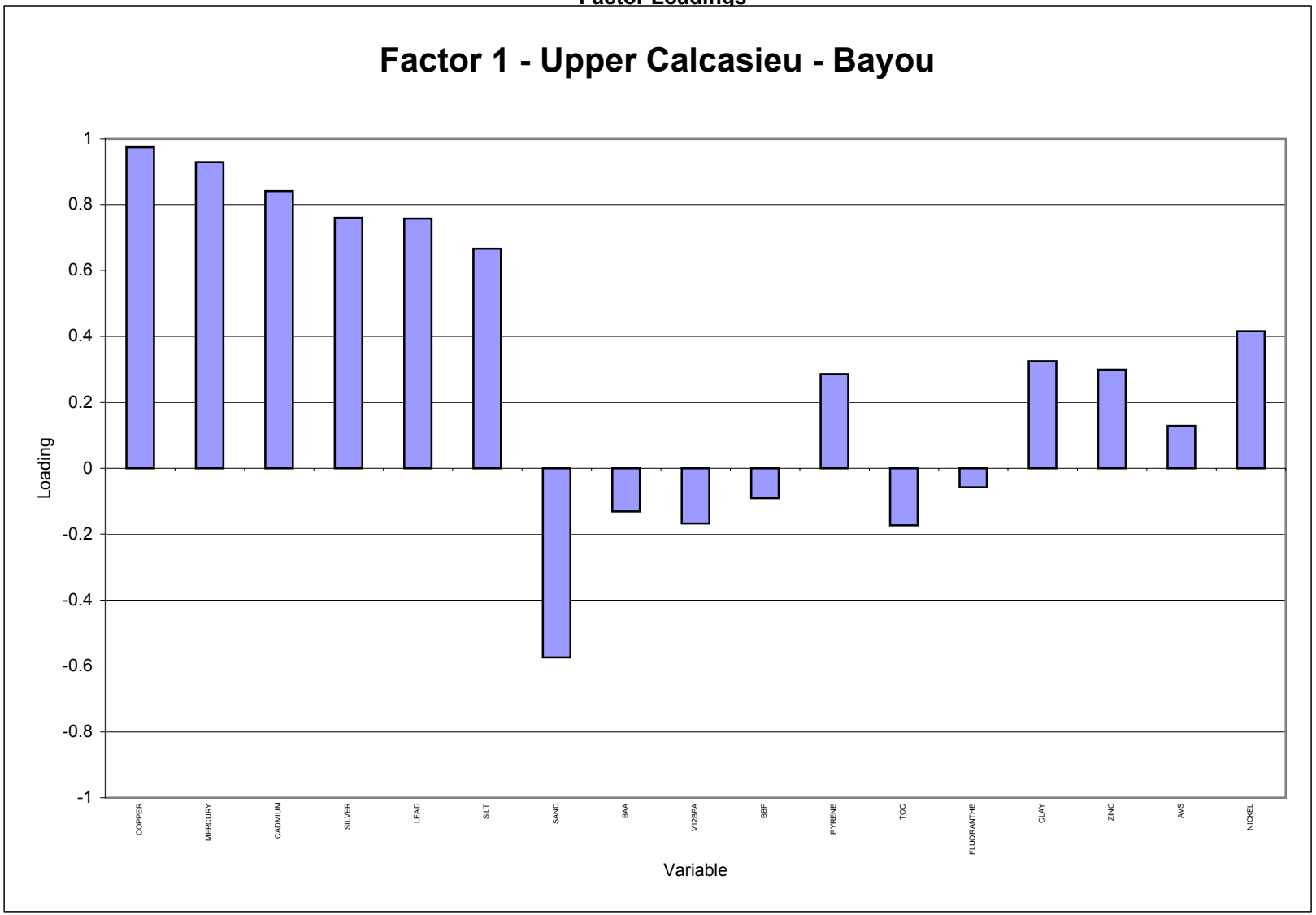
Arocl 1254 – Aroclor 1254
BIS2EHP – Bis(2-ethylhexyl)phthalate
V2378TEQ – 2,3,7,8-TCDD TEQ

Table F-1
Principal Components Analysis Results



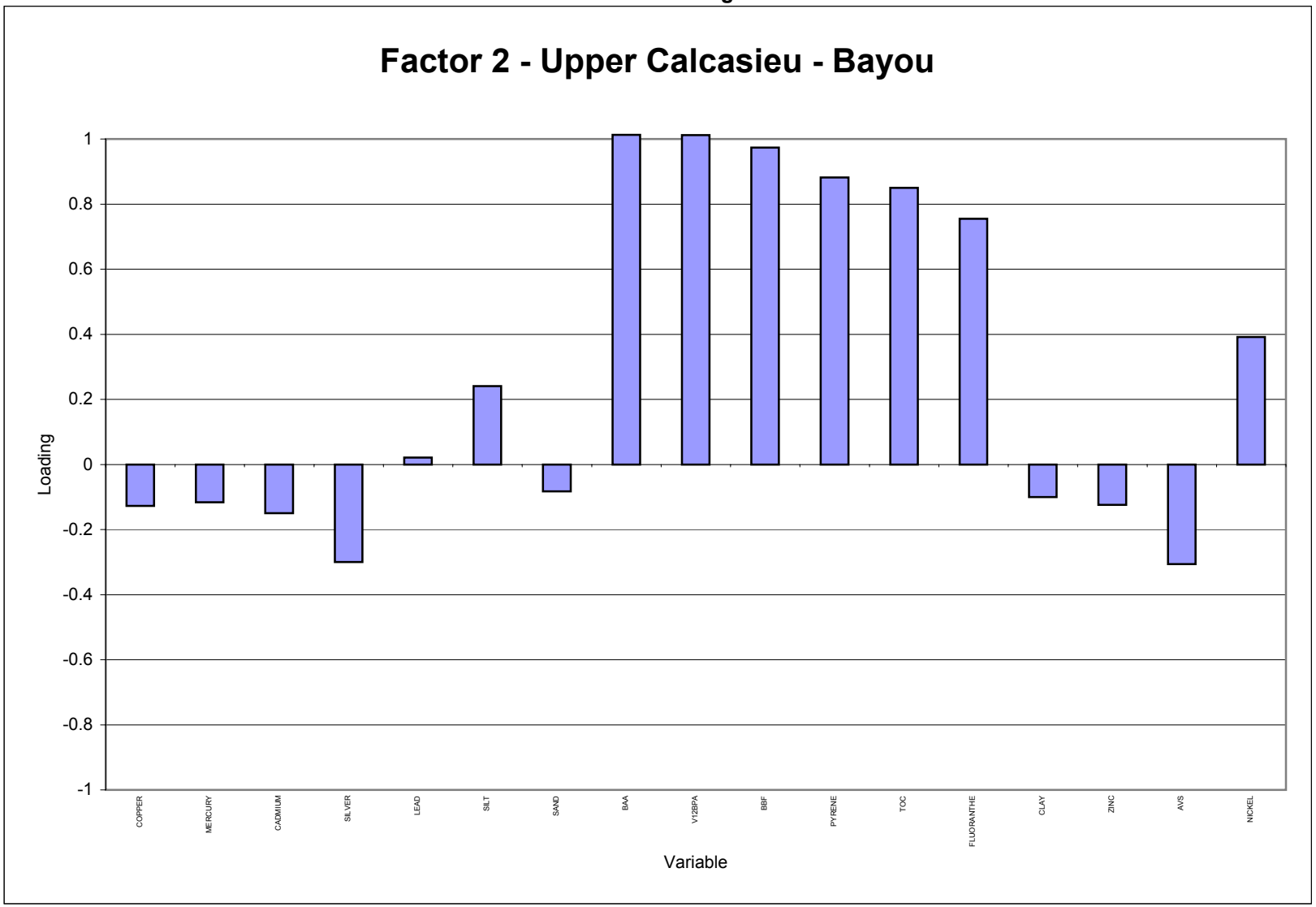
CDM

Table F-2
Upper Calcasieu-Bayou
Factor Loadings



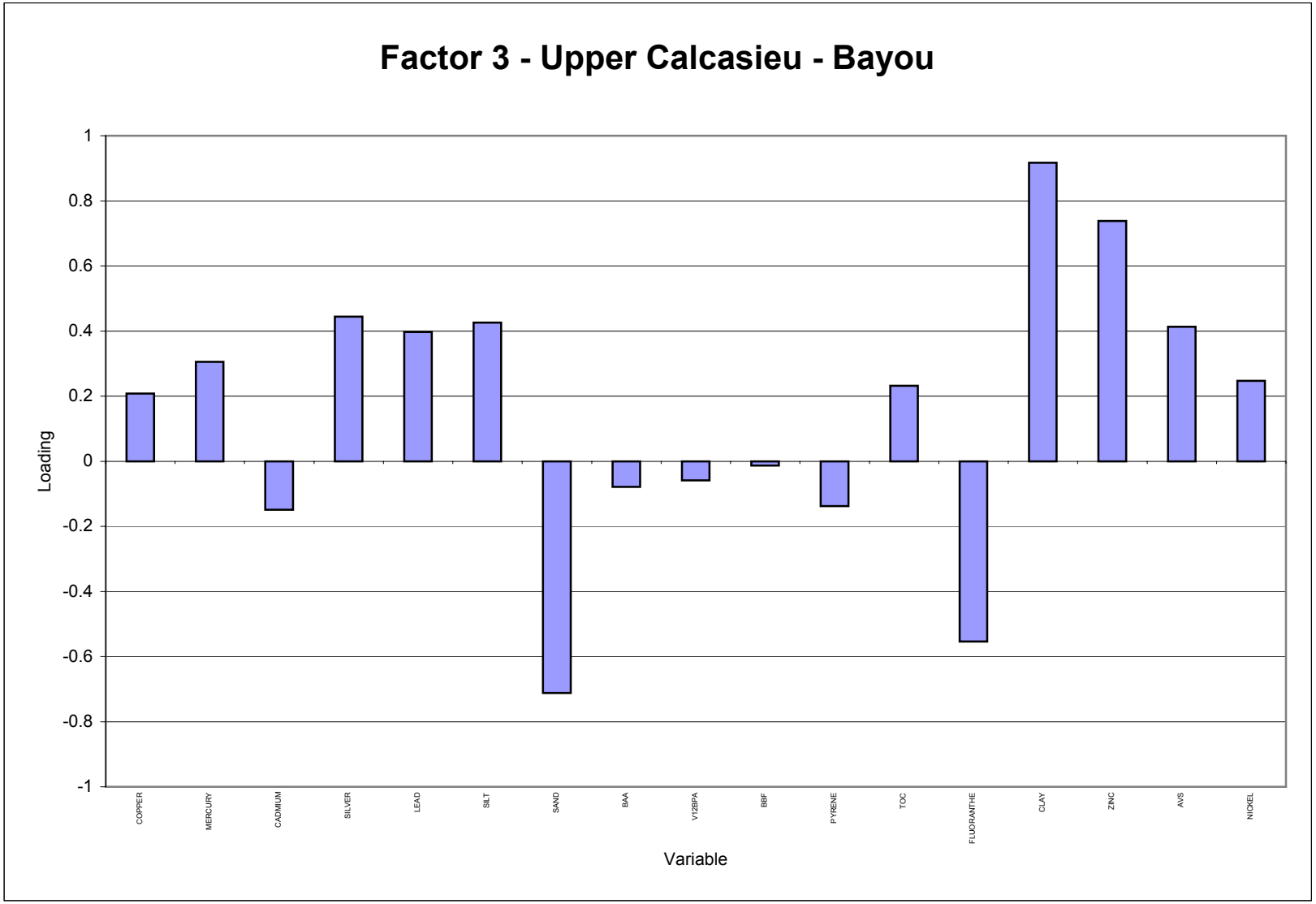
CDM

Table F-2
Upper Calcasieu-Bayou
Factor Loadings



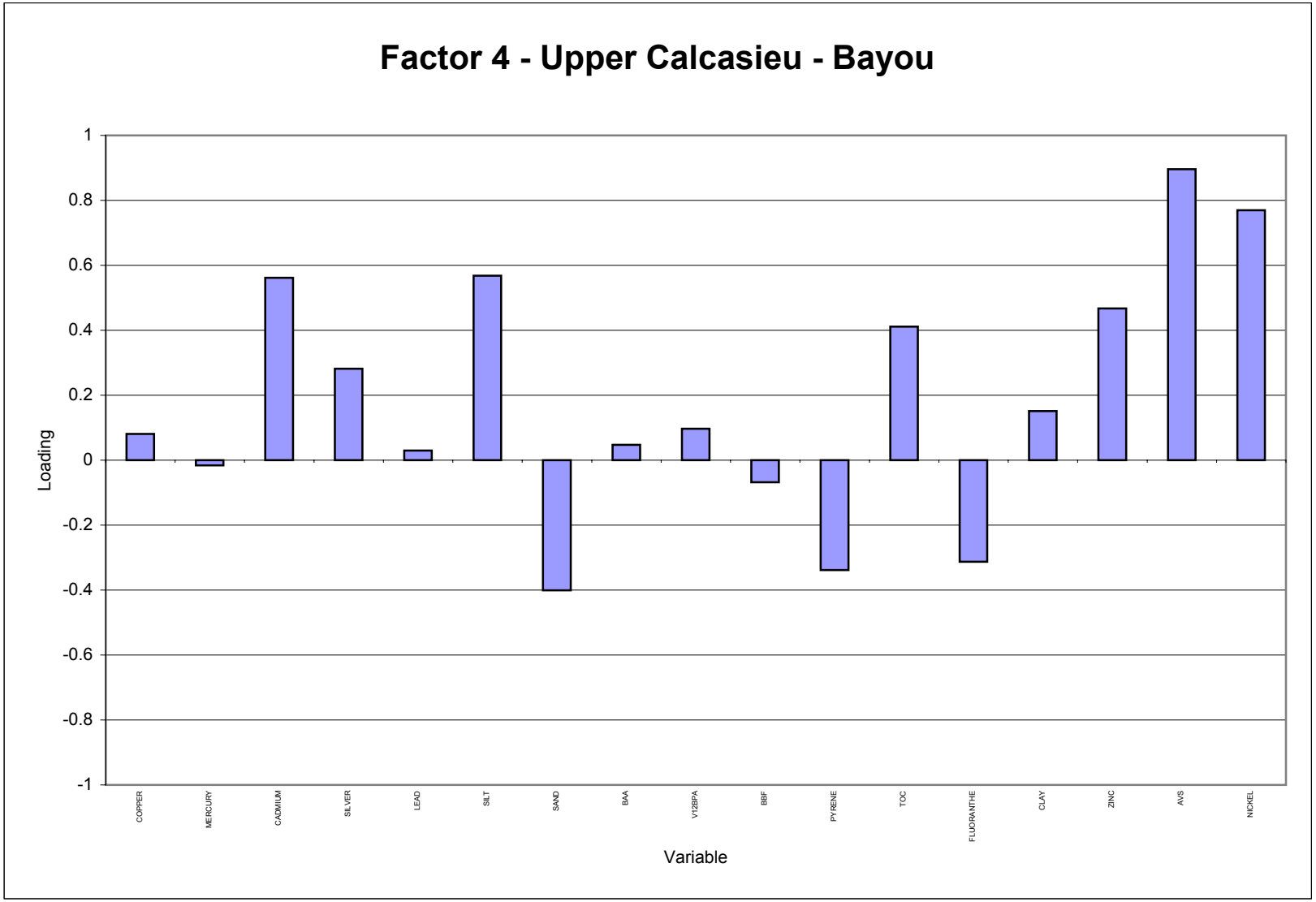
CDM

Table F-2
Upper Calcasieu-Bayou
Factor Loadings



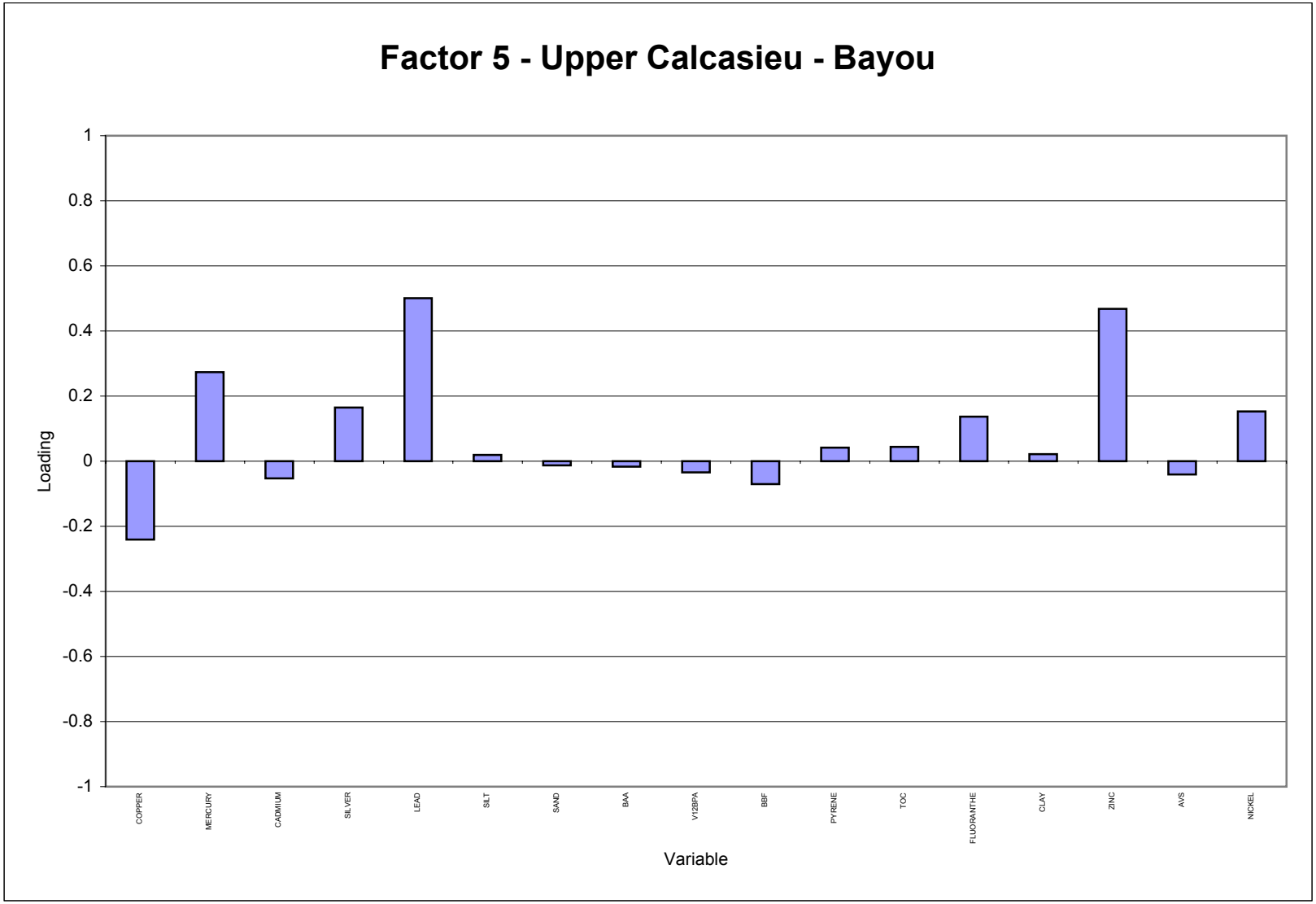
CDM

Table F-2
Upper Calcasieu-Bayou
Factor Loadings



CDM

Table F-2
Upper Calcasieu-Bayou
Factor Loadings



CDM

Table F-3
Upper Calcasieu - Bayou Energy System
Principal Components Analysis Results

Variable	Sum Ranking
COPPER	0.391
NICKEL	0.387
ZINC	0.367
PYRENE	0.356
SILT	0.353
TOC	0.346
FLUORANTHE	0.332
LEAD	0.330
CADMIUM	0.329
SAND	0.311
SILVER	0.307
CLAY	0.255
MERCURY	0.255
AVS	0.248
BBF	0.241
V12BPA	0.227
BAA	0.218

Table F-4
Upper Calcasieu - Bayou Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**1/1**										**190**	**190**			
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**21**	**21**			
1,2,3,6,7,8-HxCDD PG/G	**1/1**										**8.6**	**8.6**			
1,2,3,7,8,9-HxCDD PG/G	**1/1**										**11**	**11**			
1,2-Benzphenanthracene ug/Kg	**5/8**	76.714284	50.343973	0.65625292	41.8276908	111.600878	49.115251	71.571425	104.29487	55.17962	**49.5**	**165**	**640**	**870**	ln(y) = 4.27069589533172 + 0.55848762741194*Z
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**7.8953**	**7.8953**			
2,4,5-T ug/Kg	**1/3**										**4.1**	**4.1**	**39**	**870**	
2-Butanone ug/Kg	**1/3**										**2**	**2**	**19**	**870**	
4-Methylphenol ug/Kg	**1/9**										**33**	**33**	**59**	**870**	
Acenaphthene ug/Kg	**2/5**										**27.4**	**241**	**640**	**870**	
alpha-BHC ug/Kg	**1/9**										**10**	**10**	**3.3**	**870**	
Aluminum (Fume Or Dust) MG/KG	**4/4**	**11700**	**6849.8676**	**0.58545877**	**4987.12977**	**18412.8702**	**5420**	**11780**	**17900**	**12480**	**4140**	**19100**			ln(y) = 9.22184220618558 + 0.904436534629717*Z
Anthracene ug/Kg	**1/4**										**13**	**13**	**640**	**0**	
Aroclor-1254 ug/Kg	**1/9**										**250**	**250**	**15**	**0**	
Arsenic MG/KG	**4/4**	**2.74**	**1.8145488**	**0.66224408**	**0.96174221**	**4.51825779**	**1.32**	**2.55**	**4.35**	**3.03**	**0.96**	**4.9**			ln(y) = 0.854283430240127 + 0.907622468534554*Z
Barium MG/KG	**4/4**	**88.2**	**70.435413**	**0.79858745**	**19.173295**	**157.226705**	**30.5**	**82.5**	**151.6**	**121.1**	**16.8**	**171**			ln(y) = 4.19275721552832 + 1.30802031642925*Z
Benzo(a)anthracene ug/Kg	**5/8**	72.528462	63.10679	0.8700969	28.7976874	116.259236	44.420981	65.709232	97.199634	52.778653	**48.1**	**178**	**640**	**870**	ln(y) = 4.18523942634819 + 0.580738394161779*Z
Benzo(a)pyrene ug/Kg	**4/7**	93.014858	98.770652	1.06188037	19.8445352	166.185182	43.285019	80.068003	148.10864	104.82362	**46.6**	**244**	**640**	**870**	ln(y) = 4.38287631120659 + 0.912310326702249*Z
Benzo(b)fluoranthene ug/Kg	**6/9**	117.9184	112.68038	0.95557926	44.3005532	191.536248	67.630984	103.92187	159.68649	92.055511	**68.5**	**333**	**640**	**870**	ln(y) = 4.64363934869079 + 0.637170059531439*Z
Benzo(g,h,i)perylene ug/Kg	**2/5**										**35.8**	**144**	**640**	**870**	
Benzo(k)fluoranthene ug/Kg	**2/5**										**16.2**	**95.4**	**640**	**870**	
Beryllium MG/KG	**3/4**	0.7530272	0.5596629	0.74321732	0.20455761	1.30149687	**-1.2**	**-1.2**	**1.275**	**2.475**	**0.31**	**1.3**	**1.2**	**1.2**	ln(y) = -0.45484700408985 + 0.735673206439482*Z
beta-BHC ug/Kg	**1/9**										**10**	**10**	**3.3**	**1.2**	
bis(2-Ethylhexyl)phthalate ug/Kg	**1/9**										**180**	**180**	**59**	**1.2**	
Cadmium MG/KG	**7/9**	0.3950682	0.8680557	2.19722995	-0.1720615	0.96219792	0.0796638	0.1969116	0.4867228	0.407059	**0.029**	**2.1**	**0.49**	**0.58**	ln(y) = -1.62500046847369 + 1.34226423372471*Z
Calcium Metal MG/KG	**4/4**	**3730**	**1788.2914**	**0.4794347**	**1977.47441**	**5482.52559**	**2382.5**	**3435**	**5372.5**	**2990**	**2150**	**5900**			ln(y) = 8.1571842312649 + 0.584116775767657*Z
Chromium MG/KG	**4/4**	**14.05**	**8.5170608**	**0.6061965**	**5.70328045**	**22.3967195**	**5.9**	**14.95**	**21.3**	**15.4**	**4.1**	**22.2**			ln(y) = 2.46476089225649 + 1.00214452817302*Z
Cobalt MG/KG	**3/4**	2.6575745	1.1538228	0.43416384	1.5268282	3.7883208	**-7.8**	**-7.8**	**-7.8**	**0**	**1.5**	**3.6**	**7.8**	**7.8**	ln(y) = 0.928337080746113 + 0.649275318568356*Z
Copper MG/KG	**9/9**	**24.498889**	**19.36305**	**0.79036441**	**11.848363**	**37.1494148**	**8.99**	**20.9**	**45.8**	**36.81**	**4.81**	**53.8**			ln(y) = 2.88992483806562 + 1.02878743947062*Z
Cyanide MG/KG	**1/3**										**4.7**	**4.7**	**0.09**	**0**	
delta-BHC ug/Kg	**1/9**										**8.8**	**8.8**	**3.3**	**0**	
Dibenzo(a,h)anthracene ug/Kg	**1/4**										**17.3**	**17.3**	**640**	**0**	
Dieldrin ug/Kg	**1/9**										**0.88**	**0.88**	**6.4**	**0**	
Di-n-octylphthalate ug/Kg	**1/9**										**480**	**480**	**59**	**0**	
Fluoranthene ug/Kg	**7/9**	147.90347	67.661684	0.45747193	103.697834	192.109101	94.338682	137.8156	201.3293	106.99062	**79.5**	**280**	**640**	**870**	ln(y) = 4.9259165880827 + 0.562194289269974*Z
gamma-BHC (Lindane) ug/Kg	**1/9**										**11**	**11**	**3.3**	**870**	
HPAH ug/Kg	**7/7**	**652.15714**	**666.77361**	**1.02241249**	**158.204339**	**1146.10995**	**280**	**523.7**	**664.6**	**384.6**	**236.8**	**1841.4**			ln(y) = 6.26118058419856 + 0.805725448253017*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**2/5**										**34.2**	**150**	**640**	**870**	
Iron MG/KG	**4/4**	**7317.5**	**4112.1044**	**0.56195483**	**3287.63765**	**11347.3624**	**3387.5**	**8240**	**10325**	**6937.5**	**2290**	**10500**			ln(y) = 8.74811214097081 + 0.892672492973327*Z
Lead MG/KG	**9/9**	**25.936667**	**16.366431**	**0.6310152**	**15.2439318**	**36.6294015**	**12.9**	**22.3**	**38**	**25.1**	**8.53**	**55.4**			ln(y) = 3.08964535791222 + 0.750591157206599*Z
LPAH ug/Kg	**3/3**	**160.1**	**130.91411**	**0.81770213**	**11.9567379**	**308.243262**	**58**	**138**	**284.3**	**226.3**	**58**	**284.3**			ln(y) = 4.87924223812019 + 1.17888802540516*Z
Magnesium MG/KG	**4/4**	**3585**	**1758.5228**	**0.4905224**	**1861.64765**	**5308.35235**	**1965**	**3720**	**5070**	**3105**	**1530**	**5370**			ln(y) = 8.08745569514338 + 0.724066398188561*Z
Manganese MG/KG	**4/4**	**95.4**	**25.662371**	**0.2689976**	**70.2508763**	**120.549124**	**74.575**	**92.45**	**119.175**	**44.6**	**70.7**	**126**			ln(y) = 4.53587065099077 + 0.337084552974103*Z
Mecoprop ug/Kg	**1/3**										**3300**	**3300**	**16000**	**0**	
Mercury MG/KG	**6/9**	0.0800184	0.0869423	1.08653005	0.02321602	0.13682068	0.0265449	0.0542448	0.1108495	0.0843046	**0.0149**	**0.26**	**0.1**	**0.13**	ln(y) = -2.91424895104528 + 1.06003974052623*Z
Methyl Mercury MG/KG	**1/6**										**0.00086**	**0.00086**	**0.00053**	**0.13**	
Nickel MG/KG	**8/9**	10.074243	3.5345422	0.35084941	7.76500883	12.3834773	**-15.5**	**-15.5**	**-15.5**	**0**	**4.89**	**15.7**	**15.5**	**15.5**	ln(y) = 2.24176361633524 + 0.417234559801652*Z
OCDD PG/G	**1/1**										**2800**	**2800**			

Table F-4
Upper Calcasieu - Bayou Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
OCDF PG/G	**1/1**										**48**	**48**			
Phenanthrene ug/Kg	**3/6**	56.750972	59.542817	1.04919466	9.10679571	104.395148	16.85686	47.201944	132.17311	115.31625	**17.6**	**138**	**640**	**870**	ln(y) = 3.85443507406992 + 1.5272826724714*Z
Potassium MG/KG	**4/4**	**2132.5**	**1081.7689**	**0.50727733**	**1072.36646**	**3192.63354**	**1297.5**	**2020**	**3080**	**1782.5**	**1070**	**3420**			ln(y) = 7.5835307857462 + 0.639730837818012*Z
Pyrene ug/Kg	**7/9**	151.65113	51.824044	0.34173201	117.792752	185.509502	107.63217	145.33007	196.23158	88.59941	**82.2**	**252**	**640**	**870**	ln(y) = 4.97900751005609 + 0.445406114266737*Z
Selenium MG/KG	**3/4**	0.8177134	0.4935274	0.60354565	0.33405658	1.30137023	**-1.2**	**-1.2**	**1.35**	**2.55**	**0.51**	**1.4**	**1.2**	**1.2**	ln(y) = -0.300529843445747 + 0.55352034825625*Z
Silver MG/KG	**6/9**	0.4434	0.294716	0.66467296	0.25085222	0.63594778	0.203368	0.3627798	0.6471481	0.4437801	**0.15**	**0.87**	**0.85**	**1.3**	ln(y) = -1.01395915147309 + 0.858481601444682*Z
Sodium MG/KG	**4/4**	**7560**	**3179.6355**	**0.42058671**	**4443.95717**	**10676.0428**	**5160**	**7095**	**10425**	**5265**	**4650**	**11400**			ln(y) = 8.87925464640267 + 0.507419414603811*Z
Total HpCDD PG/G	**1/1**										**520**	**520**			
Total HpCDF PG/G	**1/1**										**56**	**56**			
Total HxCDD PG/G	**1/1**										**110**	**110**			
Total HxCDF PG/G	**1/1**										**21**	**21**			
Total Organic Carbon MG/KG	**7/7**	**36736.842**	**22339.784**	**0.608103**	**20187.2987**	**53286.3856**	**19343.465**	**29450**	**50576.145**	**31232.68**	**16000**	**74757.7253**			ln(y) = 10.3737858872623 + 0.702801521129643*Z
Total PeCDD PG/G	**1/1**										**7.1**	**7.1**			
Total PeCDF PG/G	**1/1**										**16**	**16**			
Total TCDD PG/G	**1/1**										**8.8**	**8.8**			
Total TCDF PG/G	**1/1**										**53**	**53**			
TPAH ug/Kg	**7/7**	**652.15714**	**666.77361**	**1.02241249**	**158.204339**	**1146.10995**	**280**	**523.7**	**664.6**	**384.6**	**236.8**	**1841.4**			ln(y) = 6.26118058419856 + 0.805725448253017*Z
Vanadium (Fume Or Dust) MG/KG	**4/4**	**20.65**	**12.618851**	**0.61108237**	**8.28352617**	**33.0164738**	**9.45**	**21.15**	**31.35**	**21.9**	**6.2**	**34.1**			ln(y) = 2.8621473932255 + 0.959324779511383*Z
Zinc MG/KG	**7/9**	54.879598	32.663734	0.59518902	33.5392915	76.2199041	27.784902	46.032566	76.264338	48.479436	**18.5**	**99.1**	**23.1**	**28.3**	ln(y) = 3.82934910775198 + 0.748834859653003*Z
Acid Volatile Sulfide umol/g	**6/6**	**3.01**	**1.8287427**	**0.60755572**	**1.54670106**	**4.47329894**	**1.6325**	**2.635**	**4.35**	**2.7175**	**1.28**	**5.94**			ln(y) = 0.976963542524985 + 0.70513788770013*Z
Cation Exchange Capacity meq/100g	**1/1**										**34.7**	**34.7**			
Diesel Range Organics ug/Kg	**1/1**										**23000**	**23000**			
Field Photoionization Detector ppm	**1/1**										**0.5**	**0.5**			
pH standard units	**1/1**										**7.3**	**7.3**			
Percent Clay %	**7/7**	**27.884286**	**7.7174064**	**0.27676543**	**22.1671511**	**33.6014204**	**24.01**	**30.4**	**32.27**	**8.26**	**13.95**	**33.94**			ln(y) = 3.29276653649123 + 0.329704314899571*Z
Percent Sand %	**7/7**	**40.987143**	**15.721609**	**0.38357416**	**29.340412**	**52.6338737**	**32.05**	**34.56**	**47.81**	**15.76**	**25.3**	**68.62**			ln(y) = 3.66411848504126 + 0.406282220376757*Z
Percent Silt %	**7/7**	**31.128571**	**9.6380667**	**0.30962124**	**23.9885917**	**38.2685512**	**21.79**	**33.17**	**36.83**	**15.04**	**17.43**	**45.2**			ln(y) = 3.39583997905973 + 0.395052672742644*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-5
Upper Calcasieu - Bayou Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
Aluminum (Fume Or Dust) mg/L Total	1/1										0.24	0.24		
Antimony mg/L Total	1/1										0.0495	0.0495		
Arsenic mg/L Dissolved	1/1										0.0207	0.0207		
Arsenic mg/L Total	1/1										0.0149	0.0149		
Barium mg/L Dissolved	1/1										0.0901	0.0901		
Barium mg/L Total	1/1										0.0794	0.0794		
Calcium Metal mg/L Dissolved	1/1										203	203		
Calcium Metal mg/L Total	1/1										192	192		
Copper mg/L Dissolved	1/1										0.0063	0.0063		
Copper mg/L Total	1/1										0.016	0.016		
Cyanide mg/L Total	1/1										0.0048	0.0048		
Lead mg/L Total	1/1										0.009	0.009		
Magnesium mg/L Dissolved	1/1										678	678		
Magnesium mg/L Total	1/1										617	617		
Manganese mg/L Dissolved	1/1										0.0499	0.0499		
Manganese mg/L Total	1/1										0.0584	0.0584		
Methyl tert-Butyl Ether ug/L	1/1										1	1		
Nickel mg/L Dissolved	1/1										0.0352	0.0352		
Nickel mg/L Total	1/1										0.0352	0.0352		
Potassium mg/L Dissolved	1/1										198	198		
Potassium mg/L Total	1/1										177	177		
Selenium mg/L Dissolved	1/1										0.02	0.02		
Sodium mg/L Dissolved	1/1										5390	5390		
Sodium mg/L Total	1/1										5620	5620		
Vanadium (Fume Or Dust) mg/L Total	1/1										0.0153	0.0153		
Zinc mg/L Dissolved	1/1										0.0047	0.0047		
Dissolved Oxygen %	9/9	6.9444444	2.0152483	0.29019576	5.62781554	8.26107335	5.50125	6.7425	8.715	3.21375	4.15	10.13		
Field Conductivity ms/cm	9/9	14912.037	12398.851	0.83146596	6811.45427	23012.6198	3150	15633.333	29100	25950	2750	30600		
Field pH standard units	9/9	7.3561111	0.3545532	0.04819845	7.1244697	7.58775252	7.175	7.21	7.525	0.35	7	8.09		
Field Specific Gravity NO UNITS	8/8	13.6875	2.7584217	0.20152853	11.7760113	15.5989887	11.5	13.5	15	3.5	10	18.5		
Field Temperature deg c	9/9	19.624444	4.68105	0.23853159	16.5661584	22.6827304	15.225	21.25	23.4375	8.2125	11.5	23.9		
Field Total Dissolved Solids mg/L	8/8	18458.333	2359.5577	0.12783157	16823.2433	20093.4234	17250	18833.333	20000	2750	14000	21000		
Field Turbidity NTU	8/8	12.129167	38.759713	3.19557921	-14.729944	38.9882774	1.2875	2.7916667	3.925	2.6375	0.8	80		
Salinity ppt	8/8	19.5	1.3803655	0.07078797	18.5434555	20.4565445	18.5	20	20	1.5	17	21		

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-5
Upper Calcasieu - Bayou Energy System
Summary Statistics - Surface Water Results

Regression Equation

Table F-6
Upper Calcasieu - Bayou Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit	
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum
Dissolved Oxygen (%)	**3/3**	**8.9133333**	**2.0121526**	**0.22574637**	**6.63636829**	**11.1902984**	**7.05**	**9.56**	**10.13**	**3.08**	**7.05**	**10.13**		
Field Conductivity (ms/cm)	**3/3**	**21233.333**	**20707.617**	**0.97524097**	**-2199.5409**	**44666.2075**	**3400**	**29700**	**30600**	**27200**	**3400**	**30600**		
Field pH (standard units)	**3/3**	**7.7133333**	**0.4078797**	**0.05287982**	**7.25177403**	**8.17489264**	**7.47**	**7.58**	**8.09**	**0.62**	**7.47**	**8.09**		
Field Redox Potential (millivolts)	**3/3**	**193**	**33.86086**	**0.17544487**	**154.682829**	**231.317171**	**163**	**206**	**210**	**47**	**163**	**210**		
Field Specific Gravity (No Units)	**3/3**										**14**	**15**		
Field Temperature (deg c)	**3/3**	**13.983333**	**3.0425346**	**0.21758292**	**10.5403814**	**17.4262853**	**11.5**	**13.6**	**16.85**	**5.35**	**11.5**	**16.85**		
Field Total Dissolved Solids (mg/L)	**3/3**	**19666.667**	**1754.1486**	**0.089194**	**17681.6607**	**21651.6726**	**18000**	**20000**	**21000**	**3000**	**18000**	**21000**		
Field Turbidity (NTU)	**2/2**										**1**	**80**		
Salinity (ppt)	**3/3**	**19.666667**	**1.7541486**	**0.089194**	**17.6816607**	**21.6516726**	**18**	**20**	**21**	**3**	**18**	**21**		

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-6
Upper Calcasieu - Bayou Energy System
Summary Statistics - Phase I Water Quality Results

Regression Equation
ln(y) = 2.17537222071603 + 0.268821966943227*Z
ln(y) = 9.5863961077785 + 1.62953127455824*Z
ln(y) = 2.0423456432898 + 0.059133058655136*Z
ln(y) = 5.25624463343794 + 0.187897812989414*Z
ln(y) = 2.62558916163653 + 0.283305973606029*Z
ln(y) = 9.88463076870666 + 0.114323022036037*Z
ln(y) = 2.97687548972453 + 0.114323022036038*Z

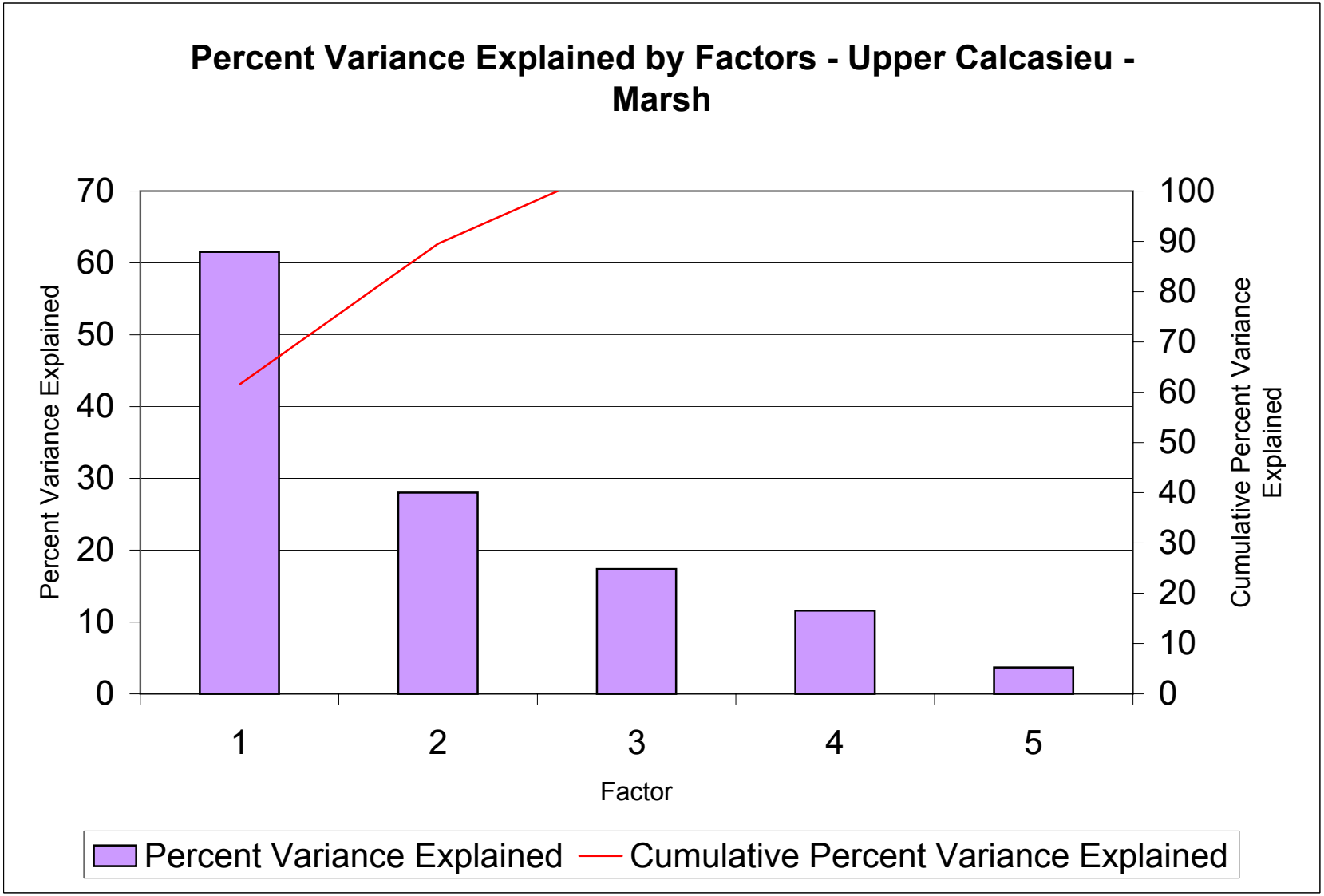
v a 40% detection threshold.

Table F-7
Upper Calcasieu - Bayou Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	8/8	7.26	2.7054031	0.37264506	5.38525128	9.13474872	5.336875	6.36875	10.255	4.918125	4.15	11.27			ln(y) = 1.92705885602482 + 0.426747950407125*Z
Field Conductivity (ms/cm)	8/8	10527.917	9708.4114	0.92215884	3800.33079	17255.5025	3125	6857.5	16902.083	13777.083	2750	28500			ln(y) = 8.92075930001279 + 1.06847958985448*Z
Field pH (standard units)	8/8	7.1825	0.0971375	0.01352419	7.11518713	7.24981287	7.14625	7.2	7.24	0.09375	7	7.305			ln(y) = 1.97157835431915 + 1.46564584742186E-02*Z
Field Redox Potential (millivolts)	8/8	178.83333	60.134385	0.33625937	137.162331	220.504336	123.41667	183.125	210.1875	86.770833	109.5	286			ln(y) = 5.14185666124525 + 0.388896021351034*Z
Field Specific Gravity (NO UNITS)	7/7	10	6.1198267	0.61198267	5.46636896	14.533631	2.5	11	13	10.5	2	18.5			ln(y) = 2.0510839607477 + 0.998858513352463*Z
Field Temperature (deg c)	8/8	20.28625	4.2775697	0.21086054	17.3220454	23.2504546	15.5875	21.5625	23.50625	7.91875	13.76	23.9			ln(y) = 2.9885628049747 1 + 0.248667828695306*Z
Field Total Dissolved Solids (mg/L)	7/7	13816.667	7131.7076	0.51616701	8533.42377	19099.9096	4250	17000	19000	14750	3800	20000			ln(y) = 9.35362690442894 + 0.801293474768779*Z
Field Turbidity (NTU)	8/8	2.2229167	1.0665365	0.47979148	1.48384459	2.96198875	1.2875	2	3.3	2.0125	0.8	3.7			ln(y) = 0.68432261400253 + 0.648027967712903*Z
Salinity (ppt)	7/7	14.857143	8.0705004	0.54320676	8.87843248	20.8358532	4	20	20	16	3	20			ln(y) = 2.47157844115145 + 0.883127028145335*Z

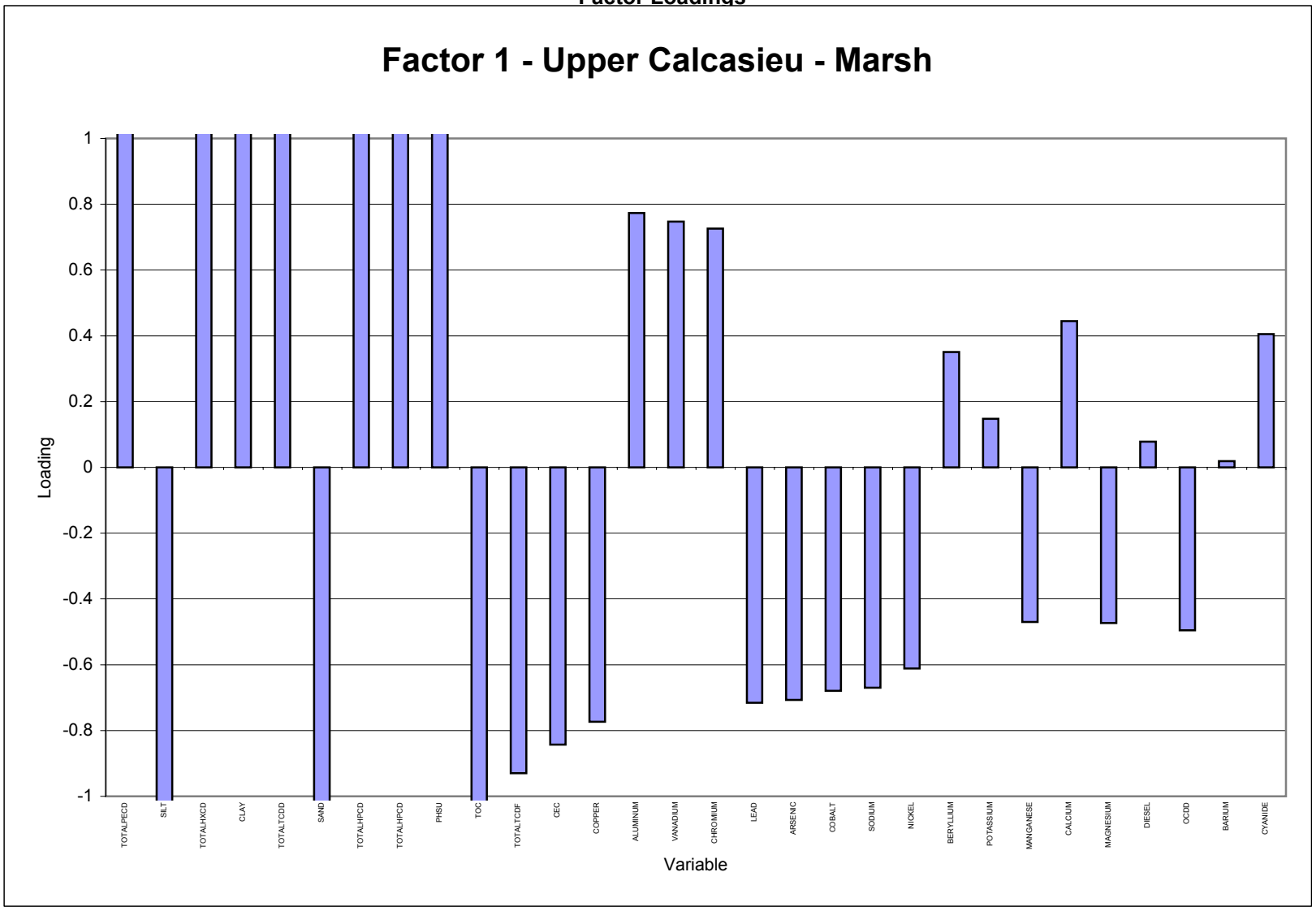
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-8
Principal Components Analysis Results



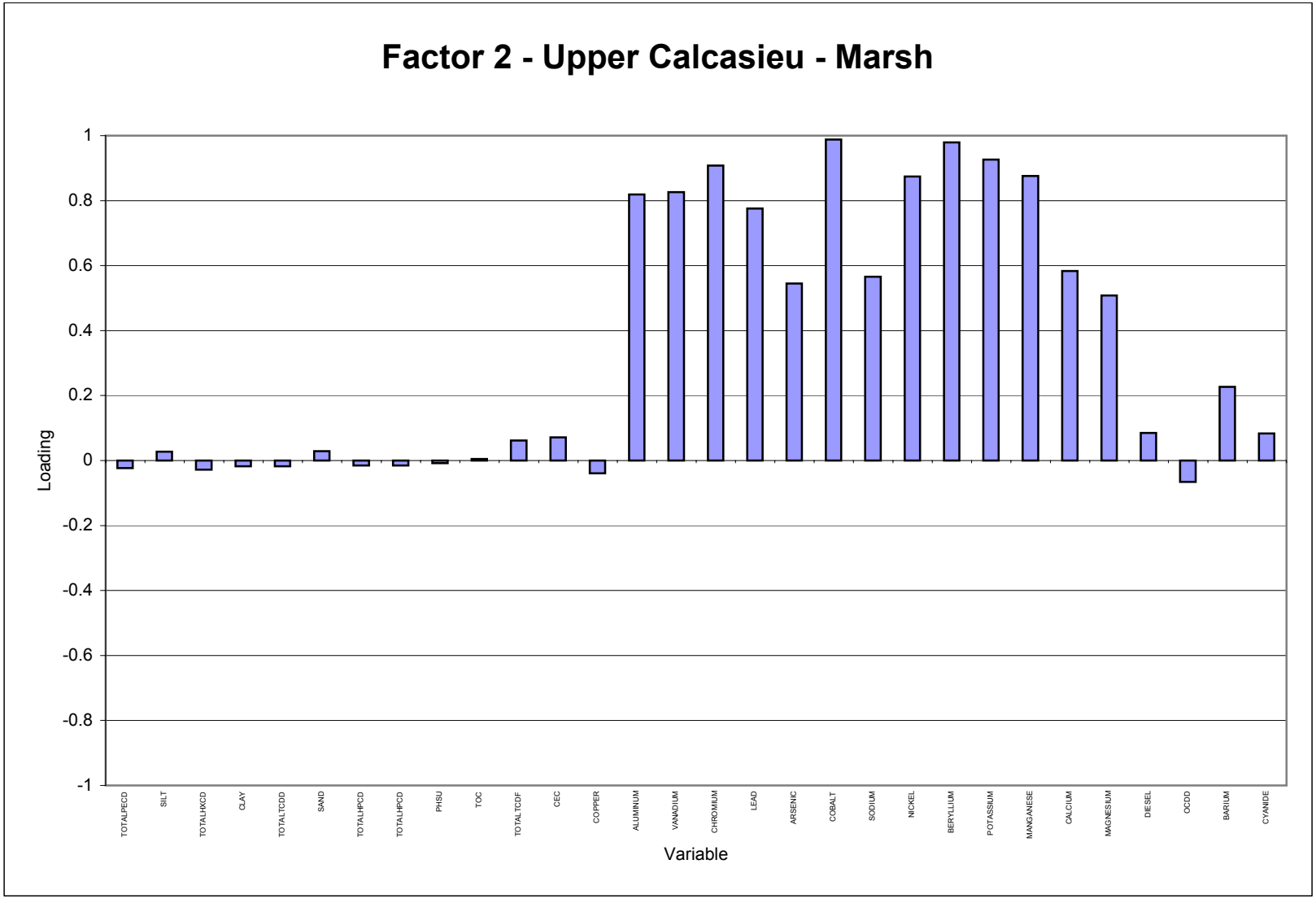
CDM

Table F-9
Upper Calcasieu-Marsh
Factor Loadings



CDM

Table F-9
Upper Calcasieu-Marsh
Factor Loadings



CDM

Table F-9
Upper Calcasieu-Marsh
Factor Loadings

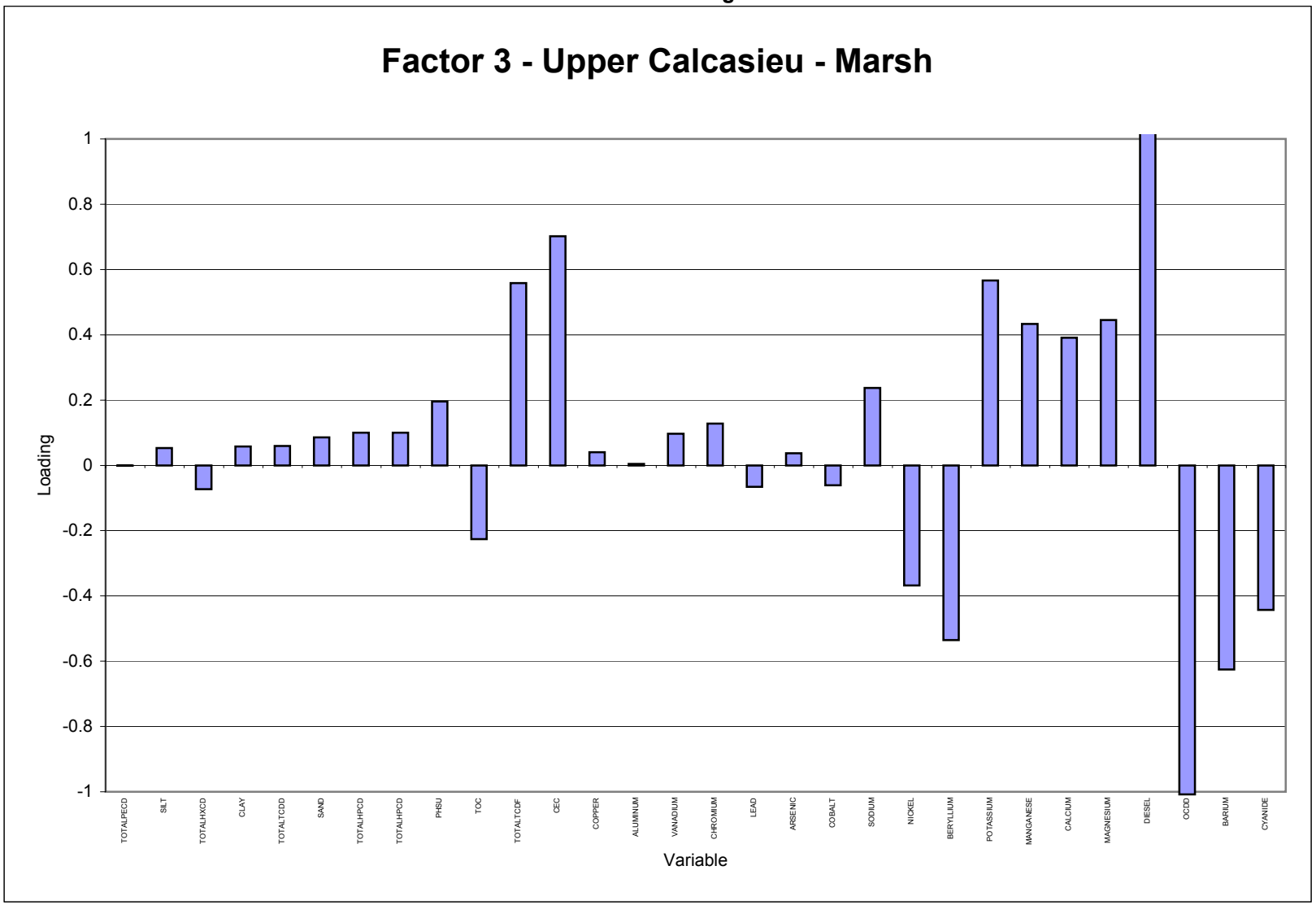


Table F-9
Upper Calcasieu-Marsh
Factor Loadings

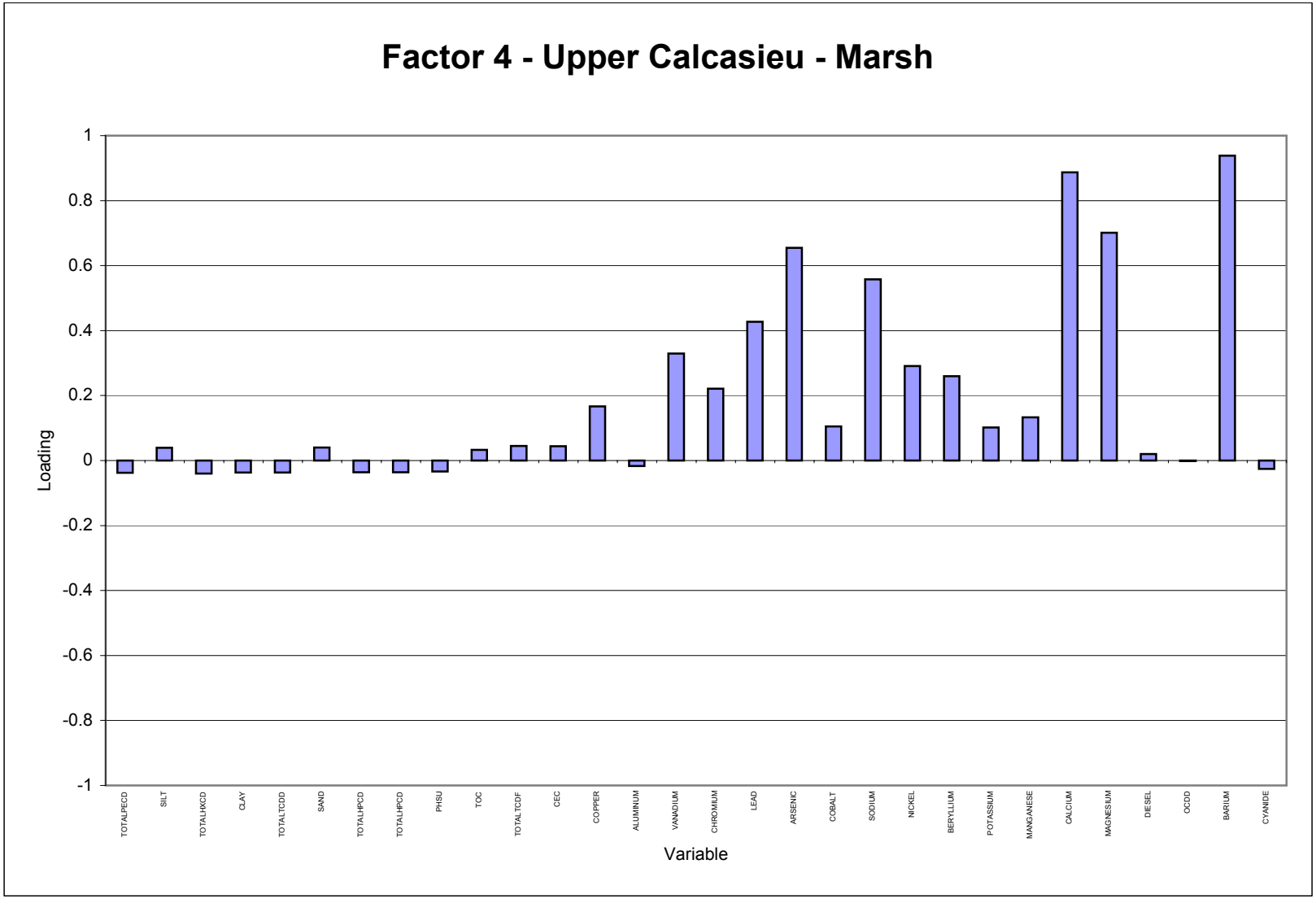


Table F-9
Upper Calcasieu-Marsh
Factor Loadings

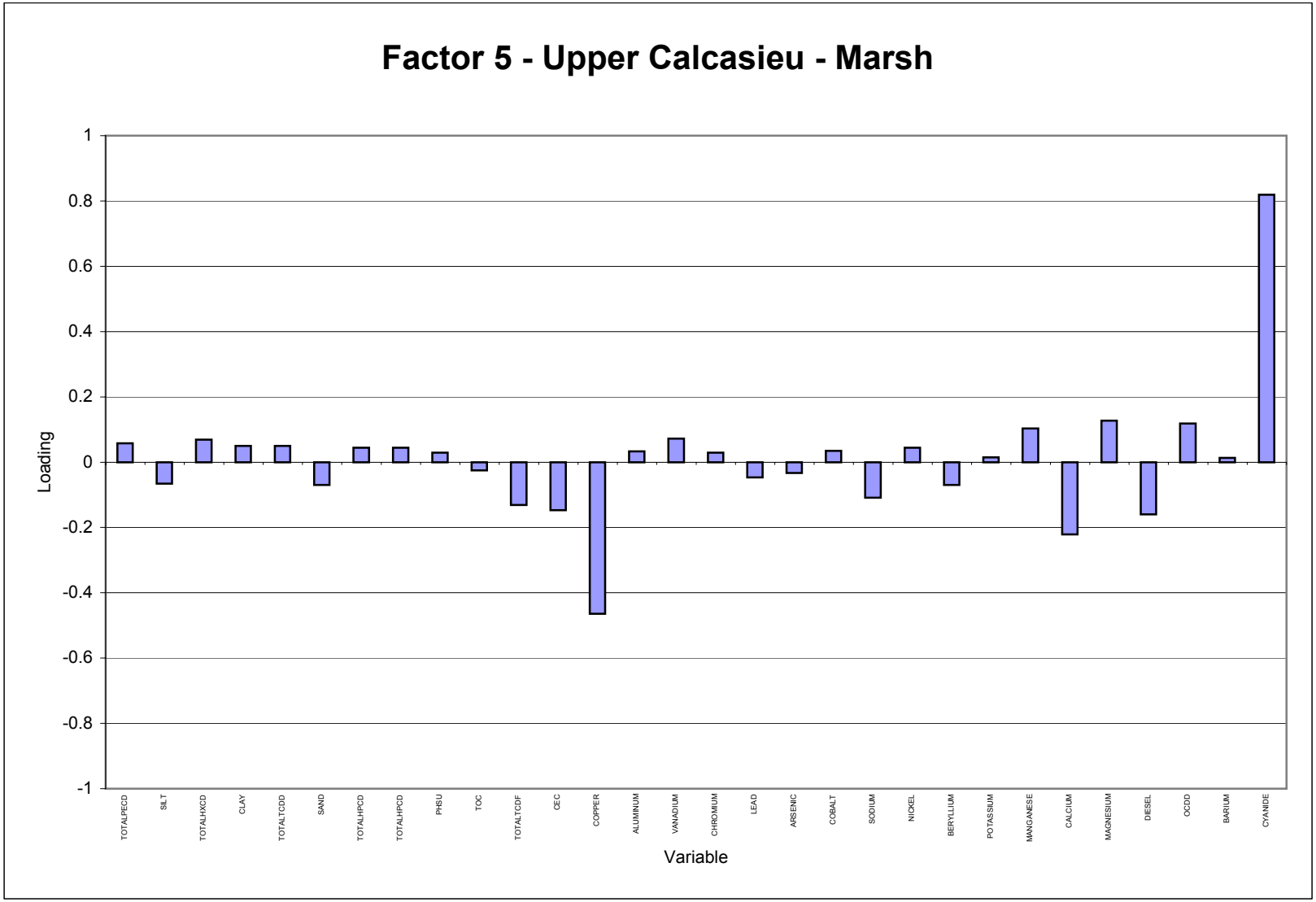


Table F-10
Upper Calcasieu - Marsh Energy System
Principal Components Analysis Results

Variable	Sum Ranking
CHROMIUM	0.750
VANADIUM	0.749
LEAD	0.721
NICKEL	0.720
COBALT	0.719
ALUMINUM	0.709
SODIUM	0.681
ARSENIC	0.671
MANGANESE	0.629
CALCIUM	0.616
BERYLLIUM	0.616
MAGNESIUM	0.597
COPPER	0.530
POTASSIUM	0.461
CYANIDE	0.382
BARIUM	0.293
TOTALTCDF	0.261
TOC	0.256
PHSU	0.256
SAND	0.255
TOTALHXCD	0.255
TOTALHPCD	0.254
TOTALHPCD	0.254
SILT	0.253
TOTALTCDD	0.252
CLAY	0.252
CEC	0.252
TOTALPECD	0.250
OCDD	0.189
DIESEL	0.104

Table F-11
Upper Calcasieu - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	3/3										35	190	36	0	
1,2,3,4,6,7,8-HpCDD PG/G	1/3	846.66667	323.3788	0.38194347	480.729102	1212.60423	540	900	1100	560	540	1100			ln(y) = 6.69900978722303 + 0.527668184615395*Z
1,2,3,4,6,7,8-HpCDF PG/G	3/3										47	47	0.42	0	
1,2,3,6,7,8-HxCDD PG/G	3/3	21	5.5719096	0.26532903	14.6947907	27.3052093	16	21	26	10	16	26			ln(y) = 3.02506923266156 + 0.360067959378957*Z
1,2,3,7,8,9-HxCDD PG/G	3/3	130.33333	66.307825	0.50875569	55.2989659	205.367701	71	130	190	119	71	190			ln(y) = 4.79241279988579 + 0.730020803254059*Z
2,3,7,8-TCDD Equivalent PG/G	1/3	28.789732	6.8056462	0.23639144	21.0884181	36.4910455	24.9885	26.397891	34.982805	9.994305	24.9885	34.982805			ln(y) = 3.34885215858238 + 0.249515244340335*Z
2,3,7,8-TCDF PG/G	1/8										2.4	2.4	0.6	0	
4,4'-DDE ug/Kg	1/8										19	19	6.9	0	
4,4'-DDT ug/Kg	2/8										29	29	6.9	0	
Acetone ug/Kg	5/8										44	49	18	0	
Acetophenone ug/Kg	8/8	161.9895	45.357883	0.28000507	130.558096	193.420914	115.08553	156.97201	214.10347	99.01794	95	220	1000	1700	ln(y) = 5.05606752388869 + 0.460392905479792*Z
Aluminum (Fume Or Dust) MG/KG	1/1	10790	3476.0519	0.32215494	8381.21896	13198.781	7582.5	10295	13125	5542.5	6860	16800			ln(y) = 9.24453689852777 + 0.376678212258367*Z
Antimony MG/KG	8/8										4.6	4.6			
Arsenic MG/KG	8/8	2.8025	2.0832294	0.74334679	1.35889569	4.24610431	1.2	2.25	4.1	2.9	0.72	6.6			ln(y) = 0.798709266279728 + 0.920998693622387*Z
Barium MG/KG	8/8	63.075	20.831612	0.33026733	48.6394294	77.5105706	48.45	58.8	71.4	22.95	42	103			ln(y) = 4.10801443359387 + 0.340745474216891*Z
Beryllium MG/KG	8/8	0.47875	0.2572829	0.5374055	0.30046206	0.65703794	0.315	0.37	0.74	0.425	0.17	0.88			ln(y) = -0.862654171619237 + 0.659523538441709*Z
Calcium Metal MG/KG	3/8	2457.5	621.67622	0.25297099	2026.70036	2888.29964	2090	2255	3095	1005	1670	3420			ln(y) = 7.78127228359288 + 0.289182810459825*Z
Carbon Disulfide ug/Kg	8/8										6	20	18	0	
Chromium MG/KG	7/8	10.9375	2.9284938	0.267748	8.90815736	12.9668426	8.45	10.7	13.875	5.425	7.2	15.2			ln(y) = 2.36208282653537 + 0.322967568877988*Z
Cobalt MG/KG	8/8	3.618053	2.7626225	0.76356606	1.70365332	5.53245276	-2	2.4	6.325	8.325	1.2	8.1	2	2	ln(y) = 1.02421158125934 + 0.87447323355807*Z
Copper MG/KG	8/8	23.4125	15.833751	0.67629474	12.4402707	34.3847293	7.825	24	39.075	31.25	7.4	46.7			ln(y) = 2.92122554718389 + 0.892177333448696*Z
Cyanide MG/KG	4/8	0.6125	0.706535	1.15352658	0.1228962	1.1021038	0.1975	0.36	0.905	0.7075	0.13	2			ln(y) = -0.877518558250518 + 1.11910696499053*Z
Dichloromethane ug/Kg	1/8	6.3616649	2.1603996	0.33959657	4.86458437	7.8587454	4.7279867	6.2233298	8.1916122	3.4636255	5	10	18	41	ln(y) = 1.82830509677258 + 0.407609097910679*Z
Ethylbenzene ug/Kg	2/8										3	3	18	41	
Iron MG/KG	8/8										2670	2910	2920	41	
Lead MG/KG	8/8	16.1125	6.9725894	0.43274411	11.280742	20.944258	9.825	14.3	23.175	13.35	8.8	25.9			ln(y) = 2.69668877662244 + 0.52084199973991*Z
Magnesium MG/KG	8/8	3403.75	838.23266	0.2462674	2822.8844	3984.6156	2867.5	3255	4047.5	1180	2270	4830			ln(y) = 8.10864968849787 + 0.28520855224311*Z
Manganese MG/KG	8/8	74.75	28.462823	0.38077356	55.0262697	94.4737303	52.725	65.8	94.8	42.075	44.7	126			ln(y) = 4.25990796655746 + 0.425460065375712*Z
Nickel MG/KG	3/3	7.25	3.1201879	0.43037075	5.08782006	9.41217994	4.275	6.9	10.325	6.05	3.2	11.4			ln(y) = 1.89166874608646 + 0.56790037057993*Z
OCDD PG/G	1/3	8000	322.32087	0.04029011	7635.2596	8364.7404	7700	8100	8200	500	7700	8200			ln(y) = 8.98682812725155 + 4.66588837418284E-02*Z
OCDF PG/G	8/8										25	25	0.81	0	
Potassium MG/KG	8/8	1680	358.42565	0.2133486	1431.6237	1928.3763	1377.5	1615	2020	642.5	1320	2260			ln(y) = 7.40856518501134 + 0.240712665418935*Z
Sodium MG/KG	3/3	11136.25	4268.4594	0.38329414	8178.35856	14094.1414	6677.5	11650	14775	8097.5	5880	17400			ln(y) = 9.24985327998723 + 0.488648060453179*Z
Total HpCDD PG/G	1/3	1136.6667	240.00506	0.21114814	865.075376	1408.25796	910	1200	1300	390	910	1300			ln(y) = 7.02454699291221 + 0.264521424889621*Z
Total HpCDF PG/G	3/3										74	74	0.5	0	
Total HxCDD PG/G	1/3	486.66667	197.20757	0.40522104	263.505292	709.828041	310	560	590	280	310	590			ln(y) = 6.14821053936938 + 0.477277221774312*Z
Total HxCDF PG/G	3/3										30	30	0.52	0	
Total Organic Carbon MG/KG	3/3	98166.667	16168.94	0.16470907	79869.7885	116463.545	85500	95500	113500	28000	85500	113500			ln(y) = 11.4875704324324 + 0.210094203653698*Z
Total PeCDD PG/G	1/3	66.333333	50.293223	0.75818928	9.42119444	123.245472	20	83	96	76	20	96			ln(y) = 3.99297369093948 + 1.16333520131536*Z
Total PeCDF PG/G	3/3										13	13	0.73	0	
Total TCDD PG/G	3/3	25.166667	19.922579	0.79162567	2.62214592	47.7111874	6.5	31	38	31.5	6.5	38			ln(y) = 2.98112518037104 + 1.30956127735263*Z
Total TCDF PG/G	8/8	26.666667	15.09757	0.56615886	9.5821584	43.7511749	15	24	41	26	15	41			ln(y) = 3.19989203271816 + 0.745726833821065*Z
Vanadium (Fume Or Dust) MG/KG	2/8	16.7125	4.3123751	0.25803292	13.7241765	19.7008235	13.125	16.9	20.725	7.6	10.5	22.6			ln(y) = 2.78658852043586 + 0.32319966553468*Z
Zinc MG/KG	3/3										17.1	50.4	21.9	0	
Cation Exchange Capacity meq/100g	3/3	33.816667	6.2461182	0.18470532	26.7485186	40.8848148	28.3	33.65	39.5	11.2	28.3	39.5			ln(y) = 3.511725177549 + 0.247288815150939*Z

Table F-11
Upper Calcasieu - Marsh Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Diesel Range Organics ug/Kg	**1/1**	**301000**	**234293.45**	**0.77838355**	**35872.0049**	**566127.995**	**83000**	**320000**	**500000**	**417000**	**83000**	**500000**			ln(y) = 12.3750118463197 + 1.3317979955226*Z
Field Photoionization Detector ppm	**3/3**										**2.3**	**2.3**			
pH standard units	**3/3**	**7.0166667**	**0.4385371**	**0.06249936**	**6.52041517**	**7.51291816**	**6.6**	**7.1**	**7.35**	**0.75**	**6.6**	**7.35**			ln(y) = 1.94728824876813 + 7.98223063823382E-02*Z
Percent Clay %	**3/3**	**34.7**	**10.568014**	**0.30455371**	**22.7411668**	**46.6588332**	**24.8**	**37.8**	**41.5**	**16.7**	**24.8**	**41.5**			ln(y) = 3.52294872767771 + 0.381828884126373*Z
Percent Sand %	**3/3**	**7.9666667**	**9.6924589**	**1.21662664**	**-3.0013831**	**18.9347165**	**3**	**4.3**	**16.6**	**13.6**	**3**	**16.6**			ln(y) = 1.78887666891004 + 1.26877630110185*Z
Percent Silt %	**3/3**	**58.1**	**0.5534224**	**0.00952534**	**57.4737435**	**58.7262565**	**57.8**	**57.9**	**58.6**	**0.8**	**57.8**	**58.6**			ln(y) = 4.06214695228008 + 1.01944099127378E-02*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-12
Upper Calcasieu - Marsh Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N mg/L	1/1										0.2	0.2			
Barium mg/L Dissolved	1/1										0.0875	0.0875			
Barium mg/L Total	1/1										0.111	0.111			
Bromide mg/L	1/1										33.7	33.7			
Calcium Metal mg/L Dissolved	1/1										152	152			
Calcium Metal mg/L Total	1/1										190	190			
Copper mg/L Dissolved	1/1										0.0057	0.0057			
Magnesium mg/L Dissolved	1/1										512	512			
Magnesium mg/L Total	1/1										646	646			
Manganese mg/L Dissolved	1/1										0.0995	0.0995			
Manganese mg/L Total	1/1										0.124	0.124			
Nickel mg/L Dissolved	1/1										0.0026	0.0026			
Nickel mg/L Total	1/1										0.003	0.003			
Potassium mg/L Dissolved	1/1										171	171			
Potassium mg/L Total	1/1										209	209			
Selenium mg/L Dissolved	1/1										0.0098	0.0098			
Selenium mg/L Total	1/1										0.01	0.01			
Sodium mg/L Dissolved	1/1										5550	5550			
Sodium mg/L Total	1/1										7210	7210			
Thallium mg/L Dissolved	1/1										0.0058	0.0058			
Thallium mg/L Total	1/1										0.0047	0.0047			
Total Organic Carbon mg/L	1/1										4.5	4.5			
Zinc mg/L Dissolved	1/1										0.0111	0.0111			
Bicarbonate Alkalinity mg/L	1/1										71.2	71.2			
Biochemical Oxygen Demand mg/L	1/1										2.1	2.1			
Chemical Oxygen Demand (COD) mg/L	1/1										71	71			
Chloride mg/L	1/1										8380	8380			
Dissolved Oxygen %	8/8	13.7125	1.3298731	0.09698254	12.790945	14.634055	12.465	13.84	14.4975	2.0325	12.18	16.03			ln(y) = 2.61458616051103 + 0.110850301551395*Z
Field Conductivity ms/cm	8/8	25125	11490.536	0.45733477	17162.4648	33087.5352	21875	28550	31300	9425	2500	32300			ln(y) = 9.94008677838692 + 0.775750936510367*Z
Field pH standard units	8/8	8.24625	0.5834002	0.07074734	7.84197426	8.65052574	7.9275	8.275	8.7875	0.86	7.21	8.91			ln(y) = 2.10771813496965 + 8.17194657888933E-02*Z
Field Specific Gravity NO UNITS	8/8	12.375	1.3955158	0.11276895	11.4079569	13.3420431	11.25	12	13	1.75	11	15			ln(y) = 2.51105742637325 + 0.118628146814439*Z
Field Temperature deg c	8/8	19.0125	3.0023112	0.15791249	16.9320045	21.0929955	16.725	19	21.775	5.05	14.2	22.9			ln(y) = 2.9343432072254 + 0.192504565900813*Z
Field Total Dissolved Solids mg/L	8/8	18043.75	1265.6373	0.0701427	17166.7081	18920.7919	17000	18000	19000	2000	16350	20000			ln(y) = 9.798506320624 + 8.31130349915589E-02*Z
Field Turbidity NTU	7/7	50.971429	54.715801	1.07346023	10.4373956	91.5054615	15	43	66.8	51.8	14	150			ln(y) = 3.58900582633917 + 1.08031596456608*Z
Hardness, as CaCO3 mg/L	1/1										2890	2890			
Nitrate-Nitrite mg/L	1/1										0.67	0.67			
Salinity ppt	8/8	18.375	1.3155928	0.07159689	17.4633407	19.2866593	17	18.5	19.75	2.75	17	20			ln(y) = 2.90879428693821 + 8.29282537811743E-02*Z
Sulfate mg/L	1/1										1200	1200			
Total Alkalinity mg/L	1/1										71.2	71.2			
Total Suspended Solids mg/L	1/1										2	2			

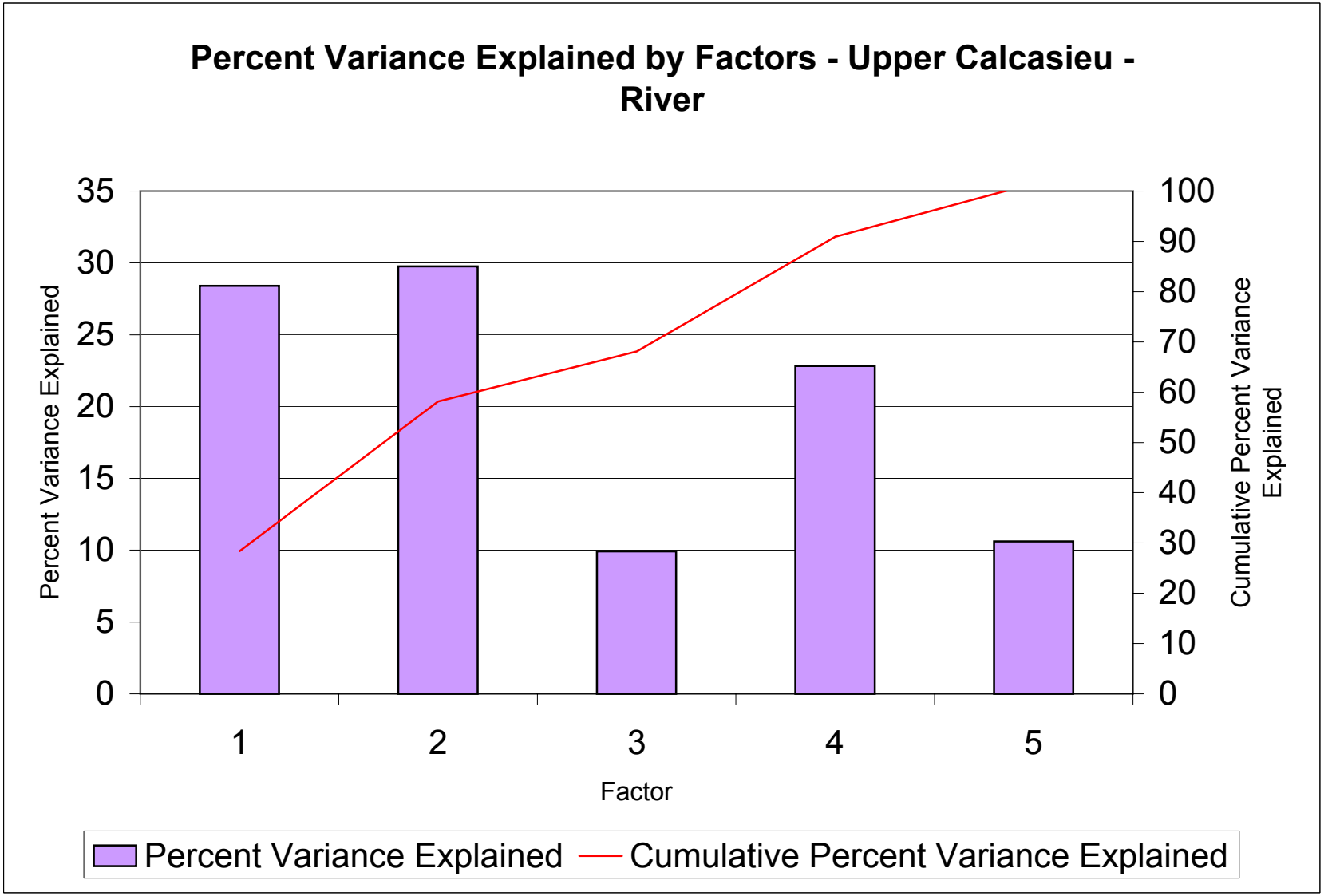
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-13
Upper Calcasieu - Marsh Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N (mg/L)	1/1										0.2	0.2			
Dissolved Oxygen (%)	8/8	13.7125	1.3298731	0.09698254	12.790945	14.634055	12.465	13.84	14.4975	2.0325	12.18	16.03			ln(y) = 2.61458616051103 + 0.110850301551395*Z
Field Conductivity (ms/cm)	8/8	25125	11490.536	0.45733477	17162.4648	33087.5352	21875	28550	31300	9425	2500	32300			ln(y) = 9.94008677838692 + 0.775750936510367*Z
Field pH (standard units)	8/8	8.24625	0.5834002	0.07074734	7.84197426	8.65052574	7.9275	8.275	8.7875	0.86	7.21	8.91			ln(y) = 2.10771813496965 + 8.17194657888933E-02*Z
Field Redox Potential (millivolts)	8/8	89.75	43.771542	0.4877052	59.417869	120.082131	61.75	102	123	61.25	8	131			ln(y) = 4.27073623156268 + 0.915132947842785*Z
Field Specific Gravity (NO UNITS)	8/8	12.375	1.3955158	0.11276895	11.4079569	13.3420431	11.25	12	13	1.75	11	15			ln(y) = 2.51105742637325 + 0.118628146814439*Z
Field Temperature (deg c)	8/8	19.0125	3.0023112	0.15791249	16.9320045	21.0929955	16.725	19	21.775	5.05	14.2	22.9			ln(y) = 2.93434320722254 + 0.192504565900813*Z
Field Total Dissolved Solids (mg/L)	8/8	18043.75	1265.6373	0.0701427	17166.7081	18920.7919	17000	18000	19000	2000	16350	20000			ln(y) = 9.798506320624 + 8.31130349915589E-02*Z
Field Turbidity (NTU)	7/7	50.971429	54.715801	1.07346023	10.4373956	91.5054615	15	43	66.8	51.8	14	150			ln(y) = 3.58900582633917 + 1.08031596456608*Z
Hardness, as CaCO3 (mg/L)	1/1										2890	2890			
Salinity (ppt)	8/8	18.375	1.3155928	0.07159689	17.4633407	19.2866593	17	18.5	19.75	2.75	17	20			ln(y) = 2.90879428693821 + 8.29282537811743E-02*Z
Total Alkalinity (mg/L)	1/1										71.2	71.2			
Total Kjeldahl Nitrogen (mg/L)	1/1										0.62	0.62			

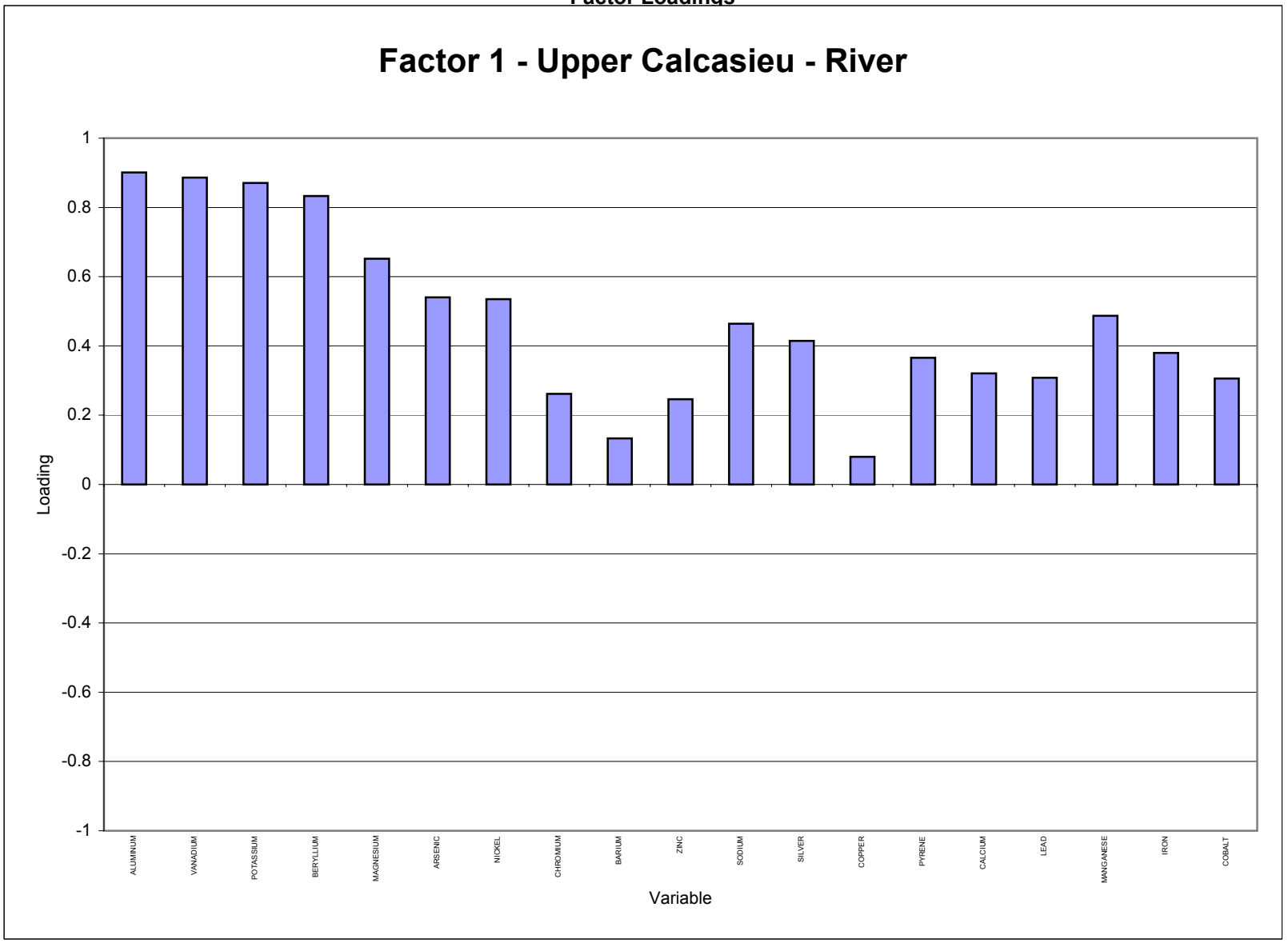
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-14
Principal Components Analysis Results



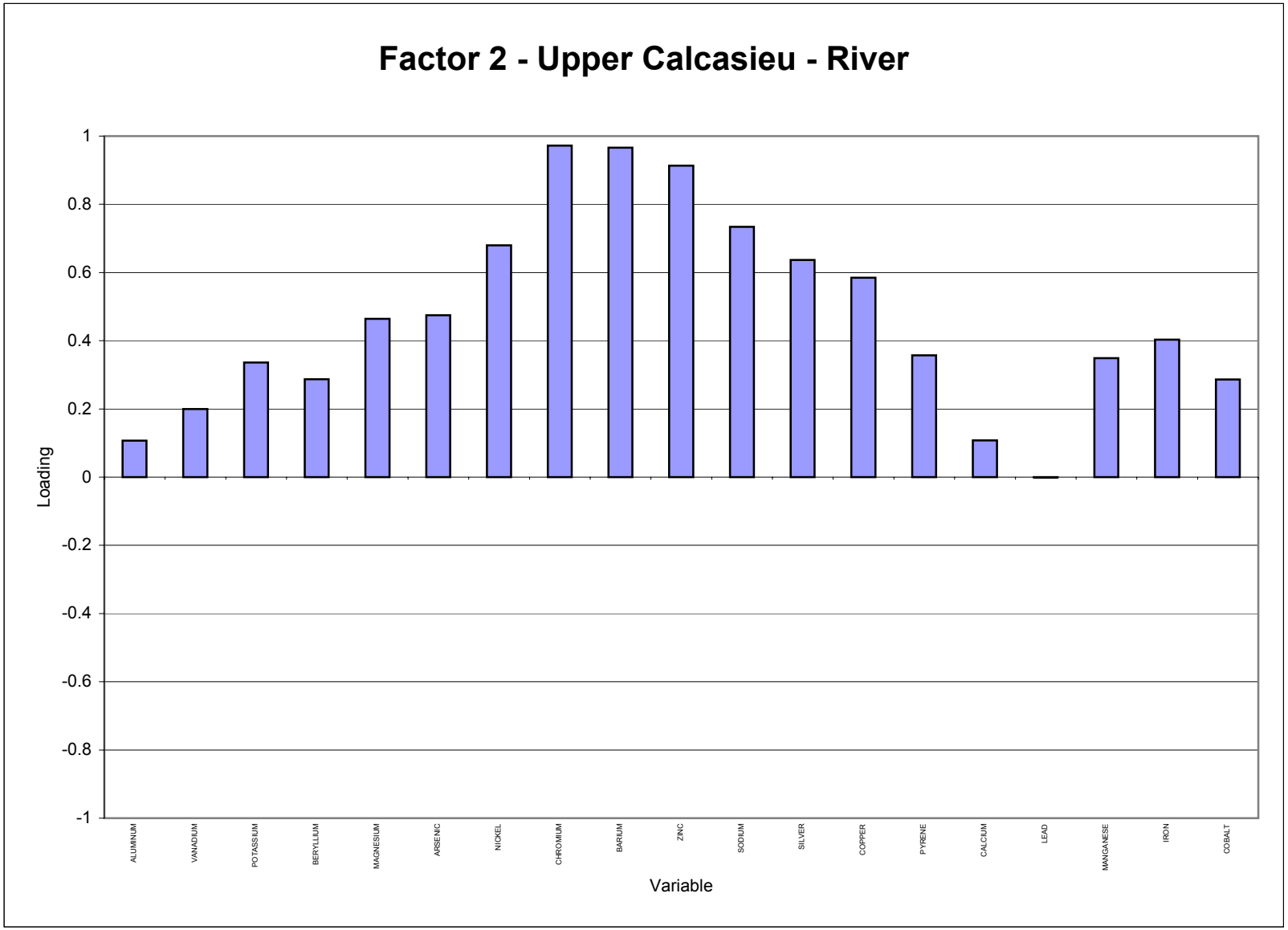
CDM

Table F-15
Upper Calcasieu_River
Factor Loadings



CDM

Table F-15
Upper Calcasieu_River
Factor Loadings



CDM

Table F-15
Upper Calcasieu_River
Factor Loadings

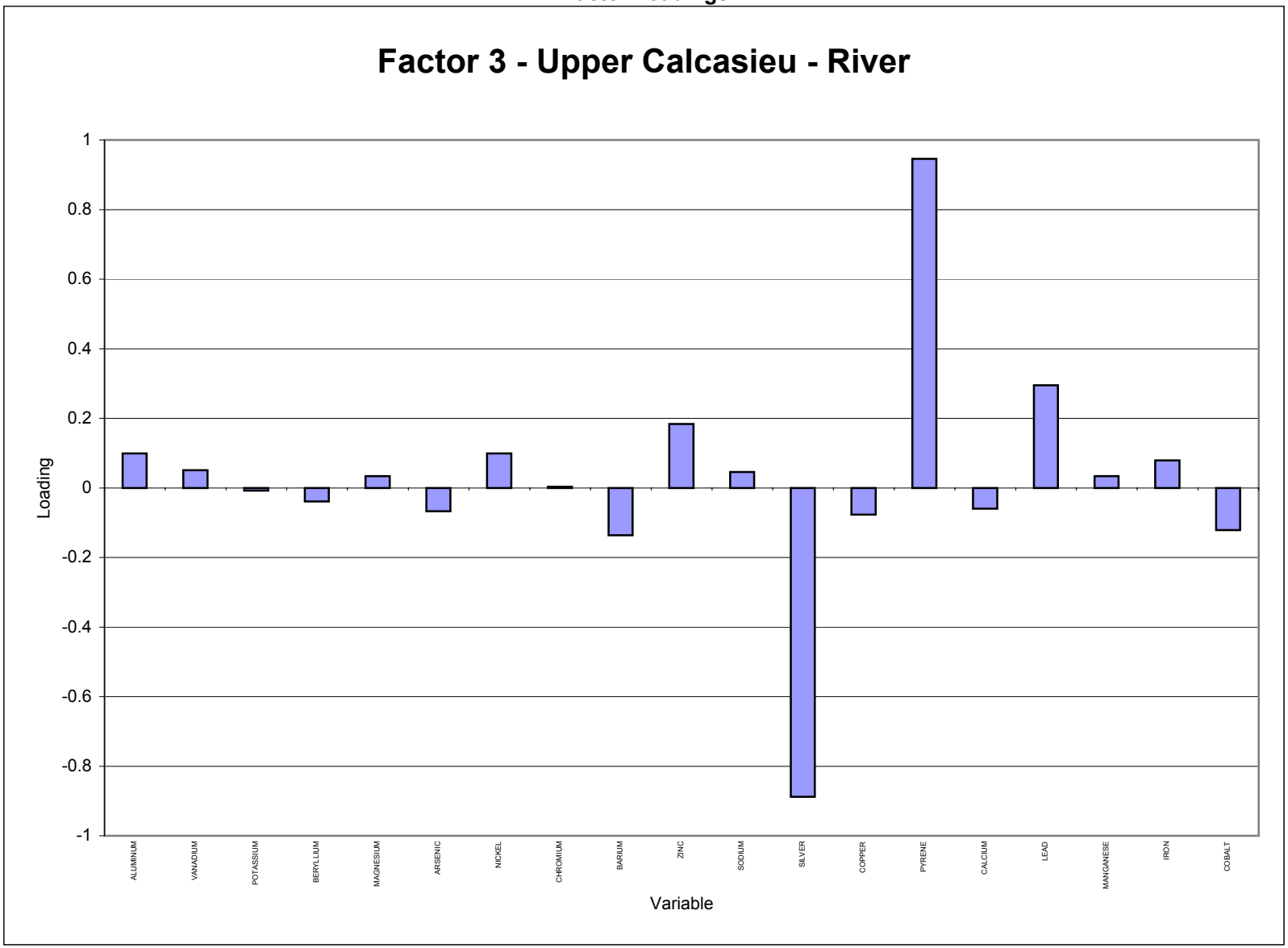
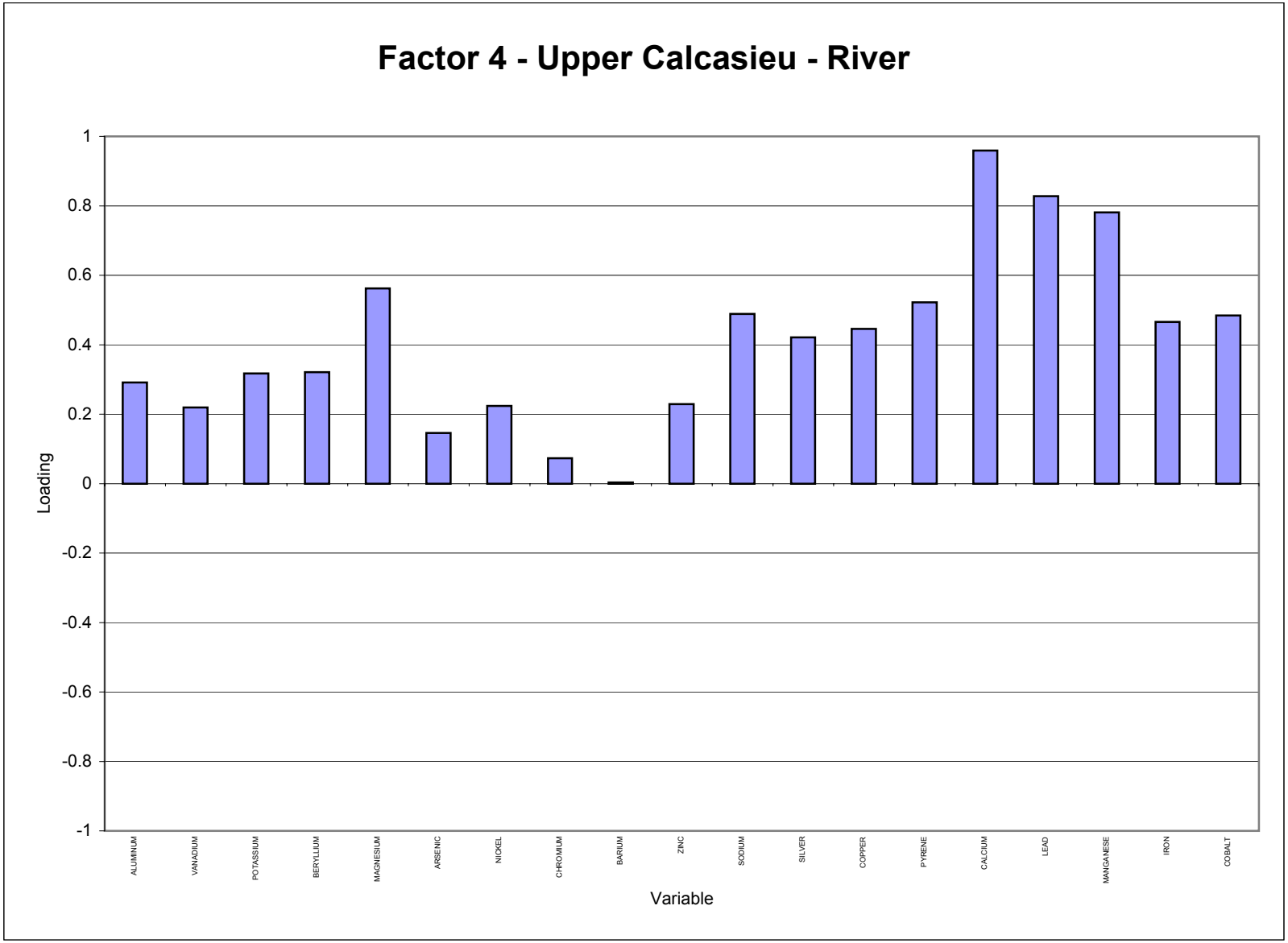
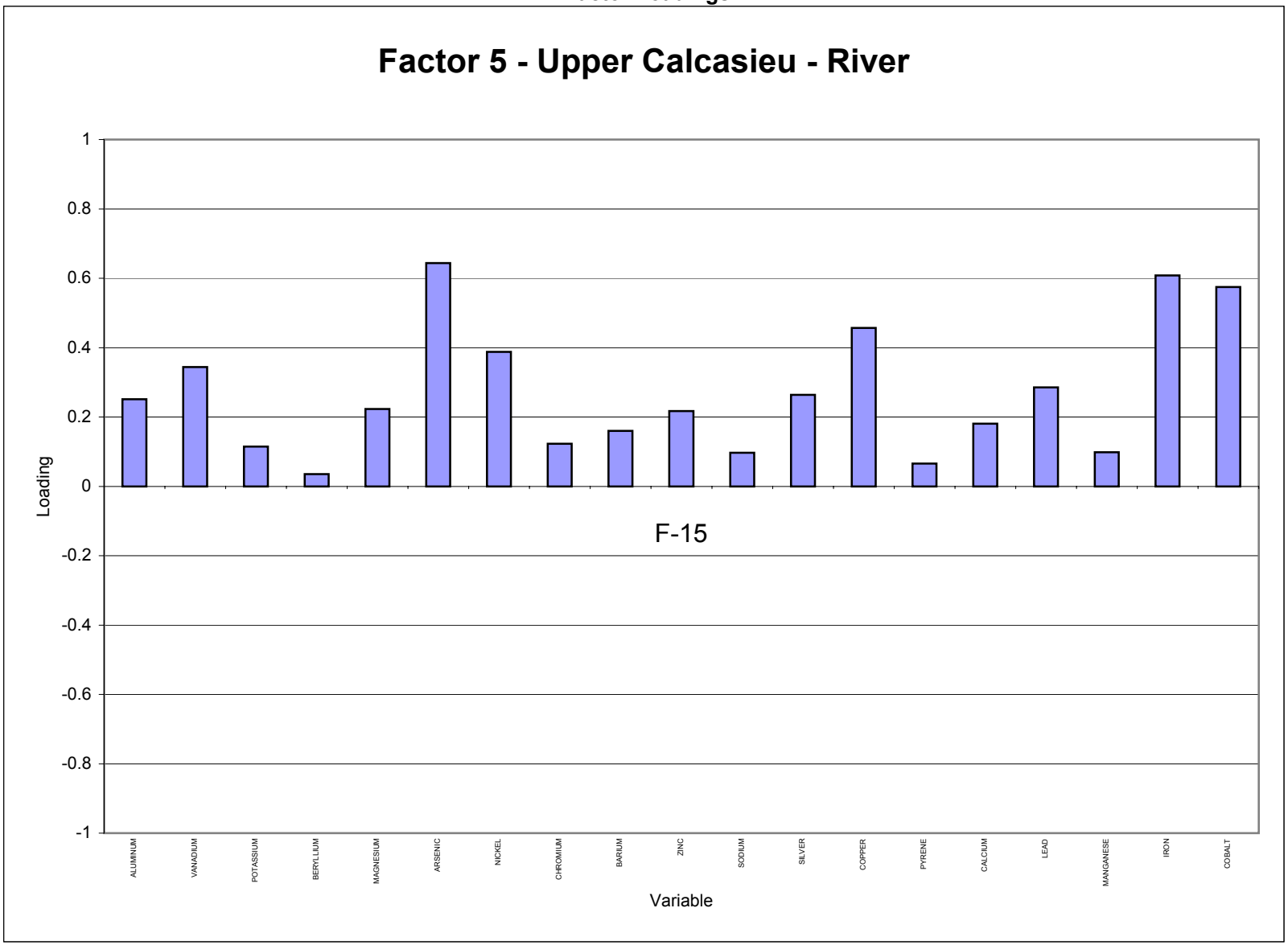


Table F-15
Upper Calcasieu_River
Factor Loadings



CDM

Table F-15
Upper Calcasieu_River
Factor Loadings



CDM

Table F-16
Upper Calcasieu_River
Rankings

Variable	Sum Ranking
NICKEL	0.456
ZINC	0.435
MAGNESIUM	0.399
SODIUM	0.397
PYRENE	0.394
MANGANESE	0.362
POTASSIUM	0.361
COPPER	0.355
IRON	0.339
LEAD	0.336
ARSENIC	0.336
BERYLLIUM	0.336
VANADIUM	0.336
CHROMIUM	0.328
ALUMINUM	0.326
CALCIUM	0.306
BARIUM	0.297
COBALT	0.296
SILVER	0.260

Table F-17
Upper Calcasieu - River Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**2/12**										**5.5**	**77**	**14**	**0**	
1,2,3,4,6,7,8-HpCDD PG/G	**2/2**										**59**	**94**			
1,2,3,4,6,7,8-HpCDF PG/G	**1/2**										**11**	**11**	**2.4**	**0**	
1,2,3,7,8,9-HxCDD PG/G	**1/2**										**5.9**	**5.9**	**1**	**0**	
1,2-Benzphenanthracene ug/Kg	**3/12**	267.31459	67.57819	0.25280397	229.078627	305.550548	192.56536	263.68097	361.06004	168.49469	**208**	**390**	**450**	**1400**	ln(y) = 5.57473993936577 + 0.466196073242879*Z
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**1.551975**	**2.87515**			
2-Butanone ug/Kg	**2/10**										**7**	**24**	**14**	**1400**	
4,4'-DDE ug/Kg	**1/12**										**0.91**	**0.91**	**4.5**	**1400**	
Acenaphthene ug/Kg	**1/11**										**39.4**	**39.4**	**450**	**1400**	
Acetone ug/Kg	**6/10**	28.267483	37.191433	1.31569669	5.21599353	51.3189719	11.026323	20.228892	37.111924	26.085601	**10**	**110**	**16**	**40**	ln(y) = 3.00711185736902 + 0.900083412114186*Z
alpha-Chlordane ug/Kg	**1/12**										**1.9**	**1.9**	**2.3**	**40**	
Aluminum (Fume Or Dust) MG/KG	**10/10**	**9465**	**4618.2973**	**0.4879342**	**6602.54971**	**12327.4503**	**5350**	**8750**	**13125**	**7775**	**4320**	**17100**			ln(y) = 9.05117404545489 + 0.577841902408926*Z
Anthracene ug/Kg	**1/11**										**68.1**	**68.1**	**450**	**0**	
Arsenic MG/KG	**10/10**	**2.521**	**1.3793302**	**0.54713615**	**1.66608226**	**3.37591774**	**1.475**	**2.3**	**3.8**	**2.325**	**0.51**	**4.8**			ln(y) = 0.757547094107823 + 0.76325420847088*Z
Barium MG/KG	**10/10**	**125.46**	**285.20717**	**2.27329162**	**-51.313234**	**302.233234**	**46.075**	**57.2**	**88.8**	**42.725**	**29.6**	**713**			ln(y) = 4.29499642129152 + 0.869451262425464*Z
Benzaldehyde ug/Kg	**1/12**										**79**	**79**	**56**	**0**	
Benzo(a)anthracene ug/Kg	**3/12**	217.97734	35.856605	0.16449694	197.689556	238.265123	170.35415	216.51634	275.18747	104.83332	**169**	**273**	**450**	**1400**	ln(y) = 5.37766601882013 + 0.355666571721308*Z
Benzo(a)pyrene ug/Kg	**3/12**	191.73531	40.743503	0.2124987	168.682499	214.788113	139.40425	189.61028	257.89787	118.49361	**140**	**259**	**450**	**1400**	ln(y) = 5.24497081571293 + 0.456241136612426*Z
Benzo(b)fluoranthene ug/Kg	**3/12**	303.39661	42.939054	0.14152779	279.101558	327.691671	250.47849	302.04908	364.23747	113.75898	**240**	**349**	**450**	**1400**	ln(y) = 5.71058953210326 + 0.277691360347616*Z
Benzo(g,h,i)perylene ug/Kg	**1/11**										**118**	**118**	**450**	**1400**	
Benzo(k)fluoranthene ug/Kg	**3/12**	134.9006	52.434315	0.38868852	105.233093	164.568105	74.708558	130.05091	226.38957	151.68101	**75.9**	**230**	**450**	**1400**	ln(y) = 4.86792596675875 + 0.822219284376474*Z
Benzyl Butyl Phthalate ug/Kg	**2/12**										**55**	**76**	**56**	**1400**	
Beryllium MG/KG	**10/10**	**0.471**	**0.2161469**	**0.45891059**	**0.33703077**	**0.60496923**	**0.255**	**0.46**	**0.6875**	**0.4325**	**0.18**	**0.8**			ln(y) = -0.861245259967475 + 0.601859152837638*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**1/12**										**53**	**53**	**66**	**0**	
Cadmium MG/KG	**1/12**										**0.13**	**0.13**	**0.04**	**0**	
Calcium Metal MG/KG	**10/10**	**1962.6**	**3257.3988**	**1.65973648**	**-56.356708**	**3981.55671**	**633**	**1042.5**	**1950**	**1317**	**426**	**9180**			ln(y) = 7.10727373368611 + 1.03928411652737*Z
Carbazole ug/Kg	**1/11**										**51.4**	**51.4**	**450**	**0**	
Chromium MG/KG	**10/10**	**16.91**	**27.598933**	**1.63210719**	**-0.1959956**	**34.0159956**	**6.95**	**9.7**	**16.875**	**9.925**	**5.6**	**76.4**			ln(y) = 2.46596774284236 + 0.811082999798981*Z
Cobalt MG/KG	**10/10**	**3.59**	**2.1305088**	**0.59345648**	**2.26949698**	**4.91050302**	**1.675**	**2.7**	**5.725**	**4.05**	**1.5**	**6.8**			ln(y) = 1.11279469106752 + 0.699163727962916*Z
Copper MG/KG	**12/12**	**11.703333**	**9.6278081**	**0.8226552**	**6.2558881**	**17.1507786**	**5.05**	**7.235**	**20.825**	**15.775**	**2.47**	**29.7**			ln(y) = 2.15905598435489 + 0.924657975665325*Z
Cyanide MG/KG	**1/10**										**0.84**	**0.84**	**0.06**	**0**	
delta-BHC ug/Kg	**1/12**										**1.4**	**1.4**	**2.3**	**0**	
Dibenzo(a,h)anthracene ug/Kg	**2/12**										**39.4**	**63.6**	**450**	**0**	
Endrin Ketone ug/Kg	**1/12**										**1.8**	**1.8**	**4.5**	**0**	
Fluoranthene ug/Kg	**4/12**	270.90687	180.98267	0.66806232	168.506281	373.307453	123.07569	232.42596	438.93175	315.85606	**49**	**500**	**470**	**1400**	ln(y) = 5.44857171780608 + 0.943017574594676*Z
Heptachlor Epoxide ug/Kg	**1/12**										**0.96**	**0.96**	**2.3**	**1400**	
HPAH ug/Kg	**4/4**	**1635.225**	**1436.1499**	**0.8782583**	**227.798077**	**3042.65192**	**561.625**	**2129.75**	**2214.3**	**1652.675**	**49**	**2232.4**			ln(y) = 6.73249270445684 + 2.08589135619805*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**2/12**										**136**	**137**	**450**	**1400**	
Iron MG/KG	**8/10**	6841.2663	4442.6823	0.64939472	4087.66335	9594.86933	3495.2837	5687.1909	9253.6524	5758.3686	**2710**	**14800**	**4370**	**4960**	ln(y) = 8.64597172154007 + 0.722055363098698*Z
LPAH ug/Kg	**3/3**	**246.83333**	**93.367379**	**0.37826082**	**141.178198**	**352.488469**	**158.4**	**270**	**312.1**	**153.7**	**158.4**	**312.1**			ln(y) = 5.46895636255181 + 0.502974706662313*Z
Lead MG/KG	**12/12**	**24.158333**	**35.706213**	**1.47800811**	**3.95564176**	**44.3610249**	**8.75**	**13.15**	**28.4**	**19.65**	**8.3**	**113**			ln(y) = 2.80867021006303 + 0.847629942912431*Z
Magnesium MG/KG	**10/10**	**2055.6**	**1080.8625**	**0.52581365**	**1385.67446**	**2725.52554**	**1117.5**	**1800**	**3067.5**	**1950**	**986**	**3870**			ln(y) = 7.51184974026949 + 0.594384286930755*Z
Manganese MG/KG	**10/10**	**78.5**	**49.395756**	**0.62924529**	**47.8841935**	**109.115807**	**46.475**	**67.9**	**102.9**	**56.425**	**18.8**	**179**			ln(y) = 4.18873692153559 + 0.768283631471938*Z
Mercury MG/KG	**3/12**	0.0462348	0.0595992	1.28905458	0.01251339	0.07995621	0.0176991	0.0341764	0.0659935	0.0482943	**0.0235**	**0.19**	**0.06**	**0.16**	ln(y) = -3.37621968872424 + 0.976016974371679*Z
Methyl Mercury MG/KG	**1/2**										**0.00128**	**0.00128**	**0.00091**	**0.16**	
Nickel MG/KG	**12/12**	**6.2808333**	**3.4714553**	**0.55270617**	**4.31667257**	**8.2449941**	**3.35**	**5.5**	**8.55**	**5.2**	**3.3**	**14.2**			ln(y) = 1.72459088672205 + 0.554215344212212*Z
OCDD PG/G	**2/2**										**1600**	**2200**			
OCDF PG/G	**1/2**										**12**	**12**	**5.5**	**0**	

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Table F-17
Upper Calcasieu - River Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Phenanthrene ug/Kg	**3/12**	202.87958	63.039048	0.3107215	167.21188	238.547278	131.8839	198.65531	299.23238	167.34848	**119**	**270**	**450**	**1400**	ln(y) = 5.29157122580104 + 0.607617667821085*Z
Potassium MG/KG	**10/10**	**1288.4**	**611.79523**	**0.47484883**	**909.205386**	**1667.59461**	**780.25**	**1048.5**	**2020**	**1239.75**	**731**	**2240**			ln(y) = 7.06609682195748 + 0.511290328106094*Z
Pyrene ug/Kg	**3/12**	406.82168	21.340973	0.05245781	394.746885	418.896469	376.81499	406.54499	438.62063	61.805634	**378**	**440**	**450**	**1400**	ln(y) = 6.00769460016435 + 0.112639408047244*Z
Silver MG/KG	**5/12**	0.4533985	0.6026331	1.32914671	0.1124267	0.79437023	0.1160648	0.2644928	0.6027359	0.4866711	**0.13**	**1.7**	**0.07**	**1.2**	ln(y) = -1.32994120488332 + 1.22171217511028*Z
Sodium MG/KG	**10/10**	**5406**	**4063.4589**	**0.75165722**	**2887.44208**	**7924.55792**	**2910**	**3965**	**7620**	**4710**	**1270**	**13700**			ln(y) = 8.3745460235057 + 0.845427290770152*Z
Total HpCDD PG/G	**2/2**										**180**	**250**			
Total HpCDF PG/G	**2/2**										**5.5**	**23**			
Total HxCDD PG/G	**2/2**										**34**	**67**			
Total HxCDF PG/G	**1/2**										**9.5**	**9.5**	**2.1**	**0**	
Total Organic Carbon MG/KG	**4/4**	**12633.166**	**7739.4504**	**0.61262953**	**5048.50437**	**20217.8271**	**5515**	**12626.331**	**19758.166**	**14243.166**	**4280**	**21000**			ln(y) = 9.28137491850961 + 0.957437976391047*Z
Total PeCDD PG/G	**1/2**										**4.6**	**4.6**	**1.1**	**0**	
Total TCDD PG/G	**1/2**										**8.3**	**8.3**	**0.69**	**0**	
Total TCDF PG/G	**1/2**										**3.2**	**3.2**	**0.5**	**0**	
TPAH ug/Kg	**4/4**	**1820.35**	**1562.1544**	**0.85816159**	**289.43864**	**3351.26136**	**601.225**	**2343.95**	**2515.875**	**1914.65**	**49**	**2544.5**			ln(y) = 6.81283668430585 + 2.16458336817006*Z
Vanadium (Fume Or Dust) MG/KG	**10/10**	**16**	**6.9471353**	**0.43419596**	**11.6941209**	**20.3058791**	**10.025**	**14.9**	**22.775**	**12.75**	**7.9**	**27.8**			ln(y) = 2.69008540497066 + 0.509874816238595*Z
Zinc MG/KG	**10/12**	42.93986	71.770428	1.67141736	2.33191787	83.547803	12.793035	25.457133	50.657691	37.864656	**10.9**	**222**	**16.6**	**19.4**	ln(y) = 3.23699597033141 + 1.02062618096398*Z
Acid Volatile Sulfide umol/g	**2/2**										**1.38**	**1.75**			
Cation Exchange Capacity meq/100g	**2/2**										**8.74**	**8.9**			
Diesel Range Organics ug/Kg	**1/2**										**18000**	**18000**	**14000**	**19.4**	
pH standard units	**2/2**										**7.5**	**7.9**			
Percent Clay %	**4/4**	**29.905**	**13.126073**	**0.43892568**	**17.0414489**	**42.7685511**	**18.325**	**29.955**	**41.435**	**23.11**	**18.1**	**41.61**			ln(y) = 3.32001649309359 + 0.579279525286145*Z
Percent Sand %	**4/4**	**32.145**	**11.682152**	**0.3634205**	**20.696491**	**43.593509**	**21.085**	**33.49**	**41.86**	**20.775**	**18.3**	**43.3**			ln(y) = 3.42070375496871 + 0.509169008583143*Z
Percent Silt %	**4/4**	**38.6475**	**20.464755**	**0.52952338**	**18.5920405**	**58.7029595**	**25.4925**	**33.325**	**57.125**	**31.6325**	**24.34**	**63.6**			ln(y) = 3.58499121409461 + 0.566698156556943*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-18
Upper Calcasieu - River Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Aluminum (Fume Or Dust) mg/L Dissolved	2/2										0.0614	0.17			
Aluminum (Fume Or Dust) mg/L Total	1/2										0.13	0.13	0.05	0	
Arsenic mg/L Dissolved	1/2										0.00043	0.00043	0.002	0	
Barium mg/L Dissolved	2/2										0.0783	0.0905			
Barium mg/L Total	1/1										0.0908	0.0908			
Barium ug/L Total	1/1										83.8	83.8			
bis(2-Ethylhexyl)phthalate ug/L	1/2										2	2	10	0	
Cadmium mg/L Dissolved	2/2										0.0016	0.0016			
Cadmium mg/L Total	1/1										0.0017	0.0017			
Calcium Metal mg/L Dissolved	2/2										151	174			
Calcium Metal mg/L Total	1/1										194	194			
Calcium Metal ug/L Total	1/1										138000	138000			
Copper mg/L Dissolved	2/2										0.0062	0.0076			
Copper mg/L Total	1/2										0.0075	0.0075	0.0053	0	
Copper ug/L Total	1/1										5.1	5.1			
Lead mg/L Dissolved	1/2										0.00024	0.00024	0.001	0	
Magnesium mg/L Dissolved	2/2										509	597			
Magnesium mg/L Total	1/1										670	670			
Magnesium ug/L Total	1/1										457000	457000			
Manganese mg/L Dissolved	2/2										0.106	0.175			
Manganese mg/L Total	1/1										0.124	0.124			
Manganese ug/L Total	1/1										170	170			
Nickel mg/L Dissolved	2/2										0.0025	0.0026			
Nickel mg/L Total	2/2										0.0024	0.0064			
Potassium mg/L Dissolved	2/2										167	195			
Potassium mg/L Total	1/1										214	214			
Potassium ug/L Total	1/1										155000	155000			
Selenium mg/L Dissolved	2/2										0.01	0.011			
Selenium mg/L Total	2/2										0.0073	0.012			
Sodium mg/L Dissolved	2/2										5580	6380			
Sodium mg/L Total	1/1										6980	6980			
Sodium ug/L Total	1/1										5400000	5400000			
Thallium mg/L Total	1/2										0.0059	0.0059	0.001	0	
Dissolved Oxygen %	12/12	10.506083	2.9268249	0.27858383	8.85007624	12.1620904	8.12	10.3465	12.7875	4.6675	6.83	16.48			ln(y) = 2.31988952759537 + 0.30511289676341*Z
Field Conductivity ms/cm	12/12	23978.667	13563.17	0.56563486	16304.581	31652.7523	9577.5	30450	31575	21997.5	224	34550			ln(y) = 9.54911464590156 + 1.43955020912488*Z
Field pH standard units	12/12	7.97925	0.8773248	0.10995079	7.48285676	8.47564324	7.48275	8.165	8.62	1.13725	5.92	8.97			ln(y) = 2.07140440839951 + 0.119393070081902*Z
Field Specific Gravity NO UNITS	11/11	13.2	2.1936941	0.16618895	11.9036096	14.4963904	13	14	14.2	1.2	8	15			ln(y) = 2.5677918745009 + 0.168748678218417*Z
Field Temperature deg c	12/12	15.39625	3.050891	0.19815806	13.6700459	17.1224541	13.125	14.55	16.925	3.8	12.91	22.745			ln(y) = 2.72047193262455 + 0.183390465579684*Z
Field Total Dissolved Solids mg/L	12/12	17708.333	6975.1622	0.39389152	13761.7638	21654.9029	19000	19000	19075	75	1400	21000			ln(y) = 9.64341027023317 + 0.501271898996559*Z
Field Turbidity NTU	7/7	19	18.620792	0.9800417	5.20552401	32.794476	5	15	38	33	2	49			ln(y) = 2.46031042557964 + 1.43586613606117*Z
Salinity ppt	12/12	17.925	7.0179088	0.39151513	13.9542443	21.8957557	18.25	19	20	1.75	1	22			ln(y) = 2.71960143380837 + 0.589194018622928*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-19
Upper Calcasieu - River Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	**10/10**	**11.0583**	**2.8631564**	**0.25891469**	**9.2836973**	**12.8329027**	**8.7575**	**10.495**	**13.485**	**4.7275**	**7.61**	**16.48**			ln(y) = 2.37586349349874 + 0.289518021531365*Z
Field Conductivity (ms/cm)	**10/10**	**25297**	**12333.97**	**0.4875665**	**17652.3264**	**32941.6736**	**22592.5**	**30450**	**31125**	**8532.5**	**3000**	**33500**			ln(y) = 9.87275668697678 + 0.86846946655641*Z
Field pH (standard units)	**10/10**	**8.2396**	**0.5178785**	**0.06285238**	**7.9186156**	**8.5605844**	**7.929**	**8.29**	**8.695**	**0.766**	**7.32**	**8.97**			ln(y) = 2.1072317871986 + 7.32459884451494E-02*Z
Field Redox Potential (millivolts)	**10/10**	**154.43**	**30.443667**	**0.19713571**	**135.56082**	**173.29918**	**126.75**	**151.5**	**177.825**	**51.075**	**118**	**211**			ln(y) = 5.02371761464497 + 0.223256754437912*Z
Field Specific Gravity (NO UNITS)	**10/10**	**13.72**	**0.9802216**	**0.07144472**	**13.1124523**	**14.3275477**	**13**	**14**	**14.4**	**1.4**	**12**	**15**			ln(y) = 2.616626907783 + 8.15910701078055E-02*Z
Field Temperature (deg c)	**10/10**	**14.741**	**1.8295939**	**0.12411599**	**13.607006**	**15.874994**	**13**	**14.15**	**16.775**	**3.775**	**12.91**	**17.6**			ln(y) = 2.68402963217583 + 0.138419291784642*Z
Field Total Dissolved Solids (mg/L)	**10/10**	**19010**	**514.70132**	**0.02707529**	**18690.9848**	**19329.0152**	**19000**	**19000**	**19025**	**25**	**18000**	**20000**			ln(y) = 9.85244180104892 + 2.34035787261152E-02*Z
Field Turbidity (NTU)	**6/8**	16.753549	18.515004	1.10513923	3.92330569	29.5837925	3.1510132	8.892016	25.092865	21.941852	**5**	**49**	**2.4**	**3.5**	ln(y) = 2.18515379961354 + 1.53878144601114*Z
Salinity (ppt)	**10/10**	**19.21**	**0.948496**	**0.04937512**	**18.6221161**	**19.7978839**	**18.75**	**19**	**20**	**1.25**	**18**	**21**			ln(y) = 2.95441747523421 + 5.37970652747694E-02*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-20
Upper Calcasieu - River System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	**4/4**	**7.16375**	**1.2619331**	**0.17615539**	**5.92705552**	**8.40044448**	**6.14375**	**7.04**	**8.3075**	**2.16375**	**5.915**	**8.66**			ln(y) = 1.95963309061349 + 0.217530031302458*Z
Field Conductivity (ms/cm)	**4/4**	**16847.5**	**19153.688**	**1.13688604**	**-1923.1138**	**35618.1138**	**259.5**	**16308**	**33975**	**33715.5**	**224**	**34550**			ln(y) = 8.03642888416904 + 3.47948143191191*Z
Field pH (standard units)	**4/4**	**6.7325**	**0.7750051**	**0.11511402**	**5.97299497**	**7.49200503**	**6**	**6.7875**	**7.41**	**1.41**	**5.92**	**7.435**			ln(y) = 1.90204315569608 + 0.15066207546122*Z
Field Redox Potential (millivolts)	**4/4**	**212.375**	**82.181509**	**0.38696414**	**131.837121**	**292.912879**	**136.625**	**213.5**	**287**	**150.375**	**130.5**	**292**			ln(y) = 5.29933855306157 + 0.531030155570916*Z
Field Specific Gravity (NO UNITS)	**2/2**										**1**	**8**			
Field Temperature (deg c)	**4/4**	**17.985**	**5.6612835**	**0.31477807**	**12.4369421**	**23.5330579**	**12.575**	**18.6475**	**22.7325**	**10.1575**	**11.9**	**22.745**			ln(y) = 2.85101247644054 + 0.425294849789274*Z
Field Total Dissolved Solids (mg/L)	**4/4**	**10975**	**10745.339**	**0.97907419**	**444.567568**	**21505.4324**	**1550**	**10750**	**20625**	**19075**	**1400**	**21000**			ln(y) = 8.66889435910071 + 1.84884233079804*Z
Field Turbidity (NTU)	**2/4**										**0.2**	**2**	**3.55**	**0**	
Salinity (ppt)	**4/4**	**11.375**	**11.444135**	**1.00607782**	**0.15974749**	**22.5902525**	**1.25**	**11.25**	**21.625**	**20.375**	**1**	**22**			ln(y) = 1.70115363001566 + 2.06575295959659*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-21
Upper Calcasieu_Shallow Lake
Percent Variance

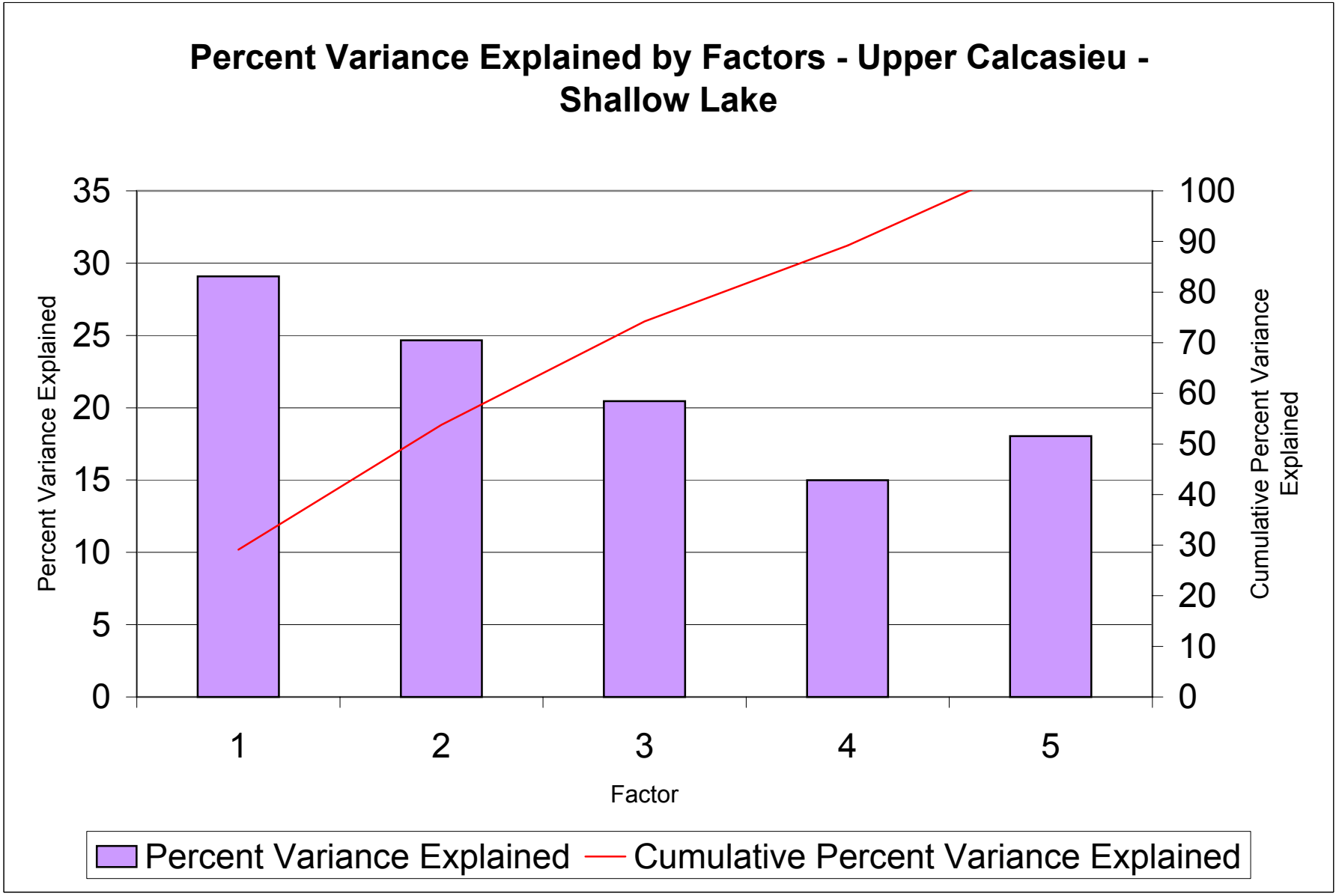

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Table F-22
Upper Calcasieu_Shallow Lake
Factor Loadings

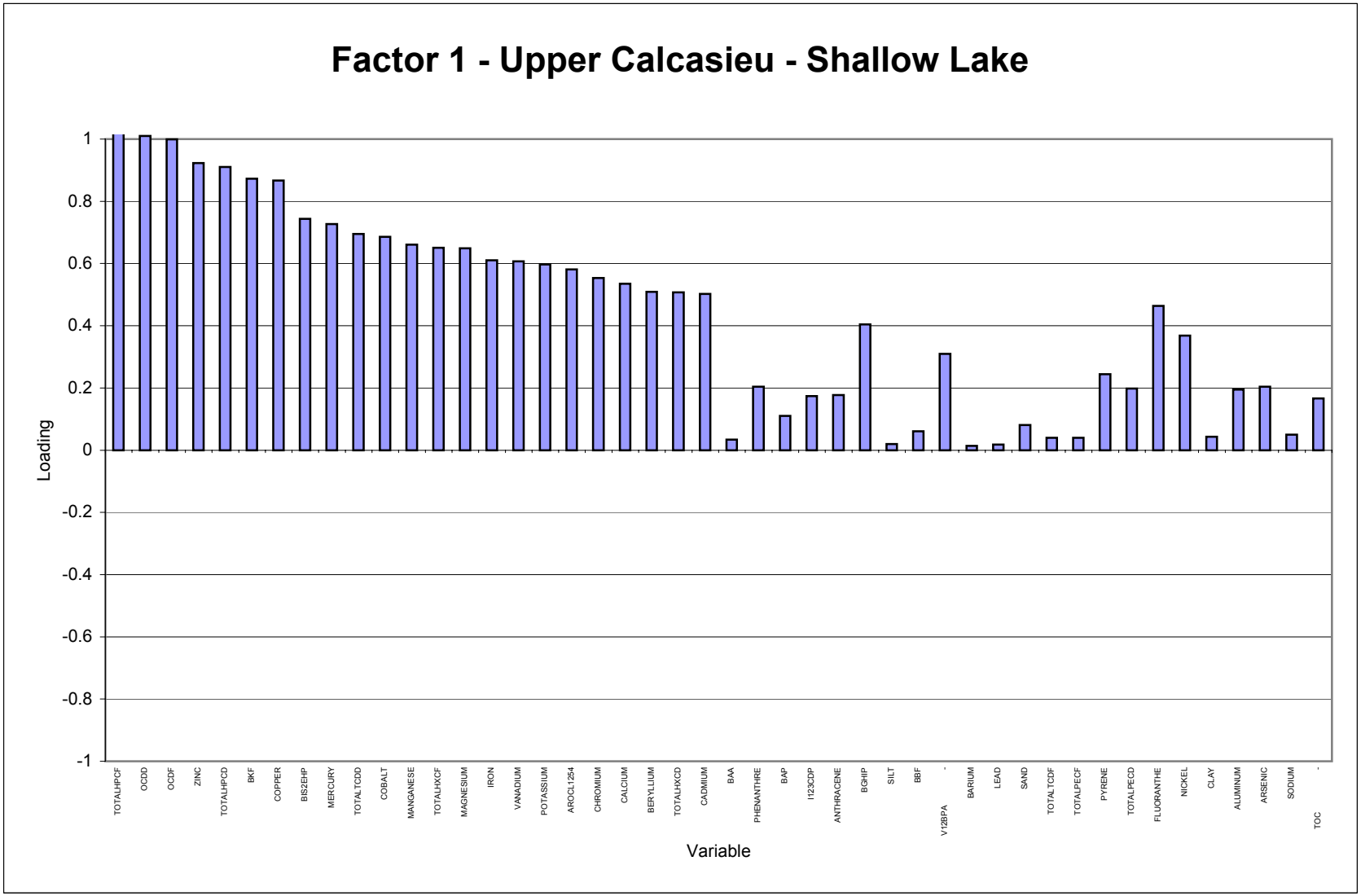

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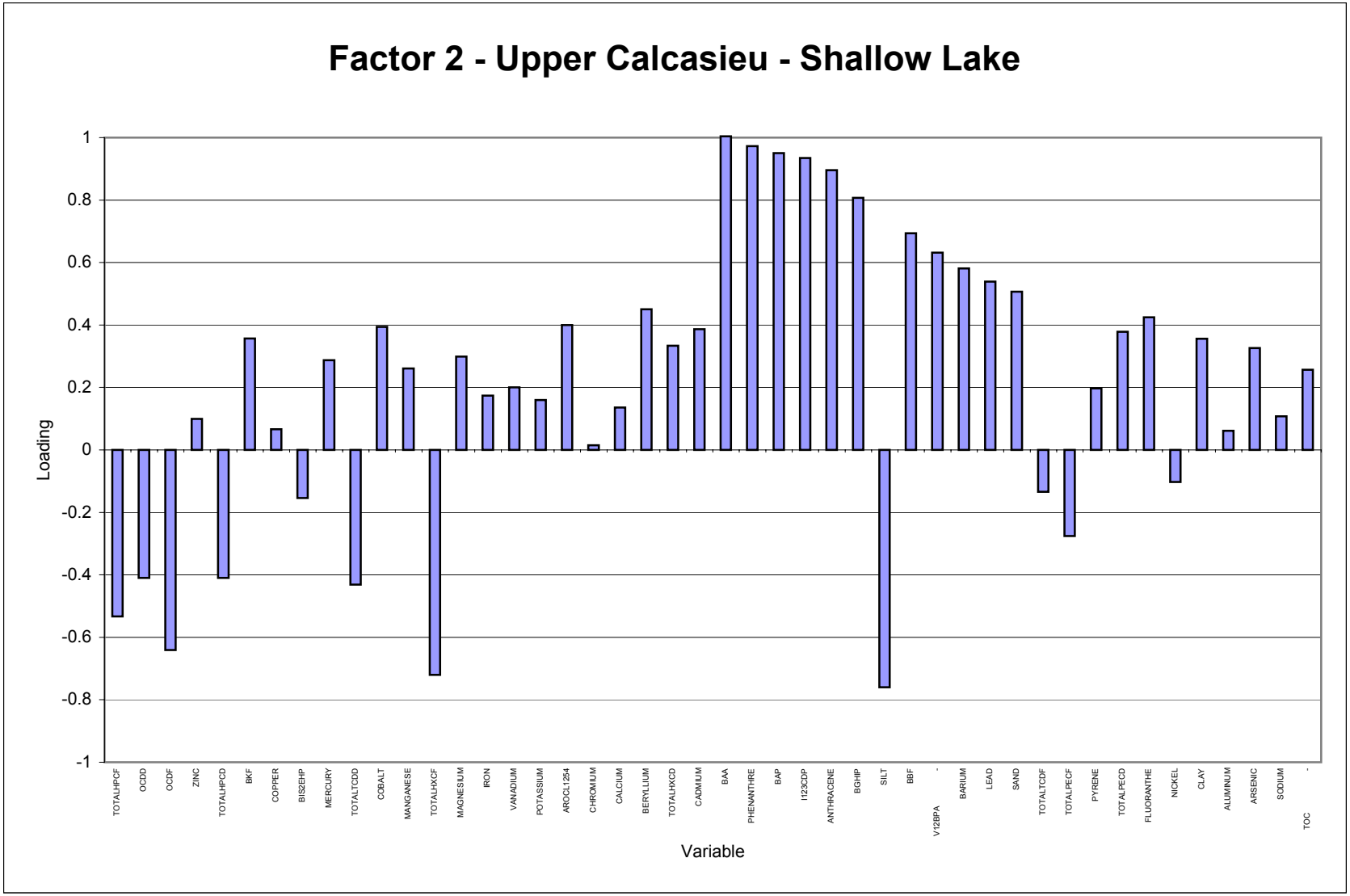
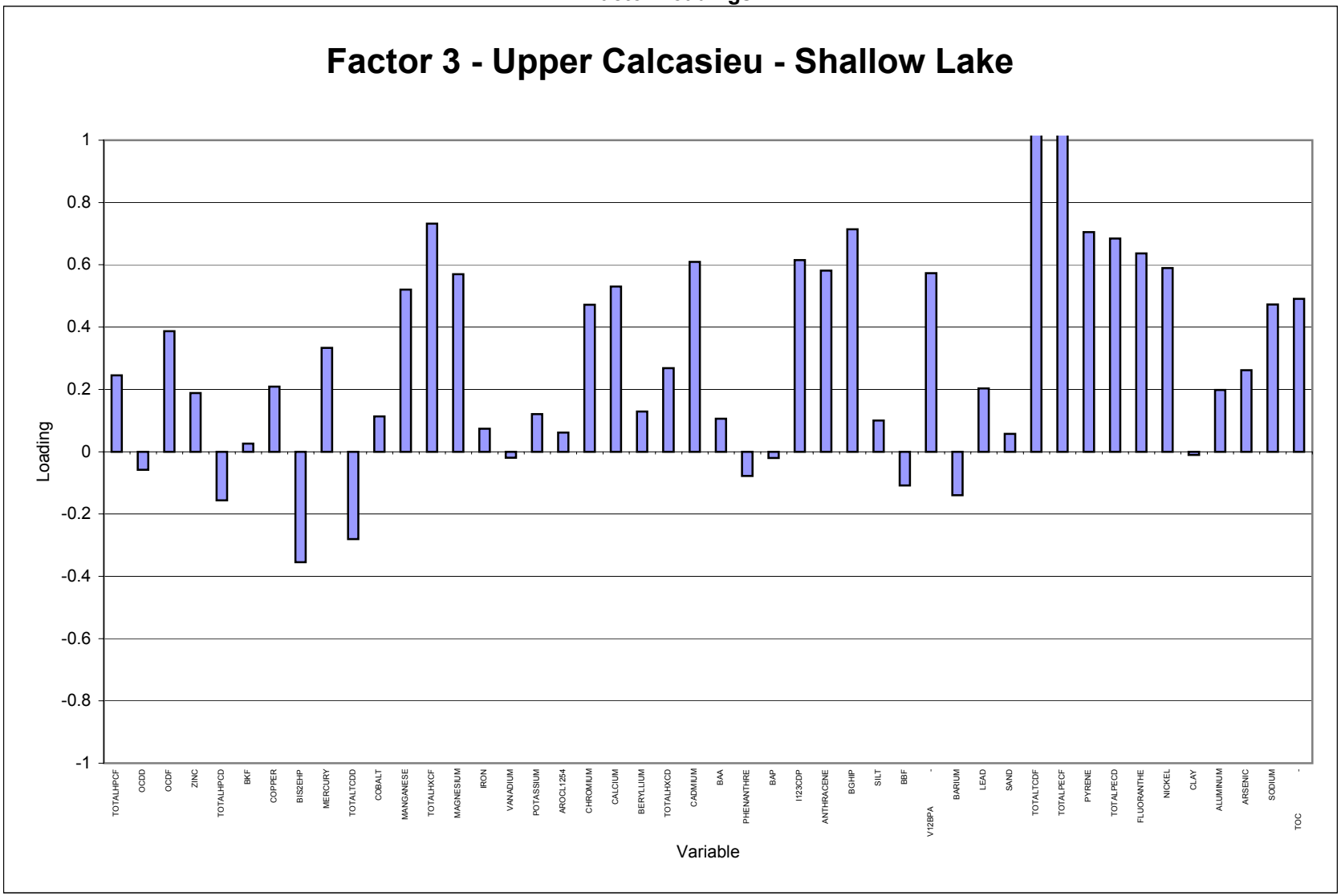
Table F-22
Upper Calcasieu_Shallow Lake
Factor Loadings



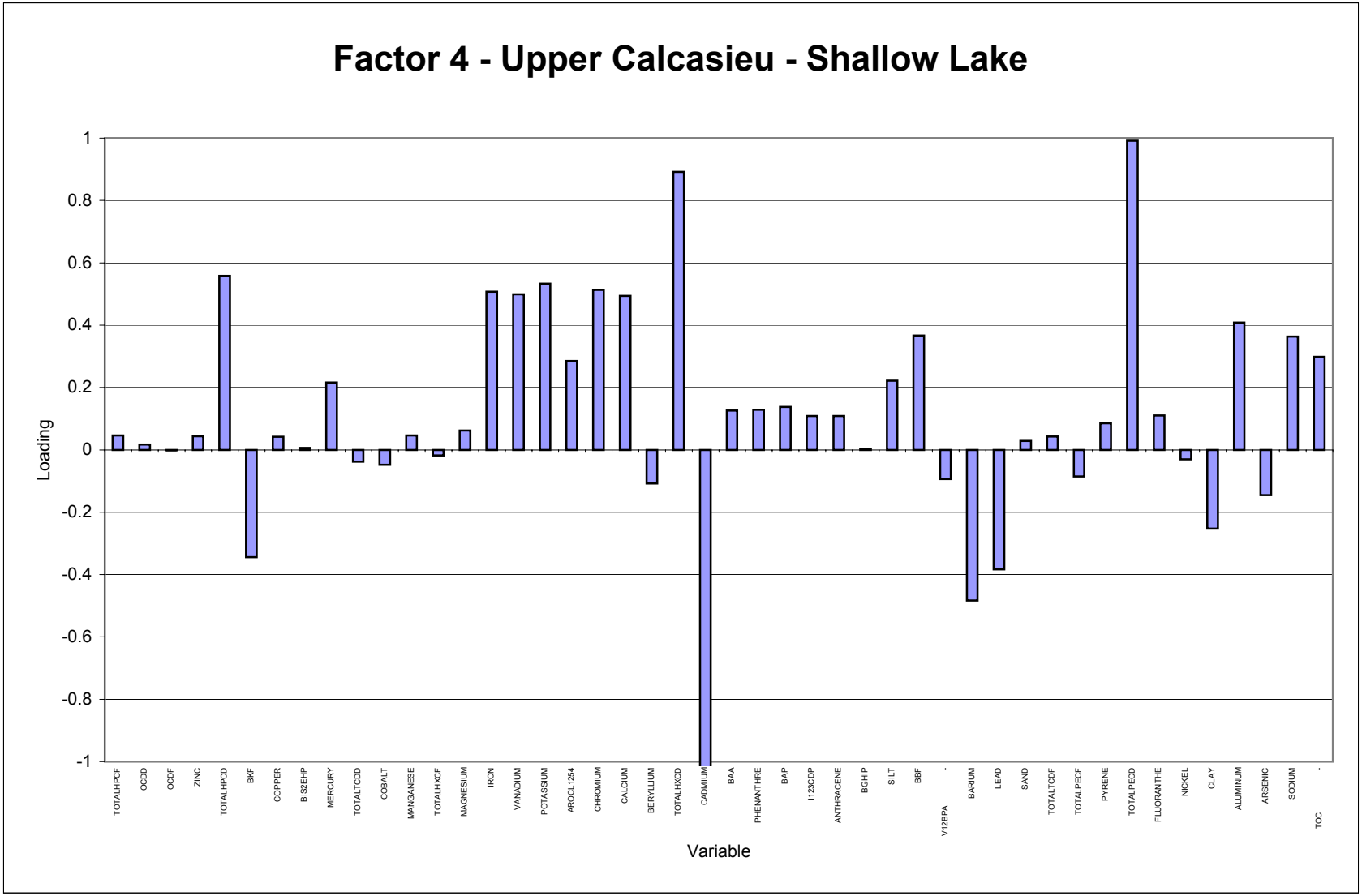
CDM

Table F-22
Upper Calcasieu_Shallow Lake
Factor Loadings



CDM

Table F-22
Upper Calcasieu_Shallow Lake
Factor Loadings



CDM

Table F-22
Upper Calcasieu_Shallow Lake
Factor Loadings

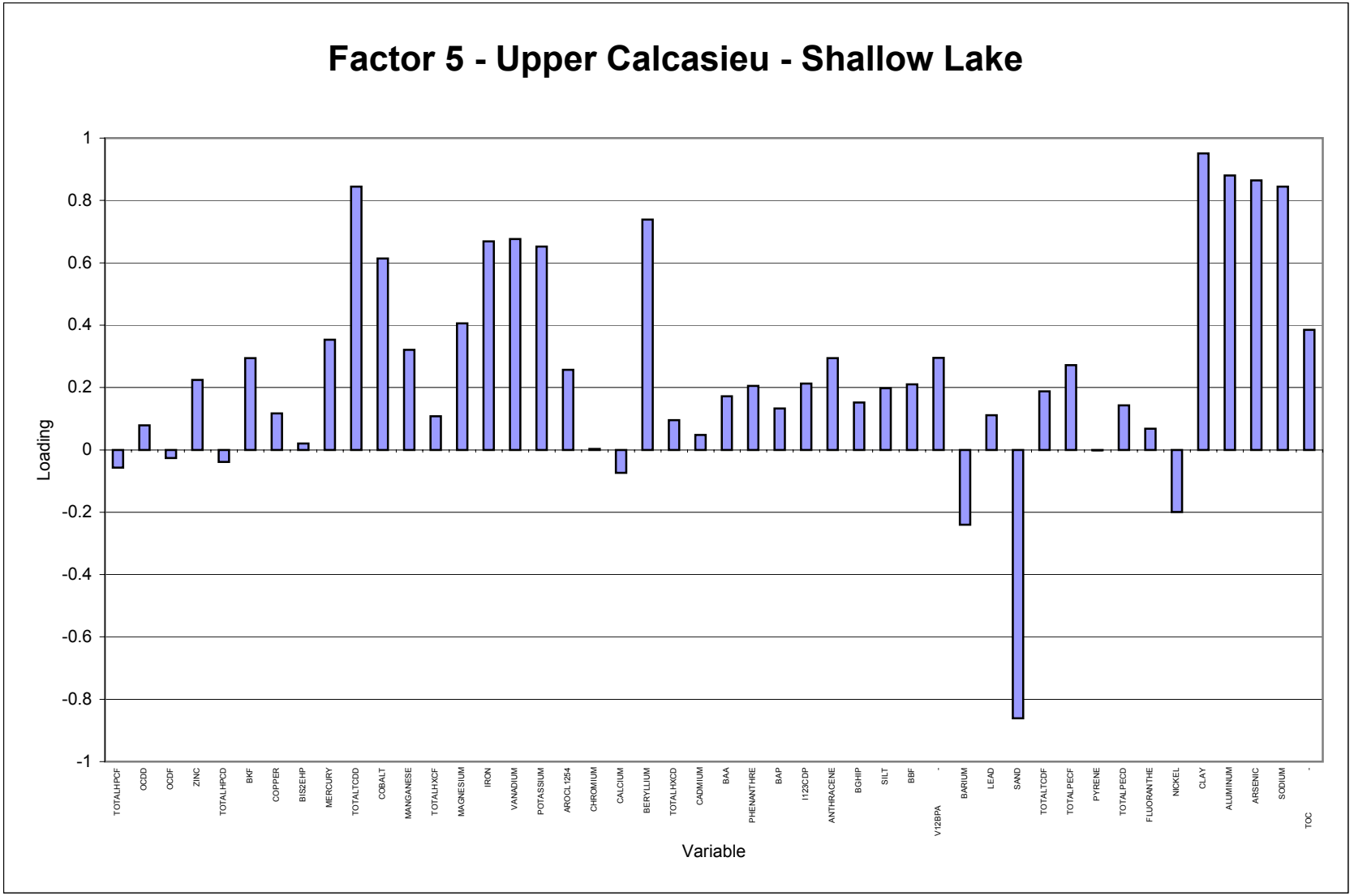


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Table F-23
Upper Calcasieu_Shallow Lake
Rankings

Variable	Sum Ranking
MAGNESIUM	0.388
COBALT	0.368
POTASSIUM	0.366
BERYLLIUM	0.366
MANGANESE	0.360
VANADIUM	0.359
IRON	0.354
COPPER	0.339
CALCIUM	0.324
MERCURY	0.315
ARSENIC	0.312
ZINC	0.292
SODIUM	0.290
NICKEL	0.287
CHROMIUM	0.285
FLUORANTHE	0.272
AROCL1254	0.269
V12BPA	0.264
LEAD	0.257
BKF	0.257
BARIUM	0.245
ALUMINUM	0.242
ANTHRACENE	0.241
PHENANTHRE	0.220
BAA	0.194
BBF	0.193
BAP	0.193
PYRENE	0.145
BGHIP	0.123
CADMIUM	0.121
SAND	0.116
I123CDP	0.115
CLAY	0.113
TOC	0.111
BIS2EHP	0.105
SILT	0.103
TOTALHXCF	0.098
OCDF	0.097
TOTALTCDD	0.095
TOTALHPCF	0.092
TOTALHPCD	0.089
TOTALPECD	0.085
TOTALHXCD	0.079
OCDD	0.077
TOTALPECF	0.068
TOTALTCDF	0.059

Table F-24
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1'-Biphenyl ug/Kg	**1/24**										**290**	**290**	**66**	**0**	
1,2,3,4,6,7,8-HpCDD PG/G	**8/8**	**769.5**	**1193.3785**	**1.55084927**	**-57.469119**	**1596.46912**	**127.5**	**580**	**834.25**	**706.75**	**19**	**3100**			ln(y) = 5.85693565751336 + 1.85605857608051*Z
1,2,3,4,6,7,8-HpCDF PG/G	**7/8**	111.75425	104.05662	0.93111995	39.6466989	183.86181	**23.5**	**83.55**	**230.25**	**206.75**	**21**	**260**	**2.8**	**2.8**	ln(y) = 4.21745612420235 + 1.39875252389729*Z
1,2,3,4,7,8,9-HpCDF PG/G	**5/8**	13.573626	12.664947	0.9330555	4.79726604	22.3499869	4.1420132	9.1094725	20.034337	15.892324	**7.4**	**35.6**	**0.62**	**3.3**	ln(y) = 2.20931480198029 + 1.1690085173263*Z
1,2,3,4,7,8-HxCDD PG/G	**3/8**	4.5044096	4.2031776	0.93312508	1.59175615	7.41706312	2.2610224	3.7096111	6.0862795	3.8252571	**4.91**	**9.6**	**0.48**	**7.7**	ln(y) = 1.31092703630992 + 0.734378389083462*Z
1,2,3,4,7,8-HxCDF PG/G	**6/8**	20.571971	19.964933	0.97049201	6.73697779	34.4069634	7.1350949	14.671558	30.168431	23.033336	**11**	**59.1**	**0.51**	**5**	ln(y) = 2.6859108035379 + 1.06926262515083*Z
1,2,3,6,7,8-HxCDD PG/G	**6/8**	24.554993	25.140732	1.02385414	7.13335526	41.9766317	7.143208	16.118845	36.372615	29.229407	**6.4**	**71**	**0.62**	**4**	ln(y) = 2.77998906487212 + 1.20711984381056*Z
1,2,3,6,7,8-HxCDF PG/G	**4/8**	7.7683987	10.591567	1.36341699	0.42881738	15.10798	2.0417973	4.7321853	10.967581	8.9257838	**6.88**	**27.1**	**0.36**	**5.8**	ln(y) = 1.55438711023793 + 1.24676681025708*Z
1,2,3,7,8,9-HxCDD PG/G	**7/8**	17.218001	11.955191	0.69434258	8.93347613	25.5025257	**8.175**	**13**	**28.75**	**20.575**	**7.8**	**36**	**1.1**	**1.1**	ln(y) = 2.62994901365148 + 0.871242660979862*Z
1,2,3,7,8,9-HxCDF PG/G	**2/8**										**2.98**	**9.64**	**0.42**	**1.1**	
1,2,3,7,8-PeCDD PG/G	**3/8**	2.9639589	1.1105999	0.37470153	2.19435237	3.73356534	2.1609869	2.8054635	3.642144	1.4811571	**3.27**	**5**	**0.7**	**7.2**	ln(y) = 1.03156877135264 + 0.387137279966927*Z
1,2,3,7,8-PeCDF PG/G	**3/8**	4.0796506	7.5518986	1.85111409	-1.1535482	9.31284934	0.8678879	2.1330185	5.2423451	4.3744573	**4.5**	**17.3**	**0.45**	**6.4**	ln(y) = 0.757538089780804 + 1.33379611217776*Z
1,2-Benzphenanthracene ug/Kg	**13/39**	345.64771	587.95317	1.70101854	161.117916	530.177509	51.881968	141.17309	384.13811	332.25615	**82.3**	**2500**	**33**	**1600**	ln(y) = 4.94998672942113 + 1.48476943832727*Z
2,3,4,6,7,8-HxCDF PG/G	**4/8**	4.7909398	8.4975371	1.77366809	-1.097553	10.6794326	0.4118686	1.5670549	5.9622445	5.550376	**1.2**	**20.7**	**0.4**	**3.2**	ln(y) = 0.449198019639805 + 1.9820090721381*Z
2,3,4,7,8-PeCDF PG/G	**3/8**	3.9616588	7.0785107	1.78675425	-0.9434989	8.86681648	0.5919922	1.7207291	5.0016011	4.409609	**3.9**	**17.4**	**0.45**	**4.6**	ln(y) = 0.542748116516414 + 1.58265671949109*Z
2,3,7,8-TCDD PG/G	**3/8**	0.7137488	0.2584473	0.36209835	0.53465401	0.89284366	0.5063498	0.6831241	0.9216128	0.415263	**0.634**	**1.2**	**0.34**	**3**	ln(y) = -0.38107877164434 + 0.444161294395526*Z
2,3,7,8-TCDD Equivalent PG/G	**8/8**	**24.363523**	**21.352061**	**0.87639464**	**9.56729945**	**39.1597455**	**6.62295**	**22.842**	**39.2635**	**32.64055**	**1.11658**	**62.2**			ln(y) = 2.69131080226986 + 1.52169633241926*Z
2,3,7,8-TCDF PG/G	**7/8**	7.002441	6.176443	0.88204143	2.7223843	11.2824976	**2.575**	**5.7**	**10.8**	**8.225**	**2.5**	**18.5**	**0.27**	**0.27**	ln(y) = 1.63649351812718 + 1.05390861538813*Z
2,4-DB ug/Kg	**4/37**										**8.3**	**220**	**19**	**0.27**	
2,4-Dimethylphenol ug/Kg	**1/42**										**82**	**82**	**52**	**0.27**	
2-Butanone ug/Kg	**5/19**	15.832541	12.431781	0.78520442	10.2425304	21.4225516	7.8286363	12.8216	20.998986	13.17035	**10**	**49**	**12**	**48**	ln(y) = 2.55113124413 + 0.731757434838804*Z
2-Methylnaphthalene ug/Kg	**3/37**										**61.4**	**1600**	**67**	**48**	
4,4'-DDT ug/Kg	**1/44**										**2.2**	**2.2**	**0.19**	**48**	
4-Methylphenol ug/Kg	**1/42**										**190**	**190**	**66**	**48**	
Acenaphthene ug/Kg	**1/35**										**68**	**68**	**52**	**48**	
Acenaphthylene ug/Kg	**2/36**										**69.6**	**100**	**59**	**48**	
Acetone ug/Kg	**8/19**	34.861668	57.031224	1.63592929	9.21730232	60.5060336	5.0358239	14.11535	39.565146	34.529322	**15**	**200**	**12**	**110**	ln(y) = 2.64726287306793 + 1.52877828356501*Z
Aluminum (Fume Or Dust) MG/KG	**32/32**	**11470.313**	**7717.0839**	**0.67278759**	**8796.47933**	**14144.1457**	**5622.5**	**9795**	**15900**	**10277.5**	**1950**	**33300**			ln(y) = 9.113869299676 + 0.78761720901393*Z
Anthracene ug/Kg	**6/37**										**68**	**550**	**36**	**0**	
Antimony MG/KG	**1/20**										**8**	**8**	**1.2**	**0**	
Aroclor-1254 ug/Kg	**5/44**										**38**	**930**	**3.8**	**0**	
Aroclor-1260 ug/Kg	**1/44**										**190**	**190**	**3.8**	**0**	
Arsenic MG/KG	**37/37**	**3.7324324**	**2.3516163**	**0.63004927**	**2.97468988**	**4.49017499**	**2.05**	**3.8**	**4.75**	**2.7**	**0.64**	**13**			ln(y) = 1.13879785791415 + 0.667974717960097*Z
Barium MG/KG	**36/37**	421.88068	1440.4843	3.41443526	-42.275064	886.036433	**78.95**	**230**	**324.5**	**245.55**	**24.8**	**6800**	**0.14**	**0.14**	ln(y) = 5.17884077084054 + 1.21866278501616*Z
Benzo(a)anthracene ug/Kg	**10/39**	147.6107	261.93336	1.77448768	65.4026019	229.818793	26.270705	68.304542	177.59365	151.32295	**70.2**	**1100**	**33**	**1600**	ln(y) = 4.22397627211001 + 1.41729042553226*Z
Benzo(a)pyrene ug/Kg	**11/40**	135.01138	266.63509	1.9749082	52.3803131	217.642451	22.671683	59.614073	156.75227	134.08058	**74.8**	**1300**	**33**	**1600**	ln(y) = 4.08789167426447 + 1.43398180386414*Z
Benzo(b)fluoranthene ug/Kg	**12/41**	230.48803	635.63809	2.75779214	35.9188502	425.057215	26.01651	76.050421	222.30755	196.29104	**74.6**	**3309**	**40**	**1600**	ln(y) = 4.33139655312552 + 1.59104495760372*Z
Benzo(g,h,i)perylene ug/Kg	**7/38**										**66.2**	**1100**	**60**	**1600**	
Benzo(k)fluoranthene ug/Kg	**7/37**										**115**	**310**	**33**	**1600**	
Beryllium MG/KG	**18/37**	0.5491157	0.431315	0.78547197	0.41013651	0.68809488	0.2209006	0.3975197	0.7153533	0.4944527	**0.26**	**1.5**	**0.037**	**0.08**	ln(y) = -0.922510723939002 + 0.87146453409145*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**11/42**	222.66196	389.0984	1.74748481	104.985157	340.338765	44.985414	109.24356	265.28942	220.30401	**59**	**2000**	**62**	**1600**	ln(y) = 4.69357985482582 + 1.31601280523252*Z
Cadmium MG/KG	**9/44**	0.2171491	0.1498669	0.69015672	0.17286624	0.26143191	0.1357093	0.1943881	0.2784389	0.1427296	**0.12**	**0.92**	**0.32**	**1.1**	ln(y) = -1.63789848853682 + 0.532998647810493*Z
Calcium Metal MG/KG	**37/37**	**10122.405**	**18935.497**	**1.87065186**	**4020.97156**	**16223.8393**	**727.5**	**1920**	**5830**	**5102.5**	**548**	**75900**			ln(y) = 7.88344667812652 + 1.51201587770016*Z
Carbazole ug/Kg	**2/18**										**42.8**	**87**	**430**	**0**	
Carbon Disulfide ug/Kg	**7/19**	13.867722	9.06077	0.65337117	9.79350337	17.9419415	7.8569671	11.873643	17.943742	10.086775	**6**	**29**	**12**	**29**	ln(y) = 2.47432105667187 + 0.612469651667488*Z
Chlorobenzene ug/Kg	**2/37**										**9**	**47**	**0.73**	**29**	
Chromium MG/KG	**37/37**	**37.42973**	**92.261739**	**2.46493202**	**7.70096621**	**67.1584932**	**8.2**	**11.6**	**27.05**	**18.85**	**2.2**	**454**			ln(y) = 2.72091424509536 + 1.20168487024883*Z
Cobalt MG/KG	**18/37**	4.5425331	2.4861471	0.54730413	3.74144174	5.34362438	2.6351667	3.9091366	5.7990064	3.1638397	**2.5**	**10.6**	**0.44**	**2.7**	ln(y) = 1.36331652600569 + 0.584954653197051*Z
Copper MG/KG	**43/44**	25.456079	29.918916	1.17531517	16.6156045	34.2965542	**12.125**	**17.95**	**28.9**	**16.775**	**3.7**	**170**	**1.9**	**1.9**	ln(y) = 2.90514571358423 + 0.836293746103389*Z

Table F-24
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Cyanide MG/KG	**3/19**										**0.8**	**1.8**	**0.06**	**1.9**	
delta-BHC ug/Kg	**3/44**										**2.1**	**2.7**	**0.16**	**1.9**	
Dibenzo(a,h)anthracene ug/Kg	**3/37**										**71.3**	**300**	**33**	**1.9**	
Dibenzofuran ug/Kg	**1/42**										**21.2**	**21.2**	**56**	**1.9**	
Dichloromethane ug/Kg	**12/37**	5.8688564	1.0757503	0.18329811	5.52222594	6.21548679	4.9157795	5.787424	6.8136247	1.8978453	**5**	**8.3**	**0.71**	**48**	ln(y) = 1.75568728996534 + 0.242123384870535*Z
Dinitrobutyl Phenol ug/Kg	**1/37**										**18**	**18**	**4.4**	**48**	
Endosulfan Sulfate ug/Kg	**1/44**										**3**	**3**	**0.22**	**48**	
Endrin Aldehyde ug/Kg	**1/44**										**6.6**	**6.6**	**0.31**	**48**	
Fluoranthene ug/Kg	**14/40**	218.4364	320.77211	1.46849198	119.028099	317.844711	34.047751	91.562608	246.23392	212.18617	**51**	**1200**	**33**	**1600**	ln(y) = 4.51702297793177 + 1.46733155276097*Z
Fluorene ug/Kg	**3/36**										**42.1**	**120**	**45**	**1600**	
HPAH ug/Kg	**21/21**	**2786.5333**	**3418.4992**	**1.22679287**	**1324.41706**	**4248.6496**	**277.65**	**2050**	**3970**	**3692.35**	**87**	**11500**			ln(y) = 7.02353867071848 + 1.75670471696248*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**7/39**										**68.3**	**317**	**57**	**1600**	
Iron MG/KG	**36/37**	9670.9147	7099.3114	0.73408893	7383.36028	11958.4691	**-15000**	**-15000**	**16350**	**31350**	**1340**	**27200**	**15000**	**15000**	ln(y) = 8.89534435027579 + 0.827302712524531*Z
Lead MG/KG	**44/44**	**29.679545**	**19.021314**	**0.64088965**	**24.0591064**	**35.2999845**	**15**	**28.35**	**39**	**24**	**4.6**	**100**			ln(y) = 3.18579767806188 + 0.7192566433685*Z
LPAH ug/Kg	**9/9**	**744.08889**	**1391.7944**	**1.87046786**	**-165.21675**	**1653.39453**	**138.7**	**373**	**823.15**	**684.45**	**62.1**	**3630**			ln(y) = 5.90154709082667 + 1.46778978423604*Z
Magnesium MG/KG	**37/37**	**3033.9459**	**2552.4249**	**0.84128886**	**2211.49845**	**3856.39344**	**1305**	**2060**	**4025**	**2720**	**594**	**12600**			ln(y) = 7.74482728722035 + 0.79275771304162*Z
Manganese MG/KG	**37/37**	**185.03784**	**208.92333**	**1.12908435**	**117.718142**	**252.357533**	**46.25**	**98.9**	**274**	**227.75**	**15.2**	**867**			ln(y) = 4.64538044565363 + 1.20004994787139*Z
MCPA (2-Methyl-4-Chlorophenoxyacetic Acid) ug/Kg	**1/37**										**2400**	**2400**	**3700**	**0**	
Mecoprop ug/Kg	**1/37**										**1900**	**1900**	**2600**	**0**	
Mercury MG/KG	**23/44**	0.1130833	0.1822413	1.61156757	0.0592344	0.16693214	0.0276587	0.0593996	0.1275663	0.0999077	**0.035**	**0.808**	**0.018**	**0.23**	ln(y) = -2.82346739857917 + 1.13373019531093*Z
Methyl Mercury MG/KG	**4/7**	0.000997	0.0003333	0.33432563	0.00075006	0.0012439	0.0007102	0.0009412	0.0012473	0.0005371	**0.00097**	**0.00147**	**0.00082**	**0.00093**	ln(y) = -6.96835402761034 + 0.417643863611093*Z
Naphthalene ug/Kg	**2/36**										**28.2**	**250**	**1.5**	**0.00093**	
Nickel MG/KG	**43/44**	16.604202	24.502653	1.47568986	9.36413104	23.8442737	**-9.4**	**11.55**	**17.375**	**26.775**	**2.4**	**140**	**9.4**	**9.4**	ln(y) = 2.46043746982476 + 0.783975781553575*Z
OCDD PG/G	**8/8**	**10626.25**	**12412.996**	**1.16814454**	**2024.48269**	**19228.0173**	**2750**	**8570**	**14125**	**11375**	**570**	**35000**			ln(y) = 8.72564437445778 + 1.52495792665742*Z
OCDF PG/G	**8/8**	**449.1625**	**535.03516**	**1.19118395**	**78.4020489**	**819.922951**	**64.5**	**290**	**900**	**835.5**	**7.3**	**1400**			ln(y) = 5.25357998694368 + 2.05124843783767*Z
PCB-105 NG/KG	**2/2**										**11700**	**37800**			
PCB-108 NG/KG	**2/2**										**2960**	**6340**			
PCB-114 NG/KG	**2/2**										**738**	**2590**			
PCB-118 NG/KG	**2/2**										**32100**	**92500**			
PCB-126 NG/KG	**2/2**										**245**	**577**			
PCB-15 NG/KG	**2/2**										**1290**	**2260**			
PCB-156 ng/kg	**2/2**										**6700**	**12900**			
PCB-157 NG/KG	**2/2**										**1030**	**2830**			
PCB-162 NG/KG	**2/2**										**8700**	**24100**			
PCB-167 NG/KG	**2/2**										**2270**	**4950**			
PCB-169 NG/KG	**2/2**										**35.5**	**41.9**			
PCB-189 NG/KG	**2/2**										**856**	**1230**			
PCB-37 ng/kg	**2/2**										**1470**	**1720**			
PCB-58 NG/KG	**2/2**										**232**	**779**			
PCB-60 NG/KG	**2/2**										**5750**	**7320**			
PCB-61/70 NG/KG	**2/2**										**19100**	**54600**			
PCB-66 NG/KG	**2/2**										**15100**	**16600**			
PCB-77 NG/KG	**2/2**										**1370**	**2500**			
PCB-79 NG/KG	**2/2**										**497**	**688**			
PCB-81 NG/KG	**2/2**										**368**	**1440**			
Phenanthrene ug/Kg	**9/39**	104.51513	172.01204	1.6458099	50.5289497	158.501312	22.297665	54.848781	134.91945	112.62179	**62.1**	**820**	**40**	**1600**	ln(y) = 4.00457996852727 + 1.33508229359233*Z
Phenol ug/Kg	**1/42**										**130**	**130**	**45**	**1600**	

Table F-24
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Potassium MG/KG	**33/37**	1527.0331	1126.7273	0.73785386	1163.97677	1890.08943	683.90569	1175.1974	2019.4144	1335.5087	**509**	**4800**	**129**	**258**	ln(y) = 7.06919144148463 + 0.802996343715523*Z
Pyrene ug/Kg	**19/41**	468.88486	902.82911	1.92548147	192.528352	745.241369	29.344128	108.64886	402.28061	372.93648	**45**	**3600**	**33**	**1600**	ln(y) = 4.68812116916331 + 1.9416342129632*Z
Selenium MG/KG	**18/37**	0.5955161	0.3090615	0.51898096	0.49592966	0.69510251	0.3436965	0.5194298	0.7850161	0.4413196	**0.15**	**1.5**	**0.16**	**2.5**	ln(y) = -0.655023603416464 + 0.612547035605732*Z
Silver MG/KG	**25/44**	0.1238169	0.0874231	0.70606811	0.09798498	0.14964876	0.0662402	0.1076658	0.1749984	0.1087582	**0.03**	**0.54**	**0.05**	**1.8**	ln(y) = -2.22872334072509 + 0.72048740653314*Z
Sodium MG/KG	**36/37**	6134.072	4553.0902	0.74226227	4666.96612	7601.17792	**3885**	**4580**	**7245**	**3360**	**1850**	**24800**	**2420**	**2420**	ln(y) = 8.56092300375292 + 0.558524231370495*Z
Thallium MG/KG	**14/37**	0.2167986	0.6323761	2.91688207	0.01303315	0.42056413	0.070677	0.1327112	0.2491936	0.1785166	**0.09**	**2.9**	**0.05**	**4.3**	ln(y) = -2.01958016693197 + 0.934537398895946*Z
Total HpCDD PG/G	**8/8**	**1860.875**	**2564.8828**	**1.37832084**	**83.501906**	**3638.24809**	**355**	**1500**	**2152.5**	**1797.5**	**57**	**6900**			ln(y) = 6.83100492147792 + 1.75085258116341*Z
Total HpCDF PG/G	**7/8**	325.00346	403.70724	1.24216291	45.2486125	604.758306	**53.25**	**220**	**548.5**	**495.25**	**52**	**1100**	**3.1**	**3.1**	ln(y) = 5.09475604054583 + 1.6473037919828*Z
Total HxCDD PG/G	**8/8**	**359.5**	**311.76974**	**0.86723154**	**143.454595**	**575.545405**	**94**	**311.5**	**700**	**606**	**10**	**811**			ln(y) = 5.3115449746071 + 1.67220832478645*Z
Total HxCDF PG/G	**7/8**	133.72246	163.4446	1.22226739	20.4611283	246.983785	**23**	**92.5**	**221.25**	**198.25**	**23**	**448**	**1.2**	**1.2**	ln(y) = 4.23118393905379 + 1.61417100047535*Z
Total Organic Carbon MG/KG	**15/15**	**26705.536**	**21921.896**	**0.82087458**	**15611.5259**	**37799.5456**	**11050**	**21900**	**46481.459**	**35431.459**	**1690**	**77015.4604**			ln(y) = 9.84580296362473 + 1.0652883638052*Z
Total PeCDD PG/G	**7/8**	38.686039	36.727158	0.94936466	13.235417	64.1366616	**7.45**	**32**	**69.55**	**62.1**	**7**	**97**	**0.7**	**0.7**	ln(y) = 3.06596451502715 + 1.51821858498882*Z
Total PeCDF PG/G	**7/8**	66.01897	130.81773	1.98151731	-24.633093	156.671032	**20.75**	**35.5**	**53.975**	**33.225**	**18**	**307**	**0.73**	**0.73**	ln(y) = 3.60111866393906 + 1.1954739821947*Z
Total TCDD PG/G	**8/8**	**12.31375**	**6.3521351**	**0.51585708**	**7.91194497**	**16.715555**	**8.825**	**12.4**	**17.75**	**8.925**	**0.81**	**19**			ln(y) = 2.24378555116083 + 1.02842399808889*Z
Total TCDF PG/G	**8/8**	**57.09**	**63.992215**	**1.1209006**	**12.7456573**	**101.434343**	**18**	**43**	**77.925**	**59.925**	**0.82**	**182**			ln(y) = 3.3606327032064 + 1.84507825334669*Z
TPAH ug/Kg	**21/21**	**3105.4286**	**4038.3632**	**1.30042058**	**1378.19209**	**4832.66505**	**277.65**	**2510**	**4473**	**4195.35**	**87**	**14930**			ln(y) = 7.07821395583418 + 1.80992732997784*Z
Vanadium (Fume Or Dust) MG/KG	**36/37**	16.352168	10.741468	0.65688342	12.8910309	19.813306	**8.75**	**12.2**	**25.7**	**16.95**	**5.1**	**47.5**	**0.52**	**0.52**	ln(y) = 2.60095086708231 + 0.67477461896398*Z
Zinc MG/KG	**33/44**	91.67715	173.34446	1.8908142	40.4571362	142.897164	24.057032	47.445565	93.572706	69.515674	**14.1**	**868**	**12.2**	**294**	ln(y) = 3.85958305235039 + 1.00736670098916*Z
Acid Volatile Sulfide umol/g	**7/7**	**24.748571**	**19.3999**	**0.78387958**	**10.3769245**	**39.1202184**	**6.51**	**23.3**	**40.5**	**33.99**	**4.93**	**52.7**			ln(y) = 2.85725719405573 + 1.18087769050803*Z
Cation Exchange Capacity meq/100g	**4/4**	**20.3525**	**15.825766**	**0.77758337**	**4.84324968**	**35.8617503**	**5.8325**	**20.6**	**34.625**	**28.7925**	**2.81**	**37.4**			ln(y) = 2.65644633497532 + 1.50371997194341*Z
Diesel Range Organics (C10-C20) ug/Kg	**4/4**	**39000**	**74451.723**	**1.90901853**	**-33962.688**	**111962.688**	**11000**	**12500**	**93500**	**82500**	**11000**	**120000**			ln(y) = 9.96334018348065 + 1.34175762493034*Z
Diesel Range Organics ug/Kg	**2/4**										**49000**	**910000**	**12000**	**0**	
pH none	**4/4**	**7.025**	**0.6481101**	**0.09225766**	**6.38985214**	**7.66014786**	**6.525**	**6.95**	**7.6**	**1.075**	**6.4**	**7.8**			ln(y) = 1.94696332117992 + 0.110165648235354*Z
pH standard units	**4/4**	**8.025**	**0.563772**	**0.07025196**	**7.47250345**	**8.57749655**	**7.6**	**7.9**	**8.575**	**0.975**	**7.6**	**8.7**			ln(y) = 2.08093841862883 + 8.61132412482252E-02*Z
Percent Clay %	**16/16**	**24.7425**	**19.064452**	**0.77051437**	**15.4009186**	**34.0840814**	**13.325**	**23.695**	**27.4275**	**14.1025**	**3.4**	**71.7**			ln(y) = 2.92628758979242 + 0.91748192331616*Z
Percent Sand %	**16/16**	**39.974375**	**25.996387**	**0.65032629**	**27.2361455**	**52.7126045**	**14.75**	**44.435**	**53.585**	**38.835**	**1.3**	**88.5**			ln(y) = 3.30633096414073 + 1.18003750976829*Z
Percent Silt %	**16/16**	**35.4475**	**20.720946**	**0.58455309**	**25.2942366**	**45.6007634**	**21.7875**	**27.285**	**51.3125**	**29.525**	**8.09**	**80**			ln(y) = 3.41742849202584 + 0.638738820310567*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-25
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Aluminum (Fume Or Dust) mg/L Total	1/2										0.3	0.3	0.073	0	
Ammonia as N mg/L	1/1										0.48	0.48			
Arsenic mg/L Dissolved	1/2										0.0124	0.0124	0.002	0	
Arsenic mg/L Total	1/2										0.0642	0.0642	0.002	0	
Barium mg/L Dissolved	2/2										0.0823	0.0983			
Barium mg/L Total	2/2										0.0781	0.0916			
bis(2-Ethylhexyl)phthalate ug/L	1/2										1	1	10	0	
Bromide mg/L	1/1										40.4	40.4			
Calcium Metal mg/L Dissolved	2/2										184	193			
Calcium Metal mg/L Total	2/2										193	205			
Caprolactam ug/L	1/2										14	14	10	0	
Copper mg/L Dissolved	2/2										0.0062	0.0065			
Copper mg/L Total	2/2										0.0063	0.0092			
Cyanide mg/L Total	1/2										0.0038	0.0038	0.0046	0	
Iron mg/L Total	1/2										0.0635	0.0635	2.08	0	
Lead mg/L Total	1/2										0.0259	0.0259	0.0004	0	
Magnesium mg/L Dissolved	2/2										623	663			
Magnesium mg/L Total	2/2										635	708			
Manganese mg/L Dissolved	2/2										0.0974	0.114			
Manganese mg/L Total	2/2										0.0869	0.13			
Nickel mg/L Dissolved	2/2										0.0025	0.0352			
Nickel mg/L Total	2/2										0.0032	0.0352			
Potassium mg/L Dissolved	2/2										182	213			
Potassium mg/L Total	2/2										181	227			
Selenium mg/L Dissolved	1/2										0.011	0.011	0.02	0	
Selenium mg/L Total	1/2										0.012	0.012	0.02	0	
Sodium mg/L Dissolved	2/2										5100	6790			
Sodium mg/L Total	2/2										5780	7530			
Thallium mg/L Dissolved	2/2										0.0032	0.0064			
Thallium mg/L Total	1/2										0.0054	0.0054	0.002	0	
Total Organic Carbon mg/L	1/1										4.4	4.4			
Bicarbonate Alkalinity mg/L	1/1										75.6	75.6			
Biochemical Oxygen Demand mg/L	1/1										1.6	1.6			
Chemical Oxygen Demand (COD) mg/L	1/1										111	111			
Chloride mg/L	1/1										9620	9620			
Dissolved Oxygen %	24/24	9.7579167	3.2028459	0.3282305	8.47651145	11.0393219	8.2283333	8.805	11.295	3.0666667	2.95	19.9			ln(y) = 2.22910622020165 + 0.330201078065439*Z
Field Conductivity ms/cm	24/24	33023.713	80475.227	2.43689216	826.916556	65220.5094	3325	28475	34400	31075	343	321000			ln(y) = 9.46162254382735 + 1.52413904072693*Z
Field pH standard units	24/24	8.0946759	0.4895017	0.06047206	7.89883445	8.2905174	7.6820833	8.1025	8.4897222	0.8076389	7.1	9.04			ln(y) = 2.08946242142897 + 6.61909797919192E-02*Z
Field Specific Gravity NO UNITS	18/18	14.032407	2.4041558	0.17132882	12.9217441	15.1430707	13.75	15	15.25	1.5	7.5	16			ln(y) = 2.62508553067503 + 0.184613827354508*Z
Field Temperature deg c	24/24	16.01338	4.4673903	0.2789786	14.2260513	17.800708	13.15	13.85	18.425	5.275	12.5	29.28			ln(y) = 2.74429460408638 + 0.236811757706001*Z
Field Total Dissolved Solids mg/L	24/24	19125.198	4968.1456	0.25976962	17137.5262	21112.8706	18625	20000	21000	2375	2200	25000			ln(y) = 9.79258107397027 + 0.349975127268341*Z
Field Turbidity NTU	21/21	23.358673	26.694382	1.14280383	11.9412979	34.776049	8.7285714	16	28.5	19.771429	1.425	110			ln(y) = 2.69854485050766 + 1.13694336592034*Z
Hardness, as CaCO3 mg/L	1/1										3300	3300			
Nitrate-Nitrite mg/L	1/1										0.12	0.12			
Salinity ppt	24/24	19.734954	5.4434276	0.27582672	17.5571291	21.9127783	19.513889	20	22	2.4861111	2	27			ln(y) = 2.90735279555686 + 0.385006991173926*Z
Sulfate mg/L	1/1										1400	1400			
Total Alkalinity mg/L	1/1										75.6	75.6			

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Table F-25
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total Kjeldahl Nitrogen mg/L	**1/1**										**1**	**1**			
Total Suspended Solids mg/L	**1/1**										**35.2**	**35.2**			

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-26
Upper Calcasieu - Shallow Lake System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N (mg/L)	**1/1**										**0.48**	**0.48**			
Dissolved Oxygen (%)	**18/18**	**10.68**	**3.5351388**	**0.3310055**	**9.0468492**	**12.3131508**	**8.635**	**10.4**	**12.6075**	**3.9725**	**2.95**	**19.9**			ln(y) = 2.31134393936561 + 0.371957732482061*Z
Field Conductivity (ms/cm)	**18/18**	**17522.84**	**14820.813**	**0.84579973**	**10675.9733**	**24369.7058**	**3250**	**14650**	**32450**	**29200**	**3100**	**34700**			ln(y) = 9.22674765792445 + 1.13117039607573*Z
Field pH (standard units)	**18/18**	**8.3612346**	**0.3205383**	**0.03833624**	**8.21315342**	**8.50931571**	**8.1475**	**8.4144444**	**8.58**	**0.4325**	**7.70333333**	**9.04**			ln(y) = 2.12293408000248 + 4.16253172374275E-02*Z
Field Redox Potential (millivolts)	**18/18**	**144.7284**	**31.234663**	**0.21581572**	**130.298717**	**159.158073**	**118.33333**	**146**	**157.25**	**38.916667**	**101**	**218**			ln(y) = 4.95442555280283 + 0.231466689493205*Z
Field Specific Gravity (NO UNITS)	**18/18**	**14.435185**	**1.705992**	**0.1181829**	**13.6470571**	**15.2233133**	**14**	**15**	**15.25**	**1.25**	**10**	**16**			ln(y) = 2.66261039753395 + 0.122351124458382*Z
Field Temperature (deg c)	**18/18**	**13.583951**	**1.1132812**	**0.08195563**	**13.069641**	**14.0982603**	**12.6**	**13.35**	**14.05**	**1.45**	**12.5**	**16.5666667**			ln(y) = 2.60609250976982 + 8.07017183275242E-02*Z
Field Total Dissolved Solids (mg/L)	**19/19**	**19550.251**	**1347.544**	**0.0689272**	**18944.321**	**20156.1803**	**19000**	**20000**	**20250**	**1250**	**16000**	**21000**			ln(y) = 9.8784929919346 + 7.08967032575964E-02*Z
Field Turbidity (NTU)	**17/18**	25.88831	27.83358	1.07514084	13.0298526	38.7467683	**12.5**	**21.5**	**26.75**	**14.25**	**3**	**110**	**3.16666667**	**3.16666667**	ln(y) = 2.89483346696756 + 0.969614847023163*Z
Hardness, as CaCO3 (mg/L)	**2/2**										**3300**	**3620**			
Nitrogen, as Ammonia (mg/L)	**1/1**										**0.37**	**0.37**			
Salinity (ppt)	**18/18**	**19.882716**	**1.7891864**	**0.08998702**	**19.0561541**	**20.709278**	**19.416667**	**20**	**21**	**1.5833333**	**15**	**22**			ln(y) = 2.98599781372768 + 9.22580019026648E-02*Z
Total Alkalinity (mg/L)	**2/2**										**75.6**	**80.65**			
Total Kjeldahl Nitrogen (mg/L)	**2/2**										**1**	**3.95**			

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-27
Upper Calcasieu - Shallow Lake Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	**10/10**	**8.5515**	**1.2840461**	**0.15015449**	**7.75563998**	**9.34736002**	**7.6925**	**8.15**	**9.205**	**1.5125**	**7.16**	**10.78**			ln(y) = 2.13723810349261 + 0.155854614479544*Z
Field Conductivity (ms/cm)	**10/10**	**20815.4**	**18392.349**	**0.88359336**	**9415.70391**	**32215.0961**	**2845.25**	**20550**	**42125**	**39279.75**	**343**	**42400**			ln(y) = 9.09856671216371 + 1.99357675580209*Z
Field pH (standard units)	**10/10**	**7.3845**	**0.4404006**	**0.05963852**	**7.11153687**	**7.65746313**	**7.16**	**7.515**	**7.65625**	**0.49625**	**6.44**	**7.91**			ln(y) = 1.9979250323908 + 6.38489391355622E-02*Z
Field Redox Potential (millivolts)	**10/10**	**118.35**	**106.54023**	**0.90021321**	**52.315679**	**184.384321**	**61.5**	**107**	**129.25**	**67.75**	**26**	**358**			ln(y) = 4.54436496034505 + 0.819248967756182*Z
Field Specific Gravity (NO UNITS)	**4/4**	**5.8125**	**6.9733996**	**1.19972467**	**-1.0214316**	**12.6464316**	**1.5**	**4**	**11.9375**	**10.4375**	**1**	**14.25**			ln(y) = 1.34120177695422 + 1.53152542129527*Z
Field Temperature (deg c)	**10/10**	**19.084**	**5.5046689**	**0.28844419**	**15.6721708**	**22.4958292**	**13.76375**	**19.185**	**23.37625**	**9.6125**	**12.3**	**29.28**			ln(y) = 2.9132994364307 + 0.33458569963662*Z
Field Total Dissolved Solids (mg/L)	**10/10**	**14965**	**9738.3188**	**0.65073964**	**8929.1275**	**21000.8725**	**4425**	**18000**	**25000**	**20575**	**2200**	**25000**			ln(y) = 9.29308228298384 + 1.06843631595158*Z
Field Turbidity (NTU)	**8/10**	4.2483431	6.0861887	1.43260292	0.47608424	8.02060192	0.6321763	1.7712949	4.9629919	4.3308156	**0.3**	**15.55**	**2.1**	**6.35**	ln(y) = 0.571710884233424 + 1.52820300718426*Z
Salinity (ppt)	**10/10**	**15.625**	**10.816812**	**0.69227599**	**8.92067028**	**22.3293297**	**3.5**	**18.75**	**27**	**23.5**	**2**	**27**			ln(y) = 2.35913608381709 + 1.19269543217033*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-28
Principal Components Analysis Results

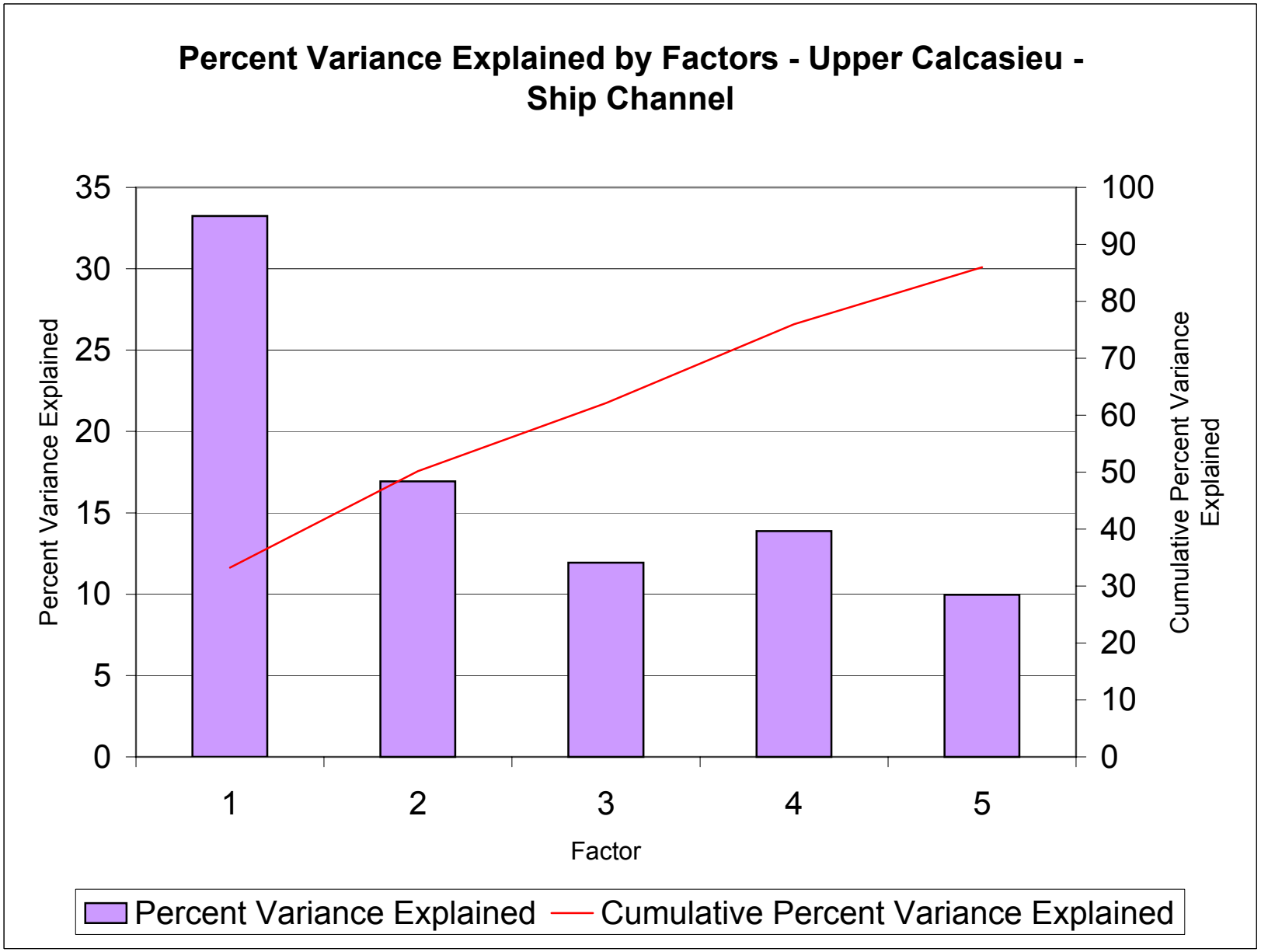

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Table F-29
Upper Calcasieu Ship Channel
Factor Loadings

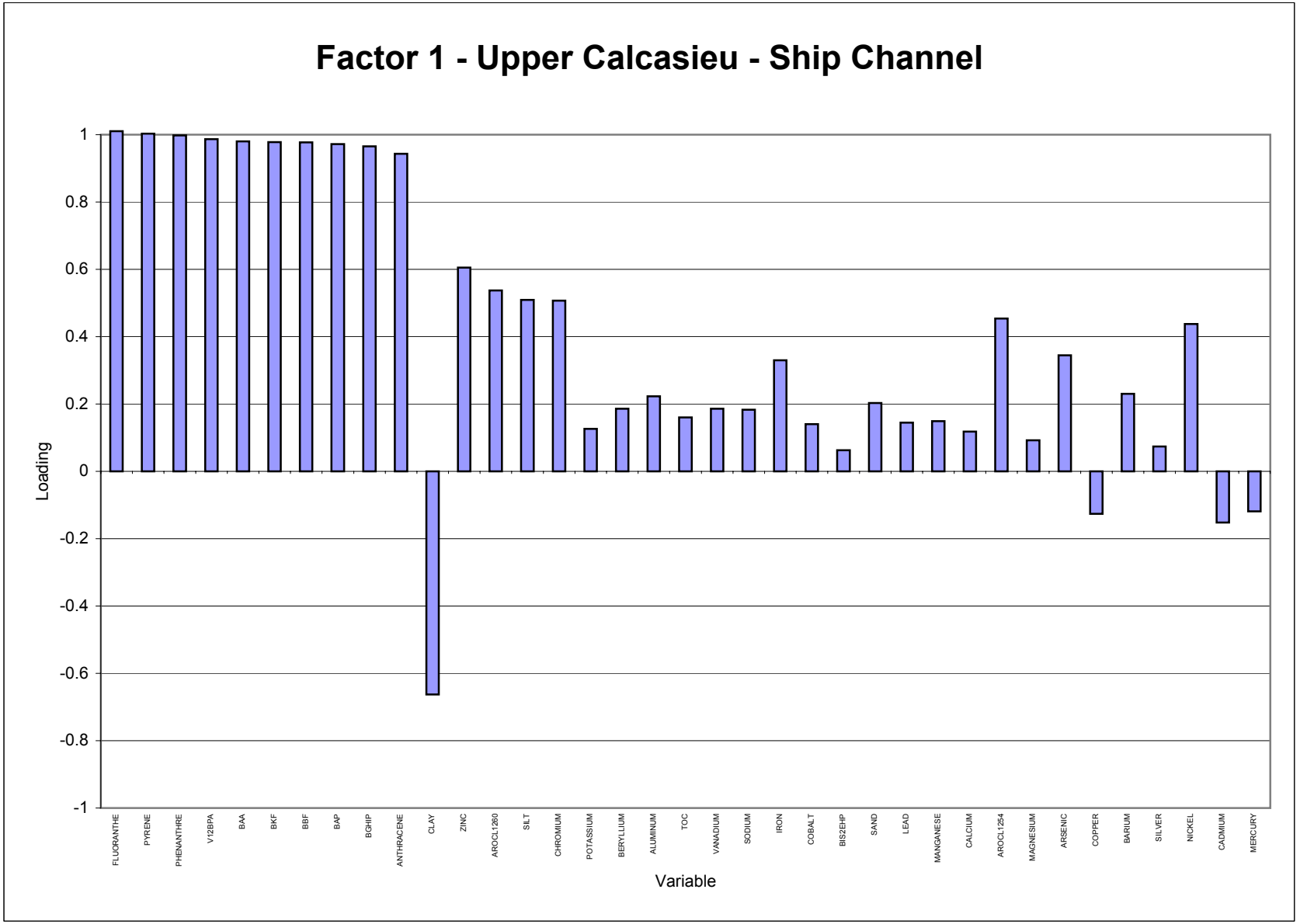

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Table F-29
Upper Calcasieu Ship Channel
Factor Loadings

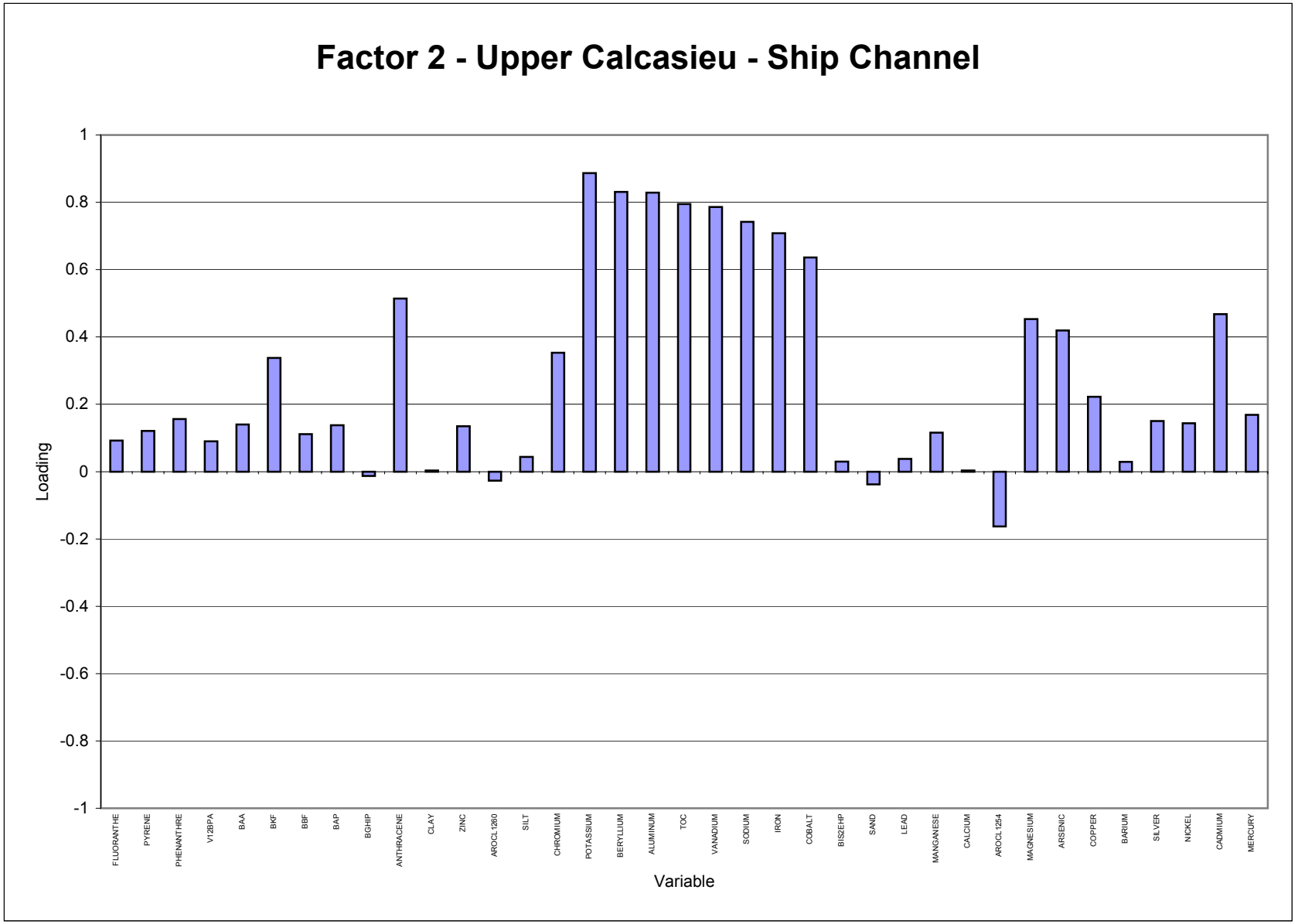

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Table F-29
Upper Calcasieu Ship Channel
Factor Loadings

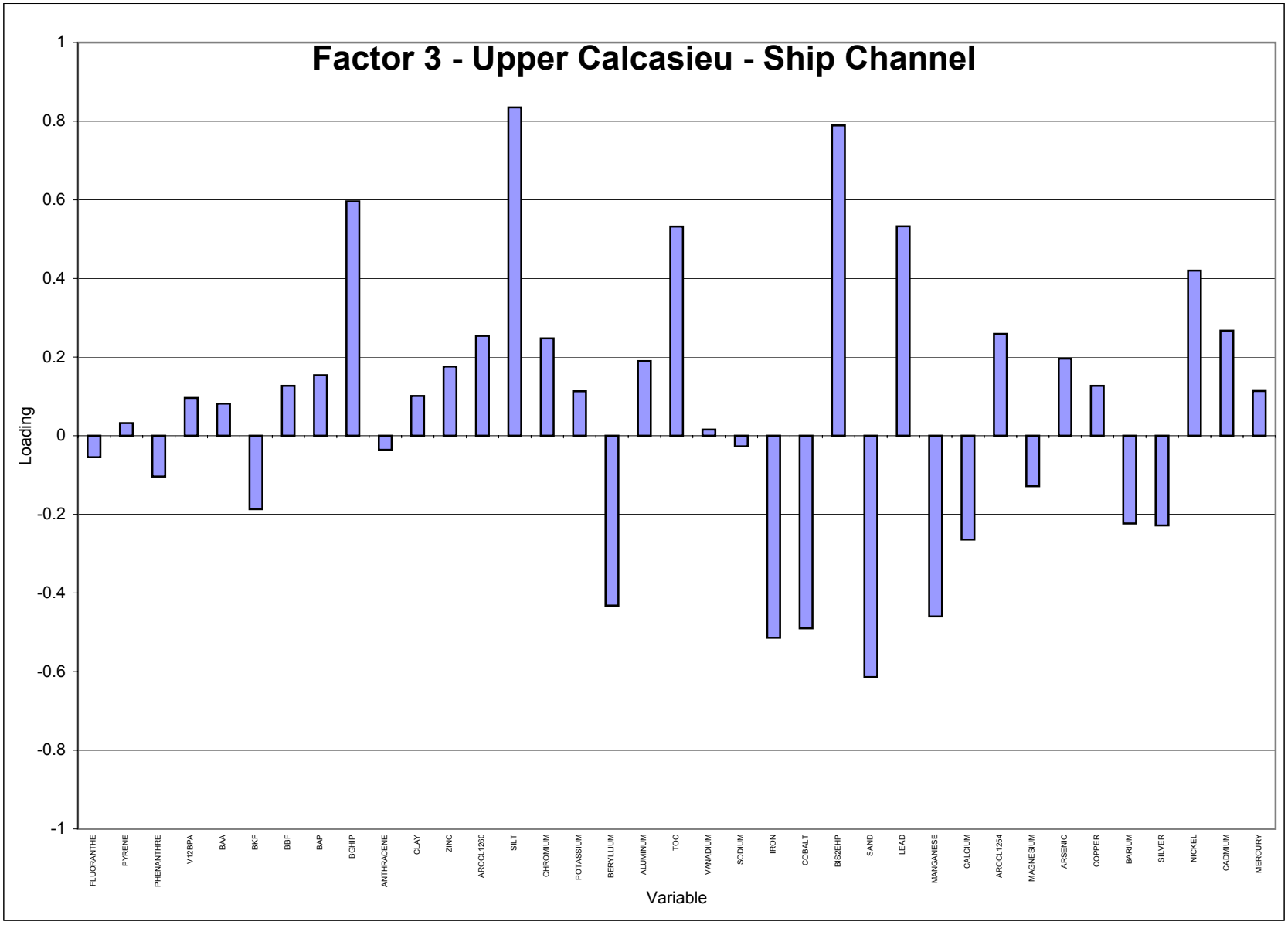

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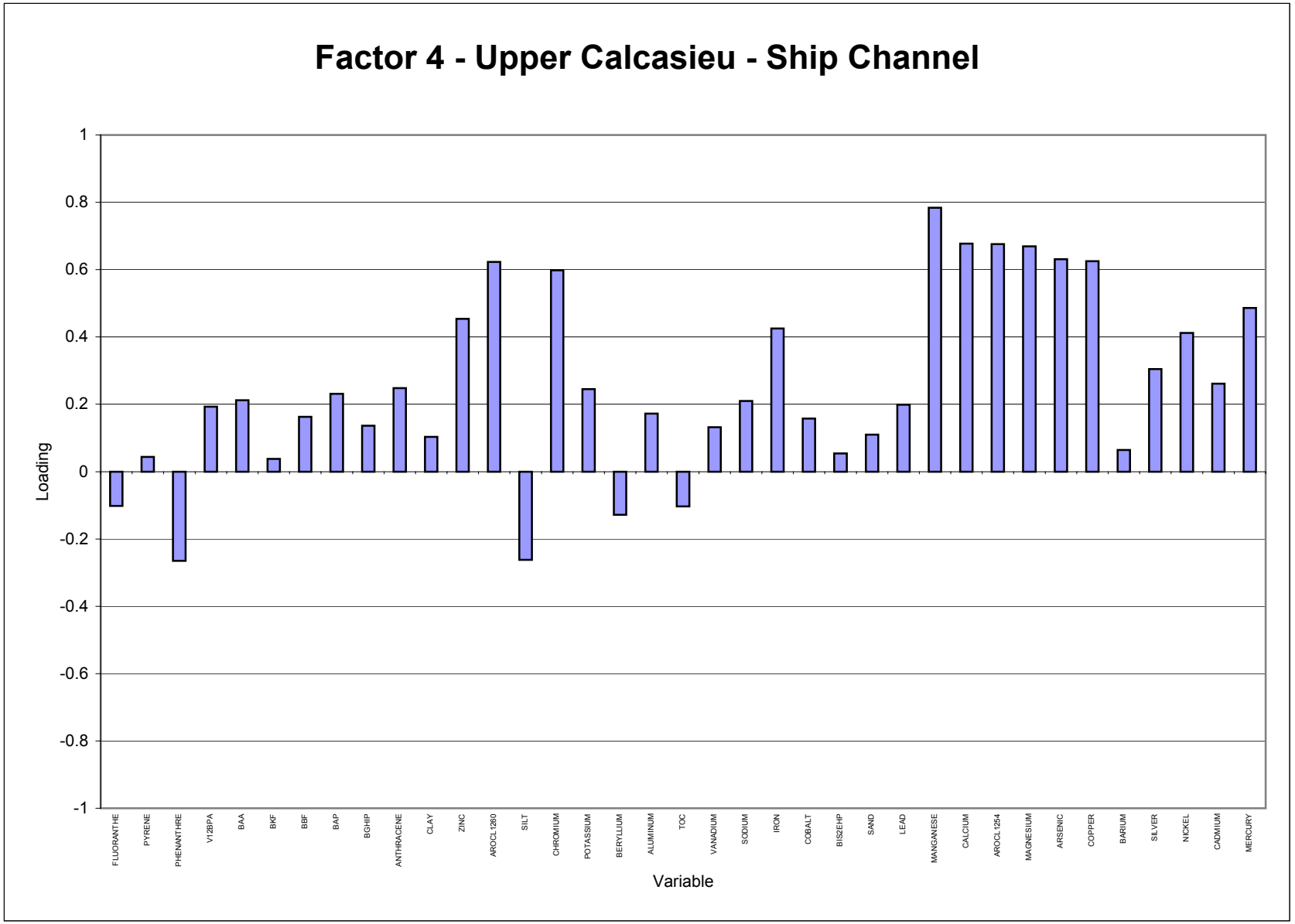
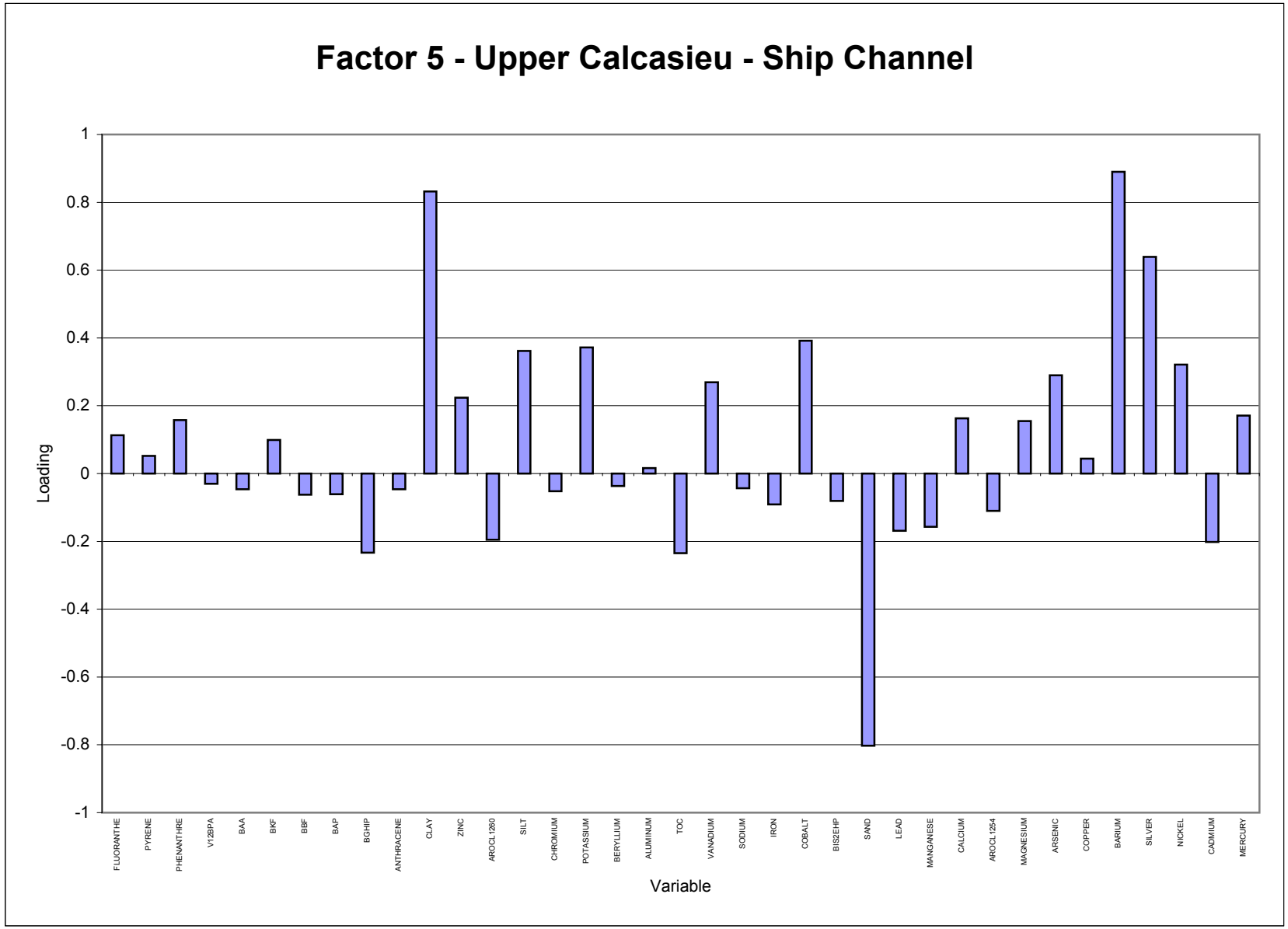
Table F-29
Upper Calcasieu Ship Channel
Factor Loadings



CDM

Table F-29
Upper Calcasieu Ship Channel
Factor Loadings



CDM

Table F-30
Upper Calcasieu_Ship Channel
Rankings

Variable	Sum Ranking
NICKEL	0.297
AROCL1260	0.282
ZINC	0.266
CHROMIUM	0.265
PYRENE	0.253
ARSENIC	0.249
AROCL1254	0.246
V12BPA	0.226
FLUORANTHE	0.226
BAA	0.216
POTASSIUM	0.212
IRON	0.211
COBALT	0.199
PHENANTHRE	0.191
ALUMINUM	0.191
BBF	0.190
BAP	0.190
BERYLLIUM	0.189
VANADIUM	0.185
MANGANESE	0.180
COPPER	0.178
MAGNESIUM	0.177
BKF	0.173
SODIUM	0.171
LEAD	0.163
BARIUM	0.157
BGHIP	0.154
CALCIUM	0.139
SILT	0.137
CLAY	0.130
TOC	0.113
ANTHRACENE	0.113
SAND	0.095
MERCURY	0.095
SILVER	0.086
CADMIUM	0.081
BIS2EHP	0.067

Table F-31
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**2/51**										**4.9**	**5.6**	**0.76**	**0**	
1,1'-Biphenyl ug/Kg	**1/37**										**1200**	**1200**	**51**	**0**	
1,2,3,4,6,7,8-HpCDD PG/G	**10/10**	**91.12**	**48.40225**	**0.53119239**	**61.1199745**	**121.120025**	**50.8**	**97**	**130**	**79.2**	**6.8**	**160**			ln(y) = 4.25819307472373 + 0.978662757976279*Z
1,2,3,4,6,7,8-HpCDF PG/G	**7/10**	47.02321	151.46203	3.22100571	-46.853927	140.900346	1.6336447	7.5572905	34.960258	33.326613	**6.36**	**365**	**0.82**	**2.3**	ln(y) = 2.02251272754408 + 2.27191318804242*Z
1,2,3,4,7,8,9-HpCDF PG/G	**2/10**										**9.6**	**54.5**	**0.749**	**2.3**	
1,2,3,4,7,8-HxCDD PG/G	**2/10**										**1.55**	**2.59**	**0.72**	**2.3**	
1,2,3,4,7,8-HxCDF PG/G	**3/10**	10.210634	29.892564	2.92759131	-8.3169689	28.7382372	0.0121991	0.1931622	3.0585518	3.0463527	**1.02**	**76.3**	**0.778**	**5.8**	ln(y) = -1.64422481089289 + 4.09701993953997*Z
1,2,3,6,7,8-HxCDD PG/G	**3/10**	2.0436698	2.9892133	1.46266942	0.19093618	3.89640334	0.575485	1.2579829	2.7498908	2.1744058	**2.85**	**8.09**	**1.3**	**3.4**	ln(y) = 0.22950956335101 + 1.15998850674636*Z
1,2,3,6,7,8-HxCDF PG/G	**3/10**	4.7508435	14.804069	3.11609277	-4.4248136	13.9265007	0.210211	0.9264266	4.0828795	3.8726685	**0.591**	**36.6**	**0.737**	**2**	ln(y) = -7.64204056375386E-02 + 2.20001009133879*Z
1,2,3,7,8,9-HxCDD PG/G	**7/10**	4.6302721	2.7704359	0.59833113	2.91313809	6.34740606	2.4183311	3.9060535	6.3090012	3.8906701	**2.18**	**8.2**	**1.3**	**2.6**	ln(y) = 1.3625275211914 + 0.711150357724187*Z
1,2,3,7,8,9-HxCDF PG/G	**1/10**										**14.4**	**14.4**	**0.241**	**2.6**	
1,2,3,7,8-PeCDD PG/G	**2/10**										**0.821**	**1.98**	**1.35**	**2.6**	
1,2,3,7,8-PeCDF PG/G	**3/10**	2.7972633	6.5464555	2.34030722	-1.2602718	6.85479842	0.1803244	0.733305	2.9820494	2.801725	**0.44**	**17.6**	**0.81**	**2.5**	ln(y) = -0.31019358523008 + 2.08072822334071*Z
1,2-Benzphenanthracene ug/Kg	**18/47**	6095.9999	60292.267	9.89046381	-11141.281	23333.2806	8.6560421	45.217929	236.21201	227.55597	**54**	**279000**	**33**	**950**	ln(y) = 3.81149367127887 + 2.45218438825736*Z
2,3,4,6,7,8-HxCDF PG/G	**2/10**										**0.629**	**16.6**	**0.72**	**950**	
2,3,4,7,8-PeCDF PG/G	**3/10**	2.1109033	4.2864712	2.03063359	-0.545879	4.76768572	0.3116498	0.9116037	2.666523	2.3548732	**0.643**	**12**	**0.79**	**2.5**	ln(y) = -0.092549894660132 + 1.59202395557665*Z
2,3,7,8-TCDD Equivalent PG/G	**10/10**	**7.5204265**	**11.212655**	**1.49096**	**0.57075088**	**14.4701021**	**3.0432475**	**4.6989075**	**7.468375**	**4.4251275**	**2.39118**	**32.0636**			ln(y) = 1.67780705192187 + 0.833036454210218*Z
2,3,7,8-TCDF PG/G	**5/10**	2.3043248	3.8166296	1.65628975	-0.0612467	4.66989639	0.1438205	0.5932224	2.4468887	2.3030682	**0.898**	**9.2**	**0.7**	**1.1**	ln(y) = -0.52218589855578 + 2.10178881925654*Z
2,4,5-T ug/Kg	**1/37**										**5.4**	**5.4**	**5.1**	**1.1**	
2,4-DB ug/Kg	**4/37**										**6.9**	**23**	**19**	**1.1**	
2-Butanone ug/Kg	**10/23**	10.02279	5.5139719	0.5501434	7.76929479	12.2762859	6.2958457	8.9546442	12.73628	6.4404343	**6**	**26**	**13**	**29**	ln(y) = 2.19217230540255 + 0.522527412896598*Z
2-Methylnaphthalene ug/Kg	**4/43**										**19.6**	**9660**	**21**	**29**	
4,4'-DDE ug/Kg	**1/51**										**2.8**	**2.8**	**0.14**	**29**	
4,4'-DDT ug/Kg	**4/51**										**2.3**	**280**	**0.19**	**29**	
4-Methylphenol ug/Kg	**1/51**										**300**	**300**	**51**	**29**	
Acenaphthene ug/Kg	**4/42**										**34.8**	**2050**	**21**	**29**	
Acenaphthylene ug/Kg	**2/40**										**130**	**308**	**21**	**29**	
Acetone ug/Kg	**7/23**	23.481469	45.822913	1.95144999	4.75418303	42.2087554	3.1154225	8.7545196	24.600713	21.48529	**6**	**160**	**13**	**67**	ln(y) = 2.1695700966774 + 1.53251552594527*Z
Acetophenone ug/Kg	**3/37**										**69**	**110**	**51**	**67**	
alpha-Chlordane ug/Kg	**1/51**										**0.47**	**0.47**	**0.17**	**67**	
Aluminum (Fume Or Dust) MG/KG	**37/37**	**5822.1622**	**3113.0666**	**0.53469253**	**4819.06356**	**6825.26076**	**3520**	**5860**	**7510**	**3990**	**670**	**13100**			ln(y) = 8.48766320617274 + 0.702395078371168*Z
Anthracene ug/Kg	**9/44**	264.46665	2043.1892	7.72569673	-339.25716	868.190474	5.3676713	22.165987	91.535223	86.167552	**26.6**	**9530**	**21**	**950**	ln(y) = 3.09855901278234 + 2.10351184478258*Z
Aroclor-1254 ug/Kg	**6/51**										**28**	**210**	**3.8**	**950**	
Aroclor-1260 ug/Kg	**4/51**										**38**	**230**	**3.8**	**950**	
Arsenic MG/KG	**39/39**	**2.1071795**	**1.3475156**	**0.63948781**	**1.68426013**	**2.53009885**	**1.1**	**1.8**	**2.9**	**1.8**	**0.32**	**6.6**			ln(y) = 0.548668962284396 + 0.708456091855384*Z
Barium MG/KG	**38/39**	122.58882	159.51353	1.30120778	72.5253116	172.65233	**48.9**	**72.6**	**132**	**83.1**	**15**	**719**	**0.14**	**0.14**	ln(y) = 4.36783868870252 + 0.935972514652555*Z
Benzo(a)anthracene ug/Kg	**16/46**	2479.4371	23733.235	9.57202581	-4379.1413	9338.0154	9.0153691	41.519621	191.21557	182.2002	**66.1**	**109000**	**33**	**950**	ln(y) = 3.7261661046275 + 2.2652920562228*Z
Benzo(a)pyrene ug/Kg	**16/47**	1874.3616	17953.043	9.57821777	-3258.3306	7007.05374	8.9095257	40.075916	180.26538	171.35586	**35.1**	**83500**	**33**	**950**	ln(y) = 3.69077556271387 + 2.23031560135849*Z
Benzo(b)fluoranthene ug/Kg	**16/47**	1862.884	17655.657	9.47759335	-3184.7867	6910.55466	12.188372	50.727343	211.12445	198.93608	**44.7**	**82200**	**40**	**950**	ln(y) = 3.92646507641611 + 2.11510777254011*Z
Benzo(g,h,i)perylene ug/Kg	**14/45**	570.3653	4533.9476	7.94919967	-754.36148	1895.09207	32.231218	77.441658	186.06838	153.83716	**46.2**	**21200**	**60**	**950**	ln(y) = 4.34952485529533 + 1.30021282056066*Z
Benzo(k)fluoranthene ug/Kg	**13/45**	266.15694	1914.0001	7.19124619	-293.07474	825.388617	11.979388	38.658911	124.75691	112.77752	**38.8**	**9090**	**33**	**950**	ln(y) = 3.65477730879913 + 1.73777614065209*Z
Beryllium MG/KG	**21/39**	0.3469128	0.3106443	0.89545343	0.24941674	0.44440888	0.1141487	0.2267383	0.4503796	0.3362309	**0.09**	**1.1**	**0.037**	**0.46**	ln(y) = -1.48395896015252 + 1.0179554674184*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**8/51**										**83**	**29000**	**51**	**0.46**	
Bromomethane ug/Kg	**2/37**										**3**	**3**	**0.97**	**0.46**	
Cadmium MG/KG	**19/51**	0.1904819	0.2081921	1.09297609	0.13334251	0.2476212	0.0757231	0.1372501	0.2487692	0.1730461	**0.046**	**1**	**0.31**	**0.92**	ln(y) = -1.98595072241862 + 0.882128043562538*Z
Calcium Metal MG/KG	**35/39**	11773.1	41365.181	3.5135335	-1209.411	24755.6111	**603**	**1690**	**7620**	**7017**	**451**	**208000**	**11.1**	**11.1**	ln(y) = 7.6280143185331 + 1.88754431153381*Z
Carbazole ug/Kg	**5/27**										**11.6**	**365**	**420**	**11.1**	
Carbon Disulfide ug/Kg	**4/23**										**7**	**57**	**12**	**11.1**	

Table F-31
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Chromium MG/KG	**39/39**	**9.1087179**	**5.8233215**	**0.63931296**	**7.28106163**	**10.9363743**	**5.9**	**7.84**	**10.9**	**5**	**1.5**	**28.5**			ln(y) = 2.02790510811078 + 0.667586534089537*Z
Cobalt MG/KG	**22/39**	2.3264926	1.8077901	0.77704528	1.75911552	2.89386961	1.0111283	1.7427098	3.0036123	1.992484	**1**	**8**	**0.44**	**6.9**	ln(y) = 0.555441256079621 + 0.807450568770303*Z
Copper MG/KG	**49/51**	20.642784	67.363992	3.26331911	2.15440673	39.1311618	4.7632998	9.5939939	19.32373	14.56043	**1.2**	**379**	**6.8**	**9.3**	ln(y) = 2.26113726448936 + 1.03857591720506*Z
Cyanide MG/KG	**7/23**	0.2569442	0.898497	3.49685602	-0.1102609	0.62414941	0.0075805	0.0356672	0.1678186	0.1602381	**0.12**	**3.4**	**0.06**	**0.46**	ln(y) = -3.33352253307283 + 2.29705698021123*Z
delta-BHC ug/Kg	**2/51**										**2**	**4.6**	**0.16**	**0.46**	
Dibenzo(a,h)anthracene ug/Kg	**7/44**										**27**	**22500**	**33**	**0.46**	
Dibenzofuran ug/Kg	**2/51**										**57.3**	**854**	**21**	**0.46**	
Dichloromethane ug/Kg	**7/37**										**3**	**7.6**	**0.71**	**0.46**	
Dieldrin ug/Kg	**1/51**										**8**	**8**	**0.2**	**0.46**	
Endrin Aldehyde ug/Kg	**4/51**										**2**	**8.1**	**0.31**	**0.46**	
Fluoranthene ug/Kg	**21/47**	1342.0856	10150.986	7.56359051	-1560.0345	4244.20576	14.707291	66.160254	297.61967	282.91238	**43.8**	**50100**	**33**	**950**	ln(y) = 4.19207988922033 + 2.2304371577635*Z
Fluorene ug/Kg	**3/41**										**115**	**1820**	**21**	**950**	
Heptachlor Epoxide ug/Kg	**1/51**										**8.4**	**8.4**	**0.19**	**950**	
HPAH ug/Kg	**25/25**	**36713.996**	**252676.88**	**6.88230406**	**-62335.342**	**135763.334**	**233.55**	**1142.4**	**1898**	**1664.45**	**63**	**863890**			ln(y) = 7.07469880578278 + 2.01348374654602*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**12/45**	474.77097	4026.8537	8.48167637	-701.79334	1651.33528	29.206141	66.76082	152.60514	123.399	**51.8**	**18300**	**57**	**950**	ln(y) = 4.20111638110974 + 1.22626923328263*Z
Iron MG/KG	**30/39**	4535.5379	3381.6978	0.74560016	3474.18807	5596.88776	2020.9837	3471.4306	5962.8539	3941.8702	**613**	**15200**	**1320**	**5340**	ln(y) = 8.15232207266705 + 0.802419353374755*Z
Lead MG/KG	**50/51**	25.637423	52.366331	2.04257391	11.2652268	40.0096185	**8.8**	**13**	**20**	**11.2**	**2.3**	**297**	**3.8**	**3.8**	ln(y) = 2.68464899820314 + 0.875513691940276*Z
LPAH ug/Kg	**16/16**	**3072.4188**	**14276.659**	**4.64671658**	**-3923.1442**	**10067.9817**	**135.925**	**225**	**952.25**	**816.325**	**51.5**	**41078**			ln(y) = 5.89819325518785 + 1.73172784728299*Z
Magnesium MG/KG	**37/39**	2049.3689	2183.8636	1.06562739	1363.96072	2734.77708	**1050**	**1650**	**2400**	**1350**	**567**	**12300**	**7.1**	**7.1**	ln(y) = 7.38762460569389 + 0.689763328255958*Z
Manganese MG/KG	**37/39**	109.12941	243.61263	2.23232796	32.6712966	185.58752	33.961181	64.99862	124.40146	90.440283	**5.1**	**1250**	**18.6**	**23.1**	ln(y) = 4.17436603549934 + 0.962857261946751*Z
Mecoprop ug/Kg	**2/37**										**3400**	**4300**	**2600**	**23.1**	
Mercury MG/KG	**23/51**	0.0989161	0.4478723	4.52780107	-0.0240047	0.22183682	0.0194487	0.0407656	0.0854469	0.0659981	**0.019**	**2.37**	**0.018**	**0.17**	ln(y) = -3.19991701375721 + 1.09769842294477*Z
Methyl Acetate ug/Kg	**3/23**										**4**	**5**	**12**	**0.17**	
Methyl Mercury MG/KG	**2/14**										**0.00086**	**0.00488**	**0.00049**	**0.17**	
Methyl N-Butyl Ketone ug/Kg	**2/23**										**1**	**4**	**12**	**0.17**	
Methyl tert-Butyl Ether ug/Kg	**1/23**										**3**	**3**	**12**	**0.17**	
Methylbenzene ug/Kg	**3/37**										**1**	**3**	**0.82**	**0.17**	
Naphthalene ug/Kg	**5/44**										**10.2**	**3810**	**1.5**	**0.17**	
Nickel MG/KG	**49/51**	8.0751661	6.5706448	0.8136854	6.2718205	9.87851175	3.7926116	6.2830279	10.408775	6.6161632	**0.83**	**36.3**	**11.5**	**13.5**	ln(y) = 1.83785201781838 + 0.748747098251239*Z
OCDD PG/G	**10/10**	**2390.4**	**1543.6207**	**0.64575833**	**1433.65398**	**3347.14602**	**825.5**	**2250**	**3670**	**2844.5**	**450**	**4700**			ln(y) = 7.51370573154492 + 0.980900426901322*Z
OCDF PG/G	**7/10**	125.32294	269.31384	2.14895892	-41.599512	292.245382	4.1774521	22.028465	116.1601	111.98265	**16.2**	**731**	**1.6**	**7.1**	ln(y) = 3.09233546048209 + 2.46612389142542*Z
PCB-105 NG/KG	**3/3**	**2546.6667**	**1291.1428**	**0.50699323**	**1085.60109**	**4007.73224**	**1360**	**2980**	**3300**	**1940**	**1360**	**3300**			ln(y) = 7.77219876856137 + 0.657410299331965*Z
PCB-108 NG/KG	**3/3**	**586.66667**	**473.83224**	**0.8076686**	**50.475008**	**1122.85833**	**284**	**446**	**1030**	**746**	**284**	**1030**			ln(y) = 6.22886909046832 + 0.955473595273057*Z
PCB-114 NG/KG	**3/3**	**120.96667**	**81.990923**	**0.67779765**	**28.1852034**	**213.74813**	**44.9**	**147**	**171**	**126.1**	**44.9**	**171**			ln(y) = 4.64551131267654 + 0.991728939499482*Z
PCB-118 NG/KG	**3/3**	**6996.6667**	**3764.4065**	**0.53802856**	**2736.83969**	**11256.4936**	**3430**	**7590**	**9970**	**6540**	**3430**	**9970**			ln(y) = 8.76074609116852 + 0.79133603570605*Z
PCB-126 NG/KG	**3/3**	**59.366667**	**33.328823**	**0.56140634**	**21.6515532**	**97.0817801**	**27.7**	**65.7**	**84.7**	**57**	**27.7**	**84.7**			ln(y) = 3.98188231344729 + 0.828909220039429*Z
PCB-127 NG/KG	**2/3**										**11.9**	**16.1**	**4.56**	**0**	
PCB-15 NG/KG	**3/3**	**421.53333**	**762.64837**	**1.80922434**	**-441.48453**	**1284.5512**	**32.6**	**132**	**1100**	**1067.4**	**32.6**	**1100**			ln(y) = 5.1233932232485 + 2.60961869705267*Z
PCB-156 ng/kg	**3/3**	**954.66667**	**431.99878**	**0.45251269**	**465.814029**	**1443.5193**	**552**	**992**	**1320**	**768**	**552**	**1320**			ln(y) = 6.79955272304746 + 0.646583367723267*Z
PCB-157 NG/KG	**3/3**	**222.66667**	**71.323392**	**0.32031464**	**141.95665**	**303.376683**	**165**	**213**	**290**	**125**	**165**	**290**			ln(y) = 5.37903952086351 + 0.418232373962377*Z
PCB-162 NG/KG	**3/3**	**1353.3333**	**671.70779**	**0.49633581**	**593.22441**	**2113.44226**	**880**	**1190**	**1990**	**1110**	**880**	**1990**			ln(y) = 7.15250680376545 + 0.605147696530576*Z
PCB-167 NG/KG	**3/3**	**418**	**199.85377**	**0.47811908**	**191.844165**	**644.155835**	**258**	**389**	**607**	**349**	**258**	**607**			ln(y) = 5.97502257319985 + 0.634517196526565*Z
PCB-169 NG/KG	**3/3**	**14.566667**	**8.9912044**	**0.61724515**	**4.39216109**	**24.7411722**	**7.1**	**13.6**	**23**	**15.9**	**7.1**	**23**			ln(y) = 2.56855293090614 + 0.871713412504955*Z
PCB-189 NG/KG	**3/3**	**109.46667**	**100.63603**	**0.91933039**	**-4.4137254**	**223.347059**	**37**	**86.4**	**205**	**168**	**37**	**205**			ln(y) = 4.46430518919755 + 1.26974165319852*Z
PCB-37 ng/kg	**3/3**	**204.16667**	**246.17299**	**1.20574524**	**-74.404291**	**482.737624**	**64.5**	**119**	**429**	**364.5**	**64.5**	**429**			ln(y) = 5.00241521194709 + 1.40523747905859*Z
PCB-58 NG/KG	**3/3**	**43.846667**	**44.598072**	**1.01713713**	**-6.6208033**	**94.3141366**	**4.54**	**61.2**	**65.8**	**61.26**	**4.54**	**65.8**			ln(y) = 3.27123134663427 + 1.98289520512466*Z
PCB-60 NG/KG	**3/3**	**562**	**498.58838**	**0.88716793**	**-2.2058644**	**1126.20586**	**149**	**507**	**1030**	**881**	**149**	**1030**			ln(y) = 6.05659046358678 + 1.43384672078373*Z
PCB-61/70 NG/KG	**3/3**	**2923.3333**	**2364.1536**	**0.80871844**	**248.041709**	**5598.62496**	**750**	**3040**	**4980**	**4230**	**750**	**4980**			ln(y) = 7.71762372364977 + 1.4039917369232*Z
PCB-66 NG/KG	**3/3**	**2036.6667**	**1728.0063**	**0.84844825**	**81.2435013**	**3992.08983**	**420**	**2550**	**3140**	**2720**	**420**	**3140**			ln(y) = 7.31202714277739 + 1.49195770751783*Z

Table F-31
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-77 NG/KG	**3/3**	**240**	**71.625573**	**0.29843989**	**158.948034**	**321.051966**	**178**	**269**	**273**	**95**	**178**	**273**			ln(y) = 5.46198890835963 + 0.317187135990796*Z
PCB-79 NG/KG	**3/3**	**134.86667**	**177.98479**	**1.3197093**	**-66.542088**	**336.275421**	**40**	**69.6**	**295**	**255**	**40**	**295**			ln(y) = 4.53953979259804 + 1.48185114795642*Z
PCB-81 NG/KG	**3/3**	**123.83333**	**60.675275**	**0.48997531**	**55.1727956**	**192.493871**	**67.5**	**143**	**161**	**93.5**	**67.5**	**161**			ln(y) = 4.75212553104095 + 0.644683157496521*Z
Phenanthrene ug/Kg	**14/46**	413.18141	2478.8534	5.99943112	-303.1731	1129.53591	13.012404	48.275514	179.10028	166.08788	**51.5**	**12700**	**40**	**950**	ln(y) = 3.87692448272443 + 1.94458991661089*Z
Potassium MG/KG	**34/39**	927.49351	488.74595	0.52695349	774.10002	1080.88701	**569**	**817**	**1230**	**661**	**325**	**2550**	**129**	**129**	ln(y) = 6.70735945299958 + 0.546527745890404*Z
Pyrene ug/Kg	**23/47**	4329.718	40375.903	9.32529625	-7213.5662	15873.0022	18.728306	86.72928	401.63633	382.90802	**57**	**189000**	**33**	**950**	ln(y) = 4.4627915430319 + 2.27347992872264*Z
Selenium MG/KG	**16/39**	0.4259326	0.3548686	0.83315672	0.3145567	0.53730858	0.2060414	0.3435447	0.5728118	0.3667703	**0.087**	**1.9**	**0.2**	**1.7**	ln(y) = -1.06843804366642 + 0.758303447166957*Z
Silver MG/KG	**24/51**	0.0847839	0.0525134	0.61937955	0.07037137	0.09919652	0.0416493	0.0725338	0.1263202	0.0846709	**0.013**	**0.26**	**0.07**	**1.3**	ln(y) = -2.62370257418496 + 0.822866316873133*Z
Sodium MG/KG	**39/39**	**4691.2821**	**2471.8089**	**0.52689412**	**3915.5019**	**5467.0622**	**3180**	**4290**	**4980**	**1800**	**1730**	**11500**			ln(y) = 8.34269582015205 + 0.491359343532579*Z
Thallium MG/KG	**11/39**	0.0942022	0.0524674	0.55696544	0.07773529	0.1106692	0.0556223	0.0855322	0.1315255	0.0759032	**0.055**	**0.28**	**0.045**	**3**	ln(y) = -2.45886284267738 + 0.638260321159482*Z
Total HpCDD PG/G	**10/10**	**244.2**	**126.50475**	**0.51803748**	**165.791542**	**322.608458**	**157.5**	**260**	**312.75**	**155.25**	**30**	**459**			ln(y) = 5.29686252627531 + 0.843212951707343*Z
Total HpCDF PG/G	**7/10**	82.669764	255.16044	3.08650261	-75.480316	240.819844	4.015774	16.723268	69.642292	65.626518	**14.5**	**618**	**1**	**2.3**	ln(y) = 2.81680107206731 + 2.11598032352503*Z
Total HxCDD PG/G	**9/10**	57.042765	30.461709	0.5340153	38.1624024	75.9231284	**25.75**	**64.75**	**75**	**49.25**	**16**	**102**	**2.7**	**2.7**	ln(y) = 3.88856692161516 + 0.708391505086241*Z
Total HxCDF PG/G	**5/10**	44.319765	148.07095	3.3409687	-47.455559	136.09509	0.267975	2.5166063	23.633949	23.365974	**8.62**	**357**	**1.1**	**5.8**	ln(y) = 0.922911305497614 + 3.32217286953728*Z
Total Organic Carbon MG/KG	**20/20**	**24846.33**	**17385.427**	**0.69971811**	**17226.8308**	**32465.8294**	**13218.033**	**16560.784**	**40550.456**	**27332.423**	**3450**	**66389.5871**			ln(y) = 9.87692761481173 + 0.820942367418226*Z
Total PeCDD PG/G	**5/10**	6.2276313	8.0534387	1.29317847	1.23605827	11.2192043	1.1347898	3.1006168	8.4718991	7.3371093	**2.67**	**22**	**1.8**	**4.3**	ln(y) = 1.13160105931892 + 1.49090748326828*Z
Total PeCDF PG/G	**5/10**	25.997437	85.936216	3.30556488	-27.266381	79.2612555	0.2272748	1.7797393	13.936751	13.709476	**4.31**	**208**	**1.3**	**4.7**	ln(y) = 0.576466906363647 + 3.05264836966444*Z
Total TCDD PG/G	**7/10**	6.3329389	7.2519642	1.14511829	1.83812493	10.8277529	1.443079	3.6246577	9.1042443	7.6611653	**2.3**	**22**	**0.246**	**0.96**	ln(y) = 1.28775985548905 + 1.36605708487997*Z
Total TCDF PG/G	**8/10**	47.842642	65.693463	1.37311527	7.12541212	88.5598724	2.9304013	13.843694	65.399869	62.469467	**2.7**	**190**	**0.73**	**1.6**	ln(y) = 2.62782981892803 + 2.30304871416895*Z
TPAH ug/Kg	**25/25**	**38680.344**	**264304.78**	**6.83305133**	**-64927.128**	**142287.816**	**298.3**	**1387.1**	**2044.5**	**1746.2**	**63**	**904968**			ln(y) = 7.19075053961934 + 2.04116330785043*Z
Vanadium (Fume Or Dust) MG/KG	**37/39**	10.424535	4.992813	0.47894825	8.85753504	11.9915355	**6.8**	**10.2**	**13.4**	**6.6**	**2.5**	**20.9**	**0.52**	**0.52**	ln(y) = 2.21813392141724 + 0.565086789880771*Z
Zinc MG/KG	**31/51**	29.175047	27.425769	0.94004199	21.64791	36.7021832	11.828397	20.977482	37.203246	25.374849	**10.4**	**131**	**9.9**	**90.7**	ln(y) = 3.04344958375767 + 0.849830411590 73*Z
Acid Volatile Sulfide umol/g	**14/14**	**5.865**	**9.0501668**	**1.54308044**	**1.12423272**	**10.6057673**	**1.4325**	**2.84**	**4.8025**	**3.37**	**0.3**	**27.7**			ln(y) = 1.08127352657002 + 1.2886598513916*Z
Cation Exchange Capacity meq/100g	**4/4**	**10.9625**	**6.8682101**	**0.62651859**	**4.23165411**	**17.6933459**	**5.1875**	**10.85**	**16.85**	**11.6625**	**3.45**	**18.7**			ln(y) = 2.23337657169236 + 0.934672336509771*Z
Diesel Range Organics (C10-C20) ug/Kg	**2/2**										**5300**	**6100**			
Diesel Range Organics ug/Kg	**3/4**										**2900**	**15000**	**15000**	**0**	
Field Photoionization Detector ppm	**2/2**										**0.2**	**0.3**			
pH none	**2/2**										**7**	**7.2**			
pH standard units	**4/4**	**7.5**	**0.6691165**	**0.08921553**	**6.84426585**	**8.15573415**	**7.125**	**7.3**	**8.075**	**0.95**	**7.1**	**8.3**			ln(y) = 2.01297783127049 + 0.089590797927054*Z
Percent Clay %	**20/20**	**18.982**	**10.452749**	**0.55066635**	**14.4008809**	**23.5631191**	**12.55**	**17.15**	**28.1525**	**15.6025**	**1.89**	**41.08**			ln(y) = 2.71832837724592 + 0.836442734073468*Z
Percent Sand %	**20/20**	**51.649**	**16.404117**	**0.31760764**	**44.4595787**	**58.8384213**	**42.32**	**50.72**	**54.6825**	**12.3625**	**19.26**	**92.2**			ln(y) = 3.89657802834913 + 0.346626088850603*Z
Percent Silt %	**20/20**	**29.233**	**10.921302**	**0.37359499**	**24.4465282**	**34.0194718**	**20.9025**	**29.06**	**33.5275**	**12.625**	**5.2**	**48**			ln(y) = 3.28707918479349 + 0.48596937480786*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-32
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Aluminum (Fume Or Dust) mg/L Dissolved	2/2										0.1	0.1			
Aluminum (Fume Or Dust) mg/L Total	2/2										0.24	1.1			
Antimony mg/L Total	2/2										0.0345	0.0396			
Arsenic mg/L Dissolved	2/2										0.022	0.0255			
Arsenic mg/L Total	2/2										0.0041	0.0143			
Barium mg/L Dissolved	2/2										0.0911	0.0973			
Barium mg/L Total	2/2										0.0741	0.0875			
bis(2-Ethylhexyl)phthalate ug/L	1/2										2	2	10	0	
Calcium Metal mg/L Dissolved	2/2										202	211			
Calcium Metal mg/L Total	2/2										197	200			
Copper mg/L Dissolved	2/2										0.0069	0.007			
Copper mg/L Total	2/2										0.0099	0.011			
Cyanide mg/L Total	2/2										0.0038	0.0042			
Lead mg/L Dissolved	2/2										0.007	0.0084			
Lead mg/L Total	2/2										0.0018	0.009			
Magnesium mg/L Dissolved	2/2										694	722			
Magnesium mg/L Total	2/2										642	663			
Manganese mg/L Dissolved	2/2										0.0487	0.0824			
Manganese mg/L Total	2/2										0.0608	0.0866			
Methyl tert-Butyl Ether ug/L	1/2										2	2	10	0	
Methylbenzene ug/L	1/2										1	1	10	0	
Nickel mg/L Dissolved	2/2										0.0352	0.0352			
Nickel mg/L Total	2/2										0.0352	0.0352			
Potassium mg/L Dissolved	2/2										203	213			
Potassium mg/L Total	2/2										187	196			
Sodium mg/L Dissolved	2/2										5510	5690			
Sodium mg/L Total	2/2										5880	5960			
Thallium mg/L Dissolved	2/2										0.003	0.0136			
Vanadium (Fume Or Dust) mg/L Dissolved	1/2										0.0134	0.0134	0.0134	0	
Vanadium (Fume Or Dust) mg/L Total	1/2										0.0151	0.0151	0.0134	0	
Dissolved Oxygen %	35/35	10.153689	2.5754799	0.25364968	9.30043109	11.0069465	7.66	10.15	12	4.34	6.33	15.82			ln(y) = 2.28675088947496 + 0.271185860080033*Z
Field Conductivity ms/cm	35/35	22946.563	15821.233	0.68948158	17704.9814	28188.1451	3600	31600	35200	31600	134	43700			ln(y) = 9.5183447001686 + 1.2506026054412*Z
Field pH standard units	35/35	8.0379541	0.6595878	0.08205916	7.81943235	8.25647582	7.52	8.02	8.65	1.13	6.52	9.25			ln(y) = 2.08089635190212 + 0.087624633310063*Z
Field Specific Gravity NO UNITS	27/27	13.965608	4.0580649	0.29057559	12.4348976	15.4963194	14	15	16	2	1	17			ln(y) = 2.52607361928531 + 0.443895586365174*Z
Field Temperature deg c	35/35	16.374184	4.5848429	0.28000436	14.8552231	17.8931443	12.3	14.1	21.265	8.965	10.7	23.84			ln(y) = 2.75842120376757 + 0.285233646752485*Z
Field Total Dissolved Solids mg/L	35/35	20477.857	4241.5311	0.20712768	19072.6359	21883.0784	20000	21000	22000	2000	4100	26000			ln(y) = 9.89325484651743 + 0.245760683132824*Z
Field Turbidity NTU	28/28	17.243878	19.366739	1.12310814	10.0703369	24.4174182	1.55	9.0392857	33.75	32.2	0.4	73			ln(y) = 1.93163719671543 + 1.72455915164518*Z
Salinity ppt	35/35	21.163776	4.7523864	0.22455286	19.5893077	22.7382434	20	21	24	4	3	28			ln(y) = 3.00857768481162 + 0.282159794357315*Z

Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-33
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	**21/21**	**11.931565**	**1.8421787**	**0.1543954**	**11.1436518**	**12.7194775**	**10.471429**	**11.5**	**13.285**	**2.8135714**	**9.39**	**15.82**			ln(y) = 2.46833278464157 + 0.166563393524483*Z
Field Conductivity (ms/cm)	**21/21**	**21827.891**	**14783.889**	**0.67729351**	**15504.7174**	**28151.0649**	**3550**	**31800**	**33400**	**29850**	**3300**	**35500**			ln(y) = 9.55182573853855 + 1.03390941181973*Z
Field pH (standard units)	**21/21**	**8.5036735**	**0.4163573**	**0.04896205**	**8.3255945**	**8.68175244**	**8.2135714**	**8.62**	**8.84**	**0.6264286**	**7.67**	**9.25**			ln(y) = 2.13936562643228 + 5.37390650037399E-02*Z
Field Redox Potential (millivolts)	**21/21**	**147.78912**	**44.495369**	**0.30107338**	**128.758132**	**166.820099**	**131**	**141**	**186.5**	**55.5**	**26**	**211.571429**			ln(y) = 4.92906295713528 + 0.399427371429162*Z
Field Specific Gravity (NO UNITS)	**21/21**	**15.408163**	**0.8113206**	**0.05265525**	**15.0611557**	**15.7551708**	**15**	**15**	**16**	**1**	**14**	**17**			ln(y) = 2.73361968690369 + 5.40781999795258E-02*Z
Field Temperature (deg c)	**21/21**	**13.279592**	**2.0487643**	**0.15427916**	**12.4033209**	**14.1558628**	**12**	**13.1**	**13.85**	**1.85**	**10.7**	**18**			ln(y) = 2.57596341460339 + 0.156103345495851*Z
Field Total Dissolved Solids (mg/L)	**21/21**	**20571.429**	**933.38124**	**0.0453727**	**20172.2148**	**20970.6423**	**20000**	**20000**	**21000**	**1000**	**19000**	**22000**			ln(y) = 9.93069684374845 + 4.73169746381846E-02*Z
Field Turbidity (NTU)	**18/21**	24.026495	22.572421	0.93948039	14.3721112	33.6808791	5.2130404	13.24879	33.671412	28.458371	**1**	**73**	**4**	**10**	ln(y) = 2.58390621132456 + 1.38350337074123*Z
Salinity (ppt)	**21/21**	**20.993197**	**1.0990544**	**0.05235288**	**20.5231239**	**21.4632706**	**20**	**21**	**22**	**2**	**19**	**23**			ln(y) = 3.04292312085779 + 5.55032004618401E-02*Z

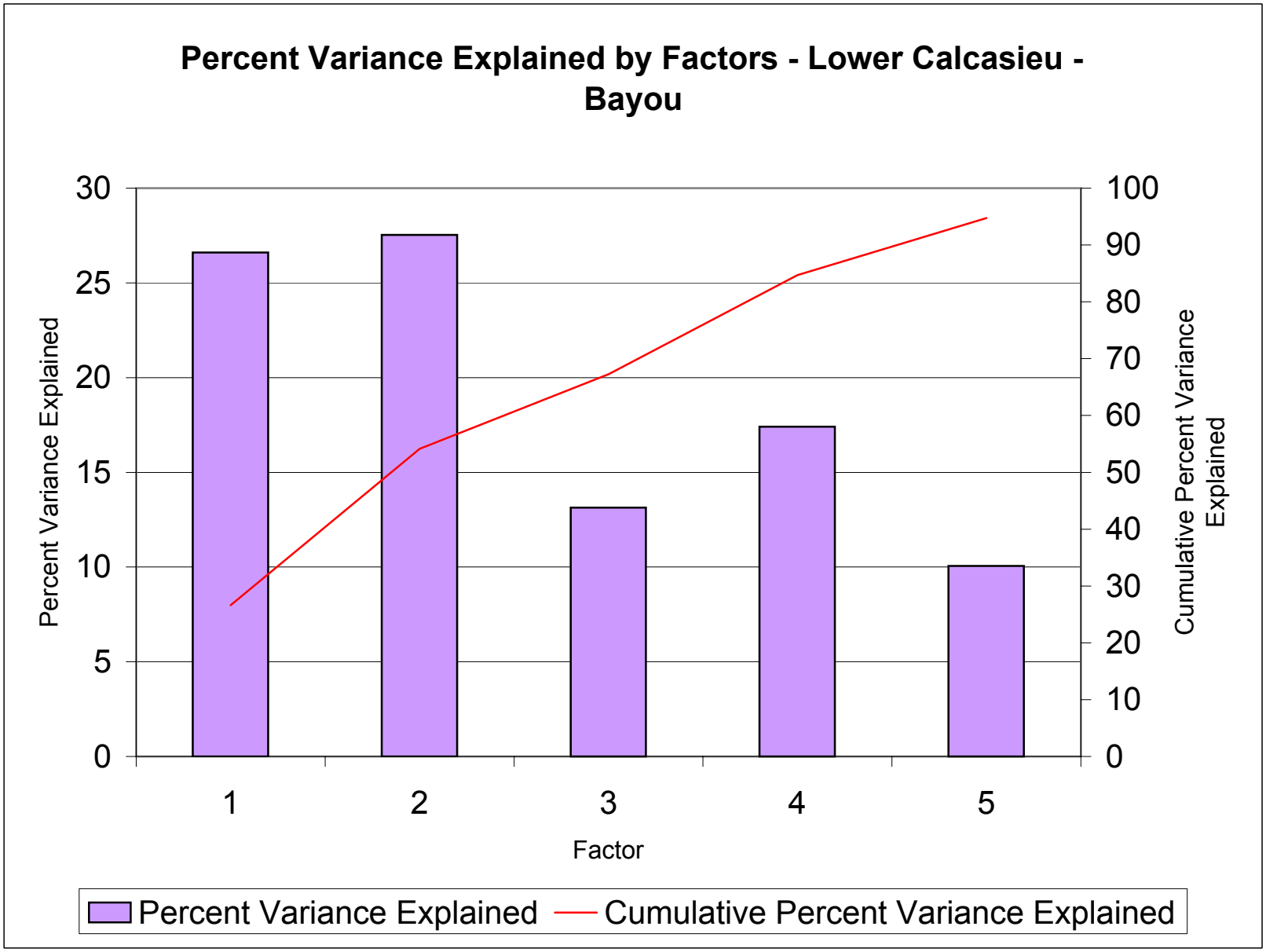
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table F-34
Upper Calcasieu - Ship Channel Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Mean		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen (%)	**23/23**	**8.017663**	**1.1530661**	**0.14381574**	**7.54641846**	**8.48890763**	**7.205**	**7.66**	**8.62**	**1.415**	**6.33**	**11.255**			ln(y) = 2.07284538723525 + 0.144776835943421*Z
Field Conductivity (ms/cm)	**23/23**	**16518.913**	**18214.296**	**1.10263284**	**9074.94423**	**23962.8819**	**641**	**3750**	**40050**	**39409**	**134**	**43700**			ln(y) = 8.51799962426938 + 2.00925387427027*Z
Field pH (standard units)	**23/23**	**7.0509239**	**0.5640394**	**0.0799951**	**6.82040765**	**7.28144017**	**6.4**	**7.15**	**7.52**	**1.12**	**6.29**	**7.9**			ln(y) = 1.95007954440585 + 8.53580927365784E-02*Z
Field Redox Potential (millivolts)	**22/23**	182.28973	89.953064	0.49346204	145.526973	219.052494	**125**	**142.5**	**278**	**153**	**64**	**337**	**3**	**3**	ln(y) = 5.09074642329091 + 0.538374271202646*Z
Field Specific Gravity (NO UNITS)	**15/15**	**5.8666667**	**5.250846**	**0.89503058**	**3.20937193**	**8.5239614**	**2**	**4**	**12**	**10**	**1**	**16**			ln(y) = 1.40115431984536 + 0.977837455271907*Z
Field Temperature (deg c)	**23/23**	**17.429783**	**5.219345**	**0.29944981**	**15.2966976**	**19.5628676**	**12**	**19.41**	**21.85**	**9.85**	**10.3**	**23.84**			ln(y) = 2.81157541081047 + 0.329400063820943*Z
Field Total Dissolved Solids (mg/L)	**23/23**	**14794.565**	**9098.8334**	**0.61501188**	**11075.9789**	**18513.1515**	**4100**	**17000**	**24500**	**20400**	**3000**	**26000**			ln(y) = 9.34851690839105 + 0.815021199398562*Z
Field Turbidity (NTU)	**16/22**	1.6878545	2.0922113	1.2395685	0.81357505	2.56213395	0.4245901	0.9541656	2.1442609	1.7196708	**0.2**	**8.65**	**0.4**	**3.5**	ln(y) = -4.69180464817353E-02 + 1.20101754480216*Z
Salinity (ppt)	**23/23**	**15.211957**	**10.175451**	**0.6689114**	**11.0533692**	**19.3705439**	**3**	**18**	**26**	**23**	**3**	**28**			ln(y) = 2.39540360184939 + 0.934165411629314*Z

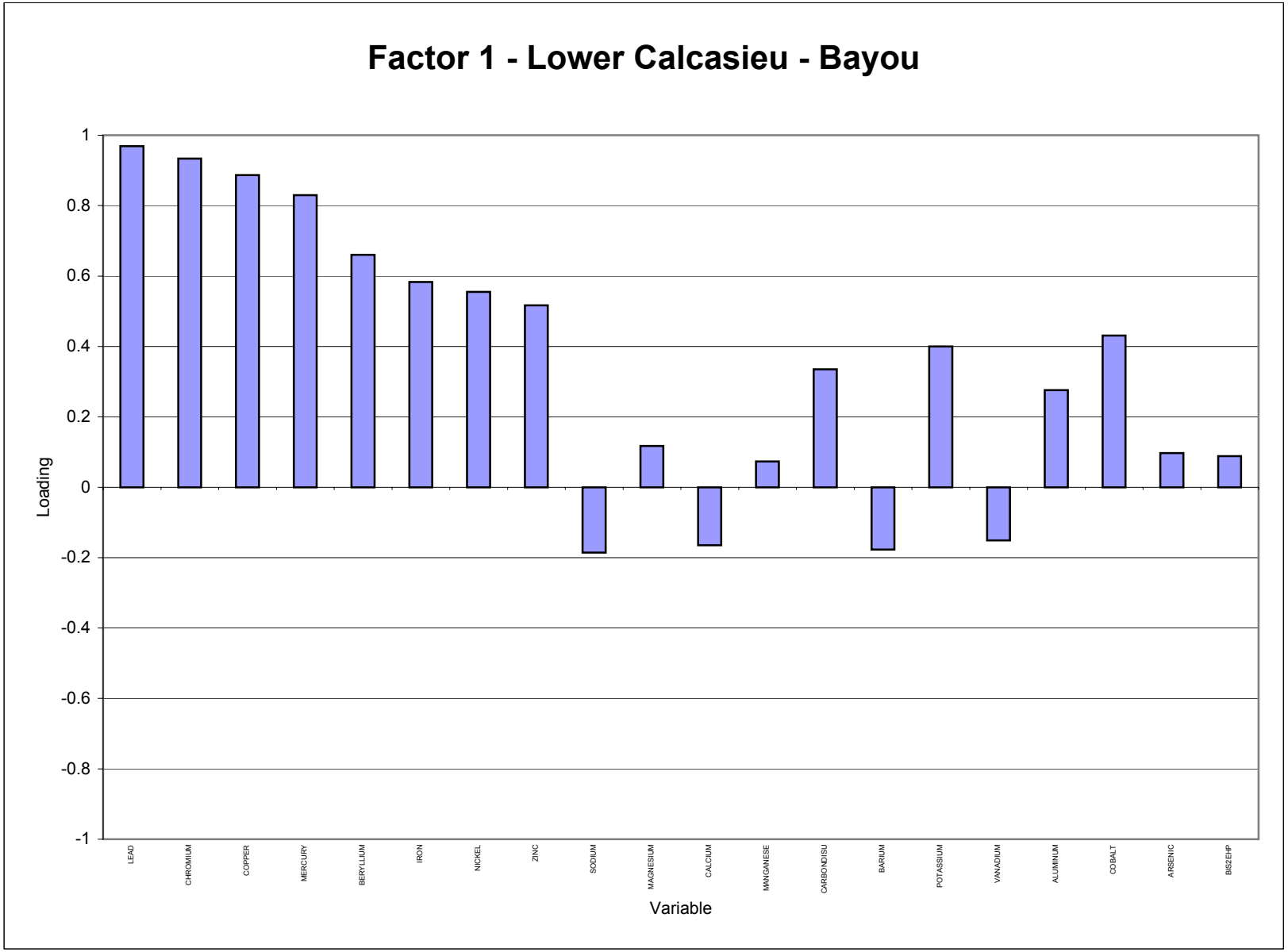
Note:
Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-1
Principal Components Analysis Results



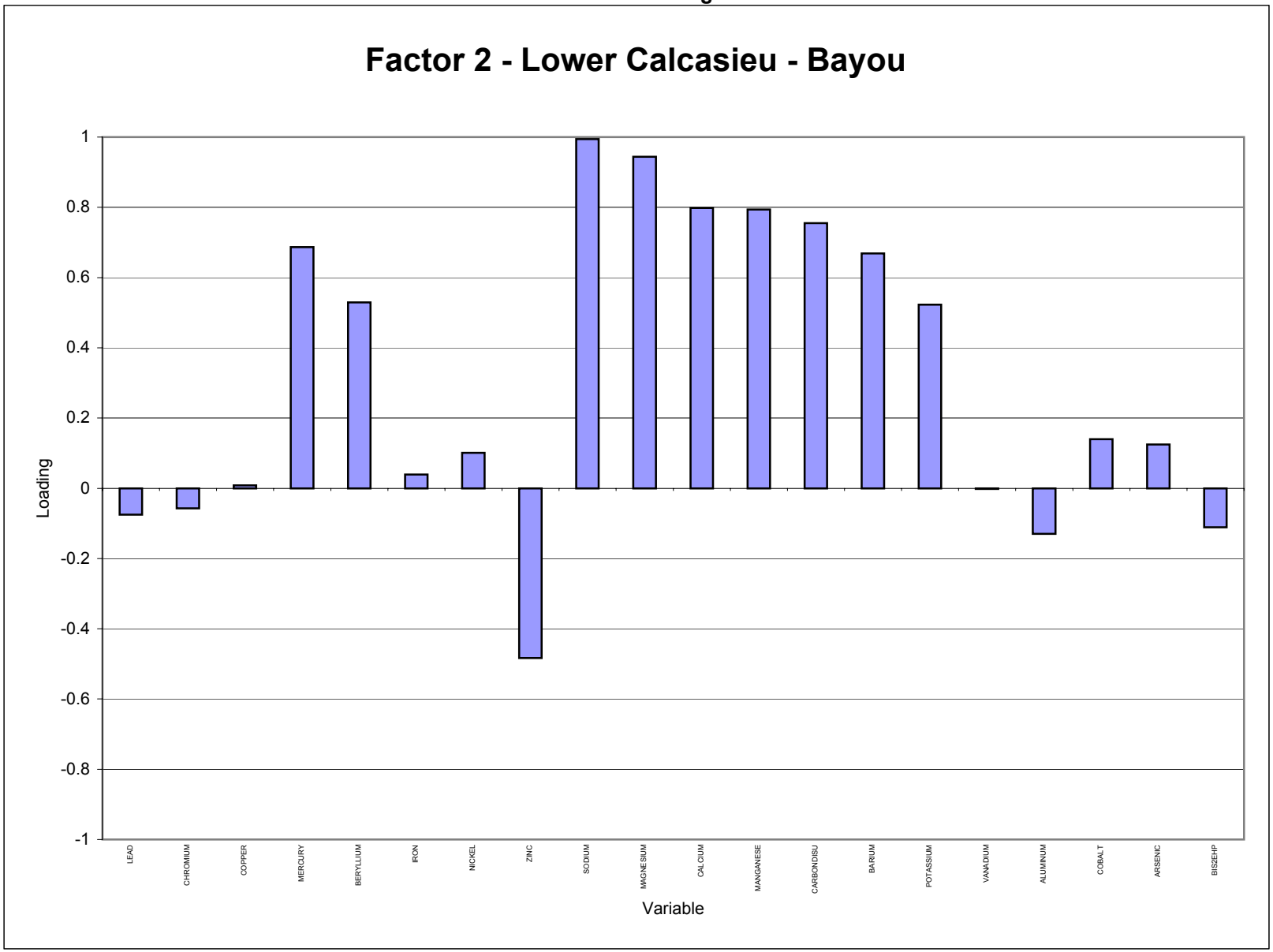
CDM

Table G-2
Lower Calcasieu-Bayou
Factor Loadings



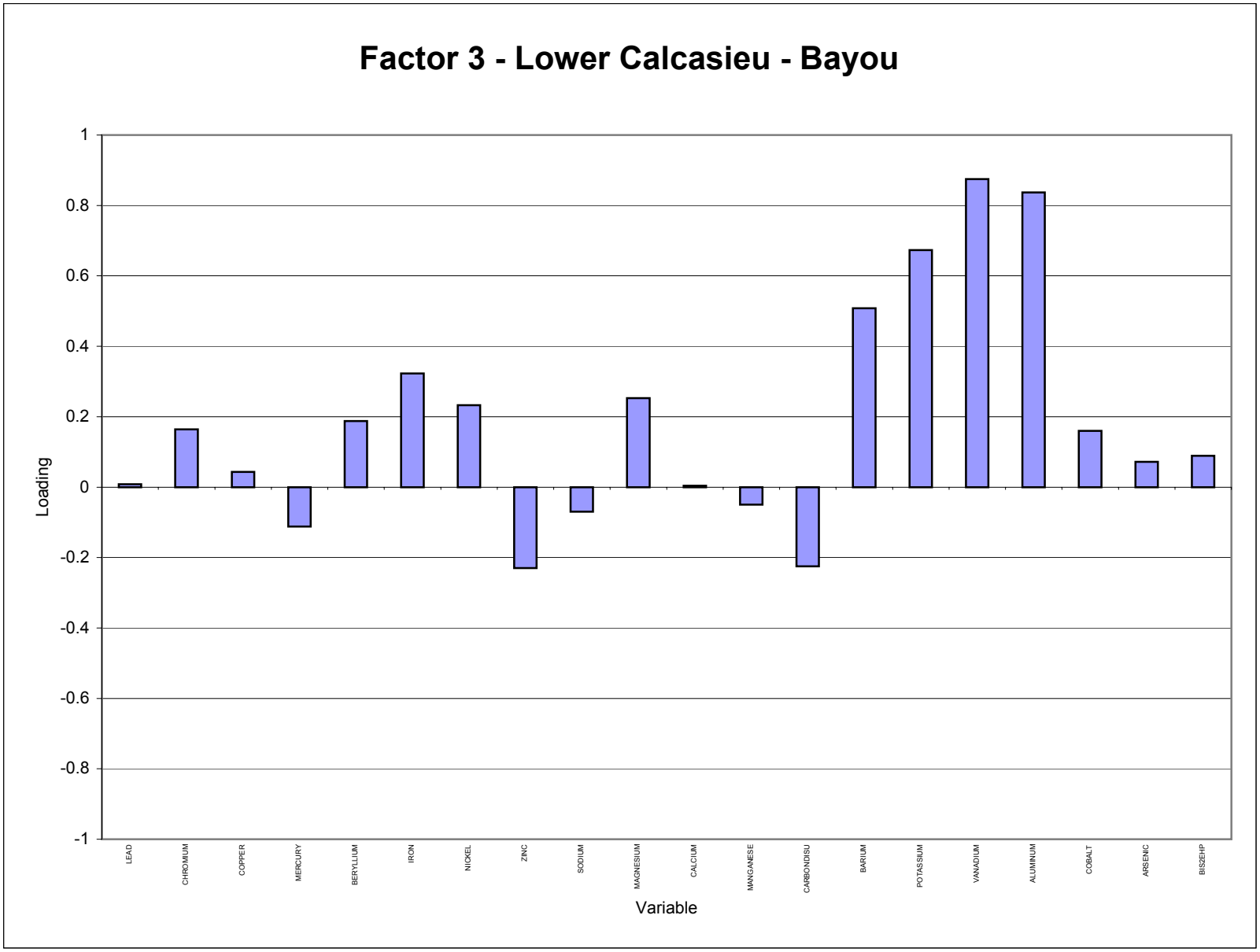
CDM

Table G-2
Lower Calcasieu-Bayou
Factor Loadings



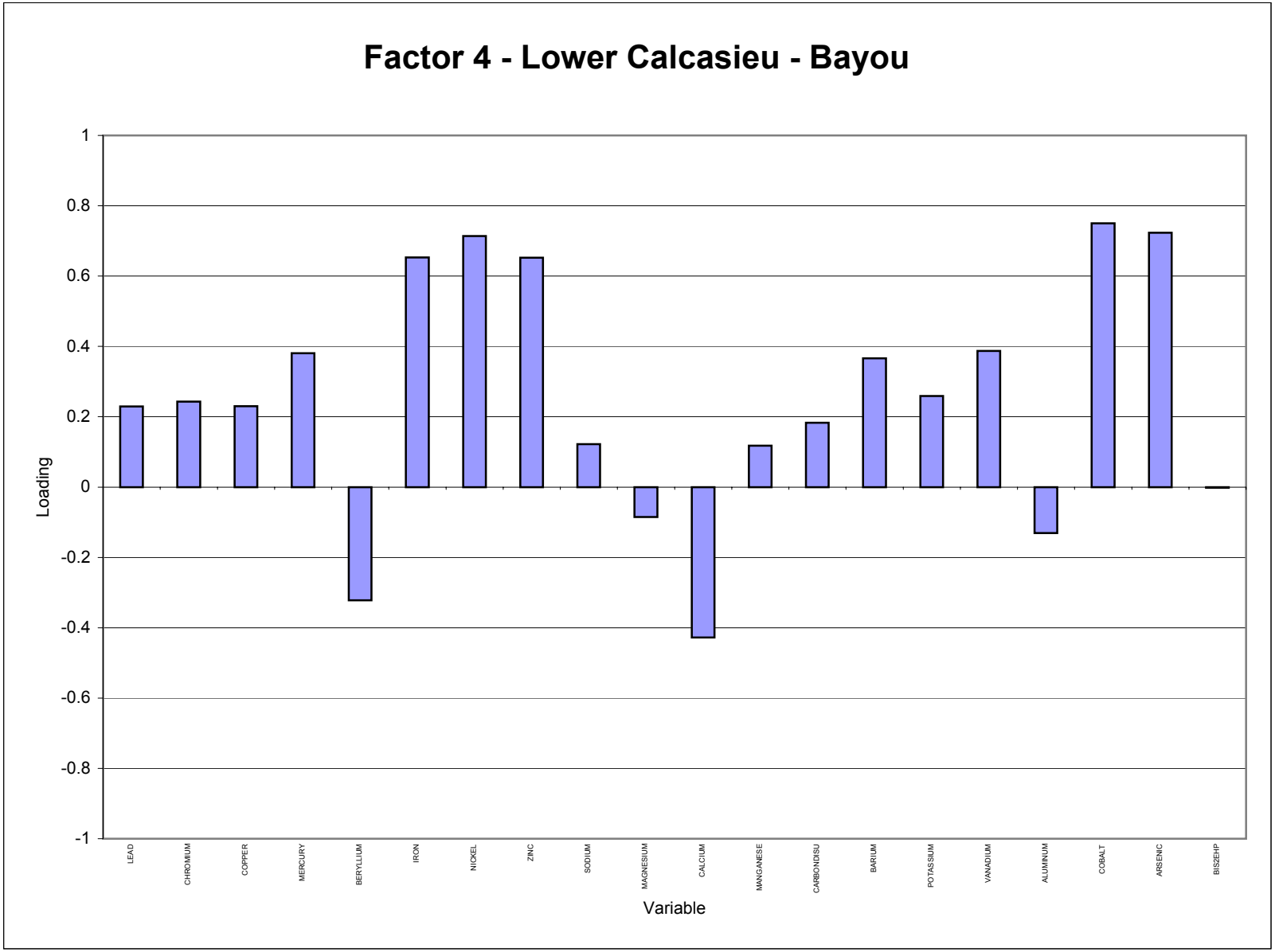
CDM

Table G-2
Lower Calcasieu-Bayou
Factor Loadings



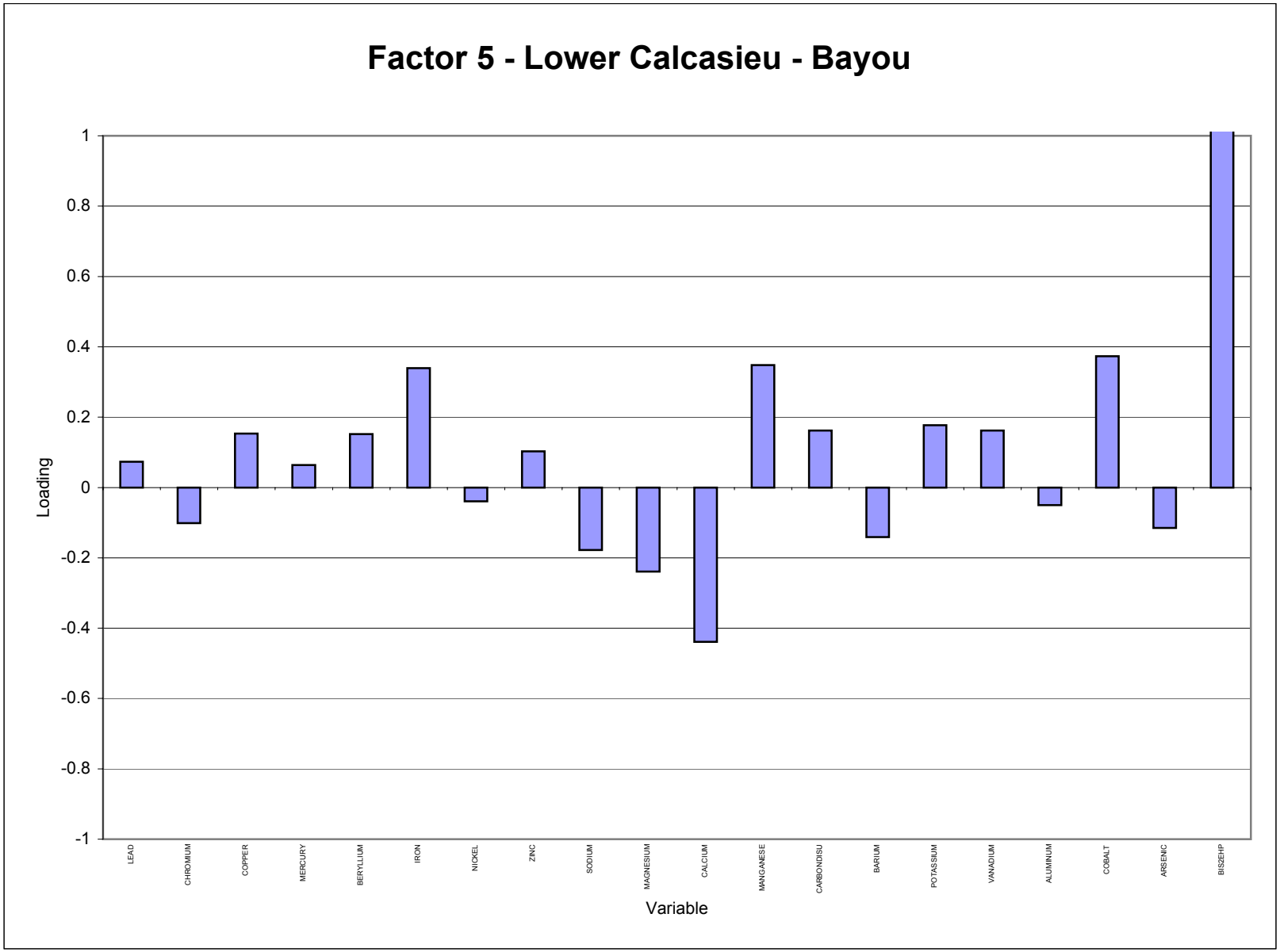
CDM

Table G-2
Lower Calcasieu-Bayou
Factor Loadings



CDM

Table G-2
Lower Calcasieu-Bayou
Factor Loadings



CDM

Table G-3
Lower Calcasieu - Bayou Energy System
Principal Component Analysis

Variable	Sum Ranking
ZINC	0.350
NICKEL	0.334
LEAD	0.327
MERCURY	0.322
COPPER	0.299
BERYLLIUM	0.295
POTASSIUM	0.284
CALCIUM	0.270
BARIUM	0.265
SODIUM	0.262
MAGNESIUM	0.256
IRON	0.251
COBALT	0.242
CHROMIUM	0.239
MANGANESE	0.212
ALUMINUM	0.174
VANADIUM	0.169
ARSENIC	0.146
BIS2EHP	0.113
CARBONDISU	0.110

Table G-4
Calcasieu Estuary Lower Calcasieu AOC - Bayou Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2-Benzphenanthracene ug/Kg	**1/13**										**220**	**220**	**750**	**0**	
2-Butanone ug/Kg	**8/12**	5.3276855	2.5114932	0.471404186	3.906674	6.748697	3.54515	4.98306	7.00418	3.45903	**3**	**11**	**26**	**38**	ln(y) = 1.60604343696455 + 0.50499693734678*Z
4,4'-DDT ug/Kg	**1/17**										**1.3**	**1.3**	**9.7**	**38**	
Acetone ug/Kg	**2/12**										**40**	**75**	**26**	**38**	
alpha-BHC ug/Kg	**3/17**										**0.68**	**0.96**	**5**	**38**	
alpha-Chlordane ug/Kg	**2/17**										**0.74**	**2.3**	**4.5**	**38**	
Aluminum (Fume Or Dust) MG/KG	**12/12**	**10367.5**	**3281.0613**	**0.316475653**	**8511.065**	**12223.94**	**8470**	**9600**	**12375**	**3905**	**5960**	**17500**			ln(y) = 9.20637928055096 + 0.340770380280755*Z
Arsenic MG/KG	**12/12**	**3.6083333**	**1.0628377**	**0.29455085**	**3.006976**	**4.20969**	**2.75**	**3.85**	**4.15**	**1.4**	**1.6**	**5.2**			ln(y) = 1.23811806716155 + 0.368516712051878*Z
Barium MG/KG	**12/12**	**51.375**	**20.642212**	**0.401794887**	**39.69557**	**63.05443**	**35.675**	**45.45**	**62.825**	**27.15**	**26.5**	**88.5**			ln(y) = 3.87188727789243 + 0.438210278654935*Z
Benzo(a)anthracene ug/Kg	**1/13**										**141**	**141**	**750**	**0**	
Benzo(a)pyrene ug/Kg	**1/13**										**149**	**149**	**750**	**0**	
Benzo(b)fluoranthene ug/Kg	**2/14**										**50.5**	**207**	**750**	**0**	
Benzo(g,h,i)perylene ug/Kg	**1/13**										**102**	**102**	**750**	**0**	
Beryllium MG/KG	**12/12**	**1.1125**	**0.2108538**	**0.189531516**	**0.993198**	**1.231802**	**0.925**	**1.1**	**1.275**	**0.35**	**0.76**	**1.5**			ln(y) = 9.03696760357077E-02 + 0.219982061628512*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**10/17**	277.00285	373.42014	1.348073289	99.49018	454.5155	94.6757	187.136	369.892	275.216	**68**	**1400**	**120**	**1700**	ln(y) = 5.23183433980765 + 1.01066152924183*Z
Cadmium MG/KG	**5/17**	0.1474566	0.0384132	0.260504842	0.129196	0.165717	0.10274	0.14411	0.20213	0.09939	**0.074**	**0.2**	**0.52**	**1.1**	ln(y) = -1.93720739509843 + 0.501851935000372*Z
Calcium Metal MG/KG	**12/12**	**3138.3333**	**929.75231**	**0.296256712**	**2612.276**	**3664.39**	**2352.5**	**3000**	**3937.5**	**1585**	**1820**	**4770**			ln(y) = 8.0119557837171 + 0.345646901534555*Z
Carbon Disulfide ug/Kg	**5/12**	4.8369481	1.3882942	0.28701863	4.051447	5.622449	3.35064	4.68952	6.56341	3.21277	**3**	**7**	**26**	**50**	ln(y) = 1.54533073296953 + 0.498643019882814*Z
Chromium MG/KG	**12/12**	**16.883333**	**9.3981101**	**0.556650152**	**11.56585**	**22.20081**	**10.325**	**13.65**	**23.275**	**12.95**	**8**	**35.3**			ln(y) = 2.70925066442257 + 0.55893124789793*Z
Cobalt MG/KG	**12/12**	**4.8833333**	**2.3420122**	**0.479592938**	**3.558215**	**6.208451**	**2.225**	**5**	**7.175**	**4.95**	**2**	**8.2**			ln(y) = 1.46286410115145 + 0.609373334143626*Z
Copper MG/KG	**17/17**	**19.247059**	**12.533385**	**0.651184418**	**13.28907**	**25.20505**	**11.9**	**15.7**	**18.6**	**6.7**	**8.7**	**51.6**			ln(y) = 2.8268777761343 + 0.523138440807886*Z
Cyanide MG/KG	**1/12**										**0.33**	**0.33**	**0.13**	**0**	
Dichloromethane ug/Kg	**1/12**										**110**	**110**	**26**	**0**	
Dieldrin ug/Kg	**1/17**										**0.87**	**0.87**	**9.7**	**0**	
Endosulfan I ug/Kg	**1/17**										**1.4**	**1.4**	**5**	**0**	
Endrin Aldehyde ug/Kg	**1/17**										**1.1**	**1.1**	**8.7**	**0**	
Endrin ug/Kg	**1/17**										**1.5**	**1.5**	**8.7**	**0**	
Fluoranthene ug/Kg	**3/15**	104.03549	64.236272	0.617445762	71.52745	136.5435	34.647	90.618	237.008	202.361	**36.4**	**249**	**750**	**1700**	ln(y) = 4.5066532291886 + 1.4260717116405*Z
gamma-BHC (Lindane) ug/Kg	**4/17**	3.4206216	0.8445734	0.246906414	3.019137	3.822106	2.56636	3.34246	4.35326	1.7869	**1.9**	**5.1**	**5**	**40**	ln(y) = 1.20670617990565 + 0.391904638423224*Z
Heptachlor ug/Kg	**1/17**										**1.5**	**1.5**	**5**	**40**	
HPAH ug/Kg	**3/3**	**545.7**	**917.37046**	**1.681089359**	**-492.402**	**1583.802**	**73**	**200.1**	**1364**	**1291**	**73**	**1364**			ln(y) = 5.60248450704716 + 2.17128786520272*Z
Iron MG/KG	**12/12**	**9577.5**	**4662.0867**	**0.486774907**	**6939.676**	**12215.32**	**5352.5**	**8725**	**13800**	**8447.5**	**3470**	**17500**			ln(y) = 9.04479575538114 + 0.620174830667707*Z
Lead MG/KG	**17/17**	**21.852941**	**9.1466861**	**0.418556294**	**17.50488**	**26.201**	**15.15**	**21.5**	**24.65**	**9.5**	**9**	**41.8**			ln(y) = 3.00719607359882 + 0.454548021129737*Z
LPAH ug/Kg	**2/2**										**141.8**	**245**			
Magnesium MG/KG	**12/12**	**5407.5**	**1093.4507**	**0.202210029**	**4788.822**	**6026.178**	**4842.5**	**5610**	**6077.5**	**1235**	**3360**	**7220**			ln(y) = 8.57574777686142 + 0.240138920364626*Z
Manganese MG/KG	**12/12**	**184.75833**	**189.8492**	**1.027554175**	**77.34104**	**292.1756**	**91.2**	**155**	**216**	**124.8**	**67.9**	**659**			ln(y) = 5.00239467687494 + 0.706611279678893*Z
Mercury MG/KG	**7/17**	0.1381452	0.1137987	0.823761255	0.084049	0.192242	0.07142	0.11379	0.1813	0.10988	**0.0749**	**0.43**	**0.12**	**0.28**	ln(y) = -2.17337259091152 + 0.690896092869681*Z
Methyl Mercury MG/KG	**1/5**										**0.00242**	**0.00242**	**0.00085**	**0.28**	
Methylbenzene ug/Kg	**4/12**										**2**	**5**	**26**	**0.28**	
Naphthalene ug/Kg	**1/13**										**65**	**65**	**750**	**0.28**	
Nickel MG/KG	**17/17**	**12.905882**	**4.8678612**	**0.37718159**	**10.59185**	**15.21992**	**7.9**	**12.1**	**18.1**	**10.2**	**6.4**	**20.8**			ln(y) = 2.48601437535944 + 0.443130534312506*Z
Phenanthrene ug/Kg	**2/14**										**76.8**	**245**	**750**	**0**	
Potassium MG/KG	**12/12**	**2443.3333**	**417.69728**	**0.170953866**	**2206.999**	**2679.668**	**2137.5**	**2530**	**2697.5**	**560**	**1690**	**3110**			ln(y) = 7.78715847634345 + 0.199635546721157*Z
Pyrene ug/Kg	**3/15**	107.06731	66.266465	0.618923438	73.53185	140.6028	31.6801	90.0932	256.211	224.531	**36.6**	**296**	**750**	**1700**	ln(y) = 4.50084509753662 + 1.55024094112702*Z
Selenium MG/KG	**1/12**										**3**	**3**	**1.5**	**1700**	

Table G-4
Calcasieu Estuary Lower Calcasieu AOC - Bayou Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Silver MG/KG	**5/17**	0.1765008	0.0438172	0.248254982	0.155671	0.19733	0.13137	0.17375	0.22979	0.09842	**0.13**	**0.29**	**0.52**	**1.2**	ln(y) = -1.7501531876442 + 0.414666563135455*Z
Sodium MG/KG	**12/12**	**18325**	**5420.3347**	**0.295789067**	**15258.16**	**21391.84**	**13900**	**17650**	**23375**	**9475**	**11000**	**28500**			ln(y) = 9.77790086277789 + 0.335054498861504*Z
Total Organic Carbon MG/KG	**5/5**	**86417.917**	**50520.458**	**0.584606299**	**42134.78**	**130701.1**	**48197.6**	**68229.4**	**133732**	**85534.9**	**47441.27**	**157826.668**			ln(y) = 11.2541417536733 + 0.673416446826706*Z
TPAH ug/Kg	**3/3**	**674.63333**	**1012.6822**	**1.501085403**	**-471.325**	**1820.591**	**73**	**341.9**	**1609**	**1536**	**73**	**1609**			ln(y) = 5.83611529492868 + 2.29379896689323*Z
Total PCB ug/Kg	**17/17**	**420.23529**	**216.16033**	**0.514379296**	**317.4792**	**522.9914**	**245.5**	**440**	**542.5**	**297**	**108.5**	**875**			ln(y) = 5.87074457368276 + 0.697474102990804*Z
Vanadium (Fume Or Dust) MG/KG	**12/12**	**20.291667**	**3.6687901**	**0.180802797**	**18.21585**	**22.36748**	**17.475**	**18.85**	**23.35**	**5.875**	**15.3**	**27.2**			ln(y) = 2.99622039544334 + 0.200561488001607*Z
Zinc MG/KG	**8/17**	43.258891	20.702468	0.478571403	33.41756	53.10022	27.6154	38.9585	54.9608	27.3453	**29.1**	**84.2**	**15.7**	**97.2**	ln(y) = 3.66249737029393 + 0.510424043546355*Z
Acid Volatile Sulfide umol/g	**5/5**	**3.582**	**4.6427309**	**1.2961281**	**-0.48753**	**7.651533**	**1.105**	**1.84**	**6.93**	**5.825**	**0.92**	**10.2**			ln(y) = 0.880175409751785 + 1.23823032447353*Z
Field Photoionization Detector ppm	**1/1**										**2**	**2**			
Percent Clay %	**5/5**	**18.742**	**5.5338613**	**0.295265248**	**13.89136**	**23.59264**	**14.12**	**20.25**	**22.61**	**8.49**	**10.82**	**23.85**			ln(y) = 2.89618846501213 + 0.380273989317869*Z
Percent Sand %	**5/5**	**49.51**	**10.163005**	**0.205271753**	**40.60173**	**58.41827**	**44.495**	**46.34**	**56.11**	**11.615**	**43.38**	**63.77**			ln(y) = 3.8923892427581 + 0.177842231067757*Z
Percent Silt %	**5/5**	**31.75**	**5.4651264**	**0.172129966**	**26.95961**	**36.54039**	**27.615**	**31.3**	**36.11**	**8.495**	**25.42**	**39.2**			ln(y) = 3.44795769125716 + 0.206527051824047*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-5
Calcasieu Estuary Lower Calcasieu AOC - Bayou Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen %	**12/12**	**8.7416667**	**1.7321527**	**0.198149021**	**7.761609**	**9.721724**	**7.23**	**8.62**	**10.4775**	**3.2475**	**6.29**	**11.52**			ln(y) = 2.15061868343075 + 0.227858467817697*Z
Field Conductivity ms/cm	**12/12**	**19550**	**19498.185**	**0.997349635**	**8517.863**	**30582.14**	**3800**	**3900**	**41500**	**37700**	**3500**	**42100**			ln(y) = 9.23949709563238 + 1.21701536330227*Z
Field pH standard units	**12/12**	**7.8666667**	**0.4857054**	**0.061742217**	**7.591853**	**8.14148**	**7.61**	**7.825**	**8.185**	**0.575**	**7**	**8.61**			ln(y) = 2.06094807906895 + 7.05925054324694E-02*Z
Field Redox Potential millivolts	**10/12**	116.73996	82.599779	0.707553611	70.00473	163.4752	32.5436	75.0016	172.852	140.309	**3**	**218**	**39**	**140**	ln(y) = 4.31750960868654 + 1.23841751882013*Z
Field Specific Gravity NO UNITS	**12/12**	**20.25**	**16.865616**	**0.832869932**	**10.70738**	**29.79262**	**16**	**17.5**	**18**	**2**	**11**	**60**			ln(y) = 2.91069095661109 + 0.341578083449137*Z
Field Temperature deg c	**12/12**	**23.025**	**1.5624371**	**0.067858287**	**22.14097**	**23.90903**	**22.1**	**23.4**	**24.25**	**2.15**	**20**	**24.6**			ln(y) = 3.13448306773964 + 7.53556051534088E-02*Z
Field Total Dissolved Solids mg/L	**12/12**	**23833.333**	**2357.6727**	**0.098923328**	**22499.35**	**25167.31**	**23000**	**24000**	**25000**	**2000**	**18000**	**26000**			ln(y) = 10.0747416495967 + 9.64657497391693E-02*Z
Field Turbidity NTU	**9/12**	42.522015	60.237031	1.416608127	8.439706	76.60432	6.09447	18.7431	57.6432	51.5487	**4.4**	**191**	**1.8**	**10**	ln(y) = 2.93082700650131 + 1.66636493635003*Z
Salinity ppt	**12/12**	**25**	**2.4201261**	**0.096805042**	**23.63068**	**26.36932**	**24.25**	**25**	**26.75**	**2.5**	**19**	**27**			ln(y) = 3.21497946778259 + 9.32467159452839E-02*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

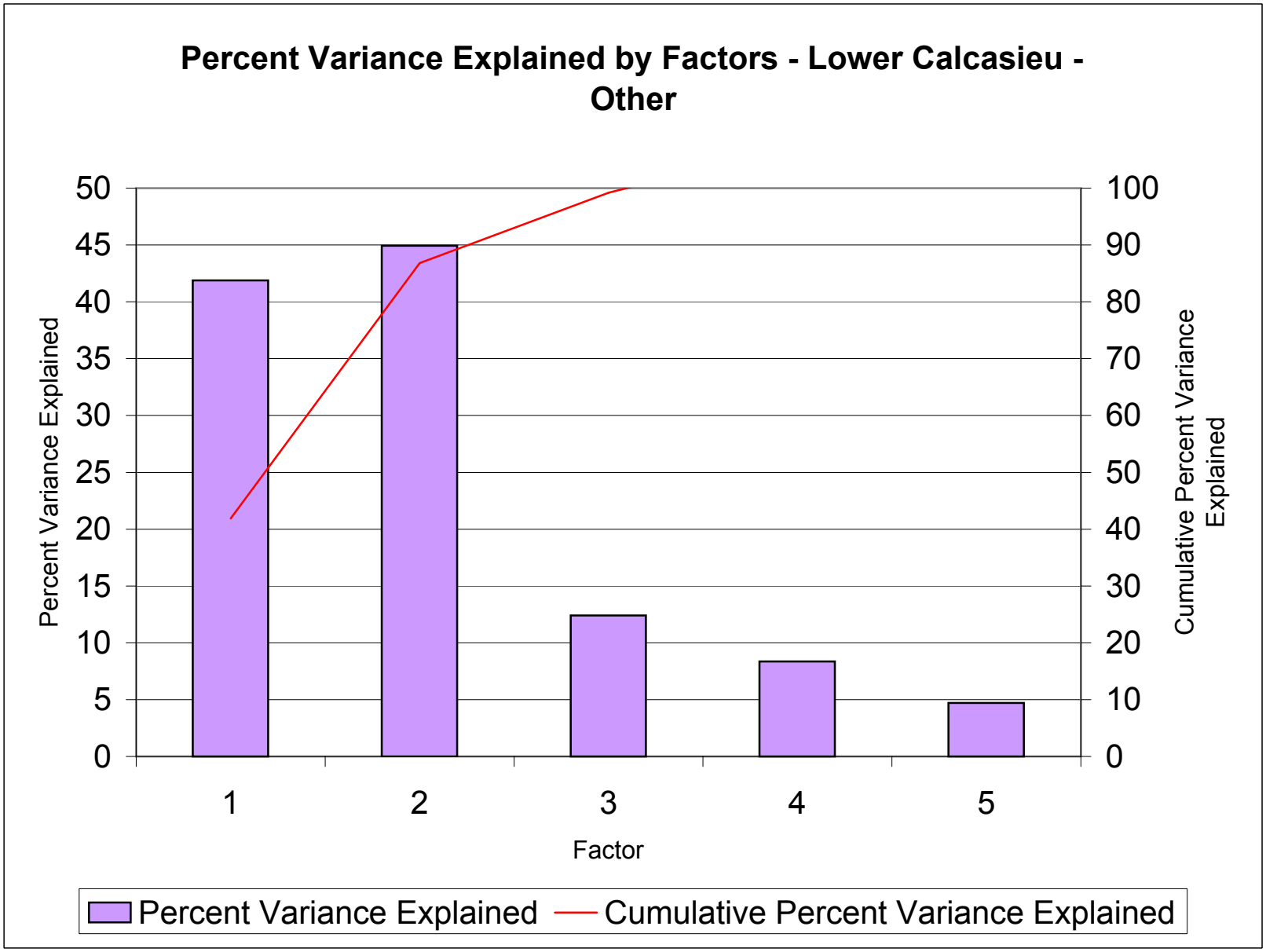
Table G-6
Calcasieu Estuary Lower Calcasieu AOC - Bayou Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen %	**5/5**	**10.152**	**1.7214026**	**0.169562903**	**8.643124**	**11.66088**	**8.6175**	**10.09**	**11.7175**	**3.1**	**7.89**	**11.995**			ln(y) = 2.30671765847483 + 0.21957392275074*Z
Field Conductivity ms/cm	**5/5**	**3733.8**	**6469.144**	**1.732589853**	**-1936.65**	**9404.255**	**880.5**	**898**	**8005**	**7124.5**	**869**	**12750**			ln(y) = 7.58074967021899 + 1.407720738193*Z
Field pH standard units	**5/5**	**7.528**	**0.3466556**	**0.046048826**	**7.224143**	**7.831857**	**7.23**	**7.63**	**7.775**	**0.545**	**7.03**	**7.82**			ln(y) = 2.01791876540103 + 5.35506240954938E-02*Z
Field Redox Potential millivolts	**5/5**	**163.3**	**97.615161**	**0.597765836**	**77.73654**	**248.8635**	**79.5**	**176**	**240.75**	**161.25**	**46**	**291**			ln(y) = 4.92989773439557 + 0.896211635868085*Z
Field Specific Gravity NO UNITS	**4/4**	**3.375**	**1.3678663**	**0.405293727**	**2.034491**	**4.715509**	**2.625**	**3**	**4.5**	**1.875**	**2.5**	**5**			ln(y) = 1.18073830541112 + 0.377742702165067*Z
Field Temperature deg c	**5/5**	**16.801**	**1.5674683**	**0.093296132**	**15.42705**	**18.17495**	**15.6275**	**16.7**	**18.025**	**2.3975**	**14.555**	**18.05**			ln(y) = 2.81845389174361 + 0.107250498953142*Z
Field Total Dissolved Solids mg/L	**5/5**	**8920**	**8043.4523**	**0.90173232**	**1869.603**	**15970.4**	**5500**	**5600**	**14000**	**8500**	**5500**	**20000**			ln(y) = 8.94924259847249 + 0.628969861856919*Z
Field Turbidity NTU	**5/5**	**12.84**	**7.5559262**	**0.588467775**	**6.216939**	**19.46306**	**5.85**	**11.9**	**20.3**	**14.45**	**3.9**	**20.9**			ln(y) = 2.38240129633267 + 0.902207732602236*Z
Salinity ppt	**5/5**	**8.4**	**8.5626557**	**1.019363775**	**0.894501**	**15.9055**	**5**	**5**	**13.5**	**8.5**	**5**	**20**			ln(y) = 1.95399123198232 + 0.66275985829656*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

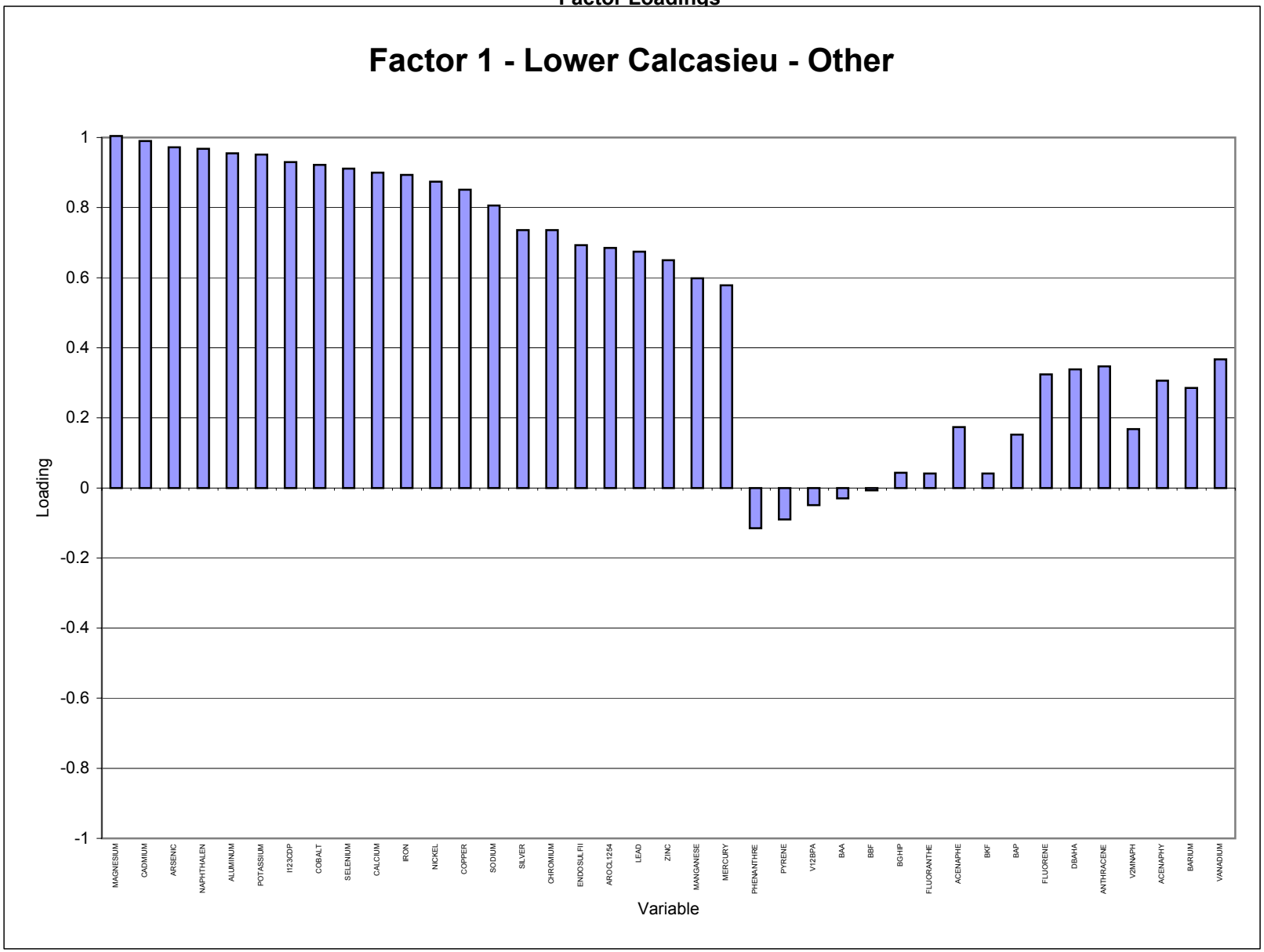
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-7
Principal Components Analysis Results



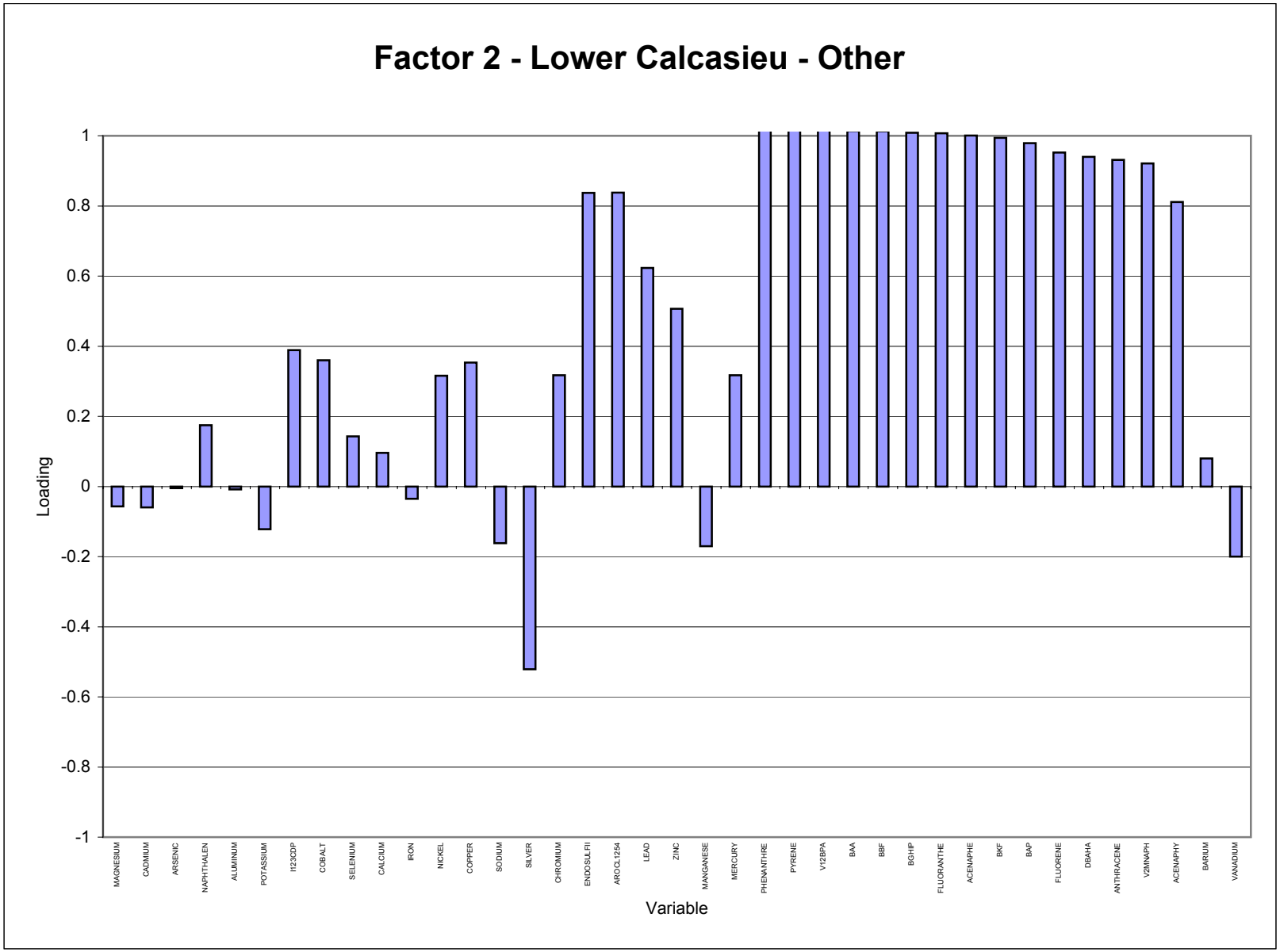
CDM

Table G-8
Lower Calcasieu-Other
Factor Loadings



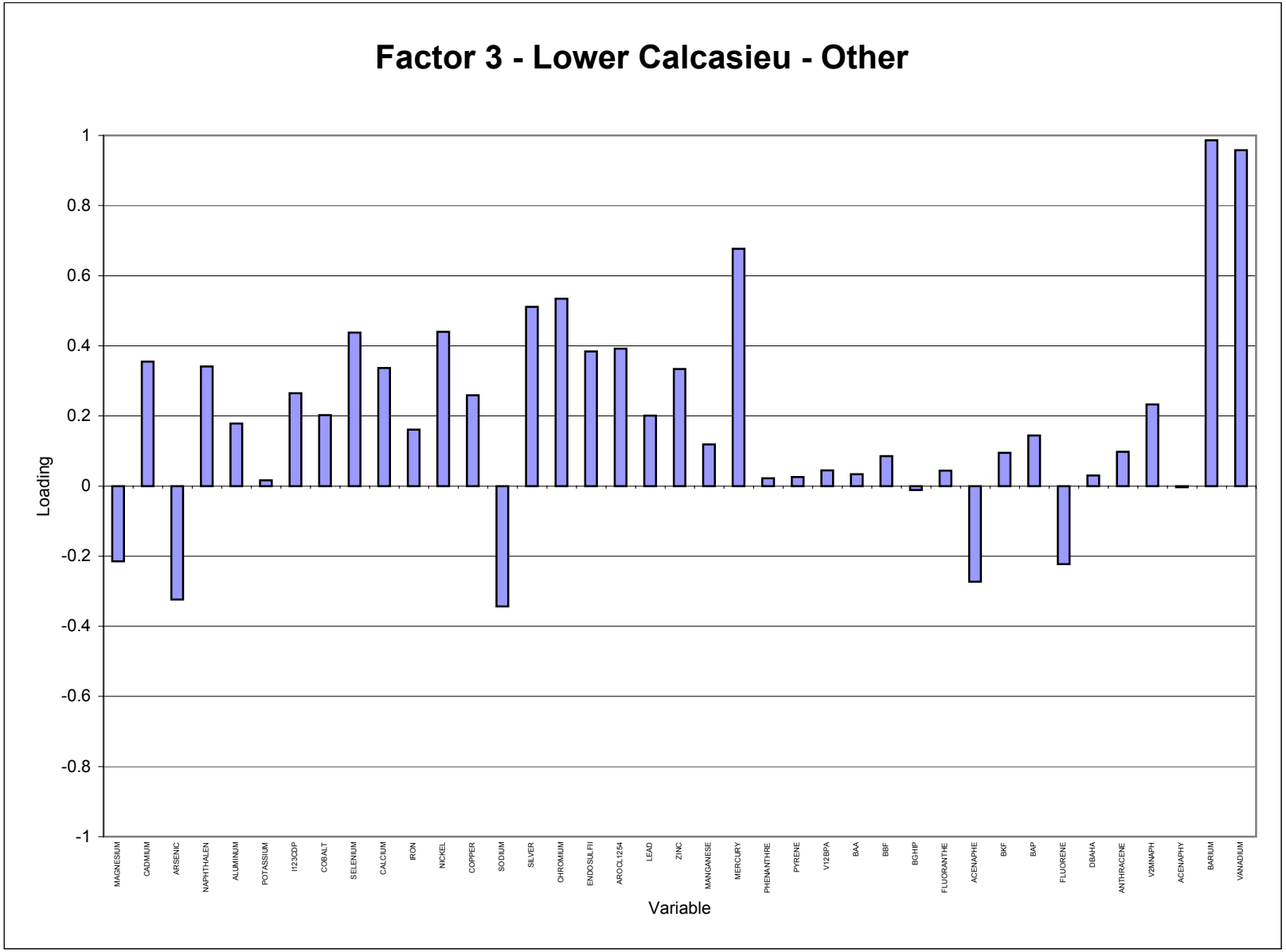
CDM

Table G-8
Lower Calcasieu-Other
Factor Loadings



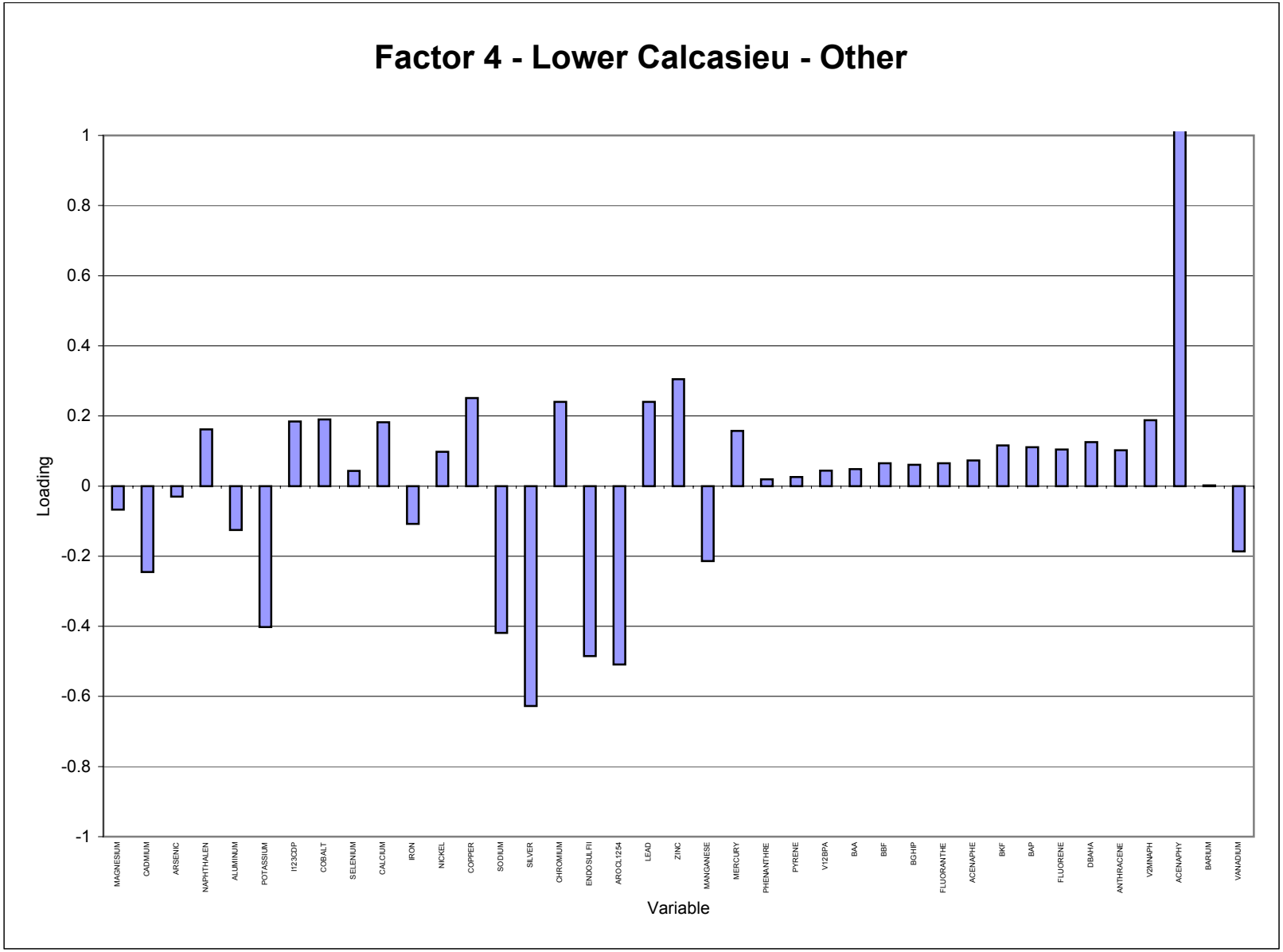
CDM

Table G-8
Lower Calcasieu-Other
Factor Loadings



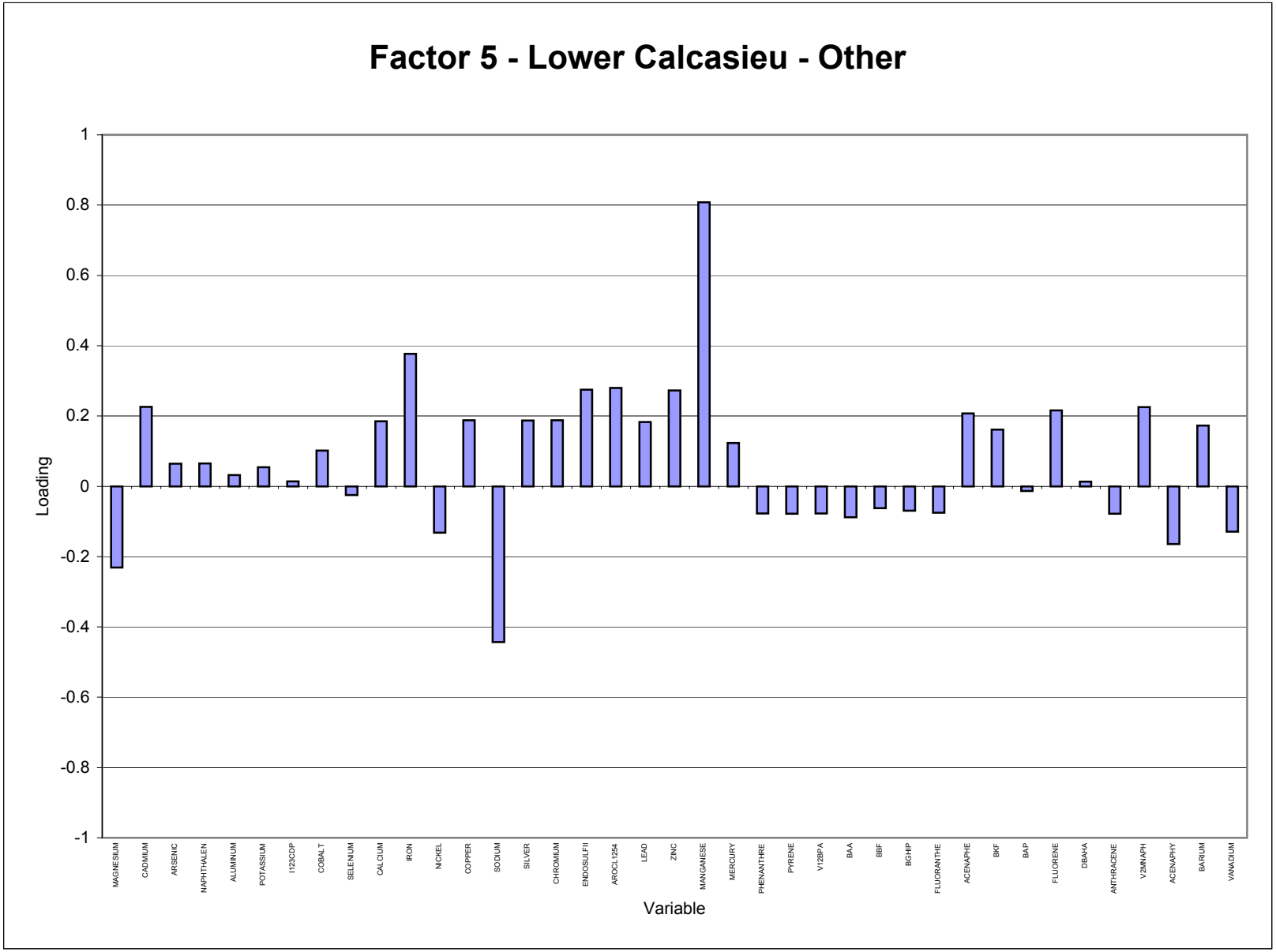
CDM

Table G-8
Lower Calcasieu-Other
Factor Loadings



CDM

Table G-8
Lower Calcasieu-Other
Factor Loadings



CDM

Table G-9
Lower Calcasieu - Other Energy System
Principal Component Analysis Results

Variable	Sum Ranking	Variable	Sum Ranking
AROCL1254	0.658	BBF	0.477
ENDOSULFII	0.658	V2MNAPH	0.462
LEAD	0.616	ARSENIC	0.455
ZINC	0.580	I123CDP	0.438
COPPER	0.577	ALUMINUM	0.438
CHROMIUM	0.546	IRON	0.437
BAP	0.531	SELENIUM	0.433
PHENANTHRE	0.515	BKF	0.422
COBALT	0.509	DBAHA	0.413
SODIUM	0.509	BGHIP	0.412
PYRENE	0.505	MANGANESE	0.398
ANTHRACENE	0.504	NAPHTHALEN	0.388
NICKEL	0.495	VANADIUM	0.384
POTASSIUM	0.491	SILVER	0.381
V12BPA	0.490	FLUORENE	0.349
MAGNESIUM	0.489	ACENAPHY	0.341
MERCURY	0.487	ACENAPHE	0.327
CALCIUM	0.486	CADMIUM	0.295
FLUORANTHE	0.484	BARIUM	0.286
BAA	0.481		

Table G-10
Calcasieu Estuary Lower Calcasieu AOC - Other Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**2/2**										**196**	**559**			
1,2,3,4,6,7,8-HpCDF PG/G	**2/2**										**68.9**	**165**			
1,2,3,4,7,8,9-HpCDF PG/G	**2/2**										**12.5**	**17.1**			
1,2,3,4,7,8-HxCDD PG/G	**2/2**										**2.72**	**6.7**			
1,2,3,4,7,8-HxCDF PG/G	**2/2**										**15.6**	**34.7**			
1,2,3,6,7,8-HxCDD PG/G	**2/2**										**8.68**	**30.3**			
1,2,3,6,7,8-HxCDF PG/G	**2/2**										**6.66**	**12.4**			
1,2,3,7,8,9-HxCDD PG/G	**2/2**										**5.37**	**16**			
1,2,3,7,8,9-HxCDF PG/G	**2/2**										**3.25**	**5.31**			
1,2,3,7,8-PeCDD PG/G	**2/2**										**2.78**	**5.68**			
1,2,3,7,8-PeCDF PG/G	**2/2**										**6.09**	**13**			
1,2-Benzphenanthracene ug/Kg	**7/7**	**16871.429**	**38060.978**	**2.255942816**	**-11324.5**	**45067.4**	**1270**	**3780**	**18000**	**16730**	**350**	**83100**			ln(y) = 8.50840253962272 + 2.21403662390748*Z
2,3,4,6,7,8-HxCDF PG/G	**2/2**										**4.42**	**12.2**			
2,3,4,7,8-PeCDF PG/G	**2/2**										**6.62**	**15.8**			
2,3,7,8-TCDD PG/G	**2/2**										**0.734**	**2.09**			
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**15.9389**	**39.0849**			
2,3,7,8-TCDF PG/G	**2/2**										**10.1**	**28.9**			
2-Butanone ug/Kg	**1/4**										**26**	**26**	**20**	**0**	
2-Methylnaphthalene ug/Kg	**6/7**	3812.9493	6662.1111	1.747233057	-1122.41	8748.31	**-660**	**-660**	**9900**	**10560**	**53**	**15400**	**660**	**660**	ln(y) = 6.45325736248886 + 2.51946107879763*Z
Acenaphthene ug/Kg	**3/7**	3262.4607	7253.2625	2.22324898	-2110.83	8635.753	20.0919	210.771	2211.07	2190.98	**252**	**15900**	**64**	**3500**	ln(y) = 5.35077338628795 + 3.48634828326894*Z
Acenaphthylene ug/Kg	**4/7**	1340.6146	4682.1508	3.492540514	-2127.97	4809.2	36.4183	172.771	819.638	783.22	**53**	**8740**	**1300**	**3500**	ln(y) = 5.1519674738856 + 2.30928619131048*Z
Acetone ug/Kg	**4/4**	**251**	**473.63552**	**1.886994094**	**-213.163**	**715.1628**	**36.5**	**94**	**622.5**	**586**	**26**	**790**			ln(y) = 4.73428223286018 + 1.95352687268281*Z
alpha-BHC ug/Kg	**1/7**										**9.4**	**9.4**	**1.6**	**0**	
Aluminum (Fume Or Dust) MG/KG	**7/7**	**9181.4286**	**5671.754**	**0.617742**	**4979.734**	**13383.12**	**5550**	**6570**	**15500**	**9950**	**5370**	**18500**			ln(y) = 8.99925046725719 + 0.574509708158773*Z
Anthracene ug/Kg	**6/7**	5288.1793	9293.0169	1.757318795	-1596.18	12172.54	**-3500**	**-3500**	**13000**	**16500**	**120**	**21700**	**3500**	**3500**	ln(y) = 6.96437946436403 + 2.31284658885259*Z
Aroclor-1254 ug/Kg	**3/6**	213.81447	409.23271	1.91396171	-113.64	541.2688	14.2956	63.3651	280.865	266.569	**140**	**860**	**16**	**66**	ln(y) = 4.14891337153961 + 2.20852120003383*Z
Arsenic MG/KG	**7/7**	**3.3042857**	**1.2012273**	**0.363536133**	**2.414404**	**4.194167**	**2.37**	**2.9**	**4.4**	**2.03**	**1.96**	**5.2**			ln(y) = 1.14357056433798 + 0.433986329360536*Z
Barium MG/KG	**7/7**	**84.042857**	**31.627953**	**0.376331243**	**60.61254**	**107.4732**	**61.8**	**78.6**	**108**	**46.2**	**47.1**	**137**			ln(y) = 4.37865729050388 + 0.436077018055486*Z
Benzo(a)anthracene ug/Kg	**7/7**	**8521.7143**	**19356.771**	**2.271464446**	**-5817.98**	**22861.41**	**492**	**1450**	**9400**	**8908**	**110**	**42400**			ln(y) = 7.62368185757937 + 2.48449977387851*Z
Benzo(a)pyrene ug/Kg	**7/7**	**5948.8571**	**9749.2948**	**1.638851721**	**-1273.52**	**13171.24**	**612**	**1300**	**11000**	**10388**	**170**	**23600**			ln(y) = 7.62803349080305 + 2.12862430204261*Z
Benzo(b)fluoranthene ug/Kg	**7/7**	**4746**	**9271.7436**	**1.953591147**	**-2122.6**	**11614.6**	**682**	**1450**	**6100**	**5418**	**190**	**21200**			ln(y) = 7.51999386022956 + 1.88441461222599*Z
Benzo(g,h,i)perylene ug/Kg	**5/7**	3752.187	7352.1257	1.959424113	-1694.34	9198.718	572.778	1573.11	4320.47	3747.69	**561**	**16800**	**660**	**3500**	ln(y) = 7.36080866586952 + 1.49855581838323*Z
Benzo(k)fluoranthene ug/Kg	**6/7**	1570.7304	2791.0458	1.776909511	-496.905	3638.366	**-660**	**-660**	**2900**	**3560**	**76.8**	**6630**	**660**	**660**	ln(y) = 6.30260946124726 + 1.79416542974871*Z
Beryllium MG/KG	**2/7**										**0.24**	**0.39**	**0.37**	**660**	
bis(2-Ethylhexyl)phthalate ug/Kg	**3/7**	196.01738	279.81931	1.427522966	-11.2757	403.3104	57.3005	139.607	340.139	282.839	**66**	**670**	**140**	**1700**	ln(y) = 4.93883170760494 + 1.32087959726754*Z
Cadmium MG/KG	**4/7**	0.1828474	0.0859961	0.470316195	0.119141	0.246554	0.10016	0.16931	0.28621	0.18606	**0.092**	**0.29**	**0.89**	**2.4**	ln(y) = -1.77602041173433 + 0.778723783459437*Z
Calcium Metal MG/KG	**7/7**	**2089.8571**	**1875.9661**	**0.897652815**	**700.122**	**3479.592**	**1120**	**1370**	**2990**	**1870**	**929**	**5490**			ln(y) = 7.44563725118146 + 0.736716228623456*Z
Carbazole ug/Kg	**1/7**										**54.1**	**54.1**	**660**	**0**	
Carbon Disulfide ug/Kg	**3/4**	14.976027	8.4009799	0.560961873	6.743066	23.20899	**-51**	**-51**	**-51**	**0**	**8**	**24**	**51**	**51**	ln(y) = 2.63218423388101 + 0.814765637279121*Z
Chromium MG/KG	**7/7**	**84.3**	**66.965195**	**0.794367677**	**34.69149**	**133.9085**	**51.3**	**78.2**	**98.3**	**47**	**19.1**	**205**			ln(y) = 4.22823560801061 + 0.873045368710303*Z
Cobalt MG/KG	**6/7**	3.8536224	1.8169417	0.471489288	2.507613	5.199632	**-6.7**	**-6.7**	**-6.7**	**0**	**2.3**	**7.1**	**6.7**	**6.7**	ln(y) = 1.26833245313379 + 0.455892809444216*Z
Copper MG/KG	**7/7**	**103.85714**	**102.36361**	**0.985619359**	**28.02512**	**179.6892**	**26.5**	**84.4**	**146**	**119.5**	**22.4**	**285**			ln(y) = 4.25562612850235 + 1.20471825028363*Z
Cyanide MG/KG	**1/4**										**0.3**	**0.3**	**0.09**	**0**	
delta-BHC ug/Kg	**1/7**										**30**	**30**	**1.6**	**0**	
Dibenzo(a,h)anthracene ug/Kg	**4/7**	2071.1038	4963.2936	2.396448536	-1605.76	5747.963	307.383	831.698	2250.36	1942.98	**376**	**10400**	**660**	**3500**	ln(y) = 6.72346989976867 + 1.47640366975122*Z

Table G-10
Calcasieu Estuary Lower Calcasieu AOC - Other Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Di-n-octylphthalate ug/Kg	**1/7**										**570**	**570**	**64**	**3500**	
Endosulfan I ug/Kg	**1/7**										**14**	**14**	**1.6**	**3500**	
Endosulfan II ug/Kg	**3/7**	16.48628	28.660319	1.738434604	-4.74558	37.71814	2.99292	7.95355	21.1362	18.1433	**13**	**67**	**3.1**	**27**	ln(y) = 2.07361831358705 + 1.44969620595866*Z
Endrin Ketone ug/Kg	**2/7**										**18**	**73**	**3.1**	**27**	
Ethylbenzene ug/Kg	**1/4**										**19**	**19**	**20**	**27**	
Fluoranthene ug/Kg	**7/7**	**4834.8571**	**9708.9933**	**2.008124138**	**-2357.67**	**12027.38**	**214**	**770**	**6500**	**6286**	**100**	**22200**			ln(y) = 7.1469588978895 + 2.40475970149157*Z
Fluorene ug/Kg	**3/7**	3030.811	6458.5731	2.130971901	-1753.77	7815.389	27.143	249.212	2288.12	2260.98	**279**	**13300**	**64**	**3500**	ln(y) = 5.51830234807737 + 3.28866862541834*Z
gamma-Chlordane ug/Kg	**1/7**										**7.9**	**7.9**	**1.6**	**3500**	
Heptachlor ug/Kg	**1/7**										**14**	**14**	**1.6**	**3500**	
HPAH ug/Kg	**7/7**	**76114.971**	**173016.49**	**2.273094032**	**-52057.4**	**204287.4**	**6178.8**	**15260**	**85130**	**78951.2**	**1280**	**378110**			ln(y) = 9.95240966664253 + 2.28186521100253*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**4/7**	871.45665	1099.4939	1.261673631	56.94019	1685.973	339.192	641.148	1211.91	872.721	**345**	**2780**	**660**	**3500**	ln(y) = 6.46326100605805 + 0.944385432056917*Z
Iron MG/KG	**7/7**	**8244.2857**	**3297.9165**	**0.400024532**	**5801.155**	**10687.42**	**6040**	**6690**	**10300**	**4260**	**5170**	**13900**			ln(y) = 8.96116662266741 + 0.433103586806938*Z
Isopropylbenzene ug/Kg	**1/4**										**590**	**590**	**20**	**0**	
Lead MG/KG	**7/7**	**330.24286**	**298.43014**	**0.903668706**	**109.1627**	**551.323**	**65.6**	**293**	**622**	**556.4**	**51.1**	**793**			ln(y) = 5.35284157079552 + 1.35733628487186*Z
LPAH ug/Kg	**7/7**	**40477.714**	**99194.535**	**2.450596265**	**-33006.6**	**113962.1**	**390**	**3258**	**56300**	**55910**	**206**	**216240**			ln(y) = 8.32504622142109 + 3.16349544408348*Z
Magnesium MG/KG	**7/7**	**2981.4286**	**1512.3881**	**0.507269615**	**1861.036**	**4101.821**	**2080**	**2270**	**4170**	**2090**	**1760**	**5630**			ln(y) = 7.91836324692564 + 0.501951930199466*Z
Manganese MG/KG	**7/7**	**68.285714**	**22.902425**	**0.335391159**	**51.31936**	**85.25207**	**47.2**	**65.2**	**88.8**	**41.6**	**47**	**105**			ln(y) = 4.18071678046115 + 0.385932455288822*Z
Mercury MG/KG	**7/7**	**0.94**	**0.8685302**	**0.923968261**	**0.296584**	**1.583416**	**0.43**	**0.69**	**1.18**	**0.75**	**0.14**	**2.5**			ln(y) = -0.377134174258018 + 1.12828692312442*Z
Methyl Mercury MG/KG	**2/3**										**0.00161**	**0.0198**	**0.00111**	**0**	
Methylcyclohexane ug/Kg	**1/4**										**25000**	**25000**	**20**	**0**	
Naphthalene ug/Kg	**3/7**	424.62895	977.53724	2.30209747	-299.541	1148.799	18.3898	99.218	535.307	516.917	**110**	**1500**	**64**	**3500**	ln(y) = 4.59731927192119 + 2.50007232185185*Z
Nickel MG/KG	**4/7**	14.05347	9.1048202	0.647869919	7.308524	20.79841	8.69938	12.6512	18.3982	9.69878	**9.1**	**30.3**	**13.1**	**34.7**	ln(y) = 2.53775137873933 + 0.555480971239643*Z
OCDD PG/G	**2/2**										**3190**	**6520**			
OCDF PG/G	**2/2**										**374**	**509**			
PCB-105 NG/KG	**2/2**										**7790**	**22800**			
PCB-108 NG/KG	**2/2**										**1260**	**2650**			
PCB-114 NG/KG	**2/2**										**638**	**1220**			
PCB-118 NG/KG	**2/2**										**20500**	**53700**			
PCB-126 NG/KG	**2/2**										**181**	**523**			
PCB-127 NG/KG	**1/2**										**12.5**	**12.5**	**47.1**	**34.7**	
PCB-15 NG/KG	**2/2**										**2590**	**4480**			
PCB-156 ng/kg	**2/2**										**2290**	**7530**			
PCB-157 NG/KG	**2/2**										**676**	**1750**			
PCB-162 NG/KG	**2/2**										**4570**	**18800**			
PCB-167 NG/KG	**2/2**										**1030**	**2750**			
PCB-169 NG/KG	**1/2**										**19.8**	**19.8**	**47.1**	**34.7**	
PCB-189 NG/KG	**2/2**										**157**	**374**			
PCB-37 ng/kg	**2/2**										**497**	**1090**			
PCB-58 NG/KG	**2/2**										**135**	**259**			
PCB-60 NG/KG	**2/2**										**2830**	**4030**			
PCB-61/70 NG/KG	**2/2**										**12400**	**18800**			
PCB-66 NG/KG	**2/2**										**5950**	**7670**			
PCB-77 NG/KG	**2/2**										**584**	**1080**			
PCB-79 NG/KG	**2/2**										**182**	**219**			
PCB-81 NG/KG	**2/2**										**434**	**643**			

Table G-10
Calcasieu Estuary Lower Calcasieu AOC - Other Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Phenanthrene ug/Kg	**4/7**	23565.895	69112.675	2.932741333	-27633.5	74765.28	54.974	908.154	15002.4	14947.4	**1360**	**140000**	**127**	**1300**	ln(y) = 6.81141369317073 + 4.15989066981739*Z
Potassium MG/KG	**7/7**	**1598.4286**	**787.46443**	**0.492649122**	**1015.067**	**2181.79**	**979**	**1240**	**2660**	**1681**	**950**	**2720**			ln(y) = 7.28776820958382 + 0.523198136438169*Z
Pyrene ug/Kg	**7/7**	**27600**	**71253.283**	**2.581640687**	**-25185.2**	**80385.17**	**1550**	**4900**	**24000**	**22450**	**360**	**149000**			ln(y) = 8.72364871315293 + 2.42736535571931*Z
Selenium MG/KG	**5/7**	1.5059868	1.1312559	0.751172503	0.667941	2.344033	0.85127	1.29978	1.98459	1.13331	**1**	**3.5**	**0.73**	**2.2**	ln(y) = 0.26219400152069 + 0.627741648750809*Z
Silver MG/KG	**4/7**	0.1631003	0.0836006	0.512571689	0.101168	0.225033	0.09796	0.1539	0.24178	0.14382	**0.1**	**0.3**	**1.1**	**2.9**	ln(y) = -1.87144741311039 + 0.670018191043567*Z
Sodium MG/KG	**6/7**	8127.7435	8134.1008	1.00078218	2101.917	14153.57	**-7840**	**-7840**	**8430**	**16270**	**4370**	**22400**	**7840**	**7840**	ln(y) = 8.81173713998647 + 0.623442313094369*Z
Thallium MG/KG	**1/7**										**0.06**	**0.06**	**0.34**	**7840**	
Total HpCDD PG/G	**2/2**										**451**	**1180**			
Total HpCDF PG/G	**2/2**										**177**	**458**			
Total HxCDD PG/G	**2/2**										**103**	**253**			
Total HxCDF PG/G	**2/2**										**93.3**	**253**			
Total Organic Carbon MG/KG	**3/3**	**36353.735**	**8831.7426**	**0.24293907**	**26359.68**	**46347.79**	**32093**	**32872.6**	**44095.6**	**12002.5**	**32093.05**	**44095.5643**			ln(y) = 10.490301250861 + 0.235630989392655*Z
TPAH ug/kg	**7/7**	**116592.69**	**272250.61**	**2.33505741**	**-85093.4**	**318278.8**	**6568.8**	**17484**	**141430**	**134861**	**1486**	**594350**			ln(y) = 10.1825188618834 + 2.45690716478073*Z
Total PCB ug/Kg	**7/7**	**432.28571**	**415.48853**	**0.961143336**	**124.4875**	**740.0839**	**63**	**329**	**835**	**772**	**56**	**1115**			ln(y) = 5.59723385177105 + 1.40687672216578*Z
Total PeCDD PG/G	**2/2**										**27.1**	**66.1**			
Total PeCDF PG/G	**2/2**										**58.2**	**146**			
Total TCDD PG/G	**2/2**										**13**	**30.8**			
Total TCDF PG/G	**2/2**										**140**	**274**			
TPAH (ug/Kg)	**7/7**	**116592.69**	**272250.61**	**2.33505741**	**-85093.4**	**318278.8**	**6568.8**	**17484**	**141430**	**134861**	**1486**	**594350**			ln(y) = 10.1825188618834 + 2.45690716478073*Z
Vanadium (Fume Or Dust) MG/KG	**7/7**	**54.7**	**33.23277**	**0.60754607**	**30.08082**	**79.31918**	**32.3**	**43.6**	**75**	**42.7**	**10.4**	**106**			ln(y) = 3.80131029119964 + 0.909213946975182*Z
Xylenes (total) ug/Kg	**1/4**										**35**	**35**	**20**	**0**	
Zinc MG/KG	**7/7**	**148.61429**	**106.89686**	**0.719290602**	**69.42398**	**227.8046**	**57.9**	**132**	**224**	**166.1**	**41.5**	**322**			ln(y) = 4.76745373390961 + 0.954141921284928*Z
Acid Volatile Sulfide umol/g	**3/3**	**16.676667**	**24.593677**	**1.474735804**	**-11.1537**	**44.50703**	**3.81**	**7.52**	**38.7**	**34.89**	**3.81**	**38.7**			ln(y) = 2.3370116423787 + 1.71925819714938*Z
Field Photoionization Detector ppm	**3/3**	**37.266667**	**39.946602**	**1.071912409**	**-7.93717**	**82.4705**	**0.1**	**40.5**	**71.2**	**71.1**	**0.1**	**71.2**			ln(y) = 1.88806989984546 + 4.87109441646448*Z
Percent Clay %	**3/3**	**20.82**	**11.081503**	**0.532252778**	**8.280099**	**33.3599**	**11.37**	**25.43**	**25.66**	**14.29**	**11.37**	**25.66**			ln(y) = 2.97061374879465 + 0.603654822571563*Z
Percent Sand %	**3/3**	**65.063333**	**18.293692**	**0.281167458**	**44.36207**	**85.76459**	**57.08**	**57.45**	**80.66**	**23.58**	**57.08**	**80.66**			ln(y) = 4.16187052878287 + 0.256448062048559*Z
Percent Silt %	**3/3**	**16.99**	**0.4381766**	**0.025790265**	**16.49416**	**17.48584**	**16.58**	**17.12**	**17.27**	**0.69**	**16.58**	**17.27**			ln(y) = 2.83247180419311 + 3.02390976283145E-02*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-11
Calcasieu Estuary Lower Calcasieu AOC - Other Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen %	**4/4**	**8.1125**	**3.063621**	**0.37764201**	**5.11015**	**11.1148**	**5.395**	**8.975**	**9.9675**	**4.5725**	**4.4**	**10.1**			ln(y) = 2.04465527118257 + 0.474582123288705*Z
Field Conductivity ms/cm	**4/4**	**3275**	**103.067**	**0.03147085**	**3173.99**	**3376.01**	**3200**	**3250**	**3375**	**175**	**3200**	**3400**			ln(y) = 8.09375515890862 + 3.80792062899493E-02*Z
Field pH standard units	**4/4**	**7.5525**	**0.473674**	**0.0627175**	**7.0883**	**8.0167**	**7.11**	**7.625**	**7.9225**	**0.8125**	**6.98**	**7.98**			ln(y) = 2.02064579803588 + 0.078336781400147*Z
Field Redox Potential millivolts	**3/4**	18.1847	43.10372	2.37032901	-24.0569	60.4263	**-76**	**-76**	**-76**	**0**	**1**	**63**	**76**	**76**	ln(y) = 1.74724900501988 + 3.07267981662041*Z
Field Specific Gravity NO UNITS	**4/4**										**13**	**14**			
Field Temperature deg c	**4/4**	**22.25**	**1.205123**	**0.05416284**	**21.069**	**23.431**	**21.55**	**21.9**	**23.3**	**1.75**	**21.5**	**23.7**			ln(y) = 3.10160446308621 + 5.60839644850587E-02*Z
Field Total Dissolved Solids mg/L	**4/4**										**20000**	**21000**			
Salinity ppt	**4/4**	**20.75**	**1.03067**	**0.04967086**	**19.7399**	**21.7601**	**20**	**20.5**	**21.75**	**1.75**	**20**	**22**			ln(y) = 3.03175735954743 + 5.99333501013048E-02*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

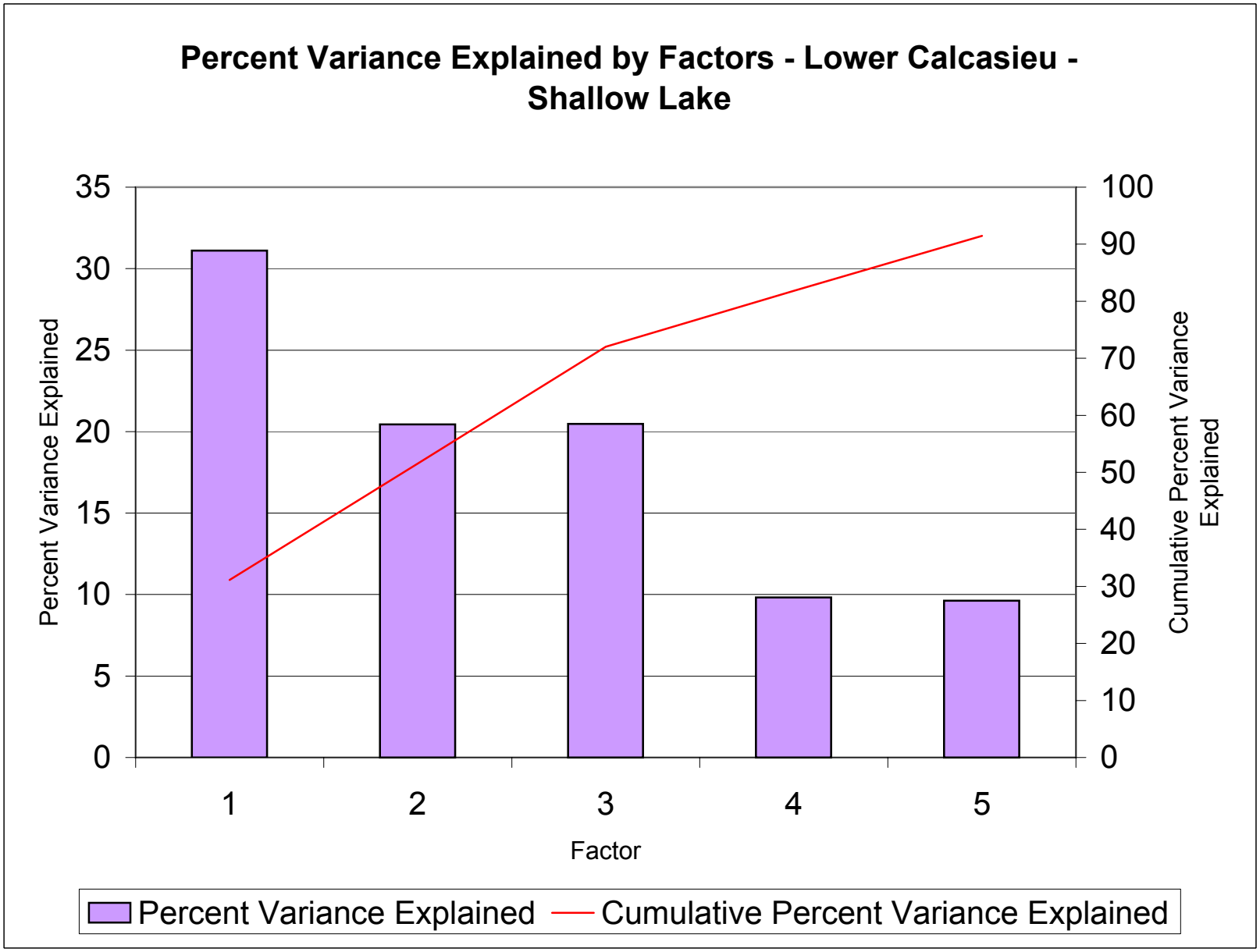
Table G-12
Calcasieu Estuary Lower Calcasieu AOC - Other Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen %	**3/3**	**9.68**	**1.3199153**	**0.136354884**	**8.186375**	**11.17362**	**8.59**	**9.53**	**10.92**	**2.33**	**8.59**	**10.92**			ln(y) = 2.26521314132635 + 0.177989543338814*Z
Field Conductivity ms/cm	**3/3**	**2550**	**322.67178**	**0.126537952**	**2184.863**	**2915.137**	**2400**	**2420**	**2830**	**430**	**2400**	**2830**			ln(y) = 7.84092627537468 + 0.122226808852675*Z
Field pH standard units	**3/3**	**7.29**	**0.3911373**	**0.053653948**	**6.847387**	**7.732613**	**7.02**	**7.19**	**7.66**	**0.64**	**7.02**	**7.66**			ln(y) = 1.98582212450773 + 6.47064455155528E-02*Z
Field Redox Potential millivolts	**3/3**										**16**	**174**			
Field Temperature deg c	**3/3**	**17**	**0.6686292**	**0.039331126**	**16.24337**	**17.75663**	**16.4**	**17**	**17.6**	**1.2**	**16.4**	**17.6**			ln(y) = 2.83279786031016 + 5.23722224370273E-02*Z
Field Total Dissolved Solids mg/L	**3/3**	**15333.333**	**2835.7892**	**0.184942776**	**12124.34**	**18542.33**	**13000**	**15000**	**18000**	**5000**	**13000**	**18000**			ln(y) = 9.62887905113544 + 0.241343549685271*Z
Field Turbidity NTU	**3/3**	**90.933333**	**197.32745**	**2.170023224**	**-132.364**	**314.2304**	**3.3**	**9.5**	**260**	**256.7**	**3.3**	**260**			ln(y) = 3.00196529936482 + 3.23852677474346*Z
Salinity ppt	**3/3**										**15**	**18**			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

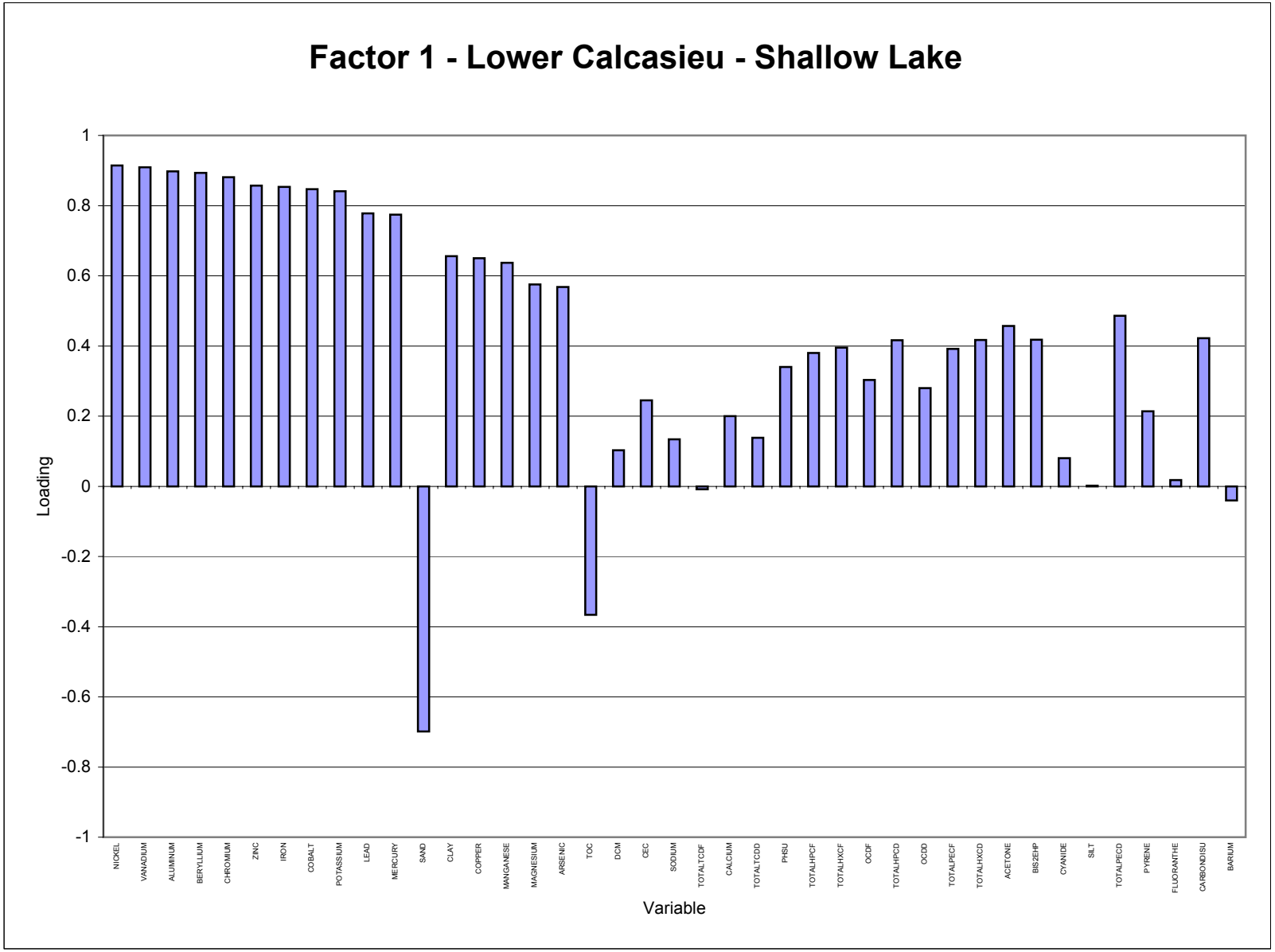
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-13
Principal Components Analysis Results



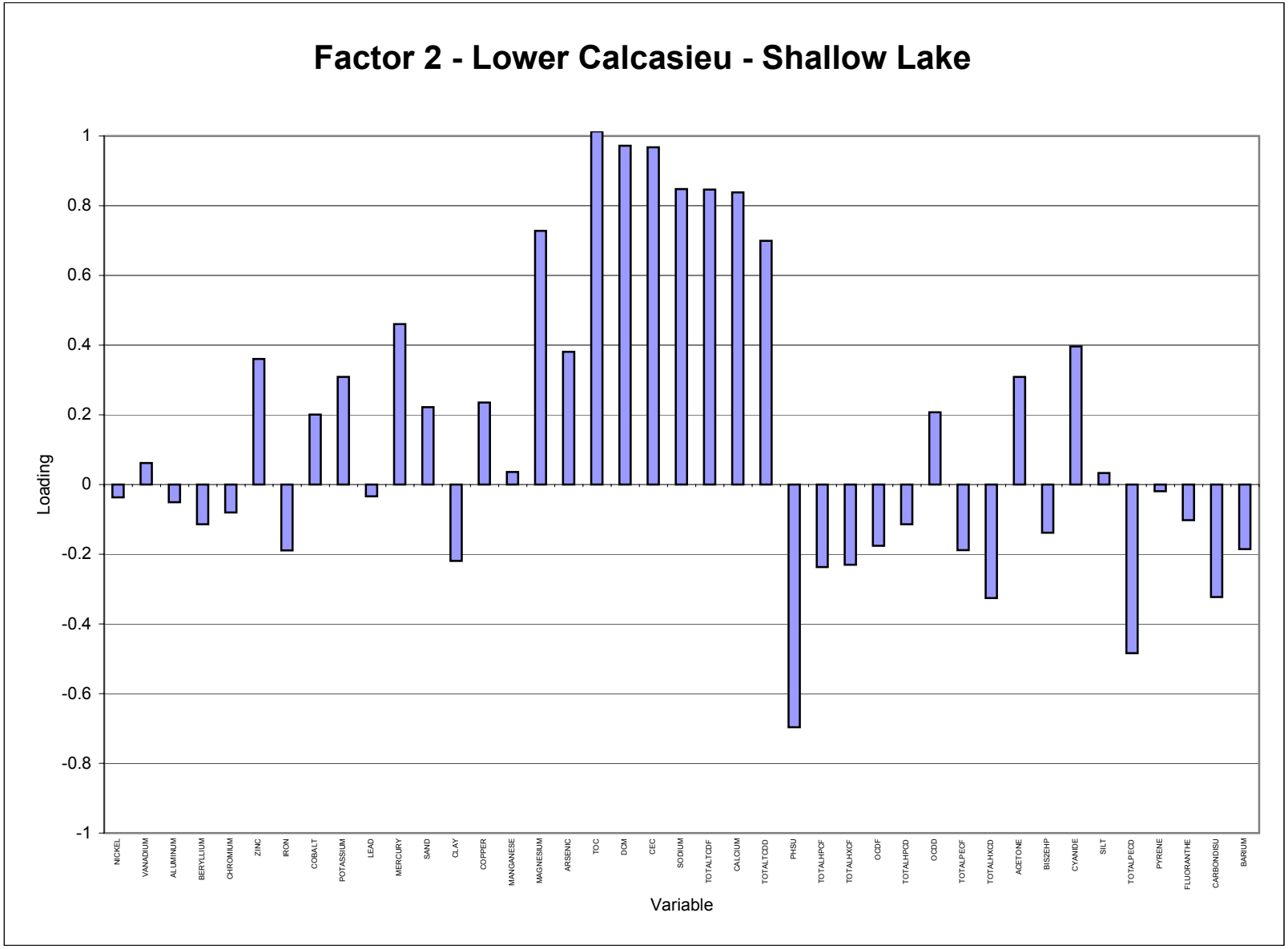
CDM

Table G-14
Lower Calcasieu-Shallow Lake
Factor Loadings



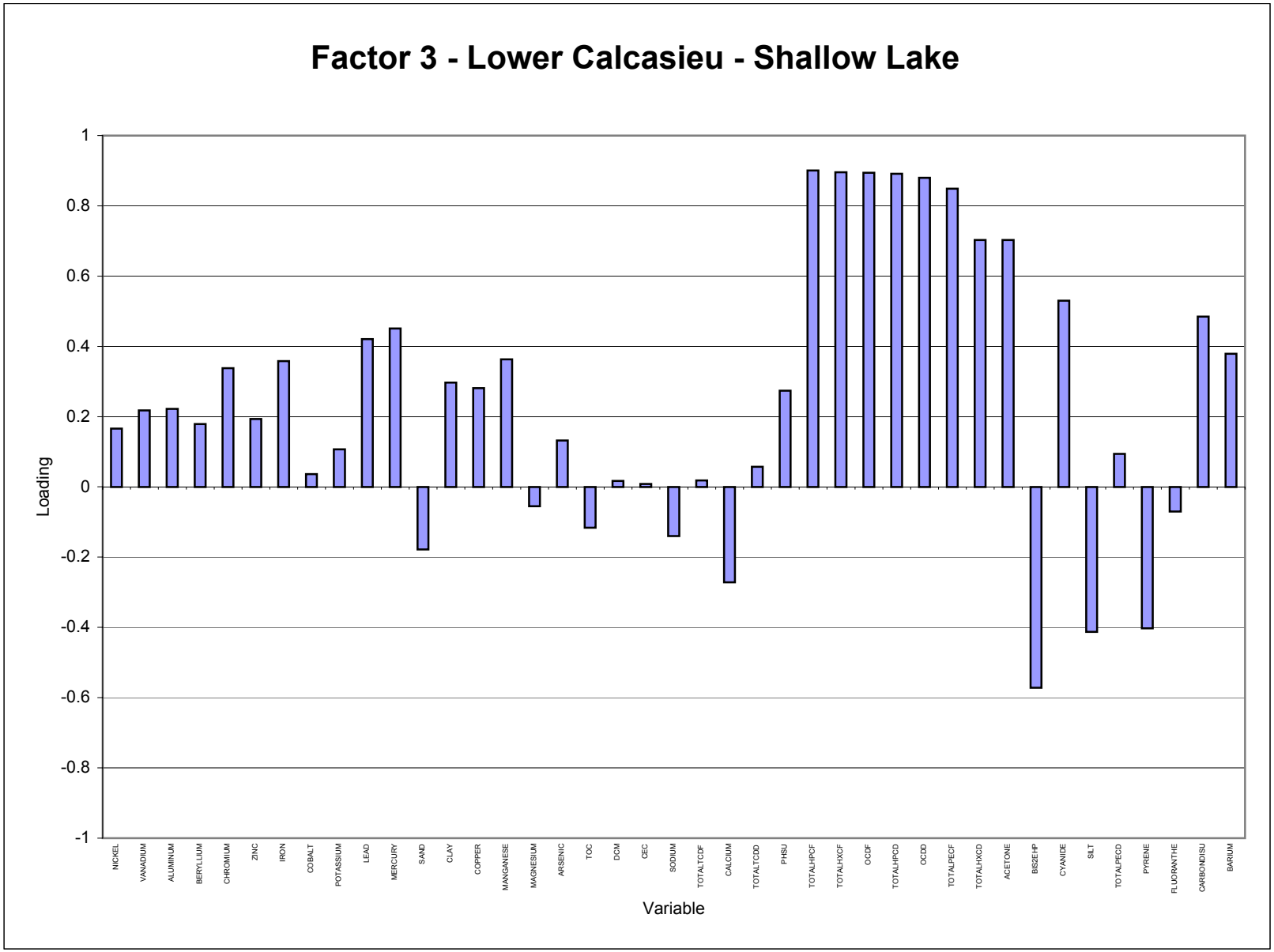
CDM

Table G-14
Lower Calcasieu-Shallow Lake
Factor Loadings



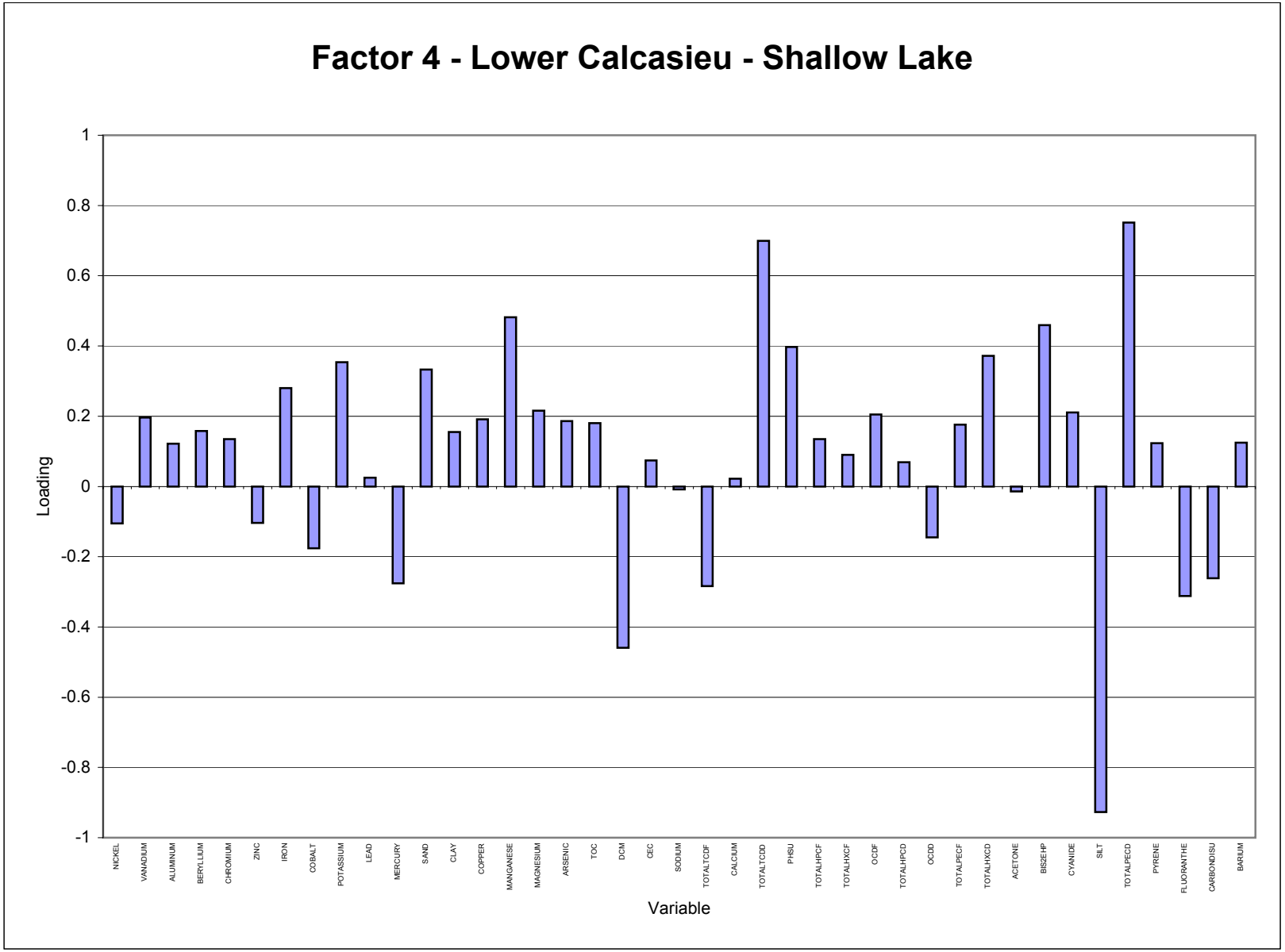
CDM

Table G-14
Lower Calcasieu-Shallow Lake
Factor Loadings



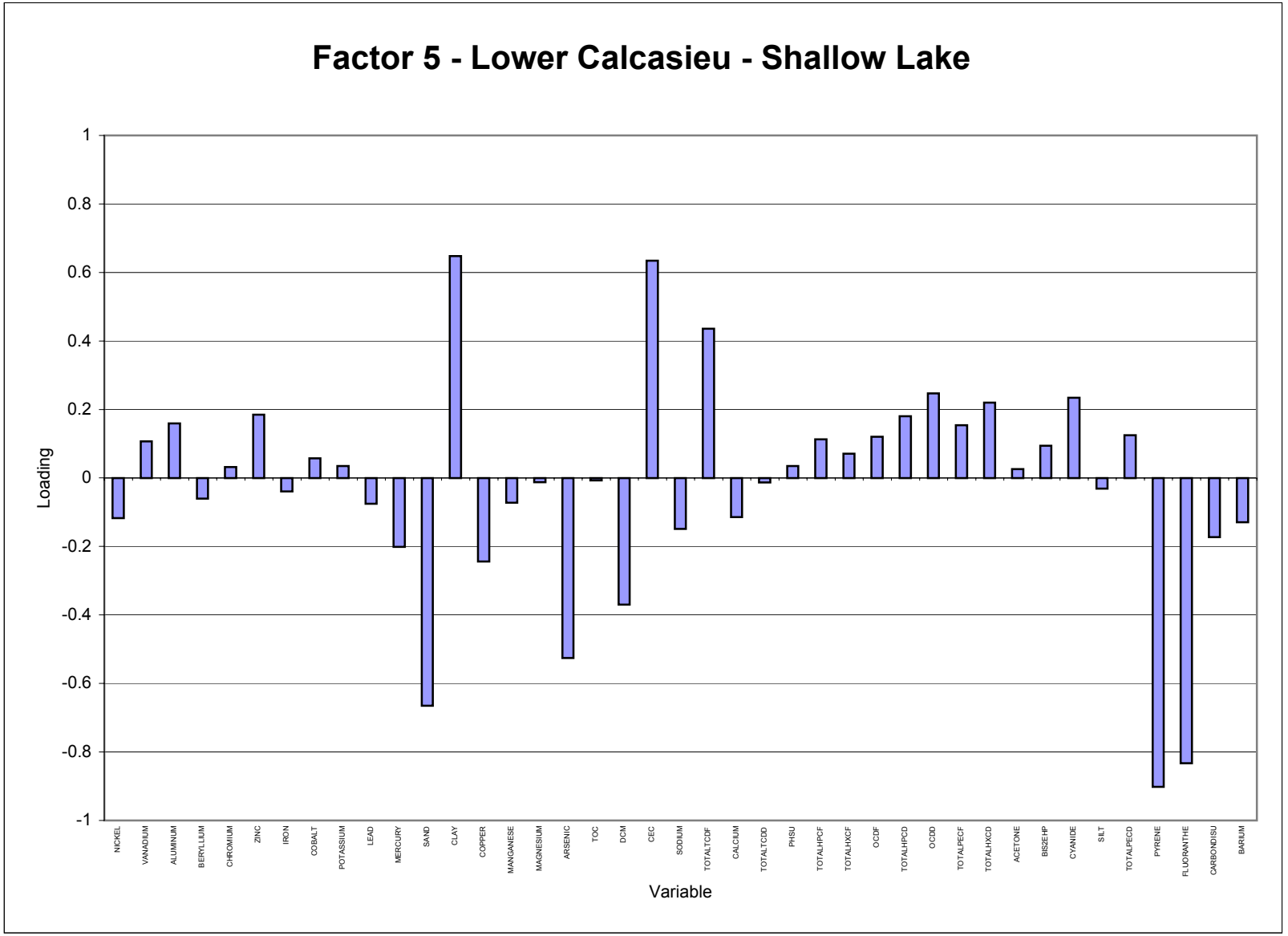
CDM

Table G-14
Lower Calcasieu-Shallow Lake
Factor Loadings



CDM

Table G-14
Lower Calcasieu-Shallow Lake
Factor Loadings



CDM

Table G-15
Lower Calcasieu AOC - Shallow Lake Energy System
Principal Component Analysis Results

Variable	Sum Ranking		Variable	Sum Ranking
IRON	0.371		CARBONDISU	0.116
LEAD	0.345		SAND	0.115
POTASSIUM	0.344		CLAY	0.112
CHROMIUM	0.336		TOC	0.105
VANADIUM	0.336		BIS2EHP	0.104
ALUMINUM	0.329		PYRENE	0.086
MAGNESIUM	0.328		TOTALHXCD	0.084
NICKEL	0.325		TOTALHPCF	0.079
ARSENIC	0.318		TOTALHXCF	0.078
ZINC	0.311		TOTALPECF	0.077
MANGANESE	0.303		TOTALHPCD	0.076
MERCURY	0.299		TOTALPECD	0.075
COPPER	0.295		OCDD	0.073
COBALT	0.273		OCDF	0.073
CALCIUM	0.267		PHSU	0.068
BERYLLIUM	0.246		CEC	0.068
SODIUM	0.221		TOTALTCDD	0.056
ACETONE	0.195		SILT	0.054
CYANIDE	0.156		TOTALTCDF	0.052
BARIUM	0.138		FLUORANTHE	0.036
DCM	0.124			

Table G-16
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**16/16**	**151.01875**	**77.960171**	**0.516228423**	**112.8183**	**189.2192**	**86.75**	**140**	**210**	**123.25**	**54**	**300**			ln(y) = 4.89238248026828 + 0.596657799606794*Z
1,2,3,4,6,7,8-HpCDF PG/G	**13/16**	65.67266	73.73032	1.12269439	29.5448	101.801	8.584	27.5164	88.205	79.621	**5.1**	**230**	**2.2**	**7.4**	ln(y) = 3.31478105278208 + 1.72783005978881*Z
1,2,3,4,7,8,9-HpCDF PG/G	**9/16**	13.38524	18.40909	1.37532718	4.36479	22.4057	1.2261	4.43074	16.012	14.786	**1.52**	**60**	**0.42**	**4.4**	ln(y) = 1.4885672620946 + 1.9056351713112*Z
1,2,3,4,7,8-HxCDD PG/G	**1/16**										**0.985**	**0.985**	**0.54**	**4.4**	
1,2,3,4,7,8-HxCDF PG/G	**10/16**	26.28671	31.63276	1.20337481	10.7867	41.7868	3.1071	10.1911	33.425	30.318	**2.74**	**98**	**0.42**	**6.7**	ln(y) = 2.32151037546483 + 1.76182716193056*Z
1,2,3,6,7,8-HxCDD PG/G	**2/16**										**2.94**	**8.8**	**1.6**	**6.7**	
1,2,3,6,7,8-HxCDF PG/G	**8/16**	7.140881	8.700224	1.21836834	2.87777	11.404	1.2419	3.3796	9.1969	7.955	**1.2**	**25**	**0.37**	**3.3**	ln(y) = 1.21775601377469 + 1.48490512127822*Z
1,2,3,7,8,9-HxCDD PG/G	**8/16**	5.236525	3.510482	0.67038399	3.51639	6.95666	2.6936	4.32731	6.9519	4.2583	**3.06**	**11**	**3**	**7.2**	ln(y) = 1.46494560405739 + 0.703165029762536*Z
1,2,3,7,8-PeCDF PG/G	**7/16**	5.1846	6.450578	1.24418041	2.02382	8.34538	1.163	2.77093	6.6017	5.4387	**1.24**	**18**	**0.73**	**13**	ln(y) = 1.01918224178583 + 1.2876985257767*Z
1,2-Benzphenanthracene ug/Kg	**12/71**										**25**	**540**	**53**	**13**	
2,3,4,6,7,8-HxCDF PG/G	**1/16**										**0.945**	**0.945**	**0.33**	**13**	
2,3,4,7,8-PeCDF PG/G	**2/16**										**1.19**	**9**	**0.37**	**13**	
2,3,7,8-TCDD PG/G	**1/16**										**0.463**	**0.463**	**0.21**	**13**	
2,3,7,8-TCDD Equivalent PG/G	**16/16**	**10.42171**	**8.668529**	**0.83177611**	**6.17413**	**14.6693**	**3.7049**	**6.8871**	**16.515**	**12.81**	**2.04465**	**30.62**			ln(y) = 2.03164773447202 + 0.930040141035487*Z
2,3,7,8-TCDF PG/G	**12/16**	6.782622	7.169882	1.05709592	3.26938	10.2959	1.2936	3.43101	9.0999	7.8063	**0.94**	**21**	**0.62**	**3.9**	ln(y) = 1.23285501355012 + 1.4467884117796*Z
2,4-Dinitrotoluene ug/Kg	**1/76**										**23**	**23**	**53**	**3.9**	
2-Butanone ug/Kg	**6/69**										**3**	**7**	**12**	**3.9**	
2-Methylnaphthalene ug/Kg	**1/69**										**170**	**170**	**53**	**3.9**	
3-Methylphenol & 4-Methylphenol ug	**1/9**										**140**	**140**	**290**	**3.9**	
4,4'-DDE ug/Kg	**3/76**										**0.044**	**1.9**	**2.3**	**3.9**	
4,4'-DDT ug/Kg	**1/76**										**3.2**	**3.2**	**2.3**	**3.9**	
4-Chloro-3-methylphenol ug/Kg	**1/76**										**56**	**56**	**53**	**3.9**	
4-Methylphenol ug/Kg	**1/76**										**600**	**600**	**53**	**3.9**	
Acenaphthene ug/Kg	**1/69**										**260**	**260**	**53**	**3.9**	
Acenaphthylene ug/Kg	**1/69**										**110**	**110**	**53**	**3.9**	
Acetone ug/Kg	**38/69**	35.4607	50.46547	1.42313807	23.5531	47.3683	10.764	21.1376	41.51	30.747	**7**	**290**	**13**	**77**	ln(y) = 3.0510545421066 + 1.00103421932028*Z
Acetophenone ug/Kg	**1/76**										**79**	**79**	**53**	**77**	
Aldrin ug/Kg	**1/76**										**1.2**	**1.2**	**1.2**	**77**	
alpha-BHC ug/Kg	**5/76**										**0.15**	**3.8**	**1.2**	**77**	
alpha-Chlordane ug/Kg	**1/76**										**0.18**	**0.18**	**1.2**	**77**	
Aluminum (Fume Or Dust) MG/KG	**69/69**	**12173.232**	**6360.8861**	**0.522530595**	**10672.34**	**13674.12**	**7235**	**11200**	**17000**	**9765**	**913**	**28200**			ln(y) = 9.22590567958368 + 0.684117431364779*Z
Anthracene ug/Kg	**3/69**										**22**	**86**	**53**	**0**	
Antimony MG/KG	**1/42**										**22.2**	**22.2**	**0.65**	**0**	
Aroclor-1254 ug/Kg	**5/76**										**5.6**	**130**	**15**	**0**	
Aroclor-1260 ug/Kg	**1/76**										**57**	**57**	**15**	**0**	
Arsenic MG/KG	**69/69**	**4.506087**	**2.8448599**	**0.631337097**	**3.834824**	**5.177349**	**2.7**	**4.2**	**5.9**	**3.2**	**0.59**	**17.6**			ln(y) = 1.31064733959899 + 0.689629067188651*Z
Barium MG/KG	**69/69**	**191.14638**	**405.37028**	**2.120732234**	**95.49672**	**286.796**	**47.75**	**76.2**	**189.5**	**141.75**	**7.2**	**2750**			ln(y) = 4.58434233815791 + 1.09193573398088*Z
Benzo(a)anthracene ug/Kg	**7/70**										**37.9**	**500**	**53**	**0**	
Benzo(a)pyrene ug/Kg	**6/70**										**46**	**610**	**53**	**0**	
Benzo(b)fluoranthene ug/Kg	**9/70**										**27**	**620**	**53**	**0**	
Benzo(g,h,i)perylene ug/Kg	**6/70**										**24**	**510**	**53**	**0**	
Benzo(k)fluoranthene ug/Kg	**5/70**										**17**	**460**	**53**	**0**	
Benzyl Butyl Phthalate ug/Kg	**1/76**										**140**	**140**	**53**	**0**	
Beryllium MG/KG	**45/69**	0.694946	0.337732	0.48598338	0.61526	0.77464	0.4221	0.60948	0.8801	0.458	**0.27**	**1.5**	**0.08**	**2.4**	ln(y) = -0.495155110040608 + 0.544950012127473*Z
beta-BHC ug/Kg	**1/76**										**0.22**	**0.22**	**1.2**	**2.4**	
bis(2-Ethylhexyl)phthalate ug/Kg	**24/76**	1967.528	19486.61	9.90410783	-2413.6	6348.65	60.487	171.26	484.89	424.41	**36**	**120000**	**91**	**3900**	ln(y) = 5.14318161091934 + 1.5437061634333*Z

Table G-16
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Cadmium MG/KG	**10/76**										**0.046**	**0.72**	**0.08**	**3900**	
Calcium Metal MG/KG	**67/69**	2726.226	1843.167	0.67608749	2291.32	3161.13	1319	2172.55	3578.4	2259.4	**244**	**8020**	**592**	**829**	ln(y) = 7.68365742018421 + 0.740159418249904*Z
Carbon Disulfide ug/Kg	**26/69**	9.958485	17.41839	1.74910075	5.84851	14.0685	3.8905	7.1346	13.084	9.1932	**1**	**120**	**14**	**77**	ln(y) = 1.96495549459715 + 0.899470911435227*Z
Chromium MG/KG	**68/69**	17.57947	10.70394	0.60888898	15.0538	20.1051	**-13.6**	**-13.6**	**26.15**	**39.75**	**2.1**	**47.6**	**13.6**	**13.6**	ln(y) = 2.66992451988066 + 0.673069773711494*Z
Cobalt MG/KG	**61/69**	5.609507	2.796769	0.49857653	4.94959	6.26942	3.2359	4.8126	7.1574	3.9215	**1.4**	**13.4**	**2.4**	**9**	ln(y) = 1.57123753183693 + 0.588729688525933*Z
Copper MG/KG	**62/76**	23.57752	18.39202	0.78006584	19.4425	27.7126	10.271	17.6607	30.368	20.098	**3.7**	**93.6**	**5.5**	**65.7**	ln(y) = 2.87134117814399 + 0.804018863927962*Z
Cyanide MG/KG	**24/69**	0.169482	0.497029	2.93263452	0.0522	0.28676	0.038	0.08001	0.1687	0.1307	**0.08**	**3.3**	**0.05**	**0.76**	ln(y) = -2.52556986233206 + 1.1062572301914*Z
delta-BHC ug/Kg	**1/76**										**2.7**	**2.7**	**1.2**	**0.76**	
Dibenzo(a,h)anthracene ug/Kg	**5/70**										**18.5**	**130**	**53**	**0.76**	
Dibenzofuran ug/Kg	**1/76**										**180**	**180**	**53**	**0.76**	
Dichloromethane ug/Kg	**30/69**	33.08701	70.22751	2.12251026	16.5164	49.6576	3.5587	9.8579	27.308	23.749	**2**	**290**	**7**	**77**	ln(y) = 2.28827275371119 + 1.51128071723844*Z
Diethyl Phthalate ug/Kg	**1/76**										**42**	**42**	**53**	**77**	
Di-n-butylphthalate ug/Kg	**11/76**										**64**	**190**	**53**	**77**	
Di-n-octylphthalate ug/Kg	**1/76**										**130**	**130**	**53**	**77**	
Endosulfan II ug/Kg	**1/76**										**1.6**	**1.6**	**2.3**	**77**	
Endosulfan Sulfate ug/Kg	**3/76**										**0.055**	**5**	**4.1**	**77**	
Endrin Ketone ug/Kg	**3/76**										**0.23**	**30**	**2.3**	**77**	
Endrin ug/Kg	**5/76**										**0.55**	**3.5**	**2.3**	**77**	
Fluoranthene ug/Kg	**17/71**	99.17475	107.0774	1.07968401	74.2676	124.082	50.883	84.9133	141.7	90.818	**28**	**770**	**53**	**3900**	ln(y) = 4.44163056316545 + 0.759568028832344*Z
Fluorene ug/Kg	**1/69**										**170**	**170**	**53**	**3900**	
gamma-BHC (Lindane) ug/Kg	**5/76**										**0.27**	**9.3**	**1.2**	**3900**	
gamma-Chlordane ug/Kg	**3/76**										**0.52**	**2**	**1.2**	**3900**	
Heptachlor Epoxide ug/Kg	**1/76**										**1.2**	**1.2**	**1.2**	**3900**	
Heptachlor ug/Kg	**1/76**										**3.7**	**3.7**	**1.2**	**3900**	
HPAH ug/kg	**27/27**	**468.3185**	**1234.004**	**2.63496835**	**2.84935**	**933.788**	**100**	**160**	**434.9**	**334.9**	**21**	**5220**			ln(y) = 5.33281622454534 + 1.24549562297729*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**5/70**										**35.2**	**410**	**53**	**3900**	
Iron MG/KG	**69/69**	**10983.188**	**6650.9623**	**0.605558431**	**9413.852**	**12552.52**	**5345**	**8840**	**16300**	**10955**	**1360**	**24300**			ln(y) = 9.09470812340387 + 0.704182529032737*Z
Lead MG/KG	**76/76**	**23.264474**	**14.222539**	**0.611341552**	**20.06686**	**26.46209**	**11.65**	**18.55**	**33.25**	**21.6**	**3.4**	**60.4**			ln(y) = 2.95877018270252 + 0.65005434204184*Z
LPAH ug/kg	**7/7**	**314.0143**	**589.5648**	**1.87750945**	**-122.741**	**750.77**	**31**	**130**	**426**	**395**	**20.1**	**1368**			ln(y) = 4.80815800342791 + 1.86474917573849*Z
Magnesium MG/KG	**69/69**	**4704.2464**	**2550.4171**	**0.542152106**	**4102.459**	**5306.033**	**2350**	**4890**	**6000**	**3650**	**417**	**10800**			ln(y) = 8.26828277124084 + 0.691713427390253*Z
Manganese MG/KG	**69/69**	**212.83188**	**197.85834**	**0.929646162**	**166.146**	**259.5178**	**82.75**	**164**	**264.5**	**181.75**	**12.9**	**895**			ln(y) = 5.02469434702039 + 0.87982896697041*Z
Mercury MG/KG	**27/76**	0.12799	0.138527	1.08232224	0.09685	0.15914	0.0449	0.08505	0.1612	0.1164	**0.0532**	**0.68**	**0.06**	**0.36**	ln(y) = -2.46456289920242 + 0.948635180796051*Z
Methyl Acetate ug/Kg	**1/69**										**8**	**8**	**12**	**0.36**	
Methyl Mercury MG/KG	**5/7**	0.001322	0.000704	0.53252887	0.0008	0.00184	0.0008	0.00117	0.0018	0.001	**0.00113**	**0.00237**	**0.00084**	**0.00105**	ln(y) = -6.74916813249769 + 0.621364508718039*Z
Methylbenzene ug/Kg	**3/69**										**1**	**2**	**12**	**0.00105**	
Naphthalene ug/Kg	**1/69**										**230**	**230**	**53**	**0.00105**	
Nickel MG/KG	**71/76**	11.50065	6.288752	0.54681734	10.0868	12.9145	6.5371	9.80949	14.72	8.183	**1.3**	**32.9**	**10.4**	**22.3**	ln(y) = 2.28335001665827 + 0.602002370068253*Z
OCDD PG/G	**16/16**	**4147.5**	**2204.9791**	**0.531640521**	**3067.06**	**5227.94**	**2325**	**4050**	**5500**	**3175**	**1100**	**8100**			ln(y) = 8.18217266574844 + 0.66527528959278*Z
OCDF PG/G	**14/16**	450.6104	596.554	1.32387979	158.299	742.922	34.283	140.082	572.38	538.1	**11**	**2000**	**10**	**16**	ln(y) = 4.94222571927772 + 2.08781389141039*Z
PCB-105 NG/KG	**1/1**										**514**	**514**			
PCB-108 NG/KG	**1/1**										**277**	**277**			
PCB-114 NG/KG	**1/1**										**10.5**	**10.5**			
PCB-118 NG/KG	**1/1**										**3140**	**3140**			
PCB-126 NG/KG	**1/1**										**10.3**	**10.3**			
PCB-15 NG/KG	**1/1**										**63.4**	**63.4**			
PCB-156 ng/kg	**1/1**										**241**	**241**			

Table G-16
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Surface Sediment

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-157 NG/KG	**1/1**										**60.4**	**60.4**			
PCB-162 NG/KG	**1/1**										**397**	**397**			
PCB-167 NG/KG	**1/1**										**115**	**115**			
PCB-189 NG/KG	**1/1**										**23.6**	**23.6**			
PCB-37 ng/kg	**1/1**										**42**	**42**			
PCB-58 NG/KG	**1/1**										**82.1**	**82.1**			
PCB-60 NG/KG	**1/1**										**209**	**209**			
PCB-61/70 NG/KG	**1/1**										**1640**	**1640**			
PCB-66 NG/KG	**1/1**										**1490**	**1490**			
PCB-77 NG/KG	**1/1**										**68.1**	**68.1**			
PCB-79 NG/KG	**1/1**										**42.6**	**42.6**			
PCB-81 NG/KG	**1/1**										**7.41**	**7.41**			
Phenanthrene ug/Kg	**7/70**										**20.1**	**480**	**53**	**16**	
Phenol ug/Kg	**1/76**										**1700**	**1700**	**53**	**16**	
Potassium MG/KG	**68/69**	2509.804	1176.682	0.46883411	2232.16	2787.45	**-2660**	**-2660**	**3250**	**5910**	**296**	**5610**	**2660**	**2660**	ln(y) = 7.68378376017984 + 0.595245712826634*Z
Pyrene ug/Kg	**25/71**	110.1277	89.01379	0.80827769	89.4223	130.833	61.74	97.6697	154.51	92.769	**31**	**670**	**53**	**3900**	ln(y) = 4.58159116242239 + 0.680315756481544*Z
Selenium MG/KG	**2/69**										**0.99**	**1.2**	**0.66**	**3900**	
Silver MG/KG	**7/76**										**0.067**	**0.18**	**0.33**	**3900**	
Sodium MG/KG	**64/69**	13457.57	10935.42	0.81258539	10877.3	16037.8	5704.9	9996.48	17516	11812	**1640**	**48600**	**2520**	**6490**	ln(y) = 9.20998849261119 + 0.831975700704153*Z
Thallium MG/KG	**2/69**										**1.3**	**2.8**	**0.7**	**6490**	
Total HpCDD PG/G	**15/16**	456.4799	230.6872	0.50536108	343.443	569.517	**-360**	**395**	**660**	**1020**	**210**	**880**	**360**	**360**	ln(y) = 6.00736434723351 + 0.538506165148548*Z
Total HpCDF PG/G	**13/16**	143.5762	164.2877	1.14425444	63.0752	224.077	16.499	55.9373	189.64	173.15	**15**	**500**	**2.2**	**7.4**	ln(y) = 4.02423144840451 + 1.81094434096718*Z
Total HxCDD PG/G	**16/16**	**108.5**	**56.418955**	**0.519990366**	**80.85471**	**136.1453**	**70.5**	**102**	**137**	**66.5**	**39**	**250**			ln(y) = 4.56937250234165 + 0.577265284512003*Z
Total HxCDF PG/G	**10/16**	74.31851	83.77791	1.12728178	33.2673	115.37	10.782	32.203	96.184	85.402	**13.3**	**240**	**0.67**	**9.2**	ln(y) = 3.47206084908525 + 1.6229823863226*Z
Total Organic Carbon MG/KG	**22/22**	**65389.269**	**67564.133**	**1.03326025**	**37156.02**	**93622.52**	**19449.7**	**29702.5**	**129875**	**110425**	**9850**	**193685.288**			ln(y) = 10.5745641833647 + 1.11316689262393*Z
Total PCB ug/Kg	**76/76**	**397.58421**	**234.15014**	**0.588932181**	**344.9408**	**450.2276**	**231.525**	**357.5**	**483.75**	**252.225**	**52.5**	**1365**			ln(y) = 5.824981647335 + 0.60842224566736*Z
Total PeCDD PG/G	**12/16**	9.666805	7.267443	0.75179369	6.10576	13.2279	4.6664	7.74853	12.866	8.1999	**4.5**	**27**	**3.9**	**6.6**	ln(y) = 2.04750327044848 + 0.752181013084589*Z
Total PeCDF PG/G	**10/16**	33.36193	38.05446	1.14065527	14.7152	52.0086	5.0383	14.7162	42.984	37.946	**6**	**120**	**1.2**	**10**	ln(y) = 2.68895047154486 + 1.58988883494763*Z
Total TCDD PG/G	**16/16**	**17.025**	**8.558456**	**0.502699323**	**12.83136**	**21.21864**	**9.8**	**17.5**	**21.5**	**11.7**	**2.1**	**32**			ln(y) = 2.67292779282384 + 0.707530057334536*Z
Total TCDF PG/G	**16/16**	**123.40625**	**141.00877**	**1.142638774**	**54.31195**	**192.5005**	**30.425**	**88**	**145**	**114.575**	**5.6**	**490**			ln(y) = 4.29742852151334 + 1.26751945760983*Z
TPAH ug/kg	**28/28**	**530.0964**	**1284.071**	**2.42233538**	**54.4698**	**1005.72**	**102.5**	**166**	**477.5**	**375**	**21**	**5646**			ln(y) = 5.39130398886138 + 1.30878574914064*Z
Trichloroethylene ug/Kg	**1/69**										**35**	**35**	**12**	**0**	
Vanadium (Fume Or Dust) MG/KG	**69/69**	**20.027536**	**9.0982174**	**0.454285405**	**17.88075**	**22.17432**	**12.55**	**19.8**	**26.55**	**14**	**2.1**	**40**			ln(y) = 2.8585615283068 + 0.590355614912498*Z
Zinc MG/KG	**54/76**	51.64471	32.44526	0.62823966	44.3501	58.9393	25.54	41.2529	66.632	41.092	**10.6**	**126**	**17.4**	**97**	ln(y) = 3.7197202143941 + 0.711170115463359*Z
Acid Volatile Sulfide umol/g	**7/7**	**12.647143**	**14.323323**	**1.132534325**	**2.036276**	**23.25801**	**1.2**	**8.67**	**31.1**	**29.9**	**0.75**	**33.1**			ln(y) = 1.6920626204959 + 1.92641966473081*Z
Cation Exchange Capacity meq/100g	**15/15**	**34.08**	**15.813328**	**0.464006099**	**26.07735**	**42.08265**	**19.8**	**35.7**	**47.8**	**28**	**10.5**	**59.9**			ln(y) = 3.39965349285724 + 0.620773459293866*Z
Diesel Range Organics ug/Kg	**7/15**	17606.44	20533.34	1.16624002	7215.14	27997.7	6590.2	12441	23486	16896	**5000**	**74000**	**17000**	**88000**	ln(y) = 9.4287564310542 + 0.942501441226392*Z
Field Photoionization Detector ppm	**1/1**										**0.3**	**0.3**			
pH standard units	**15/15**	**7.64**	**0.3846374**	**0.050345213**	**7.445347**	**7.834653**	**7.3**	**7.7**	**8**	**0.7**	**7**	**8.2**			ln(y) = 2.03222286700332 + 5.68240742077367E-02*Z
Percent Clay %	**22/22**	**31.913182**	**19.19738**	**0.601550164**	**23.89111**	**39.93526**	**17.7275**	**24.585**	**52.675**	**34.9475**	**2.31**	**64**			ln(y) = 3.22281895229331 + 0.851845945353744*Z
Percent Sand %	**22/22**	**25.295455**	**20.980922**	**0.82943449**	**16.52809**	**34.06282**	**6.55**	**22.25**	**39.5**	**32.95**	**1**	**69.97**			ln(y) = 2.71476639657764 + 1.33318233982213*Z
Percent Silt %	**22/22**	**42.645909**	**11.609659**	**0.272233831**	**37.79454**	**47.49728**	**32.95**	**41.645**	**50.95**	**18**	**26.88**	**68.71**			ln(y) = 3.71894724709738 + 0.29449962194523*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-17
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Aluminum mg/L Total	**14/17**	0.6604856	1.0474224	1.585836842	0.162573	1.158399	0.09713	0.28719	0.84916	0.75203	**0.017**	**3.8**	**0.0731**	**0.144**	ln(y) = -1.24760570105018 + 1.60800028492209*Z
Ammonia as N mg/L	**3/3**	**0.3733333**	**0.0567158**	**0.15191728**	**0.309153**	**0.437513**	**0.32**	**0.38**	**0.42**	**0.1**	**0.32**	**0.42**			ln(y) = -0.991506292384931 + 0.201674648353258*Z
Arsenic mg/L Dissolved	**13/17**	0.0026977	0.0013709	0.508185019	0.002046	0.003349	0.00171	0.00241	0.00339	0.00168	**0.0014**	**0.0052**	**0.0017**	**0.0029**	ln(y) = -6.02918129171471 + 0.508239342331852*Z
Arsenic mg/L Total	**12/17**	0.0025898	0.0019351	0.747198238	0.00167	0.00351	0.00127	0.00207	0.00337	0.0021	**0.00081**	**0.0074**	**0.0014**	**0.004**	ln(y) = -6.17833642765 + 0.721920852728559*Z
Barium mg/L Dissolved	**17/17**	**0.0885765**	**0.0173711**	**0.19611365**	**0.080319**	**0.096834**	**0.08335**	**0.0898**	**0.0988**	**0.01545**	**0.053**	**0.124**			ln(y) = -2.44342818247973 + 0.217687500907808*Z
Barium mg/L Total	**13/13**	**0.0940154**	**0.0208112**	**0.221359811**	**0.082702**	**0.105328**	**0.09065**	**0.0942**	**0.1085**	**0.01785**	**0.0528**	**0.121**			ln(y) = -2.39037027750819 + 0.259026821066975*Z
Beryllium mg/L Total	**1/13**										**0.0002**	**0.0002**	**0.0001**	**0**	
bis(2-Ethylhexyl)phthalate ug/L	**10/17**	2.2752647	0.6446857	0.283345358	1.968801	2.581729	1.72468	2.19464	2.79265	1.06797	**1**	**3**	**7**	**10**	ln(y) = 0.786018505747217 + 0.357428175322332*Z
Bromide mg/L	**3/3**	**45.133333**	**6.4668631**	**0.143283524**	**37.81539**	**52.45128**	**39.4**	**45**	**51**	**11.6**	**39.4**	**51**			ln(y) = 3.80408464626618 + 0.191385325788441*Z
Cadmium mg/L Total	**1/13**										**0.0024**	**0.0024**	**0.0003**	**0**	
Calcium Metal mg/L Dissolved	**17/17**	**210.72941**	**51.193701**	**0.242935717**	**186.3935**	**235.0654**	**211**	**218**	**237**	**26**	**80.5**	**256**			ln(y) = 5.31137520495745 + 0.277784579196174*Z
Calcium Metal mg/L Total	**13/13**	**209.77692**	**59.722386**	**0.284694737**	**177.3115**	**242.2424**	**207**	**224**	**241**	**34**	**78.7**	**276**			ln(y) = 5.29393926669175 + 0.350706063502341*Z
Cobalt mg/L Total	**1/13**										**0.0024**	**0.0024**	**0.0013**	**0**	
Copper mg/L Dissolved	**11/17**	0.009339	0.0199489	2.136080729	-0.00014	0.018822	0.00365	0.00611	0.01023	0.00657	**0.0065**	**0.0643**	**0.003**	**0.0082**	ln(y) = -5.09714700031907 + 0.76331086604592*Z
Copper mg/L Total	**13/17**	0.0081734	0.0033912	0.414904306	0.006561	0.009786	0.00586	0.00766	0.01001	0.00415	**0.0068**	**0.0166**	**0.0034**	**0.0066**	ln(y) = -4.8721828882033 + 0.397335940846989*Z
Cyanide mg/L Total	**3/17**										**0.0038**	**0.0047**	**0.0035**	**0.0066**	
Di-n-butylphthalate ug/L	**1/17**										**1**	**1**	**10**	**0.0066**	
Iron mg/L Total	**6/13**	0.2710372	0.7413287	2.735154731	-0.13195	0.674028	0.02459	0.08243	0.27634	0.25175	**0.182**	**2.08**	**0.0217**	**0.164**	ln(y) = -2.49577917663729 + 1.79422098281152*Z
Lead mg/L Dissolved	**2/17**										**0.00044**	**0.0021**	**0.00047**	**0.164**	
Lead mg/L Total	**13/17**	0.0010978	0.0012733	1.159874461	0.000492	0.001703	0.00038	0.00072	0.00138	0.001	**0.0003**	**0.0048**	**0.00031**	**0.0012**	ln(y) = -7.22973291682807 + 0.958353626895652*Z
Magnesium mg/L Dissolved	**17/17**	**711.88235**	**179.10628**	**0.251595331**	**626.7406**	**797.0241**	**690.5**	**750**	**816**	**125.5**	**271**	**894**			ln(y) = 6.52638293715164 + 0.298062185443606*Z
Magnesium mg/L Total	**13/13**	**718.76923**	**210.63932**	**0.293055563**	**604.2644**	**833.2741**	**706.5**	**750**	**838**	**131.5**	**267**	**965**			ln(y) = 6.52219040962077 + 0.367623107698444*Z
Manganese mg/L Dissolved	**17/17**	**0.0968118**	**0.0631145**	**0.651930579**	**0.066809**	**0.126815**	**0.05495**	**0.0807**	**0.122**	**0.06705**	**0.0274**	**0.276**			ln(y) = -2.49124060239063 + 0.64714364576262*Z
Manganese mg/L Total	**13/13**	**0.1330615**	**0.159991**	**1.202383501**	**0.046089**	**0.220034**	**0.0679**	**0.113**	**0.134**	**0.0661**	**0.0352**	**0.546**			ln(y) = -2.26149843869439 + 0.720231658544351*Z
Mercury mg/L Total	**1/17**										**0.000061**	**0.000061**	**0.0001**	**0**	
Naphthalene ug/L	**1/17**										**2**	**2**	**10**	**0**	
Nickel mg/L Dissolved	**17/17**	**0.0044118**	**0.0008451**	**0.191554492**	**0.00401**	**0.004813**	**0.0039**	**0.0041**	**0.0046**	**0.0007**	**0.0037**	**0.0066**			ln(y) = -5.43699504452061 + 0.164354578026487*Z
Nickel mg/L Total	**17/17**	**0.0057471**	**0.0015508**	**0.26983647**	**0.00501**	**0.006484**	**0.0044**	**0.0058**	**0.00725**	**0.00285**	**0.0037**	**0.0084**			ln(y) = -5.19266132271022 + 0.297539705321086*Z
Potassium mg/L Dissolved	**17/17**	**222.70588**	**24.597273**	**0.110447345**	**211.0131**	**234.3987**	**205**	**223**	**243**	**38**	**167**	**259**			ln(y) = 5.40010796377464 + 0.122542191206562*Z
Potassium mg/L Total	**13/13**	**228.61538**	**27.921382**	**0.122132558**	**213.4371**	**243.7936**	**210**	**227**	**247.5**	**37.5**	**167**	**275**			ln(y) = 5.42521052088205 + 0.137092798946721*Z
Selenium mg/L Dissolved	**7/17**	0.0019785	0.0022033	1.113577854	0.000931	0.003026	0.00057	0.00122	0.00263	0.00206	**0.00046**	**0.0078**	**0.0026**	**0.0029**	ln(y) = -6.70710636923661 + 1.13424308024236*Z
Selenium mg/L Total	**5/17**	0.0057253	0.0060181	1.051141353	0.002864	0.008586	0.00207	0.00411	0.00816	0.00609	**0.0024**	**0.015**	**0.0026**	**0.02**	ln(y) = -5.49436140959783 + 1.01721434293495*Z
Silver mg/L Dissolved	**1/17**										**0.002**	**0.002**	**0.0012**	**0.02**	
Silver mg/L Total	**1/17**										**0.0066**	**0.0066**	**0.0012**	**0.02**	
Sodium mg/L Dissolved	**17/17**	**7964.7059**	**3455.8673**	**0.433897666**	**6321.891**	**9607.521**	**5585**	**7910**	**10360**	**4775**	**1990**	**14300**			ln(y) = 8.87512488680339 + 0.559829230293651*Z
Sodium mg/L Total	**13/13**	**8356.9231**	**4322.0354**	**0.517180231**	**6007.438**	**10706.41**	**4385**	**9690**	**12350**	**7965**	**1170**	**13400**			ln(y) = 8.82726829120166 + 0.81732403339063*Z
Thallium mg/L Dissolved	**9/17**	0.0036421	0.0033693	0.925110561	0.00204	0.005244	0.00133	**-0.002**	**0.00615**	0.00482	**0.00069**	**0.0081**	**0.002**	**0.002**	ln(y) = -5.9615802371267 + 0.9809479791678*Z
Thallium mg/L Total	**4/17**	0.0067142	0.0011047	0.164539001	0.006189	0.007239	0.00576	0.00659	0.00754	0.00177	**0.0077**	**0.009**	**0.00015**	**0.002**	ln(y) = -5.02198772610389 + 0.19911040971984*Z
Total Organic Carbon mg/L	**3/3**	**4.7333333**	**0.8977474**	**0.189664947**	**3.717436**	**5.74923**	**3.9**	**4.8**	**5.5**	**1.6**	**3.9**	**5.5**			ln(y) = 1.54478018776262 + 0.254951851553659*Z
Vanadium mg/L Dissolved	**4/17**	0.0015329	0.0018817	1.227553165	0.000638	0.002427	0.00052	0.00102	0.00201	0.00149	**0.0022**	**0.0069**	**0.002**	**0.0059**	ln(y) = -6.88450980107391 + 1.00020776729015*Z
Vanadium mg/L Total	**4/13**	0.0016702	0.0017762	1.06348287	0.000705	0.002636	0.00048	0.00108	0.0024	0.00191	**0.002**	**0.0058**	**0.002**	**0.0059**	ln(y) = -6.83518636907333 + 1.18858519008294*Z
Zinc mg/L Dissolved	**4/17**	0.0097746	0.0258801	2.647688828	-0.00253	0.022077	0.00032	0.00156	0.00757	0.00725	**0.0131**	**0.0873**	**0.0098**	**0.0101**	ln(y) = -6.46621752556262 + 2.34656328594055*Z
Zinc mg/L Total	**3/13**	0.0094682	0.0143752	1.518265605	0.001654	0.017283	0.00254	0.00564	0.01252	0.00998	**0.0187**	**0.0385**	**0.0098**	**0.0101**	ln(y) = -5.17871015002081 + 1.18368931246973*Z
Bicarbonate Alkalinity mg/L	**3/3**	**81.4**	**6.9263239**	**0.085089974**	**73.56213**	**89.23787**	**78**	**78.7**	**87.5**	**9.5**	**78**	**87.5**			ln(y) = 4.39799692515884 + 8.52357000786107E-02*Z
Biochemical Oxygen Demand mg/L	**3/3**	**2.2**	**1.1633202**	**0.528781892**	**0.883579**	**3.516421**	**1.1**	**2.5**	**3**	**1.9**	**1.1**	**3**			ln(y) = 0.70340440011553 + 0.744080591982929*Z

Table G-17
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Chemical Oxygen Demand (COD) mg/L	3/3	107.53333	86.433123	0.803779821	9.725047	205.3416	26.6	133	163	136.4	26.6	163			ln(y) = 4.42167018160539 + 1.34445875596768*Z
Chloride mg/L	3/3	10966.667	475.81534	0.043387417	10428.23	11505.1	10700	10800	11400	700	10700	11400			ln(y) = 9.3022230226483 + 4.69969109325299E-02*Z
Dissolved Oxygen %	72/72	8.8503473	1.4149637	0.159876632	8.523507	9.177187	7.90844	8.75	10.0075	2.09906	5.405	12.9			ln(y) = 2.16758848533824 + 0.168620481161321*Z
Field Conductivity ms/cm	72/72	18832.727	15662.479	0.831662825	15214.88	22450.57	3831.82	15988.8	32425	28593.2	626	49400			ln(y) = 9.31676947005673 + 1.07208284725618*Z
Field pH standard units	72/72	7.9694562	0.4367806	0.054806825	7.868565	8.070347	7.82708	8.05	8.2675	0.44042	6.225	8.59			ln(y) = 2.0740695692853 + 0.054611349638918*Z
Field Specific Gravity NO UNITS	66/66	15.104437	3.2198611	0.21317319	14.32762	15.88126	13	16	18	5	2	20			ln(y) = 2.67893570690898 + 0.260227304405241*Z
Field Temperature deg c	72/72	19.239451	2.4914693	0.129497942	18.66395	19.81495	18.075	19.2563	20.75	2.675	12.3	24.5			ln(y) = 2.948481751599 + 0.135924299368502*Z
Field Total Dissolved Solids mg/L	72/72	21123.991	4198.4753	0.198753882	20154.19	22093.79	18000	21500	24000	6000	3950	30000			ln(y) = 9.92986336458382 + 0.231785920193082*Z
Field Turbidity NTU	65/65	43.012434	157.51529	3.662087444	4.719193	81.30567	9.125	18.25	37	27.875	0.2	990			ln(y) = 2.80480867875987 + 1.39919545598746*Z
Hardness, as CaCO3 mg/L	3/3	3926.6667	500.16011	0.12737524	3360.682	4492.651	3580	3800	4400	820	3580	4400			ln(y) = 8.27174474833853 + 0.152955400986107*Z
Nitrate-Nitrite mg/L	3/3	0.1	0.0633239	0.633239363	0.028342	0.171658	0.04	0.11	0.15	0.11	0.04	0.15			ln(y) = -2.44109024098127 + 0.980255955989886*Z
Salinity ppt	72/72	21.998271	4.9099339	0.223196353	20.86413	23.13241	19	22.375	25.8571	6.85714	3	36			ln(y) = 3.05486818846431 + 0.264733881717775*Z
Sulfate mg/L	3/3	1613.3333	95.163068	0.058985373	1505.646	1721.02	1560	1580	1700	140	1560	1700			ln(y) = 7.38533491876963 + 0.063737625464571*Z
Total Alkalinity mg/L	3/3	81.4	6.9263239	0.085089974	73.56213	89.23787	78	78.7	87.5	9.5	78	87.5			ln(y) = 4.39799692515884 + 8.52357000786107E-02*Z
Total Suspended Solids mg/L	3/3										33.6	44			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-18
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Phase I Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N mg/L	**3/3**	**0.3733333**	**0.0567158**	**0.15191728**	**0.309153**	**0.437513**	**0.32**	**0.38**	**0.42**	**0.1**	**0.32**	**0.42**			ln(y) = -0.991506292384931 + 0.201674648353258*Z
Dissolved Oxygen %	**65/65**	**9.0026924**	**1.4840832**	**0.164848816**	**8.6419**	**9.363485**	**7.985**	**8.91**	**10.2**	**2.215**	**5.405**	**12.9**			ln(y) = 2.18375335466901 + 0.17557390150049*Z
Field Conductivity ms/cm	**65/65**	**20572.374**	**15422.215**	**0.749656555**	**16823.11**	**24321.64**	**3900**	**28200**	**32800**	**28900**	**3166.6667**	**42200**			ln(y) = 9.46557516807403 + 0.988370412320175*Z
Field pH standard units	**65/65**	**8.0910899**	**0.3425597**	**0.042337898**	**8.007811**	**8.174369**	**7.91**	**8.1625**	**8.30167**	**0.39167**	**6.87**	**8.61**			ln(y) = 2.08986111776841 + 0.042170643118513*Z
Field Redox Potential millivolts	**61/65**	144.39806	44.926273	0.311127965	133.4761	155.32	101.738	133.144	174.244	72.5059	**6**	**224**	**3**	**33**	ln(y) = 4.89143190814164 + 0.399037408501589*Z
Field Specific Gravity NO UNITS	**65/65**	**15.575275**	**2.2412548**	**0.143898254**	**15.03041**	**16.12014**	**14**	**16**	**18**	**4**	**12**	**20**			ln(y) = 2.73516749828035 + 0.14948747436219*Z
Field Temperature deg c	**65/65**	**19.589931**	**2.1511373**	**0.109808316**	**19.06697**	**20.11289**	**18.4667**	**19.4**	**20.8**	**2.33333**	**12.3**	**24.5**			ln(y) = 2.9689450993742 + 0.112652747451348*Z
Field Total Dissolved Solids mg/L	**65/65**	**21760.421**	**2845.5393**	**0.130766737**	**21068.65**	**22452.19**	**19500**	**22000**	**24142.9**	**4642.86**	**17000**	**26000**			ln(y) = 9.97919617446959 + 0.135482151486953*Z
Field Turbidity NTU	**58/63**	44.091374	159.82473	3.624852498	4.624769	83.55798	6.79008	16.9511	42.3175	35.5274	**0.2**	**990**	**8.3333333**	**10**	ln(y) = 2.83033182302927 + 1.35699161320532*Z
Hardness, as CaCO3 mg/L	**3/3**	**3926.6667**	**500.16011**	**0.12737524**	**3360.682**	**4492.651**	**3580**	**3800**	**4400**	**820**	**3580**	**4400**			ln(y) = 8.27174474833853 + 0.152955400986107*Z
Salinity ppt	**65/65**	**22.728854**	**3.584191**	**0.15769343**	**21.85751**	**23.6002**	**19.5**	**23**	**26**	**6.5**	**17**	**36**			ln(y) = 3.11175366182477 + 0.157321545624035*Z
Total Alkalinity mg/L	**3/3**	**81.4**	**6.9263239**	**0.085089974**	**73.56213**	**89.23787**	**78**	**78.7**	**87.5**	**9.5**	**78**	**87.5**			ln(y) = 4.39799692515884 + 8.52357000786107E-02*Z
Total Kjeldahl Nitrogen mg/L	**3/3**	**1.3**	**0.1114382**	**0.085721686**	**1.173896**	**1.426104**	**1.2**	**1.3**	**1.4**	**0.2**	**1.2**	**1.4**			ln(y) = 0.26038601929422 + 0.114323022036037*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

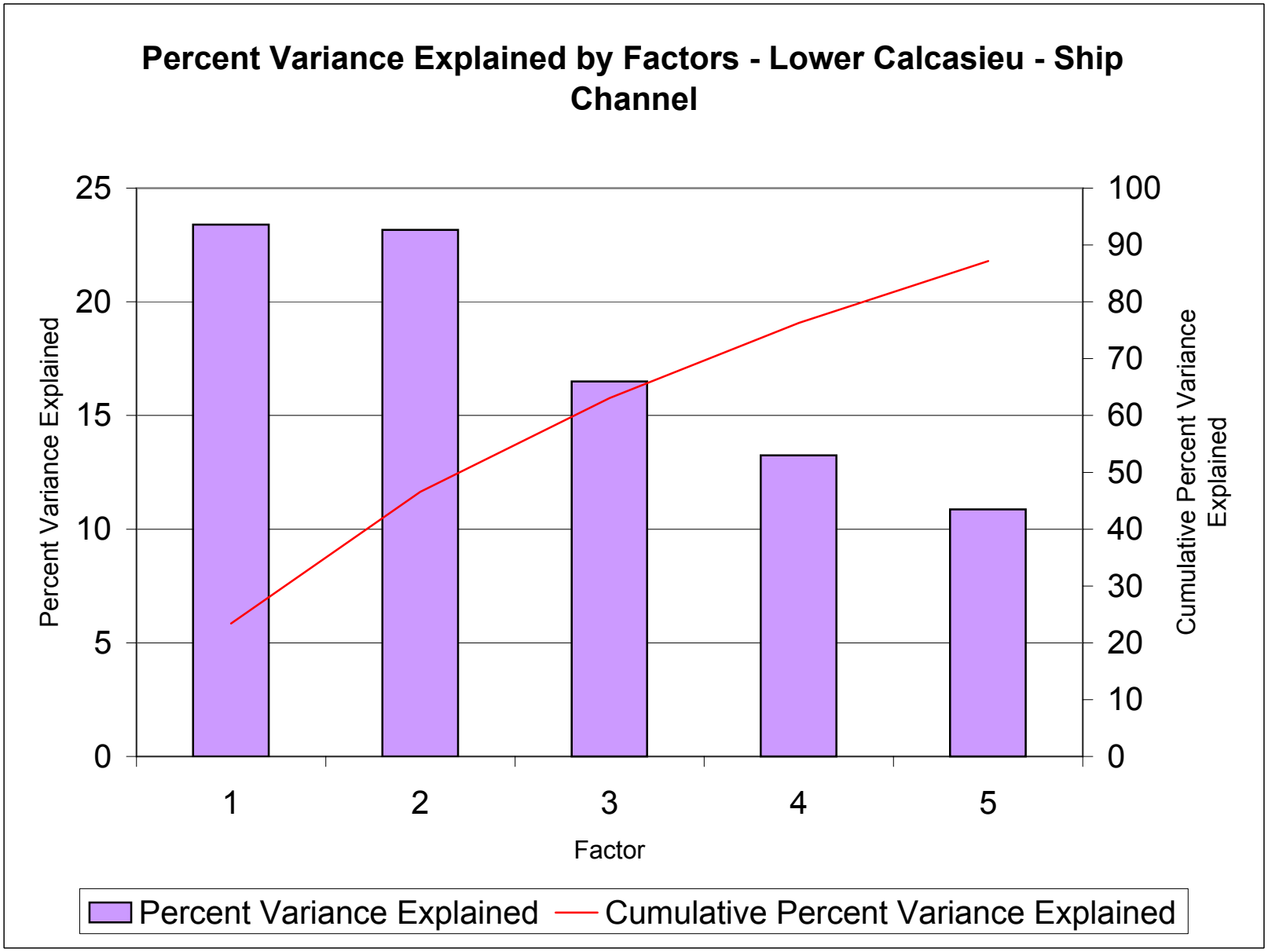
Table G-19
Calcasieu Estuary Lower Calcasieu AOC - Shallow Lake Energy System
Summary Statistics - Phase II Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Dissolved Oxygen %	**13/13**	**8.315**	**0.8135103**	**0.097836478**	**7.872771**	**8.757229**	**7.845**	**8.47**	**8.81**	**0.965**	**6.42**	**9.47**			ln(y) = 2.11369978785863 + 0.107152294198932*Z
Field Conductivity ms/cm	**13/13**	**5296.5385**	**18367.323**	**3.467797576**	**-4688.05**	**15281.13**	**477.5**	**626**	**3290**	**2812.5**	**456**	**49400**			ln(y) = 7.2767276872653 + 1.4301700138027*Z
Field pH standard units	**13/13**	**6.8788462**	**0.6493956**	**0.094404722**	**6.525831**	**7.231862**	**6.34**	**6.45**	**7.495**	**1.155**	**6.225**	**7.96**			ln(y) = 1.92449138805869 + 0.100922782662132*Z
Field Redox Potential millivolts	**13/13**	**269.92308**	**97.484183**	**0.361155422**	**216.9301**	**322.9161**	**196.5**	**226**	**353.5**	**157**	**122**	**410**			ln(y) = 5.53294194060377 + 0.436998571711222*Z
Field Specific Gravity NO UNITS	**7/7**										**1**	**2**			
Field Temperature deg c	**13/13**	**14.811154**	**4.01927**	**0.271367784**	**12.62625**	**16.99605**	**11.6**	**14.1**	**16.95**	**5.35**	**11.2**	**24.445**			ln(y) = 2.66772999170217 + 0.260540099184445*Z
Field Total Dissolved Solids mg/L	**13/13**	**11480.769**	**9884.0884**	**0.860925624**	**6107.718**	**16853.82**	**3050**	**3950**	**20000**	**16950**	**2900**	**30000**			ln(y) = 8.92906533114347 + 1.02512971761189*Z
Field Turbidity NTU	**13/13**	**5.2961538**	**7.8104541**	**1.474740781**	**1.050343**	**9.541965**	**0.5**	**0.6**	**11.025**	**10.525**	**0.2**	**24.1**			ln(y) = 0.544310983503394 + 1.7887983395165*Z
Salinity ppt	**13/13**	**11.307692**	**10.794822**	**0.954644151**	**5.43956**	**17.17582**	**2**	**3**	**20.5**	**18.5**	**2**	**32**			ln(y) = 1.84986802069224 + 1.23666361607733*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

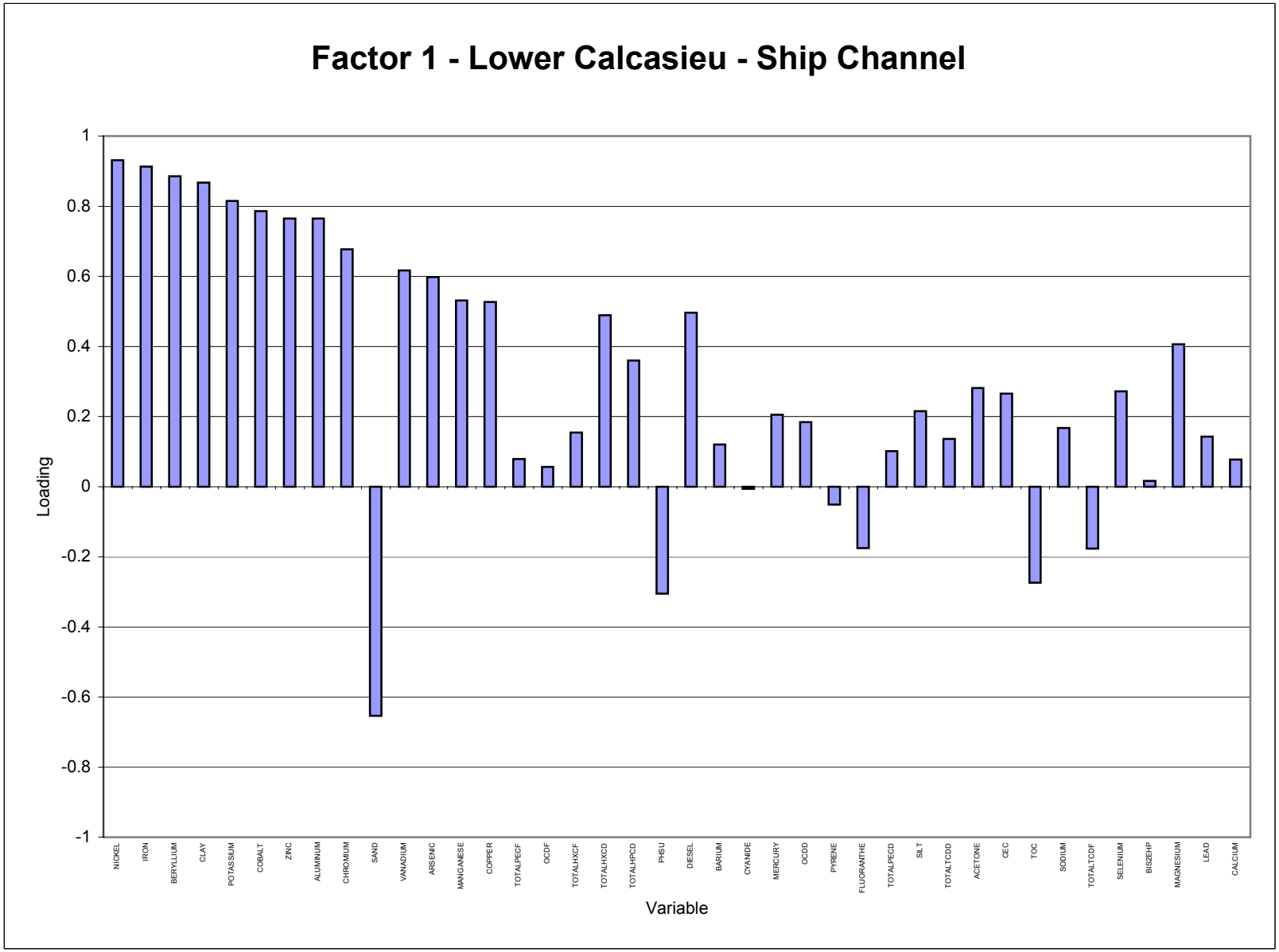
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-20
Principal Components Analysis Results



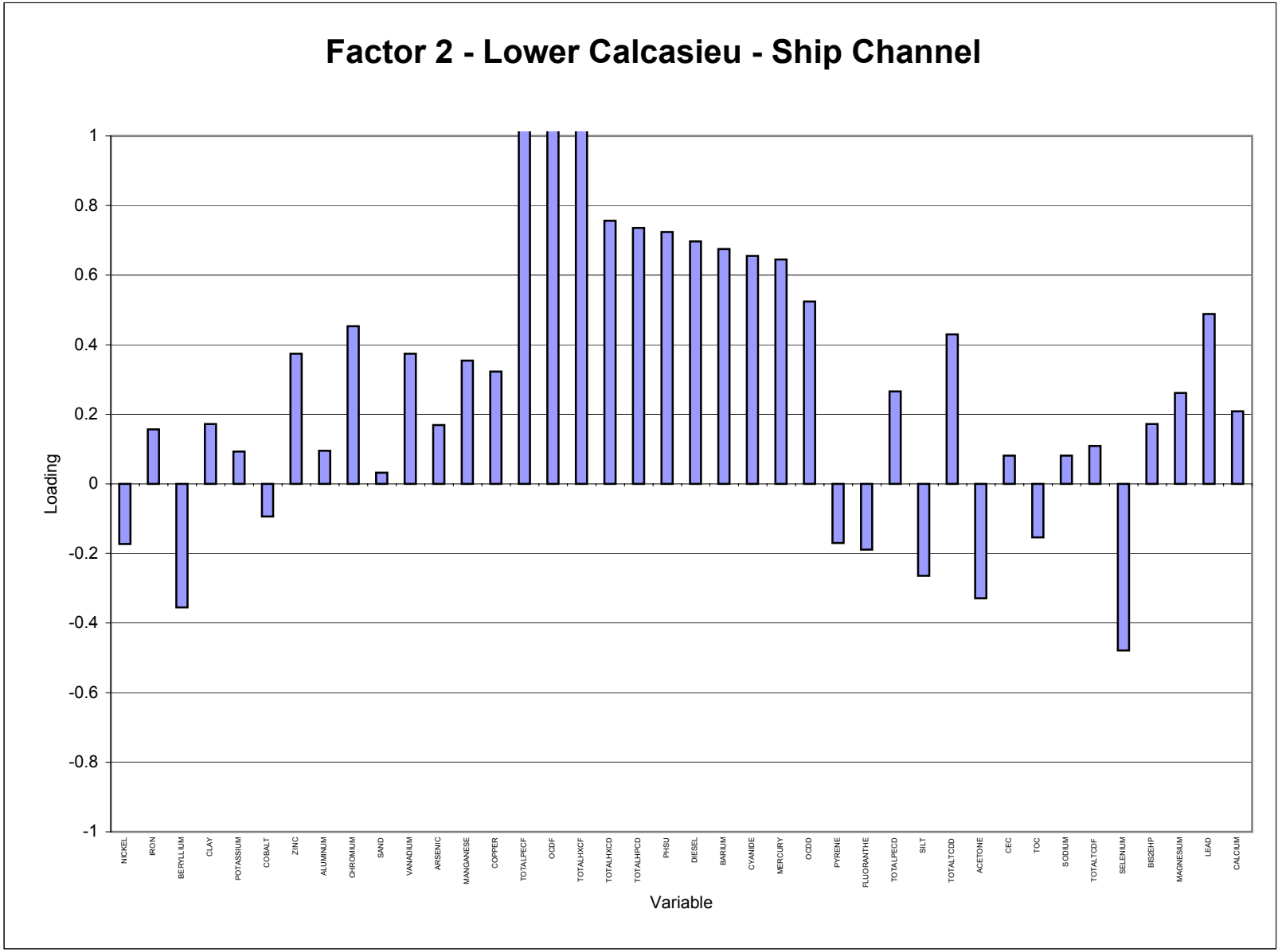
CDM

Table G-21
Lower Calcasieu-Ship Channel
Factor Loadings



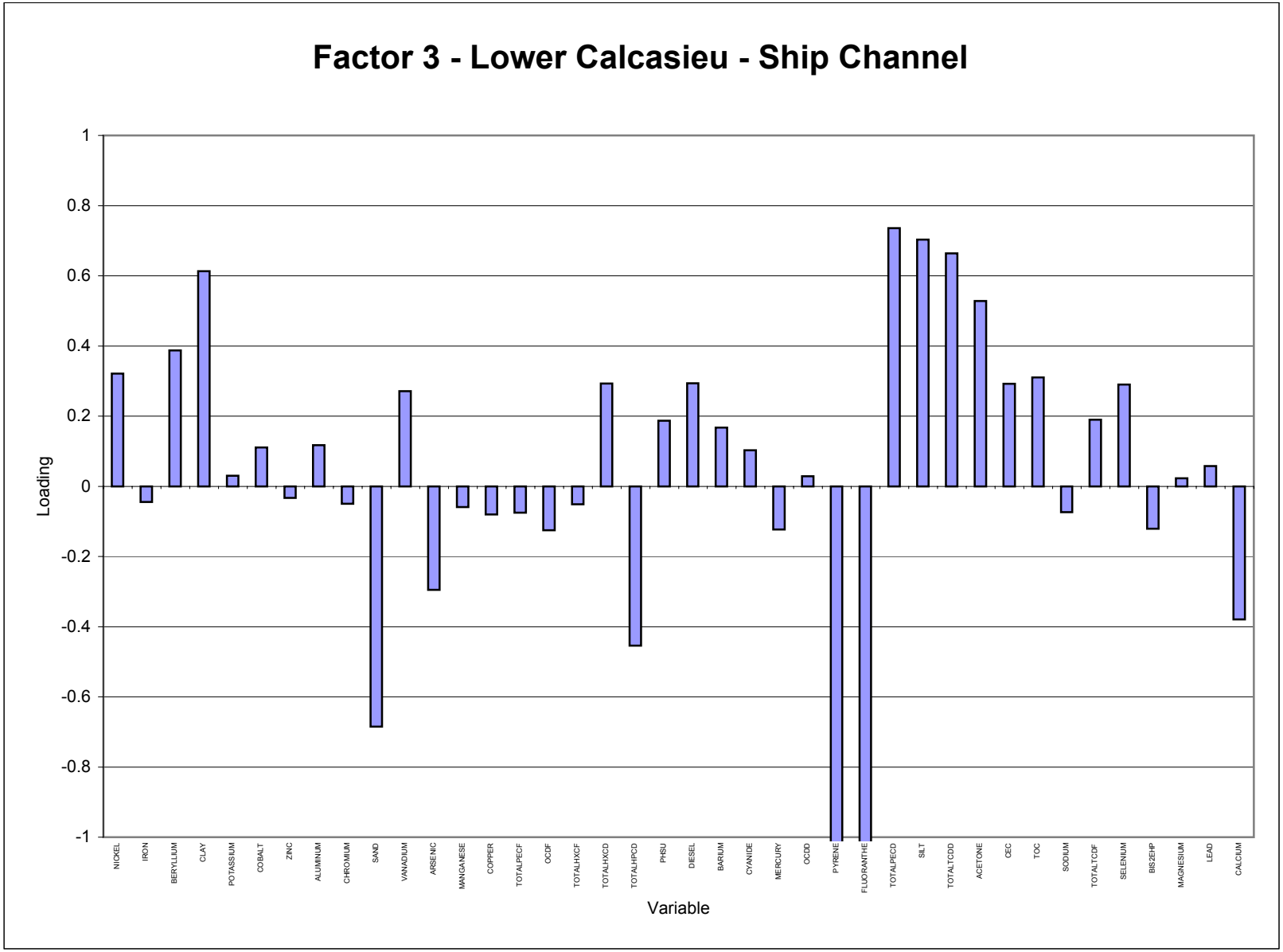
CDM

Table G-21
Lower Calcasieu-Ship Channel
Factor Loadings



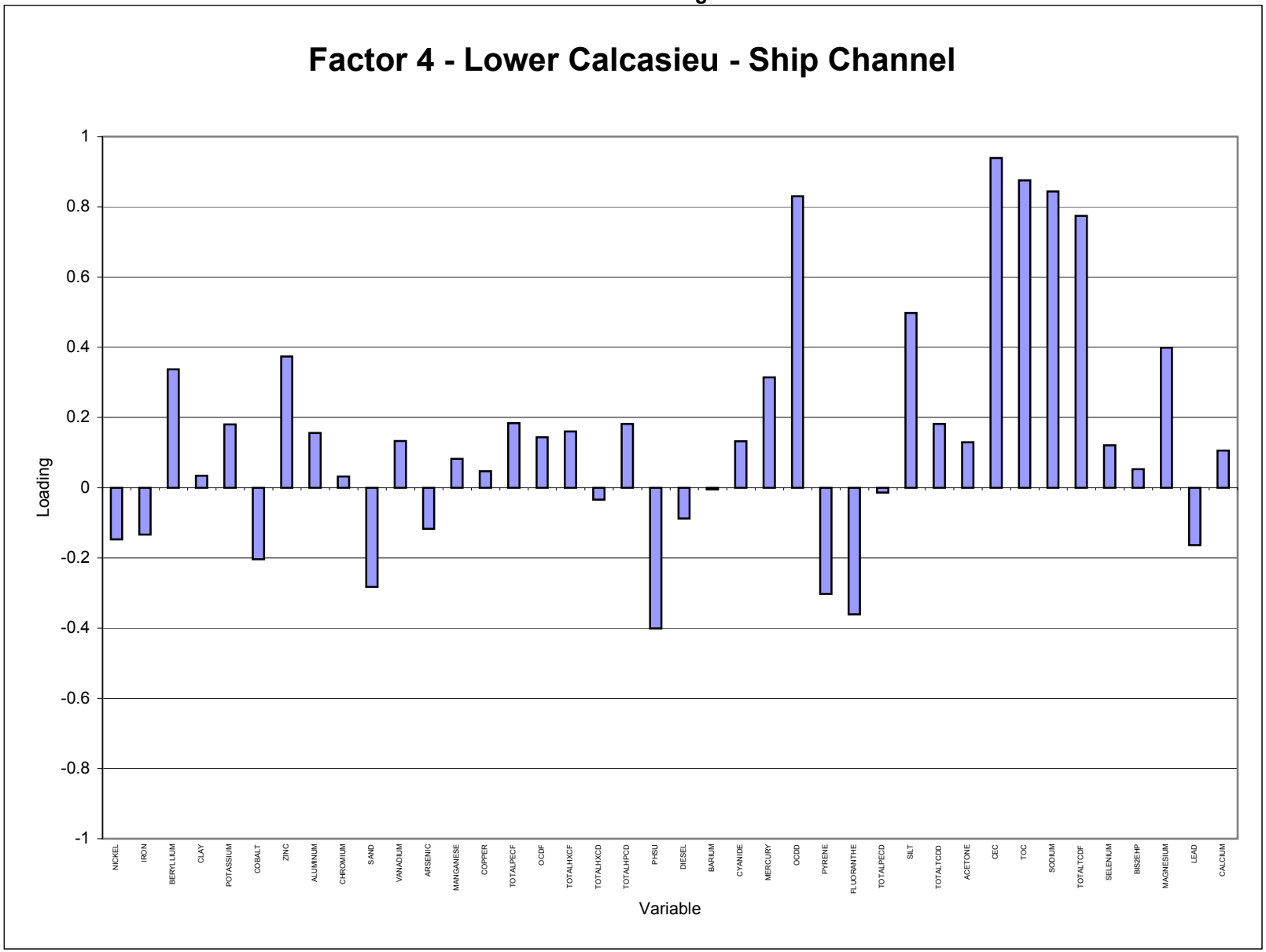
CDM

Table G-21
Lower Calcasieu-Ship Channel
Factor Loadings



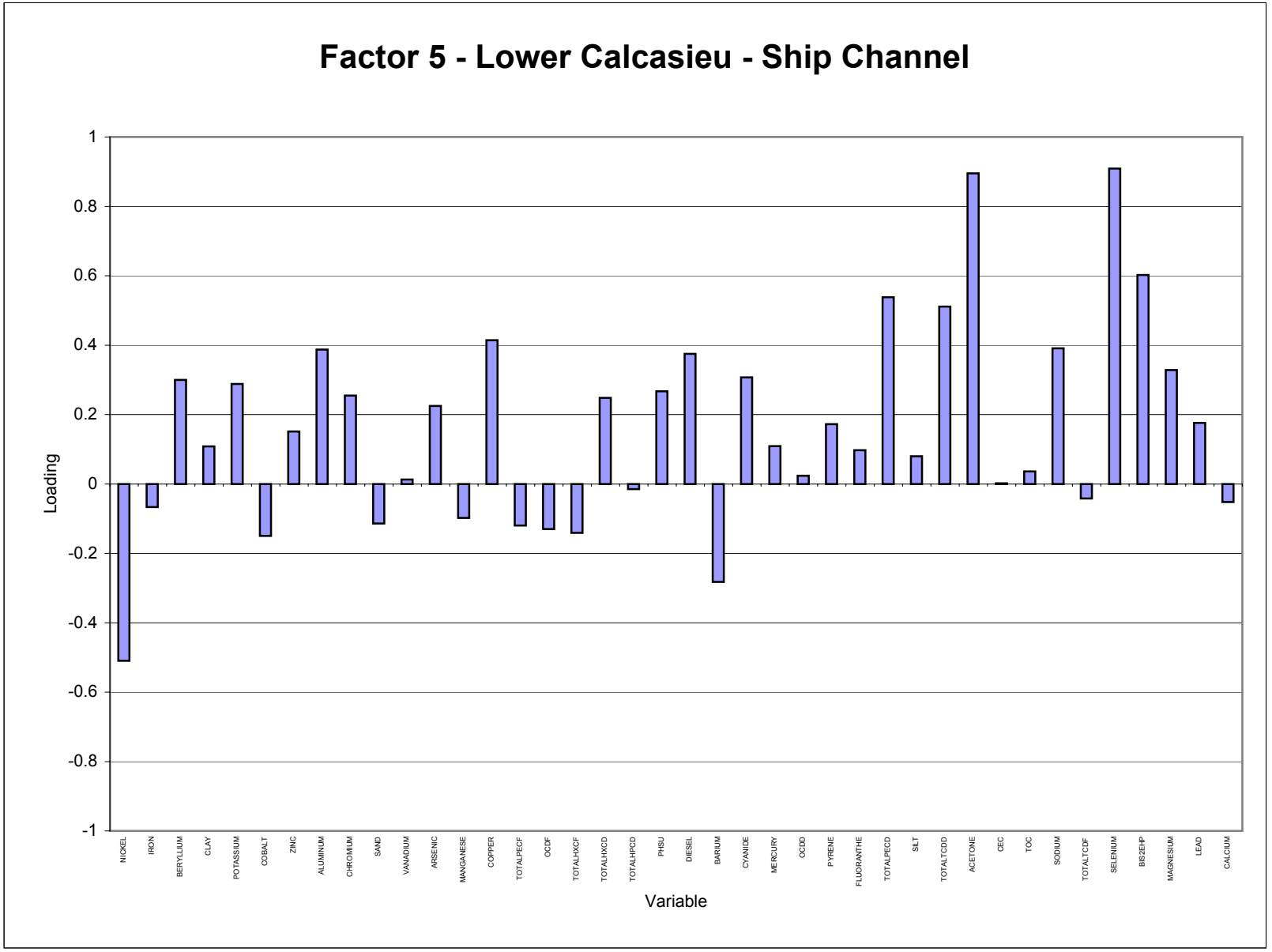
CDM

Table G-21
Lower Calcasieu-Ship Channel
Factor Loadings



CDM

Table G-21
Lower Calcasieu-Ship Channel
Factor Loadings



CDM

Table G-22
Lower Calcasieu - Ship Channel Energy System
Principal Component Analysis

Variable	Sum Ranking		Variable	Sum Ranking
CHROMIUM	0.298		SELENIUM	0.117
VANADIUM	0.289		DIESEL	0.073
ALUMINUM	0.283		TOTALHXCD	0.071
IRON	0.282		PYRENE	0.069
NICKEL	0.275		CLAY	0.069
ZINC	0.272		TOTALHPCD	0.068
ARSENIC	0.268		PHSU	0.068
POTASSIUM	0.267		FLUORANTHE	0.063
BERYLLIUM	0.257		TOTALHXCF	0.063
MAGNESIUM	0.248		SAND	0.062
BARIUM	0.243		TOTALTCDD	0.062
MANGANESE	0.237		TOTALPECF	0.061
COPPER	0.237		OCDF	0.061
MERCURY	0.235		SILT	0.058
COBALT	0.231		BIS2EHP	0.058
SODIUM	0.203		OCDD	0.054
ACETONE	0.198		TOC	0.052
LEAD	0.197		TOTALPECD	0.051
CYANIDE	0.178		CEC	0.049
CALCIUM	0.149		TOTALTCDF	0.039

Table G-23
Calcasieu Estuary Lower Calcasieu AOC - Ship Channel Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the Lower	95% Confidence Limit about the Upper	Percentiles 25th	Percentiles Median	Percentiles 75th	Percentiles IQR	Range of Detected Values Minimum	Range of Detected Values Maximum	Reporting Limit Minimum	Reporting Limit Maximum	Regression Equation
1,2,3,4,6,7,8-HpCDD PG/G	**10/10**	**88.4**	**67.391709**	**0.762349645**	**46.63019**	**130.1698**	**35.5**	**69**	**125**	**89.5**	**19**	**230**			ln(y) = 4.24019478767408 + 0.906435225024229*Z
1,2,3,4,6,7,8-HpCDF PG/G	**5/10**	28.02769	74.993026	2.675676279	-18.4535	74.50885	0.85957	4.67988	25.4793	24.6198	**8.7**	**190**	**0.32**	**2.7**	ln(y) = 1.54327307123062 + 2.51352997714087*Z
1,2,3,4,7,8,9-HpCDF PG/G	**3/10**	6.6038408	21.508899	3.257028643	-6.72751	19.93519	0.02841	0.30014	3.17072	3.14231	**5**	**52**	**0.28**	**1.6**	ln(y) = -1.20352233802415 + 3.49676419579365*Z
1,2,3,4,7,8-HxCDF PG/G	**4/10**	12.14205	35.701721	2.940337124	-9.98611	34.27021	0.21026	1.38687	9.14786	8.9376	**5.5**	**88**	**0.25**	**1.7**	ln(y) = 0.327051584925549 + 2.79812911878403*Z
1,2,3,6,7,8-HxCDD PG/G	**2/10**										**6.1**	**8.7**	**0.67**	**1.7**	
1,2,3,6,7,8-HxCDF PG/G	**1/10**										**20**	**20**	**0.21**	**1.7**	
1,2,3,7,8,9-HxCDD PG/G	**5/10**	4.5712179	3.9880511	0.872426384	2.099398	7.043038	1.78118	3.31923	6.18538	4.4042	**3.5**	**12**	**0.83**	**7**	ln(y) = 1.19973189421252 + 0.923266491976411*Z
1,2,3,7,8-PeCDF PG/G	**3/10**	2.7956541	7.784462	2.784486785	-2.02921	7.620514	0.07141	0.40845	2.33612	2.26471	**3.4**	**19**	**0.27**	**1.8**	ln(y) = -0.895378873954369 + 2.58661923888411*Z
1,2-Benzphenanthracene ug/Kg	**9/52**										**62**	**2200**	**370**	**1.8**	
2,3,4,7,8-PeCDF PG/G	**1/10**										**11**	**11**	**0.27**	**1.8**	
2,3,7,8-TCDD PG/G	**1/10**										**1.2**	**1.2**	**0.22**	**1.8**	
2,3,7,8-TCDD Equivalent PG/G	**10/10**	**5.8989541**	**10.53995**	**1.786748931**	**-0.63377**	**12.43168**	**2.39699**	**3.46563**	**5.3295**	**2.93251**	**1.518631**	**28.325**			ln(y) = 1.37051406953383 + 0.856305021010373*Z
2,3,7,8-TCDF PG/G	**5/10**	2.9670667	7.080978	2.386524706	-1.42177	7.355902	0.26587	0.93689	3.30153	3.03567	**1.8**	**18**	**0.23**	**0.71**	ln(y) = -6.51889312101018E-02 + 1.86828197464755*Z
2-Methylnaphthalene ug/Kg	**2/52**										**120**	**140**	**290**	**0.71**	
4,4'-DDD ug/Kg	**1/52**										**8**	**8**	**4**	**0.71**	
4,4'-DDT ug/Kg	**1/52**										**170**	**170**	**4**	**0.71**	
Acenaphthene ug/Kg	**2/52**										**290**	**2500**	**290**	**0.71**	
Acetone ug/Kg	**30/52**	22.867571	33.526236	1.466103951	13.75504	31.98011	6.13336	12.7912	26.6761	20.5427	**3**	**170**	**11**	**71**	ln(y) = 2.54875493705851 + 1.0902168659161*Z
Aluminum (Fume Or Dust) MG/KG	**52/52**	**8485.7308**	**5359.3474**	**0.631571701**	**7029.044**	**9942.418**	**4212.5**	**7765**	**11875**	**7662.5**	**318**	**20300**			ln(y) = 8.75811097030638 + 0.899845291686018*Z
Anthracene ug/Kg	**5/52**										**66**	**1200**	**310**	**0**	
Aroclor-1254 ug/Kg	**6/52**										**13**	**590**	**40**	**0**	
Aroclor-1260 ug/Kg	**1/52**										**60**	**60**	**40**	**0**	
Arsenic MG/KG	**52/52**	**3.6173077**	**4.7903156**	**1.324276507**	**2.315285**	**4.91933**	**1.55**	**2.35**	**3.9**	**2.35**	**0.18**	**29.6**			ln(y) = 0.916646595202625 + 0.892179306317894*Z
Barium MG/KG	**52/52**	**157.99423**	**247.45184**	**1.566208045**	**90.73606**	**225.2524**	**50.675**	**89.6**	**161**	**110.325**	**16**	**1430**			ln(y) = 4.54128563149205 + 1.00121036841947*Z
Benzo(a)anthracene ug/Kg	**8/52**										**50**	**2200**	**370**	**0**	
Benzo(a)pyrene ug/Kg	**9/52**										**63**	**930**	**370**	**0**	
Benzo(b)fluoranthene ug/Kg	**8/52**										**64**	**1200**	**370**	**0**	
Benzo(g,h,i)perylene ug/Kg	**7/52**										**100**	**350**	**310**	**0**	
Benzo(k)fluoranthene ug/Kg	**5/52**										**57**	**410**	**310**	**0**	
Beryllium MG/KG	**28/52**	0.502248	0.3723452	0.741357314	0.401043	0.603453	0.20312	0.36306	0.64892	0.4458	**0.07**	**1.2**	**0.05**	**1.2**	ln(y) = -1.01319697264377 + 0.861405611182345*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**22/52**	767.90976	5995.2429	7.807223193	-861.616	2397.435	78.969	171.969	374.495	295.526	**42**	**30000**	**400**	**7600**	ln(y) = 5.14731700374798 + 1.1543664444944*Z
Cadmium MG/KG	**2/52**										**0.75**	**1.6**	**0.27**	**7600**	
Calcium Metal MG/KG	**52/52**	**6926.9038**	**21369.896**	**3.085057358**	**1118.5**	**12735.31**	**926.25**	**2105**	**5065**	**4138.75**	**227**	**116000**			ln(y) = 7.71677707226832 + 1.3238066924306*Z
Carbazole ug/Kg	**1/52**										**820**	**820**	**290**	**0**	
Carbon Disulfide ug/Kg	**15/52**	5.5088244	6.0584422	1.099770433	3.862121	7.155528	2.3658	4.22152	7.53287	5.16708	**2**	**32**	**11**	**54**	ln(y) = 1.44019553019634 + 0.858929626186044*Z
Chromium MG/KG	**50/52**	13.110785	10.78978	0.822969792	10.17809	16.04348	5.57215	9.82283	17.3161	11.744	**1.2**	**58.9**	**1.4**	**5.9**	ln(y) = 2.28470955397387 + 0.840903055805478*Z
Cobalt MG/KG	**44/52**	4.3872487	3.7117903	0.846040555	3.378373	5.396125	1.92731	3.30262	5.65935	3.73204	**0.69**	**20.6**	**0.56**	**7.5**	ln(y) = 1.1947169053303 + 0.79887405657136*Z
Copper MG/KG	**42/52**	18.588895	17.858872	0.960728011	13.7348	23.44299	7.00284	12.8637	23.6297	16.6268	**3.3**	**80.8**	**4.2**	**31.1**	ln(y) = 2.55440950456982 + 0.901963138858958*Z
Cyanide MG/KG	**26/52**	0.1836486	0.2941988	1.601966087	0.103684	0.263613	0.04302	0.09523	0.21079	0.16777	**0.07**	**1.4**	**0.05**	**1.2**	ln(y) = -2.3514413350625 + 1.17852770143324*Z
delta-BHC ug/Kg	**1/52**										**3.1**	**3.1**	**2.1**	**1.2**	
Dibenzo(a,h)anthracene ug/Kg	**3/52**										**62**	**170**	**290**	**1.2**	
Dibenzofuran ug/Kg	**1/52**										**260**	**260**	**290**	**1.2**	
Dichloromethane ug/Kg	**12/52**	15.898718	33.254976	2.091676496	6.859913	24.93752	3.23468	7.45395	17.1768	13.9421	**4**	**150**	**7**	**77**	ln(y) = 2.00874450228889 + 1.23824990079148*Z
Di-n-butylphthalate ug/Kg	**4/52**										**53**	**77**	**310**	**77**	
Di-n-octylphthalate ug/Kg	**1/52**										**3700**	**3700**	**290**	**77**	

Table G-23
Calcasieu Estuary Lower Calcasieu AOC - Ship Channel Energy System
Summary Statistics - Surface Sediment Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Endrin ug/Kg	**2/52**										**0.93**	**2.5**	**4**	**77**	
Fluoranthene ug/Kg	**10/52**										**47**	**7600**	**370**	**77**	
Fluorene ug/Kg	**1/52**										**1000**	**1000**	**290**	**77**	
Hexachlorobenzene ug/Kg	**1/52**										**550**	**550**	**290**	**77**	
HPAH ug/kg	**12/12**	**3818.75**	**7631.332**	**1.998384824**	**-499.083**	**8136.583**	**425.25**	**1029.5**	**4117.5**	**3692.25**	**73**	**22900**			ln(y) = 7.03106168310015 + 1.97836093409318*Z
Indeno(1,2,3-cd)pyrene ug/Kg	**6/52**										**46**	**440**	**310**	**77**	
Iron MG/KG	**52/52**	**7599.8654**	**6123.5702**	**0.805747196**	**5935.46**	**9264.271**	**2895**	**6350**	**10175**	**7280**	**453**	**28000**			ln(y) = 8.60784094437961 + 0.924046934476609*Z
Lead MG/KG	**52/52**	**22.05**	**34.767346**	**1.576750407**	**12.60013**	**31.49987**	**10.65**	**13.95**	**20.05**	**9.4**	**1.5**	**213**			ln(y) = 2.71308268806207 + 0.818642199086483*Z
LPAH ug/kg	**6/6**	**1257.1667**	**2714.2339**	**2.159008774**	**-914.673**	**3429.006**	**80.5**	**421.5**	**2160**	**2079.5**	**79**	**5490**			ln(y) = 6.05189608246747 + 2.04294793882885*Z
Magnesium MG/KG	**52/52**	**4151.0962**	**6358.4459**	**1.531751043**	**2422.851**	**5879.341**	**1725**	**3180**	**5375**	**3650**	**207**	**39200**			ln(y) = 7.93006749731451 + 0.943225591551868*Z
Manganese MG/KG	**52/52**	**188.29038**	**308.92139**	**1.640664739**	**104.3246**	**272.2562**	**66.95**	**104**	**188.5**	**121.55**	**3.5**	**1770**			ln(y) = 4.61464484909997 + 1.1874009209714*Z
Mercury MG/KG	**10/52**										**0.08**	**1.7**	**0.06**	**0**	
Methylcyclohexane ug/Kg	**1/52**										**2**	**2**	**11**	**0**	
Naphthalene ug/Kg	**2/52**										**68**	**130**	**290**	**0**	
Nickel MG/KG	**37/52**	8.4020472	5.8302794	0.693911767	6.817359	9.986735	3.95113	6.63513	11.1424	7.19124	**0.78**	**29.3**	**8.5**	**38.7**	ln(y) = 1.89237883729992 + 0.768889142859323*Z
OCDD PG/G	**10/10**	**1913**	**1215.1621**	**0.635212795**	**1159.835**	**2666.165**	**1025**	**1450**	**3025**	**2000**	**430**	**4000**			ln(y) = 7.3372986883418 + 0.870841051241696*Z
OCDF PG/G	**6/10**	181.18198	514.53589	2.839884418	-137.731	500.0946	1.24655	12.4012	123.373	122.126	**13**	**1300**	**0.62**	**6.3**	ln(y) = 2.51779510627627 + 3.4076706211169*Z
Phenanthrene ug/Kg	**4/52**										**79**	**540**	**310**	**6.3**	
Potassium MG/KG	**51/52**	1928.1097	1179.6426	0.611812985	1607.479	2248.74	**911**	**1815**	**2775**	**1864**	**111**	**4740**	**250**	**250**	ln(y) = 7.3247544577615 + 0.803160777374054*Z
Pyrene ug/Kg	**12/52**	394.51138	1272.7762	3.226209118	48.56687	740.4559	61.6275	159.377	412.168	350.541	**53**	**7400**	**370**	**7600**	ln(y) = 5.07126939010673 + 1.40933992818019*Z
Selenium MG/KG	**6/52**										**0.2**	**3.5**	**0.16**	**7600**	
Sodium MG/KG	**47/52**	8607.765	7508.2754	0.872267693	6566.993	10648.54	3601.73	6291.08	10988.5	7386.79	**1200**	**33800**	**2830**	**10700**	ln(y) = 8.74688727622077 + 0.827243870862517*Z
Thallium MG/KG	**2/52**										**0.7**	**2.4**	**0.26**	**10700**	
Total HpCDD PG/G	**10/10**	**325.6**	**248.18391**	**0.762235597**	**171.774**	**479.426**	**170**	**255**	**442.5**	**272.5**	**56**	**780**			ln(y) = 5.54052101616314 + 0.896921519534717*Z
Total HpCDF PG/G	**6/10**	58.893462	156.91658	2.664414279	-38.3644	156.1514	0.63866	5.57657	48.6932	48.0545	**0.38**	**400**	**0.4**	**2.7**	ln(y) = 1.7185746014263 + 3.21417905992613*Z
Total HxCDD PG/G	**10/10**	**80.91**	**51.599667**	**0.637741534**	**48.92819**	**112.8918**	**49.5**	**73.5**	**115**	**65.5**	**7.1**	**180**			ln(y) = 4.13359128775147 + 0.994184572130693*Z
Total HxCDF PG/G	**5/10**	30.272119	96.098713	3.174495749	-29.2905	89.83472	0.74424	4.17097	23.3756	22.6313	**11**	**230**	**0.26**	**1.5**	ln(y) = 1.42814867826223 + 2.55646853747661*Z
Total Organic Carbon MG/KG	**10/10**	**37088**	**59009.986**	**1.591080306**	**513.2315**	**73662.77**	**3145**	**20900**	**50812.5**	**47667.5**	**775**	**169500**			ln(y) = 9.45559826288209 + 2.11377178226982*Z
Total PCB ug/Kg	**52/52**	**319.13462**	**187.62427**	**0.587915747**	**268.1378**	**370.1315**	**187.5**	**256**	**370.5**	**183**	**160.5**	**1010**			ln(y) = 5.64271622801246 + 0.477651170275184*Z
Total PeCDD PG/G	**6/10**	15.359936	11.321546	0.737082855	8.34277	22.3771	7.26897	12.3376	20.9406	13.6716	**7.1**	**28**	**0.71**	**2.7**	ln(y) = 2.51265080477791 + 0.784700767742909*Z
Total PeCDF PG/G	**4/10**	19.037733	63.205709	3.320022955	-20.1376	58.21304	0.19852	1.53033	11.797	11.5985	**8.5**	**150**	**0.27**	**5.8**	ln(y) = 0.425481391101021 + 3.02936372341883*Z
Total TCDD PG/G	**9/10**	15.290662	13.13574	0.85906937	7.149047	23.43228	**1.29**	**11.5**	**29.25**	**27.96**	**0.66**	**31**	**0.45**	**0.45**	ln(y) = 2.01331091226045 + 1.7136704338698*Z
Total TCDF PG/G	**8/10**	74.450698	144.60287	1.942263395	-15.1751	164.0765	**4.275**	**21**	**122.5**	**118.225**	**5.6**	**400**	**0.3**	**0.3**	ln(y) = 3.04855384783808 + 2.11104906034618*Z
TPAH ug/kg	**12/12**	**4447.3333**	**8179.7099**	**1.839239228**	**-180.773**	**9075.44**	**486**	**1128**	**4534.5**	**4048.5**	**73**	**23950**			ln(y) = 7.12583187598436 + 2.0243088290327*Z
Vanadium (Fume Or Dust) MG/KG	**51/52**	17.619313	12.449989	0.706610395	14.23537	21.00326	**9.75**	**17**	**25.075**	**15.325**	**0.54**	**71**	**3.5**	**3.5**	ln(y) = 2.59123545390607 + 0.864893433267091*Z
Zinc MG/KG	**37/52**	31.334318	22.734119	0.725534185	25.15511	37.51352	14.5474	24.2998	40.59	26.0425	**8.2**	**104**	**8**	**59.1**	ln(y) = 3.19046728645575 + 0.760993039109172*Z
Cation Exchange Capacity meq/100g	**10/10**	**26.024**	**17.383565**	**0.667982063**	**15.24955**	**36.79845**	**13.215**	**24.65**	**40.2**	**26.985**	**2.98**	**58.4**			ln(y) = 2.99383658740411 + 1.00453164884308*Z
Diesel Range Organics ug/Kg	**4/10**	73174.124	105903.05	1.447274627	7534.732	138813.5	8960.67	28742.6	92195.8	83235.1	**67000**	**280000**	**13000**	**28000**	ln(y) = 10.2661349356052 + 1.72879467346326*Z
Field Photoionization Detector ppm	**6/6**	**4.8666667**	**5.6909036**	**1.169363752**	**0.312995**	**9.420338**	**0.75**	**3.05**	**9.225**	**8.475**	**0.6**	**14.1**			ln(y) = 1.02477138051984 + 1.57418285708939*Z
pH standard units	**10/10**	**7.53**	**0.5887917**	**0.078192793**	**7.165063**	**7.894937**	**7**	**7.55**	**8**	**1**	**6.6**	**8.4**			ln(y) = 2.01623858721163 + 9.16981637215313E-02*Z
Percent Clay %	**10/10**	**36.86**	**18.15367**	**0.492503259**	**25.60824**	**48.11176**	**25.725**	**38.3**	**52.85**	**27.125**	**5.4**	**58.1**			ln(y) = 3.4213189527738 + 0.809495328841318*Z
Percent Sand %	**10/10**	**26.41**	**30.094668**	**1.139517904**	**7.757132**	**45.06287**	**9.7**	**14.55**	**37.5**	**27.8**	**0.2**	**84.9**			ln(y) = 2.5623584891133 + 1.73997639692574*Z
Percent Silt %	**10/10**	**36.729**	**15.523093**	**0.422638587**	**27.10769**	**46.35031**	**28.9**	**42**	**43.875**	**14.975**	**9.69**	**60.7**			ln(y) = 3.48798612181157 + 0.599150637332179*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-24
Calcasieu Estuary Lower Calcasieu AOC - Ship Channel Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Aluminum mg/L Dissolved	1/5										0.0438	0.0438	0.0222	0	
Aluminum mg/L Total	5/5	0.38	0.1569136	0.412930487	0.242459	0.517541	0.24	0.36	0.53	0.29	0.18	0.54			ln(y) = -1.04210701735606 + 0.579618275398685*Z
Ammonia as N mg/L	1/1										0.44	0.44			
Arsenic mg/L Dissolved	2/5										0.0018	0.0042	0.0014	0	
Arsenic mg/L Total	3/5	0.0025951	0.0005023	0.19354786	0.002155	0.003035	0.00232	0.00257	0.00285	0.00053	0.0025	0.003	0.0025	0.0029	ln(y) = -5.962551417263 + 0.151739374720051*Z
Barium mg/L Dissolved	5/5	0.08772	0.0071081	0.081031576	0.081489	0.093951	0.0812	0.0863	0.09495	0.01375	0.0799	0.0954			ln(y) = -2.4361388475509 + 0.102570122682609*Z
Barium mg/L Total	3/3	0.1035333	0.0069607	0.067231578	0.095657	0.11141	0.0976	0.103	0.11	0.0124	0.0976	0.11			ln(y) = -2.26905966316844 + 8.87012748126477E-02*Z
bis(2-Ethylhexyl)phthalate ug/L	3/5										2	5	10	0	
Bromide mg/L	1/1										42.3	42.3			
Cadmium mg/L Dissolved	2/5										0.0014	0.002	0.0026	0	
Cadmium mg/L Total	2/3										0.0014	0.0018	0.0026	0	
Calcium Metal mg/L Dissolved	5/5	220.2	17.439118	0.079196719	204.9139	235.4861	206	227	231	25	195	234			ln(y) = 5.39250273477955 + 8.81616812791209E-02*Z
Calcium Metal mg/L Total	3/3	235.66667	22.312633	0.094678783	210.4175	260.9158	216	235	256	40	216	256			ln(y) = 5.4600137887693 + 0.126002501897673*Z
Caprolactam ug/L	1/5										6	6	10	0	
Copper mg/L Dissolved	5/5	0.00768	0.0005906	0.076901246	0.007162	0.008198	0.00715	0.0076	0.00825	0.0011	0.007	0.0084			ln(y) = -4.87134957657622 + 9.86299849402794E-02*Z
Copper mg/L Total	5/5	0.01384	0.0167483	1.210140699	-0.00084	0.028521	0.0074	0.0084	0.023	0.0156	0.0074	0.036			ln(y) = -4.5042961314382 + 0.74034631197 37*Z
Iron mg/L Total	3/3	0.303	0.1928332	0.63641333	0.084789	0.521211	0.214	0.225	0.47	0.256	0.214	0.47			ln(y) = -1.26281890833868 + 0.583483649433825*Z
Lead mg/L Total	4/5	0.0008624	0.0003214	0.372660485	0.000581	0.001144	-0.002	-0.002	-0.002	0	0.00045	0.0012	0.002	0.002	ln(y) = -7.10349261830762 + 0.53452008864249*Z
Magnesium mg/L Dissolved	5/5	735.4	59.550293	0.080976738	683.2019	787.5981	680.5	732	792	111.5	665	806			ln(y) = 6.59794549632732 + 0.104352052901297*Z
Magnesium mg/L Total	3/3	809	78.962486	0.09760505	719.6455	898.3545	741	804	882	141	741	882			ln(y) = 6.69326398349395 + 0.129185877051886*Z
Manganese mg/L Dissolved	5/5	0.06108	0.0262738	0.430154211	0.03805	0.08411	0.04785	0.055	0.07735	0.0295	0.0441	0.098			ln(y) = -2.83574401306672 + 0.362642620241444*Z
Manganese mg/L Total	3/3	0.0717	0.0038964	0.054343182	0.067291	0.076109	0.068	0.0724	0.0747	0.0067	0.068	0.0747			ln(y) = -2.63602391341329 + 6.96928957922901E-02*Z
Mercury mg/L Dissolved	1/5										0.000058	0.000058	0.0001	0	
Mercury mg/L Total	1/5										0.000049	0.000049	0.0001	0	
Nickel mg/L Dissolved	5/5	0.0046	0.0009702	0.210913898	0.00375	0.00545	0.004	0.0043	0.00535	0.00135	0.004	0.006			ln(y) = -5.39365013440546 + 0.205909037573924*Z
Nickel mg/L Total	5/5	0.00528	0.0020255	0.383610763	0.003505	0.007055	0.0038	0.0046	0.0071	0.0033	0.0032	0.0081			ln(y) = -5.29356238156562 + 0.463437045906909*Z
Potassium mg/L Dissolved	5/5	220.2	16.314666	0.074090218	205.8996	234.5004	206.5	215	236.5	30	203	241			ln(y) = 5.39249716860878 + 9.31629751905313E-02*Z
Potassium mg/L Total	3/3	244	18.056776	0.074003179	223.5668	264.4332	232	239	261	29	232	261			ln(y) = 5.49590711030684 + 8.73516263172203E-02*Z
Selenium mg/L Dissolved	2/5										0.0021	0.0073	0.0026	0	
Selenium mg/L Total	1/5										0.014	0.014	0.0026	0	
Sodium mg/L Dissolved	5/5	8112	2131.905	0.262808802	6243.303	9980.697	5840	9300	9790	3950	5500	9840			ln(y) = 8.97151079749931 + 0.338318917647576*Z
Sodium mg/L Total	3/3	9826.6667	870.78097	0.088614074	8841.285	10812.05	9000	9980	10500	1500	9000	10500			ln(y) = 9.19081625392316 + 0.114323022036037*Z
Thallium mg/L Dissolved	3/5	0.0030077	0.0060361	2.006859097	-0.00228	0.008299	0.00024	-0.002	0.007	0.00676	0.00028	0.0073	0.002	0.002	ln(y) = -6.89529531036606 + 2.1329642098183*Z
Thallium mg/L Total	1/5										0.005	0.005	0.002	0.002	
Total Organic Carbon mg/L	1/1										4	4			
Vanadium mg/L Dissolved	2/5										0.0026	0.0028	0.002	0.002	
Vanadium mg/L Total	2/3										0.0028	0.0036	0.002	0.002	
Bicarbonate Alkalinity mg/L	1/1										84.7	84.7			
Biochemical Oxygen Demand mg/L	1/1										2.9	2.9			
Chemical Oxygen Demand (COD) mg/L	1/1										136	136			
Chloride mg/L	1/1										11500	11500			
Dissolved Oxygen %	49/49	8.8661435	1.2052195	0.135935032	8.528682	9.203605	7.815	8.73	9.6875	1.8725	7.02	11.79			ln(y) = 2.17354803347416 + 0.139215367852199*Z
Field Conductivity ms/cm	49/49	21610.544	15562.613	0.720139808	17253.01	25968.08	3400	29700	37100	33700	3200	41800			ln(y) = 9.49817912901389 + 1.02549533633078*Z
Field pH standard units	49/49	7.9789241	0.5189595	0.065041283	7.833615	8.124233	7.79357	8.1	8.24	0.44643	5.29	8.57			ln(y) = 2.074712436344 + 5.24187669585081E-02*Z
Field Specific Gravity NO UNITS	49/49	14.836735	1.8266242	0.123114976	14.32528	15.34819	14	15	16	2	11	19			ln(y) = 2.68943941972342 + 0.130100858069954*Z

Table G-24
Calcasieu Estuary Lower Calcasieu AOC - Ship Channel Energy System
Summary Statistics - Surface Water Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Field Temperature deg c	**49/49**	**20.874158**	**2.1588084**	**0.103420145**	**20.26969**	**21.47862**	**19.4**	**20.275**	**22.1**	**2.7**	**17.644444**	**28.4**			ln(y) = 3.03385169229688 + 0.095875762391278*Z
Field Total Dissolved Solids mg/L	**49/49**	**21233.503**	**1989.6269**	**0.093702242**	**20676.41**	**21790.6**	**20000**	**21000**	**23000**	**3000**	**17000**	**26000**			ln(y) = 9.95895433416656 + 0.097752863299533*Z
Field Turbidity NTU	**39/39**	**34.354991**	**36.926931**	**1.074863641**	**22.76543**	**45.94455**	**10**	**26**	**47**	**37**	**1.5**	**195**			ln(y) = 3.10442948032455 + 1.03791701739932*Z
Hardness, as CaCO3 mg/L	**1/1**										**3850**	**3850**			
Nitrate-Nitrite mg/L	**1/1**										**0.15**	**0.15**			
Salinity ppt	**49/49**	**21.995546**	**2.383373**	**0.108357075**	**21.3282**	**22.66289**	**21**	**22**	**24**	**3**	**17**	**27**			ln(y) = 3.08493634750895 + 0.113686559945968*Z
Sulfate mg/L	**1/1**										**1590**	**1590**			
Total Alkalinity mg/L	**1/1**										**84.7**	**84.7**			
Total Suspended Solids mg/L	**1/1**										**52.8**	**52.8**			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table G-25
Calcasieu Estuary Lower Calcasieu AOC - Ship Channel Energy System
Summary Statistics - Water Quality Results

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Ammonia as N mg/L	**1/1**										**0.44**	**0.44**			
Dissolved Oxygen %	**49/49**	**8.8661435**	**1.2052195**	**0.135935032**	**8.528682**	**9.203605**	**7.815**	**8.73**	**9.6875**	**1.8725**	**7.02**	**11.79**			ln(y) = 2.17354803347416 + 0.139215367852199*Z
Field Conductivity ms/cm	**49/49**	**21610.544**	**15562.613**	**0.720139808**	**17253.01**	**25968.08**	**3400**	**29700**	**37100**	**33700**	**3200**	**41800**			ln(y) = 9.49817912901389 + 1.02549533633078*Z
Field pH standard units	**49/49**	**7.9789241**	**0.5189595**	**0.065041283**	**7.833615**	**8.124233**	**7.79357**	**8.1**	**8.24**	**0.44643**	**5.29**	**8.57**			ln(y) = 2.074712436344 + 5.24187669585081E-02*Z
Field Redox Potential millivolts	**49/49**	**129.69246**	**34.113408**	**0.263033086**	**120.1407**	**139.2442**	**106**	**127**	**152.188**	**46.1875**	**26**	**197**			ln(y) = 4.82152924220892 + 0.31441562782174*Z
Field Specific Gravity NO UNITS	**49/49**	**14.836735**	**1.8266242**	**0.123114976**	**14.32528**	**15.34819**	**14**	**15**	**16**	**2**	**11**	**19**			ln(y) = 2.68943941972342 + 0.130100858069954*Z
Field Temperature deg c	**49/49**	**20.874158**	**2.1588084**	**0.103420145**	**20.26969**	**21.47862**	**19.4**	**20.275**	**22.1**	**2.7**	**17.644444**	**28.4**			ln(y) = 3.03385169229688 + 0.095875762391278*Z
Field Total Dissolved Solids mg/L	**49/49**	**21233.503**	**1989.6269**	**0.093702242**	**20676.41**	**21790.6**	**20000**	**21000**	**23000**	**3000**	**17000**	**26000**			ln(y) = 9.95895433416656 + 0.097752863299533*Z
Field Turbidity NTU	**39/49**	28.19272	35.076444	1.244166729	18.37132	38.01412	6.63609	15.2701	35.1374	28.5013	**1.5**	**195**	**0.3**	**10**	ln(y) = 2.72589473330779 + 1.23611018914739*Z
Hardness, as CaCO3 mg/L	**1/1**										**3850**	**3850**			
Salinity ppt	**49/49**	**21.995546**	**2.383373**	**0.108357075**	**21.3282**	**22.66289**	**21**	**22**	**24**	**3**	**17**	**27**			ln(y) = 3.08493634750895 + 0.113686559945968*Z
Total Alkalinity mg/L	**1/1**										**84.7**	**84.7**			
Total Kjeldahl Nitrogen mg/L	**1/1**										**1.2**	**1.2**			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-01
Bayou D'Inde
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**3/18**										**1.13**	**1.49**	**0.368**	**1.11**	
1,2,3,4,6,7,8-HpCDF PG/G	**16/18**	2.8674945	2.9549227	1.030489421	1.50239	4.232599	0.51202	1.44981	4.1052	3.59318	**0.0793**	**9.51**	**0.822**	**1.23**	ln(y) = 0.371433949475799 + 1.54381120010056*Z
1,2,3,4,7,8,9-HpCDF PG/G	**4/18**	0.4320428	0.2444283	0.565750211	0.319123	0.544963	0.24552	0.37464	0.57168	0.32616	**0.646**	**1.06**	**0.0389**	**0.545**	ln(y) = -0.98178212490212 + 0.626827953484657*Z
1,2,3,4,7,8-HxCDD PG/G	**1/18**										**0.152**	**0.152**	**0.0746**	**0.545**	
1,2,3,4,7,8-HxCDF PG/G	**12/18**	2.2062222	2.1930538	0.994031248	1.193083	3.219361	0.54133	1.27215	2.98962	2.44829	**0.798**	**7.23**	**0.0956**	**0.34**	ln(y) = 0.240708197871135 + 1.26735455532985*Z
1,2,3,6,7,8-HxCDD PG/G	**4/18**	0.1428483	0.0703815	0.492700793	0.110334	0.175363	0.09831	0.13321	0.18049	0.08217	**0.165**	**0.342**	**0.131**	**0.412**	ln(y) = -2.01583727754646 + 0.450532313793545*Z
1,2,3,6,7,8-HxCDF PG/G	**15/18**	7.9042935	9.2517214	1.170467843	3.630216	12.17837	0.70602	2.74021	10.6353	9.92927	**0.114**	**27.6**	**0.147**	**0.42**	ln(y) = 1.00803530301857 + 2.01151626548082*Z
1,2,3,7,8,9-HxCDD PG/G	**1/18**										**0.162**	**0.162**	**0.0767**	**0.42**	
1,2,3,7,8,9-HxCDF PG/G	**7/18**	0.1633479	0.1512216	0.925764075	0.093487	0.233209	0.06129	0.11729	0.22444	0.16315	**0.101**	**0.505**	**0.0255**	**4.72**	ln(y) = -2.14312597554765 + 0.962620447916926*Z
1,2,3,7,8-PeCDD PG/G	**17/18**	0.2680945	0.1085076	0.404736286	0.217967	0.318222	**-0.173**	**0.2715**	**0.35825**	**0.53125**	**0.0792**	**0.448**	**0.173**	**0.173**	ln(y) = -1.40626046093387 + 0.499502482848401*Z
1,2,3,7,8-PeCDF PG/G	**14/18**	2.5514461	2.1873913	0.857314313	1.540923	3.561969	0.52536	1.38274	3.63934	3.11398	**0.134**	**6.38**	**0.189**	**0.413**	ln(y) = 0.324064969153171 + 1.43540831848303*Z
2,3,4,6,7,8-HxCDF PG/G	**13/18**	0.2633376	0.2159583	0.820081373	0.16357	0.363105	0.09201	0.18289	0.36355	0.27154	**0.0479**	**0.736**	**0.0357**	**0.158**	ln(y) = -1.69884333353585 + 1.01901554589949*Z
2,3,4,7,8-PeCDF PG/G	**15/18**	4.9428625	4.058583	0.821099703	3.067893	6.817832	1.16663	2.85265	6.97534	5.80871	**0.337**	**11.4**	**0.461**	**0.553**	ln(y) = 1.04824969612962 + 1.32623290871846*Z
2,3,7,8-TCDD Equivalent PG/G	**18/18**	**4.8221419**	**4.0669543**	**0.843391673**	**2.943305**	**6.700979**	**0.62149**	**4.37254**	**8.64138**	**8.01989**	**0.404458**	**12.2224**			ln(y) = 1.03727650419166 + 1.31696968853252*Z
2,3,7,8-TCDD PG/G	**14/18**	0.182942	0.0928975	0.507797509	0.140026	0.225858	0.10603	0.1594	0.23963	0.13359	**0.0902**	**0.343**	**0.0448**	**0.143**	ln(y) = -1.83634802376201 + 0.604680887859201*Z
2,3,7,8-TCDF PG/G	**18/18**	**6.9561111**	**6.2034801**	**0.891802905**	**4.09025**	**9.821973**	**1.135**	**4.89**	**12.625**	**11.49**	**0.735**	**17.6**			ln(y) = 1.43523507290721 + 1.24174205319983*Z
2-Methylphenol ug/Kg	**5/78**										**160**	**340**	**40**	**1000**	
4,4'-DDT ug/Kg	**1/78**										**81**	**81**	**10**	**10**	
4-Methylphenol ug/Kg	**13/78**										**150**	**6300**	**40**	**1000**	
Acetophenone ug/Kg	**2/77**										**290**	**350**	**40**	**1000**	
Aroclor-1254 ug/Kg	**68/78**	129.2449	170.38114	1.318281304	91.43285	167.057	**48**	**69.5**	**140**	**92**	**12**	**820**	**10**	**10**	ln(y) = 4.32012537530452 + 1.04770650524362*Z
Arsenic MG/KG	**77/78**	0.2092799	0.1134619	0.54215389	0.1841	0.23446	**0.1575**	**0.195**	**0.24**	**0.0825**	**0.08**	**0.91**	**0.06**	**0.06**	ln(y) = -1.64566523025195 + 0.385803515126059*Z
Benzaldehyde ug/Kg	**49/78**	484.30277	599.82334	1.238529635	351.1862	617.4193	114.879	260.235	589.509	474.63	**28**	**3300**	**40**	**800**	ln(y) = 5.56158436202007 + 1.21287252179765*Z
Benzyl Butyl Phthalate ug/Kg	**3/74**										**110**	**2000**	**40**	**800**	
beta-BHC ug/Kg	**6/78**										**11**	**20**	**10**	**10**	
bis(2-Ethylhexyl)phthalate ug/Kg	**2/74**										**67**	**400**	**40**	**800**	
Cadmium MG/KG	**5/78**										**0.01**	**0.03**	**0.01**	**0.06**	
Chromium MG/KG	**78/78**	**0.3794872**	**0.2535675**	**0.668184687**	**0.323214**	**0.43576**	**0.29**	**0.35**	**0.4025**	**0.1125**	**0.19**	**2.1**			ln(y) = -1.03717140436557 + 0.29785835431504*Z
Copper MG/KG	**78/78**	**3.9167949**	**2.7006106**	**0.689495033**	**3.317458**	**4.516131**	**2**	**2.85**	**5.2**	**3.2**	**0.91**	**17.4**			ln(y) = 1.18793250296711 + 0.596408416556338*Z
Di-n-butylphthalate ug/Kg	**7/77**										**140**	**11000**	**40**	**800**	
Endosulfan Sulfate ug/Kg	**3/78**										**13**	**16**	**10**	**10**	
Hexachloro-1,3-butadiene ug/Kg	**1/77**										**19**	**19**	**40**	**800**	
Iron MG/KG	**78/78**	**22.710256**	**12.78637**	**0.563021806**	**19.87262**	**25.54789**	**14.45**	**19.1**	**26.225**	**11.775**	**10.2**	**79.7**			ln(y) = 3.01458048556832 + 0.447322654415065*Z
Lead MG/KG	**64/78**	0.3682044	0.5969196	1.621163611	0.235732	0.500677	0.08656	0.19453	0.4372	0.35064	**0.02**	**4.3**	**0.02**	**0.21**	ln(y) = -1.63715901575236 + 1.20112174805756*Z
Mercury MG/KG	**78/78**	**0.2056795**	**0.1607542**	**0.781576472**	**0.170004**	**0.241355**	**0.0635**	**0.1235**	**0.3225**	**0.259**	**0.013**	**0.65**			ln(y) = -1.94426604662794 + 0.936949837439585*Z
Naphthalene ug/Kg	**11/77**										**25**	**90**	**40**	**1000**	
Nickel MG/KG	**75/78**	0.096883	0.0929859	0.959775076	0.076247	0.117519	0.05553	0.08018	0.11577	0.06024	**0.03**	**0.63**	**0.03**	**0.13**	ln(y) = -2.52352853361102 + 0.544868232422527*Z
OCDD PG/G	**8/18**	6.135193	6.0313427	0.983073016	3.348855	8.921531	2.41169	4.44374	8.18797	5.77628	**5.04**	**23.6**	**2.26**	**5.27**	ln(y) = 1.49149675042312 + 0.906524624584711*Z
OCDF PG/G	**11/18**	8.9990955	14.763873	1.640595252	2.178534	15.81966	0.56754	2.32921	9.5592	8.99166	**1.63**	**51.4**	**0.36**	**1.21**	ln(y) = 0.845529692655598 + 2.09432921163154*Z
PCB-105 ng/kg	**18/18**	**3975.5556**	**2076.3485**	**0.522278841**	**3016.331**	**4934.78**	**2442.5**	**3230**	**4962.5**	**2520**	**1680**	**8530**			ln(y) = 8.18082167017913 + 0.512647810559524*Z
PCB-108 ng/kg	**18/18**	**1488.4444**	**618.78173**	**0.415723765**	**1202.582**	**1774.307**	**1060**	**1360**	**1605**	**545**	**671**	**2850**			ln(y) = 7.23638867826138 + 0.414001011505112*Z
PCB-114 ng/kg	**18/18**	**256.38889**	**71.08118**	**0.277239705**	**223.5511**	**289.2267**	**192.5**	**267.5**	**325.75**	**133.25**	**132**	**360**			ln(y) = 5.50620933455513 + 0.331325331236562*Z
PCB-118 ng/kg	**18/18**	**16773.333**	**8375.6854**	**0.499345312**	**12903.96**	**20642.7**	**10700**	**13750**	**20150**	**9450**	**6960**	**35400**			ln(y) = 9.630804647199 + 0.48789575606837*Z
PCB-126 ng/kg	**18/18**	**112.91111**	**51.40063**	**0.455230926**	**89.16523**	**136.657**	**76.875**	**93.25**	**160.5**	**83.625**	**43.8**	**206**			ln(y) = 4.63590674990504 + 0.476528510427816*Z
PCB-15 ng/kg	**11/18**	48.779597	42.714163	0.87565633	29.04666	68.51253	16.7599	33.2975	66.1532	49.3933	**20.6**	**126**	**19.5**	**25.1**	ln(y) = 3.50548165356597 + 1.01824828104991*Z
PCB-156 ng/kg	**18/18**	**2167.1667**	**951.06205**	**0.438850442**	**1727.798**	**2606.535**	**1565**	**1945**	**2510**	**945**	**949**	**4330**			ln(y) = 7.60710875016068 + 0.423922575116475*Z
PCB-157 ng/kg	**18/18**	**661.5**	**353.82598**	**0.53488432**	**498.0407**	**824.9593**	**415.75**	**504**	**870.25**	**454.5**	**252**	**1460**			ln(y) = 6.3812039097466 + 0.527765683725623*Z
PCB-162 ng/kg	**18/18**	**3875**	**2465.5234**	**0.636264109**	**2735.986**	**5014.014**	**2185**	**2565**	**5507.5**	**3322.5**	**1490**	**9240**			ln(y) = 8.10427387378717 + 0.606569573386377*Z
PCB-167 ng/kg	**18/18**	**1611**	**613.84505**	**0.381033552**	**1327.418**	**1894.582**	**1210**	**1515**	**1930**	**720**	**689**	**3010**			ln(y) = 7.32228701598444 + 0.40375822780988*Z
PCB-189 ng/kg	**18/18**	**275.72222**	**115.66196**	**0.419487268**	**222.2891**	**329.1553**	**165.75**	**249**	**381.5**	**215.75**	**132**	**481**			ln(y) = 5.53674045563909 + 0.468760279800548*Z

Table H-01
Bayou D'Inde
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-37 ng/kg	**18/18**	**44.944444**	**27.54652**	**0.612901559**	**32.2186**	**57.67029**	**17.825**	**40.2**	**75.75**	**57.925**	**14**	**87.4**			ln(y) = 3.6020420518343 + 0.740442017537046*Z
PCB-58 ng/kg	**18/18**	**17.655556**	**7.1233413**	**0.403461748**	**14.36474**	**20.94637**	**14.15**	**15.9**	**20.625**	**6.475**	**6.6**	**32.8**			ln(y) = 2.79694282508781 + 0.445416416906501*Z
PCB-60 ng/kg	**18/18**	**382.38889**	**118.77093**	**0.310602458**	**327.5195**	**437.2583**	**307.25**	**411**	**451.25**	**144**	**167**	**634**			ln(y) = 5.89396942456699 + 0.373798307213046*Z
PCB-61/70 ng/kg	**18/18**	**1866.2222**	**881.12461**	**0.472143457**	**1459.163**	**2273.281**	**1395**	**1670**	**2207.5**	**812.5**	**778**	**3760**			ln(y) = 7.4362224119336 + 0.495921924751447*Z
PCB-66 ng/kg	**18/18**	**4061.6667**	**1463.7494**	**0.360381466**	**3385.449**	**4737.884**	**2662.5**	**4245**	**5060**	**2397.5**	**1760**	**6490**			ln(y) = 8.24032012769904 + 0.438625369796096*Z
PCB-77 ng/kg	**18/18**	**109.25556**	**55.875511**	**0.511420318**	**83.44239**	**135.0687**	**68.975**	**98.3**	**132.5**	**63.525**	**41.6**	**227**			ln(y) = 4.57660738684356 + 0.558960631441215*Z
PCB-79 ng/kg	**18/18**	**178.98333**	**75.395802**	**0.421244818**	**144.1523**	**213.8144**	**127.75**	**169**	**220**	**92.25**	**72.2**	**330**			ln(y) = 5.10540477111631 + 0.472993839033635*Z
PCB-81 ng/kg	**18/18**	**146.6**	**91.805258**	**0.626229592**	**104.1881**	**189.0119**	**86.575**	**103.1**	**210.75**	**124.175**	**53.3**	**337**			ln(y) = 4.82589083879669 + 0.631047311725887*Z
Phenol ug/Kg	**56/78**	1071.2254	1287.6561	1.202040369	785.4606	1356.99	249.579	573.522	1317.93	1068.35	**110**	**8200**	**40**	**1000**	ln(y) = 6.35179570519565 + 1.23410415352395*Z
Selenium MG/KG	**78/78**	**0.5625641**	**0.3469675**	**0.616760854**	**0.485563**	**0.639565**	**0.4**	**0.535**	**0.7**	**0.3**	**0.23**	**2.9**			ln(y) = -0.651998412607874 + 0.353893891611178*Z
Silver MG/KG	**50/78**	0.0172863	0.0208994	1.209010441	0.012648	0.021924	0.00724	0.01237	0.02116	0.01393	**0.01**	**0.15**	**0.01**	**0.04**	ln(y) = -4.39220448318602 + 0.795895331004264*Z
Total HpCDD PG/G	**7/18**	1.5439313	0.4998901	0.323777406	1.312994	1.774869	1.11319	1.44623	1.8789	0.7657	**1.65**	**2.71**	**0.629**	**1.28**	ln(y) = 0.368959157740756 + 0.388209017197128*Z
Total HpCDF PG/G	**17/18**	3.6114554	3.5805882	0.991452964	1.957308	5.265603	**1.128**	**1.945**	**5.795**	**4.667**	**0.0793**	**12.3**	**0.822**	**0.822**	ln(y) = 0.655225555999187 + 1.47807613255541*Z
Total HxCDD PG/G	**5/18**	0.3633295	0.3731288	1.026970698	0.190953	0.535706	0.16009	0.28015	0.49024	0.33015	**0.57**	**1.32**	**0.117**	**0.365**	ln(y) = -1.27242438108865 + 0.829995576097005*Z
Total HxCDF PG/G	**16/18**	48.465841	52.779494	1.089003995	24.08296	72.84872	5.77172	19.5951	66.5256	60.7539	**1.25**	**162**	**1.43**	**2**	ln(y) = 2.97527904325833 + 1.8130052181958*Z
Total PeCDD PG/G	**17/18**	0.2680945	0.1085076	0.404736286	0.217967	0.318222	**-0.173**	**0.2715**	**0.35825**	**0.53125**	**0.0792**	**0.448**	**0.173**	**0.173**	ln(y) = -1.40626046093387 + 0.499502482848401*Z
Total PeCDF PG/G	**18/18**	**42.366667**	**41.043841**	**0.968776727**	**23.40538**	**61.32795**	**3.55**	**28.95**	**76.825**	**73.275**	**1.42**	**121**			ln(y) = 2.92527418225141 + 1.72868469285694*Z
Total TCDD PG/G	**14/18**	0.2065981	0.1332705	0.645071156	0.14503	0.268166	0.10513	0.17041	0.2762	0.17107	**0.0939**	**0.475**	**0.0448**	**0.105**	ln(y) = -1.76957238477193 + 0.716349162250338*Z
Total TCDF PG/G	**18/18**	**30.578889**	**27.527053**	**0.900197944**	**17.86204**	**43.29574**	**4.27**	**22.15**	**61**	**56.73**	**1.74**	**73.6**			ln(y) = 2.77088012183496 + 1.48243978123048*Z
Zinc MG/KG	**78/78**	**35.619231**	**22.820322**	**0.640674206**	**30.5548**	**40.68366**	**30.325**	**34.6**	**37.725**	**7.4**	**19**	**188**			ln(y) = 3.52467911195411 + 0.218348986865509*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-02
Bayou D'Inde
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**4/4**	**5.04**	**0.2732277**	**0.054211842**	**4.772237**	**5.307763**	**4.7925**	**5.08**	**5.2475**	**0.455**	**4.71**	**5.29**			ln(y) = 1.61651666875831 + 6.58670269756569E-02*Z
1,2,3,4,6,7,8-HpCDF PG/G	**4/4**	**62.35**	**25.567115**	**0.410057984**	**37.29423**	**87.40577**	**50**	**53.65**	**83.4**	**33.4**	**49.9**	**92.2**			ln(y) = 4.09875936956507 + 0.355060909149358*Z
1,2,3,4,7,8,9-HpCDF PG/G	**4/4**	**4.5025**	**2.6709844**	**0.59322253**	**1.884935**	**7.120065**	**2.325**	**5.275**	**5.9075**	**3.5825**	**1.36**	**6.1**			ln(y) = 1.36040552774988 + 0.82130557894472*Z
1,2,3,4,7,8-HxCDF PG/G	**4/4**	**13.1925**	**7.0585857**	**0.535045344**	**6.275086**	**20.10991**	**7.3275**	**15.3**	**16.95**	**9.6225**	**4.87**	**17.3**			ln(y) = 2.47199176040228 + 0.703662244637732*Z
1,2,3,6,7,8-HxCDD PG/G	**4/4**	**0.79825**	**0.0752943**	**0.094324149**	**0.724462**	**0.872038**	**0.728**	**0.808**	**0.85875**	**0.13075**	**0.708**	**0.869**			ln(y) = -0.228180663181574 + 0.119774462339811*Z
1,2,3,6,7,8-HxCDF PG/G	**4/4**	**10.11**	**1.7951101**	**0.177557874**	**8.350792**	**11.86921**	**8.42**	**10.26**	**11.65**	**3.23**	**8.02**	**11.9**			ln(y) = 2.30277096897716 + 0.235507282874848*Z
1,2,3,7,8,9-HxCDF PG/G	**3/4**										**2.45**	**2.56**	**0.462**	**0.462**	
1,2,3,7,8-PeCDD PG/G	**4/4**	**1.043**	**0.3941887**	**0.377937349**	**0.656695**	**1.429305**	**0.6745**	**1.0495**	**1.405**	**0.7305**	**0.623**	**1.45**			ln(y) = -1.25408567846358E-02 + 0.530247669558286*Z
1,2,3,7,8-PeCDF PG/G	**4/4**	**16.1975**	**8.9789448**	**0.554341397**	**7.398134**	**24.99687**	**7.9925**	**17.2**	**23.4**	**15.4075**	**5.49**	**24.9**			ln(y) = 2.64944950124572 + 0.856445388714945*Z
2,3,4,6,7,8-HxCDF PG/G	**4/4**	**1.98175**	**1.0287059**	**0.519089625**	**0.973618**	**2.989882**	**1.14275**	**2.335**	**2.4675**	**1.32475**	**0.787**	**2.47**			ln(y) = 0.589461246387271 + 0.640859482514239*Z
2,3,4,7,8-PeCDF PG/G	**4/4**	**18.755**	**10.844054**	**0.57819538**	**8.127827**	**29.38217**	**8.815**	**19.4**	**28.05**	**19.235**	**6.22**	**30**			ln(y) = 2.78461556816349 + 0.905085216913751*Z
2,3,7,8-TCDD Equivalent PG/G	**4/4**	**16.81533**	**7.7730731**	**0.462261108**	**9.197718**	**24.43294**	**9.67758**	**17.3427**	**23.4257**	**13.7481**	**7.77962**	**24.79634**			ln(y) = 2.73888531886462 + 0.669120179603146*Z
2,3,7,8-TCDD PG/G	**4/4**	**0.6085**	**0.288421**	**0.473986927**	**0.325847**	**0.891153**	**0.34425**	**0.605**	**0.87625**	**0.532**	**0.302**	**0.922**			ln(y) = -0.583473215008116 + 0.682035467356975*Z
2,3,7,8-TCDF PG/G	**4/4**	**13.925**	**6.8130545**	**0.489267827**	**7.248207**	**20.60179**	**7.85**	**14.35**	**19.575**	**11.725**	**6**	**21**			ln(y) = 2.53984736057668 + 0.704436249596249*Z
2-Methylphenol ug/Kg	**2/3**										**41**	**2700**	**2000**	**1000**	
4,4'-DDE ug/Kg	**1/19**										**2.4**	**2.4**	**10**	**10**	
Aldrin ug/Kg	**1/19**										**3.6**	**3.6**	**10**	**10**	
alpha-Chlordane ug/Kg	**1/19**										**2.3**	**2.3**	**10**	**10**	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**207**	**207**			
Aroclor-1254 ug/Kg	**11/19**	54.29128	16.333752	0.300854065	46.94673	61.63583	41.5881	52.1203	65.3198	23.7317	**44**	**90**	**10**	**100**	ln(y) = 3.95355425525914 + 0.334832698294933*Z
Arsenic MG/KG	**19/20**	0.4159981	0.1110518	0.266952701	0.367327	0.464669	**-0.75**	**-0.75**	**-0.75**	**0**	**0.15**	**0.64**	**0.75**	**0.75**	ln(y) = -0.916387639293095 + 0.328866288420872*Z
Barium MG/KG	**1/1**										**7**	**7**			
Benzaldehyde ug/Kg	**17/17**	**4788.2353**	**4023.4129**	**0.840270514**	**2875.626**	**6700.844**	**1800**	**3300**	**6800**	**5000**	**900**	**16000**			ln(y) = 8.19537648395989 + 0.864173456756051*Z
beta-BHC ug/Kg	**3/19**										**11**	**33**	**6**	**10**	
Cadmium MG/KG	**18/20**	0.015545	0.0062579	0.402566421	0.012802	0.018288	0.01092	0.01445	0.01912	0.0082	**0.01**	**0.03**	**0.003**	**0.5**	ln(y) = -4.23740156561687 + 0.415540714588894*Z
Calcium Metal MG/KG	**1/1**										**18600**	**18600**			
Chromium MG/KG	**20/20**	**0.8895**	**0.3403286**	**0.38260663**	**0.740344**	**1.038656**	**0.6125**	**0.91**	**1.1**	**0.4875**	**0.34**	**1.4**			ln(y) = -0.198282767567095 + 0.471856900141181*Z
Copper MG/KG	**20/20**	**2.1735**	**0.9840663**	**0.452756525**	**1.742214**	**2.604786**	**1.5**	**1.9**	**3.025**	**1.525**	**0.47**	**4.4**			ln(y) = 0.674285737133102 + 0.512898385696801*Z
Dieldrin ug/Kg	**1/19**										**1.7**	**1.7**	**10**	**10**	
Di-n-butylphthalate ug/Kg	**2/18**										**280**	**3600**	**80**	**2000**	
Heptachlor ug/Kg	**1/19**										**4.8**	**4.8**	**10**	**10**	
Iron MG/KG	**20/20**	**154.515**	**64.893239**	**0.419980187**	**126.0743**	**182.9557**	**91.325**	**171**	**212.25**	**120.925**	**12.3**	**232**			ln(y) = 4.89087942902094 + 0.651217393351889*Z
Lead MG/KG	**20/20**	**0.7875**	**0.4122046**	**0.523434412**	**0.606843**	**0.968157**	**0.4825**	**0.725**	**0.9225**	**0.44**	**0.06**	**1.7**			ln(y) = -0.405355526730398 + 0.677782442680081*Z
Magnesium MG/KG	**1/1**										**573**	**573**			
Manganese MG/KG	**1/1**										**10.1**	**10.1**			
Mercury MG/KG	**20/20**	**0.11845**	**0.0713895**	**0.602697374**	**0.087162**	**0.149738**	**0.06525**	**0.085**	**0.16675**	**0.1015**	**0.052**	**0.275**			ln(y) = -2.28350192711484 + 0.587302239481428*Z
Naphthalene ug/Kg	**6/18**	58.333214	28.532799	0.489134708	45.15173	71.51469	35.2008	53.8946	82.5161	47.3154	**25**	**110**	**40**	**2000**	ln(y) = 3.98703077903248 + 0.631815310174876*Z
Nickel MG/KG	**19/20**	0.2818591	0.1122762	0.398341415	0.232652	0.331066	**-4**	**-4**	**-4**	**0**	**0.06**	**0.5**	**4**	**4**	ln(y) = -1.35796865306504 + 0.520744054464667*Z
OCDD PG/G	**4/4**	**76.15**	**7.3993899**	**0.097168613**	**68.8986**	**83.4014**	**69.75**	**76.4**	**82.3**	**12.55**	**67.7**	**84.1**			ln(y) = 4.32975382695258 + 0.120358728262947*Z
OCDF PG/G	**4/4**	**151.65**	**82.448182**	**0.543674129**	**70.85078**	**232.4492**	**78.2**	**175**	**201.75**	**123.55**	**51.6**	**205**			ln(y) = 4.89665551417017 + 0.78370327254574*Z
PCB-105 ng/kg	**4/4**	**6375**	**1338.3112**	**0.209931175**	**5063.455**	**7686.545**	**5320**	**6250**	**7555**	**2235**	**5040**	**7960**			ln(y) = 8.74695293596567 + 0.253780749282775*Z
PCB-108 ng/kg	**4/4**	**2550**	**417.11861**	**0.163575927**	**2141.224**	**2958.776**	**2162.5**	**2575**	**2912.5**	**750**	**2070**	**2980**			ln(y) = 7.83485992447997 + 0.215764504704445*Z
PCB-114 ng/kg	**4/4**	**455.75**	**121.22888**	**0.265998647**	**336.9457**	**574.5543**	**386.5**	**420.5**	**560.25**	**173.75**	**381**	**601**			ln(y) = 6.10563744549626 + 0.262036396301954*Z
PCB-118 ng/kg	**4/4**	**25075**	**5899.2067**	**0.235262482**	**19293.78**	**30856.22**	**20800**	**24200**	**30225**	**9425**	**19700**	**32200**			ln(y) = 10.1140735987665 + 0.269122425754493*Z
PCB-126 ng/kg	**4/4**	**200.75**	**45.933291**	**0.228808421**	**155.7354**	**245.7646**	**161.5**	**201.5**	**239.25**	**77.75**	**149**	**251**			ln(y) = 5.28520601591149 + 0.288269192084867*Z
PCB-15 ng/kg	**4/4**	**360.25**	**189.74361**	**0.526699811**	**174.3013**	**546.1987**	**202.25**	**420**	**458.5**	**256.25**	**137**	**464**			ln(y) = 5.78440684135413 + 0.681984799968098*Z
PCB-156 ng/kg	**4/4**	**3255**	**444.44439**	**0.136542057**	**2819.444**	**3690.556**	**2855**	**3315**	**3595**	**740**	**2720**	**3670**			ln(y) = 8.08212114951145 + 0.168686531961281*Z
PCB-157 ng/kg	**4/4**	**917**	**141.73565**	**0.154564509**	**778.0991**	**1055.901**	**791.25**	**941.5**	**1018.25**	**227**	**745**	**1040**			ln(y) = 6.81378992507912 + 0.185798653399631*Z
PCB-162 ng/kg	**4/4**	**5965**	**1654.0119**	**0.277286161**	**4344.068**	**7585.932**	**4730**	**5660**	**7505**	**2775**	**4560**	**7980**			ln(y) = 8.6716520863069 + 0.329328470365927*Z
PCB-167 ng/kg	**4/4**	**2147.5**	**148.85101**	**0.069313625**	**2001.626**	**2293.374**	**2002.5**	**2175**	**2265**	**262.5**	**1970**	**2270**			ln(y) = 7.67042551277937 + 8.85489602716969E-02*Z

Table H-02
Bayou D'Inde
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-169 ng/kg	**3/4**	18.036274	10.496195	0.581949165	7.750003	28.32254	**-20**	**21.65**	**24.575**	**44.575**	**11.7**	**25**	**20**	**20**	ln(y) = 2.82496672034109 + 0.486571571403548*Z
PCB-189 ng/kg	**4/4**	**627**	**237.97204**	**0.379540734**	**393.7874**	**860.2126**	**455.75**	**577**	**848.25**	**392.5**	**436**	**918**			ln(y) = 6.4009777472527 + 0.441098699918911*Z
PCB-37 ng/kg	**4/4**	**145.75**	**42.648831**	**0.292616336**	**103.9541**	**187.5459**	**115.75**	**136**	**185.5**	**69.75**	**113**	**198**			ln(y) = 4.95828717219401 + 0.334644266852994*Z
PCB-58 ng/kg	**4/4**	**139.15**	**152.81495**	**1.098203**	**-10.6086**	**288.9086**	**76**	**87.45**	**254**	**178**	**72.7**	**309**			ln(y) = 4.74037571503989 + 0.794375486661437*Z
PCB-60 ng/kg	**4/4**	**2307.5**	**1032.9085**	**0.447630986**	**1295.25**	**3319.75**	**1452.5**	**2160**	**3310**	**1857.5**	**1390**	**3520**			ln(y) = 7.67482472226001 + 0.586811791001218*Z
PCB-61/70 ng/kg	**4/4**	**9582.5**	**2199.8034**	**0.229564664**	**7426.693**	**11738.31**	**7882.5**	**9355**	**11510**	**3627.5**	**7420**	**12200**			ln(y) = 9.15209387114556 + 0.27396574195054*Z
PCB-66 ng/kg	**4/4**	**10467.5**	**3543.5872**	**0.338532331**	**6994.785**	**13940.22**	**7737.5**	**9740**	**13925**	**6187.5**	**7690**	**14700**			ln(y) = 9.21853059880323 + 0.416441245157799*Z
PCB-77 ng/kg	**4/4**	**415**	**124.35818**	**0.299658275**	**293.129**	**536.871**	**326.5**	**393**	**525.5**	**199**	**308**	**566**			ln(y) = 6.00388233693612 + 0.340782142786935*Z
PCB-79 ng/kg	**4/4**	**315**	**55.83545**	**0.177255396**	**260.2813**	**369.7187**	**267.75**	**316**	**361.25**	**93.5**	**252**	**376**			ln(y) = 5.74262316090106 + 0.219111020593936*Z
PCB-80 ng/kg	**3/4**	53.215504	24.971526	0.469252834	28.74341	77.6876	**33.175**	**51.35**	**72.9**	**39.725**	**50.5**	**79.8**	**27.4**	**27.4**	ln(y) = 3.92889622825775 + 0.448268289485294*Z
PCB-81 ng/kg	**4/4**	**335.5**	**63.82468**	**0.190237497**	**272.9518**	**398.0482**	**284**	**327**	**395.5**	**111.5**	**276**	**412**			ln(y) = 5.80449069327449 + 0.237383925318707*Z
Phenol ug/Kg	**1/18**										**100**	**100**	**40**	**2000**	
Potassium MG/KG	**1/1**										**2670**	**2670**			
Selenium MG/KG	**20/20**	**0.652**	**0.1650198**	**0.253097928**	**0.579677**	**0.724323**	**0.5925**	**0.655**	**0.705**	**0.1125**	**0.23**	**1.1**			ln(y) = -0.460965814924917 + 0.266726630049876*Z
Silver MG/KG	**4/20**										**0.01**	**0.02**	**0.01**	**1**	
Sodium MG/KG	**1/1**										**1410**	**1410**			
Total HpCDD PG/G	**4/4**	**10.4125**	**0.395672**	**0.037999716**	**10.02474**	**10.80026**	**10.0375**	**10.45**	**10.75**	**0.7125**	**9.95**	**10.8**			ln(y) = 2.34252914541357 + 4.93759903948714E-02*Z
Total HpCDF PG/G	**4/4**	**79.375**	**16.159261**	**0.203581239**	**63.53892**	**95.21108**	**69.3**	**75.05**	**93.775**	**24.475**	**68.4**	**99**			ln(y) = 4.3637872126562 + 0.21482192943157*Z
Total HxCDD PG/G	**4/4**	**2.46**	**0.7867441**	**0.31981469**	**1.688991**	**3.231009**	**1.7525**	**2.455**	**3.1725**	**1.42**	**1.72**	**3.21**			ln(y) = 0.860548945755452 + 0.422465478513918*Z
Total HxCDF PG/G	**4/4**	**73.75**	**7.9748899**	**0.108134101**	**65.93461**	**81.56539**	**67.05**	**72.75**	**81.45**	**14.4**	**66.9**	**82.6**			ln(y) = 4.2965112680573 + 0.138569082533191*Z
Total PeCDD PG/G	**4/4**	**1.043**	**0.3941887**	**0.377937349**	**0.656695**	**1.429305**	**0.6745**	**1.0495**	**1.405**	**0.7305**	**0.623**	**1.45**			ln(y) = -1.25408567846358E-02 + 0.530247669558286*Z
Total PeCDF PG/G	**4/4**	**66.95**	**23.129062**	**0.345467696**	**44.28352**	**89.61648**	**45.5**	**68.35**	**87**	**41.5**	**40.3**	**90.8**			ln(y) = 4.16074472598073 + 0.477564155996014*Z
Total TCDD PG/G	**4/4**	**0.6605**	**0.3011523**	**0.455945936**	**0.365371**	**0.955629**	**0.3685**	**0.709**	**0.904**	**0.5355**	**0.302**	**0.922**			ln(y) = -0.501672776697893 + 0.6742830978487*Z
Total TCDF PG/G	**4/4**	**41.65**	**14.041475**	**0.337130254**	**27.88935**	**55.41065**	**28.725**	**43.25**	**52.975**	**24.25**	**24.9**	**55.2**			ln(y) = 3.68870992836772 + 0.456988487718103*Z
Vanadium (Fume Or Dust) MG/KG	**1/1**										**0.46**	**0.46**			
Zinc MG/KG	**20/20**	**24.445**	**4.8105516**	**0.196790819**	**22.33668**	**26.55332**	**21.375**	**22.9**	**26.125**	**4.75**	**18.9**	**37.8**			ln(y) = 3.18175389269475 + 0.177151507822474*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-03
Bayou D'Inde
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/2										0.535	0.759			
1,2,3,4,6,7,8-HpCDF PG/G	2/2										4.93	17.2			
1,2,3,4,7,8,9-HpCDF PG/G	1/2										1	1	0.265	0.265	
1,2,3,4,7,8-HxCDF PG/G	2/2										3.58	4.68			
1,2,3,6,7,8-HxCDD PG/G	2/2										0.278	0.59			
1,2,3,6,7,8-HxCDF PG/G	2/2										2.46	4.2			
1,2,3,7,8-PeCDD PG/G	2/2										0.568	0.724			
1,2,3,7,8-PeCDF PG/G	2/2										7.55	8.44			
2,3,4,6,7,8-HxCDF PG/G	1/2										0.734	0.734	0.558	0.558	
2,3,4,7,8-PeCDF PG/G	2/2										14.7	15			
2,3,7,8-TCDD Equivalent PG/G	2/2										10.163542	10.476856			
2,3,7,8-TCDD PG/G	2/2										0.43	0.487			
2,3,7,8-TCDF PG/G	2/2										3.9	4			
4,4'-DDE ug/Kg	3/6	10.515558	1.7418349	0.165643596	9.1218001	11.909317	9.0826	10.5	12.25	3.1674	11	13	10	10	ln(y) = 2.34048496406198 + 0.198941332920857*Z
alpha-Chlordane ug/Kg	1/6										14	14	10	10	
Aroclor-1254 ug/Kg	6/6	111.83333	53.454245	0.477981326	69.061029	154.60564	69.75	105	165	95.25	42	180			ln(y) = 4.61042492499779 + 0.671784576356041*Z
Aroclor-1260 ug/Kg	6/6	63.666667	32.616156	0.512295648	37.568306	89.765027	34.25	63.5	90.5	56.25	23	110			ln(y) = 4.03415102441517 + 0.715042321382896*Z
Arsenic MG/KG	6/6	0.31	0.1050358	0.338825183	0.2259539	0.3940461	0.245	0.305	0.3525	0.1075	0.2	0.48			ln(y) = -1.20613658380212 + 0.348552210823371*Z
Benzaldehyde ug/Kg	5/5	250	102.9213	0.411685189	159.78551	340.21449	155	230	355	200	150	370			ln(y) = 5.45326740830035 + 0.534257025860473*Z
beta-BHC ug/Kg	6/6	64	41.445885	0.64759196	30.836385	97.163615	35.75	63.5	83.5	47.75	17	130			ln(y) = 3.99282704993072 + 0.825845122245622*Z
Chromium MG/KG	6/6	0.4016667	0.1648355	0.410378739	0.2697708	0.5335625	0.28	0.345	0.59	0.31	0.22	0.62			ln(y) = -0.978249216535165 + 0.497412021408009*Z
Copper MG/KG	6/6	2.0783333	4.7611394	2.290844935	-1.731372	5.8880383	0.5875	0.73	2.895	2.3075	0.55	9			ln(y) = 4.93725192786531E-02 + 1.08154670799214*Z
Heptachlor Epoxide ug/Kg	1/6										19	19	10	10	
Hexachlorobenzene ug/Kg	1/5										94	94	80	160	
Iron MG/KG	6/6	32.816667	31.398029	0.956770805	7.6930113	57.940322	19.1	24.15	43.3	24.2	15.8	82.3			ln(y) = 3.32487316130755 + 0.677090491843174*Z
Lead MG/KG	6/6	0.2583333	0.3320049	1.285180412	-0.007326	0.5239926	0.11	0.165	0.36	0.25	0.11	0.78			ln(y) = -1.64300836712875 + 0.865933005330767*Z
Mercury MG/KG	6/6	0.109	0.0361354	0.331517079	0.0800857	0.1379143	0.08375	0.1085	0.1315	0.04775	0.062	0.163			ln(y) = -2.25838105466329 + 0.408195610186079*Z
Naphthalene ug/Kg	2/5										71	74	80	50	
Nickel MG/KG	6/6	0.1616667	0.0993903	0.614785439	0.0821379	0.2411955	0.0925	0.12	0.265	0.1725	0.07	0.31			ln(y) = -1.96113636904432 + 0.716165388264968*Z
OCDD PG/G	2/2										5.76	6.21			
OCDF PG/G	2/2										5.56	27.8			
PCB-105 ng/kg	2/2										4370	11500			
PCB-108 ng/kg	2/2										2230	4010			
PCB-114 ng/kg	2/2										414	621			
PCB-118 ng/kg	2/2										17200	44400			
PCB-126 ng/kg	2/2										113	319			
PCB-15 ng/kg	2/2										70.1	274			
PCB-156 ng/kg	2/2										2330	5090			
PCB-157 ng/kg	2/2										613	1330			
PCB-162 ng/kg	2/2										3070	10500			
PCB-167 ng/kg	2/2										1610	3180			
PCB-189 ng/kg	2/2										509	579			
PCB-37 ng/kg	2/2										59.8	99.9			
PCB-58 ng/kg	2/2										30.9	73			
PCB-60 ng/kg	2/2										824	1120			
PCB-61/70 ng/kg	2/2										1240	3170			
PCB-66 ng/kg	2/2										7130	10600			

Table H-03
Bayou D'Inde
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-77 ng/kg	**2/2**										**66.8**	**223**			
PCB-79 ng/kg	**2/2**										**186**	**527**			
PCB-81 ng/kg	**2/2**										**109**	**354**			
Selenium MG/KG	**6/6**	**0.4416667**	**0.0732035**	**0.165743815**	**0.3830917**	**0.5002417**	**0.395**	**0.415**	**0.5**	**0.105**	**0.38**	**0.56**			ln(y) = -0.826126852576252 + 0.174750043396203*Z
Total HpCDF PG/G	**2/2**										**6.02**	**20**			
Total HxCDD PG/G	**2/2**										**0.278**	**0.59**			
Total HxCDF PG/G	**2/2**										**13.7**	**29**			
Total PeCDD PG/G	**2/2**										**0.568**	**0.724**			
Total PeCDF PG/G	**2/2**										**27.3**	**33.3**			
Total TCDD PG/G	**2/2**										**0.43**	**0.487**			
Total TCDF PG/G	**2/2**										**8.63**	**15.1**			
Zinc MG/KG	**6/6**	**18.733333**	**3.4693824**	**0.18519835**	**15.957249**	**21.509417**	**16.55**	**17.25**	**22.075**	**5.525**	**15.5**	**24.1**			ln(y) = 2.91822871561696 + 0.203017457727395*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-04
Bayou D'Inde
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	2/3	167.66667	73.500672	0.438373788	84.492827	250.84051	108	158	237	129	108	237			ln(y) = 5.07092880042877 + 0.582869752218506*Z
1,2,3,4,7,8,9-HpCDF PG/G	2/3										1.7	1.7	0.693	1.11	
1,2,3,4,7,8-HxCDF PG/G	2/3	10.11	7.3753376	0.729509158	1.7640198	18.45598	3.73	13.1	13.5	9.77	3.73	13.5			ln(y) = 2.1639033831024 + 0.953947027169569*Z
1,2,3,6,7,8-HxCDD PG/G	2/3										0.759	0.935	0.626	0.626	
1,2,3,6,7,8-HxCDF PG/G	2/3	38.433333	20.071714	0.522247541	15.720051	61.146616	21.6	36.5	57.2	35.6	21.6	57.2			ln(y) = 3.57218649122144 + 0.722245825283586*Z
1,2,3,7,8,9-HxCDF PG/G	2/3										1.15	1.15	0.476	0.822	
1,2,3,7,8-PeCDD PG/G	2/3	1.6176667	0.9841353	0.608367181	0.5040127	2.7313206	0.693	1.73	2.43	1.737	0.693	2.43			ln(y) = 0.35642912868997 + 0.930463324479005*Z
1,2,3,7,8-PeCDF PG/G	2/3	19.41	14.395132	0.741634812	3.120375	35.699625	6.33	24.5	27.4	21.07	6.33	27.4			ln(y) = 2.7848387890336 + 1.08667040909603*Z
2,3,4,6,7,8-HxCDF PG/G	2/3	1.5366667	1.0781527	0.701617801	0.316622	2.7567113	0.59	1.96	2.06	1.47	0.59	2.06			ln(y) = 0.289339237987181 + 0.927290763541169*Z
2,3,4,7,8-PeCDF PG/G	2/3	36.366667	24.502727	0.673768836	8.6392212	64.094112	13.1	41.9	54.1	41	13.1	54.1			ln(y) = 3.43291074766254 + 1.0517982798968*Z
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**37.2793**	**23.657228**	**0.63459422**	**10.508626**	**64.049974**	**15.0821**	**44.1046**	**52.6512**	**37.5691**	**15.082128**	**52.651202**			ln(y) = 3.48792098007103 + 0.927172011081374*Z
2,3,7,8-TCDD PG/G	2/3	1.2853333	0.7633957	0.593928184	0.4214698	2.1491969	0.626	1.24	1.99	1.364	0.626	1.99			ln(y) = 0.144947036823769 + 0.857726324799694*Z
2,3,7,8-TCDF PG/G	2/3	83.366667	56.236207	0.674564659	19.729408	147.00393	31.1	101	118	86.9	31.1	118			ln(y) = 4.27433765349737 + 0.988948594748057*Z
2-Methylnaphthalene ug/Kg	6/15	50.926292	29.879501	0.586720516	35.805179	66.047406	29.4429	44.1675	68	38.5571	26	100	50	50	ln(y) = 3.78798950868769 + 0.601518910315585*Z
2-Methylphenol ug/Kg	3/15	31.122852	81.365505	2.614333213	-10.05378	72.299478	0.66934	3.76995	21.2337	20.5644	55	260	50	50	ln(y) = 1.3270622897133 + 2.56386222169908*Z
4,4'-DDE ug/Kg	11/16	20.521114	17.166921	0.836549144	12.109323	28.932905	7.822	14	35.5	27.678	13	57	10	10	ln(y) = 2.69220875788109 + 0.942271048165709*Z
Aldrin ug/Kg	**7/16**	9.6884076	5.8764716	0.606546699	6.8089365	12.567879	5.4527	8.31731	12	6.5473	11	24	10	10	ln(y) = 2.1183385334077 + 0.62627562250299*Z
alpha-Chlordane ug/Kg	**2/16**										12	18	10	10	
Aroclor-1254 ug/Kg	**16/16**	**622.1875**	**744.58093**	**1.196714702**	**257.34285**	**987.03215**	**170**	**425**	**795**	**625**	**95**	**2800**			ln(y) = 6.02393509117161 + 1.05757776967127*Z
Aroclor-1260 ug/Kg	**16/16**	**278.5**	**281.34613**	**1.010219513**	**140.64039**	**416.35961**	**97.75**	**250**	**297.5**	**199.75**	**73**	**1100**			ln(y) = 5.35502186329589 + 0.817866565991273*Z
Arsenic MG/KG	**16/16**	0.550625	0.1904936	0.345958938	0.4572831	0.6439669	0.3925	0.525	0.735	0.3425	0.28	0.83			ln(y) = -0.655062237567897 + 0.403409817442542*Z
Benzaldehyde ug/Kg	13/15	881.79194	946.97608	1.073922364	402.55592	1361.028	350	660	790	440	66	3000	50	50	ln(y) = 6.25914943887176 + 1.24324045641598*Z
beta-BHC ug/Kg	**15/16**	157.27997	119.81281	0.761780481	98.571692	215.98825	59.5	135	220	160.5	31	440	10	10	ln(y) = 4.77054794958607 + 0.939873277436452*Z
Chromium MG/KG	**15/16**	0.4344471	0.1869654	0.430352475	0.3428341	0.5260601	0.275	0.385	0.5975	0.3225	0.24	0.78	0.19	0.19	ln(y) = -0.916825224738402 + 0.487654495353038*Z
Copper MG/KG	**16/16**	6.606875	4.0395074	0.611409691	4.6275164	8.5862336	2.7	7.3	9.95	7.25	0.86	14.2			ln(y) = 1.61252586765808 + 0.950787419649886*Z
Dieldrin ug/Kg	**4/16**	9.3112154	15.69004	1.685068905	1.623096	16.999335	1.76877	4.45245	11.2079	9.43916	11	55	10	42	ln(y) = 1.49345374167647 + 1.3693016682436*Z
Endosulfan II ug/Kg	**1/16**										14	14	10	42	
Endosulfan Sulfate ug/Kg	**5/16**	9.1498877	8.1847825	0.894522735	5.1393442	13.160431	3.5352	6.71164	12.7422	9.207	12	30	10	42	ln(y) = 1.90384391030288 + 0.950883268674032*Z
gamma-Chlordane ug/Kg	**7/16**	17.053838	14.523746	0.851640919	9.9372021	24.170473	6.94893	12.5804	22.7755	15.8266	12	47	10	21	ln(y) = 2.5321362744173 + 0.880389006374024*Z
Hexachloro-1,3-butadiene ug/Kg	**16/16**	**505.625**	**446.69108**	**0.883443425**	**286.74637**	**724.50363**	**260**	**395**	**625**	**365**	**110**	**1800**			ln(y) = 6.00066752517484 + 0.762339671690662*Z
Iron MG/KG	**16/16**	66.01875	53.823449	0.815275188	39.64526	92.39224	19.6	58.65	102.375	82.775	14.3	173			ln(y) = 3.8567357469262 + 0.970802134558176*Z
Lead MG/KG	**16/16**	0.716875	0.4828073	0.67348886	0.4802994	0.9534506	0.2825	0.63	1.15	0.8675	0.04	1.5			ln(y) = -0.650746418407817 + 1.045936300848335*Z
Mercury MG/KG	**16/16**	0.1310625	0.0509457	0.388712821	0.1060991	0.1560259	0.09025	0.125	0.172	0.08175	0.059	0.244			ln(y) = -2.10061788323037 + 0.436201168039174*Z
Naphthalene ug/Kg	3/15	45.423024	12.987922	0.285932572	38.850228	51.995819	37.4966	44.2478	52.2146	14.718	58	67	50	50	ln(y) = 3.78980536677555 + 0.24556288222395*Z
Nickel MG/KG	**3/16**										0.38	0.52	0.07	0.32	
OCDD PG/G	2/3										6.42	17	2.22	2.22	
OCDF PG/G	2/3	26.206667	33.230277	1.268008551	-11.39693	63.810266	2.82	18.1	57.7	54.88	2.82	57.7			ln(y) = 2.66263533224529 + 2.23863016272414*Z
PCB-105 ng/kg	**3/3**	**21710**	**17924.581**	**0.82563708**	**1426.4271**	**41993.573**	**6230**	**29000**	**29900**	**23670**	**6230**	**29900**			ln(y) = 9.77259882670963 + 1.16323599301563*Z
PCB-108 ng/kg	**3/3**	**8310**	**6743.8094**	**0.811529415**	**678.66122**	**15941.339**	**2430**	**11000**	**11500**	**9070**	**2430**	**11500**			ln(y) = 8.81713313415548 + 1.15283359349045*Z
PCB-114 ng/kg	**3/3**	**1651.3333**	**1081.1201**	**0.654695264**	**427.93076**	**2874.7359**	**624**	**1880**	**2450**	**1826**	**624**	**2450**			ln(y) = 7.25967357591073 + 1.01432435939377*Z
PCB-118 ng/kg	**3/3**	**80833.333**	**65706.463**	**0.812863465**	**6479.4704**	**155187.2**	**23500**	**107000**	**112000**	**88500**	**23500**	**112000**			ln(y) = 11.0905313212845 + 1.15805666199596*Z
PCB-126 ng/kg	**3/3**	**521.33333**	**419.3399**	**0.804360425**	**46.805563**	**995.8611**	**164**	**696**	**704**	**540**	**164**	**704**			ln(y) = 6.06733148143889 + 1.08049198793104*Z
PCB-15 ng/kg	**3/3**	**1386.3333**	**1748.9431**	**1.26156028**	**-592.7821**	**3365.4487**	**238**	**891**	**3030**	**2792**	**238**	**3030**			ln(y) = 6.7603109998819 + 1.886745924644*Z
PCB-156 ng/kg	**3/3**	**9543.3333**	**6928.8374**	**0.726039547**	**1702.6157**	**17384.051**	**3030**	**11500**	**14100**	**11070**	**3030**	**14100**			ln(y) = 8.97345009640701 + 1.14034184662486*Z
PCB-157 ng/kg	**3/3**	**2597.6667**	**1944.6738**	**0.748623322**	**397.06104**	**4798.2723**	**763**	**3120**	**3910**	**3147**	**763**	**3910**			ln(y) = 7.65137965502247 + 1.21185178212005*Z
PCB-162 ng/kg	**3/3**	**15830**	**13150.074**	**0.830705857**	**949.29074**	**30710.709**	**4290**	**21000**	**22200**	**17910**	**4290**	**22200**			ln(y) = 9.44138909882933 + 1.21909821614206*Z
PCB-167 ng/kg	**3/3**	**6563.3333**	**4693.4986**	**0.715108973**	**1252.1397**	**11874.527**	**2180**	**7980**	**9530**	**7350**	**2180**	**9530**			ln(y) = 8.61132461429175 + 1.09399555202739*Z

Table H-04
Bayou D'Inde
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-189 ng/kg	**3/3**	**1850.6667**	**1279.2756**	**0.691251227**	**403.03004**	**3298.3033**	**762**	**1750**	**3040**	**2278**	**762**	**3040**			ln(y) = 7.37431013900149 + 1.02617066675438*Z
PCB-37 ng/kg	**3/3**	**698.73333**	**991.20506**	**1.418574174**	**-422.9208**	**1820.3875**	**88.2**	**388**	**1620**	**1531.8**	**88.2**	**1620**			ln(y) = 5.94359791028748 + 2.15857412433748*Z
PCB-58 ng/kg	2/3										84.4	1170	24.2	24.2	
PCB-60 ng/kg	**3/3**	**6480**	**4671.5755**	**0.720922146**	**1193.6147**	**11766.385**	**2480**	**8410**	**8550**	**6070**	**2480**	**8550**			ln(y) = 8.63562571801894 + 0.917897255577462*Z
PCB-61/70 ng/kg	**3/3**	**28440**	**20803.792**	**0.731497599**	**4898.2935**	**51981.707**	**9120**	**35000**	**41200**	**32080**	**9120**	**41200**			ln(y) = 10.0691739862925 + 1.11835712169166*Z
PCB-66 ng/kg	**3/3**	**30933.333**	**20615.927**	**0.666463156**	**7604.2158**	**54262.451**	**11400**	**36000**	**45400**	**34000**	**11400**	**45400**			ln(y) = 10.1853034119501 + 1.02485984093282*Z
PCB-77 ng/kg	**3/3**	**1261**	**1200.6334**	**0.952128027**	**-97.64464**	**2619.6446**	**273**	**1120**	**2390**	**2117**	**273**	**2390**			ln(y) = 6.80320146813322 + 1.60902684490083*Z
PCB-79 ng/kg	**3/3**	**1000.3333**	**776.7943**	**0.77653545**	**121.30784**	**1879.3588**	**281**	**1250**	**1470**	**1189**	**281**	**1470**			ln(y) = 6.68742372646762 + 1.2271504479683*Z
PCB-80 ng/kg	**3/3**	**125.76667**	**57.463716**	**0.456907362**	**60.740351**	**190.79298**	**71.3**	**135**	**171**	**99.7**	**71.3**	**171**			ln(y) = 4.77127822078711 + 0.648755057836*Z
PCB-81 ng/kg	**3/3**	**1209.6667**	**935.48858**	**0.773344104**	**151.06168**	**2268.2717**	**339**	**1500**	**1790**	**1451**	**339**	**1790**			ln(y) = 6.87639713110185 + 1.23405339290058*Z
Selenium MG/KG	**16/16**	0.56	0.1337114	0.238770442	0.4944814	0.6255186	0.485	0.545	0.66	0.175	0.3	0.78			ln(y) = -0.608625679912513 + 0.28182298940096*Z
Silver MG/KG	**9/16**	0.0141825	0.0075584	0.532937614	0.0104789	0.0178861	0.00871	-0.01	0.02	0.01129	0.01	0.03	0.01	0.01	ln(y) = -4.37698396843346 + 0.543793499840932*Z
Total HpCDD PG/G	2/3										2.12	3.98	0.674	0.674	
Total HpCDF PG/G	2/3	170	72.31319	0.425371706	88.169922	251.83008	108	165	237	129	108	237			ln(y) = 5.08537894738664 + 0.582869752218506*Z
Total HxCDD PG/G	2/3										0.759	0.935	0.555	0.555	
Total HxCDF PG/G	2/3	244.33333	119.6187	0.489571742	108.97204	379.69463	156	219	358	202	156	358			ln(y) = 5.43982024115558 + 0.616056333314559*Z
Total PeCDD PG/G	2/3	1.6176667	0.9841353	0.608367181	0.5040127	2.7313206	0.693	1.73	2.43	1.737	0.693	2.43			ln(y) = 0.35642912868997 + 0.930463324479005*Z
Total PeCDF PG/G	2/3	205.33333	108.81048	0.529921145	82.202689	328.46398	102	225	289	187	102	289			ln(y) = 5.23583330120037 + 0.77237514887977*Z
Total TCDD PG/G	2/3	1.5353333	0.9677483	0.630318055	0.440223	2.6304437	0.626	1.81	2.17	1.544	0.626	2.17			ln(y) = 0.299883034982688 + 0.921946084265416*Z
Total TCDF PG/G	2/3	201.76667	127.29908	0.630922247	57.714198	345.81914	89.3	251	265	175.7	89.3	265			ln(y) = 5.19906141766682 + 0.806693755133672*Z
Zinc MG/KG	**16/16**	18.04375	3.7880093	0.209934704	16.187625	19.899875	16.45	18.05	21.325	4.875	9.1	22.2			ln(y) = 2.86894292749234 + 0.248474562217106*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-05
Bayou D'Inde
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	**6/7**	13.43533	14.605372	1.087086979	2.6155187	24.255141	**3.71**	**8.51**	**24.9**	**21.19**	**3.71**	**38.6**	**0.62**	**0.62**	ln(y) = 2.06872505938221 + 1.44137290787038*Z
1,2,3,4,7,8-HxCDF PG/G	**6/7**	2.0270163	2.4395259	1.203505809	0.2197902	3.8342424	**0.682**	**1.67**	**2.46**	**1.778**	**0.682**	**6.4**	**0.602**	**0.602**	ln(y) = 0.30913603680576 + 1.18157805099724*Z
1,2,3,6,7,8-HxCDD PG/G	**4/7**	0.2671731	0.0889167	0.332805488	0.2013027	0.3330435	0.17967	0.25874	0.37259	0.19292	**0.161**	**0.406**	**0.445**	**2.37**	ln(y) = -1.3519424667419 + 0.540900348679457*Z
1,2,3,6,7,8-HxCDF PG/G	**6/7**	4.5485385	4.8726051	1.071246294	0.9388622	8.1582149	**-2.3**	**2.39**	**11.3**	**13.6**	**0.864**	**11.4**	**2.3**	**2.3**	ln(y) = 0.999197771831489 + 1.26787500738681*Z
1,2,3,7,8,9-HxCDD PG/G	**1/7**										**0.0878**	**0.0878**	**0.0889**	**2.3**	
1,2,3,7,8,9-HxCDF PG/G	**1/7**										**0.291**	**0.291**	**0.0741**	**2.3**	
1,2,3,7,8-PeCDF PG/G	**7/7**	**4.5528571**	**2.8263932**	**0.620795504**	**2.4590357**	**6.6466786**	**1.83**	**3.98**	**6.21**	**4.38**	**1.34**	**9.2**			ln(y) = 1.33908115824005 + 0.836180647698456*Z
2,3,4,6,7,8-HxCDF PG/G	**1/7**										**0.397**	**0.397**	**0.133**	**1.15**	
2,3,4,7,8-PeCDF PG/G	**6/7**	1.0675337	1.3329681	1.24864264	0.0800571	2.0550102	**-1.45**	**-1.45**	**-1.45**	**0**	**0.281**	**3.4**	**1.45**	**1.45**	ln(y) = -0.246797612276193 + 0.899300544792639*Z
2,3,7,8-TCDD Equivalent PG/G	**7/7**	**2.2674715**	**1.3086862**	**0.577156635**	**1.2979832**	**3.2369597**	**1.59754**	**1.81643**	**3.91318**	**2.31563**	**0.6298906**	**4.0789**			ln(y) = 0.66508268345459 + 0.756747052567591*Z
2,3,7,8-TCDD PG/G	**1/7**										**0.0946**	**0.0946**	**0.026**	**1.45**	
2,3,7,8-TCDF PG/G	**6/7**	2.1783371	1.6041708	0.736419899	0.9899508	3.3667235	**-2.35**	**-2.35**	**3.6**	**5.95**	**0.424**	**4.28**	**2.35**	**2.35**	ln(y) = 0.471828023293082 + 1.02179441579515*Z
2-Methylphenol ug/Kg	**14/22**	148.78947	242.65825	1.630883227	47.389041	250.1899	42.4016	89.2037	187.665	145.264	**31**	**990**	**50**	**2000**	ln(y) = 4.49092304119052 + 1.10315925568135*Z
Aldrin ug/Kg	**2/23**										**2.3**	**11**	**6**	**10**	
alpha-BHC ug/Kg	**4/23**										**0.62**	**1.6**	**10**	**10**	
alpha-Chlordane ug/Kg	**2/23**										**3.4**	**4.7**	**6**	**10**	
Aluminum (Fume Or Dust) MG/KG	**2/4**										**9.1**	**12.7**	**7.2**	**14.7**	
Aroclor-1254 ug/Kg	**17/24**	84.491649	82.109714	0.971808628	51.640922	117.34238	26.7731	54.7175	111.829	85.056	**20**	**310**	**10**	**100**	ln(y) = 4.00218448057472 + 1.06021815372202*Z
Aroclor-1260 ug/Kg	**18/24**	58.071943	47.224005	0.813198285	39.178406	76.96548	24.0416	43.0218	76.9865	52.9449	**22**	**190**	**10**	**100**	ln(y) = 3.76170702207679 + 0.863144541880546*Z
Arsenic MG/KG	**21/23**	0.2618504	0.1706608	0.651749321	0.1921033	0.3315974	0.15793	0.22456	0.3193	0.16137	**0.13**	**0.69**	**0.65**	**1**	ln(y) = -1.49359947729363 + 0.52208580751742*Z
Barium MG/KG	**3/4**	3.6268221	3.5890212	0.989577393	0.1095814	7.1440629	**2.825**	**3**	**6.4**	**3.575**	**2.9**	**7.5**	**2.8**	**2.8**	ln(y) = 1.07835748242727 + 0.931034672654097*Z
Benzaldehyde ug/Kg	**19/20**	611.66885	392.00167	0.640872376	439.86654	783.47115	**280**	**490**	**835**	**555**	**210**	**1500**	**50**	**50**	ln(y) = 6.22600553925524 + 0.719631224665816*Z
beta-BHC ug/Kg	**7/19**	15.014669	17.271464	1.150306028	7.2484715	22.780866	3.58762	8.35055	**22**	18.4124	**13**	**60**	**10**	**10**	ln(y) = 2.12232782287651 + 1.25311762656836*Z
Calcium Metal MG/KG	**4/4**	**17150**	**5910.1084**	**0.344612736**	**11358.094**	**22941.906**	**13075**	**15700**	**22675**	**9600**	**12800**	**24400**			ln(y) = 9.71728478505485 + 0.389307033194055*Z
Chromium MG/KG	**21/23**	0.2953718	0.1386173	0.46929765	0.2387205	0.352023	**-1**	**-1**	**-1**	**0**	**0.18**	**0.78**	**1**	**1**	ln(y) = -1.27803085338949 + 0.351377220438359*Z
Copper MG/KG	**21/23**	0.8135678	0.3181497	0.39105495	0.6835438	0.9435919	0.58	0.75932	0.99408	0.41408	**0.44**	**1.6**	**0.51**	**0.89**	ln(y) = -0.275327428900276 + 0.399580783972699*Z
Endrin Aldehyde ug/Kg	**3/23**										**1.5**	**2.7**	**6**	**10**	
gamma-Chlordane ug/Kg	**2/23**										**2.1**	**2.1**	**6**	**10**	
Heptachlor Epoxide ug/Kg	**2/23**										**1.3**	**3.6**	**10**	**22**	
Heptachlor ug/Kg	**2/23**										**1.8**	**4**	**6**	**10**	
Hexachloro-1,3-butadiene ug/Kg	**18/24**	93.345587	87.679856	0.939303707	58.266339	128.42484	41.0759	71.1539	123.256	82.1805	**27**	**380**	**50**	**2000**	ln(y) = 4.26484452410492 + 0.81493792483218*Z
Hexachlorobenzene ug/Kg	**1/22**										**58**	**58**	**50**	**2000**	
Iron MG/KG	**21/23**	12.998338	4.3819762	0.337118197	11.207476	14.7892	9.7622	12.3322	15.5787	5.81645	**7.7**	**22.2**	**13.4**	**26.6**	ln(y) = 2.51221003504088 + 0.346626452656402*Z
Lead MG/KG	**10/23**	0.0672344	0.0875782	1.302581423	0.0314422	0.1030266	0.01174	0.03128	0.08334	0.07159	**0.05**	**0.27**	**0.04**	**0.8**	ln(y) = -3.4646805785423 + 1.45332925912835*Z
Magnesium MG/KG	**4/4**	**454.75**	**95.684717**	**0.210411691**	**360.97898**	**548.52102**	**390**	**431**	**543.25**	**153.25**	**385**	**572**			ln(y) = 6.10773819591708 + 0.235538121244648*Z
Manganese MG/KG	**4/4**	**5.15**	**2.6605054**	**0.51660299**	**2.5427047**	**7.7572953**	**2.675**	**5.3**	**7.475**	**4.8**	**2.1**	**7.9**			ln(y) = 1.5287384842944 + 0.778219668476665*Z
Mercury MG/KG	**21/23**	0.1220309	0.0569746	0.466886563	0.098746	0.1453157	0.07462	0.10818	0.15683	0.08222	**0.034**	**0.251**	**0.1**	**0.13**	ln(y) = -2.22397252455232 + 0.55089661740285*Z
Nickel MG/KG	**19/23**	0.1305923	0.2568902	1.967115943	0.0256043	0.2355803	**-4**	**-4**	**-4**	**0**	**0.06**	**0.98**	**4**	**4**	ln(y) = -2.31725258403239 + 0.502131539013725*Z
OCDF PG/G	**2/7**										**2.96**	**3.03**	**0.701**	**2.35**	
PCB-105 ng/kg	**6/6**	**6505**	**3457.8824**	**0.531573012**	**3738.1178**	**9271.8822**	**4337.5**	**5355**	**9632.5**	**5295**	**2740**	**11800**			ln(y) = 8.67420475353106 + 0.644250617758766*Z
PCB-108 ng/kg	**6/6**	**2380**	**1243.9244**	**0.522657322**	**1384.6532**	**3375.3468**	**1707.5**	**1965**	**3320**	**1612.5**	**1100**	**4370**			ln(y) = 7.68374513519157 + 0.58061003374235*Z
PCB-114 ng/kg	**6/6**	**330.66667**	**148.98295**	**0.450553291**	**211.45547**	**449.87786**	**217.5**	**302**	**449**	**231.5**	**174**	**563**			ln(y) = 5.72860719843356 + 0.538516873163164*Z
PCB-118 ng/kg	**6/6**	**25983.333**	**12796.708**	**0.492496762**	**15743.835**	**36222.832**	**17625**	**22100**	**37850**	**20225**	**11400**	**45200**			ln(y) = 10.0715666902953 + 0.606128902686413*Z
PCB-126 ng/kg	**5/6**	112.48701	95.604741	0.849918077	35.987282	188.98673	**32.425**	**111.65**	**171.5**	**139.075**	**35.3**	**254**	**23.8**	**23.8**	ln(y) = 4.42598785462793 + 1.09734477390124*Z
PCB-127 ng/kg	**3/6**	10.61724	3.1227058	0.29411653	8.1185551	13.115925	7.51031	10.4245	14.4694	6.9591	**7.63**	**14.7**	**21.8**	**23.8**	ln(y) = 2.34415692097609 + 0.486332105888114*Z
PCB-15 ng/kg	**6/6**	**105.46667**	**41.627345**	**0.394696701**	**72.157853**	**138.77548**	**58.725**	**114.25**	**144.5**	**85.775**	**54**	**146**			ln(y) = 4.58361768668466 + 0.536502411413502*Z
PCB-156 ng/kg	**6/6**	**3090**	**1836.8835**	**0.594460696**	**1620.187**	**4559.813**	**1837.5**	**2550**	**4682.5**	**2845**	**1170**	**5950**			ln(y) = 7.90492490831626 + 0.724356152587154*Z

Table H-05
Bayou D'Inde
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-157 ng/kg	**6/6**	**868**	**549.58572**	**0.633163272**	**428.23984**	**1307.7602**	**524.25**	**674.5**	**1347.5**	**823.25**	**315**	**1730**			ln(y) = 6.62081774382219 + 0.754350360553215*Z
PCB-162 ng/kg	**6/6**	**5725**	**3567.1315**	**0.623079747**	**2870.7003**	**8579.2997**	**3550**	**4405**	**8900**	**5350**	**2110**	**11300**			ln(y) = 8.51150482304586 + 0.733973721765069*Z
PCB-167 ng/kg	**6/6**	**1741.8333**	**745.51131**	**0.428003813**	**1145.3**	**2338.3666**	**1162.75**	**1555**	**2592.5**	**1429.75**	**841**	**2660**			ln(y) = 7.38576260328027 + 0.552196137500383*Z
PCB-169 ng/kg	**4/6**	10.601855	3.1717011	0.299164727	8.0639657	13.139745	7.63268	10.3256	13.9685	6.33585	**7.28**	**15.2**	**20.2**	**23.8**	ln(y) = 2.33462288487789 + 0.448218142638064*Z
PCB-189 ng/kg	**6/6**	**283.83333**	**140.13781**	**0.493732738**	**171.69973**	**395.96693**	**167.25**	**264**	**392.5**	**225.25**	**141**	**502**			ln(y) = 5.55950898086839 + 0.598386399368882*Z
PCB-37 ng/kg	**6/6**	**60.333333**	**13.066837**	**0.216577404**	**49.877686**	**70.78898**	**45.5**	**64.1**	**71.5**	**26**	**44.9**	**71.8**			ln(y) = 4.07954375405009 + 0.265935065317195*Z
PCB-58 ng/kg	**6/6**	**51.9**	**28.971002**	**0.558208123**	**28.718371**	**75.081629**	**32.55**	**37.65**	**81.825**	**49.275**	**29.4**	**96**			ln(y) = 3.84243560313306 + 0.590930345208364*Z
PCB-60 ng/kg	**6/6**	**709.66667**	**277.5792**	**0.391140254**	**487.55705**	**931.77629**	**539.25**	**615**	**914.75**	**375.5**	**474**	**1160**			ln(y) = 6.51812498754789 + 0.40495758798366*Z
PCB-61/70 ng/kg	**6/6**	**4965**	**2518.6745**	**0.507285908**	**2949.6406**	**6980.3594**	**3292.5**	**3535**	**7977.5**	**4685**	**3120**	**8420**			ln(y) = 8.41788432548424 + 0.516647525622801*Z
PCB-66 ng/kg	**6/6**	**5983.3333**	**2094.3645**	**0.35003306**	**4307.4927**	**7659.1739**	**4155**	**5645**	**8007.5**	**3852.5**	**3990**	**8600**			ln(y) = 8.64526662736055 + 0.422748276174131*Z
PCB-77 ng/kg	**6/6**	**160.6**	**136.36204**	**0.849078726**	**51.487641**	**269.71236**	**99**	**116.5**	**212.5**	**113.5**	**96.9**	**376**			ln(y) = 4.9467823489077 + 0.57913658891878*Z
PCB-79 ng/kg	**6/6**	**316.5**	**193.95145**	**0.612800778**	**161.30652**	**471.69348**	**227.25**	**259.5**	**422.25**	**195**	**138**	**633**			ln(y) = 5.65132351008496 + 0.6048543426884*Z
PCB-80 ng/kg	**4/6**	10.462203	1.3143598	0.125629353	9.4104959	11.51391	9.2794	10.4166	11.6932	2.41379	**9.4**	**12.4**	**23.2**	**26.5**	ln(y) = 2.34340147087805 + 0.171472396641921*Z
PCB-81 ng/kg	**6/6**	**216.11667**	**144.62238**	**0.669186613**	**100.39466**	**331.83867**	**134.925**	**159.5**	**323**	**188.075**	**98.7**	**452**			ln(y) = 5.24556917099477 + 0.671466131454384*Z
Potassium MG/KG	**4/4**	**3090**	**168.22468**	**0.054441643**	**2925.1398**	**3254.8602**	**2952.5**	**3065**	**3252.5**	**300**	**2940**	**3290**			ln(y) = 8.03495361234479 + 6.93153322545091E-02*Z
Selenium MG/KG	**21/23**	0.5469453	0.2342949	0.428369929	0.4511917	0.6426989	0.38799	0.50667	0.66166	0.27367	**0.29**	**1.2**	**0.83**	**1.1**	ln(y) = -0.679891203201556 + 0.39585701523768*Z
Sodium MG/KG	**2/4**										**1400**	**1610**	**1160**	**1.1**	
Total HpCDF PG/G	**6/7**	13.565635	14.52777	1.070924421	2.8033126	24.327958	**3.97**	**9.03**	**24.9**	**20.93**	**3.97**	**38.6**	**0.62**	**0.62**	ln(y) = 2.09962114971836 + 1.40628480222848*Z
Total HxCDD PG/G	**4/7**	0.2870487	0.0958412	0.333884756	0.2160486	0.3580488	0.18631	0.27611	0.4092	0.22288	**0.161**	**0.406**	**0.409**	**2.13**	ln(y) = -1.28694280581606 + 0.583491156495686*Z
Total HxCDF PG/G	**7/7**	**26.252857**	**28.742144**	**1.09481966**	**4.9603788**	**47.545335**	**6.4**	**13.6**	**64.8**	**58.4**	**5.89**	**68.5**			ln(y) = 2.78306373597562 + 1.23788523473754*Z
Total PeCDF PG/G	**7/7**	**24.241429**	**23.467515**	**0.968074761**	**6.85645**	**41.626407**	**9.58**	**13.1**	**52.5**	**42.92**	**4.91**	**61.2**			ln(y) = 2.8282629985704 7 + 1.09169200076634*Z
Total TCDD PG/G	**1/7**										**0.0946**	**0.0946**	**0.026**	**0.882**	
Total TCDF PG/G	**7/7**	**23.652857**	**33.298399**	**1.407796059**	**-1.014942**	**48.320656**	**7**	**9.9**	**40.8**	**33.8**	**4.35**	**84**			ln(y) = 2.6265249383032 + 1.24579299227457*Z
Zinc MG/KG	**23/23**	**14.66087**	**2.78242**	**0.189785466**	**13.523727**	**15.798012**	**13.1**	**14.5**	**16.6**	**3.5**	**8.9**	**20.1**			ln(y) = 2.66778175945729 + 0.209967522920114*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-06
Bayou D'Inde
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/12										13	13			
1,2,3,4,6,7,8-HpCDD PG/G	3/3	6.7966667	6.369773	0.937190725	-0.41141	14.004743	2.93	4.76	12.7	9.77	2.93	12.7			ln(y) = 1.72561736157895 + 1.08767664986516*Z
1,2,3,4,6,7,8-HpCDF PG/G	3/3	31.552667	64.779511	2.053059775	-41.75225	104.85758	0.378	5.98	88.3	87.922	0.378	88.3			ln(y) = 1.7654331974033 + 4.04456321457661*Z
1,2,3,4,7,8,9-HpCDF PG/G	1/3										1.68	1.68	0.14	1.2	
1,2,3,4,7,8-HxCDD PG/G	1/3										0.458	0.458	1.58	1.69	
1,2,3,4,7,8-HxCDF PG/G	3/3	15.98	15.62902	0.978036273	-1.705901	33.665901	1.24	20.2	26.5	25.26	1.24	26.5			ln(y) = 2.16597957233876 + 2.27090082849636*Z
1,2,3,6,7,8-HxCDD PG/G	3/3	4.1033333	3.1127657	0.758594408	0.5809073	7.6257593	2.38	3	6.93	4.55	2.38	6.93			ln(y) = 1.30052419651777 + 0.792625735153314*Z
1,2,3,6,7,8-HxCDF PG/G	3/3	11.446667	10.468513	0.914546856	-0.399571	23.292904	1.54	14.1	18.7	17.16	1.54	18.7			ln(y) = 2.00216024589007 + 1.85166221104851*Z
1,2,3,7,8,9-HxCDD PG/G	1/3										1.27	1.27	0.97	1.64	
1,2,3,7,8,9-HxCDF PG/G	2/3										1.51	2.15	0.113	0.113	
1,2,3,7,8-PeCDD PG/G	2/3										1.07	3.02	2.4	2.4	
1,2,3,7,8-PeCDF PG/G	3/3	55.156667	55.925619	1.013941234	-8.129128	118.44246	3.87	57.6	104	100.13	3.87	104			ln(y) = 3.3503893246283 + 2.44081089164995*Z
2,3,4,6,7,8-HxCDF PG/G	3/3	3.001	2.4918377	0.8303358	0.1812202	5.8207798	0.633	3.49	4.88	4.247	0.633	4.88			ln(y) = 0.79258736641381 + 1.51473077463973*Z
2,3,4,7,8-PeCDF PG/G	3/3	27.843333	27.736255	0.996154248	-3.543194	59.22986	2.43	29	52.1	49.67	2.43	52.1			ln(y) = 2.73611734536608 + 2.27330396571645*Z
2,3,7,8-TCDD Equivalent PG/G	3/3	32.594887	29.098185	0.892722369	-0.332809	65.522583	5.54088	34.8897	57.3541	51.8132	5.5408839	57.354057			ln(y) = 3.10452994961682 + 1.7332595606759*Z
2,3,7,8-TCDD PG/G	3/3	1.1666667	0.4106061	0.351948119	0.7020221	1.6313113	0.78	1.28	1.44	0.66	0.78	1.44			ln(y) = 0.121013944073645 + 0.454697677900164*Z
2,3,7,8-TCDF PG/G	3/3	88.533333	80.144646	0.905248255	-2.158871	179.22554	14.7	92.9	158	143.3	14.7	158			ln(y) = 4.09398872421048 + 1.7611879205661*Z
4,4'-DDD ug/Kg	1/12										12	12			
4,4'-DDE ug/Kg	9/12	20.044573	6.8635848	0.342416116	16.161134	23.928011	10.5	21	24.75	14.25	12	30			
4,4'-DDT ug/Kg	2/12										83	180			
Acenaphthene ug/Kg	1/12							26	26	50	50				
Aldrin ug/Kg	9/12	28.016147	19.932501	0.711464754	16.738273	39.294021	11	19.5	50	39	14	59			
alpha-Chlordane ug/Kg	7/12	23.023092	15.023062	0.652521482	14.522995	31.52319	11.225	17.5	39.75	28.525	14	46			
Aroclor-1254 ug/Kg	10/11	1122.0919	725.36757	0.646442222	693.42705	1550.7567	470	1100	1600	1130	440	2300	10	10	ln(y) = 6.82849346460765 + 0.789705410875871*Z
Aroclor-1260 ug/Kg	11/11	820	601.79879	0.73390096	464.35964	1175.6404	320	720	1200	880	240	2000			ln(y) = 6.48550522668825 + 0.82410567026634*Z
Arsenic MG/KG	12/12	0.3275	0.0999473	0.305182521	0.2709495	0.3840505	0.215	0.35	0.39	0.175	0.18	0.46			ln(y) = -1.16356732307136 + 0.373274824824584*Z
Benzaldehyde ug/Kg	10/12	798.65603	522.27707	0.653944943	503.14996	1094.1621	337.5	795	1140	802.5	310	1800	50	50	ln(y) = 6.47683432243726 + 0.804270823855572*Z
beta-BHC ug/Kg	12/12	12	12	100.0%	154.58333	75.466381	0.48819	111.884	197.282	99.5	120	212.5	113	63	300
bis(2-Ethylhexyl)phthalate ug/Kg	8/12	349.87421	243.66876	0.696446747	212.00563	487.74279	170.171	335	520	349.829	190	880	50	50	ln(y) = 5.65485089185791 + 0.768402469857427*Z
Chromium MG/KG	12/12	0.3925	0.402778	1.026185886	0.1646069	0.6203931	0.2	0.3	0.445	0.245	0.11	1.4			ln(y) = -1.15670666209442 + 0.722851080586305*Z
Copper MG/KG	12/12	7.1608333	9.4166176	1.315017006	1.8328804	12.488786	0.69	1.9	17.35	16.66	0.5	25.5			ln(y) = 0.999720478358624 + 1.66845851315191*Z
Dieldrin ug/Kg	3/12	7.2569731	9.1544461	1.261468923	2.0773577	12.436589	1.96305	4.32356	9.52251	7.55946	11	28			
Diethyl Phthalate ug/Kg	1/12										42	42	50	50	
Endosulfan I ug/Kg	2/12										12	18			
Endosulfan II ug/Kg	7/12	16.505006	7.5917405	0.459965945	12.209574	20.800437	10.4618	15.5	23.5	13.0382	15	30			
Endosulfan Sulfate ug/Kg	10/11	40.071371	15.952819	0.398110129	30.643858	49.498885	36	43	54	18	13	57			
Endrin Aldehyde ug/Kg	3/11	11.780343	31.271319	2.654533842	-6.699826	30.260511	0.3949	1.9215	9.34959	8.95469	12	84			
Endrin Ketone ug/Kg	1/12										29	29			
Endrin ug/Kg	3/12										10	24			
gamma-Chlordane ug/Kg	10/12	25.664013	15.199694	0.592257091	17.063977	34.264049	11.25	24.5	36	24.75	10	56			
Heptachlor Epoxide ug/Kg	1/12										30	30			
Hexachloro-1,3-butadiene ug/Kg	8/12	94.813588	114.37928	1.206359527	30.097421	159.52976	34.0074	61	127.5	93.4926	36	380	50	50	ln(y) = 4.18156949283923 + 0.971525066010053*Z
Hexachlorobenzene ug/Kg	2/12										230	280	50	50	
Iron MG/KG	12/12	53.475	45.455951	0.850041168	27.755874	79.194126	28.075	38.75	81.475	53.4	14.6	161			ln(y) = 3.74046792874957 + 0.804852922786496*Z
Lead MG/KG	12/12	0.7183333	0.8960455	1.247395103	0.2113479	1.2253188	0.1125	0.435	1.175	1.0625	0.06	2.9			ln(y) = -0.987463019550419 + 1.48322491169161*Z
Mercury MG/KG	12/12	0.0865	0.0397392	0.459413218	0.0640154	0.1089846	0.068	0.078	0.09875	0.03075	0.049	0.185			ln(y) = -2.50936388904233 + 0.392760364283621*Z

CDM

Table H-06
Bayou D'Inde
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Nickel MG/KG	12/12	0.1991667	0.1903467	0.955715678	0.0914679	0.3068655	0.0775	0.13	0.28	0.2025	0.06	0.67			ln(y) = -1.87617500598931 + 0.834662584778823*Z
OCDD PG/G	3/3	72.8	115.05947	1.580487182	-57.40204	203.00204	22.4	25	171	148.6	22.4	171			ln(y) = 3.82320011341062 + 1.50744240519142*Z
OCDF PG/G	3/3	8.6363333	9.061091	1.049182639	-1.617256	18.889923	0.539	8.57	16.8	16.261	0.539	16.8			ln(y) = 1.45053563698192 + 2.55078166511357*Z
PCB-105 ng/kg	3/3	16410	13689.431	0.834212722	918.95078	31901.049	4730	22100	22400	17670	4730	22400			ln(y) = 9.49394320227832 + 1.15333788694463*Z
PCB-108 ng/kg	3/3	6153.3333	4863.6142	0.790403174	649.63576	11657.031	1880	8060	8520	6640	1880	8520			ln(y) = 8.52795583704934 + 1.1207126266542*Z
PCB-114 ng/kg	3/3	1121.3333	894.11807	0.797370451	109.54349	2133.1232	334	1470	1560	1226	334	1560			ln(y) = 6.81886659099769 + 1.14307693177011*Z
PCB-118 ng/kg	3/3	68633.333	53656.62	0.781786597	7915.1518	129351.51	20500	88500	96900	76400	20500	96900			ln(y) = 10.9334575980005 + 1.15194278615387*Z
PCB-126 ng/kg	3/3	569.96667	555.73599	0.975032434	-58.9078	1198.8411	80.9	787	842	761.1	80.9	842			ln(y) = 5.93240736224139 + 1.73732121376753*Z
PCB-15 ng/kg	3/3	212	112.79236	0.532039414	84.363434	339.63657	111	254	271	160	111	271			ln(y) = 5.28299442973686 + 0.661971964951867*Z
PCB-156 ng/kg	3/3	8720	6920.6702	0.793654838	888.52444	16551.476	2160	10400	13600	11440	2160	13600			ln(y) = 8.81508321917727 + 1.36457372402032*Z
PCB-157 ng/kg	3/3	2216.6667	1699.1221	0.76652126	293.92898	4139.4044	630	2730	3290	2660	630	3290			ln(y) = 7.48547318377467 + 1.225860019243*Z
PCB-162 ng/kg	3/3	14616.667	11194.861	0.765897014	1948.4885	27284.845	4050	17600	22200	18150	4050	22200			ln(y) = 9.36332463632907 + 1.26179383996787*Z
PCB-167 ng/kg	3/3	5723.3333	4564.7464	0.797567805	557.8365	10888.83	1520	7240	8410	6890	1520	8410			ln(y) = 8.41700628406236 + 1.26871751376532*Z
PCB-189 ng/kg	3/3	1779.3333	1453.5163	0.81688815	134.52478	3424.1419	398	2080	2860	2462	398	2860			ln(y) = 7.19505069393123 + 1.46259022980017*Z
PCB-37 ng/kg	3/3	255.63333	187.03582	0.731656619	43.982378	467.28429	77.9	292	397	319.1	77.9	397			ln(y) = 5.33870534527739 + 1.20775479096701*Z
PCB-58 ng/kg	3/3	326	63.211088	0.193899044	254.46992	397.53008	292	303	383	91	292	383			ln(y) = 5.7795071989861 + 0.201190712516472*Z
PCB-60 ng/kg	3/3	5290	1847.2037	0.349187842	3199.6923	7380.3077	3630	5970	6270	2640	3630	6270			ln(y) = 8.5450072557575 + 0.405334107230616*Z
PCB-61/70 ng/kg	3/3	26433.333	17643.245	0.667461971	6468.1224	46398.544	11300	33700	34300	23000	11300	34300			ln(y) = 10.066903918065 + 0.82346522845374*Z
PCB-66 ng/kg	3/3	23966.667	14247.537	0.594473052	7844.0603	40089.273	11400	29500	31000	19600	11400	31000			ln(y) = 9.99175222005926 + 0.741908901870196*Z
PCB-77 ng/kg	3/3	704.66667	364.22245	0.516871966	292.51017	1116.8232	447	617	1050	603	447	1050			ln(y) = 6.49465768722351 + 0.633343670059067*Z
PCB-79 ng/kg	3/3	985.33333	584.28085	0.592977863	324.1573	1646.5094	436	1150	1370	934	436	1370			ln(y) = 6.78257516117617 + 0.849111701353996*Z
PCB-80 ng/kg	3/3	56	47.768282	0.853005041	1.9450999	110.0549	10.8	63.1	94.1	83.3	10.8	94.1			ln(y) = 3.68954165008956 + 1.60549301663482*Z
PCB-81 ng/kg	3/3	656.66667	578.15045	0.880432154	2.4278457	1310.9055	139	872	959	820	139	959			ln(y) = 6.19038481064104 + 1.43240006923625*Z
Selenium MG/KG	12/12	0.4416667	0.1377327	0.311847712	0.363737	0.5195963	0.3425	0.44	0.5025	0.16	0.29	0.77			ln(y) = -0.851410443716766 + 0.302254498734372*Z
Silver MG/KG	4/12	0.0210151	0.0307908	1.465170228	0.0035936	0.0384366	0.00286	0.00861	0.035	0.03214	0.02	0.09	0.01	0.01	ln(y) = -4.75528179378781 + 1.63602813061887*Z
Total HpCDD PG/G	3/3	21.526667	39.358766	1.828372531	-23.01197	66.065303	4.5	5.08	55	50.5	4.5	55			ln(y) = 2.37890728119971 + 1.85649370464152*Z
Total HpCDF PG/G	3/3	36.656	71.227099	1.943122506	-43.94505	117.25705	0.378	9.59	100	99.622	0.378	100			ln(y) = 1.96434333050696 + 4.1368444981124*Z
Total HxCDD PG/G	3/3	9.5	13.613418	1.432991396	-5.905033	24.905033	3	4.1	21.4	18.4	3	21.4			ln(y) = 1.85766339480206 + 1.45714200708829*Z
Total HxCDF PG/G	3/3	70.066667	63.376532	0.90451758	-1.65063	141.78396	11.5	90.7	108	96.5	11.5	108			ln(y) = 3.87734520653817 + 1.66109483134889*Z
Total PeCDD PG/G	2/3										1.07	3.02	2.4	2.4	
Total PeCDF PG/G	3/3	121.26667	108.03837	0.890915614	-0.990254	243.52359	18.8	147	198	179.2	18.8	198			ln(y) = 4.40418549576972 + 1.74610507720976*Z
Total TCDD PG/G	3/3	1.5666667	0.3165078	0.202026264	1.2085044	1.924829	1.28	1.68	1.74	0.46	1.28	1.74			ln(y) = 0.439846328191044 + 0.227699481539547*Z
Total TCDF PG/G	3/3	124.76667	98.692844	0.791019324	13.0852	236.44813	31.3	140	203	171.7	31.3	203			ln(y) = 4.5661554997324 + 1.38654553333176*Z
Zinc MG/KG	12/12	16.316667	6.4525524	0.395457755	12.665791	19.967542	9.975	17.2	22.375	12.4	7.3	23.5			ln(y) = 2.7089635915456 + 0.491880033617502*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-07
Bayou D'Inde
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**4/21**										**10**	**22**	**10**	**6**	
1,2,3,4,6,7,8-HpCDF PG/G	**4/4**	**24.9275**	**15.52436**	**0.622780446**	**9.7136276**	**40.141372**	**10.7325**	**26.05**	**38**	**27.2675**	**6.81**	**40.8**			ln(y) = 3.03209096802798 + 1.02057671479708*Z
1,2,3,4,7,8-HxCDF PG/G	**3/4**	0.6835172	0.4651112	0.680467505	0.2277082	1.1393262	**0.182**	**0.628**	**1.05525**	**0.87325**	**0.605**	**1.19**	**0.041**	**0.041**	ln(y) = -0.483695913047598 + 0.661367328282785*Z
1,2,3,6,7,8-HxCDD PG/G	**1/4**										**0.424**	**0.424**	**0.165**	**0.041**	
1,2,3,6,7,8-HxCDF PG/G	**4/4**	**3.27875**	**2.1747466**	**0.663285265**	**1.1474984**	**5.4100016**	**1.20875**	**3.535**	**5.0925**	**3.88375**	**0.705**	**5.34**			ln(y) = 0.949118975552683 + 1.18035782020967*Z
1,2,3,7,8-PeCDF PG/G	**4/4**	**2.78425**	**2.0400085**	**0.732695861**	**0.7850417**	**4.7834583**	**1.10025**	**2.525**	**4.7275**	**3.62725**	**0.877**	**5.21**			ln(y) = 0.819538634534278 + 1.07208796110008*Z
2,3,4,6,7,8-HxCDF PG/G	**2/4**										**0.179**	**0.243**	**0.048**	**0.0767**	
2,3,4,7,8-PeCDF PG/G	**1/4**										**0.517**	**0.517**	**0.106**	**0.361**	
2,3,7,8-TCDF PG/G	**4/4**	**1.36425**	**1.9542406**	**1.432465181**	**-0.550906**	**3.2794058**	**0.33575**	**0.758**	**2.999**	**2.66325**	**0.271**	**3.67**			ln(y) = -0.163605498212857 + 1.52178258805442*Z
2-Methylphenol ug/Kg	**3/19**										**99**	**280**	**50**	**50**	
4,4'-DDE ug/Kg	**2/21**										**11**	**17**	**6**	**6**	
4,4'-DDT ug/Kg	**2/21**										**1.4**	**66**	**10**	**6**	
alpha-BHC ug/Kg	**1/21**										**2.4**	**2.4**	**10**	**6**	
alpha-Chlordane ug/Kg	**1/21**										**3.8**	**3.8**	**10**	**6**	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**5.4**	**5.4**			
Aroclor-1254 ug/Kg	**16/21**	80.174334	132.03384	1.646834228	23.702529	136.64614	16.1045	39.4858	96.8129	80.7083	**12**	**530**	**10**	**100**	ln(y) = 3.67594055822903 + 1.33024870883465*Z
Aroclor-1260 ug/Kg	**13/21**	42.50754	100.61147	2.366908841	-0.524697	85.539777	7.11102	18.1013	46.0773	38.9663	**11**	**380**	**10**	**100**	ln(y) = 2.89598353120919 + 1.38586828117411*Z
Arsenic MG/KG	**21/21**	**0.2619048**	**0.1217943**	**0.465032605**	**0.2098125**	**0.313997**	**0.17**	**0.23**	**0.34**	**0.17**	**0.11**	**0.6**			ln(y) = -1.42742823234707 + 0.46738664517343*Z
Barium MG/KG	**1/1**										**2.5**	**2.5**			
Benzaldehyde ug/Kg	**10/20**	53.199569	52.044475	0.978287523	30.390073	76.009066	23.1107	40.1345	69.6982	46.5874	**26**	**220**	**40**	**50**	ln(y) = 3.69223586682962 + 0.818670035930559*Z
Benzyl Butyl Phthalate ug/Kg	**1/17**										**330**	**330**	**50**	**50**	
beta-BHC ug/Kg	**6/20**	11.134941	20.463334	1.837758591	2.1664897	20.103392	0.75367	2.85196	**10.75**	9.99633	**10**	**73**	**10**	**10**	ln(y) = 1.04800522120382 + 1.97394076100129*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**13/20**	487.98483	267.76356	0.548712863	370.63228	605.33739	287.978	422.975	621.255	333.276	**230**	**1200**	**40**	**1000**	ln(y) = 6.047313038962 + 0.570207712641401*Z
Calcium Metal MG/KG	**1/1**										**16300**	**16300**			
Chromium MG/KG	**19/21**	0.2245137	0.1404449	0.625551305	0.1644445	0.284583	0.12184	0.18985	0.29583	0.17399	**0.08**	**0.59**	**0.1**	**0.11**	ln(y) = -1.66149659985852 + 0.657879196197437*Z
Copper MG/KG	**21/21**	**0.7480952**	**0.3423188**	**0.457587245**	**0.6016831**	**0.8945074**	**0.485**	**0.66**	**0.905**	**0.42**	**0.31**	**1.5**			ln(y) = -0.37603868807831 + 0.456100167822689*Z
Dieldrin ug/Kg	**1/21**										**10**	**10**	**6**	**10**	
Diethyl Phthalate ug/Kg	**3/21**										**50**	**93**	**40**	**1000**	
Dimethyl Phthalate ug/Kg	**1/21**										**78**	**78**	**40**	**1000**	
Di-n-butylphthalate ug/Kg	**14/21**	215.19563	122.93106	0.571252575	162.61715	267.77411	111.359	179.459	289.205	177.846	**36**	**400**	**40**	**1000**	ln(y) = 5.1899464305847 + 0.707795519607799*Z
Endosulfan Sulfate ug/Kg	**2/7**										**10**	**16**	**6**	**10**	
gamma-Chlordane ug/Kg	**1/21**										**11**	**11**	**10**	**10**	
Heptachlor ug/Kg	**1/21**										**19**	**19**	**10**	**10**	
Iron MG/KG	**21/21**	**8.2904762**	**4.617975**	**0.557021685**	**6.3153356**	**10.265617**	**4.75**	**7.1**	**10.75**	**6**	**2.8**	**19.1**			ln(y) = 1.97144694421363 + 0.617179835327767*Z
Magnesium MG/KG	**1/1**										**469**	**469**			
Manganese MG/KG	**1/1**										**2.8**	**2.8**			
Mercury MG/KG	**21/21**	**0.2162381**	**0.162155**	**0.749891182**	**0.1468832**	**0.285593**	**0.1005**	**0.178**	**0.275**	**0.1745**	**0.043**	**0.71**			ln(y) = -1.74296464009942 + 0.739535406707328*Z
Nickel MG/KG	**20/21**	0.0927657	0.0271515	0.292688509	0.0811528	0.1043786	**-4**	**-4**	**-4**	**0**	**0.03**	**0.15**	**4**	**4**	ln(y) = -2.42951321858946 + 0.359436815000006*Z
PCB-105 ng/kg	**4/4**	**5487**	**5153.503**	**0.939220525**	**436.56704**	**10537.433**	**1533.5**	**4765**	**10162.5**	**8629**	**718**	**11700**			ln(y) = 8.21360099871326 + 1.57540600551961*Z
PCB-108 ng/kg	**4/4**	**1849**	**1548.1063**	**0.837266767**	**331.85587**	**3366.1441**	**482**	**1770**	**3295**	**2813**	**246**	**3610**			ln(y) = 7.13516844512577 + 1.57532204781539*Z
PCB-114 ng/kg	**4/4**	**319.575**	**235.12665**	**0.735747934**	**89.150887**	**549.99911**	**113.475**	**347**	**498.25**	**384.775**	**38.3**	**546**			ln(y) = 5.41154669219684 + 1.45562546564016*Z
PCB-118 ng/kg	**4/4**	**22142.5**	**20884.856**	**0.943202278**	**1675.3407**	**42609.659**	**5852.5**	**19250**	**41325**	**35472.5**	**2770**	**47300**			ln(y) = 9.59345237445256 + 1.6181904294502*Z
PCB-126 ng/kg	**4/4**	**111.025**	**146.99996**	**1.32402578**	**-33.03496**	**255.08496**	**18.725**	**68.35**	**246**	**227.275**	**16.4**	**291**			ln(y) = 4.10665644880379 + 1.80701232082918*Z
PCB-156 ng/kg	**4/4**	**2802.5**	**2606.7003**	**0.930133922**	**247.93369**	**5357.0663**	**715**	**2490**	**5202.5**	**4487.5**	**310**	**5920**			ln(y) = 7.50270904421441 + 1.68235604755979*Z
PCB-157 ng/kg	**4/4**	**794.65**	**767.50582**	**0.96584134**	**42.494295**	**1546.8057**	**206.95**	**687**	**1490**	**1283.05**	**84.6**	**1720**			ln(y) = 6.23131374010179 + 1.6959039399743*Z
PCB-162 ng/kg	**4/4**	**4959.25**	**4903.9728**	**0.988853726**	**153.35662**	**9765.1434**	**1235.25**	**4185**	**9457.5**	**8222.25**	**567**	**10900**			ln(y) = 8.06576672972404 + 1.68628727076845*Z

Table H-07
Bayou D'Inde
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-167 ng/kg	4/4	1509	1343.7302	0.890477298	192.14436	2825.8556	329.5	1407.5	2790	2460.5	181	3040			ln(y) = 6.87291948546443 + 1.6959602780162*Z
PCB-189 ng/kg	4/4	268.225	260.74907	0.972128128	12.690914	523.75909	47.575	236.1	521	473.425	32.7	568			ln(y) = 5.07340696997684 + 1.78773592864453*Z
PCB-37 ng/kg	4/4	22.5825	16.49757	0.730546653	6.4148816	38.750118	7.6475	22.2	37.9	30.2525	6.63	39.3			ln(y) = 2.86264272547479 + 1.15776853884931*Z
PCB-58 ng/kg	4/4	116.5	211.31975	1.813903432	-90.59335	323.59335	7.25	46.7	295.55	288.3	5.6	367			ln(y) = 3.63161991117563 + 2.58988017205096*Z
PCB-60 ng/kg	4/4	545.475	575.91093	1.055797119	-18.91771	1109.8677	139.925	419	1077.5	937.575	93.9	1250			ln(y) = 5.9071717784826 + 1.52546009832214*Z
PCB-61/70 ng/kg	3/4	2465.0326	3459.5778	1.403461286	-925.3537	5855.4188	145.55	1818.5	5465	5319.45	347	6190	78.4	78.4	ln(y) = 6.61392407416065 + 2.70634439712267*Z
PCB-66 ng/kg	4/4	4969	3609.2694	0.726357294	1431.916	8506.084	1469.5	5415	8022.5	6553	826	8220			ln(y) = 8.19393302747181 + 1.38024844669209*Z
PCB-77 ng/kg	4/4	89.97	102.4565	1.138785112	-10.43737	190.37737	8.01	71.9	190	181.99	6.08	210			ln(y) = 3.66107881732857 + 2.29773857411995*Z
PCB-79 ng/kg	4/4	257.2	235.63657	0.916160861	26.276158	488.12384	62.1	229.5	480	417.9	32.8	537			ln(y) = 5.13010079522324 + 1.64188229158232*Z
PCB-81 ng/kg	4/4	148.475	170.26199	1.146738471	-18.38175	315.33175	25.725	109.45	310.25	284.525	18	357			ln(y) = 4.44842084330172 + 1.83212914018114*Z
Potassium MG/KG	1/1										3480	3480			
Selenium MG/KG	21/21	0.53	0.1939212	0.365889124	0.4470585	0.6129415	0.415	0.52	0.64	0.225	0.24	1.1			ln(y) = -0.690922265658808 + 0.377509760168772*Z
Sodium MG/KG	1/1										1460	1460			
TCDD Equivalent PG/G	4/4	1.1950226	0.8199695	0.686153939	0.3914525	1.9985927	0.54253	1.11534	1.92719	1.38466	0.3818172	2.1675833			ln(y) = 5.62385428433723E-03 + 0.972990561168608*Z
Total HpCDF PG/G	4/4	24.9275	15.52436	0.622780446	9.7136276	40.141372	10.7325	26.05	38	27.2675	6.81	40.8			ln(y) = 3.03209096802798 + 1.02057671479708*Z
Total HxCDD PG/G	1/4										0.424	0.424	0.145	0.39	
Total HxCDF PG/G	4/4	26.5725	17.993641	0.677152749	8.9387314	44.206269	10.6675	27.75	41.3	30.6325	5.59	45.2			ln(y) = 3.04352342601018 + 1.16092031863203*Z
Total PeCDF PG/G	4/4	16.055	10.401153	0.647845112	5.8618698	26.24813	6.64	16.65	24.875	18.235	4.02	26.9			ln(y) = 2.57285342712529 + 1.07844168891711*Z
Total TCDF PG/G	4/4	11.895	7.7607133	0.652434911	4.289501	19.500499	5.51	11.45	18.725	13.215	3.78	20.9			ln(y) = 2.31028821545233 + 0.953398983084967*Z
Zinc MG/KG	21/21	8.3380952	4.2164689	0.505687299	6.5346817	10.141509	6.05	7.7	9.85	3.8	3.1	19.9			ln(y) = 2.01427859602192 + 0.521197219292078*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-08
Bayou D'Inde
Fish Fillet - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**1/4**										**15**	**15**	**11**	**10**	
4,4'-DDE ug/Kg	**3/4**	1.7614259	0.3591345	0.203888493	1.4094741	2.1133777	**-14**	**-14**	**-14**	**0**	**1.4**	**2**	**14**	**14**	ln(y) = 0.557157767784518 + 0.264521424889621*Z
4,4'-DDT ug/Kg	**1/4**										**1.7**	**1.7**	**6**	**14**	
alpha-BHC ug/Kg	**2/4**										**1.3**	**1.3**	**6**	**14**	
alpha-Chlordane ug/Kg	**4/4**	**1.315**	**0.5845748**	**0.44454354**	**0.7421167**	**1.8878833**	**0.82**	**1.25**	**1.875**	**1.055**	**0.76**	**2**			ln(y) = 0.206043860741587 + 0.593721780152883*Z
Aluminum (Fume Or Dust) MG/KG	**3/4**	8.1604948	8.8781752	1.087945692	-0.540117	16.861107	**-8.2**	**-8.2**	**15.7**	**23.9**	**4.1**	**18.2**	**8.2**	**8.2**	ln(y) = 1.86585418452571 + 0.842515334794532*Z
Arsenic MG/KG	**3/4**										**0.43**	**0.64**	**3.4**	**8.2**	
Barium MG/KG	**3/4**	0.5577324	0.491067	0.880470548	0.0764868	1.038978	**-0.67**	**-0.67**	**0.9925**	**1.6625**	**0.36**	**1.1**	**0.67**	**0.67**	ln(y) = -0.733797006871554 + 0.645602509454317*Z
Calcium Metal MG/KG	**4/4**	**2585.75**	**1862.5749**	**0.720322887**	**760.42659**	**4411.0734**	**892.25**	**2540**	**4325**	**3432.75**	**753**	**4510**			ln(y) = 7.61268258923347 + 1.14864165221593*Z
Copper MG/KG	**3/4**	1.0310923	0.5001106	0.485029885	0.5409839	1.5212007	**0.4975**	**1.075**	**1.375**	**0.8775**	**0.85**	**1.4**	**0.38**	**0.38**	ln(y) = -1.76180429210002E-02 + 0.466662107416857*Z
Dieldrin ug/Kg	**3/4**	1.7591168	0.4173991	0.237277645	1.3500657	2.1681679	**-14**	**-14**	**-14**	**0**	**1.4**	**2.2**	**14**	**14**	ln(y) = 0.551852616015885 + 0.335206470185813*Z
Diethyl Phthalate ug/Kg	**1/4**										**480**	**480**	**4000**	**1000**	
Endosulfan II ug/Kg	**2/4**										**2**	**4.3**	**6**	**14**	
Endrin ug/Kg	**1/4**										**2.4**	**2.4**	**6**	**14**	
gamma-BHC (Lindane) ug/Kg	**3/4**	1.440654	0.8483545	0.588867614	0.6092666	2.2720414	**-6**	**-6**	**-6**	**0**	**1**	**2.3**	**6**	**6**	ln(y) = 0.309406434246476 + 0.617711761777704*Z
Heptachlor Epoxide ug/Kg	**2/4**										**0.84**	**1.7**	**22**	**6**	
Heptachlor ug/Kg	**3/4**	1.7100466	1.5634999	0.914302551	0.1778166	3.2422765	**-6**	**-6**	**-6**	**0**	**0.69**	**3.4**	**6**	**6**	ln(y) = 0.371692004899592 + 1.18278315259608*Z
Magnesium MG/KG	**3/4**	321.2516	55.010793	0.17123897	267.34102	375.16218	**264.75**	**327**	**368.25**	**103.5**	**306**	**375**	**251**	**251**	ln(y) = 5.76690276604931 + 0.19270988774591*Z
Manganese MG/KG	**3/4**	0.8110551	0.1769139	0.218128037	0.6376795	0.9844307	**-1.4**	**-1.4**	**-1.4**	**0**	**0.71**	**0.99**	**1.4**	**1.4**	ln(y) = -0.217881912528066 + 0.246548003629898*Z
Mercury MG/KG	**3/4**	0.0784531	0.0218021	0.277899811	0.057087	0.0998191	**0.03225**	**0.08**	**0.097**	**0.06475**	**0.072**	**0.1**	**0.019**	**0.019**	ln(y) = -2.56362168635842 + 0.311735673734791*Z
Potassium MG/KG	**4/4**	**3955**	**882.09371**	**0.223032544**	**3090.5482**	**4819.4518**	**3235**	**4255**	**4375**	**1140**	**2930**	**4380**			ln(y) = 8.26966316373736 + 0.227188530164414*Z
Selenium MG/KG	**3/4**	1.2317896	0.1593866	0.129394353	1.0755907	1.3879885	**-1.5**	**-1.5**	**-1.5**	**0**	**1.1**	**1.4**	**1.5**	**1.5**	ln(y) = 0.204701324406497 + 0.178853412561194*Z
Zinc MG/KG	**3/4**	6.7036726	1.2745266	0.19012363	5.4546366	7.9527087	**6.2**	**6.75**	**7.825**	**1.625**	**6.5**	**8.1**	**6.1**	**6.1**	ln(y) = 1.89568766089339 + 0.212274288168607*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-09
Bayou D'Inde
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**1/24**										**11**	**11**	**10**	**10**	
1,2,3,4,7,8-HxCDF PG/G	**1/6**										**0.533**	**0.533**	**0.177**	**0.363**	
1,2,3,6,7,8-HxCDF PG/G	**4/6**	0.6320093	0.1415746	0.224007066	0.5187261	0.7452926	0.5226	0.62041	0.73652	0.21392	**0.572**	**0.802**	**0.16**	**0.329**	ln(y) = -0.477380549094019 + 0.254473281276786*Z
1,2,3,7,8-PeCDF PG/G	**6/6**	**1.0298333**	**0.4902384**	**0.476036606**	**0.6375609**	**1.4221057**	**0.52325**	**1.004**	**1.5525**	**1.02925**	**0.485**	**1.62**			ln(y) = -7.345572364731 18E-02 + 0.641876140102367*Z
2,3,7,8-TCDD Equivalent PG/G	**6/6**	**0.625806**	**0.1713339**	**0.27378119**	**0.4887103**	**0.7629017**	**0.4634**	**0.69866**	**0.72987**	**0.26647**	**0.3601653**	**0.7895705**			ln(y) = -0.502457177085459 + 0.348838804058451*Z
2,3,7,8-TCDF PG/G	**6/6**	**0.8138333**	**0.3523667**	**0.432971627**	**0.5318812**	**1.0957854**	**0.4015**	**0.9535**	**1.0725**	**0.671**	**0.346**	**1.17**			ln(y) = -0.304819383816964 + 0.611755093888152*Z
4,4'-DDD ug/Kg	**1/24**										**0.72**	**0.72**	**6**	**10**	
4,4'-DDE ug/Kg	**2/24**										**6.4**	**8.7**	**6**	**10**	
4,4'-DDT ug/Kg	**2/24**										**1.7**	**4.5**	**6**	**10**	
Aldrin ug/Kg	**2/24**										**3.9**	**6**	**6**	**10**	
alpha-BHC ug/Kg	**2/24**										**3.3**	**6**	**6**	**10**	
alpha-Chlordane ug/Kg	**3/24**										**6**	**8**	**6**	**10**	
Aluminum (Fume Or Dust) MG/KG	**3/4**	10.864539	19.593975	1.803479584	-8.337556	30.066634	**-10**	**-10**	**26.725**	**36.725**	**3.2**	**32.3**	**10**	**10**	ln(y) = 1.79768368930123 + 1.32591284453675*Z
Antimony MG/KG	**3/24**										**0.03**	**0.35**	**0.02**	**10**	
Arsenic MG/KG	**22/24**	0.2647092	0.1801024	0.680378275	0.1926532	0.3367651	0.17287	0.23324	0.3147	0.14184	**0.14**	**0.84**	**0.01**	**0.76**	ln(y) = -1.45568352886077 + 0.444317704896585*Z
Barium MG/KG	**4/4**	**2.02**	**4.1458534**	**2.052402685**	**-2.042936**	**6.0829364**	**0.3525**	**0.605**	**5.1025**	**4.75**	**0.27**	**6.6**			ln(y) = -0.106846404133039 + 1.74464350128891*Z
Benzaldehyde ug/Kg	**15/20**	33.421075	14.584472	0.436385471	27.029149	39.813002	**-40**	**-40**	**-40**	**0**	**21**	**77**	**40**	**40**	ln(y) = 3.43979431554025 + 0.374832355501158*Z
Benzyl Butyl Phthalate ug/Kg	**2/9**										**26**	**38**	**40**	**40**	
beta-BHC ug/Kg	**1/23**										**37**	**37**	**6**	**10**	
Calcium Metal MG/KG	**4/4**	**8003.5**	**18335.442**	**2.290928003**	**-9965.233**	**25972.233**	**561**	**1542**	**21907.5**	**21346.5**	**530**	**28400**			ln(y) = 7.70144382962181 + 2.38467065813067*Z
Chromium MG/KG	**12/24**	0.1306992	0.2615883	2.001452254	0.0260421	0.2353563	0.05434	0.09028	0.15	0.09566	**0.1**	**1**	**0.01**	**1**	ln(y) = -2.40486158349896 + 0.753088503361157*Z
Copper MG/KG	**23/24**	0.3543536	0.2397066	0.676461538	0.258451	0.4502562	**0.2325**	**0.3**	**0.3475**	**0.115**	**0.21**	**1.2**	**0.01**	**0.01**	ln(y) = -1.15106738295366 + 0.457718239069899*Z
Dieldrin ug/Kg	**2/24**										**12**	**15**	**6**	**10**	
Di-n-butylphthalate ug/Kg	**16/24**	114.55075	143.13002	1.249490014	57.286815	171.81468	35.427	72.7614	149.44	114.013	**26**	**540**	**40**	**2000**	ln(y) = 4.28718527233355 + 1.06752279790687*Z
Endosulfan I ug/Kg	**2/24**										**0.93**	**6**	**6**	**10**	
Endosulfan II ug/Kg	**2/24**										**6**	**8.2**	**6**	**10**	
Endrin Aldehyde ug/Kg	**2/24**										**0.74**	**2.9**	**6**	**10**	
Endrin Ketone ug/Kg	**1/24**										**0.69**	**0.69**	**6**	**10**	
Endrin ug/Kg	**1/24**										**1.8**	**1.8**	**6**	**10**	
gamma-BHC (Lindane) ug/Kg	**3/24**										**0.84**	**6**	**6**	**10**	
gamma-Chlordane ug/Kg	**2/24**										**2.6**	**7.2**	**6**	**10**	
Heptachlor Epoxide ug/Kg	**1/24**										**6.5**	**6.5**	**10**	**10**	
Heptachlor ug/Kg	**2/24**										**9.4**	**9.9**	**6**	**10**	
Iron MG/KG	**17/24**	4.0240707	4.4153962	1.09724619	2.2575443	5.7905971	1.94047	3.11247	4.99233	3.05187	**1.9**	**20.1**	**0.15**	**7.8**	ln(y) = 1.13541589337444 + 0.700823679546923*Z
Lead MG/KG	**14/24**	0.1307298	0.1875382	1.434548051	0.0556989	0.2057607	0.03143	0.07138	0.16211	0.13068	**0.02**	**0.8**	**0.02**	**0.8**	ln(y) = -2.63968509139288 + 1.21659551179896*Z
Magnesium MG/KG	**4/4**	**407.25**	**243.12418**	**0.596989995**	**168.98831**	**645.51169**	**306.25**	**322.5**	**593**	**286.75**	**305**	**679**			ln(y) = 5.94790893336759 + 0.448847547373758*Z
Manganese MG/KG	**4/4**	**1.79**	**3.5458765**	**1.980936607**	**-1.684959**	**5.264959**	**0.37**	**0.565**	**4.435**	**4.065**	**0.33**	**5.7**			ln(y) = -0.131958360046748 + 1.59643066143665*Z
Mercury MG/KG	**24/24**	**0.199875**	**0.1122048**	**0.561374643**	**0.1549837**	**0.2447663**	**0.1105**	**0.1965**	**0.2455**	**0.135**	**0.049**	**0.56**			ln(y) = -1.75484044272172 + 0.612371913407837*Z
Nickel MG/KG	**10/24**	0.0553041	0.0633992	1.146375449	0.0299391	0.080669	0.01486	0.0329	0.07287	0.05801	**0.03**	**0.2**	**0.03**	**4**	ln(y) = -3.41415849629077 + 1.17926825434736*Z
OCDD PG/G	**3/6**	1.5446763	0.7741868	0.501196762	0.9251979	2.1641547	0.96935	1.40465	2.03542	1.06606	**1.72**	**2.7**	**0.678**	**1.07**	ln(y) = 0.339787079563859 + 0.550162986925942*Z
PCB-105 ng/kg	**6/6**	**2157**	**1835.7747**	**0.851077726**	**688.07435**	**3625.9257**	**683**	**1870**	**3535**	**2852**	**317**	**5050**			ln(y) = 7.34017869812511 + 1.25855559925459*Z
PCB-108 ng/kg	**6/6**	**682**	**531.83667**	**0.779819169**	**256.44203**	**1107.558**	**249.5**	**593**	**1108**	**858.5**	**134**	**1510**			ln(y) = 6.25417354018039 + 1.10792476106951*Z
PCB-114 ng/kg	**6/6**	**114.01667**	**90.148504**	**0.790660756**	**41.88284**	**186.15049**	**46.25**	**100.75**	**177.5**	**131.25**	**19.4**	**257**			ln(y) = 4.46044743408022 + 1.12389692759449*Z
PCB-118 ng/kg	**6/6**	**8578.3333**	**7045.9032**	**0.821360394**	**2940.4365**	**14216.23**	**2860**	**7595**	**13900**	**11040**	**1300**	**19600**			ln(y) = 8.73699183843512 + 1.22807897482099*Z
PCB-126 ng/kg	**6/6**	**43.995**	**37.146395**	**0.844332193**	**14.271694**	**73.718306**	**18.1675**	**37**	**68.075**	**49.9075**	**8.47**	**104**			ln(y) = 3.51080055459856 + 1.10034604867805*Z
PCB-15 ng/kg	**5/6**	10.645179	6.3585883	0.59732094	5.5572486	15.733109	**6.515**	**10.14**	**14.7**	**8.185**	**6.65**	**20.4**	**6.11**	**6.11**	ln(y) = 2.24867137808209 + 0.671831197680103*Z

Table H-09
Bayou D'Inde
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-156 ng/kg	**6/6**	**1047**	**906.99766**	**0.866282389**	**321.25072**	**1772.7493**	**366.25**	**929.5**	**1630**	**1263.75**	**142**	**2500**			ln(y) = 6.61867836713973 + 1.25656466390791*Z
PCB-157 ng/kg	**6/6**	**297.11667**	**259.35741**	**0.872914381**	**89.587516**	**504.64582**	**96.175**	**263**	**474.5**	**378.325**	**36.7**	**707**			ln(y) = 5.32795630877039 + 1.32548723487694*Z
PCB-162 ng/kg	**5/6**	1678.9322	2113.7946	1.259011336	-12.4558	3370.3202	**211.993**	**1102**	**3082.5**	**2870.51**	**282**	**5100**	**1.97**	**1.97**	ln(y) = 6.75419067536199 + 1.73702715050717*Z
PCB-167 ng/kg	**6/6**	**600.9**	**502.13363**	**0.83563593**	**199.10942**	**1002.6906**	**240.1**	**543**	**897.75**	**657.65**	**93.4**	**1410**			ln(y) = 6.10520340163876 + 1.15585455974285*Z
PCB-189 ng/kg	**6/6**	**72.1**	**39.981245**	**0.554524899**	**40.108341**	**104.09166**	**35.8**	**68.4**	**115.25**	**79.45**	**22.6**	**119**			ln(y) = 4.12567290930667 + 0.810563818203581*Z
PCB-37 ng/kg	**3/6**	18.274173	8.3248363	0.455552017	11.612917	24.935429	12.4823	16.907	22.9002	10.4179	**18.4**	**31.8**	**10.4**	**23.5**	ln(y) = 2.82772928982073 + 0.450046715014176*Z
PCB-58 ng/kg	**6/6**	**15.925**	**11.617502**	**0.729513447**	**6.6290626**	**25.220937**	**5.9775**	**13.7**	**25.65**	**19.6725**	**5.07**	**33.9**			ln(y) = 2.55314745345642 + 0.946382727260347*Z
PCB-60 ng/kg	**6/6**	**244.83333**	**124.23754**	**0.507437192**	**145.4226**	**344.24407**	**112.25**	**249**	**356.5**	**244.25**	**110**	**409**			ln(y) = 5.38079482109172 + 0.694161776676382*Z
PCB-61/70 ng/kg	**6/6**	**1185.8333**	**660.96785**	**0.557386802**	**656.9489**	**1714.7178**	**482.75**	**1175**	**1832.5**	**1349.75**	**467**	**2050**			ln(y) = 6.92886544898211 + 0.773953628258218*Z
PCB-66 ng/kg	**6/6**	**2016.3333**	**1502.1303**	**0.744981128**	**814.37878**	**3218.2879**	**1042**	**1815**	**2855**	**1813**	**478**	**4430**			ln(y) = 7.39711381063443 + 0.947173447377047*Z
PCB-77 ng/kg	**6/6**	**90.55**	**60.178955**	**0.664593654**	**42.396807**	**138.70319**	**46.25**	**83.55**	**131**	**84.75**	**24.8**	**185**			ln(y) = 4.32586467436904 + 0.882707036236923*Z
PCB-79 ng/kg	**6/6**	**106.1**	**86.646311**	**0.816647607**	**36.768512**	**175.43149**	**38.125**	**92.45**	**171.5**	**133.375**	**16.3**	**242**			ln(y) = 4.35351366668657 + 1.20834870147841*Z
PCB-81 ng/kg	**6/6**	**70.966667**	**61.942743**	**0.872842781**	**21.40215**	**120.53118**	**24.3**	**54.9**	**121.75**	**97.45**	**12.9**	**169**			ln(y) = 3.94561205641432 + 1.19071611054731*Z
Potassium MG/KG	**4/4**	**3960**	**430.32006**	**0.108666681**	**3538.2863**	**4381.7137**	**3725**	**3840**	**4315**	**590**	**3690**	**4470**			ln(y) = 8.28124348352468 + 0.105357222863018*Z
Selenium MG/KG	**23/24**	0.7261086	0.3212452	0.442420386	0.5975837	0.8546335	**0.5225**	**0.625**	**0.8075**	**0.285**	**0.45**	**1.5**	**0.03**	**0.03**	ln(y) = -0.393284633712756 + 0.403512085879728*Z
Sodium MG/KG	**2/4**										**868**	**1240**	**565**	**0.03**	
Total HxCDF PG/G	**6/6**	**3.4491667**	**2.0417968**	**0.591968139**	**1.815389**	**5.0829443**	**0.99375**	**4.295**	**5.0025**	**4.00875**	**0.795**	**5.37**			ln(y) = 1.00134507402815 + 0.97779912439171*Z
Total PeCDF PG/G	**6/6**	**2.7776667**	**1.5852429**	**0.570710281**	**1.5092081**	**4.0461252**	**1.079**	**3.225**	**4.19**	**3.111**	**0.536**	**4.25**			ln(y) = 0.803781346521194 + 0.972349623321012*Z
Total TCDF PG/G	**6/6**	**2.4146667**	**1.3037502**	**0.539929684**	**1.3714492**	**3.4578841**	**0.8515**	**2.925**	**3.47**	**2.6185**	**0.724**	**3.59**			ln(y) = 0.703183473985284 + 0.834538598218822*Z
Zinc MG/KG	**22/24**	4.1370372	4.3783309	1.058325244	2.38534	5.8887343	2.71153	3.56293	4.68167	1.97014	**2.8**	**20**	**0.01**	**7.7**	ln(y) = 1.27058434638281 + 0.405035080032306*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	3/3	5.5933333	8.6675964	1.54962987	-4.214975	15.401642	1.78	2	13	11.22	1.78	13			ln(y) = 1.27823663410849 + 1.47461289055308*Z
1,2,3,4,6,7,8-HpCDF PG/G	3/3	13.716667	24.490294	1.785440606	-13.99671	41.430043	2.27	3.88	35	32.73	2.27	35			ln(y) = 1.9103210155393 + 2.02878396247998*Z
1,2,3,4,7,8,9-HpCDF PG/G	2/3										0.79	8.8	0.339	0.339	
1,2,3,4,7,8-HxCDD PG/G	2/3										0.11	0.255	1.1	1.1	
1,2,3,4,7,8-HxCDF PG/G	3/3	13.233333	26.649764	2.013836046	-16.92371	43.39038	1.52	2.18	36	34.48	1.52	36			ln(y) = 1.59385138337176 + 2.34712220623621*Z
1,2,3,6,7,8-HxCDD PG/G	2/3										0.21	0.619	1.7	1.7	
1,2,3,6,7,8-HxCDF PG/G	3/3	3.55	5.8706455	1.653702971	-3.093261	10.193261	0.71	1.24	8.7	7.99	0.71	8.7			ln(y) = 0.678648032110236 + 1.85839046179705*Z
1,2,3,7,8,9-HxCDD PG/G	2/3										0.18	0.266	0.78	0.78	
1,2,3,7,8-PeCDD PG/G	1/3										0.454	0.454	0.1	0.61	
1,2,3,7,8-PeCDF PG/G	3/3	14.5	14.786781	1.01977801	-2.232818	31.232818	1.5	14	28	26.5	1.5	28			ln(y) = 2.12557564929954 + 2.17056255302407*Z
1,2-Benzphenanthracene ug/Kg	5/9	4.7546572	1.7767158	0.37367905	3.5938696	5.9154449	3.2967	4.55324	6.28873	2.99203	3.2	7.8	200	2000	ln(y) = 1.51584010129362 + 0.478973276153864*Z
1-Methylnaphthalene ug/Kg	5/5	0.448	0.1318504	0.294308942	0.332428	0.563572	0.345	0.37	0.59	0.245	0.33	0.59			ln(y) = -0.835966325912441 + 0.345530225949116*Z
2,3,4,6,7,8-HxCDF PG/G	3/3	1.4133333	1.3653156	0.966025211	-0.131667	2.9583334	0.3	1.24	2.7	2.4	0.3	2.7			ln(y) = 1.46344943376427E-03 + 1.62953127455824*Z
2,3,4,7,8-PeCDF PG/G	3/3	12.903333	12.656076	0.980837726	-1.418365	27.225032	0.91	16	21.8	20.89	0.91	21.8			ln(y) = 1.92006267085453 + 2.35558574042161*Z
2,3,7,8-TCDD Equivalent PG/G	3/3	13.070868	12.810167	0.980054758	-1.4252	27.566937	1.40489	17.5587	20.249	18.8441	1.40489	20.249			ln(y) = 2.07120494179192 + 1.97878180115739*Z
2,3,7,8-TCDD PG/G	2/3										0.307	0.67	0.1	0.1	
2,3,7,8-TCDF PG/G	3/3	30.826667	31.26376	1.014179057	-4.551608	66.204941	3.28	43	46.2	42.92	3.28	46.2			ln(y) = 2.9273411120591 + 1.96171683774207*Z
2-Methylnaphthalene ug/Kg	5/9	0.9527351	0.2086016	0.218950295	0.8164487	1.0890215	0.76329	0.93635	1.14864	0.38535	0.72	1.2	200	2000	ln(y) = -6.57712257877156E-02 + 0.303100408666028*Z
4,4'-DDE ug/Kg	5/9	2.0157267	1.0610909	0.526406155	1.3224806	2.7089727	1.11889	1.82423	2.97419	1.8553	1	3.7	6	10	ln(y) = 0.601156321881399 + 0.725043290115457*Z
4-Methylphenol ug/Kg	1/8										100	100	200	2000	
Acenaphthene ug/Kg	2/9										0.32	0.46	1.7	2000	
Acenaphthylene ug/Kg	5/9	1.0828467	0.5651446	0.521906332	0.7136189	1.4520745	0.65222	1.00004	1.53332	0.8811	0.61	2.1	200	2000	ln(y) = 3.5832789836221E-05 + 0.633950114159604*Z
alpha-Chlordane ug/Kg	2/9										1.3	1.6	2.5	10	
Aluminum (Fume Or Dust) MG/KG	1/6										23.2	23.2	36	7.7	
Anthracene ug/Kg	5/9	0.9432066	0.4767314	0.505436873	0.6317421	1.2546712	0.5317	0.86117	1.39481	0.86311	0.47	1.7	200	2000	ln(y) = -0.149458507643224 + 0.715256116890901*Z
Aroclor-1254 ug/Kg	6/9	29.796466	24.607339	0.825847588	13.719671	45.87326	10.8523	22.0434	44.7752	33.9229	17	74	10	100	ln(y) = 3.09301399281452 + 1.0511005204033*Z
Aroclor-1260 ug/Kg	3/9	13.845462	11.71491	0.846119122	6.1917205	21.499203	6.1065	11.4128	21.3302	15.2237	14	31	10	100	ln(y) = 2.43473825303529 + 0.92761002145529*Z
Arsenic MG/KG	3/9	0.4245053	0.1352959	0.318714408	0.3361119	0.5128986	0.27526	0.41373	0.62188	0.34662	0.27	0.61	0.83	0.98	ln(y) = -0.882533237364357 + 0.604457228513512*Z
Barium MG/KG	6/6	3.0833333	0.8507746	0.275926902	2.4025719	3.7640948	2.425	3	3.95	1.525	1.9	4.1			ln(y) = 1.09424028442154 + 0.356062305825194*Z
Benzaldehyde ug/Kg	3/3	1466.6667	175.41486	0.119601039	1268.1661	1665.1673	1300	1500	1600	300	1300	1600			ln(y) = 7.28703294625593 + 0.153991923368051*Z
Benzo(a)anthracene ug/Kg	5/9	2.217816	0.6972722	0.314395888	1.7622648	2.6733672	1.60076	2.144	2.87159	1.27083	1.5	3.3	200	2000	ln(y) = 0.762672002243608 + 0.43340075820382*Z
Benzo(a)pyrene ug/Kg	5/6	1.9179848	0.2302759	0.120061396	1.7337257	2.1022439	-2000	-2000	-2000	0	1.6	2.2	2000	2000	ln(y) = 0.646007777082779 + 0.166997946366925*Z
Benzo(b)fluoranthene ug/Kg	5/6	2.0356686	0.3689933	0.181263951	1.7404124	2.3309247	-2000	-2000	-2000	0	1.7	2.6	2000	2000	ln(y) = 0.700128527322106 + 0.223892364010768*Z
Benzo(g,h,i)perylene ug/Kg	5/6	2.3933038	0.580988	0.242755624	1.9284166	2.858191	-2000	-2000	-2000	0	2	3.3	2000	2000	ln(y) = 0.858586618295985 + 0.24171134781175*Z
Benzo(k)fluoranthene ug/Kg	5/6	1.1887276	0.3356405	0.282352761	0.9201592	1.4572959	-2000	-2000	-2000	0	0.84	1.6	2000	2000	ln(y) = 0.14181670397166 + 0.389323448969555*Z
beta-BHC ug/Kg	1/9										13	13	2.5	10	
Cadmium MG/KG	3/9										0.06	0.07	0.066	0.5	
Calcium Metal MG/KG	2/6										298	780	250	290	
Chromium MG/KG	5/9	0.1542932	0.0538387	0.34893739	0.1191186	0.1894678	0.11181	0.14781	0.19542	0.08361	0.1	0.23	0.12	1	ln(y) = -1.91180974896905 + 0.414106353108051*Z
Cobalt MG/KG	5/6	0.209898	0.0194938	0.092872527	0.1942998	0.2254963	-1	-1	-1	0	0.18	0.22	1	1	ln(y) = -1.56356587484918 + 9.55172215039923E-02*Z
Copper MG/KG	5/9	2.7215454	1.8920519	0.695212315	1.4854048	3.957686	1.40048	2.25547	3.63241	2.23193	1.8	6.1	1.1	4.2	ln(y) = 0.813357868176514 + 0.706833644124426*Z
Dibenzo(a,h)anthracene ug/Kg	5/6	0.7058408	0.1515139	0.214657332	0.5846045	0.8270772	-2000	-2000	-2000	0	0.52	0.93	2000	2000	ln(y) = -0.363778562459848 + 0.28043898420573*Z
Fluoranthene ug/Kg	5/9	6.3397742	3.5561259	0.560923111	4.0164387	8.6631098	3.294	5.66341	9.73716	6.44317	2.8	12	200	2000	ln(y) = 1.73402542626312 + 0.803816291628817*Z
Fluorene ug/Kg	5/9	0.4379824	0.1555727	0.355203109	0.3363415	0.5396232	0.30166	0.41904	0.5821	0.28045	0.29	0.68	200	2000	ln(y) = -0.869787335250185 + 0.487521383848337*Z
Heptachlor ug/Kg	1/9										0.9	0.9	2.5	10	
Indeno(1,2,3-cd)pyrene ug/Kg	5/6	0.8800779	0.1548992	0.176006285	0.7561327	1.0040232	-2000	-2000	-2000	0	0.71	1.1	2000	2000	ln(y) = -0.138724698795835 + 0.234151825229518*Z
Iron MG/KG	9/9	41.188889	12.107692	0.293955299	33.27853	49.099248	35.1	44	49	13.9	16.5	53			ln(y) = 3.67095527882811 + 0.372485788692149*Z

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Lead MG/KG	3/9	0.1853667	0.0892819	0.481650067	0.1270358	0.2436975	0.10929	0.17481	0.27961	0.17032	0.16	0.33	0.14	0.49	ln(y) = -1.74406331646031 + 0.696692911991529*Z
Magnesium MG/KG	1/6										246	246	120	0.49	
Manganese MG/KG	6/6	1.8166667	0.3046428	0.167693302	1.5729016	2.0604317	1.5	1.8	2.125	0.625	1.5	2.2			ln(y) = 0.585634509757424 + 0.207507126102926*Z
Mercury MG/KG	9/9	0.1077778	0.0995584	0.92373737	0.042733	0.1728226	0.0455	0.069	0.1505	0.105	0.031	0.314			ln(y) = -2.49342790548216 + 0.901365896280469*Z
Mercury ng/g	5/5	65.26	15.765874	0.241585564	51.440602	79.079398	53.9	62.9	77.8	23.9	52.9	88			ln(y) = 4.16128152972265 + 0.259542717954265*Z
Methyl Mercury MG/KG	3/3	0.0618667	0.0193354	0.312532736	0.0399866	0.0837467	0.0504	0.0555	0.0797	0.0293	0.0504	0.0797			ln(y) = -2.80287401844018 + 0.339873770949056*Z
Methyl Mercury ng/g	5/5	26.54	3.5309979	0.133044382	23.444944	29.635056	22.95	27.7	29.55	6.6	22	29.8			ln(y) = 3.27168984700469 + 0.170042672305423*Z
Naphthalene ug/Kg	5/9	0.6848468	0.0917833	0.134020234	0.6248817	0.7448119	0.60412	0.68096	0.76758	0.16345	0.58	0.83	200	2000	ln(y) = -0.384249000597697 + 0.177591599019908*Z
Nickel MG/KG	9/9	1.4877778	0.6099266	0.409958127	1.0892924	1.8862632	1.25	1.4	1.8	0.55	0.49	2.6			ln(y) = 0.317144421934885 + 0.50454229548105*Z
OCDD PG/G	3/3	57.833333	55.781925	0.964528955	-5.289857	120.95652	22.3	41.2	110	87.7	22.3	110			ln(y) = 3.84116843353799 + 1.18356525827738*Z
OCDF PG/G	3/3	64.033333	109.61724	1.711877743	-60.01025	188.07692	11.4	20.7	160	148.6	11.4	160			ln(y) = 3.5129736236352 + 1.95906482538688*Z
PCB-1 PG/G	1/1										2.42	2.42			
PCB-10 PG/G	1/1										0.471	0.471			
PCB-103 PG/G	1/1										56.4	56.4			
PCB-104 PG/G	1/1										1.53	1.53			
PCB-105 ng/kg	1/1										3290	3290			
PCB-105 PG/G	1/1										1000	1000			
PCB-107 PG/G	1/1										175	175			
PCB-108 ng/kg	1/1										1080	1080			
PCB-109 PG/G	1/1										415	415			
PCB-11 PG/G	1/1										4.31	4.31			
PCB-110/77 PG/G	1/1										4430	4430			
PCB-111 PG/G	1/1										12	12			
PCB-114 ng/kg	1/1										180	180			
PCB-114 PG/G	1/1										66.8	66.8			
PCB-118 ng/kg	1/1										12600	12600			
PCB-118 PG/G	1/1										3670	3670			
PCB-12 PG/G	1/1										5.19	5.19			
PCB-120 PG/G	1/1										53.8	53.8			
PCB-121 PG/G	1/1										11.8	11.8			
PCB-122 PG/G	1/1										32.3	32.3			
PCB-123 PG/G	1/1										77.7	77.7			
PCB-126 ng/kg	1/1										103	103			
PCB-126 PG/G	1/1										17.1	17.1			
PCB-127 PG/G	1/1										8.02	8.02			
PCB-128 PG/G	1/1										990	990			
PCB-129 PG/G	1/1										6020	6020			
PCB-130 PG/G	1/1										354	354			
PCB-131 PG/G	1/1										54.9	54.9			
PCB-132 PG/G	1/1										1420	1420			
PCB-133 PG/G	1/1										85.9	85.9			
PCB-134 PG/G	1/1										171	171			
PCB-135 PG/G	1/1										1350	1350			
PCB-136 PG/G	1/1										487	487			
PCB-139 PG/G	1/1										124	124			
PCB-14 PG/G	1/1										2.86	2.86			
PCB-141 PG/G	1/1										709	709			

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-144 PG/G	1/1										107	107			
PCB-145 PG/G	1/1										1.93	1.93			
PCB-146 PG/G	1/1										962	962			
PCB-147 PG/G	1/1										3670	3670			
PCB-148 PG/G	1/1										20.6	20.6			
PCB-15 ng/kg	1/1										615	615			
PCB-15 PG/G	1/1										78.2	78.2			
PCB-150 PG/G	1/1										16.1	16.1			
PCB-152 PG/G	1/1										4.39	4.39			
PCB-153/132 PG/G	1/1										5440	5440			
PCB-155 PG/G	1/1										8.04	8.04			
PCB-156 ng/kg	1/1										584	584			
PCB-156 PG/G	1/1										525	525			
PCB-157 ng/kg	1/1										324	324			
PCB-158 PG/G	1/1										608	608			
PCB-159 PG/G	1/1										24.9	24.9			
PCB-16 PG/G	1/1										18.9	18.9			
PCB-162 ng/kg	1/1										2350	2350			
PCB-162 PG/G	1/1										38.9	38.9			
PCB-164 PG/G	1/1										353	353			
PCB-167 ng/kg	1/1										856	856			
PCB-167 PG/G	1/1										289	289			
PCB-169 ng/kg	1/1										8.25	8.25			
PCB-17 PG/G	1/1										41.4	41.4			
PCB-170/190 PG/G	1/1										637	637			
PCB-171 PG/G	1/1										334	334			
PCB-172 PG/G	1/1										109	109			
PCB-174 PG/G	1/1										589	589			
PCB-175 PG/G	1/1										37.4	37.4			
PCB-176 PG/G	1/1										77.9	77.9			
PCB-177 PG/G	1/1										369	369			
PCB-178 PG/G	1/1										143	143			
PCB-179 PG/G	1/1										251	251			
PCB-18/17 PG/G	1/1										61.8	61.8			
PCB-180 PG/G	1/1										1160	1160			
PCB-181 PG/G	1/1										20.3	20.3			
PCB-182 PG/G	1/1										23.3	23.3			
PCB-183 PG/G	1/1										714	714			
PCB-184 PG/G	1/1										10.3	10.3			
PCB-187 PG/G	1/1										1070	1070			
PCB-188 PG/G	1/1										9.14	9.14			
PCB-189 ng/kg	1/1										51.2	51.2			
PCB-189 PG/G	1/1										39.1	39.1			
PCB-19 PG/G	1/1										8.76	8.76			
PCB-190 PG/G	1/1										184	184			
PCB-191 PG/G	1/1										60.7	60.7			
PCB-192 PG/G	1/1										10.3	10.3			

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-194 PG/G	1/1										177	177			
PCB-195/208 PG/G	1/1										142	142			
PCB-196 PG/G	1/1										296	296			
PCB-197 PG/G	1/1										132	132			
PCB-198 PG/G	1/1										493	493			
PCB-2 PG/G	1/1										1.23	1.23			
PCB-20 PG/G	1/1										444	444			
PCB-201/157/173 PG/G	1/1										38.8	38.8			
PCB-202 PG/G	1/1										101	101			
PCB-203 PG/G	1/1										409	409			
PCB-204 PG/G	1/1										15.9	15.9			
PCB-205 PG/G	1/1										56	56			
PCB-206 PG/G	1/1										1410	1410			
PCB-207 PG/G	1/1										372	372			
PCB-208 PG/G	1/1										370	370			
PCB-209 PG/G	1/1										3010	3010			
PCB-21 PG/G	1/1										51.8	51.8			
PCB-22 PG/G	1/1										45.1	45.1			
PCB-23 PG/G	1/1										9.78	9.78			
PCB-24 PG/G	1/1										1.24	1.24			
PCB-25 PG/G	1/1										21.9	21.9			
PCB-26 PG/G	1/1										41.9	41.9			
PCB-27 PG/G	1/1										6.52	6.52			
PCB-31 PG/G	1/1										156	156			
PCB-32 PG/G	1/1										38.3	38.3			
PCB-34 PG/G	1/1										3.43	3.43			
PCB-35 PG/G	1/1										5.62	5.62			
PCB-37 ng/kg	1/1										334	334			
PCB-37 PG/G	1/1										52	52			
PCB-39 PG/G	1/1										7.33	7.33			
PCB-4 PG/G	1/1										9.88	9.88			
PCB-40 PG/G	1/1										242	242			
PCB-42 PG/G	1/1										165	165			
PCB-43 PG/G	1/1										15.2	15.2			
PCB-44 PG/G	1/1										764	764			
PCB-45 PG/G	1/1										64.2	64.2			
PCB-46 PG/G	1/1										19.3	19.3			
PCB-48 PG/G	1/1										48.2	48.2			
PCB-49 PG/G	1/1										731	731			
PCB-50 PG/G	1/1										85.1	85.1			
PCB-52 PG/G	1/1										1170	1170			
PCB-54 PG/G	1/1										1.75	1.75			
PCB-56 PG/G	1/1										163	163			
PCB-57 PG/G	1/1										8.64	8.64			
PCB-58 ng/kg	1/1										50.4	50.4			
PCB-58 PG/G	1/1										9.19	9.19			
PCB-59 PG/G	1/1										63.2	63.2			

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-6 PG/G	1/1										4.4	4.4			
PCB-60 ng/kg	1/1										1230	1230			
PCB-60 PG/G	1/1										58.3	58.3			
PCB-61/70 ng/kg	1/1										5980	5980			
PCB-61/70 PG/G	1/1										1460	1460			
PCB-63 PG/G	1/1										41.1	41.1			
PCB-64 PG/G	1/1										203	203			
PCB-66 ng/kg	1/1										4760	4760			
PCB-66 PG/G	1/1										834	834			
PCB-67 PG/G	1/1										16.6	16.6			
PCB-68 PG/G	1/1										40.5	40.5			
PCB-7 PG/G	1/1										4.04	4.04			
PCB-72 PG/G	1/1										49.5	49.5			
PCB-77 ng/kg	1/1										379	379			
PCB-77 PG/G	1/1										71.9	71.9			
PCB-79 ng/kg	1/1										211	211			
PCB-79 PG/G	1/1										32.2	32.2			
PCB-80 ng/kg	1/1										33.5	33.5			
PCB-81 ng/kg	1/1										188	188			
PCB-81 PG/G	1/1										6.29	6.29			
PCB-82 PG/G	1/1										246	246			
PCB-83 PG/G	1/1										3320	3320			
PCB-84 PG/G	1/1										562	562			
PCB-85 PG/G	1/1										578	578			
PCB-86 PG/G	1/1										2180	2180			
PCB-88 PG/G	1/1										556	556			
PCB-89 PG/G	1/1										14.6	14.6			
PCB-9 PG/G	1/1										5.91	5.91			
PCB-90 PG/G	1/1										4550	4550			
PCB-92 PG/G	1/1										893	893			
PCB-93 PG/G	1/1										2420	2420			
PCB-94 PG/G	1/1										17.1	17.1			
PCB-96 PG/G	1/1										12.1	12.1			
Phenanthrene ug/Kg	6/9	11.098414	33.097638	2.98219528	-10.52538	32.722204	1.5899	4.3449	11.8738	10.2839	1.7	72	200	2000	ln(y) = 1.46900334968644 + 1.4911721083067*Z
Potassium MG/KG	1/6										808	808	220	380	
Pyrene ug/Kg	5/9	10.319253	5.1867075	0.502624311	6.9306042	13.707902	5.98127	9.4813	15.0294	9.04814	5.5	19	200	2000	ln(y) = 2.24932111747408 + 0.683321668552734*Z
Selenium MG/KG	3/9	0.4600443	0.2498723	0.54314836	0.2967944	0.6232943	0.25255	0.42751	0.72367	0.47112	0.36	0.82	0.19	0.98	ln(y) = -0.849770585142662 + 0.780725410654474*Z
Silver MG/KG	1/9										0.18	0.18	0.01	0.98	
Sodium MG/KG	1/6										1690	1690	430	0.98	
Thallium MG/KG	1/6										0.58	0.58	0.93	0.98	
Total HpCDD PG/G	2/2										4.4	26			
Total HpCDF PG/G	2/2										3.83	65			
Total HxCDD PG/G	2/2										5.05	9.3			
Total HxCDF PG/G	2/2										22.7	85			
Total PeCDD PG/G	1/2										2.92	2.92	2.8	2.8	
Total PeCDF PG/G	2/2										126	150			
Total TCDD PG/G	2/2										6	6.81			

Table H-10
Bayou D'Inde
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total TCDF PG/G	**2/2**										**170**	**289**			
Vanadium (Fume Or Dust) MG/KG	**5/6**	0.1397967	0.0197659	0.141390445	0.1239807	0.1556127	**-1**	**-1**	**-1**	**0**	**0.11**	**0.16**	**1**	**1**	ln(y) = -1.97486343504727 + 0.189144300845445*Z
Zinc MG/KG	**4/9**	5.604304	1.4140699	0.252318556	4.680445	6.528163	4.46766	5.44354	6.63259	2.16493	**4.4**	**8.5**	**6.5**	**9.7**	ln(y) = 1.69443047863942 + 0.293040876336528*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-11
Bayou D'Inde
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	3/3	5.7433333	3.2884698	0.572571647	2.0220794	9.4645873	2.69	5.99	8.55	5.86	2.69	8.55			ln(y) = 1.64185462956326 + 0.857615482548876*Z
1,2,3,4,6,7,8-HpCDF PG/G	3/3	157.6	327.44351	2.077687236	-212.9372	528.13721	10.6	23.2	439	428.4	10.6	439			ln(y) = 3.86316856428849 + 2.76157326690097*Z
1,2,3,4,7,8,9-HpCDF PG/G	3/3	70.786667	160.16307	2.262616329	-110.4549	252.02824	1.5	3.86	207	205.5	1.5	207			ln(y) = 2.36295036161676 + 3.65420724875562*Z
1,2,3,4,7,8-HxCDD PG/G	3/3	0.3533333	0.1029145	0.291267391	0.2368746	0.469792	0.26	0.39	0.41	0.15	0.26	0.41			ln(y) = -1.06009343570295 + 0.33779506493798*Z
1,2,3,4,7,8-HxCDF PG/G	3/3	207.06667	452.21561	2.183913133	-304.6635	718.79681	14.4	16.8	590	575.6	14.4	590			ln(y) = 3.95624320996364 + 2.75359992455475*Z
1,2,3,6,7,8-HxCDD PG/G	3/3	1.0966667	0.1687537	0.153878746	0.9057039	1.2876294	0.94	1.15	1.2	0.26	0.94	1.2			ln(y) = 8.67360318170086E-02 + 0.181104193176675*Z
1,2,3,6,7,8-HxCDF PG/G	3/3	49.176667	102.63188	2.087003613	-66.96224	165.31557	5.6	5.93	136	130.4	5.6	136			ln(y) = 2.8051485654956 + 2.36572209379552*Z
1,2,3,7,8,9-HxCDD PG/G	3/3	0.5933333	0.2600604	0.438304071	0.2990473	0.8876194	0.39	0.55	0.84	0.45	0.39	0.84			ln(y) = -0.571266309252948 + 0.569020699936202*Z
1,2,3,7,8,9-HxCDF PG/G	3/3	1.4233333	2.3934566	1.681585423	-1.285118	4.1317844	0.23	0.5	3.54	3.31	0.23	3.54			ln(y) = -0.299565474491068 + 2.02747458749408*Z
1,2,3,7,8-PeCDD PG/G	3/3	0.5266667	0.0897747	0.17045837	0.425077	0.6282564	0.45	0.52	0.61	0.16	0.45	0.61			ln(y) = -0.648910161813072 + 0.225612781587854*Z
1,2,3,7,8-PeCDF PG/G	3/3	14.366667	15.324003	1.066635963	-2.974076	31.707409	6.55	8.55	28	21.45	6.55	28			ln(y) = 2.45253361425701 + 1.07739755377453*Z
1,2-Benzphenanthracene ug/Kg	4/5	5.413662	3.6678787	0.677522654	2.1986246	8.6286994	-2000	-2000	-2000	0	0.97	9.2	2000	2000	ln(y) = 1.45822195921071 + 1.28916911371979*Z
1-Methylnaphthalene ug/Kg	4/4	0.475	0.1654609	0.348338719	0.3128483	0.6371517	0.3225	0.49	0.6125	0.29	0.28	0.64			ln(y) = -0.788159686773762 + 0.477317380989279*Z
2,3,4,6,7,8-HxCDF PG/G	3/3	2.4466667	2.7709299	1.132532653	-0.688936	5.582269	0.92	1.46	4.96	4.04	0.92	4.96			ln(y) = 0.63215352250601 + 1.24949161118766*Z
2,3,4,7,8-PeCDF PG/G	3/3	4.5866667	1.3869143	0.302379561	3.0172254	6.1561079	3.29	4.72	5.75	2.46	3.29	5.75			ln(y) = 1.497298739728 + 0.414062061275644*Z
2,3,7,8-TCDD Equivalent PG/G	3/3	32.83807	61.956462	1.88672665	-37.27227	102.94841	5.48372	7.19649	85.834	80.3503	5.48372	85.834			ln(y) = 2.70926410277516 + 2.03995535692304*Z
2,3,7,8-TCDD PG/G	3/3	0.16	0.0111438	0.06964887	0.1473896	0.1726104	0.15	0.16	0.17	0.02	0.15	0.17			ln(y) = -1.83388609685536 + 9.28249474219982E-02*Z
2,3,7,8-TCDF PG/G	3/3	5.58	0.8742987	0.156684347	4.5906379	6.5693621	4.75	5.78	6.21	1.46	4.75	6.21			ln(y) = 1.71290306555874 + 0.198769352678699*Z
2-Methylnaphthalene ug/Kg	4/5	2.5153492	1.5627685	0.621292879	1.1455222	3.8851762	-2000	-2000	-2000	0	0.57	4	2000	2000	ln(y) = 0.745144506445578 + 1.08965340106955*Z
4,4'-DDD ug/Kg	1/5										2	2	5	10	
4,4'-DDE ug/Kg	1/5										3.8	3.8	5	10	
Acenaphthene ug/Kg	1/5										0.71	0.71	1.7	2000	
Acenaphthylene ug/Kg	3/5	0.6200254	0.1973532	0.318298558	0.4470377	0.7930131	0.47536	0.61006	0.78294	0.30758	0.51	0.84	1.7	2000	ln(y) = -0.494192070948171 + 0.370067638650281*Z
alpha-BHC ug/Kg	1/5										1.4	1.4	2.5	10	
Aluminum (Fume Or Dust) MG/KG	4/5	166.2293	34.05504	0.204867846	136.37875	196.07986	80	160	200	120	150	200	10	10	ln(y) = 5.1019815654109 + 0.237944888103261*Z
Anthracene ug/Kg	3/5	0.7544318	0.2104104	0.278899114	0.569999	0.9388646	0.5496	0.74108	0.99927	0.44967	0.55	1	1.7	2000	ln(y) = -0.299647364513181 + 0.443374837450815*Z
Aroclor-1254 ug/Kg	4/5	28.858692	7.7255844	0.267703903	22.086918	35.630465	-100	-100	-100	0	19	34	100	100	ln(y) = 3.34263065276687 + 0.32232915006633*Z
Aroclor-1260 ug/Kg	4/5	27.040112	7.9666794	0.294624502	20.057009	34.023214	-100	-100	-100	0	18	35	100	100	ln(y) = 3.26578069934001 + 0.433700662310544*Z
Arsenic MG/KG	4/5	0.8328823	0.1303009	0.156445754	0.7186686	0.9470961	-0.8	0.81	0.945	1.745	0.8	1	0.8	0.8	ln(y) = -0.187426870352395 + 0.172756066128402*Z
Barium MG/KG	5/5	91.122	62.699762	0.688085882	36.163236	146.08076	42.805	100	135	92.195	0.61	140			ln(y) = 3.6725403987457 + 2.42713200235771*Z
Benzo(a)anthracene ug/Kg	4/5	2.6438063	1.6135907	0.610328652	1.2294317	4.058181	-2000	-2000	-2000	0	0.68	4.4	2000	2000	ln(y) = 0.806043441490375 + 1.07940507586728*Z
Benzo(a)pyrene ug/Kg	4/5	3.424568	2.3966527	0.699840885	1.3238093	5.5253268	-2000	-2000	-2000	0	0.81	6.5	2000	2000	ln(y) = 1.03419471407216 + 1.19163159769087*Z
Benzo(b)fluoranthene ug/Kg	4/5	2.9216455	1.9702887	0.674376378	1.1946113	4.6486797	-2000	-2000	-2000	0	0.62	5.3	2000	2000	ln(y) = 0.870551444188905 + 1.18497295992697*Z
Benzo(g,h,i)perylene ug/Kg	4/5	4.2064195	3.0176934	0.717401915	1.5612946	6.8515444	-2000	-2000	-2000	0	0.74	7.8	2000	2000	ln(y) = 1.19152488820006 + 1.34846066141002*Z
Benzo(k)fluoranthene ug/Kg	4/5	1.4174119	0.9715642	0.685449417	0.5657984	2.2690254	-2000	-2000	-2000	0	0.39	2.7	2000	2000	ln(y) = 0.179868151431873 + 1.07787761819661*Z
Cadmium MG/KG	4/5	0.0624335	0.0072734	0.116498883	0.056058	0.0688089	-0.5	-0.5	-0.5	0	0.053	0.07	0.5	0.5	ln(y) = -2.77792633853183 + 0.164517004752562*Z
Calcium Metal MG/KG	5/5	25302	15223.773	0.601682613	11957.774	38646.226	14755	30000	33500	18745	3510	37000			ln(y) = 9.8931603292757 + 1.04376784205214*Z
Cobalt MG/KG	4/5	0.1662012	0.0620819	0.373534317	0.1117841	0.2206184	-1	-1	-1	0	0.12	0.25	1	1	ln(y) = -1.82631305436028 + 0.421863361671457*Z
Copper MG/KG	5/5	24.528	17.8151	0.726316863	8.9123763	40.143624	14.82	30	31.5	16.68	0.64	33			ln(y) = 2.64398221042977 + 1.70780481987917*Z
Dibenzo(a,h)anthracene ug/Kg	3/5	1.665828	0.6474101	0.388641615	1.0983481	2.233308	1.15135	1.57779	2.16218	1.01084	1.2	2.7	1.7	2000	ln(y) = 0.456026281343237 + 0.467365231078777*Z
Dieldrin ug/Kg	1/5										4.3	4.3	5	10	
Endosulfan II ug/Kg	1/5										8.5	8.5	5	10	
Endrin Aldehyde ug/Kg	1/5										4.2	4.2	5	10	
Fluoranthene ug/Kg	4/5	1.8647294	0.8888796	0.476680192	1.0855921	2.6438667	-2000	-2000	-2000	0	0.72	2.6	2000	2000	ln(y) = 0.532771193707918 + 0.753559547752372*Z
Fluorene ug/Kg	3/5	0.5711793	0.2326913	0.407387517	0.3672164	0.7751423	0.37455	0.55295	0.81632	0.44177	0.39	0.85	1.7	2000	ln(y) = -0.592490674206662 + 0.577797508211578*Z
gamma-BHC (Lindane) ug/Kg	1/5										1.2	1.2	2.5	10	
Indeno(1,2,3-cd)pyrene ug/Kg	4/5	1.5673232	1.1576698	0.738628641	0.5525809	2.5820655	-2000	-2000	-2000	0	0.36	3.1	2000	2000	ln(y) = 0.244212837910626 + 1.20514917409183*Z

Table H-11
Bayou D'Inde
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Iron MG/KG	4/5	290.97779	61.388704	0.210973845	237.16822	344.78737	137.85	290	340	202.15	270	370	5.7	5.7	ln(y) = 5.66356203728573 + 0.228941227263088*Z
Lead MG/KG	4/5	1.3192615	0.945349	0.716574424	0.4906265	2.1478964	-0.8	1.4	2.1	2.9	0.47	2.2	0.8	0.8	ln(y) = 8.37365256573476E-02 + 0.862321916247048*Z
Magnesium MG/KG	5/5	1522.6	844.56102	0.554683447	782.30963	2262.8904	956.5	1700	2000	1043.5	313	2200			ln(y) = 7.1508200424086 + 0.864026676938475*Z
Manganese MG/KG	5/5	21.28	13.953295	0.655699963	9.0493975	33.510603	12.7	24	28.5	15.8	1.4	32			ln(y) = 2.67543832499701 + 1.35809815033622*Z
Mercury MG/KG	5/5	0.088	0.025784	0.293000021	0.0653993	0.1106007	0.0625	0.097	0.109	0.0465	0.062	0.12			ln(y) = -2.46426741670361 + 0.369743501386911*Z
Naphthalene ug/Kg	4/5	1.1393834	0.4188551	0.367615574	0.7722408	1.5065261	-2000	-2000	-2000	0	0.61	1.6	2000	2000	ln(y) = 8.33454379256929E-02 + 0.552877561785017*Z
Nickel MG/KG	4/5	0.582358	0.0332332	0.057066601	0.5532279	0.6114882	-4	-4	-4	0	0.54	0.62	4	4	ln(y) = -0.541645464472715 + 7.80877151833264E-02*Z
OCDD PG/G	3/3	67.1	44.759871	0.667062159	16.449438	117.75056	25.4	70.9	105	79.6	25.4	105			ln(y) = 4.04999331924003 + 1.05253191711294*Z
OCDF PG/G	3/3	180.6	256.07925	1.417936021	-109.1809	470.38095	17.8	104	420	402.2	17.8	420			ln(y) = 4.52128135590561 + 2.3443393450214*Z
PCB-1 PG/G	3/3	2.65	2.0417679	0.770478463	0.3395221	4.9604779	1.53	1.92	4.5	2.97	1.53	4.5			ln(y) = 0.860556772740103 + 0.800079382250667*Z
PCB-103 PG/G	3/3	19.353333	12.768265	0.659744992	4.9046816	33.801985	8.26	18.7	31.1	22.84	8.26	31.1			ln(y) = 2.8257186435262 + 0.983242797093351*Z
PCB-104 PG/G	2/2										0.415	0.826			
PCB-105 PG/G	3/3	1576.6667	719.80535	0.456536163	762.13023	2391.2031	1020	1450	2260	1240	1020	2260			ln(y) = 7.30999894465309 + 0.590014091547738*Z
PCB-107 PG/G	3/3	201.33333	110.49385	0.548810503	76.297774	326.36889	124	174	306	182	124	306			ln(y) = 5.23430732225732 + 0.669918486294*Z
PCB-109 PG/G	3/3	562.66667	234.89625	0.417469633	296.85654	828.47679	371	533	784	413	371	784			ln(y) = 6.28637750237456 + 0.554893955793252*Z
PCB-11 PG/G	2/2										3.09	6.67			
PCB-110/77 PG/G	3/3	6506.6667	3244.6601	0.498667031	2834.9881	10178.345	3470	6830	9220	5750	3470	9220			ln(y) = 8.70337338068546 + 0.72473760371381*Z
PCB-111 PG/G	3/3	14.3	4.1717556	0.291731161	9.5792141	19.020786	10.8	13.9	18.2	7.4	10.8	18.2			ln(y) = 2.63761885611652 + 0.387039355097774*Z
PCB-114 PG/G	3/3	74.166667	25.265552	0.34065913	45.576003	102.75733	50.2	78.4	93.9	43.7	50.2	93.9			ln(y) = 4.27335644675609 + 0.46442112630018*Z
PCB-118 PG/G	3/3	5176.6667	2590.8114	0.500478699	2244.8876	8108.4458	3370	4530	7630	4260	3370	7630			ln(y) = 8.49366278870066 + 0.606042913179818*Z
PCB-12 PG/G	1/1										5.4	5.4			
PCB-120 PG/G	3/3	59.733333	22.202317	0.371690567	34.609047	84.85762	40.1	68.3	70.8	30.7	40.1	70.8			ln(y) = 4.05838170052965 + 0.421604734207544*Z
PCB-121 PG/G	3/3	16.093333	16.521282	1.026591699	-2.602258	34.788924	6.08	10.8	31.4	25.32	6.08	31.4			ln(y) = 2.54378624100749 + 1.21761320334428*Z
PCB-122 PG/G	3/3	54.2	29.367909	0.541843341	20.967082	87.432918	32.7	47.8	82.1	49.4	32.7	82.1			ln(y) = 3.920779577953 + 0.68271860512024*Z
PCB-123 PG/G	3/3	113.16667	75.509972	0.667245704	27.719089	198.61424	75.4	84.1	180	104.6	75.4	180			ln(y) = 4.64925689762767 + 0.645330460099367*Z
PCB-126 PG/G	3/3	62.433333	35.5889	0.570030435	22.160702	102.70597	30	63.5	93.8	63.8	30	93.8			ln(y) = 4.03113404785766 + 0.845435951606089*Z
PCB-127 PG/G	3/3	15.766667	6.2651468	0.397366603	8.6769857	22.856348	10.8	14.8	21.7	10.9	10.8	21.7			ln(y) = 2.71716185848222 + 0.517485439153921*Z
PCB-128 PG/G	3/3	1983.3333	1111.7036	0.560522799	725.32234	3241.3443	1320	1620	3010	1690	1320	3010			ln(y) = 7.52842126718326 + 0.611333150597431*Z
PCB-129 PG/G	3/3	11463.333	6451.291	0.562776181	4163.0104	18763.656	7340	9550	17500	10160	7340	17500			ln(y) = 9.27844890499832 + 0.64437558149277*Z
PCB-130 PG/G	3/3	868.33333	444.53489	0.511940373	365.29475	1371.3719	521	794	1290	769	521	1290			ln(y) = 6.69841033345207 + 0.672398442627019*Z
PCB-131 PG/G	3/3	37.166667	21.465306	0.577541856	12.876387	61.456947	16.8	42.2	52.5	35.7	16.8	52.5			ln(y) = 3.50820409234959 + 0.845040520168537*Z
PCB-132 PG/G	3/3	1555.3333	979.87099	0.630007066	446.50492	2664.1617	656	1600	2410	1754	656	2410			ln(y) = 7.21710057455222 + 0.96502684503121*Z
PCB-133 PG/G	3/3	223	107.02754	0.479944104	101.88694	344.11306	128	221	320	192	128	320			ln(y) = 5.33950465374371 + 0.679550201457772*Z
PCB-134 PG/G	3/3	261.66667	164.15908	0.627359538	75.903181	447.43015	106	301	378	272	106	378			ln(y) = 5.43514785149351 + 0.942951336642586*Z
PCB-135 PG/G	3/3	1807.6667	1158.3871	0.640818989	496.82823	3118.5051	713	2110	2600	1887	713	2600			ln(y) = 7.36239712363133 + 0.959512121117935*Z
PCB-136 PG/G	3/3	155.3	123.88607	0.797721006	15.109712	295.49029	37.9	175	253	215.1	37.9	253			ln(y) = 4.77770885824647 + 1.4079419734625*Z
PCB-137 PG/G	3/3	685	353.20093	0.515621801	285.31552	1084.6845	434	601	1020	586	434	1020			ln(y) = 6.46639912497131 + 0.633734156651507*Z
PCB-139 PG/G	3/3	249	124.97145	0.501893376	107.58149	390.41851	139	245	363	224	139	363			ln(y) = 5.44337832598009 + 0.711913648647977*Z
PCB-14 PG/G	1/3										2.49	2.49	0.325	0.336	
PCB-141 PG/G	3/3	1257	848.86892	0.675313382	296.41439	2217.5856	671	1040	2060	1389	671	2060			ln(y) = 7.02873546363024 + 0.831882374091547*Z
PCB-144 PG/G	3/3	159.66667	107.94931	0.676091698	37.510525	281.82281	60	195	224	164	60	224			ln(y) = 4.92633005754696 + 0.976952468819286*Z
PCB-145 PG/G	2/2										1.64	2.25			
PCB-146 PG/G	3/3	2096.6667	1017.6018	0.485342655	945.14187	3248.1915	1160	2150	2980	1820	1160	2980			ln(y) = 7.57635899490719 + 0.699731899670188*Z
PCB-147 PG/G	3/3	4900	3021.4287	0.616618101	1480.9316	8319.0684	2130	5030	7540	5410	2130	7540			ln(y) = 8.37167666093309 + 0.937496710654011*Z
PCB-148 PG/G	3/3	26.7	15.104122	0.565697461	9.6080767	43.791923	12.4	29	38.7	26.3	12.4	38.7			ln(y) = 3.18027730087773 + 0.844082958197472*Z
PCB-15 PG/G	3/3	110.13333	41.508925	0.376897016	63.161563	157.1051	83.5	97.9	149	65.5	83.5	149			ln(y) = 4.67091316244624 + 0.429478643078886*Z
PCB-150 PG/G	3/3	9.2166667	5.8005659	0.629356158	2.6527084	15.780625	3.75	10.8	13.1	9.35	3.75	13.1			ln(y) = 2.0913047347732 + 0.927674680538772*Z

Table H-11
Bayou D'Inde
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-152 PG/G	3/3	3.237	2.4705917	0.763234995	0.4412623	6.0327377	0.891	3.68	5.14	4.249	0.891	5.14			ln(y) = 0.941518326712195 + 1.2996827054095*Z
PCB-153/132 PG/G	3/3	9330	4817.6369	0.516359795	3878.3306	14781.669	5900	8190	13900	8000	5900	13900			ln(y) = 9.07767364195324 + 0.635531216929655*Z
PCB-155 PG/G	3/3	4.6733333	2.5347231	0.542380111	1.8050242	7.5416425	3.42	3.69	6.91	3.49	3.42	6.91			ln(y) = 1.48941221563551 + 0.521611106535976*Z
PCB-156 PG/G	3/3	1103	484.62055	0.439365869	554.60022	1651.3998	709	1040	1560	851	709	1560			ln(y) = 6.95442420630371 + 0.584840015118599*Z
PCB-158 PG/G	3/3	1141.6667	577.56112	0.50589295	488.09474	1795.2386	725	1010	1690	965	725	1690			ln(y) = 6.97878702420237 + 0.627651873039715*Z
PCB-159 PG/G	3/3	35.333333	19.820253	0.560950559	12.904606	57.762061	17.5	42.6	45.9	28.4	17.5	45.9			ln(y) = 3.48017341709043 + 0.715128870271536*Z
PCB-16 PG/G	2/2										2.87	9.42			
PCB-162 PG/G	2/2										54.8	65.6			
PCB-164 PG/G	3/3	658	445.92905	0.677703725	153.38378	1162.6162	349	545	1080	731	349	1080			ln(y) = 6.38019134566131 + 0.837780031463619*Z
PCB-165 PG/G	2/2										4.06	5.7			
PCB-167 PG/G	3/3	585.66667	266.03214	0.45423815	284.62296	886.71038	414	508	835	421	414	835			ln(y) = 6.32792638208488 + 0.520303360997825*Z
PCB-169 PG/G	1/3										6.82	6.82	2.07	3.83	
PCB-17 PG/G	1/3										35.4	35.4	12	12.6	
PCB-170/190 PG/G	3/3	1112	397.54032	0.357500292	662.14077	1561.8592	736	1170	1430	694	736	1430			ln(y) = 6.97713962325821 + 0.492591444355216*Z
PCB-171 PG/G	3/3	452.66667	207.03612	0.457369925	218.38324	686.95009	256	491	611	355	256	611			ln(y) = 6.05223951048189 + 0.64515983944516*Z
PCB-172 PG/G	3/3	314	136.93263	0.436091167	159.04615	468.95385	186	355	401	215	186	401			ln(y) = 5.69727529683173 + 0.569732370313774*Z
PCB-174 PG/G	3/3	828.33333	481.67256	0.581496048	283.26952	1373.3971	371	914	1200	829	371	1200			ln(y) = 6.60803648994589 + 0.8705826773576*Z
PCB-175 PG/G	3/3	88.866667	46.770399	0.526298567	35.940978	141.79236	48.6	108	110	61.4	48.6	110			ln(y) = 4.42207837460769 + 0.60580687700894*Z
PCB-176 PG/G	2/2										111	123			
PCB-177 PG/G	3/3	1018.6667	414.55545	0.406958884	549.55301	1487.7803	646	1020	1390	744	646	1390			ln(y) = 6.87847214539522 + 0.568282308947385*Z
PCB-178 PG/G	3/3	325	170.92166	0.525912787	131.58394	518.41606	164	372	439	275	164	439			ln(y) = 5.70108656505751 + 0.730234979154151*Z
PCB-179 PG/G	3/3	275.66667	186.61136	0.676945666	64.496039	486.83729	104	338	385	281	104	385			ln(y) = 5.47356004297072 + 0.970686382653923*Z
PCB-18/17 PG/G	3/3	23.6	26.333054	1.11580739	-6.198656	53.398656	12.2	12.6	46	33.8	12.2	46			ln(y) = 2.95459138739525 + 0.984297555330402*Z
PCB-180 PG/G	3/3	3113.3333	1364.8342	0.438383566	1568.8781	4657.7886	1820	3330	4190	2370	1820	4190			ln(y) = 7.98592512532051 + 0.618420101510214*Z
PCB-181 PG/G	3/3	57.866667	29.810816	0.515163873	24.132553	91.600781	30.4	59.5	83.7	53.3	30.4	83.7			ln(y) = 3.97588596615306 + 0.751121835793871*Z
PCB-182 PG/G	3/3	29	14.707878	0.507168197	12.35647	45.64353	16.8	27.4	42.8	26	16.8	42.8			ln(y) = 3.29615333413033 + 0.6935436664839*Z
PCB-183 PG/G	3/3	1080	526.24457	0.487263492	484.49821	1675.5018	580	1180	1480	900	580	1480			ln(y) = 6.91203172925278 + 0.694737728315757*Z
PCB-184 PG/G	3/3	12.6	7.5443192	0.598755489	4.0627992	21.137201	7.6	10.5	19.7	12.1	7.6	19.7			ln(y) = 2.4533807133999 + 0.706382179628748*Z
PCB-187 PG/G	3/3	2140	1095.7462	0.512030938	900.04644	3379.9536	1100	2330	2990	1890	1100	2990			ln(y) = 7.58657255724365 + 0.741604357149705*Z
PCB-188 PG/G	2/2										9.85	16.1			
PCB-189 PG/G	3/3	76.5	25.210812	0.329553103	47.97128	105.02872	52.7	83.2	93.6	40.9	52.7	93.6			ln(y) = 4.30829772895267 + 0.42600428709021*Z
PCB-19 PG/G	3/3	1.1126667	1.0781802	0.969005594	-0.107409	2.3327424	0.588	0.69	2.06	1.472	0.588	2.06			ln(y) = -5.97953432242842E-02 + 0.929809039792934*Z
PCB-190 PG/G	3/3	206.66667	74.35885	0.359800887	122.52171	290.81163	136	222	262	126	136	262			ln(y) = 5.29455892378981 + 0.486280169080532*Z
PCB-191 PG/G	3/3	74.6	29.047073	0.389370948	41.730143	107.46986	47.6	83.7	92.5	44.9	47.6	92.5			ln(y) = 4.27242679441706 + 0.4927221782587*Z
PCB-192 PG/G	2/2										2.18	7.18			
PCB-194 PG/G	3/3	409.66667	153.32785	0.374274661	236.15987	583.17347	265	430	534	269	265	534			ln(y) = 5.97463695787801 + 0.519636086787868*Z
PCB-195/208 PG/G	3/3	122.4	60.568357	0.494839518	53.860452	190.93955	68.2	145	154	85.8	68.2	154			ln(y) = 4.74537696989454 + 0.60406493459082*Z
PCB-196 PG/G	3/3	354.33333	173.17482	0.488734193	158.36758	550.29909	190	384	489	299	190	489			ln(y) = 5.7966763714077 + 0.701092884152398*Z
PCB-197 PG/G	3/3	100.86667	58.937371	0.584309691	34.172753	167.56058	46.6	104	152	105.4	46.6	152			ln(y) = 4.50329065370642 + 0.876816244502778*Z
PCB-198 PG/G	3/3	778.66667	443.13315	0.569092234	277.2143	1280.119	385	771	1180	795	385	1180			ln(y) = 6.55806714177027 + 0.830647007381315*Z
PCB-2 PG/G	3/3	1.0536667	0.4452962	0.422615848	0.5497665	1.5575668	0.802	0.899	1.46	0.658	0.802	1.46			ln(y) = 1.71058400313686E-02 + 0.444298989151158*Z
PCB-20 PG/G	3/3	329.66667	150.17714	0.455542394	159.72523	499.6081	238	282	469	231	238	469			ln(y) = 5.75492683768529 + 0.503072546326704*Z
PCB-201/157/173 PG/G	3/3	94.6	54.909992	0.580443891	32.463495	156.73651	43.9	97.9	142	98.1	43.9	142			ln(y) = 4.44056264240628 + 0.870610832921984*Z
PCB-202 PG/G	3/3	160.76667	97.905978	0.608994267	49.975623	271.55771	73.3	160	249	175.7	73.3	249			ln(y) = 4.96239577353038 + 0.906935617127808*Z
PCB-203 PG/G	3/3	415.33333	219.24956	0.527888177	167.2291	663.43756	207	462	577	370	207	577			ln(y) = 5.9420419836184 + 0.760264006311987*Z
PCB-204 PG/G	3/3	13.476667	12.623203	0.936671018	-0.807832	27.761166	6.33	9.1	25	18.67	6.33	25			ln(y) = 2.42415015818236 + 1.01868712140918*Z
PCB-205 PG/G	3/3	21.3	11.577381	0.543538994	8.1989606	34.401039	12.5	19.1	32.3	19.8	12.5	32.3			ln(y) = 2.98349473652982 + 0.704059535770156*Z

Table H-11
Bayou D'Inde
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-206 PG/G	3/3	621.66667	608.61013	0.978997534	-67.04053	1310.3739	318	387	1160	842	318	1160			ln(y) = 6.25888378663679 + 0.959763235905199*Z
PCB-207 PG/G	3/3	215	189.88614	0.883191364	0.1236007	429.8764	118	143	384	266	118	384			ln(y) = 5.22805726910443 + 0.875094137563719*Z
PCB-208 PG/G	3/3	258.33333	269.59561	1.043595896	-46.74281	563.40948	119	157	499	380	119	499			ln(y) = 5.34932513140379 + 1.06311605860923*Z
PCB-209 PG/G	3/3	1422.6667	1434.5965	1.008385533	-200.7321	3046.0654	642	906	2720	2078	642	2720			ln(y) = 7.06067158967433 + 1.07076691824739*Z
PCB-21 PG/G	1/3										38.3	38.3	14.1	0	
PCB-22 PG/G	3/3	22.333333	15.031181	0.673037964	5.3239506	39.342716	13.7	17.2	36.1	22.4	13.7	36.1			ln(y) = 3.01619936066411 + 0.718564698656007*Z
PCB-23 PG/G	1/1										9.62	9.62			
PCB-24 PG/G	2/2										0.153	0.828			
PCB-25 PG/G	3/3	14.573333	13.078302	0.897413225	-0.226159	29.372825	8.34	9.38	26	17.66	8.34	26			ln(y) = 2.53924650580342 + 0.84325989111733*Z
PCB-26 PG/G	3/3	26.033333	20.38628	0.783083751	2.9640855	49.102581	16	18.1	44	28	16	44			ln(y) = 3.15089676480994 + 0.750235246753964*Z
PCB-27 PG/G	2/2										0.783	3.44			
PCB-3 PG/G	1/3										5.34	5.34	2.71	2.85	
PCB-31 PG/G	3/3	110.46667	66.245494	0.599687639	35.502833	185.4305	72.8	87.6	171	98.2	72.8	171			ln(y) = 4.63405350321588 + 0.633314563065459*Z
PCB-32 PG/G	3/3	21.433333	13.377419	0.624140858	6.2953586	36.571308	15.1	16.1	33.1	18	15.1	33.1			ln(y) = 2.99768243273144 + 0.582061095282336*Z
PCB-34 PG/G	2/2										0.944	3.96			
PCB-35 PG/G	3/3	1.9466667	1.0785907	0.554070545	0.7261264	3.1672069	1.24	1.64	2.96	1.72	1.24	2.96			ln(y) = 0.5983229659634 + 0.645277294635094*Z
PCB-36 PG/G	1/2										0.137	0.137	0.159	0.159	
PCB-37 PG/G	3/3	48.966667	13.011497	0.26572152	34.242772	63.690562	40.4	45.3	61.2	20.8	40.4	61.2			ln(y) = 3.87542800232479 + 0.308012529335975*Z
PCB-39 PG/G	2/2										2.06	5.38			
PCB-4 PG/G	2/3										2.22	2.55	6.26	6.26	
PCB-40 PG/G	3/3	115.5	66.14576	0.572690562	40.649026	190.35097	57.5	113	176	118.5	57.5	176			ln(y) = 4.6498855871846 + 0.829662613048744*Z
PCB-42 PG/G	3/3	103.4	59.444001	0.574893626	36.132781	170.66722	65.5	85.7	159	93.5	65.5	159			ln(y) = 4.56726905682172 + 0.657719033802625*Z
PCB-43 PG/G	2/2										6.5	18.1			
PCB-44 PG/G	3/3	441.33333	163.79874	0.371145178	255.97761	626.68905	335	394	595	260	335	595			ln(y) = 6.05968094888954 + 0.426016112988454*Z
PCB-45 PG/G	3/3	20.506667	16.348406	0.79722397	2.0067035	39.00663	7.62	17.9	36	28.38	7.62	36			ln(y) = 2.83303200700046 + 1.15156302329 18*Z
PCB-46 PG/G	1/1										3.98	3.98			
PCB-48 PG/G	3/3	18.833333	14.640341	0.77736325	2.2662277	35.400439	12.1	12.9	31.5	19.4	12.1	31.5			ln(y) = 2.83347343660064 + 0.709579876329229*Z
PCB-49 PG/G	3/3	416.66667	193.04238	0.463301705	198.21865	635.11468	261	390	599	338	261	599			ln(y) = 5.97530958152061 + 0.61610395469985*Z
PCB-50 PG/G	3/3	10.533333	10.675778	1.013523244	-1.547447	22.614114	4.14	7.06	20.4	16.26	4.14	20.4			ln(y) = 2.13022524673085 + 1.18278315259608*Z
PCB-52 PG/G	3/3	658.33333	287.12857	0.436144658	333.41677	983.24989	404	652	919	515	404	919			ln(y) = 6.4349151874145 + 0.609525721774258*Z
PCB-56 PG/G	3/3	97.5	33.214163	0.34065808	59.914637	135.08536	71.5	92	129	57.5	71.5	129			ln(y) = 4.55043281037023 + 0.43764792371455*Z
PCB-57 PG/G	3/3	3.66	2.4222255	0.661810248	0.9189938	6.4010062	2.63	2.64	5.71	3.08	2.63	5.71			ln(y) = 1.22666059567194 + 0.574938938817998*Z
PCB-58 PG/G	3/3	8.28	1.8207327	0.219895248	6.219647	10.340353	6.55	8.67	9.62	3.07	6.55	9.62			ln(y) = 2.10105936837241 + 0.285067788992981*Z
PCB-59 PG/G	3/3	36.8	13.680807	0.371761048	21.31871	52.28129	26.7	33.9	49.8	23.1	26.7	49.8			ln(y) = 3.57203118794107 + 0.462297137109294*Z
PCB-6 PG/G	2/2										1.49	4.72			
PCB-60 PG/G	3/3	41.266667	6.3364267	0.153548305	34.096325	48.437008	37.2	39.4	47.2	10	37.2	47.2			ln(y) = 3.7148228233915 + 0.176571467242198*Z
PCB-61/70 PG/G	3/3	879	264.79173	0.301242014	579.35995	1178.6401	636	891	1110	474	636	1110			ln(y) = 6.75321942837244 + 0.41302707051205*Z
PCB-63 PG/G	3/3	29.366667	10.918038	0.371783355	17.011744	41.72159	23	25.7	39.4	16.4	23	39.4			ln(y) = 3.35191700804474 + 0.399199251667087*Z
PCB-64 PG/G	3/3	145.33333	54.74528	0.376687708	83.383217	207.28345	101	138	197	96	101	197			ln(y) = 4.94185931024548 + 0.495471650473193*Z
PCB-66 PG/G	3/3	504.66667	139.47499	0.276370521	346.83586	662.49748	396	481	637	241	396	637			ln(y) = 6.2046837123108 + 0.352538639444074*Z
PCB-67 PG/G	3/3	10.296667	6.385724	0.620173907	3.0705397	17.522794	6.99	7.9	16	9.01	6.99	16			ln(y) = 2.26131067931949 + 0.614151220190863*Z
PCB-68 PG/G	3/3	39.366667	15.102181	0.38362865	22.27694	56.456393	25.9	39.2	53	27.1	25.9	53			ln(y) = 3.63107054301801 + 0.531044555835344*Z
PCB-7 PG/G	3/3	3.35	4.2650076	1.273136594	-1.47631	8.1763104	1.5	1.57	6.98	5.48	1.5	6.98			ln(y) = 0.933196548080887 + 1.14032080713087*Z
PCB-72 PG/G	3/3	44.733333	15.202279	0.339842305	27.530335	61.936332	31.7	51	51.5	19.8	31.7	51.5			ln(y) = 3.77657470709242 + 0.359887973540539*Z
PCB-73 PG/G	1/3										4.17	4.17	0.182	0.201	
PCB-77 PG/G	3/3	199	91.891156	0.461764601	95.015368	302.98463	126	185	286	160	126	286			ln(y) = 5.23754318094988 + 0.607922803247549*Z
PCB-79 PG/G	2/2										21.3	26.4			

Table H-11
Bayou D'Inde
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-8/5 PG/G	1/3										34.4	34.4	11	11.6	
PCB-81 PG/G	3/3	6.0966667	1.3710065	0.224878046	4.5452268	7.6481066	4.85	6.58	6.86	2.01	4.85	6.86			ln(y) = 1.79624029734147 + 0.257145002933543*Z
PCB-82 PG/G	3/3	231.66667	107.20146	0.462740104	110.3568	352.97654	136	272	287	151	136	287			ln(y) = 5.39264638926389 + 0.553870780220211*Z
PCB-83 PG/G	3/3	4923.3333	2503.9912	0.508596717	2089.8006	7756.8661	2870	4620	7280	4410	2870	7280			ln(y) = 8.43103447800673 + 0.690324700556034*Z
PCB-84 PG/G	3/3	185.56667	127.03983	0.684604814	41.807562	329.32577	68.7	228	260	191.3	68.7	260			ln(y) = 5.07325881973276 + 0.987061606852427*Z
PCB-85 PG/G	3/3	1059	537.76116	0.507800906	450.46596	1667.534	662	945	1570	908	662	1570			ln(y) = 6.90176046059104 + 0.640447384208726*Z
PCB-86 PG/G	3/3	2023.3333	918.94591	0.454174257	983.44814	3063.2185	1150	2210	2710	1560	1150	2710			ln(y) = 7.55098964324761 + 0.635716775607938*Z
PCB-88 PG/G	3/3	545.66667	340.48678	0.623983105	160.3696	930.96373	224	635	778	554	224	778			ln(y) = 6.17399919164204 + 0.923391077052469*Z
PCB-89 PG/G	3/3	4.98	3.173776	0.637304418	1.3885344	8.5714656	2.3	4.7	7.94	5.64	2.3	7.94			ln(y) = 1.48412830230339 + 0.918884685864515*Z
PCB-9 PG/G	3/3	4.22	6.1868959	1.466089073	-2.781132	11.221132	1.6	1.61	9.45	7.85	1.6	9.45			ln(y) = 1.06408418324925 + 1.31714604016449*Z
PCB-90 PG/G	3/3	4783.3333	2362.8047	0.493966133	2109.5681	7457.0985	2600	4930	6820	4220	2600	6820			ln(y) = 8.39799191396127 + 0.715191012099346*Z
PCB-92 PG/G	3/3	1115.6667	594.7871	0.533122588	442.6017	1788.7316	567	1150	1630	1063	567	1630			ln(y) = 6.92807060629529 + 0.783145209076796*Z
PCB-93 PG/G	3/3	841	620.44744	0.737749633	138.89763	1543.1024	313	1100	1110	797	313	1110			ln(y) = 6.587127981211 + 0.938840474117466*Z
PCB-94 PG/G	3/3	8.7466667	6.344005	0.725305455	1.5677491	15.925584	3.12	8.62	14.5	11.38	3.12	14.5			ln(y) = 1.98868891197451 + 1.13938029875891*Z
PCB-96 PG/G	2/2										2.55	3.4			
Phenanthrene ug/Kg	4/5	3.5527652	2.2258493	0.626511794	1.6017223	5.5038082	-2000	-2000	-2000	0	0.79	5.5	2000	2000	ln(y) = 1.08984937915338 + 1.07678759552624*Z
Pyrene ug/Kg	4/5	4.9159967	2.9681343	0.603770599	2.3143123	7.5176812	-2000	-2000	-2000	0	1.2	7.5	2000	2000	ln(y) = 1.43030734706498 + 1.02959081268353*Z
Selenium MG/KG	1/5										1.3	1.3	0.84	4	
Sodium MG/KG	4/5	1916.5765	964.37502	0.503175842	1071.2646	2761.8885	-2200	2300	2450	4650	1130	2500	2200	2200	ln(y) = 7.50196767617581 + 0.43824633352822*Z
Total Dichloro Biphenyls PG/G	1/1										226	226			
Total Heptachloro Biphenyls PG/G	1/1										12300	12300			
Total Hepta-Dioxins PG/G	3/3	13.436667	8.3528945	0.621649307	3.9844767	22.888857	5.91	13.5	20.9	14.99	5.91	20.9			ln(y) = 2.47302822527772 + 0.936757396797881*Z
Total Hepta-Furans PG/G	3/3	255.5	524.80764	2.054041656	-338.3758	849.37575	17.1	41.4	708	690.9	17.1	708			ln(y) = 4.37493447934453 + 2.76136577188553*Z
Total Hexachloro Biphenyls PG/G	1/1										37200	37200			
Total Hexa-Dioxins PG/G	3/3	7.3666667	4.8134961	0.653415766	1.919683	12.81365	4.16	6.04	11.9	7.74	4.16	11.9			ln(y) = 1.90015249544579 + 0.779472156564836*Z
Total Hexa-Furans PG/G	3/3	303.33333	611.25732	2.015134012	-388.3694	995.0361	33.8	50.2	826	792.2	33.8	826			ln(y) = 4.71769020090254 + 2.37035408997144*Z
Total Monochloro Biphenyls PG/G	1/1										11.3	11.3			
Total Nonachloro Biphenyls PG/G	1/1										2050	2050			
Total Octachloro Biphenyls PG/G	1/1										3530	3530			
Total Pentachloro Biphenyls PG/G	1/1										30100	30100			
Total Penta-Dioxins PG/G	3/3	1.1933333	0.7633565	0.639684232	0.3295141	2.0571526	0.53	1.5	1.55	1.02	0.53	1.55			ln(y) = 6.96139222011167E-02 + 0.79586954137097*Z
Total Penta-Furans PG/G	3/3	44.3	19.511968	0.440450751	22.220129	66.379871	27	43.9	62	35	27	62			ln(y) = 3.73496185704352 + 0.616516545332777*Z
Total Tetrachloro Biphenyls PG/G	1/1										5060	5060			
Total Tetra-Dioxins PG/G	3/3	0.3066667	0.1929563	0.629205465	0.088316	0.5250173	0.16	0.27	0.49	0.33	0.16	0.49			ln(y) = -1.28508822386985 + 0.830057553136302*Z
Total Tetra-Furans PG/G	3/3	21.533333	7.059455	0.327838469	13.544808	29.521859	15	22	27.6	12.6	15	27.6			ln(y) = 3.03896947572788 + 0.452221443066939*Z
Total Trichloro Biphenyls PG/G	1/1										997	997			
Vanadium (Fume Or Dust) MG/KG	4/5	0.584659	0.0561559	0.09604891	0.5354363	0.6338818	-1	-1	-1	0	0.54	0.66	1	1	ln(y) = -0.539061813520024 + 0.115107379006942*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-12
Bayou D'Inde
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**2/2**										**1.2**	**1.31**			
1,2,3,4,6,7,8-HpCDF PG/G	**2/2**										**2.52**	**2.61**			
1,2,3,4,7,8-HxCDF PG/G	**2/2**										**1.58**	**1.88**			
1,2,3,6,7,8-HxCDD PG/G	**1/2**										**0.222**	**0.222**	**0.244**	**0.244**	
1,2,3,6,7,8-HxCDF PG/G	**2/2**										**0.61**	**0.77**			
1,2,3,7,8-PeCDD PG/G	**2/2**										**0.125**	**0.214**			
1,2,3,7,8-PeCDF PG/G	**2/2**										**2.3**	**2.73**			
2,3,4,7,8-PeCDF PG/G	**2/2**										**2.29**	**2.65**			
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**2.270971**	**2.64244**			
2,3,7,8-TCDF PG/G	**2/2**										**5.15**	**5.53**			
4-Chloro-3-methylphenol ug/Kg	**1/13**										**150**	**150**	**40**	**400**	
4-Methylphenol ug/Kg	**1/13**										**260**	**260**	**40**	**400**	
4-Nitrophenol ug/Kg	**1/13**										**40**	**40**	**100**	**1000**	
Aroclor-1254 ug/Kg	**10/13**	30.316371	20.461718	0.674939559	19.193254	41.439488	18.9951	27.3295	39.3207	20.3256	**20**	**82**	**10**	**100**	ln(y) = 3.30796598816225 + 0.539588038550731*Z
Arsenic MG/KG	**11/13**	0.369188	0.053476	0.14484868	0.340118	0.398258	**-0.37**	**0.38**	**0.405**	**0.775**	**0.26**	**0.42**	**0.37**	**0.37**	ln(y) = -1.00506913196223 + 0.14494932549352*Z
Benzaldehyde ug/Kg	**9/13**	129.11789	102.78209	0.796032958	73.244904	184.99087	47.8617	**110**	**220**	172.138	**35**	**310**	**40**	**40**	ln(y) = 4.53444956561196 + 0.988052556974653*Z
bis(2-Ethylhexyl)phthalate ug/Kg	**3/13**	10345.545	51807.937	5.007753319	-17817.57	38508.66	0.00228	0.39503	68.3164	68.3141	**290**	**130000**	**40**	**640**	ln(y) = -0.928796973890264 + 7.64317736758555*Z
Chromium MG/KG	**13/13**	**0.8484615**	**0.2789688**	**0.328793701**	**0.6968124**	**1.0001107**	**0.675**	**0.81**	**1.035**	**0.36**	**0.41**	**1.4**			ln(y) = -0.214066161622294 + 0.384126864834072*Z
Copper MG/KG	**13/13**	**16.792308**	**3.2021072**	**0.190688933**	**15.051622**	**18.532993**	**15.4**	**16.2**	**18.05**	**2.65**	**11.2**	**24.2**			ln(y) = 2.80611571417208 + 0.198791124023774*Z
Di-n-butylphthalate ug/Kg	**1/13**										**12000**	**12000**	**40**	**640**	
Di-n-octylphthalate ug/Kg	**1/5**										**120**	**120**	**40**	**640**	
Iron MG/KG	**13/13**	**62.292308**	**26.957773**	**0.432762477**	**47.637895**	**76.94672**	**49.75**	**52.2**	**68.9**	**19.15**	**41.2**	**131**			ln(y) = 4.07722339963122 + 0.33391876068237*Z
Lead MG/KG	**13/13**	**0.1623077**	**0.0422031**	**0.260019261**	**0.1393658**	**0.1852496**	**0.14**	**0.15**	**0.18**	**0.04**	**0.12**	**0.27**			ln(y) = -1.84048118952102 + 0.230650354360361*Z
Magnesium MG/KG	**5/5**	**1522.6**	**844.56102**	**0.554683447**	**782.30963**	**2262.8904**	**956.5**	**1700**	**2000**	**1043.5**	**313**	**2200**			ln(y) = 7.1508200424086 + 0.864026676938475*Z
Manganese MG/KG	**5/5**	**21.28**	**13.953295**	**0.655699963**	**9.0493975**	**33.510603**	**12.7**	**24**	**28.5**	**15.8**	**1.4**	**32**			ln(y) = 2.67543832499701 + 1.35809815033622*Z
Mercury MG/KG	**13/13**	**0.0353077**	**0.0052897**	**0.149816247**	**0.0324322**	**0.0381832**	**0.033**	**0.035**	**0.036**	**0.003**	**0.029**	**0.049**			ln(y) = -3.35108143995875 + 0.129293882026908*Z
Methyl Mercury MG/KG	**10/10**	**0.03249**	**0.0033368**	**0.10270318**	**0.0304218**	**0.0345582**	**0.03033**	**0.03265**	**0.0356**	**0.00528**	**0.0269**	**0.0375**			ln(y) = -3.4314568534714 + 0.120842578671327*Z
Nickel MG/KG	**9/13**	0.342653	0.065441	0.190982192	0.307079	0.378226	0.2899	0.33639	0.3903	0.1004	**0.32**	**0.47**	**0.26**	**0.31**	ln(y) = -1.08949210784193 + 0.220537724630788*Z
OCDD PG/G	**2/2**										**20**	**21.3**			
OCDF PG/G	**2/2**										**6.95**	**8.46**			
PCB-105 ng/kg	**2/2**										**1870**	**2190**			
PCB-108 ng/kg	**2/2**										**845**	**866**			
PCB-114 ng/kg	**2/2**										**89.4**	**107**			
PCB-118 ng/kg	**2/2**										**7970**	**9710**			
PCB-126 ng/kg	**2/2**										**51.9**	**64.7**			
PCB-15 ng/kg	**2/2**										**145**	**199**			
PCB-156 ng/kg	**2/2**										**702**	**895**			
PCB-157 ng/kg	**2/2**										**186**	**246**			
PCB-162 ng/kg	**2/2**										**1390**	**1650**			
PCB-167 ng/kg	**2/2**										**426**	**503**			
PCB-189 ng/kg	**2/2**										**59.1**	**63.6**			
PCB-37 ng/kg	**2/2**										**64.7**	**75.9**			
PCB-58 ng/kg	**2/2**										**18.9**	**23.3**			
PCB-60 ng/kg	**2/2**										**239**	**368**			
PCB-61/70 ng/kg	**2/2**										**2340**	**2760**			
PCB-66 ng/kg	**2/2**										**1740**	**1940**			
PCB-77 ng/kg	**2/2**										**178**	**210**			

Table H-12
Bayou D'Inde
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-79 ng/kg	2/2										99.8	104			
PCB-81 ng/kg	2/2										46.6	64.8			
Selenium MG/KG	13/13	0.4569231	0.0549629	0.12028915	0.4270449	0.4868012	0.43	0.45	0.495	0.065	0.35	0.55			ln(y) = -0.789713607400635 + 0.133142119874459*Z
Silver MG/KG	13/13	0.0484615	0.0123775	0.25540861	0.0417331	0.05519	0.04	0.05	0.055	0.015	0.03	0.07			ln(y) = -3.05506130050019 + 0.273649178577591*Z
Total HpCDD PG/G	2/2										1.2	3.2			
Total HpCDF PG/G	2/2										3.65	3.78			
Total HxCDD PG/G	2/2										1.89	2.03			
Total HxCDF PG/G	2/2										7.21	8.8			
Total PeCDD PG/G	2/2										0.699	1.11			
Total PeCDF PG/G	2/2										18.1	22.4			
Total TCDD PG/G	1/2										0.127	0.127	0.0907	0.0907	
Total TCDF PG/G	2/2										37.7	38.8			
Zinc MG/KG	13/13	11.976923	1.5895874	0.132720849	11.112814	12.841033	10.8	11.5	13.1	2.3	10	14.8			ln(y) = 2.47553448624585 + 0.140561162520435*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-13
Bayou D'Inde
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/3										0.763	1.01	0.825	0.825	
1,2,3,4,6,7,8-HpCDF PG/G	3/3	3.93	1.6576899	0.421804053	2.0541473	5.8058527	2.54	3.77	5.48	2.94	2.54	5.48			ln(y) = 1.32011472781676 + 0.570270992410286*Z
1,2,3,4,7,8-HxCDF PG/G	3/3	12.533333	1.7474097	0.13942099	10.555953	14.510714	10.9	12.7	14	3.1	10.9	14			ln(y) = 2.52314070410497 + 0.185626351356*Z
1,2,3,6,7,8-HxCDF PG/G	3/3	3.67	0.2833805	0.077215397	3.3493248	3.9906752	3.53	3.56	3.92	0.39	3.53	3.92			ln(y) = 1.29905002320384 + 0.077718385415132*Z
1,2,3,7,8-PeCDF PG/G	3/3	21.666667	2.2535574	0.104010343	19.116526	24.216807	20.1	21.1	23.8	3.7	20.1	23.8			ln(y) = 3.07322614540816 + 0.12531035845634*Z
2,3,4,6,7,8-HxCDF PG/G	3/3	3.3766667	0.7099439	0.210249912	2.5732895	4.1800438	2.96	3.14	4.03	1.07	2.96	4.03			ln(y) = 1.20772614807157 + 0.228850547490869*Z
2,3,4,7,8-PeCDF PG/G	3/3	22.233333	3.4645103	0.155825053	18.312871	26.153796	20.5	20.9	25.3	4.8	20.5	25.3			ln(y) = 3.0969928136162 + 0.156024101467724*Z
2,3,7,8-TCDD Equivalent PG/G	3/3	21.776576	3.187907	0.146391559	18.16912	25.384033	19.9993	20.6542	24.6763	4.67698	19.999297	24.676273			ln(y) = 3.07648533343247 + 0.155850238642808*Z
2,3,7,8-TCDD PG/G	2/3										0.478	0.491	0.616	0.616	
2,3,7,8-TCDF PG/G	3/3	62.4	8.0114674	0.128388901	53.334171	71.465829	57.9	59.6	69.7	11.8	57.9	69.7			ln(y) = 4.13019109213891 + 0.137560012592024*Z
4,4'-DDD ug/Kg	3/8	13.759768	12.093439	0.878898491	5.3794419	22.140093	6.69005	11.2352	18.8684	12.1783	16	29	6	10	ln(y) = 2.41905413398687 + 0.768973163013912*Z
4,4'-DDE ug/Kg	1/8										2.1	2.1	10	10	
4,4'-DDT ug/Kg	3/8	32.131963	6.6064348	0.205603212	27.553937	36.709989	26.7319	31.4142	36.9167	10.1848	36	43	6	10	ln(y) = 3.44726157768828 + 0.239402577550831*Z
Aldrin ug/Kg	3/8										10	10	6	10	
alpha-Chlordane ug/Kg	1/8										1.9	1.9	10	10	
Aluminum (Fume Or Dust) MG/KG	1/1										56.4	56.4			
Aroclor-1254 ug/Kg	7/8	143.19156	112.06255	0.782605832	65.536174	220.84694	-100	130	212.5	312.5	13	330	100	100	ln(y) = 4.60908169246597 + 1.13963575151895*Z
Arsenic MG/KG	7/8	0.3461876	0.0778001	0.224733936	0.2922749	0.4001004	-0.62	-0.62	-0.62	0	0.25	0.48	0.62	0.62	ln(y) = -1.08027819738096 + 0.281985507446202*Z
Barium MG/KG	1/1										97.6	97.6			
beta-BHC ug/Kg	6/8	30.342262	13.829344	0.455778275	20.759016	39.925509	21.3345	28.5435	38.1885	16.854	25	56	6	10	ln(y) = 3.3514301817452 + 0.431784527585938*Z
Cadmium MG/KG	6/8	0.0229198	0.0160845	0.701770785	0.0117739	0.0340658	0.00997	0.01854	0.03447	0.02449	0.01	0.05	0.01	0.5	ln(y) = -3.98776116951638 + 0.919644644375552*Z
Calcium Metal MG/KG	1/1										59400	59400			
Chromium MG/KG	2/8										0.13	0.81	0.08	0.5	
Copper MG/KG	8/8	10.775	2.6518314	0.246109641	8.9373746	12.612625	8.775	10.4	12.325	3.55	7.8	15.6			ln(y) = 2.35463349663791 + 0.274907517413066*Z
Dieldrin ug/Kg	1/8										2	2	10	10	
Endosulfan Sulfate ug/Kg	2/8										11	11	6	10	
Endrin Aldehyde ug/Kg	1/8										14	14	6	10	
Endrin ug/Kg	3/8	10.763664	9.1866073	0.853483294	4.3976698	17.129658	4.69862	8.3951	14.9996	10.301	13	25	6	10	ln(y) = 2.1276479840312 + 0.860853596156651*Z
gamma-Chlordane ug/Kg	1/8										15	15	6	10	
Heptachlor ug/Kg	1/8										0.68	0.68	10	10	
Iron MG/KG	6/8	21.483114	70.665171	3.289335644	-27.48535	70.451579	0.80924	3.59087	15.9339	15.1247	3	146	1.9	2.5	ln(y) = 1.27839371218196 + 2.21014772935422*Z
Lead MG/KG	5/8	0.1348853	0.2835554	2.102197407	-0.061609	0.3313792	0.01343	0.06	0.135	0.12157	0.05	0.67	0.02	0.02	ln(y) = -3.04678778321386 + 1.87440034871379*Z
Magnesium MG/KG	1/1										3290	3290			
Manganese MG/KG	1/1										176	176			
Mercury MG/KG	8/8	0.161625	0.1028321	0.636238685	0.090366	0.232884	0.072	0.1275	0.279	0.207	0.064	0.302			ln(y) = -2.00775847935928 + 0.777079344125289*Z
Nickel MG/KG	7/8	0.1091139	0.0519858	0.476436627	0.0730895	0.1451382	-4	-4	-4	0	0.07	0.21	4	4	ln(y) = -2.27389099616657 + 0.449937699703901*Z
OCDD PG/G	3/3	2.22	0.900212	0.40550091	1.2013142	3.2386858	1.74	1.89	3.03	1.29	1.74	3.03			ln(y) = 0.766341520606422 + 0.411366390638688*Z
PCB-105 ng/kg	3/3	10220	1986.0804	0.194332721	7972.5384	12467.462	8640	9920	12100	3460	8640	12100			ln(y) = 9.22247559788728 + 0.249783665875345*Z
PCB-108 ng/kg	3/3	3260	330.52067	0.101386708	2885.9807	3634.0193	3100	3130	3550	450	3100	3550			ln(y) = 8.08754951882563 + 0.100524826006183*Z
PCB-114 ng/kg	3/3	825	106.34289	0.128900476	704.66169	945.33831	765	788	922	157	765	922			ln(y) = 6.71197304908034 + 0.138439926307672*Z
PCB-118 ng/kg	3/3	43533.333	5858.1779	0.13456764	36904.181	50162.486	39100	42400	49100	10000	39100	49100			ln(y) = 10.676798566992 + 0.168896645082805*Z
PCB-126 ng/kg	3/3	271.33333	51.769113	0.190795258	212.75107	329.9156	223	287	304	81	223	304			ln(y) = 5.59456056287532 + 0.229798962592452*Z
PCB-127 ng/kg	3/3	38.7	11.910301	0.307759716	25.222226	52.177774	28.6	43.7	43.8	15.2	28.6	43.8			ln(y) = 3.63679621243658 + 0.316103504373571*Z
PCB-15 ng/kg	3/3	984.33333	443.84943	0.450913746	482.07042	1486.5962	777	806	1370	593	777	1370			ln(y) = 6.85669670389882 + 0.420598341600464*Z
PCB-156 ng/kg	3/3	4960	612.40966	0.123469689	4266.9932	5653.0068	4580	4770	5530	950	4580	5530			ln(y) = 8.505832985169 + 0.139789271446911*Z
PCB-157 ng/kg	3/3	1363.3333	236.07429	0.173159628	1096.1901	1630.4765	1250	1270	1570	320	1250	1570			ln(y) = 7.21216730269711 + 0.169041634244778*Z
PCB-162 ng/kg	3/3	6766.6667	1330.9528	0.196692536	5260.5518	8272.7816	5810	6460	8030	2220	5810	8030			ln(y) = 8.81055341785447 + 0.239994934562472*Z

Table H-13
Bayou D'Inde
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-167 ng/kg	3/3	3486.6667	468.14759	0.13426795	2956.9078	4016.4255	3160	3370	3930	770	3160	3930			ln(y) = 8.15246334493022 + 0.161725682994788*Z
PCB-169 ng/kg	2/3										23.1	25.4	19.9	19.9	
PCB-189 ng/kg	3/3	468.66667	90.404915	0.192898111	366.36388	570.96946	418	437	551	133	418	551			ln(y) = 6.14238314559109 + 0.204878245747484*Z
PCB-37 ng/kg	3/3	491	197.94467	0.403145977	267.00451	714.99549	369	429	675	306	369	675			ln(y) = 6.16232208461369 + 0.447883250383714*Z
PCB-58 ng/kg	3/3	43.633333	6.5039528	0.149059269	36.273418	50.993249	37.6	45.7	47.6	10	37.6	47.6			ln(y) = 3.77064503651113 + 0.174898034419817*Z
PCB-60 ng/kg	3/3	818.33333	191.20939	0.23365709	601.95955	1034.7071	678	777	1000	322	678	1000			ln(y) = 6.69411430576339 + 0.288203983096475*Z
PCB-61/70 ng/kg	3/3	635	475.29662	0.748498619	97.151239	1172.8488	238	587	1080	842	238	1080			ln(y) = 6.27733727120595 + 1.12167755056809*Z
PCB-66 ng/kg	3/3	11633.333	2332.1428	0.200470725	8994.2654	14272.401	10200	10900	13800	3600	10200	13800			ln(y) = 9.3530283128783 + 0.224181059823593*Z
PCB-77 ng/kg	3/3	811.66667	210.46826	0.259303814	573.49941	1049.8339	640	785	1010	370	640	1010			ln(y) = 6.68161916799048 + 0.338360117646121*Z
PCB-79 ng/kg	3/3	845.33333	226.81465	0.268313855	588.6684	1101.9983	688	788	1060	372	688	1060			ln(y) = 6.72310370496578 + 0.320559412411329*Z
PCB-80 ng/kg	3/3	66.4	14.921803	0.224725945	49.514391	83.285609	57.1	61.8	80.3	23.2	57.1	80.3			ln(y) = 4.18482570069278 + 0.252870807344096*Z
PCB-81 ng/kg	3/3	81.5	13.928311	0.170899522	65.738632	97.261368	68.3	84.9	91.3	23	68.3	91.3			ln(y) = 4.39317821583166 + 0.215251925450424*Z
Potassium MG/KG	1/1										2350	2350			
Selenium MG/KG	8/8	0.66625	0.2029528	0.304619558	0.5256109	0.8068891	0.495	0.7	0.855	0.36	0.36	0.89			ln(y) = -0.450610157364272 + 0.390235177957668*Z
Silver MG/KG	7/8	0.0370213	0.0091068	0.245987791	0.0307106	0.043332	-1	-1	-1	0	0.03	0.05	1	1	ln(y) = -3.31951028017944 + 0.272339180293653*Z
Sodium MG/KG	1/1										5090	5090			
Total HpCDD PG/G	2/3										1.43	1.91	0.825	0.825	
Total HpCDF PG/G	3/3	3.93	1.6576899	0.421804053	2.0541473	5.8058527	2.54	3.77	5.48	2.94	2.54	5.48			ln(y) = 1.32011472781676 + 0.570270992410286*Z
Total HxCDD PG/G	1/3										2.31	2.31	0.48	2.08	
Total HxCDF PG/G	3/3	60.066667	4.2946232	0.071497612	55.206843	64.92649	57.6	58.6	64	6.4	57.6	64			ln(y) = 4.09438011588149 + 7.81386923935444E-02*Z
Total PeCDF PG/G	3/3	167.66667	11.933428	0.071173526	154.16272	181.17061	159	165	179	20	159	179			ln(y) = 5.12074516065386 + 8.78697064246027E-02*Z
Total TCDD PG/G	3/3	3.7533333	0.7091277	0.188932779	2.9508798	4.5557869	3.08	3.88	4.3	1.22	3.08	4.3			ln(y) = 1.31312659110673 + 0.247471670704006*Z
Total TCDF PG/G	3/3	300	28.039332	0.093464441	268.27051	331.72949	274	302	324	50	274	324			ln(y) = 5.70143287985176 + 0.124308891562307*Z
Zinc MG/KG	8/8	30.7125	4.7269595	0.153909955	27.436884	33.988116	28.225	31.15	34.675	6.45	22.2	36.2			ln(y) = 3.4144738352722 + 0.184184037899697*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-14
Lower Calcasieu
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	1/3										1.31	1.31	1.27	0.44	
1,2,3,4,6,7,8-HpCDF PG/G	3/3	1.0733333	0.881194	0.820988166	0.076168	2.070498	0.24	1.3	1.68	1.44	0.24	1.68			ln(y) = -0.215319432585829 + 1.44314854206217*Z
1,2,3,4,7,8-HxCDF PG/G	1/3										0.229	0.229	0.215	0.327	
1,2,3,6,7,8-HxCDD PG/G	1/3										0.184	0.184	0.223	0.226	
1,2,3,6,7,8-HxCDF PG/G	2/3										0.648	0.908	0.366	0.366	
1,2,3,7,8,9-HxCDD PG/G	1/3										0.15	0.15	0.187	0.188	
1,2,3,7,8-PeCDD PG/G	3/3	0.209	0.0393869	0.188454262	0.164429	0.253571	0.189	0.194	0.244	0.055	0.189	0.244			ln(y) = -1.57216414584341 + 0.189428451945361*Z
1,2,3,7,8-PeCDF PG/G	3/3	0.2466667	0.0443674	0.179867759	0.19646	0.296873	0.219	0.233	0.288	0.069	0.219	0.288			ln(y) = -1.40673172447609 + 0.20312456405175*Z
2,2'-oxybis(1-Chloropropane) ug/Kg	1/17										29	29	50	800	
2,3,4,7,8-PeCDF PG/G	2/3										0.575	0.716	0.626	0.626	
2,3,7,8-TCDD Equivalent PG/G	3/3	1.74106	0.304233	0.17474009	1.39679	2.08533	1.5806	1.62853	2.0141	0.4335	1.580593	2.0140595			ln(y) = 0.548542679690934 + 0.179736327626158*Z
2,3,7,8-TCDD PG/G	3/3	0.944	0.1641965	0.173936986	0.758194	1.129806	0.819	0.913	1.1	0.281	0.819	1.1			ln(y) = -6.51268045706371E-02 + 0.218767521911166*Z
2,3,7,8-TCDF PG/G	3/3	1.7133333	0.2094616	0.122253881	1.476305	1.950362	1.54	1.69	1.91	0.37	1.54	1.91			ln(y) = 0.534538062473019 + 0.159688737806698*Z
2-Methylphenol ug/Kg	3/17										70	84	50	800	
4-Methylphenol ug/Kg	2/17										63	140	50	800	
Antimony MG/KG	4/17										0.03	0.04	0.03	0.03	
Aroclor-1254 ug/Kg	6/17	23.414963	39.670263	1.694227041	4.556917	42.27301	4.17356	10.8969	33	28.8264	25	140	10	10	ln(y) = 2.38848159603535 + 1.42350451460964*Z
Aroclor-1260 ug/Kg	1/17										21	21	10	10	
Arsenic MG/KG	8/17	0.2454968	0.0917679	0.373805056	0.201873	0.289121	0.17146	0.22781	0.30268	0.13122	0.24	0.43	0.16	0.26	ln(y) = -1.47923995132697 + 0.421491920752596*Z
Benzaldehyde ug/Kg	14/17	1036.2007	1704.2375	1.644698277	226.0576	1846.344	159.299	406.644	1038.04	878.745	170	5000	50	800	ln(y) = 6.00793734569303 + 1.39004839899787*Z
Benzyl Butyl Phthalate ug/Kg	1/17										160	160	50	800	
Cadmium MG/KG	3/17										0.003	0.01	0.003	0.26	
Chromium MG/KG	17/17	0.3176471	0.0655205	0.206268121	0.286501	0.348794	0.28	0.29	0.33	0.05	0.26	0.51			ln(y) = -1.1611338068139 + 0.172661165137692*Z
Copper MG/KG	17/17	2.4823529	2.1197154	0.853913771	1.474704	3.490002	1.4	1.6	2.1	0.7	1	7.3			ln(y) = 0.69530804245542 + 0.607276699321628*Z
Diethyl Phthalate ug/Kg	2/17										32	42	50	800	
Di-n-butylphthalate ug/Kg	2/17										6700	8000	50	800	
Endosulfan Sulfate ug/Kg	1/17										30	30	10	10	
Hexachloro-1,3-butadiene ug/Kg	1/17										29	29	50	800	
Iron MG/KG	17/17	17.288235	3.4739693	0.200944121	15.63682	18.93966	13.9	17.9	20.5	6.6	12.5	22.9			ln(y) = 2.83102805277729 + 0.225849235654277*Z
Lead MG/KG	8/17	0.1417012	0.2045052	1.443214436	0.044486	0.238917	0.01497	0.04925	0.16209	0.14712	0.04	0.59	0.04	0.08	ln(y) = -3.0107597196934 + 1.76680909877825*Z
Mercury MG/KG	17/17	0.0674118	0.0312247	0.463193597	0.052568	0.082255	0.0425	0.06	0.088	0.0455	0.029	0.134			ln(y) = -2.79598082635186 + 0.524078182482026*Z
Nickel MG/KG	8/17	0.0539257	0.0639744	1.186343504	0.023514	0.084337	0.02292	0.03971	0.0688	0.04588	0.04	0.24	0.03	0.19	ln(y) = -3.22604781153194 + 0.815113448470549*Z
OCDD PG/G	3/3	11.766667	0.3986797	0.033882123	11.31552	12.21782	11.4	11.9	12	0.6	11.4	12			ln(y) = 2.46501946843531 + 3.80407302201982E-02*Z
OCDF PG/G	1/3										1.17	1.17	1.05	1.29	
PCB-105 ng/kg	3/3	7536.6667	256.18111	0.033991301	7246.77	7826.563	7350	7480	7780	430	7350	7780			ln(y) = 8.92725176011595 + 0.04216622724144*Z
PCB-108 ng/kg	3/3	1656.6667	70.946212	0.042824675	1576.383	1736.95	1620	1630	1720	100	1620	1720			ln(y) = 7.41219876394491 + 4.44223571869023E-02*Z
PCB-114 ng/kg	3/3	390.66667	7.0165943	0.017960566	382.7266	398.6067	384	392	396	12	384	396			ln(y) = 5.96777286787756 + 2.28212357920639E-02*Z
PCB-118 ng/kg	3/3	21700	445.75277	0.020541602	21195.58	22204.42	21300	21700	22100	800	21300	22100			ln(y) = 9.9849542595773 + 2.73443560704327E-02*Z
PCB-126 ng/kg	3/3	139.66667	32.051958	0.229488957	103.3965	175.9369	110	150	159	49	110	159			ln(y) = 4.92667328736963 + 0.273234775336298*Z
PCB-15 ng/kg	2/3										25.5	27	30.1	30.1	
PCB-156 ng/kg	3/3										2970	3200			
PCB-157 ng/kg	3/3	867	48.09861	0.055477059	812.5713	921.4287	842	849	910	68	842	910			ln(y) = 6.76442793335486 + 5.75985140190626E-02*Z
PCB-162 ng/kg	3/3	5920	263.3233	0.044480286	5622.022	6217.978	5670	5980	6110	440	5670	6110			ln(y) = 8.68560076527737 + 5.54278102425681E-02*Z
PCB-167 ng/kg	3/3										1550	1670			
PCB-189 ng/kg	3/3	153.66667	8.9774742	0.058421741	143.5077	163.8256	146	153	162	16	146	162			ln(y) = 5.03388029277772 + 7.71220621540763E-02*Z
PCB-37 ng/kg	3/3	16.566667	0.7871981	0.047516987	15.67587	17.45747	15.9	16.5	17.3	1.4	15.9	17.3			ln(y) = 2.80679533054548 + 6.25843604304614E-02*Z
PCB-60 ng/kg	3/3	375.66667	15.359423	0.040885775	358.2858	393.0475	366	371	390	24	366	390			ln(y) = 5.9283273783775 + 0.047103551473883*Z
PCB-61/70 ng/kg	3/3	1636.6667	50.424679	0.030809376	1579.606	1693.728	1590	1640	1680	90	1590	1680			ln(y) = 7.40016329614328 + 0.040834073046244*Z
PCB-66 ng/kg	3/3	2946.6667	141.78946	0.048118595	2786.217	3107.117	2830	2930	3080	250	2830	3080			ln(y) = 7.98782485620534 + 6.27812584795545E-02*Z
PCB-77 ng/kg	3/3	70.766667	11.026245	0.155811286	58.2893	83.24404	60.3	73.3	78.7	18.4	60.3	78.7			ln(y) = 4.25317862268303 + 0.19750470296296*Z

Table H-14
Lower Calcasieu
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-79 ng/kg	**3/3**	**153.66667**	**41.286172**	**0.268673569**	**106.947**	**200.3864**	**116**	**155**	**190**	**74**	**116**	**190**			ln(y) = 5.01467979339537 + 0.365946180193898*Z
PCB-81 ng/kg	**3/3**	**299.66667**	**64.849535**	**0.216405568**	**226.2825**	**373.0508**	**240**	**303**	**356**	**116**	**240**	**356**			ln(y) = 5.6897674865678 + 0.292419281245546*Z
Phenol ug/Kg	**6/17**	328.31688	182.48926	0.555832702	241.567	415.0668	200.79	290.083	419.084	218.294	**330**	**800**	**50**	**600**	ln(y) = 5.67016600289887 + 0.545700026123553*Z
Selenium MG/KG	**15/17**	0.3288673	0.1705893	0.518717684	0.247774	0.40996	**0.18**	**0.3**	**0.48**	**0.3**	**0.13**	**0.63**	**0.06**	**0.06**	ln(y) = -1.25186123834809 + 0.632395509473943*Z
Silver MG/KG	**3/14**										**0.01**	**0.02**	**0.01**	**0.06**	
Total HpCDD PG/G	**1/3**										**2.33**	**2.33**	**2.21**	**2.34**	
Total HpCDF PG/G	**3/3**	**1.581**	**0.9559635**	**0.604657508**	**0.499225**	**2.662775**	**0.713**	**1.92**	**2.11**	**1.397**	**0.713**	**2.11**			ln(y) = 0.353579758319941 + 0.804642007423991*Z
Total HxCDD PG/G	**2/3**										**0.355**	**0.704**	**0.197**	**0.197**	
Total HxCDF PG/G	**1/3**										**5.12**	**5.12**	**2.76**	**3.51**	
Total PeCDD PG/G	**3/3**	**0.209**	**0.0393869**	**0.188454262**	**0.164429**	**0.253571**	**0.189**	**0.194**	**0.244**	**0.055**	**0.189**	**0.244**			ln(y) = -1.57216414584341 + 0.189428451945361*Z
Total PeCDF PG/G	**3/3**	**3.27**	**0.9826795**	**0.30051362**	**2.157993**	**4.382007**	**2.35**	**3.56**	**3.9**	**1.55**	**2.35**	**3.9**			ln(y) = 1.1617174753852 + 0.375681833844867*Z
Total TCDD PG/G	**3/3**	**0.944**	**0.1641965**	**0.173936986**	**0.758194**	**1.129806**	**0.819**	**0.913**	**1.1**	**0.281**	**0.819**	**1.1**			ln(y) = -6.51268045706371E-02 + 0.218767521911166*Z
Total TCDF PG/G	**3/3**	**3.4566667**	**0.3930292**	**0.113701806**	**3.011912**	**3.901421**	**3.17**	**3.37**	**3.83**	**0.66**	**3.17**	**3.83**			ln(y) = 1.23716971181534 + 0.140267177317046*Z
Zinc MG/KG	**17/17**	**31.935294**	**2.6615492**	**0.083341935**	**30.67007**	**33.20051**	**29.95**	**31.5**	**34.35**	**4.4**	**27.8**	**37.2**			ln(y) = 3.46052955388081 + 9.26806865360743E-02*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-15
Lower Calcasieu
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	1/1										0.861	0.861			
1,2,3,4,6,7,8-HpCDF PG/G	1/1										0.944	0.944			
1,2,3,4,7,8-HxCDF PG/G	1/1										0.864	0.864			
1,2,3,7,8-PeCDF PG/G	1/1										0.408	0.408			
2,3,4,7,8-PeCDF PG/G	1/1										0.178	0.178			
2,3,7,8-TCDD Equivalent PG/G	1/1										0.3913265	0.3913265			
2,3,7,8-TCDF PG/G	1/1										0.218	0.218			
Antimony MG/KG	1/1										0.03	0.03			
Arsenic MG/KG	1/1										0.36	0.36			
Chromium MG/KG	1/1										0.26	0.26			
Copper MG/KG	1/1										0.65	0.65			
Iron MG/KG	1/1										36.2	36.2			
Lead MG/KG	1/1										0.1	0.1			
Mercury MG/KG	1/1										0.064	0.064			
Nickel MG/KG	1/1										0.13	0.13			
OCDD PG/G	1/1										10.6	10.6			
PCB-105 ng/kg	1/1										874	874			
PCB-108 ng/kg	1/1										519	519			
PCB-114 ng/kg	1/1										53.2	53.2			
PCB-118 ng/kg	1/1										4750	4750			
PCB-126 ng/kg	1/1										11.8	11.8			
PCB-156 ng/kg	1/1										457	457			
PCB-157 ng/kg	1/1										119	119			
PCB-162 ng/kg	1/1										834	834			
PCB-167 ng/kg	1/1										229	229			
PCB-189 ng/kg	1/1										56.6	56.6			
PCB-37 ng/kg	1/1										7.83	7.83			
PCB-58 ng/kg	1/1										9.64	9.64			
PCB-60 ng/kg	1/1										106	106			
PCB-61/70 ng/kg	1/1										402	402			
PCB-66 ng/kg	1/1										1150	1150			
PCB-77 ng/kg	1/1										6.55	6.55			
PCB-79 ng/kg	1/1										61.9	61.9			
PCB-81 ng/kg	1/1										24.9	24.9			
Selenium MG/KG	1/1										0.52	0.52			
Total HpCDD PG/G	1/1										1.49	1.49			
Total HxCDD PG/G	1/1										0.265	0.265			
Total HxCDF PG/G	1/1										2.6	2.6			
Total PeCDF PG/G	1/1										1.52	1.52			
Total TCDD PG/G	1/1										0.115	0.115			
Total TCDF PG/G	1/1										1.88	1.88			
Zinc MG/KG	1/1										29.7	29.7			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-16
Lower Calcasieu
Fish Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**10.3**	**10.3**			
1,2,3,4,7,8-HxCDF PG/G	**1/1**										**1.16**	**1.16**			
1,2,3,6,7,8-HxCDD PG/G	**1/1**										**0.381**	**0.381**			
1,2,3,6,7,8-HxCDF PG/G	**1/1**										**2.23**	**2.23**			
1,2,3,7,8-PeCDD PG/G	**1/1**										**0.322**	**0.322**			
1,2,3,7,8-PeCDF PG/G	**1/1**										**1.53**	**1.53**			
2,3,4,7,8-PeCDF PG/G	**1/1**										**2.86**	**2.86**			
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**2.698791**	**2.698791**			
2,3,7,8-TCDD PG/G	**1/1**										**0.272**	**0.272**			
2,3,7,8-TCDF PG/G	**1/1**										**0.881**	**0.881**			
2-Methylnaphthalene ug/Kg	3/12	42.662543	2.9441049	0.069009128	40.996759	44.328327	39.7198	42.5947	45.6777	5.95797	40	46	80	200	ln(y) = 3.75173015629547 + 0.103651879030697*Z
4,4'-DDE ug/Kg	1/13										10	10	10	10	
Acetophenone ug/Kg	1/12										48	48	40	0	
alpha-Chlordane ug/Kg	1/13										13	13	10	10	
Antimony MG/KG	1/12										0.03	0.03	0.03	0.03	
Aroclor-1254 ug/Kg	12/13	55.624335	42.206061	0.758769719	32.680859	78.567811	26	38	88.5	62.5	24	140	10	10	ln(y) = 3.79203516863535 + 0.782049294303328*Z
Aroclor-1260 ug/Kg	11/13	33.552595	22.59388	0.673386966	21.270422	45.834768	16	29	53.5	37.5	14	78	10	10	ln(y) = 3.30142547705004 + 0.80085007338614*Z
Arsenic MG/KG	**12/12**	**0.4466667**	**0.098112**	**0.219653833**	**0.3911546**	**0.5021788**	**0.41**	**0.44**	**0.49**	**0.08**	**0.24**	**0.63**			**ln(y) = -0.828788136462842 + 0.249768551569492*Z**
Benzaldehyde ug/Kg	**12/12**	**493.33333**	**707.5162**	**1.43415445**	**93.018361**	**893.64831**	**285**	**350**	**425**	**140**	**160**	**2200**			**ln(y) = 5.92348857983269 + 0.691074837391963*Z**
beta-BHC ug/Kg	9/13	20.136959	21.040795	1.044884409	8.6990528	31.574865	5.85089	12	30	24.1491	10	68	10	10	ln(y) = 2.54434410789524 + 1.1536083872289*Z
Chromium MG/KG	**12/12**	**0.2933333**	**0.0649706**	**0.221490633**	**0.2565728**	**0.3300939**	**0.245**	**0.27**	**0.34**	**0.095**	**0.23**	**0.44**			**ln(y) = -1.24485282323709 + 0.219087008901118*Z**
Copper MG/KG	**12/12**	**0.9791667**	**0.355925**	**0.363497864**	**0.7777831**	**1.1805502**	**0.665**	**0.91**	**1.25**	**0.585**	**0.56**	**1.7**			**ln(y) = -7.65749756519011E-02 + 0.40454998216181*Z**
Diethyl Phthalate ug/Kg	1/12										27	27	80	0	
Endosulfan Sulfate ug/Kg	2/13										16	32	10	10	
Endrin Ketone ug/Kg	1/13										12	12	10	10	
Iron MG/KG	**12/12**	**47.308333**	**31.095**	**0.657283773**	**29.714681**	**64.901986**	**19.75**	**39.35**	**71.5**	**51.75**	**17.1**	**111**			**ln(y) = 3.67168262436731 + 0.740733975612375*Z**
Lead MG/KG	**12/12**	**0.175**	**0.0939339**	**0.536765384**	**0.1218519**	**0.2281481**	**0.1225**	**0.13**	**0.185**	**0.0625**	**0.1**	**0.37**			**ln(y) = -1.83444494915374 + 0.440453000186398*Z**
Mercury MG/KG	**12/12**	**0.0469167**	**0.0183157**	**0.390388185**	**0.0365536**	**0.0572798**	**0.0355**	**0.0465**	**0.05075**	**0.01525**	**0.027**	**0.092**			**ln(y) = -3.10727974709028 + 0.350398820122705*Z**
Naphthalene ug/Kg	7/12	74.334286	10.076634	0.135558362	68.632894	80.035679	66.3618	73.932	82.3657	16.0039	61	97	110	200	ln(y) = 4.30314540520089 + 0.160227899151471*Z
Nickel MG/KG	**12/12**	**0.0991667**	**0.0408195**	**0.411625258**	**0.0760709**	**0.1222625**	**0.0725**	**0.09**	**0.1375**	**0.065**	**0.05**	**0.17**			**ln(y) = -2.38437325387638 + 0.454734881370959*Z**
OCDD PG/G	**1/1**										**11.8**	**11.8**			
OCDF PG/G	**1/1**										**2.81**	**2.81**			
PCB-105 ng/kg	**1/1**										**1890**	**1890**			
PCB-108 ng/kg	**1/1**										**1210**	**1210**			
PCB-114 ng/kg	**1/1**										**120**	**120**			
PCB-118 ng/kg	**1/1**										**12100**	**12100**			
PCB-126 ng/kg	**1/1**										**33.6**	**33.6**			
PCB-156 ng/kg	**1/1**										**1120**	**1120**			
PCB-157 ng/kg	**1/1**										**282**	**282**			
PCB-162 ng/kg	**1/1**										**2000**	**2000**			
PCB-167 ng/kg	**1/1**										**773**	**773**			
PCB-189 ng/kg	**1/1**										**217**	**217**			
PCB-37 ng/kg	**1/1**										**26.8**	**26.8**			
PCB-58 ng/kg	**1/1**										**51.4**	**51.4**			
PCB-60 ng/kg	**1/1**										**362**	**362**			
PCB-61/70 ng/kg	**1/1**										**1380**	**1380**			
PCB-66 ng/kg	**1/1**										**5160**	**5160**			

Table H-16
Lower Calcasieu
Fish Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-77 ng/kg	**1/1**										**36.5**	**36.5**			
PCB-79 ng/kg	**1/1**										**215**	**215**			
PCB-81 ng/kg	**1/1**										**56.4**	**56.4**			
Phenol ug/Kg	2/12										370	6800	40	0	
Selenium MG/KG	**12/12**	**0.6191667**	**0.107912**	**0.174285901**	**0.5581097**	**0.6802236**	**0.5175**	**0.605**	**0.7325**	**0.215**	**0.47**	**0.77**			**ln(y) = -0.493206567580787 + 0.20199848578859*Z**
Total HpCDF PG/G	**1/1**										**10.3**	**10.3**			
Total HxCDD PG/G	**1/1**										**0.644**	**0.644**			
Total HxCDF PG/G	**1/1**										**19.1**	**19.1**			
Total PeCDD PG/G	**1/1**										**0.322**	**0.322**			
Total PeCDF PG/G	**1/1**										**11.7**	**11.7**			
Total TCDD PG/G	**1/1**										**0.272**	**0.272**			
Total TCDF PG/G	**1/1**										**10.1**	**10.1**			
Zinc MG/KG	**12/12**	**17.3**	**6.0599738**	**0.350287505**	**13.871247**	**20.728753**	**14.025**	**15.1**	**17.325**	**3.3**	**12.9**	**31.1**			**ln(y) = 2.81148837973603 + 0.280637570729722*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-17
Lower Calcasieu
Fish - Whole Body - Group 3a

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
2-Methylnaphthalene ug/Kg	1/9										42	42	40	2000	
4-Nitrophenol ug/Kg	1/8										5300	5300	100	2000	
Aldrin ug/Kg	1/9										13	13	10	10	
alpha-Chlordane ug/Kg	1/9										10	10	10	10	
Aroclor-1254 ug/Kg	**9/9**	**118.22222**	**53.760716**	**0.454742894**	**83.098555**	**153.34589**	**64.5**	**130**	**160**	**95.5**	**45**	**200**			**ln(y) = 4.66548799252107 + 0.610520904338378*Z**
Aroclor-1260 ug/Kg	**9/9**	**81.555556**	**34.681143**	**0.425245628**	**58.897208**	**104.2139**	**47.5**	**80**	**105**	**57.5**	**38**	**140**			**ln(y) = 4.31748635923769 + 0.533070602209136*Z**
Arsenic MG/KG	**9/9**	**0.5666667**	**0.1828245**	**0.322631521**	**0.4472213**	**0.686112**	**0.44**	**0.56**	**0.63**	**0.19**	**0.37**	**0.94**			**ln(y) = -0.603382915901111 + 0.324988750303628*Z**
Benzaldehyde ug/Kg	**9/9**	**926.66667**	**652.72039**	**0.704374525**	**500.22268**	**1353.1107**	**485**	**550**	**1650**	**1165**	**380**	**2000**			**ln(y) = 6.6354304681536 + 0.717117988698467*Z**
beta-BHC ug/Kg	8/9	37.682566	24.308179	0.645077588	21.801223	53.56391	16.5	37	60	43.5	13	75	10	10	ln(y) = 3.43013026615861 + 0.836467886341155*Z
Cadmium MG/KG	**8/8**										**0.01**	**0.02**			
Chromium MG/KG	**9/9**	**0.81**	**0.5159689**	**0.636998645**	**0.4729003**	**1.1470997**	**0.565**	**0.61**	**0.9**	**0.335**	**0.46**	**1.9**			**ln(y) = -0.304344497823495 + 0.475978371530713*Z**
Copper MG/KG	**9/9**	**7.5111111**	**3.1116293**	**0.414270177**	**5.4781799**	**9.5440423**	**4.6**	**8.2**	**9.35**	**4.75**	**2.6**	**12.3**			**ln(y) = 1.92282656725769 + 0.565197597247551*Z**
Endosulfan Sulfate ug/Kg	1/9										12	12	10	10	
gamma-Chlordane ug/Kg	1/9										12	12	10	10	
Hexachloro-1,3-butadiene ug/Kg	2/9										22	260	80	0	
Iron MG/KG	**9/9**	**176.94444**	**127.61524**	**0.721216436**	**93.569153**	**260.31974**	**99.95**	**110**	**296.5**	**196.55**	**52.6**	**388**			**ln(y) = 4.97557561470492 + 0.772625083439269*Z**
Lead MG/KG	**9/9**	**0.6766667**	**0.3113641**	**0.460143931**	**0.4732421**	**0.8800912**	**0.46**	**0.58**	**0.855**	**0.395**	**0.37**	**1.3**			**ln(y) = -0.463405277363853 + 0.473187609874661*Z**
Mercury MG/KG	**9/9**	**0.0507778**	**0.0196369**	**0.38672276**	**0.0379483**	**0.0636072**	**0.032**	**0.052**	**0.0665**	**0.0345**	**0.026**	**0.083**			**ln(y) = -3.04948003959831 + 0.484556410930991*Z**
Naphthalene ug/Kg	1/9										65	65	40	2000	
Nickel MG/KG	**9/9**	**0.3755556**	**0.350688**	**0.933784488**	**0.1464394**	**0.6046717**	**0.25**	**0.27**	**0.385**	**0.135**	**0.16**	**1.1**			**ln(y) = -1.13503586239748 + 0.581795905153275*Z**
Selenium MG/KG	**9/9**	**0.6388889**	**0.1696846**	**0.265593342**	**0.5280283**	**0.7497495**	**0.515**	**0.62**	**0.79**	**0.275**	**0.37**	**0.89**			**ln(y) = -0.480151256245298 + 0.328750172506848*Z**
Silver MG/KG	**8/8**	**0.045**	**0.023809**	**0.529087853**	**0.0285012**	**0.0614988**	**0.025**	**0.045**	**0.05**	**0.025**	**0.02**	**0.09**			**ln(y) = -3.20711751123832 + 0.584332809504473*Z**
Zinc MG/KG	**9/9**	**20.611111**	**4.6637291**	**0.226272572**	**17.564141**	**23.658081**	**18.6**	**21.6**	**23.25**	**4.65**	**11**	**25.9**			**ln(y) = 3.00143925676502 + 0.263979385776648*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-18
Lower Calcasieu
Fish - Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/22										13	13	10	22	
1,2,3,4,6,7,8-HpCDF PG/G	3/4	5.5615423	10.783061	1.938861569	-5.005857	16.128942	0.6725	2.28	13.765	13.0925	2	17.5	0.23	0.23	ln(y) = 0.757727821266058 + 2.11991699580812*Z
1,2,3,4,7,8-HxCDF PG/G	1/4										1.14	1.14	0.222	0.23	
1,2,3,6,7,8-HxCDD PG/G	1/4										0.457	0.457	0.109	0.23	
1,2,3,6,7,8-HxCDF PG/G	1/4										2.95	2.95	0.333	0.23	
1,2,3,7,8,9-HxCDD PG/G	1/4										0.155	0.155	0.0918	0.23	
1,2,3,7,8-PeCDD PG/G	1/4										0.413	0.413	0.104	0.23	
1,2,3,7,8-PeCDF PG/G	3/4	1.1334941	1.3819603	1.219203851	-0.220827	2.4878152	-0.58	0.7005	2.32025	2.90025	0.477	2.82	0.58	0.58	ln(y) = -0.206715430259495 + 0.994397066287577*Z
2,3,4,7,8-PeCDF PG/G	3/4	1.2947376	2.8297769	2.185598811	-1.478444	4.067919	-0.29	0.4145	3.52475	3.81475	0.0646	4.52	0.29	0.29	ln(y) = -1.2164400002796 + 2.48837131758561*Z
2,3,7,8-TCDD Equivalent PG/G	4/4	**1.4335436**	**2.1141614**	**1.474779952**	**-0.638335**	**3.5054218**	**0.34897**	**0.80563**	**3.14603**	**2.79705**	**0.2161312**	**3.9067865**			ln(y) = -0.151659697386974 + 1.60113313571873*Z
2,3,7,8-TCDD PG/G	1/4										0.282	0.282	0.0401	0.29	
2,3,7,8-TCDF PG/G	3/4	0.5939989	0.6337963	1.066999083	-0.027121	1.2151193	-0.44	0.5345	1.19225	1.63225	0.186	1.38	0.44	0.44	ln(y) = -0.898031501011865 + 1.20329867194427*Z
2,4,5-Trichlorophenol ug/Kg	1/23										110	110	50	1000	
2,4-Dimethylphenol ug/Kg	1/23										50	50	50	1000	
2-Methylnaphthalene ug/Kg	2/23										28	66	50	2000	
2-Methylphenol ug/Kg	6/23	46.454242	64.804338	1.395014424	19.969471	72.939014	8.71953	23.0058	60.6989	51.9794	56	230	50	2000	ln(y) = 3.13574559975593 + 1.43903214303757*Z
4,4'-DDD ug/Kg	2/22										0.71	1.1	6	22	
4,4'-DDE ug/Kg	5/22	4.246147	5.2820559	1.24396446	2.0389163	6.4533777	2.1039	3.36636	5.38637	3.28247	2.6	19	10	10	ln(y) = 1.21383337677671 + 0.697191792231162*Z
4,4'-DDT ug/Kg	2/22										1.4	1.8	6	10	
Aldrin ug/Kg	2/22										4	41	6	10	
alpha-BHC ug/Kg	1/22										1.1	1.1	6	10	
alpha-Chlordane ug/Kg	3/22										1.1	1.8	6	10	
Aluminum (Fume Or Dust) MG/KG	2/4										6	7.5	6.2	6.5	
Antimony MG/KG	3/22										0.03	0.03	0.03	1	
Aroclor-1254 ug/Kg	13/23	85.854519	181.24454	2.111065786	11.782006	159.92703	12.6815	34.6217	94.5206	81.8392	19	730	10	100	ln(y) = 3.54447960145624 + 1.48969841631884*Z
Aroclor-1260 ug/Kg	15/23	45.653941	88.255464	1.933140087	9.58497	81.722912	10.7119	23.9434	53.5185	42.8066	12	360	10	100	ln(y) = 3.17569192382162 + 1.19304066384462*Z
Arsenic MG/KG	18/22	0.41538	0.1523203	0.366701143	0.3517294	0.4790306	0.29171	0.38636	0.51171	0.22	0.15	0.71	0.04	0.78	ln(y) = -0.950986183316596 + 0.416787888255369*Z
Barium MG/KG	2/4										1	1.6	0.69	0.78	
Benzaldehyde ug/Kg	16/19	462.46872	474.65844	1.026357944	249.03625	675.90118	170	310	630	460	170	1900	50	50	ln(y) = 5.77943608941901 + 0.960874606272458*Z
beta-BHC ug/Kg	10/19	13.489264	9.2046452	0.682368248	9.3503504	17.628177	6.35107	10.6838	17.9723	11.6213	10	29	4.4	10	ln(y) = 2.36872887973114 + 0.771453416211198*Z
Calcium Metal MG/KG	4/4	7250	3159.5959	0.435806327	4153.596	10346.404	4877.5	6595	10277.5	5400	4710	11100			ln(y) = 8.83143686757511 + 0.528232654102307*Z
Chromium MG/KG	17/22	0.248615	0.072205	0.290428905	0.2184425	0.2787875	0.19823	0.2414	0.29396	0.09573	0.17	0.45	0.01	1	ln(y) = -1.42130705268145 + 0.292208645055845*Z
Copper MG/KG	19/22	0.9558471	1.8075739	1.891070181	0.20051	1.7111842	0.4394	0.681	1.05543	0.61603	0.37	7	0.05	1.1	ln(y) = -0.384199781259867 + 0.649883978553742*Z
Dieldrin ug/Kg	5/22	3.8401901	3.150593	0.820426312	2.5236411	5.1567391	1.87103	3.07561	5.05571	3.18468	1.8	14	10	10	ln(y) = 1.12350414406731 + 0.73720362360072*Z
Diethyl Phthalate ug/Kg	8/23	41.760698	10.175765	0.243668454	37.601983	45.919413	33.9143	40.6094	48.6263	14.7121	29	63	50	4000	ln(y) = 3.7040003639545 + 0.267232219024652*Z
Endosulfan I ug/Kg	1/22										17	17	6	10	
Endosulfan II ug/Kg	1/22										1.4	1.4	6	10	
Endosulfan Sulfate ug/Kg	1/13										36	36	6	10	
Endrin Aldehyde ug/Kg	3/22										1	26	6	10	
gamma-BHC (Lindane) ug/Kg	2/22										1.1	4	6	10	
gamma-Chlordane ug/Kg	1/22										11	11	6	10	
Heptachlor Epoxide ug/Kg	1/22										0.88	0.88	10	10	
Hexachloro-1,3-butadiene ug/Kg	10/23	101.84008	219.38172	2.154178501	12.181352	191.49881	20.955	50.4209	121.32	100.365	40	880	50	2000	ln(y) = 3.92040628796397 + 1.30234658771414*Z
Iron MG/KG	18/22	17.238765	11.058667	0.641499965	12.617642	21.859887	9.40843	14.4878	22.3094	12.901	8.8	42.7	0.11	15.8	ln(y) = 2.67330764507635 + 0.640326928229933*Z
Lead MG/KG	13/22	0.1067389	0.1217056	1.14021814	0.0558814	0.1575965	0.04189	0.0777	0.14414	0.10226	0.05	0.52	0.04	0.8	ln(y) = -2.55485242904218 + 0.916521859009627*Z
Magnesium MG/KG	4/4	329.25	77.180621	0.234413428	253.61299	404.88701	255	347.5	385.25	130.25	235	387			ln(y) = 5.77768852468 + 0.30258199096186*Z

Table H-18
Lower Calcasieu
Fish - Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Manganese MG/KG	3/4	3.8227302	0.9263151	0.242317664	2.9149414	4.7305189	2.3	3.95	4.475	2.175	3.5	4.5	1.9	1.9	ln(y) = 1.33098840388681 + 0.234183767166135*Z
Mercury MG/KG	21/23	0.0496998	0.0269673	0.542604439	0.0386785	0.060721	0.02895	0.04336	0.06495	0.036	0.015	0.111	0.018	0.024	ln(y) = -3.13814759275047 + 0.599280994708217*Z
Nickel MG/KG	12/22	0.0549399	0.0527915	0.960894953	0.0328798	0.0770001	0.02028	0.03925	0.07596	0.05568	0.03	0.19	0.03	4	ln(y) = -3.23787683157711 + 0.979488980564138*Z
OCDD PG/G	2/4										3.03	10.9	0.626	0.44	
PCB-105 ng/kg	3/3	2283.6667	2224.8666	0.974251887	-234.0069	4801.3402	951	1560	4340	3389	951	4340			ln(y) = 7.52852826329447 + 1.12588254124912*Z
PCB-108 ng/kg	3/3	797	985.6867	1.236746176	-318.4095	1912.4095	380	381	1630	1250	380	1630			ln(y) = 6.42643530721598 + 1.07993733107806*Z
PCB-114 ng/kg	3/3	139.3	141.20836	1.013699633	-20.4923	299.0923	59.9	90	268	208.1	59.9	268			ln(y) = 4.72782438532084 + 1.111194460424 85*Z
PCB-118 ng/kg	3/3	9570	10191.358	1.064927685	-1962.607	21102.607	3990	5920	18800	14810	3990	18800			ln(y) = 8.93975012886 + 1.14957772742716*Z
PCB-126 ng/kg	2/3										14.5	130	19.8	0	
PCB-15 ng/kg	1/3										25.1	25.1	19.8	20.3	
PCB-156 ng/kg	3/3	1338.3333	1329.5232	0.993417106	-166.1638	2842.8305	455	970	2590	2135	455	2590			ln(y) = 6.95233554838065 + 1.28978326143825*Z
PCB-157 ng/kg	3/3	358.66667	311.87016	0.869526479	5.7523536	711.58098	129	292	655	526	129	655			ln(y) = 5.6737338140884 + 1.20502002684973*Z
PCB-162 ng/kg	3/3	2320.6667	2268.2191	0.977399763	-246.0648	4887.3982	842	1670	4450	3608	842	4450			ln(y) = 7.51900609827114 + 1.23472721676516*Z
PCB-167 ng/kg	3/3	784.66667	1169.9936	1.49107089	-539.3058	2108.6391	278	296	1780	1502	278	1780			ln(y) = 6.26744973710028 + 1.37702272204815*Z
PCB-189 ng/kg	3/3	168.06667	257.48901	1.532064738	-123.3096	459.44292	47.4	64.8	392	344.6	47.4	392			ln(y) = 4.66706322394991 + 1.56680038702025*Z
PCB-37 ng/kg	2/3										5.96	43.6	19.8	19.8	
PCB-58 ng/kg	3/3	15.21	20.315764	1.335684684	-7.779451	38.199451	2.67	8.86	34.1	31.43	2.67	34.1			ln(y) = 2.23097420710621 + 1.88909814812032*Z
PCB-60 ng/kg	3/3	310.4	457.50603	1.473924075	-207.3168	828.11681	64.2	144	723	658.8	64.2	723			ln(y) = 5.23840857747689 + 1.795791320005*Z
PCB-61/70 ng/kg	3/3	740	781.76823	1.05644356	-144.654	1624.654	118	622	1480	1362	118	1480			ln(y) = 6.167807361321 + 1.87567003981257*Z
PCB-66 ng/kg	3/3	2213.3333	3205.8911	1.448444793	-1414.474	5841.1407	674	946	5020	4346	674	5020			ln(y) = 7.29555263088332 + 1.48916304232108*Z
PCB-77 ng/kg	3/3	30.01	32.189013	1.072609559	-6.415297	66.435297	4.53	25	60.5	55.97	4.53	60.5			ln(y) = 2.94408037646665 + 1.92225094680057*Z
PCB-79 ng/kg	3/3	102.33333	116.25154	1.136008543	-29.21767	233.88434	48.7	55.3	203	154.3	48.7	203			ln(y) = 4.40388597255287 + 1.05869915737706*Z
PCB-81 ng/kg	3/3	47.866667	60.170025	1.257033941	-20.22213	115.95546	15.8	25.8	102	86.2	15.8	102			ln(y) = 3.54511908174825 + 1.38311548086604*Z
Pentachlorophenol ug/Kg	1/23										150	150	120	2000	
Potassium MG/KG	4/4	3212.5	646.90422	0.201370963	2578.5339	3846.4661	2907.5	2995	3735	827.5	2900	3960			ln(y) = 8.06634830429516 + 0.176886996752266*Z
Selenium MG/KG	19/22	0.7566877	0.4927093	0.651139582	0.5507976	0.9625778	0.41938	0.63937	0.97476	0.55538	0.29	2	0.06	1.5	ln(y) = -0.447269469695752 + 0.625503150095761*Z
Silver MG/KG	1/22										0.02	0.02	0.01	1.5	
Sodium MG/KG	2/4										843	1570	1500	1.5	
Total HpCDF PG/G	3/4	5.5615423	10.783061	1.938861569	-5.005857	16.128942	0.725	2.28	13.765	13.04	2	17.5	0.3	0.3	ln(y) = 0.757727821266058 + 2.11991699580812*Z
Total HxCDD PG/G	1/4										0.901	0.901	0.0967	0.3	
Total HxCDF PG/G	3/4	6.5799885	13.617665	2.069557614	-6.765323	19.9253	0.84	2.245	16.9325	16.0925	1.86	21.7	0.5	0.5	ln(y) = 0.717324521751674 + 2.39726614570439*Z
Total PeCDD PG/G	1/4										0.413	0.413	0.104	0.5	
Total PeCDF PG/G	3/4	5.61974	9.698564	1.725802969	-3.884853	15.124333	0.8275	2.665	13.69	12.8625	1.57	17	0.58	0.58	ln(y) = 0.734764009581898 + 2.29377493932973*Z
Total TCDD PG/G	1/4										0.282	0.282	0.0401	0.58	
Total TCDF PG/G	3/4	3.3841225	5.1414739	1.519293053	-1.654522	8.4227669	0.695	1.96	7.665	6.97	1.46	9.4	0.44	0.44	ln(y) = 0.543325556484665 + 1.80239186906763*Z
Zinc MG/KG	21/22	14.206909	5.187425	0.365133973	12.039222	16.374596	11.375	13.25	14.975	3.6	9.5	29.9	0.04	0.04	ln(y) = 2.60891417615029 + 0.320624042551355*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-19
Lower Calcasieu
Fish - Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/3										3.75	6.27	0.813	0.813	
1,2,3,4,6,7,8-HpCDF PG/G	**3/3**	**23.236667**	**26.364093**	**1.134590133**	**-6.597113**	**53.070446**	**1.81**	**19.8**	**48.1**	**46.29**	**1.81**	**48.1**			**ln(y) = 2.48409698669665 + 2.43251866354837*Z**
1,2,3,4,7,8-HxCDD PG/G	2/3										0.316	0.689	0.138	0.138	
1,2,3,4,7,8-HxCDF PG/G	2/3										2.76	12.1	0.44	0.44	
1,2,3,6,7,8-HxCDD PG/G	**3/3**	**1.92**	**1.7563297**	**0.914755054**	**-0.067474**	**3.9074742**	**0.33**	**2.55**	**2.88**	**2.55**	**0.33**	**2.88**			**ln(y) = 0.295073676265526 + 1.60671003876618*Z**
1,2,3,6,7,8-HxCDF PG/G	2/3										4.49	11	0.502	0.502	
1,2,3,7,8,9-HxCDD PG/G	2/3										0.712	0.814	0.141	0.141	
1,2,3,7,8,9-HxCDF PG/G	1/3										0.944	0.944	0.0634	0.334	
1,2,3,7,8-PeCDD PG/G	2/3										0.764	1.79	0.249	0.249	
1,2,3,7,8-PeCDF PG/G	**3/3**	**15.27**	**26.509651**	**1.736060968**	**-14.72849**	**45.268494**	**0.95**	**5.66**	**39.2**	**38.25**	**0.95**	**39.2**			**ln(y) = 1.78360244820799 + 2.75884749563376*Z**
2,3,4,6,7,8-HxCDF PG/G	1/3										2.36	2.36	0.295	0.725	
2,3,4,7,8-PeCDF PG/G	**3/3**	**7.7636667**	**13.089242**	**1.6859613**	**-7.048205**	**22.575538**	**0.881**	**2.91**	**19.5**	**18.619**	**0.881**	**19.5**			**ln(y) = 1.30395663123571 + 2.29691635081564*Z**
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**11.020644**	**16.463777**	**1.49390345**	**-7.609874**	**29.651162**	**1.01797**	**5.7625**	**26.2815**	**25.2635**	**1.0179727**	**26.281463**			ln(y) = 1.67934915126128 + 2.41108215582213*Z
2,3,7,8-TCDD PG/G	2/3										0.419	0.95	0.0853	0.0853	
2,3,7,8-TCDF PG/G	**3/3**	**32.96**	**54.434752**	**1.651539797**	**-28.63872**	**94.55872**	**2.28**	**14**	**82.6**	**80.32**	**2.28**	**82.6**			**ln(y) = 2.62574748436951 + 2.66233466570667*Z**
2-Methylphenol ug/Kg	1/10										200	200	50	1000	
4,4'-DDE ug/Kg	2/10										14	39	6	22	
4,4'-DDT ug/Kg	1/10										14	14	6	22	
Aldrin ug/Kg	2/10										13	41	6	22	
alpha-BHC ug/Kg	1/10										1.2	1.2	10	22	
alpha-Chlordane ug/Kg	2/10										18	19	6	22	
Aluminum (Fume Or Dust) MG/KG	**2/2**										**5.1**	**10**			
Antimony MG/KG	2/10										0.35	0.42	0.03	0.03	
Aroclor-1254 ug/Kg	6/10	214.307	399.0111	1.861867254	-33.00269	461.6166	32.142	91.8881	262.69	230.55	95	1100	10	100	ln(y) = 4.52057161285565 + 1.55803113375299*Z
Aroclor-1260 ug/Kg	5/10	79.42162	87.86054	1.106254762	24.96509	133.8781	26.135	53.4134	109.16	83.026	52	270	10	100	ln(y) = 3.97806095209552 + 1.06019071191375*Z
Arsenic MG/KG	**10/10**	**0.586**	**0.2211289**	**0.377353079**	**0.4489429**	**0.7230571**	**0.4375**	**0.46**	**0.755**	**0.3175**	**0.39**	**1**			**ln(y) = -0.587918402223785 + 0.373982661542154*Z**
Barium MG/KG	**2/2**										**3.2**	**10.1**			
beta-BHC ug/Kg	2/9										24	51	10	22	
Cadmium MG/KG	7/10	0.007322	0.003624	0.494968475	0.005076	0.009568	0.0044	0.00658	0.0098	0.0054	0.003	0.01	0.003	0.5	ln(y) = -5.02432847705869 + 0.596533115502587*Z
Calcium Metal MG/KG	2/2										5860	27100			
Chromium MG/KG	9/10	0.540596	0.311008	0.575306353	0.347831	0.733361	-1	-1	-1	0	0.2	1.1	1	1	ln(y) = -0.77148951550378 + 0.653361874161273*Z
Copper MG/KG	**10/10**	**5.72**	**2.4056176**	**0.420562524**	**4.2289827**	**7.2110173**	**4.15**	**5.85**	**7.95**	**3.8**	**1.2**	**8.6**			**ln(y) = 1.62626619952651 + 0.629561825054091*Z**
Dieldrin ug/Kg	1/10										30	30	6	22	
Diethyl Phthalate ug/Kg	2/10										62	76	50	1000	
Endosulfan II ug/Kg	2/10										9	17	10	22	
Endrin Aldehyde ug/Kg	2/5										20	29	6	22	
Endrin ug/Kg	1/10										11	11	10	22	
gamma-Chlordane ug/Kg	1/10										19	19	6	22	
Heptachlor Epoxide ug/Kg	1/10										5.7	5.7	10	22	
Heptachlor ug/Kg	1/10										26	26	6	22	
Hexachloro-1,3-butadiene ug/Kg	2/10										140	150	50	1000	
Hexachlorobenzene ug/Kg	1/10										140	140	50	1000	
Iron MG/KG	**10/10**	**95.6**	**111.33888**	**1.164632683**	**26.591444**	**164.60856**	**23.05**	**37.7**	**163**	**139.95**	**14**	**330**			**ln(y) = 4.02149211818463 + 1.27013929143999*Z**
Lead MG/KG	9/10	0.336396	0.21287	0.632796486	0.204458	0.468334	-0.8	-0.8	-0.8	0	0.06	0.71	0.8	0.8	ln(y) = -1.3319530398086 + 1.00706328808302*Z
Magnesium MG/KG	2/2										324	665			
Manganese MG/KG	2/2										3.5	15.4			
Mercury MG/KG	8/10	0.049198	0.083827	1.70387454	-0.002759	0.101154	0.0158	0.03134	0.0623	0.0465	0.022	0.229	0.009	0.0091	ln(y) = -3.4629586271516 + 1.01890838228964*Z

Table H-19
Lower Calcasieu
Fish - Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Nickel MG/KG	8/10	0.18384	0.159574	0.86800282	0.084935	0.282745	-4	-4	-4	0	0.04	0.51	4	4	ln(y) = -2.02501746500252 + 1.17422425794195*Z
OCDD PG/G	2/3										31.7	69.9	4.62	4.62	
OCDF PG/G	2/3										7.78	21.4	0.483	0.483	
PCB-105 ng/kg	**3/3**	**8933.3333**	**13033.893**	**1.459017892**	**-5815.905**	**23682.572**	**1890**	**4210**	**20700**	**18810**	**1890**	**20700**			**ln(y) = 8.60914633799453 + 1.77513751633999*Z**
PCB-108 ng/kg	**3/3**	**3668.6667**	**5097.9394**	**1.389589163**	**-2100.195**	**9437.5282**	**706**	**1950**	**8350**	**7644**	**706**	**8350**			**ln(y) = 7.72173890229864 + 1.83212798428712*Z**
PCB-114 ng/kg	**3/3**	**583.46667**	**911.24182**	**1.561771863**	**-447.7005**	**1614.6339**	**81.4**	**259**	**1410**	**1328.6**	**81.4**	**1410**			**ln(y) = 5.73584943936008 + 2.11511098367773*Z**
PCB-118 ng/kg	**3/3**	**38220**	**52252.333**	**1.367146331**	**-20909.08**	**97349.081**	**7860**	**20600**	**86200**	**78340**	**7860**	**86200**			**ln(y) = 10.0890045656176 + 1.77612143906283*Z**
PCB-126 ng/kg	**3/3**	**215.16667**	**296.31626**	**1.377147615**	**-120.1467**	**550.48008**	**46.5**	**113**	**486**	**439.5**	**46.5**	**486**			**ln(y) = 4.91768291840205 + 1.74042874018737*Z**
PCB-127 ng/kg	2/3										11.7	36.1	21.3	21.3	
PCB-15 ng/kg	1/3										196	196	19.8	21.1	
PCB-156 ng/kg	**3/3**	**3952.6667**	**5445.3812**	**1.377647456**	**-2209.362**	**10114.696**	**768**	**2130**	**8960**	**8192**	**768**	**8960**			**ln(y) = 7.80273083260671 + 1.82199298898782*Z**
PCB-157 ng/kg	**3/3**	**1108.6667**	**1512.1342**	**1.36392144**	**-602.4743**	**2819.8076**	**250**	**586**	**2490**	**2240**	**250**	**2490**			**ln(y) = 6.57160623229934 + 1.70469749145531*Z**
PCB-162 ng/kg	**3/3**	**6920**	**8984.035**	**1.298270947**	**-3246.393**	**17086.393**	**1890**	**3770**	**15100**	**13210**	**1890**	**15100**			**ln(y) = 8.46720413709959 + 1.54119800462509*Z**
PCB-167 ng/kg	**3/3**	**2609**	**3510.3456**	**1.345475527**	**-1363.33**	**6581.3301**	**517**	**1460**	**5850**	**5333**	**517**	**5850**			**ln(y) = 7.40281050981224 + 1.79931262728557*Z**
PCB-189 ng/kg	**3/3**	**686.16667**	**932.04534**	**1.358336665**	**-368.5419**	**1740.8753**	**83.5**	**415**	**1560**	**1476.5**	**83.5**	**1560**			**ln(y) = 5.93518875077703 + 2.17119669726412*Z**
PCB-37 ng/kg	**3/3**	**116**	**86.808151**	**0.748346128**	**17.76733**	**214.23267**	**67.5**	**85.5**	**195**	**127.5**	**67.5**	**195**			**ln(y) = 4.64454784412832 + 0.786776215808743*Z**
PCB-58 ng/kg	**3/3**	**160.66667**	**215.07677**	**1.338652118**	**-82.71561**	**404.04895**	**13**	**105**	**364**	**351**	**13**	**364**			**ln(y) = 4.37202119175193 + 2.47126830755618*Z**
PCB-60 ng/kg	**3/3**	**2615**	**3516.4153**	**1.344709465**	**-1364.198**	**6594.1985**	**305**	**1620**	**5920**	**5615**	**305**	**5920**			**ln(y) = 7.26552831090396 + 2.19951625969538*Z**
PCB-61/70 ng/kg	**3/3**	**14630**	**21468.446**	**1.467426255**	**-9663.834**	**38923.834**	**1350**	**7940**	**34600**	**33250**	**1350**	**34600**			**ln(y) = 8.87971246223982 + 2.40566696862318*Z**
PCB-66 ng/kg	**3/3**	**13703.333**	**16905.385**	**1.233669581**	**-5426.911**	**32833.578**	**2000**	**9410**	**29700**	**27700**	**2000**	**29700**			**ln(y) = 9.01644433897077 + 2.00092207438655*Z**
PCB-77 ng/kg	**3/3**	**289.16667**	**362.08318**	**1.252160839**	**-120.569**	**698.90235**	**43.5**	**193**	**631**	**587.5**	**43.5**	**631**			**ln(y) = 5.16091899651358 + 1.98352714808988*Z**
PCB-79 ng/kg	**3/3**	**612.33333**	**749.03161**	**1.223241607**	**-235.2757**	**1459.9424**	**101**	**416**	**1320**	**1219**	**101**	**1320**			**ln(y) = 5.94373093089431 + 1.90619096784473*Z**
PCB-80 ng/kg	1/3										91.8	91.8	19.8	21.3	
PCB-81 ng/kg	**3/3**	**421.23333**	**697.76079**	**1.656470986**	**-368.3573**	**1210.824**	**69.7**	**154**	**1040**	**970.3**	**69.7**	**1040**			**ln(y) = 5.40937630410518 + 2.00446396555371*Z**
Potassium MG/KG	**2/2**										**2900**	**3140**			
Selenium MG/KG	**10/10**	**0.789**	**0.3965182**	**0.502557878**	**0.5432355**	**1.0347645**	**0.56**	**0.615**	**1.03**	**0.47**	**0.45**	**1.6**			**ln(y) = -0.321063974246428 + 0.460545765928255*Z**
Silver MG/KG	5/10	0.063877	0.03397	0.531798277	0.042823	0.084932	0.0381	0.05763	0.0872	0.0491	0.06	0.13	0.01	1	ln(y) = -2.85374543029158 + 0.613995057773552*Z
Sodium MG/KG	2/2										1260	1370			
Total HpCDD PG/G	2/3										6	23.7	1.21	1.21	
Total HpCDF PG/G	2/3										22.5	49.5	1.81	1.81	
Total HxCDD PG/G	**3/3**	**3.9133333**	**3.9230287**	**1.00247752**	**-0.525992**	**8.3526582**	**0.33**	**4.05**	**7.36**	**7.03**	**0.33**	**7.36**			**ln(y) = 0.762038063112541 + 2.30256049293743*Z**
Total HxCDF PG/G	**3/3**	**35.67**	**39.125359**	**1.096870176**	**-8.604512**	**79.944512**	**3.61**	**30.9**	**72.5**	**68.89**	**3.61**	**72.5**			**ln(y) = 2.99935017270304 + 2.22480503714662*Z**
Total PeCDD PG/G	2/3										0.764	1.79	0.235	0.235	
Total PeCDF PG/G	**3/3**	**40.393333**	**54.027581**	**1.337537087**	**-20.74463**	**101.5313**	**4.28**	**25.6**	**91.3**	**87.02**	**4.28**	**91.3**			**ln(y) = 3.07023204956005 + 2.2695395077193*Z**
Total TCDD PG/G	**3/3**	**0.6183333**	**0.3669046**	**0.593376655**	**0.2031417**	**1.0335249**	**0.419**	**0.486**	**0.95**	**0.531**	**0.419**	**0.95**			**ln(y) = -0.547574769509731 + 0.607093036695797*Z**
Total TCDF PG/G	**3/3**	**52.113333**	**69.562591**	**1.334832875**	**-26.60415**	**130.83081**	**8.44**	**30.9**	**117**	**108.56**	**8.44**	**117**			**ln(y) = 3.44197080910311 + 1.94989170696295*Z**
Vanadium (Fume Or Dust) MG/KG	1/2										0.57	0.57	1	1	
Zinc MG/KG	**10/10**	**19.68**	**3.7166021**	**0.188851734**	**17.376426**	**21.983574**	**17.35**	**19.85**	**22.075**	**4.725**	**13.3**	**25.4**			**ln(y) = 2.96321369172287 + 0.227183098065054*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-20
Lower Calcasieu
Fish - Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	2/10										12	26	10	22	
1,2,3,4,6,7,8-HpCDF PG/G	1/2										0.247	0.247	0.0758	0.0758	
1,2,3,4,7,8-HxCDF PG/G	**2/2**										**0.184**	**0.308**			
1,2,3,6,7,8-HxCDD PG/G	1/2										0.224	0.224	0.146	0.146	
1,2,3,6,7,8-HxCDF PG/G	**2/2**										**0.228**	**1.2**			
1,2,3,7,8-PeCDF PG/G	**2/2**										**0.659**	**0.718**			
2,3,4,7,8-PeCDF PG/G	1/2										0.0994	0.0994	0.116	0.116	
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**0.2692781**	**0.3981454**			
2,3,7,8-TCDF PG/G	**2/2**										**0.194**	**0.268**			
2-Methylphenol ug/Kg	1/10										32	32	50	2000	
4,4'-DDD ug/Kg	1/10										5.3	5.3	10	22	
4,4'-DDE ug/Kg	2/10										7	11	10	22	
4,4'-DDT ug/Kg	1/10										9.7	9.7	10	22	
Aldrin ug/Kg	2/10										9.1	17	10	22	
alpha-BHC ug/Kg	1/10										1.7	1.7	10	22	
alpha-Chlordane ug/Kg	1/10										3.7	3.7	10	22	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**11.1**	**11.1**			
Aroclor-1254 ug/Kg	7/10	56.168668	42.104781	0.7496133	30.071855	82.265482	23.6211	42.542	76.619	52.998	22	120	10	100	ln(y) = 3.75049202605739 + 0.872682950742553*Z
Aroclor-1260 ug/Kg	6/10	28.230133	23.561839	0.834634347	13.626354	42.833913	9.66042	20.1745	42.132	32.4715	11	62	10	100	ln(y) = 3.00442163485363 + 1.0922528332175*Z
Arsenic MG/KG	**10/10**	**0.422**	**0.1779975**	**0.42179491**	**0.311676**	**0.532324**	**0.2925**	**0.385**	**0.5475**	**0.255**	**0.23**	**0.78**			**ln(y) = -0.932469177648373 + 0.464425822910975*Z**
Barium MG/KG	**1/1**										**4.7**	**4.7**			
beta-BHC ug/Kg	1/10										15	15	6	22	
Calcium Metal MG/KG	**1/1**										**34700**	**34700**			
Chromium MG/KG	**10/10**	**0.229**	**0.1794253**	**0.783516761**	**0.117791**	**0.340209**	**0.14**	**0.185**	**0.24**	**0.1**	**0.12**	**0.63**			**ln(y) = -1.59713210673058 + 0.521837483092053*Z**
Copper MG/KG	**10/10**	**0.897**	**0.3353735**	**0.373883453**	**0.6891334**	**1.1048666**	**0.7275**	**0.84**	**1.1**	**0.3725**	**0.45**	**1.6**			**ln(y) = -0.161975073777495 + 0.397805622655042*Z**
Dieldrin ug/Kg	1/10										10	10	10	22	
Diethyl Phthalate ug/Kg	8/10	44.942044	7.9952389	0.177901097	39.986544	49.897544	38.2141	44.1554	51.0203	12.8062	32	56	50	2000	ln(y) = 3.78771487381264 + 0.214345012419849*Z
Endrin Aldehyde ug/Kg	1/10										2.4	2.4	10	22	
Heptachlor Epoxide ug/Kg	1/10										4	4	10	22	
Heptachlor ug/Kg	1/10										6.8	6.8	10	22	
Hexachloro-1,3-butadiene ug/Kg	7/10	72.866732	66.104742	0.907200586	31.894589	113.83888	35.3468	59.5466	100.315	64.968	30	220	50	1000	ln(y) = 4.08676000673842 + 0.773600389796405*Z
Iron MG/KG	**10/10**	**10.59**	**5.0310057**	**0.475071356**	**7.4717504**	**13.70825**	**5.675**	**9.85**	**14.15**	**8.475**	**5.2**	**19.3**			**ln(y) = 2.26421397428067 + 0.543354441575035*Z**
Lead MG/KG	2/10										0.06	0.07	0.04	0.8	
Magnesium MG/KG	**1/1**										**595**	**595**			
Manganese MG/KG	**1/1**										**9.4**	**9.4**			
Mercury MG/KG	9/10	0.1044361	0.0520128	0.498034662	0.0721982	0.1366739	0.06575	0.096	0.138	0.07225	0.062	0.203	0.02	0.02	ln(y) = -2.35352094914995 + 0.5514165325518*Z
Nickel MG/KG	9/10	0.0791876	0.0395837	0.499872158	0.0546534	0.1037219	-4	-4	-4	0	0.04	0.16	4	4	ln(y) = -2.6328090648759 + 0.573802134706606*Z
PCB-105 ng/kg	**2/2**										**1010**	**1890**			
PCB-108 ng/kg	**2/2**										**357**	**866**			
PCB-114 ng/kg	**2/2**										**68.5**	**106**			
PCB-118 ng/kg	**2/2**										**3910**	**8530**			
PCB-126 ng/kg	**2/2**										**20**	**28.8**			
PCB-15 ng/kg	**1/2**										**29**	**29**	**10**	**100**	
PCB-156 ng/kg	**2/2**										**512**	**1040**			
PCB-157 ng/kg	**2/2**										**132**	**262**			
PCB-162 ng/kg	**2/2**										**770**	**1830**			
PCB-167 ng/kg	**2/2**										**237**	**632**			
PCB-189 ng/kg	**2/2**										**54.2**	**174**			
PCB-37 ng/kg	1/2										26.2	26.2	10	100	

Table H-20
Lower Calcasieu
Fish - Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-58 ng/kg	**2/2**										**4.83**	**23.4**			
PCB-60 ng/kg	**2/2**										**103**	**337**			
PCB-61/70 ng/kg	**2/2**										**244**	**1850**			
PCB-66 ng/kg	**2/2**										**1200**	**2460**			
PCB-77 ng/kg	**2/2**										**6.43**	**52.1**			
PCB-79 ng/kg	**2/2**										**38**	**107**			
PCB-81 ng/kg	**2/2**										**20.1**	**48.9**			
Phenol ug/Kg	1/10										80	80	50	1000	
Potassium MG/KG	**1/1**										**3230**	**3230**			
Selenium MG/KG	**10/10**	**0.848**	**0.3711246**	**0.437646927**	**0.6179746**	**1.0780254**	**0.585**	**0.8**	**1.05**	**0.465**	**0.42**	**1.6**			**ln(y) = -0.239996829557783 + 0.487970528709743*Z**
Sodium MG/KG	**1/1**										**1710**	**1710**			
Total HpCDF PG/G	1/2										0.247	0.247	0.0952	0.0952	
Total HxCDD PG/G	1/2										0.224	0.224	0.129	0.129	
Total HxCDF PG/G	**2/2**										**1.8**	**9.87**			
Total PeCDF PG/G	**2/2**										**1.54**	**4.69**			
Total TCDD PG/G	1/2										0.0596	0.0596	0.052	0.052	
Total TCDF PG/G	**2/2**										**0.805**	**3.29**			
Zinc MG/KG	**10/10**	**11**	**5.0181748**	**0.45619771**	**7.889703**	**14.110297**	**8.25**	**10.05**	**11.575**	**3.325**	**7.3**	**22.3**			**ln(y) = 2.34512402214704 + 0.356790567082738*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-21
Lower Calcasieu
Fish - Fillet - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
4,4'-DDD ug/Kg	1/5										22	22	6	10	
4,4'-DDE ug/Kg	3/5	6.1621794	12.292098	1.994764779	-4.61232	16.936679	1.21263	-6	14	12.7874	1.7	22	6	6	ln(y) = 1.13787232302363 + 1.40180577358282*Z
alpha-Chlordane ug/Kg	1/5										2.5	2.5	6	6	
Aluminum (Fume Or Dust) MG/KG	2/4										4.7	5.4	10	5.4	
Antimony MG/KG	1/4										0.39	0.39	1	5.4	
Arsenic MG/KG	**4/4**	**0.6925**	**0.1904708**	**0.27504808**	**0.5058386**	**0.8791614**	**0.525**	**0.68**	**0.8725**	**0.3475**	**0.5**	**0.91**			**ln(y) = -0.393180082374734 + 0.365069681446846*Z**
Barium MG/KG	**4/4**	**0.38**	**0.2027519**	**0.533557698**	**0.1813031**	**0.5786969**	**0.2125**	**0.375**	**0.5525**	**0.34**	**0.16**	**0.61**			**ln(y) = -1.07217852129217 + 0.733690508721025*Z**
Calcium Metal MG/KG	**4/4**	**1660**	**1029.2201**	**0.620012103**	**651.36431**	**2668.6357**	**737.5**	**1840**	**2402.5**	**1665**	**410**	**2550**			**ln(y) = 7.22269627997072 + 1.01742960619147*Z**
Chromium MG/KG	1/4										0.69	0.69	1	1	
Copper MG/KG	**4/4**	**0.8575**	**0.5678525**	**0.662218619**	**0.3010046**	**1.4139954**	**0.3575**	**0.815**	**1.4**	**1.0425**	**0.3**	**1.5**			**ln(y) = -0.334518947212354 + 0.996704770758117*Z**
Dieldrin ug/Kg	4/5	6.197429	12.066808	1.947066699	-4.379594	16.774452	-6	-6	14	20	1.6	22	6	6	ln(y) = 1.19304147082786 + 1.2767928620769*Z
Endosulfan II ug/Kg	1/5										3.1	3.1	6	6	
Endrin Aldehyde ug/Kg	1/5										1.6	1.6	6	6	
Endrin Ketone ug/Kg	1/5										0.71	0.71	6	6	
Endrin ug/Kg	2/5										2.2	22	6	6	
gamma-BHC (Lindane) ug/Kg	1/5										0.89	0.89	6	6	
Heptachlor Epoxide ug/Kg	3/5	17.579746	49.776366	2.831461086	-26.05116	61.210654	0.53154	-22	51.5	50.9685	0.85	81	22	22	ln(y) = 1.03109239327629 + 2.46678170338976*Z
Iron MG/KG	1/4										5.7	5.7	3.1	4.9	
Magnesium MG/KG	**4/4**	**318.5**	**42.536579**	**0.133552838**	**276.81415**	**360.18585**	**294.25**	**305**	**356.25**	**62**	**294**	**370**			**ln(y) = 5.7591576920356 + 0.136046297019884*Z**
Manganese MG/KG	**4/4**	**0.92**	**0.2870163**	**0.311974245**	**0.638724**	**1.201276**	**0.685**	**1**	**1.075**	**0.39**	**0.58**	**1.1**			**ln(y) = -0.112354248909337 + 0.348799572209033*Z**
Mercury MG/KG	3/4	0.0336474	0.0366235	1.088451886	-0.002244	0.0695384	0.019	0.0265	0.0625	0.0435	0.025	0.074	0.017	0.017	ln(y) = -3.66016476741577 + 1.06118719669034*Z
Potassium MG/KG	**4/4**	**4085**	**648.82867**	**0.158831989**	**3449.1479**	**4720.8521**	**3517.5**	**4030**	**4707.5**	**1190**	**3460**	**4820**			**ln(y) = 8.30636327505516 + 0.208366181650355*Z**
Pyrene ug/Kg	1/5										230	230	1000	2000	
Selenium MG/KG	**4/4**										**1.2**	**1.4**			
Sodium MG/KG	2/4										802	896	463	517	
Zinc MG/KG	3/4	6.0701001	2.3434292	0.386061038	3.7735395	8.3666607	5.375	6	8.125	2.75	5.6	8.7	5.3	5.3	ln(y) = 1.76534512490636 + 0.425813014885688*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-22
Lower Calcasieu
Fish - Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/23										3.2	3.2	10	200	
1,2,3,7,8-PeCDF PG/G	2/3										0.352	0.381	0.226	0.226	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**100.0%**	**0.393294**	**0.031744607**	**0.0807147**	**0.3573716**	**0.42922**	**0.36419**	**0.40409**	**0.4116**	**0.0474034**	**0.36419455**	**0.411598**		
2,3,7,8-TCDF PG/G	2/3										0.317	0.621	0.192	0.192	
4,4'-DDD ug/Kg	1/23										12	12	6	200	
4,4'-DDE ug/Kg	5/23	4.5970833	5.97247	1.299186805	2.156205	7.0379617	1.71173	3.18441	5.92412	4.21239	1.7	25	6	10	ln(y) = 1.15826826340964 + 0.920755918279018*Z
Aldrin ug/Kg	3/23										2.3	49	6	10	
alpha-BHC ug/Kg	2/23										0.88	8.3	6	10	
alpha-Chlordane ug/Kg	5/23	4.2545395	4.9208137	1.156603152	2.2434607	6.2656182	1.5941	2.96448	5.5129	3.91879	1.6	21	6	10	ln(y) = 1.08670113753792 + 0.920200641897996*Z
Aluminum (Fume Or Dust) MG/KG	3/5	5.41169	1.5554107	0.287416812	4.0483124	6.7750675	4.0105	-10	-10	-14.01	3.9	6.8	10	10	ln(y) = 1.66688858768626 + 0.412307189500814*Z
Antimony MG/KG	7/23	0.0205767	0.0131907	0.6410506	0.0151858	0.0259676	0.01079	0.01733	0.02783	0.01704	0.02	0.05	0.02	1	ln(y) = -4.05549815217665 + 0.702793875573403*Z
Aroclor-1254 ug/Kg	5/23	47.233602	176.11937	3.72868812	-24.74432	119.21152	0.55025	3.40583	21.0809	20.5307	29	670	10	100	ln(y) = 1.22548842125953 + 2.70381040139819*Z
Aroclor-1260 ug/Kg	2/23										17	360	10	100	
Arsenic MG/KG	**23/23**	**0.3578261**	**0.2186818**	**0.611139928**	**0.2684534**	**0.4471988**	**0.21**	**0.24**	**0.58**	**0.37**	**0.17**	**0.99**			**ln(y) = -1.16314645356632 + 0.522678650765798*Z**
Barium MG/KG	5/5	1.014	1.3082672	1.290204332	-0.132747	2.1607468	0.195	0.28	2.2	2.005	0.14	2.9			ln(y) = -0.631039409641004 + 1.65168444673357*Z
Benzaldehyde ug/Kg	12/18	33.259942	17.503421	0.526261314	25.173774	41.34611	22.7003	30.2672	40.3565	17.6562	21	85	40	55	ln(y) = 3.41006414957256 + 0.426715768889301*Z
beta-BHC ug/Kg	3/20										14	69	2	10	
Cadmium MG/KG	1/23										0.005	0.005	0.003	0.5	
Calcium Metal MG/KG	**5/5**	**4652.2**	**6535.3979**	**1.404797281**	**-1076.329**	**10380.729**	**660.5**	**1020**	**10460**	**9799.5**	**337**	**14100**			**ln(y) = 7.60416231217734 + 1.98271830035603*Z**
Chromium MG/KG	17/23	0.1353779	0.0629938	0.465318453	0.1096331	0.1611227	0.09678	0.1264	0.16509	0.06831	0.1	0.3	0.07	1	ln(y) = -2.06827142968358 + 0.396073338408181*Z
Copper MG/KG	**23/23**	**0.5904348**	**0.6153828**	**1.042253667**	**0.3389351**	**0.8419345**	**0.35**	**0.41**	**0.72**	**0.37**	**0.19**	**2.8**			**ln(y) = -0.721095789175093 + 0.593162504573783*Z**
Dieldrin ug/Kg	4/23										2.3	14	6	10	
Diethyl Phthalate ug/Kg	3/23										26	88	40	55	
Di-n-butylphthalate ug/Kg	12/23	146.62369	98.193422	0.669696828	106.4932	186.75419	70.3042	119.766	204.028	133.724	62	340	40	2000	ln(y) = 4.78554369026282 + 0.790152876436538*Z
Endosulfan I ug/Kg	1/23										0.95	0.95	6	10	
Endosulfan II ug/Kg	2/23										1.5	1.6	6	10	
Endosulfan Sulfate ug/Kg	1/21										3.6	3.6	6	10	
Endrin Aldehyde ug/Kg	4/23										0.72	1.9	6	10	
gamma-BHC (Lindane) ug/Kg	2/23										1.3	1.7	6	10	
gamma-Chlordane ug/Kg	1/23										3.8	3.8	6	10	
Heptachlor Epoxide ug/Kg	1/23										11	11	10	10	
Heptachlor ug/Kg	2/23										1.2	3.9	6	10	
Hexachloro-1,3-butadiene ug/Kg	1/23										570	570	40	2000	
Iron MG/KG	18/23	4.6179109	3.111075	0.673697488	3.3464511	5.8893707	2.85367	4.04045	5.7208	2.86713	1.9	15	5.3	7.5	ln(y) = 1.3963561603088 + 0.515807754669628*Z
Lead MG/KG	2/23										0.25	0.76	0.02	7.5	
Magnesium MG/KG	**5/5**	**369.8**	**89.192894**	**0.241192249**	**291.61898**	**447.98102**	**318.5**	**338**	**437**	**118.5**	**313**	**498**			**ln(y) = 5.89803636444601 + 0.228953540372221*Z**
Manganese MG/KG	**5/5**	**2.024**	**2.3210591**	**1.146768322**	**-0.010498**	**4.058498**	**0.285**	**0.55**	**4.5**	**4.215**	**0.17**	**4.9**			**ln(y) = -5.71724791469616E-02 + 1.89702057373494*Z**
Mercury MG/KG	22/23	0.1021151	0.0494992	0.484739162	0.0818854	0.1223449	0.066	0.092	0.144	0.078	0.027	0.205	0.02	0.02	ln(y) = -2.41223717471306 + 0.600538397088607*Z
Naphthalene ug/Kg	1/23										41	41	40	2000	
Nickel MG/KG	17/23	0.1884188	0.1081501	0.573987862	0.1442191	0.2326184	0.10381	0.16287	0.25553	0.15172	0.06	0.48	0.06	4	ln(y) = -1.81480709744538 + 0.668031012194731*Z
PCB-105 ng/kg	**3/3**	**298.33333**	**51.53304**	**0.172736448**	**240.01821**	**356.64846**	**254**	**295**	**346**	**92**	**254**	**346**			**ln(y) = 5.69024946613869 + 0.229241684328621*Z**
PCB-108 ng/kg	**3/3**										**114**	**122**			
PCB-114 ng/kg	**3/3**	**19.833333**	**4.3295895**	**0.218298631**	**14.933942**	**24.732725**	**15.8**	**20.2**	**23.5**	**7.7**	**15.8**	**23.5**			**ln(y) = 2.97423098853006 + 0.294420702988249*Z**
PCB-118 ng/kg	**3/3**	**1303.3333**	**175.41486**	**0.134589404**	**1104.8327**	**1501.8339**	**1170**	**1270**	**1470**	**300**	**1170**	**1470**			**ln(y) = 7.16818296233907 + 0.169283839225232*Z**
PCB-126 ng/kg	**3/3**	**7.8033333**	**2.4888865**	**0.318951709**	**4.9868931**	**10.619774**	**5.48**	**8.03**	**9.9**	**4.42**	**5.48**	**9.9**			**ln(y) = 2.02560812868638 + 0.438622947962808*Z**
PCB-15 ng/kg	1/3										19.7	19.7	10.4	10.8	

Table H-22
Lower Calcasieu
Fish - Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-156 ng/kg	3/3	149.66667	24.55808	0.164085167	121.87658	177.45675	131	145	173	42	131	173			ln(y) = 5.0017408867065 + 0.20624351148608*Z
PCB-157 ng/kg	3/3	40.233333	5.9297916	0.147385044	33.523142	46.943524	35.1	39.9	45.7	10.6	35.1	45.7			ln(y) = 3.6888919174226 + 0.195714490010462*Z
PCB-162 ng/kg	3/3	304	36.113551	0.118794577	263.13367	344.86633	280	294	338	58	280	338			ln(y) = 5.71380508866365 + 0.139616823478997*Z
PCB-167 ng/kg	3/3	100.2	11.554934	0.115318702	87.124361	113.27564	90.5	99.1	111	20.5	90.5	111			ln(y) = 4.60366983111805 + 0.151426609002731*Z
PCB-189 ng/kg	3/3	24.4	6.1617954	0.252532599	17.427272	31.372728	18.7	24.8	29.7	11	18.7	29.7			ln(y) = 3.17683807428004 + 0.343096242931464*Z
PCB-58 ng/kg	3/3	10.36	12.168926	1.17460673	-3.410436	24.130436	2.76	6.62	21.7	18.94	2.76	21.7			ln(y) = 1.9942127700748 + 1.52930495193446*Z
PCB-60 ng/kg	3/3	113.73333	23.494961	0.206579377	87.146282	140.32038	97.2	108	136	38.8	97.2	136			ln(y) = 4.72385227477556 + 0.249102332209088*Z
PCB-61/70 ng/kg	3/3	415.33333	83.616519	0.201323882	320.71233	509.95433	364	389	493	129	364	493			ln(y) = 6.02041412843262 + 0.224977894472209*Z
PCB-66 ng/kg	3/3	476	103.51435	0.217467129	358.86248	593.13752	416	441	571	155	416	571			ln(y) = 6.15570644845471 + 0.234877670511274*Z
PCB-77 ng/kg	3/3	23.233333	3.9701049	0.170879695	18.740737	27.72593	19.5	23.7	26.5	7	19.5	26.5			ln(y) = 3.13767808223432 + 0.227480872357843*Z
PCB-79 ng/kg	3/3	18.433333	1.1193778	0.060725737	17.166638	19.700029	17.4	18.5	19.4	2	17.4	19.4			ln(y) = 2.91317133479135 + 8.06916437735919E-02*Z
PCB-81 ng/kg	3/3	9.81	2.8963722	0.295246912	6.5324463	13.087554	7.13	10	12.3	5.17	7.13	12.3			ln(y) = 2.25883186326621 + 0.40440285638325*Z
Potassium MG/KG	5/5	4314	313.96687	0.072778598	4038.7959	4589.2041	4035	4270	4615	580	3950	4700			ln(y) = 8.36764868252733 + 9.32226126987129E-02*Z
Selenium MG/KG	23/23	0.9034783	0.2824699	0.312647102	0.7880361	1.0189204	0.73	0.8	0.95	0.22	0.57	1.7			ln(y) = -0.138534376292684 + 0.277611416746033*Z
Sodium MG/KG	2/5										987	1070	519	566	
Total HxCDF PG/G	3/3	0.6603333	0.2426521	0.367469171	0.3857466	0.9349201	0.437	0.673	0.871	0.434	0.437	0.871			ln(y) = -0.453981778451197 + 0.511509857391502*Z
Total PeCDF PG/G	2/3										0.886	1	0.229	0.229	
Total TCDF PG/G	3/3	0.9186667	0.5716781	0.622291128	0.271752	1.5655814	0.376	1.05	1.33	0.954	0.376	1.33			ln(y) = -0.214732343063049 + 0.936936686450286*Z
Zinc MG/KG	21/23	5.1806012	3.3939581	0.65512822	3.7935305	6.567672	3.38623	4.53914	6.08457	2.69834	3.3	15.4	5.1	5.4	ln(y) = 1.51273758124848 + 0.434624695369425*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-23
Lower Calcasieu
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/3										3.05	5	0.443	0.443	
1,2,3,4,6,7,8-HpCDF PG/G	1/3										2.19	2.19	0.27	1.9	
1,2,3,4,7,8-HxCDD PG/G	2/3										0.152	0.168	1.8	1.8	
1,2,3,4,7,8-HxCDF PG/G	1/3										0.762	0.762	0.262	0.91	
1,2,3,6,7,8-HxCDD PG/G	2/3										0.292	0.38	1.5	1.5	
1,2,3,7,8,9-HxCDD PG/G	2/3										0.202	0.272	1.5	1.5	
1,2,3,7,8-PeCDD PG/G	2/3										0.179	0.202	0.89	0.89	
1,2,3,7,8-PeCDF PG/G	2/3										1.13	1.49	0.67	0.67	
2,3,4,7,8-PeCDF PG/G	2/3										1.88	2.39	0.74	0.74	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**1.8464948**	**0.5617354**	**0.304217171**	**1.2108313**	**2.4821583**	**1.40829**	**1.75179**	**2.37941**	**0.97112**	**1.40829**	**2.3794095**			ln(y) = 0.58995460606042 + 0.38896810558601*Z
2,3,7,8-TCDD PG/G	2/3										0.0823	0.13	0.43	0.43	
2,3,7,8-TCDF PG/G	2/3										2.14	6.79	1.7	1.7	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**37.1**	**37.1**			
Arsenic MG/KG	7/8	0.3173622	0.0825446	0.260095996	0.2601617	0.3745627	-0.5	-0.5	-0.5	0	0.21	0.45	0.5	0.5	ln(y) = -1.1747456219566 + 0.338373638864924*Z
Barium MG/KG	**1/1**										**1.4**	**1.4**			
Benzaldehyde ug/Kg	**7/7**	**430**	**921.64084**	**2.143350785**	**-252.7611**	**1112.7611**	**83**	**200**	**360**	**277**	**37**	**2000**			**ln(y) = 5.28299059928353 + 1.52092702650862*Z**
Benzo(a)pyrene ug/Kg	3/5	110.3681	132.26567	1.198404926	-5.567875	226.30407	29.5307	75.3098	192.056	162.525	27	240	80	2000	ln(y) = 4.32160964417959 + 1.38859885136183*Z
Benzo(b)fluoranthene ug/Kg	1/4										32	32	40	2000	
Benzo(k)fluoranthene ug/Kg	1/4										23	23	40	2000	
Cadmium MG/KG	7/8	0.1644464	0.1152408	0.700779983	0.0845887	0.2443042	-0.5	-0.5	-0.5	0	0.02	0.37	0.5	0.5	ln(y) = -2.07488041786581 + 1.15633484604003*Z
Calcium Metal MG/KG	**1/1**										**253**	**253**			
Copper MG/KG	**8/8**	**60.475**	**60.790265**	**1.005213142**	**18.349496**	**102.6005**	**2.625**	**58.95**	**104.275**	**101.65**	**1.7**	**163**			**ln(y) = 3.11995681758134 + 2.18980468725213*Z**
Diethyl Phthalate ug/Kg	2/8										29	37	80	0	
Iron MG/KG	**8/8**	**56.2625**	**59.602435**	**1.059363436**	**14.96012**	**97.56488**	**20.325**	**26**	**95.075**	**74.75**	**15.1**	**170**			**ln(y) = 3.65657318633574 + 1.0420634896524*Z**
Lead MG/KG	7/8	0.4164546	0.4024636	0.966404395	0.1375616	0.6953477	-0.8	-0.8	-0.8	0	0.17	1.2	0.8	0.8	ln(y) = -1.08655175884309 + 0.713307982381102*Z
Magnesium MG/KG	**1/1**										**159**	**159**			
Manganese MG/KG	**1/1**										**4.6**	**4.6**			
Mercury MG/KG	7/8	0.0189169	0.0117244	0.61978643	0.0107923	0.0270415	0.0105	0.0155	0.0285	0.018	0.01	0.039	0.002	0.002	ln(y) = -4.1191542868968 + 0.726191769522373*Z
Methyl Mercury MG/KG	**7/7**	**0.0079429**	**0.0014344**	**0.180592575**	**0.0068802**	**0.0090055**	**0.0073**	**0.0078**	**0.0086**	**0.0013**	**0.0061**	**0.0104**			**ln(y) = -4.84707293550701 + 0.199298152069525*Z**
Nickel MG/KG	7/8	0.4132488	0.1808012	0.437511732	0.2879599	0.5385376	-4	-4	-4	0	0.25	0.72	4	4	ln(y) = -0.951943223235551 + 0.503506635169111*Z
OCDD PG/G	**3/3**	**48.63**	**51.550502**	**1.060055561**	**-9.704884**	**106.96488**	**3.69**	**69.2**	**73**	**69.31**	**3.69**	**73**			**ln(y) = 3.27769558727482 + 2.21364659100277*Z**
OCDF PG/G	2/3										7.4	11	1.41	1.41	
PCB-105 ng/kg	**2/2**										**220**	**770**			
PCB-108 ng/kg	**2/2**										**87.3**	**335**			
PCB-114 ng/kg	1/2										39.6	39.6	29.9	2000	
PCB-118 ng/kg	**2/2**										**938**	**3650**			
PCB-126 ng/kg	1/2										22.8	22.8	29.9	2000	
PCB-15 ng/kg	**2/2**										**32.4**	**127**			
PCB-156 ng/kg	**2/2**										**84.7**	**161**			
PCB-157 ng/kg	**2/2**										**31.9**	**65.8**			
PCB-162 ng/kg	**2/2**										**210**	**488**			
PCB-167 ng/kg	**2/2**										**78.7**	**149**			
PCB-189 ng/kg	**2/2**										**10.5**	**10.9**			
PCB-37 ng/kg	**2/2**										**24.6**	**71.6**			
PCB-58 ng/kg	**2/2**										**4.11**	**14.6**			
PCB-60 ng/kg	**2/2**										**76.5**	**266**			
PCB-61/70 ng/kg	**2/2**										**360**	**1200**			

Table H-23
Lower Calcasieu
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-66 ng/kg	**2/2**										**306**	**1230**			
PCB-77 ng/kg	**2/2**										**16.9**	**71.7**			
PCB-79 ng/kg	**2/2**										**13.7**	**63.7**			
PCB-81 ng/kg	**2/2**										**15.8**	**41.6**			
Potassium MG/KG	**1/1**										**790**	**790**			
Selenium MG/KG	7/8	0.8964575	0.4884623	0.544880609	0.5579704	1.2349447	-1.3	-1.3	-1.3	0	0.25	1.6	1.3	1.3	ln(y) = -0.286990397946346 + 0.707150425149164*Z
Silver MG/KG	6/8	0.2124709	0.1504339	0.708021171	0.1082255	0.3167163	0.08736	0.1697	0.32964	0.24228	0.08	0.46	0.01	1	ln(y) = -1.77374950349813 + 0.984863684809656*Z
Sodium MG/KG	**1/1**										**1940**	**1940**			
Total HpCDD PG/G	**3/3**	**8.23**	**7.5177309**	**0.913454544**	**-0.277113**	**16.737113**	**1.09**	**9.6**	**14**	**12.91**	**1.09**	**14**			**ln(y) = 1.66233270811003 + 1.89329631830779*Z**
Total HpCDF PG/G	1/3										4.17	4.17	0.27	1.29	
Total HxCDD PG/G	**3/3**	**4.0966667**	**1.571865**	**0.383693651**	**2.317934**	**5.8753994**	**2.61**	**4.5**	**5.18**	**2.57**	**2.61**	**5.18**			**ln(y) = 1.36941089146076 + 0.508354995819682*Z**
Total HxCDF PG/G	2/3										2.86	5.54	1.6	1.6	
Total PeCDD PG/G	2/3										1.36	1.56	0.92	0.92	
Total PeCDF PG/G	**3/3**	**14.433333**	**8.6941694**	**0.602367398**	**4.5949544**	**24.271712**	**6.2**	**16.6**	**20.5**	**14.3**	**6.2**	**20.5**			**ln(y) = 2.55145895785264 + 0.886899182339605*Z**
Total TCDD PG/G	**3/3**	**2.3966667**	**1.1522254**	**0.480761656**	**1.0928008**	**3.7005325**	**1.5**	**2.2**	**3.49**	**1.99**	**1.5**	**3.49**			**ln(y) = 0.814608068228924 + 0.626260924383858*Z**
Total TCDF PG/G	**3/3**	**30.066667**	**26.448847**	**0.879673412**	**0.1369785**	**59.996355**	**17**	**19.8**	**53.4**	**36.4**	**17**	**53.4**			**ln(y) = 3.26556867590762 + 0.848869652391904*Z**
Zinc MG/KG	**8/8**	**569.8125**	**790.36127**	**1.387054994**	**22.12008**	**1117.5049**	**7.7**	**293**	**1052.75**	**1045.05**	**5.3**	**2080**			**ln(y) = 4.8074209688758 + 2.86292836520278*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-24
Lower Calcasieu
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
4,4'-DDE ug/Kg	**1/1**										**1.2**	**1.2**			
Aluminum (Fume Or Dust) MG/KG	**1/1**										**143**	**143**			
Barium MG/KG	**1/1**										**79.8**	**79.8**			
Calcium Metal MG/KG	**1/1**										**30900**	**30900**			
Chromium MG/KG	**1/1**										**0.73**	**0.73**			
Copper MG/KG	**1/1**										**20.3**	**20.3**			
gamma-BHC (Lindane) ug/Kg	**1/1**										**0.96**	**0.96**			
Heptachlor ug/Kg	**1/1**										**0.91**	**0.91**			
Iron MG/KG	**1/1**										**257**	**257**			
Lead MG/KG	**1/1**										**0.98**	**0.98**			
Magnesium MG/KG	**1/1**										**2040**	**2040**			
Manganese MG/KG	**1/1**										**16.9**	**16.9**			
Mercury MG/KG	**1/1**										**0.011**	**0.011**			
Potassium MG/KG	**1/1**										**1820**	**1820**			
Selenium MG/KG	**1/1**										**0.83**	**0.83**			
Sodium MG/KG	**1/1**										**3030**	**3030**			
Vanadium (Fume Or Dust) MG/KG	**1/1**										**0.37**	**0.37**			
Zinc MG/KG	**1/1**										**19.1**	**19.1**			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-25
Lower Calcasieu
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**2/2**										**1.43**	**2.54**			
1,2,3,4,6,7,8-HpCDF PG/G	1/2										1.29	1.29	0.635	0.635	
1,2,3,4,7,8-HxCDF PG/G	**2/2**										**1.63**	**2.11**			
1,2,3,6,7,8-HxCDF PG/G	1/2										0.808	0.808	0.437	0.437	
1,2,3,7,8-PeCDF PG/G	**2/2**										**2.51**	**2.88**			
2,3,4,7,8-PeCDF PG/G	**2/2**										**2.46**	**2.81**			
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**2.74733**	**2.789836**			
2,3,7,8-TCDF PG/G	**2/2**										**4.02**	**4.25**			
Aroclor-1260 ug/Kg	1/20										49	49	10	10	
Arsenic MG/KG	**20/20**	**0.3565**	**0.1250645**	**0.350812137**	**0.3016881**	**0.4113119**	**0.3125**	**0.34**	**0.45**	**0.1375**	**0.13**	**0.6**			**ln(y) = -1.09900388389434 + 0.424025045481273*Z**
Benzaldehyde ug/Kg	16/19	88.524902	70.943037	0.801390744	56.625022	120.42478	35.3915	65.5501	121.408	86.0166	16	230	40	610	ln(y) = 4.18281518858357 + 0.914198208782731*Z
bis(2-Ethylhexyl)phthalate ug/Kg	2/19										2300	250000	40	610	
Cadmium MG/KG	3/20										0.01	0.01	0.01	0.01	
Chromium MG/KG	19/20	0.3389971	0.1119404	0.330210587	0.289937	0.3880571	0.28	0.34	0.43	0.15	0.16	0.53	0.14	0.14	ln(y) = -1.13855594539163 + 0.387144455348802*Z
Copper MG/KG	**20/20**	**15.255**	**2.2117463**	**0.144985009**	**14.285659**	**16.224341**	**13.725**	**14.75**	**16.525**	**2.8**	**12**	**19.4**			**ln(y) = 2.71546547171764 + 0.154071352322988*Z**
Diethyl Phthalate ug/Kg	1/18										47	47	40	610	
Iron MG/KG	**20/20**	**51.53**	**27.210426**	**0.528050183**	**39.604505**	**63.455495**	**36.175**	**45.7**	**60.025**	**23.85**	**26.8**	**140**			**ln(y) = 3.86242369790209 + 0.416172757457677*Z**
Lead MG/KG	15/20	0.14551	0.0735478	0.505448366	0.1132763	0.1777437	0.09416	0.13021	0.18006	0.0859	0.08	0.33	0.11	0.23	ln(y) = -2.03861345711934 + 0.480815195069548*Z
Mercury MG/KG	**20/20**	**0.0269**	**0.0055136**	**0.204966226**	**0.0244836**	**0.0293164**	**0.022**	**0.027**	**0.033**	**0.011**	**0.018**	**0.035**			**ln(y) = -3.63627806378198 + 0.231182218284873*Z**
Methyl Mercury MG/KG	**12/12**	**0.02285**	**0.0028013**	**0.122594969**	**0.021265**	**0.024435**	**0.0203**	**0.0228**	**0.02573**	**0.00543**	**0.0185**	**0.0268**			**ln(y) = -3.78558184800418 + 0.140936972665086*Z**
Nickel MG/KG	2/20										0.18	0.18	0.14	0.33	
OCDD PG/G	**2/2**										**20.1**	**31**			
OCDF PG/G	**2/2**										**1.8**	**3.11**			
PCB-105 ng/kg	**2/2**										**780**	**847**			
PCB-108 ng/kg	**2/2**										**313**	**338**			
PCB-114 ng/kg	**2/2**										**45.3**	**48.8**			
PCB-118 ng/kg	**2/2**										**3460**	**3750**			
PCB-126 ng/kg	**2/2**										**16**	**17.3**			
PCB-15 ng/kg	**2/2**										**47.7**	**143**			
PCB-156 ng/kg	**2/2**										**356**	**413**			
PCB-157 ng/kg	**2/2**										**80.7**	**93.9**			
PCB-162 ng/kg	**2/2**										**497**	**543**			
PCB-167 ng/kg	**2/2**										**218**	**258**			
PCB-189 ng/kg	**2/2**										**44.7**	**54.2**			
PCB-37 ng/kg	**2/2**										**28.6**	**252**			
PCB-58 ng/kg	**2/2**										**7.21**	**8.92**			
PCB-60 ng/kg	**2/2**										**118**	**702**			
PCB-61/70 ng/kg	**2/2**										**888**	**2150**			
PCB-66 ng/kg	**2/2**										**920**	**2080**			
PCB-77 ng/kg	**2/2**										**49.3**	**130**			
PCB-79 ng/kg	**2/2**										**43.1**	**48.7**			
PCB-81 ng/kg	**2/2**										**10.2**	**15**			
Selenium MG/KG	**20/20**	**0.462**	**0.1622094**	**0.3511025**	**0.3909086**	**0.5330914**	**0.37**	**0.42**	**0.6175**	**0.2475**	**0.17**	**0.77**			**ln(y) = -0.834184849010352 + 0.403291205939817*Z**
Silver MG/KG	14/20	0.0261685	0.009076	0.346827718	0.0221908	0.0301462	0.0192	0.02469	0.03173	0.01253	0.02	0.04	0.02	0.03	ln(y) = -3.70149061857177 + 0.372444817097786*Z
Total HpCDD PG/G	**2/2**										**3.85**	**6.44**			
Total HpCDF PG/G	1/2										1.29	1.29	0.755	0.755	
Total HxCDD PG/G	**2/2**										**1.84**	**3.13**			

Table H-25
Lower Calcasieu
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total HxCDF PG/G	**2/2**										**5.34**	**7.79**			
Total PeCDF PG/G	**2/2**										**26.7**	**27.1**			
Total TCDD PG/G	1/2										0.289	0.289	0.195	0.195	
Total TCDF PG/G	**2/2**										**24.7**	**26.1**			
Zinc MG/KG	**20/20**	**9.82**	**1.6369783**	**0.1666984**	**9.1025626**	**10.537437**	**9.05**	**9.9**	**11.075**	**2.025**	**6.7**	**12.3**			**ln(y) = 2.27034788145523 + 0.189013443942715*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-26
Lower Calcasieu
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**1/1**										**0.64**	**0.64**			
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**0.555**	**0.555**			
1,2,3,4,7,8-HxCDF PG/G	**1/1**										**0.893**	**0.893**			
1,2,3,7,8-PeCDF PG/G	**1/1**										**1.92**	**1.92**			
2,3,4,7,8-PeCDF PG/G	**1/1**										**2.07**	**2.07**			
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**2.716479**	**2.716479**			
2,3,7,8-TCDF PG/G	**1/1**										**4.96**	**4.96**			
Aroclor-1254 ug/Kg	6/7	23.084796	8.5729883	0.371369463	16.733837	29.435755	17	20	30	13	17	35	10	10	ln(y) = 3.08817163882421 + 0.435151102265192*Z
Arsenic MG/KG	**7/7**	**0.7457143**	**0.1826355**	**0.244913516**	**0.610416**	**0.8810126**	**0.54**	**0.72**	**0.96**	**0.42**	**0.53**	**0.97**			**ln(y) = -0.318947770506182 + 0.301782573645446*Z**
Benzaldehyde ug/Kg	**7/7**	**194**	**271.47232**	**1.399341875**	**-7.109512**	**395.10951**	**87**	**130**	**160**	**73**	**61**	**660**			**ln(y) = 4.96040653477521 + 0.864440750012907*Z**
Cadmium MG/KG	**7/7**	**0.0414286**	**0.0381807**	**0.921602271**	**0.0131439**	**0.0697132**	**0.02**	**0.04**	**0.04**	**0.02**	**0.02**	**0.11**			**ln(y) = -3.37142448629697 + 0.704809433978983*Z**
Chromium MG/KG	2/7										0.21	0.24	0.13	0.16	
Copper MG/KG	**7/7**	**7.7714286**	**1.3693606**	**0.176204492**	**6.756992**	**8.7858651**	**6.2**	**8.2**	**9.1**	**2.9**	**6.2**	**9.4**			**ln(y) = 2.03702937383563 + 0.215101385444846*Z**
Iron MG/KG	**7/7**	**9.7428571**	**8.8904024**	**0.912504645**	**3.1567549**	**16.328959**	**5.1**	**6.7**	**14.4**	**9.3**	**2.8**	**25.8**			**ln(y) = 2.0401111887484 + 0.873510830850487*Z**
Lead MG/KG	5/7	0.0892959	0.0863241	0.966719476	0.0253461	0.1532456	0.02138	0.06	0.16	0.13862	0.03	0.22	0.02	0.02	ln(y) = -2.91475983445661 + 1.38055411250377*Z
Mercury MG/KG	**7/7**	**0.0905714**	**0.0389305**	**0.429832315**	**0.0617313**	**0.1194116**	**0.071**	**0.091**	**0.101**	**0.03**	**0.04**	**0.157**			**ln(y) = -2.473038073403 + 0.507238377048136*Z**
Nickel MG/KG	**7/7**	**0.0957143**	**0.020936**	**0.218734426**	**0.0802047**	**0.1112239**	**0.08**	**0.09**	**0.12**	**0.04**	**0.07**	**0.12**			**ln(y) = -2.36663784568444 + 0.264668015871103*Z**
OCDD PG/G	**1/1**										**6.85**	**6.85**			
OCDF PG/G	**1/1**										**1.44**	**1.44**			
PCB-105 ng/kg	**1/1**										**1500**	**1500**			
PCB-108 ng/kg	**1/1**										**408**	**408**			
PCB-114 ng/kg	**1/1**										**82.1**	**82.1**			
PCB-118 ng/kg	**1/1**										**6910**	**6910**			
PCB-126 ng/kg	**1/1**										**25.3**	**25.3**			
PCB-15 ng/kg	**1/1**										**120**	**120**			
PCB-156 ng/kg	**1/1**										**615**	**615**			
PCB-157 ng/kg	**1/1**										**186**	**186**			
PCB-162 ng/kg	**1/1**										**1040**	**1040**			
PCB-167 ng/kg	**1/1**										**493**	**493**			
PCB-189 ng/kg	**1/1**										**64.6**	**64.6**			
PCB-37 ng/kg	**1/1**										**72.8**	**72.8**			
PCB-58 ng/kg	**1/1**										**18.5**	**18.5**			
PCB-60 ng/kg	**1/1**										**214**	**214**			
PCB-61/70 ng/kg	**1/1**										**164**	**164**			
PCB-66 ng/kg	**1/1**										**2440**	**2440**			
PCB-77 ng/kg	**1/1**										**131**	**131**			
PCB-79 ng/kg	**1/1**										**219**	**219**			
PCB-80 ng/kg	**1/1**										**9.25**	**9.25**			
PCB-81 ng/kg	**1/1**										**9.47**	**9.47**			
Phenol ug/Kg	1/6										16	16	40	0	
Selenium MG/KG	**7/7**	**1.1142857**	**0.3145208**	**0.282262231**	**0.8812855**	**1.347286**	**0.95**	**1.1**	**1.3**	**0.35**	**0.65**	**1.6**			**ln(y) = 7.54176314045002E-02 + 0.347413151388606*Z**
Silver MG/KG	**7/7**	**0.06**	**0.0214192**	**0.356987146**	**0.0441324**	**0.0758676**	**0.04**	**0.07**	**0.07**	**0.03**	**0.03**	**0.09**			**ln(y) = -2.87241310217034 + 0.465133200421185*Z**
Total HpCDD PG/G	**1/1**										**2.12**	**2.12**			
Total HpCDF PG/G	**1/1**										**0.555**	**0.555**			
Total HxCDD PG/G	**1/1**										**3.13**	**3.13**			
Total HxCDF PG/G	**1/1**										**4.12**	**4.12**			
Total PeCDF PG/G	**1/1**										**26.6**	**26.6**			

Table H-26
Lower Calcasieu
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total TCDD PG/G	**1/1**										**2.3**	**2.3**			
Total TCDF PG/G	**1/1**										**50**	**50**			
Zinc MG/KG	**7/7**	**26.371429**	**3.7629352**	**0.142689852**	**23.583807**	**29.15905**	**24.1**	**26.2**	**30**	**5.9**	**20.7**	**31.2**			**ln(y) = 3.26386003348437 + 0.175863405522448*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-27
Upper Calcasieu
Fish - Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	**6/6**	**2.695**	**2.9686418**	**1.101536834**	**0.3195919**	**5.0704081**	**1.0625**	**1.77**	**4.135**	**3.0725**	**1.04**	**7.51**			**ln(y) = 0.722977652371975 + 0.924020618847525*Z**
1,2,3,6,7,8-HxCDD PG/G	2/6										0.152	0.163	0.124	0.214	
1,2,3,6,7,8-HxCDF PG/G	4/6	0.8796245	1.149953	1.307322612	-0.04053	1.7997786	0.26951	0.58871	1.28595	1.01644	0.661	2.64	0.261	0.278	ln(y) = -0.529827363584919 + 1.15891464464877*Z
1,2,3,7,8,9-HxCDD PG/G	1/6										0.117	0.117	0.0846	0.278	
1,2,3,7,8-PeCDD PG/G	4/6	0.1378935	0.0273882	0.198618509	0.1159784	0.1598086	0.11809	0.13529	0.155	0.03691	0.115	0.182	0.162	0.168	ln(y) = -2.0003190294074 + 0.201682309251288*Z
1,2,3,7,8-PeCDF PG/G	4/6	0.1421109	0.0809433	0.569578002	0.0773428	0.206879	0.08298	0.12618	0.19186	0.10888	0.0817	0.259	0.0995	0.121	ln(y) = -2.07004387823826 + 0.621603919081487*Z
2,3,4,7,8-PeCDF PG/G	1/6										0.953	0.953	0.156	0.121	
2,3,7,8-TCDD Equivalent PG/G	**6/6**	**0.5217734**	**0.4238268**	**0.812281246**	**0.1826414**	**0.8609055**	**0.28047**	**0.40338**	**0.72961**	**0.44914**	**0.2521357**	**1.21350465**			ln(y) = -0.807503497438226 + 0.714482622184389*Z
2,3,7,8-TCDD PG/G	1/6										0.122	0.122	0.0697	0.121	
2,3,7,8-TCDF PG/G	**6/6**	**0.3068333**	**0.1848743**	**0.602523471**	**0.1589031**	**0.4547636**	**0.148**	**0.2665**	**0.4785**	**0.3305**	**0.139**	**0.57**			**ln(y) = -1.33415878079261 + 0.755165624269958*Z**
2-Methylphenol ug/Kg	7/29	54.503247	85.706756	1.572507341	23.309171	85.697323	11.4588	27.8216	67.5499	56.0911	64	340	40	540	ln(y) = 3.32581096446894 + 1.31573704296801*Z
4-Methylphenol ug/Kg	10/29	72.226507	73.781886	1.021534742	45.37264	99.080373	24.633	49.052	97.6778	73.0448	56	300	40	540	ln(y) = 3.89288165151584 + 1.02166129035549*Z
Aroclor-1254 ug/Kg	6/33										12	35	10	0	
Aroclor-1260 ug/Kg	2/33										12	17	10	0	
Arsenic MG/KG	30/34	0.3166019	0.0428866	0.135458942	0.3021862	0.3310177	0.28766	0.31424	0.34327	0.05561	0.27	0.46	0.26	0.28	ln(y) = -1.15760144933768 + 0.131063784143359*Z
Benzaldehyde ug/Kg	18/29	831.8752	1702.5503	2.04664153	212.21011	1451.5403	77.6958	248.743	796.351	718.655	140	6400	40	540	ln(y) = 5.51642027527738 + 1.72595375526861*Z
Cadmium MG/KG	4/34										0.003	0.01	0.003	0.28	
Chromium MG/KG	**34/34**	**0.3411765**	**0.061439**	**0.180079749**	**0.3205245**	**0.3618284**	**0.3**	**0.325**	**0.385**	**0.085**	**0.26**	**0.51**			**ln(y) = -1.08972847777533 + 0.179554033909878*Z**
Copper MG/KG	**34/34**	**1.7558824**	**0.637733**	**0.363198041**	**1.5415165**	**1.9702482**	**1.3**	**1.5**	**2.05**	**0.75**	**1.1**	**3.3**			**ln(y) = 0.507577008759869 + 0.344549074447857*Z**
Diethyl Phthalate ug/Kg	1/29										35	35	40	540	
Iron MG/KG	**34/34**	**28.211765**	**16.920222**	**0.599757665**	**22.524248**	**33.899281**	**15.925**	**20.8**	**37.4**	**21.475**	**13.8**	**73**			**ln(y) = 3.20198048310652 + 0.521735519792298*Z**
Lead MG/KG	26/34	0.1419618	0.2128019	1.499007663	0.0704312	0.2134924	0.02426	0.06169	0.15687	0.13261	0.03	0.88	0.02	0.04	ln(y) = -2.7856204424435 + 1.38431954929715*Z
Mercury MG/KG	**34/34**	**0.048**	**0.0295033**	**0.614652187**	**0.0380828**	**0.0579172**	**0.028**	**0.0375**	**0.061**	**0.033**	**0.011**	**0.127**			**ln(y) = -3.21601516453845 + 0.668526328100643*Z**
Nickel MG/KG	22/34	0.0467695	0.021865	0.467506579	0.0394198	0.0541191	0.03082	0.04247	0.05851	0.02769	0.03	0.11	0.03	0.18	ln(y) = -3.15899209386501 + 0.475410871408352*Z
OCDD PG/G	3/6	15.85106	5.1835911	0.327018567	11.703324	19.998797	11.5688	15.0739	19.6411	8.07233	17.1	23.7	5.89	6.68	ln(y) = 2.71296792550393 + 0.392556296993636*Z
PCB-105 ng/kg	**6/6**	**1103.8333**	**871.15793**	**0.789211474**	**406.76181**	**1800.9049**	**436.75**	**882**	**1785**	**1348.25**	**385**	**2460**			**ln(y) = 6.76139975418824 + 0.956116657220299*Z**
PCB-108 ng/kg	**6/6**	**297.5**	**160.1159**	**0.538204702**	**169.3806**	**425.6194**	**150**	**292**	**446.25**	**296.25**	**126**	**483**			**ln(y) = 5.55822862015732 + 0.720505018593064*Z**
PCB-114 ng/kg	**6/6**	**74.933333**	**68.580861**	**0.915225015**	**20.057216**	**129.80945**	**22.575**	**59.15**	**123.75**	**101.175**	**21.3**	**183**			**ln(y) = 3.97278544910927 + 1.13123780543944*Z**
PCB-118 ng/kg	**6/6**	**4481.6667**	**3261.6258**	**0.72777072**	**1871.8225**	**7091.5108**	**1750**	**3780**	**7382.5**	**5632.5**	**1570**	**9160**			**ln(y) = 8.16949038829516 + 0.944884449834547*Z**
PCB-126 ng/kg	**6/6**	**28.366667**	**15.609274**	**0.55026818**	**15.876646**	**40.856687**	**14.525**	**27.25**	**40.8**	**26.275**	**12.5**	**50.4**			**ln(y) = 3.21499657938546 + 0.711608366752583*Z**
PCB-156 ng/kg	**6/6**	**631.66667**	**453.67887**	**0.718225119**	**268.64797**	**994.68537**	**276.5**	**516.5**	**993.25**	**716.75**	**266**	**1330**			**ln(y) = 6.24651675905303 + 0.848905226254968*Z**
PCB-157 ng/kg	**6/6**	**168.4**	**108.4691**	**0.644115798**	**81.606643**	**255.19336**	**81.125**	**143.15**	**257.75**	**176.625**	**76.4**	**332**			**ln(y) = 4.96167183470906 + 0.771603328957995*Z**
PCB-162 ng/kg	**6/6**	**1023.1667**	**665.93124**	**0.650853144**	**490.3107**	**1556.0226**	**503.75**	**890**	**1530**	**1026.25**	**431**	**2040**			**ln(y) = 6.76426420625596 + 0.785619487639687*Z**
PCB-167 ng/kg	**6/6**	**448.16667**	**287.96437**	**0.642538582**	**217.74718**	**678.58616**	**208.25**	**388.5**	**697.75**	**489.5**	**194**	**862**			**ln(y) = 5.92845718432562 + 0.798968764003877*Z**
PCB-169 ng/kg	1/6										3.29	3.29	19.5	0	
PCB-189 ng/kg	**6/6**	**80.4**	**59.063591**	**0.734621782**	**33.139284**	**127.66072**	**31.55**	**62.9**	**139**	**107.45**	**30.8**	**163**			**ln(y) = 4.14516304530111 + 0.928266366012457*Z**
PCB-37 ng/kg	5/6	5.2183411	0.8456664	0.162056559	4.5416671	5.8950152	-21.2	-21.2	-21.2	0	4.55	6.55	21.2	21.2	ln(y) = 1.6448140859448 + 0.18247534437661*Z
PCB-58 ng/kg	**6/6**	**3.1116667**	**1.9026809**	**0.611466818**	**1.5892049**	**4.6341285**	**1.4075**	**2.91**	**4.72**	**3.3125**	**1.1**	**5.92**			**ln(y) = 0.974130280929173 + 0.825747496838463*Z**
PCB-60 ng/kg	**6/6**	**111.26667**	**105.75489**	**0.950463325**	**26.645134**	**195.8882**	**38.025**	**83.35**	**179.5**	**141.475**	**33.3**	**283**			**ln(y) = 4.40407599980126 + 1.07028328968329*Z**
PCB-61/70 ng/kg	**6/6**	**246.23333**	**147.28851**	**0.598166418**	**128.37798**	**364.08869**	**124.6**	**221.5**	**367**	**242.4**	**99.4**	**469**			**ln(y) = 5.36363551465037 + 0.760477236694957*Z**
PCB-66 ng/kg	**6/6**	**1081.3333**	**1018.153**	**0.941571854**	**266.64123**	**1896.0254**	**298.75**	**817.5**	**1875**	**1576.25**	**262**	**2670**			**ln(y) = 6.60144896195037 + 1.21949104304874*Z**
PCB-77 ng/kg	**6/6**	**10.926667**	**4.0071827**	**0.366734235**	**7.7202527**	**14.133081**	**7.19**	**11.04**	**14.375**	**7.185**	**5.99**	**16.1**			**ln(y) = 2.33295293090203 + 0.486443193080605*Z**
PCB-79 ng/kg	**6/6**	**58.266667**	**49.541297**	**0.850251085**	**18.625373**	**97.90796**	**27.2**	**38.4**	**96.1**	**68.9**	**23.6**	**139**			**ln(y) = 3.85060138915139 + 0.85879770385955*Z**
PCB-81 ng/kg	**6/6**	**19.556667**	**10.07412**	**0.515124611**	**11.495692**	**27.617642**	**10.735**	**17.7**	**30.85**	**20.115**	**8.74**	**31**			**ln(y) = 2.85507008612273 + 0.675617686579541*Z**
Phenol ug/Kg	16/29	675.21303	1072.0814	1.587767592	285.01523	1065.4108	116.542	306.158	804.279	687.737	240	4900	40	220	ln(y) = 5.72409982521429 + 1.43260516417661*Z
Selenium MG/KG	**34/34**	**0.4029412**	**0.1268967**	**0.31492606**	**0.3602865**	**0.4455959**	**0.31**	**0.41**	**0.47**	**0.16**	**0.23**	**0.89**			**ln(y) = -0.948041320743308 + 0.293077886292461*Z**
Silver MG/KG	2/31										0.05	0.05	0.01	0.04	

CDM

Table H-27
Upper Calcasieu
Fish - Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total HpCDD PG/G	3/6	3.8401475	0.8253366	0.214923151	3.1797407	4.5005543	3.1703	3.75496	4.44745	1.27716	4.13	5.07	0.804	0.929	ln(y) = 1.3230782355702 + 0.251047637150836*Z
Total HpCDF PG/G	3/6	2.302371	3.3129557	1.438932184	-0.348546	4.9532876	0.40808	1.17511	3.38388	2.9758	2.07	7.51	1.04	1.47	ln(y) = 0.161359127708491 + 1.56879229572211*Z
Total HxCDD PG/G	4/6	0.6070118	0.6791191	1.118790541	0.0636034	1.1504203	0.15804	0.38315	0.92891	0.77087	0.13	1.37	0.137	0.191	ln(y) = -0.959339564064091 + 1.31357257564596*Z
Total HxCDF PG/G	2/6										4.54	9.89	1.64	0.191	
Total PeCDD PG/G	4/6	0.1378935	0.0273882	0.198618509	0.1159784	0.1598086	0.11809	0.13529	0.155	0.03691	0.115	0.182	0.162	0.168	ln(y) = -2.0003190294074 + 0.201682309251288*Z
Total PeCDF PG/G	**6/6**	**3.805**	**3.2050315**	**0.842321035**	**1.2404407**	**6.3695593**	**1.435**	**3.085**	**5.885**	**4.45**	**1.33**	**9.02**			**ln(y) = 1.10744856995113 + 0.939215370327837*Z**
Total TCDD PG/G	4/6	0.2289807	0.206748	0.902905766	0.0635478	0.3944135	0.10236	0.18336	0.32844	0.22608	0.122	0.391	0.0697	0.0896	ln(y) = -1.69631878936409 + 0.864627913947756*Z
Total TCDF PG/G	**6/6**	**4.685**	**4.600105**	**0.981879397**	**1.0041494**	**8.3658506**	**1.365**	**3.455**	**7.84**	**6.475**	**1.29**	**12.1**			**ln(y) = 1.1862962737747 + 1.15840944928762*Z**
Zinc MG/KG	**34/34**	**35.808824**	**3.3008959**	**0.092181076**	**34.69927**	**36.918378**	**33.5**	**34.85**	**37.325**	**3.825**	**31.2**	**45.7**			**ln(y) = 3.57444590695687 + 8.92425691243735E-02*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-28
Upper Cakcasieu
Fish - Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**1/1**										**0.873**	**0.873**			
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**55.9**	**55.9**			
1,2,3,4,7,8-HxCDF PG/G	**1/1**										**7.48**	**7.48**			
1,2,3,6,7,8-HxCDF PG/G	**1/1**										**7.36**	**7.36**			
1,2,3,7,8-PeCDD PG/G	**1/1**										**0.431**	**0.431**			
1,2,3,7,8-PeCDF PG/G	**1/1**										**1.7**	**1.7**			
2,3,4,7,8-PeCDF PG/G	**1/1**										**1.75**	**1.75**			
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**4.69741**	**4.69741**			
2,3,7,8-TCDD PG/G	**1/1**										**0.429**	**0.429**			
2,3,7,8-TCDF PG/G	**1/1**										**7.49**	**7.49**			
2,6-Dinitrotoluene ug/Kg	1/13										1200	1200	50	50	
Aroclor-1254 ug/Kg	10/14	32.726159	28.872621	0.882248991	17.601756	47.850563	11.0726	24	54	42.9274	14	100	10	10	ln(y) = 3.11631872917874 + 1.0558515880476*Z
Aroclor-1260 ug/Kg	7/14	23.212994	28.542117	1.229575017	8.2617184	38.164269	4.62601	11	30.75	26.124	12	90	10	10	ln(y) = 2.47575826238259 + 1.40029324764621*Z
Arsenic MG/KG	**13/13**	**0.4376923**	**0.1547098**	**0.353467129**	**0.3535911**	**0.5217935**	**0.36**	**0.4**	**0.44**	**0.08**	**0.28**	**0.81**			**ln(y) = -0.867218351876167 + 0.301570068667847*Z**
Benzaldehyde ug/Kg	**13/13**	**16995.385**	**16528.452**	**0.97252593**	**8010.4156**	**25980.354**	**915**	**20000**	**36000**	**35085**	**330**	**39000**			**ln(y) = 8.65193098199919 + 2.06156701436096*Z**
Chromium MG/KG	**13/13**	**0.5623077**	**0.2927975**	**0.520706917**	**0.4031412**	**0.7214742**	**0.27**	**0.52**	**0.775**	**0.505**	**0.25**	**1.2**			**ln(y) = -0.697304052727963 + 0.59222033795201*Z**
Copper MG/KG	**13/13**	**1.4530769**	**0.7847792**	**0.540080984**	**1.0264661**	**1.8796878**	**0.895**	**1.2**	**2.05**	**1.155**	**0.53**	**3.1**			**ln(y) = 0.241834552728862 + 0.628495233083033*Z**
Iron MG/KG	**13/13**	**169.25385**	**109.9776**	**0.649779039**	**109.46934**	**229.03835**	**69.55**	**167**	**242.5**	**172.95**	**17.5**	**353**			**ln(y) = 4.86023885308694 + 0.974301396036609*Z**
Lead MG/KG	**13/13**	**0.6292308**	**0.4620461**	**0.734303152**	**0.3780596**	**0.8804019**	**0.18**	**0.63**	**0.97**	**0.79**	**0.07**	**1.4**			**ln(y) = -0.845030785872639 + 1.15825955174838*Z**
Mercury MG/KG	**13/13**	**0.0387692**	**0.0299602**	**0.772783974**	**0.0224827**	**0.0550558**	**0.0225**	**0.037**	**0.0465**	**0.024**	**0.013**	**0.117**			**ln(y) = -3.41777704024862 + 0.66192062237655*Z**
Nickel MG/KG	**13/13**	**0.2284615**	**0.1358646**	**0.594693671**	**0.1546047**	**0.3023184**	**0.1**	**0.23**	**0.31**	**0.21**	**0.08**	**0.53**			**ln(y) = -1.63541497537795 + 0.682477682802093*Z**
OCDD PG/G	**1/1**										**11.1**	**11.1**			
PCB-105 ng/kg	**1/1**										**3860**	**3860**			
PCB-108 ng/kg	**1/1**										**1780**	**1780**			
PCB-114 ng/kg	**1/1**										**241**	**241**			
PCB-118 ng/kg	**1/1**										**16600**	**16600**			
PCB-126 ng/kg	**1/1**										**134**	**134**			
PCB-127 ng/kg	**1/1**										**49.1**	**49.1**			
PCB-15 ng/kg	**1/1**										**104**	**104**			
PCB-156 ng/kg	**1/1**										**1730**	**1730**			
PCB-157 ng/kg	**1/1**										**519**	**519**			
PCB-162 ng/kg	**1/1**										**2940**	**2940**			
PCB-167 ng/kg	**1/1**										**1340**	**1340**			
PCB-189 ng/kg	**1/1**										**75.8**	**75.8**			
PCB-37 ng/kg	**1/1**										**104**	**104**			
PCB-58 ng/kg	**1/1**										**88.5**	**88.5**			
PCB-60 ng/kg	**1/1**										**436**	**436**			
PCB-61/70 ng/kg	**1/1**										**1570**	**1570**			
PCB-66 ng/kg	**1/1**										**5930**	**5930**			
PCB-77 ng/kg	**1/1**										**312**	**312**			
PCB-79 ng/kg	**1/1**										**226**	**226**			
PCB-80 ng/kg	**1/1**										**49.9**	**49.9**			
PCB-81 ng/kg	**1/1**										**86.2**	**86.2**			
Selenium MG/KG	**13/13**	**0.7276923**	**0.1067816**	**0.146740091**	**0.6696451**	**0.7857395**	**0.655**	**0.74**	**0.795**	**0.14**	**0.54**	**0.89**			**ln(y) = -0.327798277733718 + 0.168585602815534*Z**
Silver MG/KG	2/13										0.02	0.02	0.01	0.01	
Total HpCDF PG/G	**1/1**										**55.9**	**55.9**			
Total HxCDF PG/G	**1/1**										**55.2**	**55.2**			

CDM

Table H-28
Upper Cakcasieu
Fish - Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total PeCDF PG/G	**1/1**										**34.3**	**34.3**			
Total TCDD PG/G	**1/1**										**0.602**	**0.602**			
Total TCDF PG/G	**1/1**										**72.8**	**72.8**			
Zinc MG/KG	**13/13**	**21.761538**	**7.6843326**	**0.353115318**	**17.584288**	**25.938789**	**17.7**	**20.3**	**24.35**	**6.65**	**9.1**	**36.2**			**ln(y) = 3.02445361635089 + 0.393042451358076*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-29
Upper Calcasieu
Fish - Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**6.92**	**6.92**			
1,2,3,4,7,8-HxCDF PG/G	**1/1**										**0.487**	**0.487**			
1,2,3,6,7,8-HxCDF PG/G	**1/1**										**1.21**	**1.21**			
1,2,3,7,8-PeCDD PG/G	**1/1**										**0.278**	**0.278**			
1,2,3,7,8-PeCDF PG/G	**1/1**										**1.36**	**1.36**			
2,3,4,7,8-PeCDF PG/G	**1/1**										**1.85**	**1.85**			
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**2.0771915**	**2.0771915**			
2,3,7,8-TCDD PG/G	**1/1**										**0.258**	**0.258**			
2,3,7,8-TCDF PG/G	**1/1**										**1.94**	**1.94**			
2-Methylphenol ug/Kg	3/4	77.89681	64.190684	0.824047669	14.989939	140.80368	-50	55.5	135.25	185.25	48	160	50	50	ln(y) = 4.19411414726928 + 0.656432248983918*Z
Aroclor-1254 ug/Kg	**5/5**	**35.4**	**21.038972**	**0.594321246**	**16.958528**	**53.841472**	**24.5**	**31**	**48.5**	**24**	**22**	**65**			**ln(y) = 3.49219793930863 + 0.500067606065583*Z**
Aroclor-1260 ug/Kg	**5/5**	**31.4**	**24.002528**	**0.764411735**	**10.360856**	**52.439144**	**14**	**31**	**49**	**35**	**12**	**66**			**ln(y) = 3.26937464426782 + 0.868628901006659*Z**
Arsenic MG/KG	**4/4**	**0.3975**	**0.0517783**	**0.130259885**	**0.3467573**	**0.4482427**	**0.3575**	**0.39**	**0.445**	**0.0875**	**0.35**	**0.46**			**ln(y) = -0.927556418033384 + 0.157338431250506*Z**
Benzaldehyde ug/Kg	**4/4**	**635**	**186.91942**	**0.294361294**	**451.81897**	**818.18103**	**465**	**630**	**810**	**345**	**440**	**840**			**ln(y) = 6.42274924257952 + 0.399516480530766*Z**
beta-BHC ug/Kg	1/5										12	12	10	10	
Chromium MG/KG	**4/4**	**0.335**	**0.0288899**	**0.086238508**	**0.3066879**	**0.3633121**	**0.3075**	**0.34**	**0.3575**	**0.05**	**0.3**	**0.36**			**ln(y) = -1.09602720021955 + 0.108998086842443*Z**
Copper MG/KG	**4/4**	**0.6425**	**0.2243299**	**0.349151604**	**0.4226567**	**0.8623433**	**0.5525**	**0.565**	**0.81**	**0.2575**	**0.55**	**0.89**			**ln(y) = -0.464077057604514 + 0.265194001335428*Z**
Hexachloro-1,3-butadiene ug/Kg	3/4	45.810093	32.5819	0.711238467	13.879831	77.740355	-50	56	66.5	116.5	26	68	50	50	ln(y) = 3.7197752111718 + 0.615665628267826*Z
Iron MG/KG	**4/4**	**32**	**14.567809**	**0.455244021**	**17.723547**	**46.276453**	**18.975**	**32.3**	**44.725**	**25.75**	**15.6**	**47.8**			**ln(y) = 3.38864185610293 + 0.642794818614736*Z**
Lead MG/KG	3/4	0.1052159	0.0313202	0.297675177	0.0745221	0.1359097	0.055	0.105	0.1325	0.0775	0.1	0.14	0.04	0.04	ln(y) = -2.27242373018026 + 0.325593236239349*Z
Mercury MG/KG	**4/4**	**0.035**	**0.0143508**	**0.410023294**	**0.0209362**	**0.0490638**	**0.02325**	**0.039**	**0.04275**	**0.0195**	**0.018**	**0.044**			**ln(y) = -3.40733410796371 + 0.487101714038969*Z**
OCDD PG/G	**1/1**										**7.27**	**7.27**			
PCB-105 ng/kg	**1/1**										**2070**	**2070**			
PCB-108 ng/kg	**1/1**										**889**	**889**			
PCB-114 ng/kg	**1/1**										**124**	**124**			
PCB-118 ng/kg	**1/1**										**9710**	**9710**			
PCB-126 ng/kg	**1/1**										**58.4**	**58.4**			
PCB-156 ng/kg	**1/1**										**1070**	**1070**			
PCB-157 ng/kg	**1/1**										**281**	**281**			
PCB-162 ng/kg	**1/1**										**2070**	**2070**			
PCB-167 ng/kg	**1/1**										**767**	**767**			
PCB-169 ng/kg	**1/1**										**11**	**11**			
PCB-189 ng/kg	**1/1**										**165**	**165**			
PCB-37 ng/kg	**1/1**										**23.6**	**23.6**			
PCB-58 ng/kg	**1/1**										**30.5**	**30.5**			
PCB-60 ng/kg	**1/1**										**434**	**434**			
PCB-61/70 ng/kg	**1/1**										**1450**	**1450**			
PCB-66 ng/kg	**1/1**										**3160**	**3160**			
PCB-77 ng/kg	**1/1**										**72.2**	**72.2**			
PCB-79 ng/kg	**1/1**										**158**	**158**			
PCB-81 ng/kg	**1/1**										**70.6**	**70.6**			
Selenium MG/KG	**4/4**	**0.705**	**0.035468**	**0.050309285**	**0.6702413**	**0.7397587**	**0.6725**	**0.705**	**0.7375**	**0.065**	**0.67**	**0.74**			**ln(y) = -0.350488971258183 + 6.57774921339075E-02*Z**
Total HpCDF PG/G	**1/1**										**6.92**	**6.92**			
Total HxCDF PG/G	**1/1**										**11.1**	**11.1**			
Total PeCDD PG/G	**1/1**										**0.278**	**0.278**			
Total PeCDF PG/G	**1/1**										**7.24**	**7.24**			
Total TCDD PG/G	**1/1**										**0.258**	**0.258**			

Table H-29
Upper Calcasieu
Fish - Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total TCDF PG/G	1/1										6.14	6.14			
Zinc MG/KG	4/4	14.1	3.1722539	0.224982546	10.991191	17.208809	11.55	15.05	15.7	4.15	10.4	15.9			ln(y) = 2.63271746507415 + 0.232434416852846*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-30
Upper Calcasieu
Fish - Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/11										11	11	10	22	
1,2,3,4,6,7,8-HpCDF PG/G	**3/3**	**53.966667**	**36.791712**	**0.681748837**	**12.332925**	**95.600408**	**23.2**	**50.3**	**88.4**	**65.2**	**23.2**	**88.4**			**ln(y) = 3.84800977514052 + 0.992095253036401*Z**
1,2,3,4,7,8-HxCDF PG/G	**3/3**	**2.4853333**	**1.9178356**	**0.771661309**	**0.3150981**	**4.6555686**	**0.846**	**3.28**	**3.33**	**2.484**	**0.846**	**3.33**			**ln(y) = 0.741193269004164 + 1.01618977671476*Z**
1,2,3,6,7,8-HxCDF PG/G	**3/3**	**24.363333**	**16.01939**	**0.657520462**	**6.2356868**	**42.49098**	**9.79**	**30**	**33.3**	**23.51**	**9.79**	**33.3**			**ln(y) = 3.06270541173032 + 0.907902447349808*Z**
1,2,3,7,8-PeCDD PG/G	2/3										0.726	0.836	0.474	0.474	
1,2,3,7,8-PeCDF PG/G	**3/3**	**3.6013333**	**3.3259691**	**0.923538252**	**-0.162355**	**7.3650217**	**0.784**	**5**	**5.02**	**4.236**	**0.784**	**5.02**			**ln(y) = 0.993173862502003 + 1.37704397924303*Z**
2,3,4,6,7,8-HxCDF PG/G	1/3										0.598	0.598	0.245	0.354	
2,3,4,7,8-PeCDF PG/G	**3/3**	**9.3833333**	**8.5944879**	**0.91593121**	**-0.342245**	**19.108912**	**1.45**	**12.2**	**14.5**	**13.05**	**1.45**	**14.5**			**ln(y) = 1.84904938586607 + 1.70766996695179*Z**
2,3,7,8-TCDD PG/G	2/3										0.659	0.763	0.172	0.172	
2,3,7,8-TCDF PG/G	**3/3**	**12.56**	**11.359128**	**0.904389182**	**-0.294064**	**25.414064**	**1.78**	**15.2**	**20.7**	**18.92**	**1.78**	**20.7**			**ln(y) = 2.10934749747585 + 1.81960831926905*Z**
4,4'-DDE ug/Kg	1/11										11	11	10	22	
4-Nitrophenol ug/Kg	3/12	722.69272	639.20956	0.884483189	361.02586	1084.3596	310.277	556.021	996.398	686.121	1200	2100	200	1000	ln(y) = 6.32080543039031 + 0.865248571534981*Z
Aroclor-1254 ug/Kg	9/11	80.967637	81.816676	1.010486158	32.617071	129.3182	25	57	120	95	25	250	10	10	ln(y) = 3.95796218879128 + 1.17785864648089*Z
Aroclor-1260 ug/Kg	9/11	50.620427	47.840985	0.945092484	22.348211	78.892642	19	35	72	53	19	140	10	10	ln(y) = 3.51875774296866 + 1.13176104241294*Z
Arsenic MG/KG	**11/11**	**0.6963636**	**0.22177**	**0.318468626**	**0.565306**	**0.8274213**	**0.56**	**0.68**	**0.83**	**0.27**	**0.4**	**1.1**			**ln(y) = -0.406287951527618 + 0.370411984650485*Z**
Benzaldehyde ug/Kg	**12/12**	**1427.5**	**791.27666**	**0.554309392**	**979.79309**	**1875.2069**	**717.5**	**1350**	**2225**	**1507.5**	**330**	**2600**			**ln(y) = 7.09109579463845 + 0.749134479415111*Z**
beta-BHC ug/Kg	3/11	12.783522	22.265753	1.7417542	-0.374697	25.941741	1.38339	4.5416	20	18.6166	20	64	10	10	ln(y) = 1.51327830714152 + 1.76321868999705*Z
Cadmium MG/KG	8/11										0.003	0.01	0.003	0.003	
Chromium MG/KG	**11/11**	**0.5181818**	**0.2717648**	**0.524458401**	**0.3575791**	**0.6787846**	**0.31**	**0.58**	**0.64**	**0.33**	**0.21**	**1.1**			**ln(y) = -0.7728824747794 + 0.591621477433104*Z**
Copper MG/KG	**11/11**	**3.8545455**	**1.676704**	**0.434993952**	**2.8636767**	**4.8454142**	**2.3**	**3.8**	**5.3**	**3**	**1.9**	**6.5**			**ln(y) = 1.26373815758129 + 0.513457486444331*Z**
Di-n-butylphthalate ug/Kg	1/12										7200	7200	80	0	
Iron MG/KG	**11/11**	**116.37273**	**94.957886**	**0.815980586**	**60.256203**	**172.48925**	**28.4**	**71.9**	**210**	**181.6**	**19.9**	**275**			**ln(y) = 4.38220725310087 + 1.12539087345688*Z**
Lead MG/KG	**11/11**	**0.4327273**	**0.3196247**	**0.738628614**	**0.2438411**	**0.6216134**	**0.2**	**0.42**	**0.68**	**0.48**	**0.1**	**1.1**			**ln(y) = -1.08363164335837 + 0.89829252124893*Z**
Mercury MG/KG	**12/12**	**0.0230833**	**0.0111762**	**0.484167363**	**0.0167598**	**0.0294069**	**0.01625**	**0.022**	**0.02675**	**0.0105**	**0.01**	**0.049**			**ln(y) = -3.85459382911976 + 0.496268995372842*Z**
Naphthalene ug/Kg	2/11										72	280	80	1.7	
Nickel MG/KG	**11/11**	**0.2172727**	**0.1484906**	**0.683429701**	**0.1295204**	**0.3050251**	**0.1**	**0.17**	**0.32**	**0.22**	**0.07**	**0.51**			**ln(y) = -1.72390692280157 + 0.772538150908415*Z**
OCDD PG/G	2/3										21.6	21.8	4.04	4.04	
OCDF PG/G	1/3										3.57	3.57	3.28	3.91	
PCB-105 ng/kg	**3/3**	**8440**	**9432.7797**	**1.117627927**	**-2234.195**	**19114.195**	**1220**	**6700**	**17400**	**16180**	**1220**	**17400**			**ln(y) = 8.56023147610299 + 1.9709746046225*Z**
PCB-108 ng/kg	**3/3**	**3760**	**4149.5382**	**1.103600593**	**-935.6445**	**8455.6445**	**560**	**3020**	**7700**	**7140**	**560**	**7700**			**ln(y) = 7.7633081673133 + 1.94384533095874*Z**
PCB-114 ng/kg	**3/3**	**613.83333**	**562.33373**	**0.916101658**	**-22.50719**	**1250.1739**	**79.5**	**722**	**1040**	**960.5**	**79.5**	**1040**			**ln(y) = 5.96825271756284 + 1.90689735102373*Z**
PCB-118 ng/kg	**3/3**	**36743.333**	**42154.647**	**1.147273359**	**-10959.14**	**84445.808**	**5630**	**27800**	**76800**	**71170**	**5630**	**76800**			**ln(y) = 10.0392053133161 + 1.93795408647056*Z**
PCB-126 ng/kg	**3/3**	**244.63333**	**292.44593**	**1.195445952**	**-86.30039**	**575.56705**	**36.9**	**175**	**522**	**485.1**	**36.9**	**522**			**ln(y) = 5.01022170428421 + 1.9649204351363*Z**
PCB-15 ng/kg	2/3										34.5	75.4	20.3	0	
PCB-156 ng/kg	**3/3**	**4215**	**4074.1497**	**0.966583547**	**-395.3343**	**8825.3343**	**655**	**4040**	**7950**	**7295**	**655**	**7950**			**ln(y) = 7.92318747141294 + 1.8513291180074*Z**
PCB-157 ng/kg	**3/3**	**1144.3333**	**1152.5116**	**1.007146769**	**-159.8563**	**2448.523**	**173**	**1040**	**2220**	**2047**	**173**	**2220**			**ln(y) = 6.60184335383317 + 1.89262235832261*Z**
PCB-162 ng/kg	**3/3**	**7136.6667**	**8276.2826**	**1.159684618**	**-2228.829**	**16502.162**	**1060**	**5350**	**15000**	**13940**	**1060**	**15000**			**ln(y) = 8.3888938356935 + 1.96516165538352*Z**
PCB-167 ng/kg	**3/3**	**2900.3333**	**2601.2134**	**0.896867066**	**-43.21678**	**5843.8834**	**501**	**3050**	**5150**	**4649**	**501**	**5150**			**ln(y) = 7.59541832144803 + 1.72810992804127*Z**
PCB-189 ng/kg	**3/3**	**722**	**683.13226**	**0.946166571**	**-51.03693**	**1495.0369**	**110**	**976**	**1080**	**970**	**110**	**1080**			**ln(y) = 6.18955309077459 + 1.6940616650834*Z**
PCB-37 ng/kg	**3/3**	**47.8**	**47.479783**	**0.993300901**	**-5.928432**	**101.52843**	**10.4**	**40.2**	**92.8**	**82.4**	**10.4**	**92.8**			**ln(y) = 3.52203981385482 + 1.6231652986165*Z**
PCB-58 ng/kg	**3/3**	**359.26667**	**521.78232**	**1.452353836**	**-231.1856**	**949.71895**	**23.8**	**206**	**848**	**824.2**	**23.8**	**848**			**ln(y) = 5.08014746175297 + 2.64999452148169*Z**
PCB-60 ng/kg	**3/3**	**1594**	**1501.7176**	**0.94210639**	**-105.3534**	**3293.3534**	**272**	**2180**	**2330**	**2058**	**272**	**2330**			**ln(y) = 7.01550192287963 + 1.59289237447948*Z**
PCB-61/70 ng/kg	**3/3**	**10420**	**9838.8466**	**0.944227123**	**-713.7031**	**21553.703**	**1460**	**10700**	**19100**	**17640**	**1460**	**19100**			**ln(y) = 8.80721144972903 + 1.90692177210622*Z**
PCB-66 ng/kg	**3/3**	**11816.667**	**10731.8**	**0.908191851**	**-327.5087**	**23960.842**	**1850**	**15200**	**18400**	**16550**	**1850**	**18400**			**ln(y) = 8.99069918950127 + 1.7036502734063*Z**
PCB-77 ng/kg	**3/3**	**210**	**193.74216**	**0.922581731**	**-9.239897**	**429.2399**	**27**	**261**	**342**	**315**	**27**	**342**			**ln(y) = 4.89838933679654 + 1.88298336494648*Z**
PCB-79 ng/kg	**3/3**	**411.43333**	**431.46727**	**1.048693021**	**-76.81784**	**899.68451**	**77.3**	**336**	**821**	**743.7**	**77.3**	**821**			**ln(y) = 5.62510940833634 + 1.75234886882577*Z**

CDM

Table H-30
Upper Calcasieu
Fish - Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-80 ng/kg	**3/3**	**43.15**	**39.704453**	**0.920149552**	**-1.779818**	**88.079818**	**8.25**	**58.7**	**62.5**	**54.25**	**8.25**	**62.5**			**ln(y) = 3.43927316130767 + 1.50176948583425*Z**
PCB-81 ng/kg	**3/3**	**377.73333**	**444.32228**	**1.176285611**	**-125.0647**	**880.53133**	**46.2**	**287**	**800**	**753.8**	**46.2**	**800**			**ln(y) = 5.39235791383841 + 2.11486047476011*Z**
Selenium MG/KG	**11/11**	**0.5518182**	**0.1238814**	**0.22449675**	**0.478609**	**0.6250274**	**0.44**	**0.57**	**0.68**	**0.24**	**0.36**	**0.72**			**ln(y) = -0.6183748009349 + 0.270477973911526*Z**
Silver MG/KG	**10/10**	**0.042**	**0.031475**	**0.749405336**	**0.0224916**	**0.0615084**	**0.02**	**0.03**	**0.0625**	**0.0425**	**0.02**	**0.11**			**ln(y) = -3.34422462724469 + 0.656142406724698*Z**
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**10.652841**	**8.955677**	**0.840684364**	**0.5185386**	**20.787144**	**2.7137**	**14.0858**	**15.159**	**12.4453**	**2.7136955**	**15.159004**			ln(y) = 2.1206916465049 + 1.27581654581337*Z
Total HpCDD PG/G	1/3										2.6	2.6	1.01	2.09	
Total HpCDF PG/G	**3/3**	**53.966667**	**36.791712**	**0.681748837**	**12.332925**	**95.600408**	**23.2**	**50.3**	**88.4**	**65.2**	**23.2**	**88.4**			**ln(y) = 3.84800977514052 + 0.992095253036401*Z**
Total HxCDF PG/G	**3/3**	**106.4**	**66.846341**	**0.628255089**	**30.756244**	**182.04376**	**43.2**	**116**	**160**	**116.8**	**43.2**	**160**			**ln(y) = 4.53153483386342 + 0.97104302206621*Z**
Total PeCDD PG/G	2/3										0.726	0.836	0.474	0.474	
Total PeCDF PG/G	**3/3**	**102.4**	**65.952399**	**0.644066392**	**27.767835**	**177.03216**	**45.2**	**129**	**133**	**87.8**	**45.2**	**133**			**ln(y) = 4.5204195398072 + 0.800407465265776*Z**
Total TCDD PG/G	2/3										0.659	0.763	0.172	0.172	
Total TCDF PG/G	**3/3**	**73.933333**	**30.534389**	**0.412998954**	**39.380419**	**108.48625**	**46.3**	**84.9**	**90.6**	**44.3**	**46.3**	**90.6**			**ln(y) = 4.26102342248614 + 0.497866408760021*Z**
Zinc MG/KG	**11/11**	**18.527273**	**5.3586488**	**0.289230309**	**15.360514**	**21.694032**	**15.2**	**17.3**	**19.3**	**4.1**	**13.3**	**29.7**			**ln(y) = 2.88921663584268 + 0.278038471775337*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-31
Upper Calcasieu
Fish - Whole Body -Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	4/24										6.2	22	4.2	10	
1,2,3,4,6,7,8-HpCDF PG/G	3/4	7.1227198	4.2215508	0.592688038	2.9856	11.25984	2.2775	7.185	10.54	8.2625	5.51	11.1	1.2	1.2	ln(y) = 1.86706364926378 + 0.661936818510626*Z
1,2,3,4,7,8-HxCDF PG/G	2/4										0.715	0.906	0.63	1.2	
1,2,3,6,7,8-HxCDF PG/G	2/4										1.32	2.04	0.56	1.2	
1,2,3,7,8-PeCDF PG/G	3/4	1.7370102	1.70585	0.982061006	0.0652772	3.4087433	0.8525	1.835	2.7125	1.86	1.07	2.75	0.78	0.78	ln(y) = 0.371479902454523 + 0.877981581211337*Z
2,3,4,7,8-PeCDF PG/G	3/4	0.6500546	0.5217629	0.802644695	0.138727	1.1613822	0.346	0.627	1.085	0.739	0.424	1.17	0.32	0.32	ln(y) = -0.631309956026 + 0.960263599417461*Z
2,3,7,8-TCDD Equivalent PG/G	**4/4**	**1.1392153**	**0.2894267**	**0.254057916**	**0.8555772**	**1.4228535**	**0.91008**	**1.08976**	**1.41781**	**0.50773**	**0.8895413**	**1.48779905**			ln(y) = 0.110088802312998 + 0.315940431621786*Z
2,3,7,8-TCDF PG/G	**4/4**	**0.7785**	**0.2383741**	**0.306196609**	**0.5448934**	**1.0121066**	**0.65475**	**0.702**	**0.97875**	**0.324**	**0.65**	**1.06**			**ln(y) = -0.270592501647922 + 0.281929816521601*Z**
4,4'-DDD ug/Kg	2/24										1.8	1.9	1	10	
4,4'-DDE ug/Kg	3/24										5.4	10	1	10	
4,4'-DDT ug/Kg	5/24	5.937185	7.8582722	1.323568682	2.7932214	9.0811487	1.99502	3.92684	7.72927	5.73424	1.6	33	6	10	ln(y) = 1.36783445772237 + 1.00443525928902*Z
Aldrin ug/Kg	3/24										6.6	9.8	6	10	
alpha-BHC ug/Kg	4/24										1.2	5.8	1	10	
alpha-Chlordane ug/Kg	6/24	7.0697919	4.2355772	0.59910917	5.3752081	8.7643757	4.19073	6.14349	9.00619	4.81546	3.9	19	6	10	ln(y) = 1.81539351643526 + 0.567375817800328*Z
Aluminum (Fume Or Dust) MG/KG	3/5	7.5114316	6.3275938	0.842395177	1.9650511	13.057812	4.28867	6.5327	9.9509	5.66222	5.1	15.8	7.7	11.7	ln(y) = 1.87682019659122 + 0.624220369238542*Z
Aroclor-1254 ug/Kg	11/24	111.37383	134.01998	1.203334573	57.754673	164.99299	21.7304	54.8224	138.308	116.578	51	460	10	100	ln(y) = 4.00409825226033 + 1.37258889940503*Z
Aroclor-1260 ug/Kg	13/24	61.73515	92.848256	1.503977171	24.588111	98.882189	5.81843	19.475	65.1856	59.3671	14	300	10	100	ln(y) = 2.96913390378408 + 1.79193657537463*Z
Arsenic MG/KG	21/24	0.3763503	0.3062277	0.813677317	0.2538337	0.4988669	0.24202	0.33163	0.45441	0.21239	0.18	1.5	0.52	1	ln(y) = -1.1037446093312 + 0.467214560470976*Z
Barium MG/KG	4/5	3.6330481	1.8359998	0.50536072	2.0237233	5.242373	-2.3	4.1	4.95	7.25	2	5.2	2.3	2.3	ln(y) = 1.21427278869914 + 0.524972022913907*Z
Benzaldehyde ug/Kg	18/19	715.27053	419.48791	0.586474481	526.64576	903.8953	490	660	880	390	240	1900	50	50	ln(y) = 6.44691186953577 + 0.567045125545325*Z
bis(2-Ethylhexyl)phthalate ug/Kg	6/24	196.03249	109.30539	0.557588126	152.30122	239.76375	124.035	177.143	252.993	128.958	220	530	50	2000	ln(y) = 5.17696004535114 + 0.528635299491732*Z
Calcium Metal MG/KG	**5/5**	**19380**	**8387.6978**	**0.432801742**	**12027.859**	**26732.141**	**11350**	**19200**	**27500**	**16150**	**10600**	**29400**			**ln(y) = 9.79426663069906 + 0.584018168429666*Z**
Chromium MG/KG	23/24	0.2565829	0.1545364	0.602286264	0.1947555	0.3184104	-1	-1	-1	0	0.08	0.64	1	1	ln(y) = -1.5233032513817 + 0.655966523212382*Z
Copper MG/KG	22/24	0.6782597	0.3838164	0.565884149	0.5247012	0.8318183	0.43999	0.60901	0.84297	0.40298	0.28	2	1	1.3	ln(y) = -0.495916273260607 + 0.482194804894619*Z
Dieldrin ug/Kg	4/24										5.1	17	1	10	
Diethyl Phthalate ug/Kg	1/24										80	80	50	2000	
Di-n-octylphthalate ug/Kg	1/24										8600	8600	50	2000	
Endosulfan I ug/Kg	2/24										0.99	1.5	1	10	
Endosulfan II ug/Kg	2/24										2.9	4.3	6	10	
Endosulfan Sulfate ug/Kg	2/24										14	16	6	10	
Endrin Aldehyde ug/Kg	5/24	2.0538583	1.1592755	0.564437926	1.5900515	2.5176651	0.97156	1.64415	2.78238	1.81082	0.9	5.7	1	10	ln(y) = 0.49722552857385 + 0.780315674243618*Z
Endrin Ketone ug/Kg	2/24										0.79	11	1	10	
Endrin ug/Kg	2/24										22	24	6	10	
gamma-BHC (Lindane) ug/Kg	3/24										1.8	3.5	1	10	
gamma-Chlordane ug/Kg	3/24										10	29	6	10	
Heptachlor Epoxide ug/Kg	5/24	3.4282248	3.5374165	1.031850801	2.0129635	4.8434862	1.22746	2.36937	4.57359	3.34613	1.2	12	1	22	ln(y) = 0.862622237588169 + 0.975507529197035*Z
Heptachlor ug/Kg	3/24										2.7	11	1	22	
Hexachloro-1,3-butadiene ug/Kg	1/24										120	120	50	2000	
Iron MG/KG	22/24	15.016704	9.3352653	0.621658732	11.28182	18.751588	9.38149	13.157	18.4519	9.07041	7.6	45.3	16.8	21.3	ln(y) = 2.57695308962046 + 0.501661071283009*Z
Lead MG/KG	11/24	0.0890444	0.0906009	1.017479362	0.0527965	0.1252923	0.02798	0.05788	0.11972	0.09173	0.06	0.33	0.04	0.8	ln(y) = -2.84938074978413 + 1.07798485246596*Z
Magnesium MG/KG	**5/5**	**470.4**	**139.96251**	**0.29753934**	**347.71745**	**593.08255**	**327**	**507**	**595.5**	**268.5**	**314**	**623**			**ln(y) = 6.11670350892365 + 0.394136026127068*Z**
Manganese MG/KG	**5/5**	**8.68**	**5.5202169**	**0.635969692**	**3.8413165**	**13.518683**	**4.35**	**5.8**	**14.45**	**10.1**	**4.3**	**15.8**			**ln(y) = 2.00613993028323 + 0.770946412073827*Z**
Mercury MG/KG	22/24	0.0710202	0.034388	0.484200529	0.0572621	0.0847782	0.043	0.068	0.10225	0.05925	0.021	0.13	0.03	0.03	ln(y) = -2.77781550962894 + 0.595014193374972*Z
Nickel MG/KG	16/24	0.0658457	0.0442406	0.671883498	0.0481457	0.0835456	0.0373	0.05699	0.08708	0.04979	0.03	0.21	0.03	4	ln(y) = -2.86488962593338 + 0.62890263221586*Z
OCDD PG/G	2/4										2.08	3.36	2.4	3.63	
OCDF PG/G	1/4										1.28	1.28	0.861	1.3	

Table H-31
Upper Calcasieu
Fish - Whole Body -Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-105 ng/kg	3/3	3503.3333	2153.4431	0.614684049	1066.483	5940.1836	1550	4270	4690	3140	1550	4690			ln(y) = 8.05285572585876 + 0.821117981413864*Z
PCB-108 ng/kg	3/3	1443.3333	912.87743	0.632478586	410.31528	2476.3514	650	1810	1870	1220	650	1870			ln(y) = 7.17058273233273 + 0.783697989329119*Z
PCB-114 ng/kg	3/3	202.23333	120.90384	0.59784327	65.417762	339.0489	90.7	242	274	183.3	90.7	274			ln(y) = 5.20320772988862 + 0.819926251849701*Z
PCB-118 ng/kg	3/3	15520	9477.4214	0.610658595	4795.2881	26244.712	7160	19200	20200	13040	7160	20200			ln(y) = 9.55078956711995 + 0.769200037372278*Z
PCB-126 ng/kg	3/3	85.8	46.22337	0.538733913	33.493333	138.10667	44.4	103	110	65.6	44.4	110			ln(y) = 4.37614960782008 + 0.672838557067196*Z
PCB-15 ng/kg	1/3										54.6	54.6	19.9	0	
PCB-156 ng/kg	3/3	1673	1120.8939	0.669990379	404.58914	2941.4109	669	2090	2260	1591	669	2260			ln(y) = 7.29127449911781 + 0.902814922278257*Z
PCB-157 ng/kg	3/3	445.33333	281.17087	0.631371722	127.15854	763.50813	204	561	571	367	204	571			ln(y) = 5.99841003634097 + 0.763338620187255*Z
PCB-162 ng/kg	3/3	3106.6667	2142.5178	0.689651663	682.1795	5531.1538	1270	3990	4060	2790	1270	4060			ln(y) = 7.91575231397744 + 0.861899134913737*Z
PCB-167 ng/kg	3/3	1038	634.91155	0.611668157	319.52995	1756.4701	494	1300	1320	826	494	1320			ln(y) = 6.85268069207266 + 0.728913772127319*Z
PCB-189 ng/kg	3/3	250.1	189.74966	0.758695144	35.378051	464.82195	75.3	313	362	286.7	75.3	362			ln(y) = 5.31977584572392 + 1.16448336509769*Z
PCB-37 ng/kg	3/3	19.033333	7.2722842	0.382081484	10.803969	27.262698	15.1	16.4	25.6	10.5	15.1	25.6			ln(y) = 2.91818947671218 + 0.391505570403226*Z
PCB-58 ng/kg	3/3	48.066667	32.338142	0.67277689	11.472614	84.66072	18.5	59.2	66.5	48	18.5	66.5			ln(y) = 3.73196474054535 + 0.948866675229541*Z
PCB-60 ng/kg	3/3	678.33333	466.36433	0.687514978	150.59242	1206.0742	252	839	944	692	252	944			ln(y) = 6.37058865337471 + 0.979470745071051*Z
PCB-61/70 ng/kg	3/3	3753.3333	2974.5181	0.79250037	387.34929	7119.3174	1160	4940	5160	4000	1160	5160			ln(y) = 8.03666258425266 + 1.10689752009303*Z
PCB-66 ng/kg	3/3	4133.3333	2897.4418	0.700993975	854.56932	7412.0973	1570	5250	5580	4010	1570	5580			ln(y) = 8.18391943643446 + 0.940472844869265*Z
PCB-77 ng/kg	3/3	101.3	67.402372	0.665373859	25.027036	177.57296	38.9	123	142	103.1	38.9	142			ln(y) = 4.47633522119936 + 0.960288982772452*Z
PCB-79 ng/kg	3/3	206.13333	124.39488	0.603468034	65.367278	346.89939	94.4	252	272	177.6	94.4	272			ln(y) = 5.22759074231963 + 0.78483983966024*Z
PCB-80 ng/kg	1/3										10.2	10.2	19.9	0	
PCB-81 ng/kg	3/3	138.73333	98.333669	0.708796267	27.458312	250.00835	51.2	176	189	137.8	51.2	189			ln(y) = 4.78265684738109 + 0.96857647612825*Z
Potassium MG/KG	5/5	2738	239.86247	0.087604993	2527.7513	2948.2487	2505	2790	2945	440	2420	2970			ln(y) = 7.91207779514376 + 0.111385570195608*Z
Selenium MG/KG	22/24	0.7148737	0.2860918	0.400199096	0.6004132	0.8293343	0.51426	0.66641	0.86356	0.3493	0.25	1.5	1.1	1.4	ln(y) = -0.40585515398438 + 0.384407383650486*Z
Silver MG/KG	1/24										0.02	0.02	0.01	1.4	
Sodium MG/KG	3/5										1370	1560	1070	1.4	
Total HpCDF PG/G	3/4	8.0695627	6.0824997	0.753758271	2.1087131	14.030412	2.5775	7.905	13.075	10.4975	5.51	14	1.6	1.6	ln(y) = 1.91784635863555 + 0.881697802410511*Z
Total HxCDF PG/G	3/4	7.3084912	6.5574113	0.897231885	0.8822281	13.734754	1.6475	7.185	12.325	10.6775	4.37	13.1	0.74	0.74	ln(y) = 1.75576999041484 + 1.03283141425446*Z
Total PeCDF PG/G	3/4	6.2348114	4.9027875	0.786356988	1.4300796	11.039543	1.645	6.405	9.635	7.99	4.24	9.99	0.78	0.78	ln(y) = 1.68423346856114 + 0.802983049878528*Z
Total TCDF PG/G	**4/4**	**3.83**	**2.5948889**	**0.677516673**	**1.2870089**	**6.3729911**	**1.4375**	**4.605**	**5.4475**	**4.01**	**0.65**	**5.46**			**ln(y) = 1.07247900831377 + 1.21768330478514*Z**
Zinc MG/KG	**24/24**	**14.691667**	**5.5316977**	**0.376519409**	**12.478527**	**16.904807**	**10.075**	**12.75**	**18.35**	**8.275**	**8.5**	**27.4**			**ln(y) = 2.62547152131883 + 0.383249186082936*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-32
Upper Cakcasieu
Fish - Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/22										10	10	10	1.7	
1,2,3,4,6,7,8-HpCDD PG/G	**3/3**	**4.69**	**3.0526606**	**0.650887112**	**1.2355894**	**8.1444106**	**2.36**	**4.12**	**7.59**	**5.23**	**2.36**	**7.59**			**ln(y) = 1.43378212460216 + 0.86635181656513*Z**
1,2,3,4,6,7,8-HpCDF PG/G	**3/3**	**12.506667**	**9.1517305**	**0.731748174**	**2.1505087**	**22.862825**	**3.82**	**14.1**	**19.6**	**15.78**	**3.82**	**19.6**			**ln(y) = 2.32065159541303 + 1.21277475895928*Z**
1,2,3,4,7,8-HxCDD PG/G	1/3										0.352	0.352	0.137	0.254	
1,2,3,4,7,8-HxCDF PG/G	2/3										1.49	2.52	0.884	0.884	
1,2,3,6,7,8-HxCDD PG/G	**3/3**	**1.4426667**	**1.2542757**	**0.869414788**	**0.0233201**	**2.8620133**	**0.288**	**1.86**	**2.18**	**1.892**	**0.288**	**2.18**			**ln(y) = 5.17021885599722E-02 + 1.50115120181047*Z**
1,2,3,6,7,8-HxCDF PG/G	**3/3**	**2.6476667**	**1.8765235**	**0.708746121**	**0.5241804**	**4.7711529**	**0.873**	**3.13**	**3.94**	**3.067**	**0.873**	**3.94**			**ln(y) = 0.792131334906456 + 1.11763921794673*Z**
1,2,3,7,8,9-HxCDD PG/G	2/3										0.863	0.988	0.143	0.143	
1,2,3,7,8-PeCDD PG/G	1/3										0.766	0.766	0.235	0.651	
1,2,3,7,8-PeCDF PG/G	**3/3**	**3.4166667**	**3.0989119**	**0.906998601**	**-0.090082**	**6.9234156**	**2.08**	**2.12**	**6.05**	**3.97**	**2.08**	**6.05**			**ln(y) = 1.0946140848133 + 0.791832970092729*Z**
2,3,4,7,8-PeCDF PG/G	**3/3**	**1.7333333**	**1.3126602**	**0.757303987**	**0.2479184**	**3.2187482**	**1.02**	**1.26**	**2.92**	**1.9**	**1.02**	**2.92**			**ln(y) = 0.440832654846586 + 0.780034063524395*Z**
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**3.6019513**	**2.3505166**	**0.652567562**	**0.9420914**	**6.2618113**	**1.45046**	**3.69466**	**5.66074**	**4.21027**	**1.450463**	**5.660735**			ln(y) = 1.13744133651137 + 1.0098582473053*Z
2,3,7,8-TCDD PG/G	2/3										0.387	0.519	0.0769	0.0769	
2,3,7,8-TCDF PG/G	**3/3**	**9.9133333**	**8.0494328**	**0.811980444**	**0.8045426**	**19.022124**	**3.07**	**9.27**	**17.4**	**14.33**	**3.07**	**17.4**			**ln(y) = 2.06831038246578 + 1.28657712026474*Z**
2-Methylphenol ug/Kg	7/22	82.126834	91.045617	1.10859767	44.081292	120.17238	23.3442	50.636	109.835	86.4903	29	320	50	2000	ln(y) = 3.92466195060952 + 1.14850978300867*Z
4,4'-DDD ug/Kg	3/22										10	34	6	1.7	
4,4'-DDE ug/Kg	8/22	10.8136	6.4711436	0.59842641	8.1094808	13.517718	6.30911	9.30536	12.5	6.19089	9.2	29	10	10	ln(y) = 2.23059090494687 + 0.5763916622988*Z
4,4'-DDT ug/Kg	2/22										3.1	47	10	10	
4-Methylphenol ug/Kg	10/21	742.32334	1468.6596	1.978463392	114.16727	1370.4794	18.4881	103.999	1040	1021.51	75	5300	50	50	ln(y) = 4.64438397521076 + 2.56197873547334*Z
Acetophenone ug/Kg	1/21										100	100	50	50	
Aldrin ug/Kg	5/22	6.6646293	4.0537515	0.608248614	4.9706743	8.3585843	3.70033	5.65451	8.6407	4.94038	10	17	6	10	ln(y) = 1.73245259638322 + 0.62895044996972*Z
alpha-BHC ug/Kg	1/22										6.8	6.8	10	10	
alpha-Chlordane ug/Kg	10/22	11.514282	10.430679	0.905890534	7.1555787	15.872986	4.05383	7.89543	15.75	11.6962	4.1	35	10	10	ln(y) = 2.06628452343347 + 0.9887756526978*Z
Antimony MG/KG	1/19										0.45	0.45	0.03	1	
Aroclor-1254 ug/Kg	21/22	339.94268	355.86185	1.046828963	191.23748	488.64789	107.5	150	610	502.5	12	1300	100	100	ln(y) = 5.22214182632099 + 1.34016258811383*Z
Aroclor-1260 ug/Kg	20/22	128.67832	128.11712	0.995638744	75.141583	182.21506	34.4398	76.9976	172.145	137.705	14	430	7.8	100	ln(y) = 4.34377451375279 + 1.19337814053525*Z
Arsenic MG/KG	18/19	0.3249499	0.1439291	0.442927015	0.2602315	0.3896683	-0.58	-0.58	-0.58	0	0.19	0.74	0.58	0.58	ln(y) = -1.19779388676668 + 0.398176669113854*Z
Barium MG/KG	**1/1**										**4.4**	**4.4**			
Benzaldehyde ug/Kg	19/21	576.4076	1083.4814	1.879713911	112.99496	1039.8203	250	350	565	315	140	4200	50	50	ln(y) = 5.91756491858832 + 0.897753719691722*Z
beta-BHC ug/Kg	14/22	18.347984	16.800967	0.915684615	11.327307	25.368661	6.16027	11.5	27.5	21.3397	6	56	10	10	ln(y) = 2.50822370446567 + 1.023605245188*Z
bis(2-Ethylhexyl)phthalate ug/Kg	2/21										340	350	50	50	
Cadmium MG/KG	11/19	0.0057454	0.0033108	0.57623988	0.0042567	0.0072341	0.00313	0.00486	0.00754	0.00441	0.003	0.01	0.003	0.5	ln(y) = -5.3262165691261 + 0.651263811102181*Z
Calcium Metal MG/KG	**1/1**										**5510**	**5510**			
Chromium MG/KG	**19/19**	**0.6389474**	**0.4405402**	**0.68947801**	**0.4408564**	**0.8370384**	**0.31**	**0.51**	**1**	**0.69**	**0.1**	**1.5**			**ln(y) = -0.667756133257978 + 0.768639534297268*Z**
Copper MG/KG	**19/19**	**2.7952632**	**5.2017774**	**1.860925821**	**0.4562588**	**5.1342675**	**0.98**	**1.3**	**2.8**	**1.82**	**0.35**	**19.5**			**ln(y) = 0.526624943339613 + 0.965856953461375*Z**
Dieldrin ug/Kg	2/22										8.9	11	10	10	
Diethyl Phthalate ug/Kg	8/22	49.549655	22.566453	0.455431093	40.119734	58.979576	32.7864	45.0675	61.9488	29.1624	43	110	50	4000	ln(y) = 3.80816101526946 + 0.471895632547625*Z
Endosulfan II ug/Kg	1/22										10	10	6	10	
Endrin Aldehyde ug/Kg	6/20	5.9102441	5.9240212	1.002331056	3.3139274	8.5065609	2.72823	4.62432	10.75	8.02177	3	14	10	10	ln(y) = 1.53132835333886 + 0.782683462178828*Z
Endrin ug/Kg	1/22										17	17	6	10	
gamma-Chlordane ug/Kg	5/22	6.0872128	6.0213509	0.989180273	3.5710505	8.6033752	2.08099	4.07872	7.99422	5.91323	10	23	6	10	ln(y) = 1.40578247424752 + 0.998142566568704*Z
Heptachlor Epoxide ug/Kg	1/22										1.7	1.7	10	10	
Hexachloro-1,3-butadiene ug/Kg	17/22	147.7398	273.05147	1.848191674	33.638853	261.84074	40.3285	84.67	177.765	137.437	26	1100	50	2000	ln(y) = 4.43876099517602 + 1.10014075682126*Z
Iron MG/KG	**19/19**	**165.72105**	**138.78013**	**0.83743213**	**103.31789**	**228.12421**	**58.9**	**134**	**224**	**165.1**	**16.2**	**539**			**ln(y) = 4.76429177650116 + 1.02946263670677*Z**
Lead MG/KG	**19/19**	**2.31**	**12.251486**	**5.303673495**	**-3.19894**	**7.8189399**	**0.22**	**0.31**	**0.57**	**0.35**	**0.05**	**37.2**			**ln(y) = -0.998944489717595 + 1.32999299071706*Z**
Magnesium MG/KG	**1/1**										**314**	**314**			

Table H-32
Upper Cakcasieu
Fish - Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Manganese MG/KG	**1/1**										**8.1**	**8.1**			
Mercury MG/KG	21/22	0.0368296	0.0189528	0.514607442	0.0289098	0.0447495	0.018	0.035	0.0555	0.0375	0.012	0.074	0.014	0.014	ln(y) = -3.4425521522401 + 0.617788223270447*Z
Naphthalene ug/Kg	2/22										29	73	50	1.7	
Nickel MG/KG	18/19	0.3160632	0.1870656	0.591861514	0.2319482	0.4001781	-4	-4	-4	0	0.05	0.76	4	4	ln(y) = -1.32726946575923 + 0.735769191939159*Z
OCDD PG/G	**3/3**	**58.6**	**49.124617**	**0.838304041**	**3.0102629**	**114.18974**	**34.2**	**39.6**	**102**	**67.8**	**34.2**	**102**			**ln(y) = 3.94534252520442 + 0.810415879099968*Z**
OCDF PG/G	**3/3**	**7.5966667**	**4.2372222**	**0.557773878**	**2.8017983**	**12.391535**	**3.61**	**8.78**	**10.4**	**6.79**	**3.61**	**10.4**			**ln(y) = 1.93266332871305 + 0.784718983855595*Z**
PCB-105 ng/kg	**3/3**	**3377**	**3439.6484**	**1.018551491**	**-515.3286**	**7269.3286**	**411**	**4780**	**4940**	**4529**	**411**	**4940**			**ln(y) = 7.66530321672123 + 1.84408739921706*Z**
PCB-108 ng/kg	**3/3**	**1639.6667**	**1615.7719**	**0.985427086**	**-188.7514**	**3468.0847**	**159**	**2190**	**2570**	**2411**	**159**	**2570**			**ln(y) = 6.87074073430668 + 2.06378062949089*Z**
PCB-114 ng/kg	**3/3**	**227.2**	**234.28878**	**1.031200598**	**-37.92271**	**492.32271**	**26.6**	**324**	**331**	**304.4**	**26.6**	**331**			**ln(y) = 4.95459103565235 + 1.86980700951919*Z**
PCB-118 ng/kg	**3/3**	**16790**	**17688.489**	**1.053513355**	**-3226.41**	**36806.41**	**1770**	**24200**	**24400**	**22630**	**1770**	**24400**			**ln(y) = 9.22506038299798 + 1.94574743932011*Z**
PCB-126 ng/kg	**3/3**	**78.766667**	**70.496338**	**0.895002176**	**-1.00745**	**158.54078**	**13.3**	**101**	**122**	**108.7**	**13.3**	**122**			**ln(y) = 4.00230186560074 + 1.64364632850891*Z**
PCB-127 ng/kg	2/3										9.57	17.6	19.9	0	
PCB-15 ng/kg	2/3										49	86.9	19.9	0	
PCB-156 ng/kg	**3/3**	**2028.3333**	**2035.5723**	**1.003568939**	**-275.1336**	**4331.8003**	**225**	**2810**	**3050**	**2825**	**225**	**3050**			**ln(y) = 7.12664567804456 + 1.93328274853964*Z**
PCB-157 ng/kg	**3/3**	**523.5**	**521.07128**	**0.995360602**	**-66.14766**	**1113.1477**	**56.5**	**717**	**797**	**740.5**	**56.5**	**797**			**ln(y) = 5.76339038584741 + 1.96281272082473*Z**
PCB-162 ng/kg	**3/3**	**3415**	**3248.9879**	**0.951387377**	**-261.5759**	**7091.5759**	**355**	**4310**	**5580**	**5225**	**355**	**5580**			**ln(y) = 7.62258500931619 + 2.04306633129907*Z**
PCB-167 ng/kg	**3/3**	**1401.3333**	**1391.2986**	**0.992839128**	**-173.0692**	**2975.7359**	**164**	**1930**	**2110**	**1946**	**164**	**2110**			**ln(y) = 6.77319497873108 + 1.89455498977763*Z**
PCB-189 ng/kg	**3/3**	**395.66667**	**379.41091**	**0.95891552**	**-33.67719**	**825.01053**	**61**	**543**	**583**	**522**	**61**	**583**			**ln(y) = 5.59205679015258 + 1.67409498915404*Z**
PCB-37 ng/kg	**3/3**	**71.366667**	**63.002253**	**0.882796637**	**0.0729055**	**142.66043**	**12.1**	**89**	**113**	**100.9**	**12.1**	**113**			**ln(y) = 3.90307654701573 + 1.65694034018859*Z**
PCB-58 ng/kg	**3/3**	**58.41**	**52.923347**	**0.906066555**	**-1.478405**	**118.29841**	**8.13**	**69.9**	**97.2**	**89.07**	**8.13**	**97.2**			**ln(y) = 3.63979909475529 + 1.84014369302008*Z**
PCB-60 ng/kg	**3/3**	**1206.6667**	**1253.1857**	**1.038551667**	**-211.4464**	**2624.7798**	**160**	**1080**	**2380**	**2220**	**160**	**2380**			**ln(y) = 6.6115819673392 + 2.00216956272704*Z**
PCB-61/70 ng/kg	**3/3**	**5829.3333**	**5336.6417**	**0.915480628**	**-209.6453**	**11868.312**	**758**	**6950**	**9780**	**9022**	**758**	**9780**			**ln(y) = 8.22175836241002 + 1.89665720306781*Z**
PCB-66 ng/kg	**3/3**	**5811**	**5497.398**	**0.946033045**	**-409.8915**	**12031.891**	**663**	**6370**	**10400**	**9737**	**663**	**10400**			**ln(y) = 8.16856360796051 + 2.04155327595957*Z**
PCB-77 ng/kg	**3/3**	**142.16667**	**136.42265**	**0.959596585**	**-12.21009**	**296.54343**	**13.5**	**160**	**253**	**239.5**	**13.5**	**253**			**ln(y) = 4.40375099646858 + 2.17349971188711*Z**
PCB-79 ng/kg	**3/3**	**263.13333**	**275.13756**	**1.045620335**	**-48.21413**	**574.4808**	**24.4**	**374**	**391**	**366.6**	**24.4**	**391**			**ln(y) = 5.02918216323302 + 2.05737845874229*Z**
PCB-80 ng/kg	**2/3**										**19.8**	**22.8**	**19.9**	**0**	
PCB-81 ng/kg	**3/3**	**121.76667**	**118.70921**	**0.974890826**	**-12.56545**	**256.09878**	**16.3**	**167**	**182**	**165.7**	**16.3**	**182**			**ln(y) = 4.37105520243542 + 1.78943966607728*Z**
Potassium MG/KG	**1/1**										**2840**	**2840**			
Selenium MG/KG	18/19	0.5205665	0.0956899	0.183818726	0.4775391	0.5635939	-2	-2	-2	0	0.24	0.64	2	2	ln(y) = -0.671847969592036 + 0.213424662221174*Z
Silver MG/KG	4/19										0.01	0.29	0.01	2	
Total HpCDD PG/G	**3/3**	**9.52**	**6.1877755**	**0.649976422**	**2.5178728**	**16.522127**	**5.93**	**7.43**	**15.2**	**9.27**	**5.93**	**15.2**			**ln(y) = 2.16894849986384 + 0.698076518098557*Z**
Total HpCDF PG/G	**3/3**	**13.776667**	**9.1930246**	**0.667289467**	**3.3737801**	**24.179553**	**5.23**	**14.5**	**21.6**	**16.37**	**5.23**	**21.6**			**ln(y) = 2.46708441406449 + 1.05184283784382*Z**
Total HxCDD PG/G	**3/3**	**4.8233333**	**3.0763984**	**0.637815844**	**1.3420608**	**8.3046059**	**1.91**	**5.59**	**6.97**	**5.06**	**1.91**	**6.97**			**ln(y) = 1.43656591799933 + 0.960051049347014*Z**
Total HxCDF PG/G	**3/3**	**16.733333**	**11.504519**	**0.687521082**	**3.714744**	**29.751923**	**5.8**	**19.1**	**25.3**	**19.5**	**5.8**	**25.3**			**ln(y) = 2.64611688277948 + 1.09238371748799*Z**
Total PeCDD PG/G	1/3										0.766	0.766	0.235	0.651	
Total PeCDF PG/G	**3/3**	**18.003333**	**13.572702**	**0.753899402**	**2.6443749**	**33.362292**	**5.21**	**21.7**	**27.1**	**21.89**	**5.21**	**27.1**			**ln(y) = 2.67580861473245 + 1.22291637033373*Z**
Total TCDD PG/G	2/3										0.977	3.29	0.0769	0.0769	
Total TCDF PG/G	**3/3**	**25.203333**	**22.137731**	**0.878365206**	**0.1521324**	**50.254534**	**4.61**	**32.1**	**38.9**	**34.29**	**4.61**	**38.9**			**ln(y) = 2.88602604592298 + 1.58172704582487*Z**
Zinc MG/KG	**19/19**	**15.278947**	**4.6743371**	**0.305933186**	**13.177109**	**17.380786**	**13.1**	**15.6**	**19.5**	**6.4**	**5.4**	**22.1**			**ln(y) = 2.66945907143373 + 0.388593250673242*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-33
Upper Calcasieu
Fish - Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	2/3										0.104	2.74	0.142	0.142	
1,2,3,4,7,8-HxCDF PG/G	**3/3**	**1.1423333**	**1.94836**	**1.705596718**	**-1.062444**	**3.3471102**	**0.161**	**0.396**	**2.87**	**2.709**	**0.161**	**2.87**			**ln(y) = -0.566126650651267 + 2.13639079352726*Z**
1,2,3,6,7,8-HxCDD PG/G	2/3										0.122	0.757	0.313	0.313	
1,2,3,6,7,8-HxCDF PG/G	2/3										0.557	6.17	0.0405	0.0405	
1,2,3,7,8-PeCDD PG/G	1/3										0.39	0.39	0.158	0.407	
1,2,3,7,8-PeCDF PG/G	**3/3**	**6.127**	**12.362426**	**2.017696403**	**-7.862402**	**20.116402**	**0.291**	**1.19**	**16.9**	**16.609**	**0.291**	**16.9**			**ln(y) = 0.58894497241394 + 3.01231909006923*Z**
2,3,4,6,7,8-HxCDF PG/G	2/3										0.238	0.445	0.0435	0.0435	
2,3,4,7,8-PeCDF PG/G	2/3										0.175	9.67	0.278	0.278	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**3.8161063**	**7.6593871**	**2.007120989**	**-4.851306**	**12.483519**	**0.27503**	**0.7208**	**10.4525**	**10.1775**	**0.2750342**	**10.4524861**			ln(y) = 0.242861488730065 + 2.69783332360733*Z
2,3,7,8-TCDD PG/G	1/3										0.245	0.245	0.0383	0.145	
2,3,7,8-TCDF PG/G	**3/3**	**10.755667**	**23.352045**	**2.171138812**	**-15.66966**	**37.180994**	**0.317**	**1.15**	**30.8**	**30.483**	**0.317**	**30.8**			**ln(y) = 0.80614104241661 + 3.39397946605188*Z**
2-Methylphenol ug/Kg	2/21										110	360	50	2000	
Acetophenone ug/Kg	3/21										39	45	50	2000	
Antimony MG/KG	3/21										0.03	0.03	0.03	6.5	
Aroclor-1254 ug/Kg	16/21	87.440042	315.32938	3.606235495	-47.42856	222.30865	12	28	66	54	14	1100	10	10	ln(y) = 3.24715362830667 + 1.54380910639711*Z
Aroclor-1260 ug/Kg	13/21	50.753333	211.19484	4.161201517	-39.57619	141.08286	4.18917	12.4013	36.712	32.5229	11	710	10	83	ln(y) = 2.51780339694413 + 1.60978781019112*Z
Arsenic MG/KG	**21/21**	**0.3490476**	**0.3365598**	**0.964223222**	**0.2050986**	**0.4929966**	**0.195**	**0.28**	**0.385**	**0.19**	**0.13**	**1.5**			**ln(y) = -1.23577981122283 + 0.596616655417705*Z**
Benzaldehyde ug/Kg	2/21										160	1000	50	2000	
beta-BHC ug/Kg	3/21										10	38	10	1.7	
bis(2-Ethylhexyl)phthalate ug/Kg	2/21										290	7000	50	2000	
Cadmium MG/KG	4/21										0.003	0.005	0.003	0.003	
Chromium MG/KG	**21/21**	**0.1980952**	**0.1231043**	**0.62144015**	**0.1454426**	**0.2507478**	**0.11**	**0.16**	**0.265**	**0.155**	**0.08**	**0.49**			**ln(y) = -1.76961971771483 + 0.58766178282485*Z**
Copper MG/KG	**21/21**	**0.7180952**	**1.0120464**	**1.409348369**	**0.2852359**	**1.1509546**	**0.385**	**0.53**	**0.715**	**0.33**	**0.24**	**4.1**			**ln(y) = -0.56876789114777 + 0.58662242116748*Z**
Diethyl Phthalate ug/Kg	13/21	38.208897	11.154663	0.291938886	33.437969	42.979825	29.7842	-50	-50	-79.784	25	62	50	50	ln(y) = 3.60072073354145 + 0.30665138815261*Z
Hexachloro-1,3-butadiene ug/Kg	2/21										37	50	50	50	
Iron MG/KG	**21/21**	**7.3380952**	**3.7956249**	**0.517249331**	**5.7146797**	**8.9615108**	**4.45**	**6.4**	**8.75**	**4.3**	**2.8**	**16.2**			**ln(y) = 1.88302230303333 + 0.525102026675549*Z**
Lead MG/KG	8/21	0.0374971	0.0328411	0.875828709	0.0234508	0.0515435	0.01421	0.02663	0.055	0.04079	0.04	0.12	0.04	0.04	ln(y) = -3.62555725004657 + 0.931816679090937*Z
Mercury MG/KG	**21/21**	**0.1129524**	**0.0634309**	**0.561572026**	**0.0858225**	**0.1400822**	**0.0725**	**0.108**	**0.133**	**0.0605**	**0.016**	**0.3**			**ln(y) = -2.3240492855521 + 0.616633421357685*Z**
Nickel MG/KG	18/21	0.0898876	0.1445577	1.608206278	0.0280592	0.1517159	0.04	0.06	0.105	0.065	0.03	0.58	0.03	0.03	ln(y) = -2.8122236640582 + 0.898881891057012*Z
PCB-105 ng/kg	**3/3**	**4890.6667**	**8420.5179**	**1.721752573**	**-4638.046**	**14419.38**	**322**	**1850**	**12500**	**12178**	**322**	**12500**			**ln(y) = 7.57699212896906 + 2.71358003297925*Z**
PCB-108 ng/kg	**3/3**	**1978.3333**	**3536.4502**	**1.787590682**	**-2023.537**	**5980.2035**	**140**	**655**	**5140**	**5000**	**140**	**5140**			**ln(y) = 6.65702867223126 + 2.672221875013*Z**
PCB-114 ng/kg	**3/3**	**368.33333**	**696.108**	**1.889885981**	**-419.387**	**1156.0537**	**19**	**101**	**985**	**966**	**19**	**985**			**ln(y) = 4.81740037905993 + 2.92811202932754*Z**
PCB-118 ng/kg	**3/3**	**19916.667**	**33957.702**	**1.704989233**	**-18510.09**	**58343.424**	**1500**	**7650**	**50600**	**49100**	**1500**	**50600**			**ln(y) = 9.02912938972881 + 2.60942090224058*Z**
PCB-126 ng/kg	**3/3**	**152.61**	**288.42962**	**1.889978503**	**-173.7788**	**478.99884**	**8.13**	**41.7**	**408**	**399.87**	**8.13**	**408**			**ln(y) = 3.94577640892288 + 2.90401166250828*Z**
PCB-127 ng/kg	1/3										33.2	33.2	9.7	0	
PCB-15 ng/kg	1/3										93.5	93.5	9.7	0	
PCB-156 ng/kg	**3/3**	**2054.6667**	**3267.3234**	**1.590196355**	**-1642.658**	**5751.9912**	**170**	**944**	**5050**	**4880**	**170**	**5050**			**ln(y) = 6.83768937515506 + 2.51512882942704*Z**
PCB-157 ng/kg	**3/3**	**647.33333**	**1125.304**	**1.738368698**	**-626.068**	**1920.7347**	**47**	**235**	**1660**	**1613**	**47**	**1660**			**ln(y) = 5.57476866573494 + 2.6434905784833*Z**
PCB-162 ng/kg	**3/3**	**3910.3333**	**6544.6273**	**1.673675039**	**-3495.61**	**11316.276**	**321**	**1570**	**9840**	**9519**	**321**	**9840**			**ln(y) = 7.44149433717289 + 2.53843444192558*Z**
PCB-167 ng/kg	**3/3**	**1718.3333**	**3101.0392**	**1.804678493**	**-1790.823**	**5227.4895**	**108**	**557**	**4490**	**4382**	**108**	**4490**			**ln(y) = 6.47143481592927 + 2.76441471110955*Z**
PCB-189 ng/kg	**3/3**	**201.56667**	**297.81835**	**1.477517857**	**-135.4465**	**538.57985**	**25.7**	**103**	**476**	**450.3**	**25.7**	**476**			**ln(y) = 4.68221261145408 + 2.1647685263387*Z**
PCB-37 ng/kg	1/3										143	143	11.2	0	
PCB-58 ng/kg	**3/3**	**54.463333**	**102.64532**	**1.884668418**	**-61.69079**	**170.61745**	**3.79**	**14.6**	**145**	**141.21**	**3.79**	**145**			**ln(y) = 2.99670709674307 + 2.70277842438406*Z**
PCB-60 ng/kg	**3/3**	**985.06667**	**1903.5258**	**1.932382696**	**-1168.976**	**3139.1089**	**74.2**	**231**	**2650**	**2575.8**	**74.2**	**2650**			**ln(y) = 5.87716559322513 + 2.65174159329918*Z**
PCB-61/70 ng/kg	**3/3**	**4775.6667**	**9449.4826**	**1.978672982**	**-5917.43**	**15468.763**	**335**	**992**	**13000**	**12665**	**335**	**13000**			**ln(y) = 7.39551942518454 + 2.71331432629095*Z**
PCB-66 ng/kg	**3/3**	**6658.3333**	**11996.801**	**1.801772377**	**-6917.325**	**20233.992**	**385**	**2190**	**17400**	**17015**	**385**	**17400**			**ln(y) = 7.80304188076698 + 2.82634495615725*Z**
PCB-77 ng/kg	**3/3**	**232**	**470.15547**	**2.026532218**	**-300.031**	**764.031**	**13.4**	**42.6**	**640**	**626.6**	**13.4**	**640**			**ln(y) = 4.2695257121953 + 2.867306249659*Z**

Table H-33
Upper Calcasieu
Fish - Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-79 ng/kg	**3/3**	**161.26667**	**237.6282**	**1.473510981**	**-107.635**	**430.16829**	**18.6**	**84.2**	**381**	**362.4**	**18.6**	**381**			**ln(y) = 4.43305195903138 + 2.23945894041955*Z**
PCB-80 ng/kg	2/3										6.07	45.8	9.98	0	
PCB-81 ng/kg	**3/3**	**182.53333**	**359.14869**	**1.967578658**	**-223.8817**	**588.94834**	**10**	**40.6**	**497**	**487**	**10**	**497**			**ln(y) = 4.07164772856612 + 2.8968168582867*Z**
Selenium MG/KG	**21/21**	**0.5885714**	**0.1822422**	**0.309634869**	**0.5106251**	**0.6665177**	**0.475**	**0.63**	**0.7**	**0.225**	**0.15**	**1**			**ln(y) = -0.587897659932883 + 0.383124363157352*Z**
Silver MG/KG	1/21										0.02	0.02	0.01	0.01	
Total HpCDD PG/G	1/3										1.42	1.42	0.375	0.474	
Total HpCDF PG/G	2/3										0.104	2.74	0.184	0.184	
Total HxCDD PG/G	2/3										0.122	0.757	0.277	0.277	
Total HxCDF PG/G	**3/3**	**24.858333**	**51.464305**	**2.07030393**	**-33.37901**	**83.095677**	**0.575**	**4.3**	**69.7**	**69.125**	**0.575**	**69.7**			**ln(y) = 1.7164767007604 + 3.55804126097539*Z**
Total PeCDD PG/G	1/3										0.39	0.39	0.158	0.407	
Total PeCDF PG/G	**3/3**	**20.63**	**41.667954**	**2.0197748**	**-26.52173**	**67.781729**	**1.04**	**3.95**	**56.9**	**55.86**	**1.04**	**56.9**			**ln(y) = 1.8180772110662 + 2.96806518399412*Z**
Total TCDD PG/G	1/3										0.318	0.318	0.0383	0.145	
Total TCDF PG/G	**3/3**	**20.423333**	**41.528552**	**2.033387544**	**-26.57065**	**67.417313**	**1.04**	**3.73**	**56.5**	**55.46**	**1.04**	**56.5**			**ln(y) = 1.79662319498713 + 2.96283319302832*Z**
Zinc MG/KG	**21/21**	**8.5904762**	**4.2433507**	**0.493959888**	**6.7755651**	**10.405387**	**5.7**	**6.6**	**10.8**	**5.1**	**4.5**	**21**			**ln(y) = 2.06124965656546 + 0.454067910141469*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-34
Upper Calcasieu
Fish - Fillet - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
4,4'-DDE ug/Kg	1/2										1.4	1.4	6	1.7	
Aldrin ug/Kg	1/2										2.5	2.5	6	1.7	
alpha-Chlordane ug/Kg	1/2										1.2	1.2	6	1.7	
Aluminum (Fume Or Dust) MG/KG	1/2										5	5	4.4	6.5	
Arsenic MG/KG	1/2										0.76	0.76	0.83	6.5	
Barium MG/KG	1/2										0.77	0.77	1	6.5	
beta-BHC ug/Kg	**1/1**										**5.1**	**5.1**			
Calcium Metal MG/KG	**2/2**										**4180**	**4380**			
Copper MG/KG	1/2										0.55	0.55	0.54	6.5	
Dieldrin ug/Kg	**2/2**										**1.2**	**1.4**			
Heptachlor Epoxide ug/Kg	1/2										0.7	0.7	22	1.7	
Iron MG/KG	1/2										4.4	4.4	5.2	6.5	
Magnesium MG/KG	**2/2**										**313**	**349**			
Manganese MG/KG	1/2										1.1	1.1	1.4	6.5	
Mercury MG/KG	1/2										0.043	0.043	0.037	6.5	
Potassium MG/KG	**2/2**										**3650**	**4100**			
Selenium MG/KG	1/2										1.3	1.3	1.5	6.5	
Zinc MG/KG	**2/2**										**6.6**	**7.3**			

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-35
Upper Calcasieu
Fish - Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,7,8-HxCDF PG/G	**1/3**										**0.781**	**0.781**	**0.385**	**0.493**	
1,2,3,6,7,8-HxCDF PG/G	**2/3**										**1.05**	**1.13**	**0.399**	**0.399**	
1,2,3,7,8-PeCDF PG/G	**2/3**										**1.33**	**2.4**	**0.706**	**0.706**	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**100.0%**	**0.793844**	**0.230083888**	**0.2898352**	**0.5334795**	**1.05421**	**0.67829**	**0.70553**	**0.99771**	**0.3194196**	**0.6782914**	**0.997711**		
2,3,7,8-TCDF PG/G	**3/3**	**1.01**	**0.3069427**	**0.303903637**	**0.6626617**	**1.3573383**	**0.74**	**1.13**	**1.16**	**0.42**	**0.74**	**1.16**			ln(y) = -1.01558183137998E-02 + 0.333382037178256*Z
4,4'-DDD ug/Kg	3/25										0.69	2.6	6	1.7	
4,4'-DDE ug/Kg	4/25										1.9	10	10	1.7	
4,4'-DDT ug/Kg	2/25										2.1	3.9	6	1.7	
Aldrin ug/Kg	1/25										2.3	2.3	6	1.7	
alpha-BHC ug/Kg	2/25										1.6	6	6	1.7	
alpha-Chlordane ug/Kg	4/25										0.95	12	10	1.7	
Antimony MG/KG	3/25										0.02	0.03	0.02	9.5	
Aroclor-1254 ug/Kg	1/25										24	24	10	0	
Arsenic MG/KG	21/25	0.2668017	0.1268419	0.475416193	0.2170797	0.3165238	0.18752	0.24673	0.32464	0.13712	0.13	0.69	0.43	1	ln(y) = -1.39945432257638 + 0.407039558884571*Z
Benzaldehyde ug/Kg	14/21	35.114649	16.460582	0.468766814	28.074342	42.154957	24.4714	-40	-40	-64.471	21	84	40	40	ln(y) = 3.47568906973608 + 0.412617516112031*Z
Calcium Metal MG/KG	**4/4**	**3891.25**	**4088.7984**	**1.050767344**	**-115.7725**	**7898.2725**	**552.75**	**3246**	**7875**	**7322.25**	**473**	**8600**			**ln(y) = 7.63534892909265 + 1.9039443633451*Z**
Caprolactam ug/Kg	2/21										130	180	40	40	
Chromium MG/KG	2/25										0.1	1	0.09	1	
Copper MG/KG	21/25	0.2664663	0.0761852	0.285909397	0.2366017	0.2963309	0.2122	0.25691	0.31103	0.09884	0.17	0.49	0.33	0.62	ln(y) = -1.35904847477695 + 0.283591430276721*Z
delta-BHC ug/Kg	2/23										1.1	1.5	10	1.7	
Dieldrin ug/Kg	4/25										1.3	9.2	10	1.7	
Diethyl Phthalate ug/Kg	8/25	31.179125	11.477787	0.368124088	26.679833	35.678418	22.2808	29.2469	38.3909	16.1101	24	58	40	4000	ln(y) = 3.37577407887059 + 0.403517816237831*Z
Di-n-butylphthalate ug/Kg	19/25	235.69267	163.98067	0.695739375	171.41224	299.97309	106.274	187.523	330.888	224.614	68	610	40	2000	ln(y) = 5.2338991777272 + 0.842314765775201*Z
Endrin Aldehyde ug/Kg	2/25										2.5	2.7	6	1.7	
Endrin ug/Kg	2/25										1.8	4.6	6	1.7	
Heptachlor ug/Kg	1/25										3.6	3.6	6	1.7	
Iron MG/KG	18/25	3.5990961	1.9505846	0.541965133	2.834467	4.3637253	2.30263	3.20888	4.47181	2.16919	2.5	9.6	1.5	6.6	ln(y) = 1.1659221259882 + 0.492253168857077*Z
Lead MG/KG	14/25	0.0868043	0.1981714	2.282967533	0.0091211	0.1644875	0.02357	0.04804	0.0979	0.07432	0.02	0.8	0.02	0.8	ln(y) = -3.03569303355417 + 1.05590922802474*Z
Magnesium MG/KG	3/4	319.79181	41.792331	0.130686057	278.83533	360.74829	281.5	322.5	356.75	75.25	313	365	271	271	ln(y) = 5.76541956682712 + 0.147845441379031*Z
Manganese MG/KG	1/4										2.6	2.6	0.23	271	
Mercury MG/KG	21/25	0.1059709	0.0474081	0.447369146	0.0873869	0.1245548	0.07467	0.09801	0.12864	0.05397	0.043	0.26	0.029	0.11	ln(y) = -2.32270955726748 + 0.403400986915846*Z
PCB-105 ng/kg	**3/3**	**1041.6667**	**744.08489**	**0.714321491**	**199.65535**	**1883.678**	**425**	**960**	**1740**	**1315**	**425**	**1740**			**ln(y) = 6.79355428186496 + 1.04536779040493*Z**
PCB-108 ng/kg	**3/3**	**418.33333**	**326.11576**	**0.779559588**	**49.298609**	**787.36806**	**150**	**380**	**725**	**575**	**150**	**725**			**ln(y) = 5.84565940055712 + 1.16846762071634*Z**
PCB-114 ng/kg	**3/3**	**70.6**	**47.905763**	**0.678551879**	**16.389526**	**124.81047**	**36.9**	**58.9**	**116**	**79.1**	**36.9**	**116**			**ln(y) = 4.14588094427013 + 0.849449043325062*Z**
PCB-118 ng/kg	**3/3**	**4166.6667**	**3041.7553**	**0.730021278**	**724.59649**	**7608.7368**	**1590**	**3910**	**7000**	**5410**	**1590**	**7000**			**ln(y) = 8.16548245874371 + 1.09922872142967*Z**
PCB-126 ng/kg	**3/3**	**28.066667**	**16.724061**	**0.595869168**	**9.1416097**	**46.991724**	**12.9**	**28.4**	**42.9**	**30**	**12.9**	**42.9**			**ln(y) = 3.22082942748959 + 0.891177596311577*Z**
PCB-15 ng/kg	**3/3**	**19.166667**	**15.054519**	**0.785453176**	**2.1308745**	**36.202459**	**12.6**	**12.9**	**32**	**19.4**	**12.6**	**32**			**ln(y) = 2.85222000937493 + 0.691229681319408*Z**
PCB-156 ng/kg	**3/3**	**512.33333**	**373.55324**	**0.729121489**	**89.618045**	**935.04862**	**203**	**471**	**863**	**660**	**203**	**863**			**ln(y) = 6.07615958804721 + 1.07329577568445*Z**
PCB-157 ng/kg	**3/3**	**136.06667**	**105.91205**	**0.77838348**	**16.215905**	**255.91743**	**50.2**	**122**	**236**	**185.8**	**50.2**	**236**			**ln(y) = 4.72795595881885 + 1.14790990123964*Z**
PCB-162 ng/kg	**3/3**	**973.33333**	**664.55646**	**0.682763485**	**221.31691**	**1725.3498**	**389**	**951**	**1580**	**1191**	**389**	**1580**			**ln(y) = 6.72875784406162 + 1.03947149186689*Z**
PCB-167 ng/kg	**3/3**	**328**	**244.28435**	**0.74476935**	**51.566238**	**604.43376**	**128**	**298**	**558**	**430**	**128**	**558**			**ln(y) = 5.62449423760211 + 1.09192555249933*Z**
PCB-169 ng/kg	**3/3**	**3.3033333**	**2.2240487**	**0.673274081**	**0.7865853**	**5.8200814**	**1.26**	**3.41**	**5.24**	**3.98**	**1.26**	**5.24**			**ln(y) = 1.03804850353059 + 1.05698066960704*Z**
PCB-189 ng/kg	**3/3**	**79.766667**	**57.701218**	**0.723375074**	**14.471591**	**145.06174**	**32.2**	**73.1**	**134**	**101.8**	**32.2**	**134**			**ln(y) = 4.22054487308567 + 1.05747279413974*Z**
PCB-37 ng/kg	1/3										28.2	28.2	22.1	0	
PCB-58 ng/kg	**3/3**	**17.733333**	**7.9669193**	**0.449262368**	**8.7179154**	**26.748751**	**11.1**	**16.9**	**25.2**	**14.1**	**11.1**	**25.2**			**ln(y) = 2.82036757492156 + 0.60806295852408*Z**
PCB-60 ng/kg	**3/3**	**279.33333**	**150.06258**	**0.537216867**	**109.52154**	**449.14513**	**158**	**259**	**421**	**263**	**158**	**421**			**ln(y) = 5.55401864280296 + 0.72682704485009*Z**
PCB-61/70 ng/kg	**3/3**	**1358.3333**	**902.94302**	**0.664743328**	**336.55712**	**2380.1095**	**625**	**1240**	**2210**	**1585**	**625**	**2210**			**ln(y) = 7.08712203428243 + 0.936677906658546*Z**

CDM

Table H-35
Upper Calcasieu
Fish - Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-66 ng/kg	**3/3**	**1336**	**976.36439**	**0.730811668**	**231.13968**	**2440.8603**	**558**	**1190**	**2260**	**1702**	**558**	**2260**			**ln(y) = 7.04306254691774 + 1.03736551570317*Z**
PCB-77 ng/kg	**3/3**	**70.733333**	**47.384501**	**0.669903401**	**17.112723**	**124.35394**	**30.9**	**66.3**	**115**	**84.1**	**30.9**	**115**			**ln(y) = 4.12329273648626 + 0.974634465615328*Z**
PCB-79 ng/kg	**3/3**	**48.033333**	**39.331336**	**0.818834206**	**3.5257364**	**92.54093**	**15.3**	**43.9**	**84.9**	**69.6**	**15.3**	**84.9**			**ln(y) = 3.65041374726561 + 1.27087575513958*Z**
PCB-80 ng/kg	1/3										3.25	3.25	4.78	0	
PCB-81 ng/kg	**3/3**	**39.133333**	**31.203881**	**0.797373452**	**3.8228178**	**74.443849**	**14.5**	**34.2**	**68.7**	**54.2**	**14.5**	**68.7**			**ln(y) = 3.4787078309078 + 1.15368259247088*Z**
Potassium MG/KG	**4/4**	**3522.5**	**478.73378**	**0.13590739**	**3053.3409**	**3991.6591**	**3100**	**3525**	**3942.5**	**842.5**	**2990**	**4050**			**ln(y) = 8.16101141786628 + 0.174198552137592*Z**
Selenium MG/KG	21/25	0.9018476	0.161772	0.179378378	0.838433	0.9652622	0.78518	0.88714	1.00235	0.21717	0.65	1.3	0.7	1.3	ln(y) = -0.119751265570069 + 0.181097340236338*Z
Total HpCDF PG/G	**2/3**										**1.48**	**1.59**	**0.816**	**0.816**	
Total HxCDF PG/G	**3/3**	**3.4613333**	**3.3713622**	**0.974006789**	**-0.353722**	**7.2763888**	**0.834**	**2.89**	**6.66**	**5.826**	**0.834**	**6.66**			ln(y) = 0.925284703351083 + 1.54084457741503*Z
Total PeCDF PG/G	**2/3**										**4.18**	**6.17**	**0.709**	**0.709**	
Total TCDF PG/G	**3/3**	**3.0933333**	**2.1886106**	**0.707524976**	**0.6166873**	**5.5699794**	**1.12**	**3.89**	**4.27**	**3.15**	**1.12**	**4.27**			ln(y) = 0.974450556725964 + 0.992514609362846*Z
Zinc MG/KG	24/25	3.9511552	1.8975323	0.480247472	3.2073225	4.6949878	-6.5	-6.5	-6.5	0	2.7	9.4	6.5	6.5	ln(y) = 1.29742801254078 + 0.336655071020791*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-36
Upper Calcasieu
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/22										1.2	1.2	10	1.7	
1,2,3,4,6,7,8-HpCDD PG/G	1/1										11	11			
1,2,3,4,6,7,8-HpCDF PG/G	1/1										4.6	4.6			
1,2,3,4,7,8-HxCDF PG/G	1/1										3.9	3.9			
1,2-Benzphenanthracene ug/Kg	10/22	3.3805268	1.3251642	0.391999323	2.8267759	3.9342776	2.29566	3.16984	4.3769	2.08124	1.9	5.7	80	2000	ln(y) = 1.15368088567199 + 0.478589738273348*Z
1-Methylnaphthalene ug/Kg	7/10	0.2653313	0.03828	0.144272387	0.2416051	0.2890575	0.23285	-1.7	-1.7	-1.9328	0.21	0.31	1.7	1.7	ln(y) = -1.3351251273603 + 0.181326583220421*Z
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**2.26285**	**2.26285**			
2,3,7,8-TCDF PG/G	1/1										4.3	4.3			
2-Methylnaphthalene ug/Kg	10/19	0.4724578	0.050216	0.106286759	0.4498779	0.4950376	0.43199	0.47045	0.51233	0.08034	0.39	0.58	80	2000	ln(y) = -0.754063576520576 + 0.126496820770223*Z
4,4'-DDD ug/Kg	1/22										1.2	1.2	5	1.7	
4,4'-DDE ug/Kg	3/22										1.8	2.7	5	1.7	
4,4'-DDT ug/Kg	1/22										1.5	1.5	5	1.7	
4-Methylphenol ug/Kg	3/19										65	470	80	400	
Acenaphthene ug/Kg	1/21										0.33	0.33	1.7	2000	
Acenaphthylene ug/Kg	5/21	0.4198356	0.0711415	0.169450936	0.3894078	0.4502633	0.35666	0.41506	0.48302	0.12636	0.34	0.51	1.7	2000	ln(y) = -0.879333278986784 + 0.224913277405129*Z
alpha-BHC ug/Kg	1/22										1.6	1.6	2.5	1.7	
alpha-Chlordane ug/Kg	1/22										1.6	1.6	2.5	1.7	
Aluminum (Fume Or Dust) MG/KG	5/11	47.469893	20.311727	0.427886513	35.46643	59.473357	30.8448	43.2358	60.6045	29.7597	51.5	89	21	44	ln(y) = 3.76666938755222 + 0.50089784472878*Z
Anthracene ug/Kg	10/22	1.1669082	0.9361948	0.802286575	0.7756973	1.5581191	0.44715	0.87731	1.72129	1.27413	0.35	2.9	80	2000	ln(y) = -0.130892281547467 + 0.999666754480825*Z
Aroclor-1254 ug/Kg	2/22										23	35	10	0	
Aroclor-1260 ug/Kg	1/22										25	25	10	0	
Arsenic MG/KG	12/22	0.296241	0.1112325	0.37547992	0.2497598	0.3427221	0.21359	0.28351	0.37632	0.16273	0.18	0.63	0.85	0.97	ln(y) = -1.26049921215561 + 0.420048373020242*Z
Barium MG/KG	11/11	2.3	0.7213613	0.31363535	1.8737027	2.7262973	1.8	2.1	2.5	0.7	1.6	3.9			ln(y) = 0.798504338560335 + 0.303053152838105*Z
Benzaldehyde ug/Kg	11/11	131.45455	86.691419	0.65947829	80.223191	182.6859	74	130	180	106	31	320			ln(y) = 4.68731333255827 + 0.789863633224269*Z
Benzo(a)anthracene ug/Kg	10/22	1.6454422	0.7353459	0.446898673	1.3381607	1.9527237	1.03971	1.50945	2.19142	1.1517	0.82	2.8	80	2000	ln(y) = 0.411746954287935 + 0.552963158493061*Z
Benzo(a)pyrene ug/Kg	10/12	1.0658802	0.1678883	0.157511422	0.9708885	1.160872	0.92987	1.05528	1.19761	0.26774	0.84	1.4	200	2000	ln(y) = 5.38073822062811E-02 + 0.18765814077071*Z
Benzo(b)fluoranthene ug/Kg	10/12	1.4778381	0.4355481	0.294719735	1.2314036	1.7242726	1.11757	1.42203	1.80943	0.69185	0.99	2.2	200	2000	ln(y) = 0.352084473919005 + 0.357355275956394*Z
Benzo(g,h,i)perylene ug/Kg	10/12	1.2482862	0.163684	0.131127002	1.1556732	1.3408991	1.11414	1.23972	1.37945	0.26531	1	1.6	200	2000	ln(y) = 0.214883213246598 + 0.158415555393813*Z
Benzo(k)fluoranthene ug/Kg	10/12	1.1037432	0.5671463	0.513839048	0.7828499	1.4246364	0.63496	0.98246	1.52013	0.88516	0.5	2.1	200	2000	ln(y) = -1.76967180929491E-02 + 0.647431631261492*Z
Benzyl Butyl Phthalate ug/Kg	3/22										140	150	80	0	
beta-BHC ug/Kg	1/22										1.2	1.2	2.5	1.7	
Cadmium MG/KG	11/22	0.0242134	0.0054533	0.22521637	0.0219346	0.0264922	0.02004	0.02379	0.02825	0.00821	0.02	0.04	0.043	0.5	ln(y) = -3.73842823225683 + 0.25458284816545*Z
Calcium Metal MG/KG	3/11	345.76755	45.314104	0.131053665	318.98862	372.54647	301.496	339.819	383.013	81.5167	390	440	260	330	ln(y) = 5.82841366392695 + 0.177480630484231*Z
Chromium MG/KG	10/22	0.1175873	0.0359046	0.305344514	0.1025837	0.1325909	0.09122	0.11268	0.13919	0.04797	0.091	0.22	0.09	1	ln(y) = -2.18318298602889 + 0.313374234872624*Z
Cobalt MG/KG	10/11	0.2266269	0.052612	0.2321525	0.1955352	0.2577186	-1	-1	-1	0	0.18	0.35	1	1	ln(y) = -1.50104927987971 + 0.214995335803425*Z
Copper MG/KG	12/22	1.3571797	0.7309794	0.538601801	1.0517229	1.6626366	0.80727	1.18899	1.7512	0.94393	0.86	2.9	0.8	4	ln(y) = 0.173104561853068 + 0.574314760696696*Z
Dibenzo(a,h)anthracene ug/Kg	6/12	0.3914664	0.0764669	0.195334512	0.3482012	0.4347316	0.33678	0.38744	0.44572	0.10894	0.34	0.55	1.7	2000	ln(y) = -0.948192201022336 + 0.20784627825829*Z
Dieldrin ug/Kg	1/22										1.8	1.8	5	1.7	
Diethyl Phthalate ug/Kg	1/21										24	24	80	0	
Endosulfan I ug/Kg	1/22										1	1	2.5	1.7	
Endosulfan II ug/Kg	1/22										1.5	1.5	5	1.7	
Endrin Ketone ug/Kg	1/22										1.2	1.2	5	1.7	
Fluoranthene ug/Kg	10/22	5.4449821	4.153563	0.762823995	3.7093186	7.1806455	2.27437	4.26987	8.0162	5.74182	1.7	14	80	2000	ln(y) = 1.45158428977007 + 0.934277427597627*Z
Fluorene ug/Kg	5/21	0.4238683	0.0417002	0.098380085	0.4060329	0.4417038	0.3886	0.42238	0.45909	0.0705	0.36	0.46	1.7	2000	ln(y) = -0.861853280920473 + 0.123636354749306*Z
gamma-BHC (Lindane) ug/Kg	1/22										1.9	1.9	2.5	1.7	
Heptachlor Epoxide ug/Kg	1/22										1.1	1.1	2.5	1.7	

Table H-36
Upper Calcasieu
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Heptachlor ug/Kg	1/22										0.87	0.87	2.5	1.7	
Indeno(1,2,3-cd)pyrene ug/Kg	10/12	0.4676969	0.1140565	0.243868518	0.4031633	0.5322304	0.37418	0.45618	0.55615	0.18197	0.34	0.68	200	2000	ln(y) = -0.784865080348297 + 0.293911514384099*Z
Iron MG/KG	22/22	56.195455	19.420389	0.345586474	48.08019	64.310719	44.275	54.6	66.525	22.25	25	104			ln(y) = 3.97410734179272 + 0.376213237595703*Z
Lead MG/KG	7/22	0.1604395	0.0450976	0.281088021	0.1415944	0.1792846	0.11918	0.15527	0.2023	0.08312	0.14	0.25	0.12	0.8	ln(y) = -1.86257291941663 + 0.392429726387329*Z
Magnesium MG/KG	1/11										306	306	110	0.8	
Manganese MG/KG	11/11	1.6272727	0.4865857	0.299019142	1.339719	1.9148265	1.3	1.5	2	0.7	1.1	2.5			ln(y) = 0.451390692656452 + 0.315105000217933*Z
Mercury MG/KG	20/22	0.0193775	0.0148611	0.766927004	0.0131674	0.0255875	0.00736	0.01405	0.02681	0.01944	0.002	0.056	0.003	0.014	ln(y) = -4.26519272319632 + 0.958325539303066*Z
Mercury ng/g	10/10	32.8	14.639374	0.446322382	23.726422	41.873578	23.6	31.25	39.2	15.6	14.4	62.2			ln(y) = 3.40741375930646 + 0.513712677951589*Z
Methyl Mercury MG/KG	11/11	0.0048909	0.001052	0.2150908	0.0042692	0.0055126	0.0041	0.0047	0.0054	0.0013	0.0038	0.0068			ln(y) = -5.33958417313587 + 0.234109861643018*Z
Methyl Mercury ng/g	10/10	10.262	3.6417869	0.35488081	8.0047971	12.519203	7.5475	8.88	14.475	6.9275	6.84	16.4			ln(y) = 2.27816841274992 + 0.373250408769644*Z
Naphthalene ug/Kg	10/19	0.4215546	0.0420411	0.099728827	0.4026506	0.4404586	0.38635	0.41987	0.45629	0.06994	0.37	0.49	80	2000	ln(y) = -0.867817045261584 + 0.123399632741185*Z
Nickel MG/KG	22/22	0.8218182	0.2523379	0.307048359	0.7163729	0.9272635	0.6175	0.83	0.995	0.3775	0.37	1.2			ln(y) = -0.246708986921267 + 0.366025161215735*Z
Nitrobenzene ug/Kg	1/19										260	260	80	0	
OCDD PG/G	1/1										140	140			
OCDF PG/G	1/1										11	11			
Phenanthrene ug/Kg	10/21	1.8480717	0.8256621	0.446769536	1.4949302	2.2012132	1.1921	1.70757	2.44594	1.25384	1	3.5	80	2000	ln(y) = 0.535072338562778 + 0.533019479975289*Z
Potassium MG/KG	1/11										736	736	150	250	
Pyrene ug/Kg	10/22	7.1071931	3.4925155	0.491405749	5.6477637	8.5666224	4.28043	6.42058	9.63076	5.35034	3.4	13	80	2000	ln(y) = 1.85950775516726 + 0.601396307005782*Z
Selenium MG/KG	8/22	0.2639671	0.1416415	0.536587839	0.2047789	0.3231554	0.15815	0.23917	0.36171	0.20357	0.22	0.66	0.15	0.97	ln(y) = -1.43056594702825 + 0.61357736248347*Z
Silver MG/KG	4/22										0.07	0.12	0.02	0.97	
Sodium MG/KG	1/11										1590	1590	300	0.97	
Total HpCDD PG/G	1/1										26	26			
Total HpCDF PG/G	1/1										7.4	7.4			
Total HxCDD PG/G	1/1										11	11			
Total HxCDF PG/G	1/1										11	11			
Total PeCDF PG/G	1/1										22	22			
Total TCDD PG/G	1/1										4.5	4.5			
Total TCDF PG/G	1/1										35	35			
Vanadium (Fume Or Dust) MG/KG	10/11	0.1173059	0.0455079	0.387941566	0.0904125	0.1441994	-1	-1	-1	0	0.07	0.22	1	1	ln(y) = -2.19493889008392 + 0.408886700515413*Z
Zinc MG/KG	12/22	6.0807779	1.7414759	0.286390312	5.3530614	6.8084943	4.86033	5.84088	7.01925	2.15891	4.9	11.5	5.1	9.5	ln(y) = 1.7648815052907 + 0.272585664530305*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-37
Upper Calcasieu
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2-Benzphenanthracene ug/Kg	**3/3**										**4.5**	**10**			
1-Methylnaphthalene ug/Kg	**3/3**	**0.4133333**	**0.1236881**	**0.299245383**	**0.2733671**	**0.5532996**	**0.33**	**0.38**	**0.53**	**0.2**	**0.33**	**0.53**			**ln(y) = -0.903708307739762 + 0.351373467729843*Z**
2-Methylnaphthalene ug/Kg	**3/3**	**1.1033333**	**0.328785**	**0.297992481**	**0.731278**	**1.4753886**	**0.81**	**1.1**	**1.4**	**0.59**	**0.81**	**1.4**			**ln(y) = 7.36871283699618E-02 + 0.405815842644476*Z**
Acenaphthene ug/Kg	2/3										0.35	1.6	1.7	0	
Acenaphthylene ug/Kg	2/3										0.66	0.76	1.7	0	
alpha-Chlordane ug/Kg	1/3										0.43	0.43	2.5	1.7	
Aluminum (Fume Or Dust) MG/KG	**3/3**	**176.66667**	**135.38866**	**0.766350885**	**23.459979**	**329.87335**	**50**	**190**	**290**	**240**	**50**	**290**			**ln(y) = 4.94297600018972 + 1.30368305653769*Z**
Anthracene ug/Kg	2/3										0.99	2.6	1.7	0	
Aroclor-1254 ug/Kg	1/3										20	20	50	0	
Aroclor-1260 ug/Kg	1/3										26	26	50	0	
Arsenic MG/KG	**3/3**	**0.8566667**	**0.0771847**	**0.090098834**	**0.769324**	**0.9440093**	**0.8**	**0.84**	**0.93**	**0.13**	**0.8**	**0.93**			**ln(y) = -0.156689210431274 + 0.111669596509445*Z**
Barium MG/KG	**3/3**	**75**	**28.495942**	**0.379945889**	**42.753806**	**107.24619**	**48**	**82**	**95**	**47**	**48**	**95**			**ln(y) = 4.27726571659089 + 0.506294035416225*Z**
Benzo(a)anthracene ug/Kg	**3/3**	**4.9666667**	**2.9943375**	**0.602886742**	**1.5782548**	**8.3550785**	**2.3**	**6.1**	**6.5**	**4.2**	**2.3**	**6.5**			**ln(y) = 1.50433335700532 + 0.770475963095267*Z**
Benzo(a)pyrene ug/Kg	**3/3**	**4.4666667**	**1.7861351**	**0.399880981**	**2.4454646**	**6.4878687**	**2.9**	**4.4**	**6.1**	**3.2**	**2.9**	**6.1**			**ln(y) = 1.45153468303197 + 0.551460999608406*Z**
Benzo(b)fluoranthene ug/Kg	**3/3**	**6.2666667**	**3.233788**	**0.516030005**	**2.607291**	**9.9260423**	**3.2**	**6.8**	**8.8**	**5.6**	**3.2**	**8.8**			**ln(y) = 1.7516083811573 + 0.750235246753964*Z**
Benzo(g,h,i)perylene ug/Kg	**3/3**	**4**	**1.3372583**	**0.334314575**	**2.4867498**	**5.5132502**	**2.8**	**4**	**5.2**	**2.4**	**2.8**	**5.2**			**ln(y) = 1.35485746796281 + 0.459099065557813*Z**
Benzo(k)fluoranthene ug/Kg	**3/3**	**5.2333333**	**3.7782277**	**0.72195434**	**0.9578662**	**9.5088005**	**1.7**	**5.6**	**8.4**	**6.7**	**1.7**	**8.4**			**ln(y) = 1.46054218488418 + 1.1848332759294*Z**
Cadmium MG/KG	2/3										0.06	0.089	0.3	0.3	
Calcium Metal MG/KG	**3/3**	**28666.667**	**2835.7892**	**0.09892288**	**25457.669**	**31875.664**	**26000**	**29000**	**31000**	**5000**	**26000**	**31000**			**ln(y) = 10.2608818031465 + 0.130446084056147*Z**
Cobalt MG/KG	**3/3**	**0.1233333**	**0.0247376**	**0.200575284**	**0.0953401**	**0.1513266**	**0.1**	**0.13**	**0.14**	**0.04**	**0.1**	**0.14**			**ln(y) = -2.10297292596448 + 0.249538457857386*Z**
Copper MG/KG	**3/3**	**25**	**4.2169905**	**0.168679621**	**20.228026**	**29.771974**	**22**	**24**	**29**	**7**	**22**	**29**			**ln(y) = 3.21213070456425 + 0.204878245747484*Z**
Dibenzo(a,h)anthracene ug/Kg	**3/3**	**1.3**	**0.5262446**	**0.404803516**	**0.7044982**	**1.8955018**	**0.9**	**1.2**	**1.8**	**0.9**	**0.9**	**1.8**			**ln(y) = 0.221582568679416 + 0.514059882747007*Z**
Dieldrin ug/Kg	1/3										1.2	1.2	5	1.7	
Fluoranthene ug/Kg	**3/3**	**8.5333333**	**6.9266774**	**0.811720014**	**0.6950599**	**16.371607**	**2.7**	**7.9**	**15**	**12.3**	**2.7**	**15**			**ln(y) = 1.92272157786182 + 1.27174877659832*Z**
Fluorene ug/Kg	2/3										0.42	0.75	1.7	0	
Heptachlor Epoxide ug/Kg	1/3										0.83	0.83	2.5	1.7	
Indeno(1,2,3-cd)pyrene ug/Kg	**3/3**	**2.5333333**	**1.4033189**	**0.553941654**	**0.9453286**	**4.1213381**	**1.2**	**2.8**	**3.6**	**2.4**	**1.2**	**3.6**			**ln(y) = 0.830958273145726 + 0.814765637279121*Z**
Iron MG/KG	**3/3**	**178.66667**	**97.545929**	**0.545966019**	**68.283057**	**289.05028**	**86**	**200**	**250**	**164**	**86**	**250**			**ln(y) = 5.0913751935546 + 0.791405229057959*Z**
Lead MG/KG	2/3										0.72	0.77	0.46	0.46	
Magnesium MG/KG	**3/3**										**1300**	**1600**			
Manganese MG/KG	**3/3**	**21.333333**	**13.343952**	**0.625497742**	**6.2332303**	**36.433436**	**11**	**19**	**34**	**23**	**11**	**34**			**ln(y) = 2.95623159219366 + 0.836905539404927*Z**
Mercury MG/KG	**3/3**	**0.0396667**	**0.0154953**	**0.390638983**	**0.022132**	**0.0572013**	**0.025**	**0.042**	**0.052**	**0.027**	**0.025**	**0.052**			**ln(y) = -3.27182555840447 + 0.543147204704434*Z**
Mercury ng/g	**3/3**	**42.366667**	**19.598753**	**0.46259841**	**20.18859**	**64.544743**	**25.1**	**50**	**52**	**26.9**	**25.1**	**52**			**ln(y) = 3.6953781900491 + 0.540186595409184*Z**
Methyl Mercury ng/g	**3/3**	**34.6**	**12.433586**	**0.359352184**	**20.530073**	**48.669927**	**23.7**	**39.5**	**40.6**	**16.9**	**23.7**	**40.6**			**ln(y) = 3.51518126221862 + 0.399215136001758*Z**
Naphthalene ug/Kg	**3/3**	**1.0333333**	**0.4910854**	**0.475243928**	**0.4776179**	**1.5890488**	**0.67**	**0.93**	**1.5**	**0.83**	**0.67**	**1.5**			**ln(y) = -2.25277171079321E-02 + 0.597712590456076*Z**
Nickel MG/KG	**3/3**	**0.34**	**0.0445753**	**0.131103755**	**0.2895583**	**0.3904417**	**0.3**	**0.34**	**0.38**	**0.08**	**0.3**	**0.38**			**ln(y) = -1.08345549731986 + 0.175313397994695*Z**
Phenanthrene ug/Kg	**3/3**	**4.5**	**3.4723589**	**0.771635303**	**0.570656**	**8.429344**	**1.9**	**3.8**	**7.8**	**5.9**	**1.9**	**7.8**			**ln(y) = 1.34365956220009 + 1.04738400816751*Z**
Pyrene ug/Kg	**3/3**	**9.8666667**	**6.6036339**	**0.66928722**	**2.3939514**	**17.339382**	**3.6**	**11**	**15**	**11.4**	**3.6**	**15**			**ln(y) = 2.12895977312088 + 1.05839464838343*Z**
Sodium MG/KG	1/3										2400	2400	2000	2200	
Vanadium (Fume Or Dust) MG/KG	**3/3**	**0.4866667**	**0.328785**	**0.675585693**	**0.1146114**	**0.858722**	**0.19**	**0.49**	**0.78**	**0.59**	**0.19**	**0.78**			**ln(y) = -0.874180817999205 + 1.04738400816751*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-38
Upper Calcasieu
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/3										1.36	3.46	1.35	1.35	
1,2,3,4,6,7,8-HpCDF PG/G	**3/3**	**1.6653333**	**1.6238694**	**0.975101742**	**-0.172248**	**3.5029146**	**0.646**	**1.17**	**3.18**	**2.534**	**0.646**	**3.18**			**ln(y) = 0.292309723467405 + 1.18203993310336*Z**
1,2,3,4,7,8,9-HpCDF PG/G	1/3										0.52	0.52	0.0903	0.732	
1,2,3,4,7,8-HxCDD PG/G	1/3										0.326	0.326	0.187	1.01	
1,2,3,4,7,8-HxCDF PG/G	**3/3**	**1.244**	**0.9585475**	**0.770536613**	**0.1593013**	**2.3286987**	**0.402**	**1.62**	**1.71**	**1.308**	**0.402**	**1.71**			**ln(y) = 3.58721097985818E-02 + 1.07373174298288*Z**
1,2,3,6,7,8-HxCDD PG/G	2/3										0.215	0.469	1.08	1.08	
1,2,3,6,7,8-HxCDF PG/G	2/3										0.39	0.653	0.633	0.633	
1,2,3,7,8,9-HxCDD PG/G	1/3										0.394	0.394	0.191	0.999	
1,2,3,7,8,9-HxCDF PG/G	1/3										0.473	0.473	0.0744	0.962	
1,2,3,7,8-PeCDD PG/G	1/3										0.358	0.358	0.262	0.569	
1,2,3,7,8-PeCDF PG/G	**3/3**	**1.7753333**	**1.6241654**	**0.914850966**	**-0.062583**	**3.6132495**	**0.356**	**2.42**	**2.55**	**2.194**	**0.356**	**2.55**			**ln(y) = 0.262345450402941 + 1.46021182362411*Z**
2,3,4,6,7,8-HxCDF PG/G	1/3										0.373	0.373	0.154	0.704	
2,3,4,7,8-PeCDF PG/G	**3/3**	**1.7323333**	**1.4205016**	**0.819993211**	**0.1248845**	**3.3397822**	**0.517**	**2.32**	**2.36**	**1.843**	**0.517**	**2.36**			**ln(y) = 0.346838800080676 + 1.12607422259403*Z**
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**1.9912128**	**0.8973905**	**0.450675324**	**0.9757199**	**3.0067058**	**1.13902**	**2.19281**	**2.64181**	**1.50279**	**1.139019**	**2.641808**			ln(y) = 0.628938469098562 + 0.623931858025785*Z
2,3,7,8-TCDD PG/G	2/3										0.106	0.146	0.434	0.434	
2,3,7,8-TCDF PG/G	**3/3**	**2.4743333**	**2.3316811**	**0.942347197**	**-0.164212**	**5.1128789**	**0.493**	**3.45**	**3.48**	**2.987**	**0.493**	**3.48**			**ln(y) = 0.592720139963401 + 1.44935470081902*Z**
2-Methylnaphthalene ug/Kg	1/19										41	41	40	0	
3,5,5-Trimethyl-2-cyclohexene-1-one ug/Kg	6/19	47.576874	16.762501	0.352324543	40.039535	55.114214	33.308	45.405	61.8955	28.5876	29	78	40	400	ln(y) = 3.81562217498837 + 0.45955297278986*Z
Arsenic MG/KG	**19/19**	**0.4142105**	**0.0834523**	**0.20147312**	**0.3766858**	**0.4517353**	**0.36**	**0.43**	**0.48**	**0.12**	**0.22**	**0.55**			**ln(y) = -0.903033783887634 + 0.235933741597101*Z**
Benzaldehyde ug/Kg	18/19	120.59328	54.799464	0.454415563	95.952438	145.23413	-400	-400	-400	0	50	240	400	400	ln(y) = 4.69384343931261 + 0.53371328640712*Z
Chromium MG/KG	10/19	0.1844202	0.2491332	1.350899174	0.0723963	0.2964442	0.07286	0.131	0.23551	0.16265	0.16	0.95	0.1	0.15	ln(y) = -2.03258620303446 + 0.870060447141491*Z
Copper MG/KG	**19/19**	**13.078947**	**2.1939647**	**0.167747805**	**12.092421**	**14.065474**	**11.9**	**13.1**	**14.7**	**2.8**	**8.8**	**16.3**			**ln(y) = 2.55674785669261 + 0.192215272871041*Z**
Iron MG/KG	**19/19**	**36.068421**	**17.895457**	**0.496153043**	**28.021642**	**44.1152**	**21.2**	**33.5**	**50.9**	**29.7**	**14.5**	**75.7**			**ln(y) = 3.46692605477447 + 0.56458581409565*Z**
Lead MG/KG	5/19	0.3190037	0.5739238	1.799113594	0.060936	0.5770713	0.03594	0.11409	0.36219	0.32625	0.25	1.7	0.04	0.2	ln(y) = -2.17072801243414 + 1.71339440478903*Z
Mercury MG/KG	**19/19**	**0.0234211**	**0.0115056**	**0.491249307**	**0.0182475**	**0.0285946**	**0.013**	**0.019**	**0.033**	**0.02**	**0.006**	**0.042**			**ln(y) = -3.88752483741354 + 0.615147928520046*Z**
Nickel MG/KG	5/19	0.108875	0.1198778	1.101059265	0.0549713	0.1627786	0.04069	0.07731	0.14691	0.10622	0.18	0.44	0.08	0.16	ln(y) = -2.55991373010603 + 0.952199717083742*Z
OCDD PG/G	**3/3**	**22.666667**	**11.193567**	**0.493833839**	**9.9999532**	**35.33338**	**13.2**	**21.7**	**33.1**	**19.9**	**13.2**	**33.1**			**ln(y) = 3.05235412417392 + 0.681794171834054*Z**
OCDF PG/G	2/3										1.39	5.38	2.4	2.4	
PCB-105 ng/kg	**3/3**	**460**	**144.44639**	**0.314013902**	**296.54352**	**623.45648**	**323**	**484**	**573**	**250**	**323**	**573**			**ln(y) = 6.10354098221801 + 0.425128023758476*Z**
PCB-108 ng/kg	**3/3**	**193.33333**	**88.477854**	**0.457644073**	**93.211216**	**293.45545**	**112**	**223**	**245**	**133**	**112**	**245**			**ln(y) = 5.20897628443331 + 0.580519095278916*Z**
PCB-114 ng/kg	**3/3**	**27.833333**	**12.275702**	**0.44104317**	**13.942069**	**41.724597**	**17.1**	**32.7**	**33.7**	**16.6**	**17.1**	**33.7**			**ln(y) = 3.28131712625671 + 0.503137275250469*Z**
PCB-118 ng/kg	**3/3**	**2126.6667**	**820.58458**	**0.38585482**	**1198.0878**	**3055.2455**	**1350**	**2250**	**2780**	**1430**	**1350**	**2780**			**ln(y) = 7.61891719110521 + 0.535714899831965*Z**
PCB-126 ng/kg	**3/3**	**11.923333**	**4.2028365**	**0.352488384**	**7.1673761**	**16.679291**	**8.57**	**11.3**	**15.9**	**7.33**	**8.57**	**15.9**			**ln(y) = 2.44646318918472 + 0.458366458244038*Z**
PCB-15 ng/kg	1/3										57.5	57.5	28.1	0	
PCB-156 ng/kg	**3/3**	**233**	**101.46773**	**0.435483807**	**118.17846**	**347.82154**	**137**	**248**	**314**	**177**	**137**	**314**			**ln(y) = 5.39426755263379 + 0.615118229304939*Z**
PCB-157 ng/kg	**3/3**	**55.733333**	**24.797926**	**0.444938867**	**27.671838**	**83.794829**	**32.2**	**61.5**	**73.5**	**41.3**	**32.2**	**73.5**			**ln(y) = 3.96276301119388 + 0.612082652069567*Z**
PCB-162 ng/kg	**3/3**	**308**	**136.65797**	**0.443694723**	**153.35694**	**462.64306**	**180**	**322**	**422**	**242**	**180**	**422**			**ln(y) = 5.67083790349021 + 0.6319061021148*Z**
PCB-167 ng/kg	**3/3**	**141.23333**	**67.781167**	**0.479923294**	**64.531723**	**217.93494**	**77.7**	**161**	**185**	**107.3**	**77.7**	**185**			**ln(y) = 4.88487181581213 + 0.643365871815279*Z**
PCB-189 ng/kg	**3/3**	**30.7**	**19.780381**	**0.644312073**	**8.3163922**	**53.083608**	**12.5**	**37.3**	**42.3**	**29.8**	**12.5**	**42.3**			**ln(y) = 3.29650301900342 + 0.904092315745143*Z**
PCB-37 ng/kg	**3/3**	**25.6**	**9.1420682**	**0.35711204**	**15.254776**	**35.945224**	**17.8**	**29.4**	**29.6**	**11.8**	**17.8**	**29.6**			**ln(y) = 3.21598916432423 + 0.377175983581773*Z**
PCB-58 ng/kg	**3/3**	**4.7333333**	**2.3376817**	**0.493876413**	**2.0879975**	**7.3786692**	**2.71**	**5.68**	**5.81**	**3.1**	**2.71**	**5.81**			**ln(y) = 1.4978268128295 + 0.565591976105705*Z**
PCB-60 ng/kg	**3/3**	**96.2**	**17.395895**	**0.180830509**	**76.514692**	**115.88531**	**80.8**	**95.8**	**112**	**31.2**	**80.8**	**112**			**ln(y) = 4.55757950726632 + 0.242158977632794*Z**
PCB-61/70 ng/kg	**3/3**	**559**	**200.77102**	**0.35916103**	**331.80621**	**786.19379**	**369**	**589**	**719**	**350**	**369**	**719**			**ln(y) = 6.28902806180439 + 0.494716299967144*Z**
PCB-66 ng/kg	**3/3**	**623.66667**	**219.40304**	**0.351795362**	**375.38875**	**871.94458**	**417**	**684**	**770**	**353**	**417**	**770**			**ln(y) = 6.40247821808969 + 0.454845870855709*Z**
PCB-77 ng/kg	**3/3**	**35.3**	**8.3213399**	**0.235732009**	**25.883517**	**44.716483**	**27.4**	**37.2**	**41.3**	**13.9**	**27.4**	**41.3**			**ln(y) = 3.5492380915467 + 0.304305915211419*Z**
PCB-79 ng/kg	**3/3**	**22.466667**	**12.720939**	**0.56621392**	**8.0715686**	**36.861765**	**12.3**	**20.6**	**34.5**	**22.2**	**12.3**	**34.5**			**ln(y) = 3.02528322073707 + 0.764889257629304*Z**

Table H-38
Upper Calcasieu
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-80 ng/kg	2/3										3.64	3.98	28.1	0	
PCB-81 ng/kg	**3/3**	**7.0766667**	**4.477339**	**0.632690386**	**2.0100807**	**12.143253**	**4.44**	**5.59**	**11.2**	**6.76**	**4.44**	**11.2**			**ln(y) = 1.87584914730406 + 0.686201650917625*Z**
Pyrene ug/Kg	1/19										120	120	40	0	
Selenium MG/KG	**19/19**	**0.6668421**	**0.167502**	**0.251186898**	**0.591524**	**0.7421602**	**0.56**	**0.65**	**0.74**	**0.18**	**0.35**	**0.96**			**ln(y) = -0.436724719794655 + 0.288623154963374*Z**
Total HpCDD PG/G	**3/3**	**4.8133333**	**3.5256778**	**0.732481541**	**0.8236533**	**8.8030134**	**3.1**	**3.43**	**7.91**	**4.81**	**3.1**	**7.91**			**ln(y) = 1.47736338481617 + 0.694705398420003*Z**
Total HpCDF PG/G	2/3										1.17	4.24	1.17	1.17	
Total HxCDD PG/G	**3/3**	**2.54**	**1.4637474**	**0.576278487**	**0.8836139**	**4.1963861**	**1.64**	**2.08**	**3.9**	**2.26**	**1.64**	**3.9**			**ln(y) = 0.862680229561645 + 0.642460891051906*Z**
Total HxCDF PG/G	**3/3**	**5.2533333**	**2.4167126**	**0.460034129**	**2.5185656**	**7.9881011**	**3.12**	**6.19**	**6.45**	**3.33**	**3.12**	**6.45**			**ln(y) = 1.60828273977519 + 0.538607851900157*Z**
Total PeCDD PG/G	2/3										0.224	0.96	0.569	0.569	
Total PeCDF PG/G	**3/3**	**16.99**	**13.337216**	**0.78500387**	**1.8975196**	**32.08248**	**5.57**	**22.5**	**22.9**	**17.33**	**5.57**	**22.9**			**ln(y) = 2.65401575790325 + 1.04847569669408*Z**
Total TCDD PG/G	2/3										0.146	0.338	0.434	0.434	
Total TCDF PG/G	**3/3**	**18.293333**	**14.259671**	**0.779500939**	**2.1569971**	**34.42967**	**5.78**	**23.9**	**25.2**	**19.42**	**5.78**	**25.2**			**ln(y) = 2.71837537871304 + 1.0920083285074*Z**
Zinc MG/KG	**19/19**	**13.626316**	**7.6227149**	**0.559411288**	**10.198725**	**17.053906**	**10.4**	**11.6**	**12.6**	**2.2**	**8.5**	**37.3**			**ln(y) = 2.5327713038537 + 0.349728529373058*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-39
Upper Calcasieu
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/7										25	25	10	1.7	
1,2,3,4,6,7,8-HpCDF PG/G	**1/1**										**0.933**	**0.933**			
1,2,3,4,7,8-HxCDF PG/G	**1/1**										**2.48**	**2.48**			
1,2,3,7,8-PeCDF PG/G	**1/1**										**4.18**	**4.18**			
2,3,4,6,7,8-HxCDF PG/G	**1/1**										**1.28**	**1.28**			
2,3,4,7,8-PeCDF PG/G	**1/1**										**5.19**	**5.19**			
2,3,7,8-TCDD Equivalent PG/G	**1/1**										**5.4543398**	**5.45433975**			
2,3,7,8-TCDF PG/G	**1/1**										**14.8**	**14.8**			
4,4'-DDD ug/Kg	1/7										14	14	10	1.7	
4,4'-DDT ug/Kg	2/7										14	15	10	1.7	
4-Methylphenol ug/Kg	3/7	56.372296	82.296984	1.459883473	-4.594162	117.33875	21.8494	39.0536	42	20.1506	34	200	40	40	ln(y) = 3.66493604429974 + 0.861421726071191*Z
Aroclor-1254	6/7	62.02774	31.38646	0.506006822	38.776325	85.279154	32	66	71	39	32	110	10	10	ln(y) = 4.03951816622471 + 0.55468799713172*Z
Arsenic MG/KG	**7/7**	**0.5085714**	**0.0822223**	**0.161673132**	**0.4476603**	**0.5694826**	**0.5**	**0.52**	**0.56**	**0.06**	**0.36**	**0.58**			**ln(y) = -0.686086269453853 + 0.172822284616195*Z**
Benzaldehyde ug/Kg	**7/7**	**170.85714**	**85.858877**	**0.502518512**	**107.252**	**234.46229**	**78**	**140**	**260**	**182**	**78**	**280**			**ln(y) = 5.02230643850744 + 0.655462925658583*Z**
beta-BHC ug/Kg	2/7										10	16	10	1.7	
Cadmium MG/KG	**7/7**	**0.0528571**	**0.0375761**	**0.710899915**	**0.0250204**	**0.0806939**	**0.03**	**0.05**	**0.05**	**0.02**	**0.03**	**0.12**			**ln(y) = -3.04849313948146 + 0.53484184886406*Z**
Copper MG/KG	**7/7**	**8.1571429**	**1.4866134**	**0.182246827**	**7.0558442**	**9.2584415**	**7**	**7.9**	**9**	**2**	**6.7**	**10.7**			**ln(y) = 2.08688456900154 + 0.203410461276353*Z**
Iron MG/KG	**7/7**	**6.3285714**	**1.7680115**	**0.279369766**	**5.0188102**	**7.6383327**	**4.5**	**6.4**	**8.3**	**3.8**	**4.2**	**8.6**			**ln(y) = 1.81162828509524 + 0.349923989472421*Z**
Lead MG/KG	3/7	0.0433521	0.0350548	0.808604808	0.0173832	0.0693211	0.0186	0.03376	0.07	0.0514	0.05	0.1	0.02	0.02	ln(y) = -3.38836895171483 + 0.884167493978004*Z
Mercury MG/KG	**7/7**	**0.1022857**	**0.0562808**	**0.550231552**	**0.0605923**	**0.1439791**	**0.051**	**0.1**	**0.126**	**0.075**	**0.047**	**0.201**			**ln(y) = -2.38792727353344 + 0.620348056801242*Z**
Nickel MG/KG	**7/7**	**0.0914286**	**0.0280451**	**0.306742788**	**0.0706525**	**0.1122046**	**0.07**	**0.09**	**0.1**	**0.03**	**0.06**	**0.14**			**ln(y) = -2.42537543557341 + 0.342213330880284*Z**
OCDD PG/G	**1/1**										**2.89**	**2.89**			
PCB-105 ng/kg	**1/1**										**3670**	**3670**			
PCB-108 ng/kg	**1/1**										**1190**	**1190**			
PCB-114 ng/kg	**1/1**										**236**	**236**			
PCB-118 ng/kg	**1/1**										**15700**	**15700**			
PCB-126 ng/kg	**1/1**										**74.7**	**74.7**			
PCB-15 ng/kg	**1/1**										**192**	**192**			
PCB-156 ng/kg	**1/1**										**1900**	**1900**			
PCB-157 ng/kg	**1/1**										**463**	**463**			
PCB-162 ng/kg	**1/1**										**2600**	**2600**			
PCB-167 ng/kg	**1/1**										**1200**	**1200**			
PCB-189 ng/kg	**1/1**										**224**	**224**			
PCB-37 ng/kg	**1/1**										**108**	**108**			
PCB-58 ng/kg	**1/1**										**31.7**	**31.7**			
PCB-60 ng/kg	**1/1**										**304**	**304**			
PCB-61/70 ng/kg	**1/1**										**177**	**177**			
PCB-66 ng/kg	**1/1**										**4280**	**4280**			
PCB-77 ng/kg	**1/1**										**260**	**260**			
PCB-79 ng/kg	**1/1**										**318**	**318**			
PCB-80 ng/kg	**1/1**										**21.4**	**21.4**			
PCB-81 ng/kg	**1/1**										**21.5**	**21.5**			
Selenium MG/KG	**7/7**	**0.87**	**0.198211**	**0.227828712**	**0.7231633**	**1.0168367**	**0.79**	**0.89**	**0.93**	**0.14**	**0.59**	**1.2**			**ln(y) = -0.158545056495776 + 0.255595972478155*Z**
Silver MG/KG	**7/7**	**0.1957143**	**0.0786674**	**0.401950147**	**0.1374367**	**0.2539919**	**0.11**	**0.19**	**0.28**	**0.17**	**0.11**	**0.3**			**ln(y) = -1.70271649546925 + 0.510872218535813*Z**
Total HpCDD PG/G	**1/1**										**0.961**	**0.961**			
Total HpCDF PG/G	**1/1**										**0.933**	**0.933**			

Table H-39
Upper Calcasieu
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total HxCDD PG/G	**1/1**										**1.76**	**1.76**			
Total HxCDF PG/G	**1/1**										**15.4**	**15.4**			
Total PeCDF PG/G	**1/1**										**85.8**	**85.8**			
Total TCDD PG/G	**1/1**										**2.26**	**2.26**			
Total TCDF PG/G	**1/1**										**153**	**153**			
Zinc MG/KG	**7/7**	**28.142857**	**5.5908761**	**0.198660571**	**24.001078**	**32.284636**	**23.5**	**30.8**	**32.1**	**8.6**	**20.3**	**34.6**			**ln(y) = 3.31986523718826 + 0.244572533090349*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-40
Reference Area
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDF PG/G	**1/3**										**1.12**	**1.12**	**0.327**	**0.1**	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**0.3162445**	**0.0603125**	**0.190714792**	**0.2479945**	**0.3844945**	**0.25966**	**0.33365**	**0.35542**	**0.09577**	**0.259657**	**0.35542245**			ln(y) = -1.16016418264002 + 0.232831956230527*Z
2,3,7,8-TCDF PG/G	**3/3**	**0.424**	**0.0253019**	**0.059674394**	**0.3953682**	**0.4526318**	**0.4**	**0.43**	**0.442**	**0.042**	**0.4**	**0.442**			ln(y) = -0.858902066357708 + 7.40484598752963E-02*Z
4,4'-DDT ug/Kg	**1/14**										**26**	**26**	**10**	**0.1**	
Antimony MG/KG	**6/15**	0.0289721	0.0112322	0.387689234	0.0232878	0.0346564	0.01973	0.02698	0.0369	0.01717	**0.03**	**0.05**	**0.03**	**0.08**	ln(y) = -3.61254264563392 + 0.464193292873552*Z
Aroclor-1254 ug/Kg	**3/14**	60.257767	183.24713	3.041054059	-35.73295	156.24848	0.53014	4.04715	30.8964	30.3662	**87**	**550**	**10**	**10**	ln(y) = 1.39801328201188 + 3.01491804619738*Z
Arsenic MG/KG	**15/15**	**0.46**	**0.1836518**	**0.399243004**	**0.3670594**	**0.5529406**	**0.36**	**0.38**	**0.48**	**0.12**	**0.27**	**0.86**			ln(y) = -0.83687773680997 + 0.378627031082263*Z
Benzaldehyde ug/Kg	**14/15**	2398.145	2816.7416	1.174550148	972.67709	3823.6129	**-600**	**950**	**4500**	**5100**	**240**	**7900**	**600**	**600**	ln(y) = 7.03532486107411 + 1.4271026880825*Z
Cadmium MG/KG	**5/15**	0.0082654	0.0310073	3.751460264	-0.007426	0.0239572	0.00017	0.00091	0.00474	0.00457	**0.004**	**0.09**	**0.003**	**0.01**	ln(y) = -7.00497324477464 + 2.452605158826*Z
Chromium MG/KG	**15/15**	**0.3226667**	**0.0711406**	**0.22047715**	**0.2866645**	**0.3586688**	**0.26**	**0.29**	**0.4**	**0.14**	**0.22**	**0.43**			ln(y) = -1.15340464705241 + 0.239854382694771*Z
Copper MG/KG	**15/15**	**1.7993333**	**0.9215781**	**0.512177513**	**1.3329505**	**2.2657162**	**1.1**	**1.4**	**2.9**	**1.8**	**0.89**	**3.3**			ln(y) = 0.47313483072358 + 0.523700359421619*Z
Diethyl Phthalate ug/Kg	**1/15**										**16**	**16**	**80**	**600**	
Endrin ug/Kg	**1/14**										**12**	**12**	**10**	**0.1**	
Iron MG/KG	**15/15**	**23.7**	**10.344172**	**0.436462961**	**18.465127**	**28.934873**	**16.4**	**20.3**	**33.9**	**17.5**	**9.8**	**41.8**			ln(y) = 3.07296550916538 + 0.51680037758651*Z
Lead MG/KG	**8/15**	0.0767251	0.0559878	0.729718796	0.0483914	0.1050588	0.0359	**0.07**	**0.1**	0.0641	**0.07**	**0.21**	**0.04**	**0.04**	ln(y) = -2.7963710662703 + 0.787198082337509*Z
Mercury MG/KG	**15/15**	**0.0260667**	**0.0120245**	**0.461296419**	**0.0199815**	**0.0321519**	**0.017**	**0.022**	**0.035**	**0.018**	**0.015**	**0.054**			ln(y) = -3.72790158335583 + 0.447282451064697*Z
Nickel MG/KG	**13/15**	0.0927221	0.0637485	0.687522426	0.0604609	0.1249833	**0.05**	**0.08**	**0.13**	**0.08**	**0.05**	**0.25**	**0.03**	**0.03**	ln(y) = -2.56995059532123 + 0.728458305221213*Z
PCB-105 ng/kg	**3/3**	**4813.3333**	**1792.7706**	**0.37245926**	**2784.6224**	**6842.0442**	**3110**	**5200**	**6130**	**3020**	**3110**	**6130**			ln(y) = 8.43991397955769 + 0.503250485252092*Z
PCB-108 ng/kg	**3/3**	**1317.6667**	**392.84142**	**0.298134141**	**873.12475**	**1762.2086**	**963**	**1460**	**1530**	**567**	**963**	**1530**			ln(y) = 7.16308938029566 + 0.343352907285491*Z
PCB-114 ng/kg	**3/3**	**230.66667**	**90.324926**	**0.391582049**	**128.45439**	**332.87894**	**146**	**257**	**289**	**143**	**146**	**289**			ln(y) = 5.399703131572 + 0.506400968102382*Z
PCB-118 ng/kg	**3/3**	**19900**	**6480.6694**	**0.32566178**	**12566.432**	**27233.568**	**13800**	**21700**	**24200**	**10400**	**13800**	**24200**			ln(y) = 9.87053310760621 + 0.416562658487346*Z
PCB-126 ng/kg	**3/3**	**46.9**	**7.1390742**	**0.152219067**	**38.821377**	**54.978623**	**40.6**	**46.7**	**53.4**	**12.8**	**40.6**	**53.4**			ln(y) = 3.84177432574956 + 0.203238722697947*Z
PCB-156 ng/kg	**3/3**	**1696.6667**	**652.22539**	**0.384415753**	**958.60415**	**2434.7292**	**1090**	**1900**	**2100**	**1010**	**1090**	**2100**			ln(y) = 7.39774492136308 + 0.486332105888114*Z
PCB-157 ng/kg	**3/3**	**480**	**174.82933**	**0.364227766**	**282.16199**	**677.83801**	**325**	**547**	**568**	**243**	**325**	**568**			ln(y) = 6.14346513449096 + 0.414050155387807*Z
PCB-162 ng/kg	**3/3**	**3600**	**1272.8716**	**0.353575454**	**2159.6101**	**5040.3899**	**2450**	**4060**	**4290**	**1840**	**2450**	**4290**			ln(y) = 8.1589411893522 + 0.415461088817967*Z
PCB-167 ng/kg	**3/3**	**1040**	**409.76159**	**0.39400153**	**576.31111**	**1503.6889**	**690**	**1210**	**1220**	**530**	**690**	**1220**			ln(y) = 6.91389112463646 + 0.42266665708927*Z
PCB-189 ng/kg	**3/3**	**59.066667**	**19.768723**	**0.334684935**	**36.69625**	**81.437083**	**42.1**	**67.2**	**67.9**	**25.8**	**42.1**	**67.9**			ln(y) = 4.05525234092736 + 0.354491243989486*Z
PCB-37 ng/kg	**3/3**	**15.766667**	**5.1949491**	**0.329489375**	**9.8880283**	**21.645305**	**12**	**14.6**	**20.7**	**8.7**	**12**	**20.7**			ln(y) = 2.73202062625787 + 0.40435763356281*Z
PCB-58 ng/kg	**1/3**										**9.11**	**9.11**	**19.7**	**0**	
PCB-60 ng/kg	**3/3**	**161.33333**	**31.264951**	**0.193791017**	**125.95371**	**196.71296**	**137**	**156**	**191**	**54**	**137**	**191**			ln(y) = 5.07403678704143 + 0.246438634562665*Z
PCB-61/70 ng/kg	**3/3**	**1246.6667**	**261.93294**	**0.210106636**	**950.26164**	**1543.0717**	**1010**	**1250**	**1480**	**470**	**1010**	**1480**			ln(y) = 7.11613393562994 + 0.28337133767707*Z
PCB-66 ng/kg	**3/3**	**3093.3333**	**779.0768**	**0.251856724**	**2211.7249**	**3974.9417**	**2410**	**3400**	**3470**	**1060**	**2410**	**3470**			ln(y) = 8.02360753667662 + 0.270345385890362*Z
PCB-77 ng/kg	**3/3**	**26.6**	**3.7374267**	**0.140504761**	**22.370704**	**30.829296**	**24.2**	**25.5**	**30.1**	**5.9**	**24.2**	**30.1**			ln(y) = 3.27651875236062 + 0.16180365837558*Z
PCB-79 ng/kg	**3/3**	**282**	**165.20224**	**0.585823539**	**95.056069**	**468.94393**	**159**	**248**	**439**	**280**	**159**	**439**			ln(y) = 5.55561078715346 + 0.753197545417068*Z
PCB-81 ng/kg	**3/3**	**159.46667**	**69.242536**	**0.434213226**	**81.111361**	**237.82197**	**95.4**	**164**	**219**	**123.6**	**95.4**	**219**			ln(y) = 5.01567224536498 + 0.616290816631123*Z
Percent Lipids %	**15/15**	**4.9666667**	**1.5504692**	**0.312175013**	**4.182021**	**5.7513124**	**3.9**	**4.8**	**6.3**	**2.4**	**2.4**	**7.9**			ln(y) = 1.55419091464178 + 0.375040591621748*Z
Phenol ug/Kg	**6/15**	300.78381	502.38768	1.670261665	46.540572	555.02706	111.212	209.099	393.143	281.931	**170**	**1600**	**40**	**800**	ln(y) = 5.34280788668217 + 0.936481205906813*Z
Selenium MG/KG	**15/15**	**0.2513333**	**0.0993908**	**0.395454279**	**0.2010346**	**0.301632**	**0.17**	**0.3**	**0.33**	**0.16**	**0.07**	**0.39**			ln(y) = -1.47310410904195 + 0.515928375268745*Z
Silver MG/KG	**10/15**	0.0183779	0.0163619	0.890305739	0.0100976	0.0266581	0.00683	**-0.01**	**0.03**	0.02317	**0.01**	**0.06**	**0.01**	**0.01**	ln(y) = -4.33449370038991 + 0.966327765147264*Z
Total HxCDD PG/G	**3/3**	**0.3493333**	**0.0855897**	**0.245008573**	**0.2524795**	**0.4461872**	**0.268**	**0.366**	**0.414**	**0.146**	**0.268**	**0.414**			ln(y) = -1.06792651640296 + 0.322520022561115*Z
Total PeCDF PG/G	**1/3**										**2.51**	**2.51**	**1.1**	**0**	
Total TCDD PG/G	**3/3**	**0.2115**	**0.1463087**	**0.691766845**	**0.0459361**	**0.3770639**	**0.0725**	**0.239**	**0.323**	**0.2505**	**0.0725**	**0.323**			ln(y) = -1.72852113331054 + 1.10804644618425*Z
Total TCDF PG/G	**3/3**	**2.2066667**	**1.3329973**	**0.604077311**	**0.6982383**	**3.7150951**	**1.37**	**1.8**	**3.45**	**2.08**	**1.37**	**3.45**			ln(y) = 0.713657211928474 + 0.684943909912207*Z
Zinc MG/KG	**15/15**	**29.066667**	**3.8576232**	**0.132716394**	**27.11444**	**31.018893**	**27.6**	**29.7**	**31.7**	**4.1**	**20.4**	**33.5**			ln(y) = 3.36085190161248 + 0.147534251382886*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-41
Reference Area
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/2										0.388	1.36			
1,2,3,4,6,7,8-HpCDF PG/G	2/2										1.81	1.87			
1,2,3,6,7,8-HxCDD PG/G	1/2										0.267	0.267	0.126	0.1	
1,2,3,7,8,9-HxCDD PG/G	1/2										0.187	0.187	0.108	0.1	
1,2,3,7,8-PeCDD PG/G	2/2										0.108	0.248			
1,2,3,7,8-PeCDF PG/G	2/2										0.256	0.584			
2,3,4,7,8-PeCDF PG/G	2/2										0.408	0.622			
2,3,7,8-TCDD Equivalent PG/G	2/2										0.5337575	0.98711975			
2,3,7,8-TCDD PG/G	2/2										0.0733	0.14			
2,3,7,8-TCDF PG/G	2/2										0.497	1.33			
Arsenic MG/KG	3/3	0.9066667	0.7870917	0.868115835	0.0159886	1.7973448	0.52	0.6	1.6	1.08	0.52	1.6			ln(y) = -0.231582820642306 + 0.833542124825822*Z
Benzaldehyde ug/Kg	3/3	3680	4232.1554	1.150042227	-1109.135	8469.1347	440	2900	7700	7260	440	7700			ln(y) = 7.66940545024288 + 2.12269874351994*Z
Cadmium MG/KG	1/3										0.02	0.02	0.004		
Chromium MG/KG	3/3	0.55	0.2427957	0.441446787	0.2752508	0.8247492	0.38	0.49	0.78	0.4	0.38	0.78			ln(y) = -0.643131757812557 + 0.533324125420504*Z
Copper MG/KG	3/3	1.55	0.6703774	0.43250154	0.7913966	2.3086034	0.95	1.8	1.9	0.95	0.95	1.9			ln(y) = 0.392782418895654 + 0.514059882747007*Z
Iron MG/KG	3/3	177.5	197.34253	1.1117889	-45.81409	400.81409	32.5	135	365	332.5	32.5	365			ln(y) = 4.76213740711887 + 1.79375276208944*Z
Lead MG/KG	3/3	1.69	2.8881532	1.708966397	-1.578253	4.958253	0.34	0.53	4.2	3.86	0.34	4.2			ln(y) = -9.28678028395255E-02 + 1.86438347738717*Z
Mercury MG/KG	3/3	0.0173333	0.003936	0.227076373	0.0128793	0.0217873	0.014	0.017	0.021	0.007	0.014	0.021			ln(y) = -4.0688242418505 + 0.300705754532114*Z
Nickel MG/KG	3/3	0.1933333	0.1759182	0.909921811	-0.005737	0.3924035	0.07	0.15	0.36	0.29	0.07	0.36			ln(y) = -1.85934375645021 + 1.21450249799009*Z
OCDD PG/G	1/2										23.1	23.1	4.48	0.1	
PCB-105 ng/kg	2/2										439	790			
PCB-108 ng/kg	2/2										220	307			
PCB-114 ng/kg	2/2										39.3	39.4			
PCB-118 ng/kg	2/2										1970	3790			
PCB-126 ng/kg	1/2										25.2	25.2	21.9		
PCB-156 ng/kg	2/2										194	315			
PCB-157 ng/kg	2/2										56.5	99.2			
PCB-162 ng/kg	2/2										411	733			
PCB-167 ng/kg	2/2										134	218			
PCB-189 ng/kg	2/2										41.4	46.4			
PCB-37 ng/kg	2/2										12.3	26.4			
PCB-58 ng/kg	2/2										10.6	11			
PCB-60 ng/kg	2/2										132	169			
PCB-61/70 ng/kg	2/2										635	1050			
PCB-66 ng/kg	2/2										757	951			
PCB-77 ng/kg	2/2										34.3	37.3			
PCB-79 ng/kg	2/2										38.5	59.2			
PCB-81 ng/kg	2/2										8	34.9			
Percent Lipids %	3/3										0.5	1			
Phenol ug/Kg	1/3										150	150	50		
Selenium MG/KG	3/3	0.5566667	0.2994337	0.537904938	0.2178255	0.8955079	0.29	0.67	0.71	0.42	0.29	0.71			ln(y) = -0.660280743848506 + 0.664045142433853*Z
Silver MG/KG	2/3										0.01	0.02	0.01		
Total HpCDD PG/G	1/2										3.78	3.78	0.783	0.1	
Total HpCDF PG/G	2/2										1.81	1.87			
Total HxCDD PG/G	1/2										1.98	1.98	0.114	0.1	
Total HxCDF PG/G	1/2										2.98	2.98	2.19	0.1	
Total PeCDD PG/G	1/2										0.414	0.414	0.108	0.1	
Total PeCDF PG/G	2/2										1.67	2.71			
Total TCDD PG/G	2/2										0.148	0.414			
Total TCDF PG/G	2/2										1.29	3.67			
Zinc MG/KG	3/3	21.333333	2.3693932	0.111065306	18.652113	24.014554	19.2	22.2	22.6	3.4	19.2	22.6			ln(y) = 3.05765082473007 + 0.1209153467186*Z

Table H-41
Reference Area
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-42
Reference Area
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**1/19**										**13**	**13**	**10**	**0**	
1,2,3,4,6,7,8-HpCDF PG/G	**2/3**										**1.07**	**7.07**	**0.653**	**0.1**	
1,2,3,4,7,8-HxCDF PG/G	**1/3**										**1.93**	**1.93**	**0.268**	**0.1**	
1,2,3,6,7,8-HxCDD PG/G	**1/3**										**1.29**	**1.29**	**0.5**	**0.1**	
1,2,3,6,7,8-HxCDF PG/G	**1/3**										**2.42**	**2.42**	**0.253**	**0.1**	
1,2,3,7,8,9-HxCDD PG/G	**1/3**										**0.498**	**0.498**	**0.428**	**0.1**	
1,2,3,7,8-PeCDD PG/G	**1/3**										**1.13**	**1.13**	**0.538**	**0.1**	
1,2,3,7,8-PeCDF PG/G	**2/3**										**0.538**	**5.82**	**0.465**	**0.1**	
2,3,4,6,7,8-HxCDF PG/G	**1/3**										**0.318**	**0.318**	**0.392**	**0.1**	
2,3,4,7,8-PeCDF PG/G	**2/3**										**0.85**	**4.75**	**0.523**	**0.1**	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**2.8058257**	**3.4334077**	**1.223671055**	**-1.079441**	**6.6910923**	**0.88981**	**1.59812**	**5.92955**	**5.03974**	**0.889805**	**5.92954915**			ln(y) = 0.710675018553927 + 1.4066535710701*Z
2,3,7,8-TCDD PG/G	**2/3**										**0.277**	**0.629**	**0.272**	**0.1**	
2,3,7,8-TCDF PG/G	**3/3**	**4.2046667**	**3.7222607**	**0.885268916**	**-0.007468**	**8.4168012**	**0.824**	**4.29**	**7.5**	**6.676**	**0.824**	**7.5**			ln(y) = 1.09253500146984 + 1.63788441435962*Z
2-Methylnaphthalene ug/Kg	**10/19**	53.016019	41.191608	0.776965315	34.494013	71.538025	24.9785	**-50**	**66**	41.0215	**27**	**150**	**50**	**50**	ln(y) = 3.72504122648988 + 0.752052909638815*Z
2-Methylphenol ug/Kg	**2/19**										**76**	**560**	**50**	**0.1**	
4,4'-DDD ug/Kg	**1/19**										**16**	**16**	**10**	**0**	
4,4'-DDE ug/Kg	**3/19**										**15**	**17**	**10**	**0**	
Aldrin ug/Kg	**1/19**										**26**	**26**	**10**	**0**	
alpha-Chlordane ug/Kg	**1/19**										**11**	**11**	**10**	**0**	
Aroclor-1254 ug/Kg	**10/19**	43.988454	62.129348	1.412401271	16.051692	71.925216	5.69324	**17**	**64**	58.3068	**17**	**210**	**10**	**10**	ln(y) = 2.85071049201168 + 1.64854406687946*Z
Aroclor-1260 ug/Kg	**8/19**	27.397645	51.121705	1.865916013	4.4105233	50.384768	2.56121	8.66946	**37**	34.4388	**18**	**190**	**10**	**10**	ln(y) = 2.15980661814946 + 1.80858174188792*Z
Arsenic MG/KG	**17/18**	1.0508729	0.6489974	0.617579374	0.7510514	1.3506944	**-0.55**	**0.85**	**1.725**	**2.275**	**0.38**	**2.1**	**0.55**	**0.55**	ln(y) = -0.154697058928986 + 0.707487330696374*Z
Benzaldehyde ug/Kg	**13/19**	934.74678	1879.1341	2.010313495	89.785055	1779.7085	207.762	**630**	**960**	752.238	**170**	**6900**	**50**	**50**	ln(y) = 6.17042456599816 + 1.23708541231132*Z
beta-BHC ug/Kg	**3/19**										**38**	**230**	**10**	**0**	
Cadmium MG/KG	**13/18**	0.0058399	0.0035364	0.605556236	0.0042062	0.0074737	0.00301	**0.0045**	**0.01**	0.00699	**0.003**	**0.01**	**0.003**	**0.003**	ln(y) = -5.33736234773501 + 0.696577605572524*Z
Chromium MG/KG	**18/18**	**0.5144444**	**0.1904795**	**0.370262511**	**0.4264474**	**0.6024415**	**0.355**	**0.54**	**0.67**	**0.315**	**0.18**	**0.83**			ln(y) = -0.743521481823235 + 0.470608078997593*Z
Copper MG/KG	**18/18**	**3.4977778**	**2.0588913**	**0.588628393**	**2.5466185**	**4.448937**	**2.475**	**2.95**	**4.55**	**2.075**	**0.66**	**8.4**			ln(y) = 1.09043504574983 + 0.672404202104259*Z
Endosulfan Sulfate ug/Kg	**1/19**										**30**	**30**	**10**	**0**	
gamma-Chlordane ug/Kg	**1/19**										**23**	**23**	**10**	**0**	
Hexachloro-1,3-butadiene ug/Kg	**19/19**	**576.15789**	**398.63764**	**0.691889573**	**396.90855**	**755.40724**	**240**	**520**	**770**	**530**	**53**	**1400**			ln(y) = 6.04314969526617 + 1.00570802328057*Z
Iron MG/KG	**18/18**	**155.5**	**107.51238**	**0.691397927**	**105.83182**	**205.16818**	**39**	**164**	**269.25**	**230.25**	**6.7**	**300**			ln(y) = 4.61038190949623 + 1.22236746559118*Z
Lead MG/KG	**17/18**	0.3095652	0.1753271	0.566365689	0.2285682	0.3905622	**0.15**	**0.32**	**0.4325**	**0.2825**	**0.07**	**0.68**	**0.04**	**0.04**	ln(y) = -1.35902809756358 + 0.740906631972304*Z
Mercury MG/KG	**19/19**	**0.0249474**	**0.0154953**	**0.621118253**	**0.0179798**	**0.0319149**	**0.013**	**0.019**	**0.039**	**0.026**	**0.01**	**0.057**			ln(y) = -3.86278762665522 + 0.655148659617206*Z
Naphthalene ug/Kg	**9/19**	69.695311	46.887116	0.672744192	48.612293	90.77833	34.8686	56.7657	**110**	75.1314	**37**	**180**	**50**	**50**	ln(y) = 4.03893254405165 + 0.722862335206752*Z
Nickel MG/KG	**18/18**	**0.2677778**	**0.1369676**	**0.511497355**	**0.204502**	**0.3310536**	**0.1725**	**0.27**	**0.325**	**0.1525**	**0.06**	**0.58**			ln(y) = -1.46293098541489 + 0.648650080214191*Z
OCDD PG/G	**2/3**										**6.62**	**12.1**	**4.38**	**0**	
PCB-105 ng/kg	**2/3**										**56.6**	**3790**	**89.9**	**10**	
PCB-108 ng/kg	**3/3**	**218.6**	**460.15119**	**2.104991721**	**-302.1101**	**739.31009**	**23**	**24.8**	**608**	**585**	**23**	**608**			ln(y) = 4.25217091702208 + 2.42860680448414*Z
PCB-114 ng/kg	**1/3**										**340**	**340**	**26.4**	**0**	
PCB-118 ng/kg	**3/3**	**5407.6667**	**12302.624**	**2.2750337**	**-8514.063**	**19329.396**	**211**	**212**	**15800**	**15589**	**211**	**15800**			ln(y) = 6.79206987572105 + 3.20081326529651*Z
PCB-126 ng/kg	**1/3**										**66.7**	**66.7**	**26.4**	**0**	
PCB-156 ng/kg	**2/3**										**20.8**	**1430**	**89.9**	**0**	
PCB-157 ng/kg	**2/3**										**5.81**	**391**	**89.9**	**0**	
PCB-162 ng/kg	**3/3**	**1233.5333**	**2774.6035**	**2.249313723**	**-1906.226**	**4373.2927**	**56.8**	**63.8**	**3580**	**3523.2**	**56.8**	**3580**			ln(y) = 5.45946919849087 + 3.0730113461939*Z
PCB-167 ng/kg	**2/3**										**17.3**	**925**	**89.9**	**0**	
PCB-37 ng/kg	**3/3**	**52.096667**	**85.255926**	**1.63649483**	**-44.3795**	**148.57283**	**8.49**	**19.8**	**128**	**119.51**	**8.49**	**128**			ln(y) = 3.32553373398112 + 2.0121514145289*Z

Table H-42
Reference Area
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-58 ng/kg	**1/3**										**189**	**189**	**26.4**	**0**	
PCB-60 ng/kg	**2/3**										**50.6**	**1650**	**32.2**	**0**	
PCB-61/70 ng/kg	**2/3**										**161**	**9180**	**86.5**	**0**	
PCB-66 ng/kg	**3/3**	**2215.3333**	**4967.4268**	**2.242293152**	**-3405.839**	**7836.5059**	**102**	**124**	**6420**	**6318**	**102**	**6420**			ln(y) = 6.07080925852444 + 3.07198702661808*Z
PCB-77 ng/kg	**2/3**										**6.9**	**445**	**89.9**	**0**	
PCB-79 ng/kg	**2/3**										**5.17**	**527**	**89.9**	**0**	
PCB-81 ng/kg	**2/3**										**3.43**	**156**	**89.9**	**0**	
Percent Lipids %	**17/19**	5.8298366	5.9489824	1.020437257	3.1548478	8.5048253	**1.6**	**3.7**	**9.4**	**7.8**	**0.9**	**21.9**	**0.1**	**0.1**	ln(y) = 1.2857959647031 + 1.17692395027949*Z
Selenium MG/KG	**18/18**	**0.7333333**	**0.3572999**	**0.487227184**	**0.5682692**	**0.8983975**	**0.415**	**0.665**	**0.915**	**0.5**	**0.33**	**1.5**			ln(y) = -0.419381931406447 + 0.536936714050365*Z
Silver MG/KG	**8/18**	0.0256381	0.0312881	1.220375023	0.0111838	0.0400925	0.00492	0.01262	**0.035**	0.03008	**0.02**	**0.1**	**0.01**	**0.01**	ln(y) = -4.37259905209838 + 1.39797868129681*Z
Total HpCDD PG/G	**1/3**										**3.06**	**3.06**	**1.69**	**0**	
Total HpCDF PG/G	**2/3**										**1.07**	**7.07**	**1.02**	**0**	
Total HxCDD PG/G	**1/3**										**1.79**	**1.79**	**0.451**	**0**	
Total HxCDF PG/G	**1/3**										**14.4**	**14.4**	**0.471**	**0**	
Total PeCDD PG/G	**1/3**										**1.13**	**1.13**	**0.538**	**0**	
Total PeCDF PG/G	**3/3**	**7.2183333**	**12.103021**	**1.676705778**	**-6.477524**	**20.914191**	**0.785**	**2.77**	**18.1**	**17.315**	**0.785**	**18.1**			ln(y) = 1.22422923242377 + 2.32722786017429*Z
Total TCDD PG/G	**2/3**										**1.01**	**1.13**	**0.272**	**0**	
Total TCDF PG/G	**3/3**	**12.576667**	**11.094084**	**0.882116381**	**0.0225292**	**25.130804**	**2.33**	**16.2**	**19.2**	**16.87**	**2.33**	**19.2**			ln(y) = 2.19526326294989 + 1.56413229329133*Z
Zinc MG/KG	**18/18**	**18.9**	**4.6484052**	**0.245947367**	**16.752546**	**21.047454**	**17.1**	**20**	**21.675**	**4.575**	**6.3**	**24.6**			ln(y) = 2.90058191463002 + 0.303633247099648*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-43
Reference Area
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,6,7,8-HxCDD PG/G	1/4										0.0909	0.0909	0.0746		
1,2,3,7,8-PeCDF PG/G	1/4										0.0774	0.0774	0.0623		
2,3,7,8-TCDD Equivalent PG/G	4/4	0.2495992	0.4287177	1.717624697	-0.170544	0.6697425	0.09251	0.09801	0.55828	0.46577	0.0907475	0.7116275			
2-Methylphenol ug/Kg	2/12										180	210	50		
4,4'-DDE ug/Kg	2/12										1.9	2.4	10		
4-Chloro-3-methylphenol ug/Kg	1/12										82	82	50		
Aldrin ug/Kg	1/12										2.9	2.9	6		
alpha-Chlordane ug/Kg	1/12										1.1	1.1	6		
Aluminum (Fume Or Dust) MG/KG	2/2										15.1	16.8			
Antimony MG/KG	1/11										0.04	0.04	0.03		
Aroclor-1254 ug/Kg	2/12										10	27	10		
Aroclor-1260 ug/Kg	1/12										16	16	10		
Arsenic MG/KG	11/11	0.6118182	0.2174362	0.355393526	0.4833216	0.7403148	0.43	0.58	0.83	0.4	0.32	0.9			ln(y) = -0.554320131618286 + 0.43910720652931*Z
Barium MG/KG	2/2										2.5	9			
Benzaldehyde ug/Kg	9/10	556.01422	323.71901	0.582213545	355.3711	756.65734	272.5	495	872.5	600	250	1000	50	50	ln(y) = 6.154617515056 + 0.736658941023976*Z
bis(2-Ethylhexyl)phthalate ug/Kg	1/12										2247	2247	50	50	
Cadmium MG/KG	1/11										0.01	0.01	0.003		
Calcium Metal MG/KG	2/2										12900	43800			
Chromium MG/KG	11/11	0.4527273	0.2657868	0.587079314	0.2956573	0.6097972	0.25	0.35	0.7	0.45	0.22	0.98			ln(y) = -0.921064399662088 + 0.589173238912843*Z
Copper MG/KG	11/11	1.4190909	2.5436428	1.792445308	-0.084106	2.9222878	0.51	0.77	1.4	0.89	0.46	7.2			ln(y) = -5.94836420953662E-02 + 0.84100703617548*Z
Dieldrin ug/Kg	2/12										2.6	4.2	10		
Diethyl Phthalate ug/Kg	8/12	52.575696	8.6483749	0.164493777	47.682417	57.468975	45.873	51.9784	58.8963	13.0233	44	70	50	4000	ln(y) = 3.95082779660577 + 0.185334540874698*Z
Endosulfan II ug/Kg	2/12										1.5	1.6	10		
gamma-BHC (Lindane) ug/Kg	2/12										1.3	2.3	10		
Heptachlor Epoxide ug/Kg	1/12										0.7	0.7	10		
Hexachloro-1,3-butadiene ug/Kg	10/12	145.95358	156.24247	1.070494295	57.551078	234.35608	-2000	-2000	-2000	0	32	530	2000	2000	ln(y) = 4.66817664140874 + 1.03407636132441*Z
Iron MG/KG	11/11	25.790909	11.172127	0.433180812	19.188604	32.393214	17.4	25.7	36.6	19.2	10.2	43.4			ln(y) = 3.1531351867627 + 0.561349454506286*Z
Lead MG/KG	5/11	0.0728182	0.0279452	0.383766562	0.0563037	0.0893328	0.05253	0.06919	0.09113	0.03859	0.06	0.11	0.04	0.8	ln(y) = -2.6708983481726 + 0.408490755220283*Z
Magnesium MG/KG	2/2										423	917			
Manganese MG/KG	2/2										7.2	17			
Mercury MG/KG	10/12	0.0267043	0.01588	0.594661565	0.0177193	0.0356892	0.01487	0.02307	0.03579	0.02092	0.014	0.06	0.013	0.016	ln(y) = -3.76938077153151 + 0.651434933731772*Z
Naphthalene ug/Kg	1/12										61	61	50		
Nickel MG/KG	9/11	0.0791087	0.0374386	0.473255175	0.0569839	0.1012335	-4	-4	-4	0	0.04	0.16	4	4	ln(y) = -2.61430093156192 + 0.525366241301971*Z
OCDD PG/G	1/4										5.42	5.42	0.911		
PCB-105 ng/kg	3/3	97.4	67.308804	0.691055484	21.232918	173.56708	51.4	79.8	161	109.6	51.4	161			ln(y) = 4.46685534730045 + 0.846769937921268*Z
PCB-108 ng/kg	3/3	49.5	35.507413	0.717321475	9.3195797	89.68042	20.7	44.8	83	62.3	20.7	83			ln(y) = 3.75039414916295 + 1.0299089862498*Z
PCB-114 ng/kg	2/3										4.11	4.18	20		
PCB-118 ng/kg	3/3	456	341.8276	0.74962193	69.185657	842.81434	181	408	779	598	181	779			ln(y) = 5.95592508384691 + 1.08242177744894*Z
PCB-156 ng/kg	3/3	40.933333	24.239336	0.592166187	13.503943	68.362724	20.9	38.2	63.7	42.8	20.9	63.7			ln(y) = 3.61225641238714 + 0.826500560017735*Z
PCB-157 ng/kg	3/3	13.95	9.2237394	0.661199959	3.5123563	24.387644	6.75	12.4	22.7	15.95	6.75	22.7			ln(y) = 2.51653463399426 + 0.8994674843954*Z
PCB-162 ng/kg	3/3	109.73333	61.300746	0.558633771	40.365009	179.10166	58.2	104	167	108.8	58.2	167			ln(y) = 4.60875668876517 + 0.781760187958261*Z
PCB-167 ng/kg	3/3	34.3	20.838942	0.607549325	10.718517	57.881483	15.6	34.3	53	37.4	15.6	53			ln(y) = 3.41756939399317 + 0.907031073815615*Z
PCB-189 ng/kg	2/3										6.1	10.6	21.9		
PCB-37 ng/kg	3/3	7.3833333	2.3044509	0.312115242	4.7756017	9.991065	5.59	6.99	9.57	3.98	5.59	9.57			ln(y) = 1.9746976829592 + 0.398741159093212*Z
PCB-58 ng/kg	2/3										1.3	2.59	21.9		
PCB-60 ng/kg	1/3										48.2	48.2	24.1		
PCB-61/70 ng/kg	1/3										143	143	72.6		

Table H-43
Reference Area
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-66 ng/kg	**3/3**	**163.1**	**120.98822**	**0.741803909**	**26.188943**	**300.01106**	**75.3**	**136**	**278**	**202.7**	**75.3**	**278**			ln(y) = 4.95391871141085 + 0.968675480890178*Z
PCB-77 ng/kg	**3/3**	**5.91**	**4.0756217**	**0.689614501**	**1.2979999**	**10.522**	**3.49**	**4.57**	**9.67**	**6.18**	**3.49**	**9.67**			ln(y) = 1.67948108352855 + 0.755816515514762*Z
PCB-79 ng/kg	**3/3**	**8.0066667**	**5.0461799**	**0.630247285**	**2.2963765**	**13.716957**	**3.37**	**8.25**	**12.4**	**9.03**	**3.37**	**12.4**			ln(y) = 1.94760747244062 + 0.966185637581627*Z
PCB-81 ng/kg	**2/3**										**1.63**	**3.16**	**21.9**		
Percent Lipids %	**7/11**	0.5488494	0.7341695	1.337652125	0.1149829	0.9827159	0.25431	**0.5**	**0.5**	0.24569	**0.5**	**2.1**	**0.1**	**0.1**	ln(y) = -0.865802661176157 + 0.746645082938028*Z
Potassium MG/KG	**2/2**										**2840**	**2960**			
Selenium MG/KG	**11/11**	**0.6772727**	**0.4591649**	**0.677961666**	**0.4059236**	**0.9486219**	**0.41**	**0.56**	**0.87**	**0.46**	**0.07**	**1.6**			ln(y) = -0.636940094140761 + 0.933233939439244*Z
Silver MG/KG	**1/11**										**0.02**	**0.02**	**0.01**		
Sodium MG/KG	**2/2**										**1470**	**2390**			
Total HxCDD PG/G	**2/4**										**0.151**	**0.465**	**0.0815**		
Total PeCDF PG/G	**3/4**	0.4790015	0.2052573	0.428510741	0.2778493	0.6801536	**0.321**	**0.468**	**0.654**	**0.333**	**0.444**	**0.708**	**0.28**	**0.28**	ln(y) = -0.780532807618132 + 0.453218807377776*Z
Total TCDD PG/G	**2/4**										**0.0583**	**0.0683**	**0.0538**	**0.28**	
Total TCDF PG/G	**3/4**	0.6077251	0.1410397	0.232078176	0.4695062	0.7459441	**0.50225**	**0.6185**	**0.7295**	**0.22725**	**0.569**	**0.75**	**0.48**	**0.48**	ln(y) = -0.51008608832772 + 0.262569137624766*Z
Zinc MG/KG	**11/11**	**15.590909**	**7.0201454**	**0.450271713**	**11.442268**	**19.73955**	**10.6**	**12.8**	**20.2**	**9.6**	**9.8**	**30.7**			ln(y) = 2.67367344584486 + 0.434458023041708*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-44
Reference Area
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/12										11	11	10		
1,2,3,4,6,7,8-HpCDF PG/G	3/3	3.1066667	1.832487	0.589856329	1.0330124	5.1803209	2.04	2.49	4.79	2.75	2.04	4.79			ln(y) = 1.06392097658519 + 0.633042385933313*Z
1,2,3,4,7,8-HxCDD PG/G	1/3										0.21	0.21	0.181		
1,2,3,6,7,8-HxCDD PG/G	1/3										0.342	0.342	0.231		
1,2,3,6,7,8-HxCDF PG/G	2/3										0.658	1.09	0.421		
1,2,3,7,8,9-HxCDD PG/G	1/3										0.21	0.21	0.19		
1,2,3,7,8-PeCDF PG/G	1/3										3.39	3.39	0.283		
2,3,4,7,8-PeCDF PG/G	2/3										0.735	1.82	0.381		
2,3,7,8-TCDD Equivalent PG/G	3/3	1.2881768	0.9248745	0.717971766	0.2415827	2.3347708	0.51895	1.19032	2.15527	1.63632	0.5189492	2.15526615			ln(y) = 9.53942732975079E-02 + 1.05598229957656*Z
2,3,7,8-TCDD PG/G	2/3										0.0902	0.186	0.101		
2,3,7,8-TCDF PG/G	3/3	3.37	4.1288402	1.225175126	-1.302222	8.0422225	1.03	1.94	7.14	6.11	1.03	7.14			ln(y) = 0.885986517222758 + 1.43591305400258*Z
4,4'-DDD ug/Kg	1/12										11	11	10		
4,4'-DDE ug/Kg	2/12										12	18	10		
Acetophenone ug/Kg	1/12										52	52	50	50	
Aroclor-1254 ug/Kg	1/12										1800	1800	10		
Arsenic MG/KG	12/12	0.5691667	0.2014653	0.353965376	0.4551769	0.6831564	0.44	0.525	0.695	0.255	0.27	0.96			ln(y) = -0.617793437837199 + 0.398814352404712*Z
Benzaldehyde ug/Kg	1/12										360	360	50	50	
Cadmium MG/KG	6/12	0.0033705	0.0034082	1.011163544	0.0014422	0.0052989	0.00104	-0.003	0.004	0.00296	0.003	0.01	0.003	0.003	ln(y) = -6.12630603655308 + 1.10164759728194*Z
Chromium MG/KG	12/12	0.375	0.3349157	0.893108426	0.1855036	0.5644964	0.22	0.235	0.47	0.25	0.19	1.2			ln(y) = -1.17715213473059 + 0.585887326681245*Z
Copper MG/KG	12/12	4.6941667	3.4343637	0.731623719	2.7509925	6.6373408	1.675	4.65	6.25	4.575	0.63	12			ln(y) = 1.26447200841154 + 0.983703747852066*Z
Dieldrin ug/Kg	1/12										12	12	10		
Diethyl Phthalate ug/Kg	2/12										53	58	50	50	
Endosulfan I ug/Kg	1/12										12	12	10		
Endrin Aldehyde ug/Kg	1/1										19	19			
gamma-Chlordane ug/Kg	1/12										27	27	10		
Iron MG/KG	12/12	95.108333	171.40589	1.802217326	-1.873676	192.09034	17.325	24	147.75	130.425	12.9	522			ln(y) = 3.69901076816405 + 1.30947256072948*Z
Lead MG/KG	10/12	0.1292803	0.1536585	1.18856847	0.0423398	0.2162207	0.0525	0.085	0.1775	0.125	0.05	0.51	0.04	0.04	ln(y) = -2.4411820816976 + 1.03456435689364*Z
Mercury MG/KG	12/12	0.01575	0.0078969	0.501389013	0.0112819	0.0202181	0.01025	0.014	0.023	0.01275	0.005	0.028			ln(y) = -4.28118535914342 + 0.644562976437291*Z
Nickel MG/KG	11/12	0.1407465	0.2105066	1.49564347	0.0216412	0.2598518	0.04	0.05	0.21	0.17	0.04	0.66	0.03	0.03	ln(y) = -2.59650657842343 + 1.22325015612826*Z
OCDD PG/G	2/3										7.8	27.9	3.95		
PCB-105 ng/kg	3/3	728.66667	270.07282	0.370639732	423.0505	1034.2828	472	783	931	459	472	931			ln(y) = 6.55212365295114 + 0.50377575916446*Z
PCB-108 ng/kg	3/3	373.33333	120.00571	0.321443869	237.53409	509.13258	274	360	486	212	274	486			ln(y) = 5.89514692057957 + 0.425014646094421*Z
PCB-114 ng/kg	3/3	45.8	28.981431	0.632782344	13.004423	78.595577	29.8	35.5	72.1	42.3	29.8	72.1			ln(y) = 3.74736504476121 + 0.655265413147101*Z
PCB-118 ng/kg	3/3	3660	1005.5951	0.274752762	2522.062	4797.938	2710	3800	4470	1760	2710	4470			ln(y) = 8.18420131573195 + 0.371141971896576*Z
PCB-126 ng/kg	3/3	16.236667	9.562018	0.588915091	5.4162246	27.057109	8.71	14.7	25.3	16.59	8.71	25.3			ln(y) = 2.69437456012753 + 0.790826002329667*Z
PCB-156 ng/kg	3/3	366.66667	200.0535	0.545600465	140.28482	593.04852	195	449	456	261	195	456			ln(y) = 5.83417175194013 + 0.63001107589486*Z
PCB-157 ng/kg	3/3	112.3	53.145462	0.473245428	52.160249	172.43975	61.9	125	150	88.1	61.9	150			ln(y) = 4.65482307036304 + 0.656429377035677*Z
PCB-162 ng/kg	3/3	698.33333	272.72428	0.390535956	389.71676	1006.9499	455	801	839	384	455	839			ln(y) = 6.51278969082884 + 0.453814257136315*Z
PCB-167 ng/kg	3/3	284.66667	107.24037	0.376722616	163.31276	406.02057	185	293	376	191	185	376			ln(y) = 5.6100391924951 + 0.525989871526263*Z
PCB-189 ng/kg	3/3	70	34.68908	0.495558281	30.745611	109.25439	37.9	81.2	90.9	53	37.9	90.9			ln(y) = 4.18054212014648 + 0.648785954219647*Z
PCB-37 ng/kg	2/3										8.75	14.3	19.9		
PCB-58 ng/kg	3/3	14.633333	5.2068086	0.355818357	8.7412747	20.525392	11.9	12.7	19.3	7.4	11.9	19.3			ln(y) = 2.65941516316429 + 0.358628363371655*Z
PCB-60 ng/kg	3/3	208	83.818516	0.402973634	113.15042	302.84958	131	212	281	150	131	281			ln(y) = 5.29004608906897 + 0.565981636906493*Z
PCB-61/70 ng/kg	3/3	1048.3333	488.89621	0.466355688	495.09519	1601.5715	826	849	1470	644	826	1470			ln(y) = 6.91789054653504 + 0.427493467348621*Z
PCB-66 ng/kg	3/3	1330	192.08515	0.144424925	1112.6352	1547.3648	1150	1350	1490	340	1150	1490			ln(y) = 7.18730283057643 + 0.192093110225395*Z
PCB-77 ng/kg	3/3	37.033333	7.4181165	0.200309178	28.638944	45.427722	30.9	36.2	44	13.1	30.9	44			ln(y) = 3.60133497888456 + 0.262117430423051*Z

Table H-44
Reference Area
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-79 ng/kg	**3/3**	**70.8**	**35.476903**	**0.501086204**	**30.654105**	**110.9459**	**51.2**	**58.2**	**103**	**51.8**	**51.2**	**103**			ln(y) = 4.21145129167083 + 0.518392699220329*Z
PCB-81 ng/kg	**3/3**	**26.3**	**22.17482**	**0.843149062**	**1.2068286**	**51.393171**	**14.6**	**18.1**	**46.2**	**31.6**	**14.6**	**46.2**			ln(y) = 3.13663775502459 + 0.854328704626857*Z
Percent Lipids %	**12/12**	**1.1666667**	**0.7636961**	**0.654596648**	**0.7345649**	**1.5987684**	**0.5**	**1**	**1.5**	**1**	**0.5**	**2.5**			ln(y) = -3.47299262272436E-02 + 0.70881938186338*Z
Selenium MG/KG	**12/12**	**0.3416667**	**0.2597761**	**0.760320332**	**0.1946845**	**0.4886488**	**0.1875**	**0.265**	**0.435**	**0.2475**	**0.15**	**0.99**			ln(y) = -1.22372455897298 + 0.608616696752201*Z
Silver MG/KG	**9/12**	0.0599181	0.0473834	0.790803548	0.0331084	0.0867278	**0.0175**	**0.05**	**0.07**	**0.0525**	**0.04**	**0.17**	**0.01**	**0.01**	ln(y) = -3.03114864027956 + 0.770993804764074*Z
Total HpCDD PG/G	**2/3**										**1.67**	**4.39**	**0.766**		
Total HpCDF PG/G	**3/3**	**3.1066667**	**1.832487**	**0.589856329**	**1.0330124**	**5.1803209**	**2.04**	**2.49**	**4.79**	**2.75**	**2.04**	**4.79**			ln(y) = 1.06392097658519 + 0.633042385933313*Z
Total HxCDD PG/G	**2/3**										**0.56**	**2.35**	**0.202**		
Total HxCDF PG/G	**3/3**	**5.49**	**3.5695875**	**0.650198086**	**1.4506315**	**9.5293685**	**3.38**	**4.31**	**8.78**	**5.4**	**3.38**	**8.78**			ln(y) = 1.61709667375254 + 0.707962084713175*Z
Total PeCDF PG/G	**3/3**	**5.0566667**	**2.8519455**	**0.563997128**	**1.8293866**	**8.2839468**	**2.38**	**5.37**	**7.42**	**5.04**	**2.38**	**7.42**			ln(y) = 1.51736915112782 + 0.843293448351044*Z
Total TCDD PG/G	**3/3**	**0.347**	**0.1101081**	**0.317314465**	**0.2224009**	**0.4715991**	**0.272**	**0.318**	**0.451**	**0.179**	**0.272**	**0.451**			ln(y) = -1.08131501612252 + 0.375017367659017*Z
Total TCDF PG/G	**3/3**	**6.39**	**3.9437479**	**0.61717495**	**1.9272291**	**10.852771**	**3.15**	**5.92**	**10.1**	**6.95**	**3.15**	**10.1**			ln(y) = 1.74609144186022 + 0.864099480254764*Z
Zinc MG/KG	**12/12**	**17.483333**	**4.854967**	**0.277691156**	**14.736377**	**20.23029**	**12.5**	**18.85**	**21.3**	**8.8**	**9.1**	**23.9**			ln(y) = 2.82138772289835 + 0.343444019500936*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-45
Reference Area
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/18										12	12	10		
1,2,3,4,6,7,8-HpCDF PG/G	2/3										0.375	1.17	0.124		
1,2,3,6,7,8-HxCDF PG/G	1/3										0.205	0.205	0.108		
1,2,3,7,8-PeCDF PG/G	2/3										0.19	0.295	0.119		
2,3,4,7,8-PeCDF PG/G	1/3										0.106	0.106	0.127		
2,3,7,8-TCDD Equivalent PG/G	3/3	1.2881768	0.9248745	0.717971766	0.2415827	2.3347708	0.51895	1.19032	2.15527	1.63632	0.5189492	2.15526615			ln(y) = 9.53942732975079E-02 + 1.05598229957656*Z
2,3,7,8-TCDF PG/G	2/3										0.223	0.627	0.0991		
Aroclor-1254 ug/Kg	10/18	24.814468	19.763858	0.796465119	15.684031	33.944905	9.66859	15	39	29.3314	12	66	10	10	ln(y) = 2.89333847655524 + 0.926232454232678*Z
Aroclor-1260 ug/Kg	4/18	7.2909882	13.148066	1.803331137	1.2168916	13.365085	0.98766	2.85976	8.2804	7.29274	14	46	10	10	ln(y) = 1.05073720871783 + 1.5769367768113*Z
Arsenic MG/KG	19/19	0.7131579	0.5297409	0.742810087	0.4749573	0.9513584	0.32	0.45	1.1	0.78	0.21	2.1			ln(y) = -0.571906169191019 + 0.760553031774368*Z
Benzaldehyde ug/Kg	1/19										77	77	50		
Benzyl Butyl Phthalate ug/Kg	2/19										1100	1500	50		
Cadmium MG/KG	3/19										0.003	0.01	0.003		
Chromium MG/KG	19/19	0.1973684	0.0840329	0.425766765	0.1595826	0.2351542	0.12	0.21	0.26	0.14	0.1	0.41			ln(y) = -1.70649596224788 + 0.459671938387577*Z
Copper MG/KG	19/19	0.64	0.3066993	0.479217734	0.5020912	0.7779088	0.38	0.66	0.79	0.41	0.21	1.3			ln(y) = -0.561035629965508 + 0.564617699056376*Z
Diethyl Phthalate ug/Kg	7/19	43.137463	17.5719	0.407346635	35.236173	51.038753	29.6799	39.7992	51	21.3201	32	84	50	50	ln(y) = 3.68384649706673 + 0.435156667743599*Z
Di-n-butylphthalate ug/Kg	1/19										730	730	50	50	
Hexachloro-1,3-butadiene ug/Kg	9/19	68.746958	96.459257	1.403105815	25.373587	112.12033	23.694	45.1485	76	52.306	40	380	50	50	ln(y) = 3.80995668842303 + 0.956311800391683*Z
Iron MG/KG	19/19	10.173684	8.3101402	0.816827026	6.4369895	13.910379	5.9	7.6	11.3	5.4	2.7	36			ln(y) = 2.12221543441561 + 0.687854072510625*Z
Lead MG/KG	2/19										0.04	0.07	0.04		
Mercury MG/KG	19/19	0.1074737	0.1932521	1.798134471	0.0205769	0.1943704	0.064	0.071	0.098	0.034	0.042	0.69			ln(y) = -2.50465500983942 + 0.526004237845442*Z
Nickel MG/KG	19/19	0.1	0.0947757	0.947756863	0.0573837	0.1426163	0.05	0.08	0.1	0.05	0.04	0.4			ln(y) = -2.5011432829603 + 0.598990249943328*Z
PCB-105 ng/kg	3/3	299.03333	279.17433	0.933589347	-16.88217	614.94883	34.1	364	499	464.9	34.1	499			ln(y) = 5.21301911589258 + 1.99002664985797*Z
PCB-108 ng/kg	3/3	153.1	149.36991	0.975636277	-15.92797	322.12797	14.3	200	245	230.7	14.3	245			ln(y) = 4.48661170478621 + 2.10697451541294*Z
PCB-114 ng/kg	3/3	12.873333	11.771025	0.914372711	-0.446835	26.193502	2.22	17.1	19.3	17.08	2.22	19.3			ln(y) = 2.19889691843455 + 1.60385103495416*Z
PCB-118 ng/kg	3/3	1227	1235.6784	1.007072825	-171.3017	2625.3017	131	1700	1850	1719	131	1850			ln(y) = 6.61217392377261 + 1.96365043398734*Z
PCB-126 ng/kg	1/3										7.29	7.29	19.7		
PCB-156 ng/kg	3/3	118.73333	120.3197	1.013360716	-17.42122	254.88789	12.2	116	228	215.8	12.2	228			ln(y) = 4.22812392393334 + 2.17143046610563*Z
PCB-157 ng/kg	3/3	47.34	49.008224	1.035239213	-8.118027	102.79803	4.52	66.8	70.7	66.18	4.52	70.7			ln(y) = 3.32288688242976 + 2.03943775991534*Z
PCB-162 ng/kg	3/3	427.63333	414.31855	0.968864011	-41.21224	896.47891	33.9	514	735	701.1	33.9	735			ln(y) = 5.45516959301813 + 2.28159673754814*Z
PCB-167 ng/kg	3/3	80.533333	82.371447	1.022824254	-12.67873	173.7454	10.2	74.4	157	146.8	10.2	157			ln(y) = 3.89602982249253 + 2.02751566487887*Z
PCB-189 ng/kg	2/3										1.7	36.8	19.8		
PCB-37 ng/kg	2/3										2.78	4.55	19.9		
PCB-58 ng/kg	3/3	2.0643333	2.2821185	1.105499022	-0.518127	4.6467935	0.993	1.15	4.05	3.057	0.993	4.05			ln(y) = 0.510484736185547 + 1.04254237613876*Z
PCB-60 ng/kg	2/3										42.4	49.2	20.3		
PCB-61/70 ng/kg	2/3										106	204	59.6		
PCB-66 ng/kg	2/3										297	346	65.3		
PCB-77 ng/kg	3/3	5.6833333	5.2150609	0.917606015	-0.218064	11.58473	2.57	3.98	10.5	7.93	2.57	10.5			ln(y) = 1.55885432512232 + 1.04382381342268*Z
PCB-79 ng/kg	3/3	21.013333	19.81023	0.942745723	-1.404052	43.430719	2.94	27.9	32.2	29.26	2.94	32.2			ln(y) = 2.62633424090942 + 1.77513751633999*Z
PCB-80 ng/kg	1/3										0.802	0.802	19.7		
PCB-81 ng/kg	3/3	3.77	2.5078482	0.665211711	0.9321027	6.6078973	1.47	3.88	5.96	4.49	1.47	5.96			ln(y) = 1.1753893451677 + 1.03814196725023*Z
Percent Lipids %	2/19										0.5	0.5	0.1		
Selenium MG/KG	19/19	0.5357895	0.1800371	0.336022038	0.4548349	0.616744	0.39	0.51	0.67	0.28	0.29	0.92			ln(y) = -0.674725065968452 + 0.365700287064153*Z
Silver MG/KG	1/19										0.02	0.02	0.01		
Total HpCDF PG/G	2/3										0.375	1.17	0.154		
Total HxCDF PG/G	2/3										0.578	1.85	0.242		
Total PeCDF PG/G	3/3	0.8313333	0.1098264	0.13210871	0.7070531	0.9556136	0.728	0.862	0.904	0.176	0.728	0.904			ln(y) = -0.188960052564619 + 0.160584248050613*Z

CDM

Table H-45
Reference Area
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total TCDD PG/G	1/3										0.0773	0.0773	0.0454		
Total TCDF PG/G	3/3	0.706	0.2408863	0.341198685	0.4334115	0.9785885	0.498	0.804	0.816	0.318	0.498	0.816			ln(y) = -0.372884045259562 + 0.366228294561172*Z
Zinc MG/KG	19/19	10.147368	3.731215	0.367702719	8.4696096	11.825127	6.4	10.2	13.4	7	4.2	15.9			ln(y) = 2.24588955481827 + 0.444467032259356*Z

Table H-46
Reference Area
Fish Fillet - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**2/5**										**6.3**	**11**	**11**	**0**	
4,4'-DDE ug/Kg	**1/5**										**3.1**	**3.1**	**6**	**0**	
alpha-BHC ug/Kg	**1/5**										**2.8**	**2.8**	**6**	**0**	
Aluminum (Fume Or Dust) MG/KG	**2/5**										**3.9**	**3.9**	**10**	**0**	
Antimony MG/KG	**2/5**										**0.37**	**0.46**	**1**	**0**	
Arsenic MG/KG	**3/5**	0.618592	0.1905197	0.307989339	0.4515941	0.7855899	0.46664	0.60414	0.78217	0.31553	**0.57**	**0.85**	**0.42**	**1**	ln(y) = -0.503947982139341 + 0.383066295206696*Z
Barium MG/KG	**5/5**	**0.444**	**0.2624632**	**0.591133274**	**0.2139409**	**0.6740591**	**0.225**	**0.42**	**0.675**	**0.45**	**0.2**	**0.81**			ln(y) = -0.938028002399637 + 0.751349189258264*Z
Calcium Metal MG/KG	**5/5**	**1513.4**	**1544.2476**	**1.020382954**	**159.80733**	**2866.9927**	**423.5**	**1250**	**2735**	**2311.5**	**243**	**3740**			ln(y) = 6.94205040989442 + 1.38158502540701*Z
Chromium MG/KG	**2/5**										**0.8**	**2**	**1**	**0**	
Copper MG/KG	**5/5**	**0.774**	**0.3532804**	**0.45643465**	**0.4643361**	**1.0836639**	**0.49**	**0.75**	**1.07**	**0.58**	**0.31**	**1.2**			ln(y) = -0.347779293495197 + 0.649020001863675*Z
Dieldrin ug/Kg	**1/5**										**4.6**	**4.6**	**6**	**0**	
Diethyl Phthalate ug/Kg	**2/5**										**320**	**370**	**4000**	**0**	
Endrin ug/Kg	**2/5**										**2.2**	**5.5**	**6**	**0**	
gamma-BHC (Lindane) ug/Kg	**1/5**										**0.91**	**0.91**	**6**	**0**	
Heptachlor Epoxide ug/Kg	**1/5**										**2.2**	**2.2**	**22**	**0**	
Iron MG/KG	**3/5**	8.1907025	7.6566661	0.934799679	1.4793388	14.902066	4.18051	6.7104	10.7713	6.59077	**4.9**	**19.2**	**6.2**	**12.3**	ln(y) = 1.90365822032812 + 0.701917656073666*Z
Magnesium MG/KG	**5/5**	**337**	**61.429923**	**0.182284637**	**283.1543**	**390.8457**	**288.5**	**334**	**387**	**98.5**	**253**	**406**			ln(y) = 5.80794201905344 + 0.228522317727763*Z
Manganese MG/KG	**5/5**	**1.266**	**0.7808971**	**0.616822363**	**0.5815135**	**1.9504865**	**0.565**	**1.2**	**2**	**1.435**	**0.52**	**2.3**			ln(y) = 0.079527228313957 + 0.838279687352533*Z
Mercury MG/KG	**4/5**	0.0166456	0.0083616	0.50232862	0.0093164	0.0239748	**-0.016**	**-0.016**	**0.022**	**0.038**	**0.013**	**0.028**	**0.016**	**0.016**	ln(y) = -4.15685557964325 + 0.378299355932912*Z
Nickel MG/KG	**1/5**										**0.93**	**0.93**	**4**	**0.016**	
Percent Lipids %	**5/5**	**0.2802**	**0.3993821**	**1.425346601**	**-0.069874**	**0.6302739**	**0.103**	**0.17**	**0.5125**	**0.4095**	**0.036**	**0.835**			ln(y) = -1.74184095706854 + 1.37793196348295*Z
Potassium MG/KG	**5/5**	**4320**	**854.21629**	**0.197735253**	**3571.2464**	**5068.7536**	**3765**	**4430**	**4820**	**1055**	**3100**	**4920**			ln(y) = 8.35841900092351 + 0.211480845241327*Z
Selenium MG/KG	**5/5**	**0.798**	**0.2528353**	**0.316836246**	**0.5763801**	**1.0196199**	**0.59**	**0.83**	**0.99**	**0.4**	**0.46**	**1.1**			ln(y) = -0.264777125273617 + 0.414709891280907*Z
Sodium MG/KG	**3/5**										**747**	**1020**	**633**	**0**	
Zinc MG/KG	**5/5**	**5.74**	**2.0295578**	**0.3535815**	**3.9610141**	**7.5189859**	**4.25**	**5.7**	**7.25**	**3**	**3.6**	**8.6**			ln(y) = 1.70746995591806 + 0.411403736858231*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-47
Reference Area
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	**2/28**										**1.2**	**1.8**	**10**	**0**	
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**0.261346**	**0.0141954**	**0.054316359**	**0.2452824**	**0.2774095**	**0.25519**	**0.25542**	**0.27343**	**0.01824**	**0.255187**	**0.2734287**			ln(y) = -1.34243675866183 + 5.12054254079356E-02*Z
2-Methylnaphthalene ug/Kg	**2/27**										**11**	**13**	**40**	**0**	
4,4'-DDD ug/Kg	**2/28**										**1.2**	**2.2**	**6**	**0**	
4,4'-DDE ug/Kg	**5/28**										**1.3**	**3.9**	**6**	**0**	
4,4'-DDT ug/Kg	**1/28**										**1.6**	**1.6**	**6**	**0**	
Aldrin ug/Kg	**2/28**										**3.2**	**3.3**	**6**	**0**	
alpha-BHC ug/Kg	**1/28**										**0.72**	**0.72**	**6**	**0**	
alpha-Chlordane ug/Kg	**2/28**										**1.5**	**2**	**6**	**0**	
Aluminum (Fume Or Dust) MG/KG	**3/6**	5.0518369	1.60704	0.318110039	3.7659371	6.3377368	3.65477	**-10**	**-10**	-13.655	**3.9**	**7**	**10**	**10**	ln(y) = 1.58850057496348 + 0.433805264114853*Z
Antimony MG/KG	**2/28**										**0.37**	**0.4**	**0.02**	**10**	
Aroclor-1254 ug/Kg	**2/28**										**31**	**60**	**10**	**0**	
Arsenic MG/KG	**26/28**	0.8263944	0.6549055	0.792485407	0.583814	1.0689748	0.33206	0.60149	1.08951	0.75745	**0.14**	**2.2**	**0.45**	**0.72**	ln(y) = -0.508351206113749 + 0.881181862348037*Z
Barium MG/KG	**6/6**	**1.12**	**2.493719**	**2.226534806**	**-0.875391**	**3.1153908**	**0.295**	**0.395**	**1.6275**	**1.3325**	**0.25**	**4.8**			ln(y) = -0.56943361011484 + 1.18339684325667*Z
Benzaldehyde ug/Kg	**8/22**	210.10985	1108.11	5.273955426	-252.9398	673.15955	6.64769	24.2565	88.5083	81.8606	**20**	**3700**	**40**	**200**	ln(y) = 3.18868273383568 + 1.91995584838522*Z
beta-BHC ug/Kg	**1/28**										**2**	**2**	**1.3**	**0**	
bis(2-Ethylhexyl)phthalate ug/Kg	**5/28**										**41**	**520000**	**40**	**200**	
Cadmium MG/KG	**6/28**										**0.01**	**0.02**	**0.01**	**0**	
Calcium Metal MG/KG	**6/6**	**4270.3333**	**10302.957**	**2.412682138**	**-3973.749**	**12514.416**	**826.5**	**1215**	**6420**	**5593.5**	**795**	**19500**			ln(y) = 7.51394476642642 + 1.33918428032496*Z
Caprolactam ug/Kg	**2/21**										**23**	**46**	**40**	**200**	
Chromium MG/KG	**1/28**										**0.52**	**0.52**	**0.12**	**0**	
Copper MG/KG	**28/28**	**0.4664286**	**0.204217**	**0.43783124**	**0.3907855**	**0.5420716**	**0.32**	**0.38**	**0.565**	**0.245**	**0.28**	**1**			ln(y) = -0.836697321788321 + 0.390233752190809*Z
Dieldrin ug/Kg	**5/28**										**1.4**	**3.8**	**6**	**0**	
Diethyl Phthalate ug/Kg	**13/28**	20.316817	13.948785	0.686563473	15.150115	25.483519	12.0547	17.7703	26.1958	14.1411	**11**	**70**	**40**	**4000**	ln(y) = 2.87752754591098 + 0.575612384276714*Z
Di-n-butylphthalate ug/Kg	**2/28**										**320**	**1000**	**40**	**4000**	
Endosulfan I ug/Kg	**1/28**										**0.67**	**0.67**	**6**	**0**	
Endosulfan II ug/Kg	**3/28**										**1.7**	**2.6**	**6**	**0**	
Endrin Aldehyde ug/Kg	**3/28**										**1.5**	**2.3**	**6**	**0**	
Endrin Ketone ug/Kg	**1/28**										**1.2**	**1.2**	**6**	**0**	
Endrin ug/Kg	**1/28**										**1.2**	**1.2**	**6**	**0**	
gamma-BHC (Lindane) ug/Kg	**2/28**										**1**	**1.1**	**6**	**0**	
gamma-Chlordane ug/Kg	**1/28**										**2.1**	**2.1**	**6**	**0**	
Heptachlor Epoxide ug/Kg	**3/28**										**0.63**	**3.9**	**10**	**0**	
Heptachlor ug/Kg	**1/28**										**2.6**	**2.6**	**6**	**0**	
Iron MG/KG	**8/28**	2.7606445	4.4450242	1.610140058	1.1141844	4.4071045	0.88804	1.75563	3.47083	2.58278	**3.4**	**19.4**	**1.7**	**7.9**	ln(y) = 0.56282985197122 + 1.01093739240045*Z
Lead MG/KG	**20/28**	0.1314523	0.0971662	0.73917458	0.0954614	0.1674432	0.05704	0.10193	0.18214	0.1251	**0.04**	**0.36**	**0.02**	**0.8**	ln(y) = -2.28350736802455 + 0.86105574345011*Z
Magnesium MG/KG	**6/6**	**356.33333**	**108.468**	**0.304400364**	**269.54086**	**443.12581**	**306**	**325**	**399.5**	**93.5**	**291**	**530**			ln(y) = 5.85466136343444 + 0.243097158006559*Z
Manganese MG/KG	**6/6**	**2.1233333**	**4.7900056**	**2.255889625**	**-1.709469**	**5.9561361**	**0.515**	**0.71**	**3.125**	**2.61**	**0.5**	**9.2**			ln(y) = 4.58820559443081E-02 + 1.19424102035632*Z
Mercury MG/KG	**28/28**	**0.0696071**	**0.0304639**	**0.437654482**	**0.0583232**	**0.0808911**	**0.0475**	**0.0645**	**0.087**	**0.0395**	**0.023**	**0.143**			ln(y) = -2.76075350584905 + 0.49773974505131*Z
Naphthalene ug/Kg	**3/27**										**16**	**32**	**40**	**0**	
Nickel MG/KG	**1/28**										**0.26**	**0.26**	**0.03**	**0**	
PCB-105 ng/kg	**3/3**	**36.543333**	**59.904401**	**1.639270306**	**-31.24488**	**104.33154**	**9.13**	**12.2**	**88.3**	**79.17**	**9.13**	**88.3**			ln(y) = 3.064580584652 + 1.68289154943763*Z
PCB-108 ng/kg	**3/3**	**16.533333**	**30.437103**	**1.840953832**	**-17.90949**	**50.976158**	**3.22**	**3.88**	**42.5**	**39.28**	**3.22**	**42.5**			ln(y) = 2.09157352970729 + 1.91350065072858*Z
PCB-114 ng/kg	**3/3**	**2.328**	**3.748862**	**1.610335916**	**-1.914237**	**6.5702367**	**0.528**	**0.846**	**5.61**	**5.082**	**0.528**	**5.61**			ln(y) = 0.306218601627605 + 1.75263110486966*Z
PCB-118 ng/kg	**3/3**	**156.2**	**271.47888**	**1.73802102**	**-151.0073**	**463.40728**	**37.1**	**43.5**	**388**	**350.9**	**37.1**	**388**			ln(y) = 4.44912774911043 + 1.74089749492187*Z
PCB-126 ng/kg	**2/3**										**0.572**	**2.28**	**2.01**	**0**	

Table H-47
Reference Area
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-156 ng/kg	3/3	19.213333	35.434381	1.844259942	-20.88444	59.31111	4.15	4.29	49.2	45.05	4.15	49.2			ln(y) = 2.25842956356027 + 1.83389581823936*Z
PCB-157 ng/kg	3/3	5.35	9.0424581	1.690179079	-4.882505	15.582505	1.51	1.54	13	11.49	1.51	13			ln(y) = 1.13628047490464 + 1.59661404995072*Z
PCB-162 ng/kg	3/3	43.653333	78.705515	1.802966905	-45.41034	132.71701	8.86	11.1	111	102.14	8.86	111			ln(y) = 3.09934069141587 + 1.87483251104647*Z
PCB-167 ng/kg	3/3	13.103333	24.132729	1.841724406	-14.20542	40.412087	2.89	2.92	33.5	30.61	2.89	33.5			ln(y) = 1.88146185241185 + 1.81721181132438*Z
PCB-189 ng/kg	1/3										6.14	6.14	1.99	0	
PCB-61/70 ng/kg	1/3										92.9	92.9	20.8	0	
PCB-66 ng/kg	1/3										124	124	20.9	0	
PCB-77 ng/kg	3/3	2.8933333	3.7397181	1.292529304	-1.338556	7.1252228	1.03	1.45	6.2	5.17	1.03	6.2			ln(y) = 0.741890550241691 + 1.33122174713032*Z
PCB-79 ng/kg	3/3	2.7576667	4.8058315	1.742716621	-2.680644	8.195977	0.633	0.77	6.87	6.237	0.633	6.87			ln(y) = 0.402838161753963 + 1.76838280346597*Z
PCB-81 ng/kg	2/3										0.583	2.33	2.01	0	
Percent Lipids %	28/28	1.3210714	2.0551005	1.555631632	0.5598515	2.0822913	0.2	0.47	1.7	1.5	0.2	7.6			ln(y) = -0.502277020704193 + 1.18682892547727*Z
Phenanthrene ug/Kg	3/28										25	26	40	0	
Phenol ug/Kg	1/27										300	300	40	4000	
Potassium MG/KG	6/6	4100	407.77748	0.099457923	3773.7101	4426.2899	3770	4105	4347.5	577.5	3620	4730			ln(y) = 8.31523180804829 + 0.115302086848287*Z
Selenium MG/KG	28/28	0.7	0.2723733	0.389104669	0.5991115	0.8008885	0.4925	0.59	0.8325	0.34	0.42	1.4			ln(y) = -0.4196053027496 + 0.371199587833679*Z
Silver MG/KG	1/28										0.02	0.02	0.01	0	
Sodium MG/KG	1/6										1180	1180	384	0	
Zinc MG/KG	28/28	4.6464286	2.4549372	0.528349282	3.7371071	5.55575	3.6	4	4.975	1.375	3.3	14.4			ln(y) = 1.47508149065445 + 0.30005402296597*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-48
Reference Area
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/2										1.11	2.6			
1,2,3,7,8-PeCDF PG/G	1/2										0.0848	0.0848	0.43		
2,3,4,7,8-PeCDF PG/G	1/2										0.0981	0.0981	0.43		
2,3,7,8-TCDD Equivalent PG/G	2/2										0.1937023	1.0126785			
2,3,7,8-TCDF PG/G	1/2										0.242	0.242	0.31		
4,4'-DDD ug/Kg	1/4										0.97	0.97	10		
Aldrin ug/Kg	1/4										3.7	3.7	10		
Arsenic MG/KG	3/3	0.7366667	0.0816406	0.110824348	0.6442816	0.8290517	0.66	0.76	0.79	0.13	0.66	0.79			ln(y) = -0.308558207728165 + 0.133340259996656*Z
Benzaldehyde ug/Kg	3/3	1500	334.31458	0.222876383	1121.6874	1878.3126	1200	1500	1800	600	1200	1800			ln(y) = 7.29961305558355 + 0.300705754532114*Z
Cadmium MG/KG	3/3	0.2266667	0.0989505	0.436546206	0.1146937	0.3386397	0.16	0.2	0.32	0.16	0.16	0.32			ln(y) = -1.52715121979026 + 0.514059882747007*Z
Copper MG/KG	3/3										0.82	1.7			
Endrin Aldehyde ug/Kg	1/4										0.64	0.64	10		
gamma-BHC (Lindane) ug/Kg	1/4										3.1	3.1	10		
Iron MG/KG	3/3	63.433333	7.526707	0.118655392	54.916063	71.950604	56.6	63.6	70.1	13.5	56.6	70.1			ln(y) = 4.14618174986525 + 0.158645249623617*Z
Mercury MG/KG	3/3	0.0093333	0.0035083	0.375888979	0.0053633	0.0133033	0.006	0.01	0.012	0.006	0.006	0.012			ln(y) = -4.71467154164544 + 0.514059882747007*Z
Methyl Mercury MG/KG	3/3	0.0089333	0.0013652	0.152826129	0.0073884	0.0104783	0.0081	0.0085	0.0102	0.0021	0.0081	0.0102			ln(y) = -4.72298263049384 + 0.170963639815543*Z
Nickel MG/KG	3/3	0.4633333	0.241044	0.520238777	0.1905664	0.7361003	0.24	0.48	0.67	0.43	0.24	0.67			ln(y) = -0.853854365772491 + 0.761387812459468*Z
OCDD PG/G	2/2										14.2	23			
PCB-105 ng/kg	1/1										21.8	21.8			
PCB-108 ng/kg	1/1										8.86	8.86			
PCB-118 ng/kg	1/1										73	73			
PCB-156 ng/kg	1/1										3.35	3.35			
PCB-162 ng/kg	1/1										18.7	18.7			
PCB-167 ng/kg	1/1										7.32	7.32			
PCB-37 ng/kg	1/1										5.42	5.42			
PCB-77 ng/kg	1/1										2.7	2.7			
PCB-79 ng/kg	1/1										2.81	2.81			
Percent Lipids %	4/4	1.7725	1.2244374	0.690796817	0.5725514	2.9724486	0.7175	2.05	2.55	1.8325	0.29	2.7			ln(y) = 0.297615485574497 + 1.2238836778357*Z
Selenium MG/KG	3/3	0.4566667	0.0283579	0.062097574	0.4245767	0.4887566	0.43	0.46	0.48	0.05	0.43	0.48			ln(y) = -0.784822678291242 + 8.15801447107714E-02*Z
Silver MG/KG	1/3										0.07	0.07	0.03		
Total HpCDD PG/G	2/2										4.21	7			
Total HxCDD PG/G	2/2										2.9	3.71			
Total PeCDD PG/G	1/2										0.513	0.513	0.73		
Total PeCDF PG/G	1/2										1.56	1.56	0.76		
Total TCDD PG/G	1/2										2.57	2.57	0.5		
Total TCDF PG/G	2/2										1.3	4.6			
Zinc MG/KG	3/3	5.6666667	0.8977474	0.158426015	4.6507698	6.6825635	4.9	5.6	6.5	1.6	4.9	6.5			ln(y) = 1.72793465991976 + 0.209560607700426*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-49
Reference Area
Shellfish - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,7,8-PeCDF PG/G	**1/4**										**0.0919**	**0.0919**	**0.129**	**0**	
2,3,4,7,8-PeCDF PG/G	**1/4**										**0.104**	**0.104**	**0.127**	**0**	
2,3,7,8-TCDD Equivalent PG/G	**4/4**	**0.3503213**	**0.1817985**	**0.518947952**	**0.1721587**	**0.5284838**	**0.18676**	**0.35461**	**0.50959**	**0.32284**	**0.180071**	**0.511987**			ln(y) = -1.16203449671958 + 0.714866392607477*Z
2,3,7,8-TCDF PG/G	**2/4**										**0.223**	**0.265**	**0.241**	**0**	
Arsenic MG/KG	**10/10**	**0.587**	**0.1868286**	**0.318277045**	**0.4712024**	**0.7027976**	**0.43**	**0.59**	**0.675**	**0.245**	**0.35**	**0.97**			ln(y) = -0.572356527756498 + 0.348424318523442*Z
Benzaldehyde ug/Kg	**9/10**	100.88096	93.073898	0.922611144	43.19316	158.56876	**-40**	**78.5**	**127.5**	**167.5**	**37**	**310**	**40**	**40**	ln(y) = 4.38404058351663 + 0.777499113636775*Z
Benzyl Butyl Phthalate ug/Kg	**1/9**										**4400**	**4400**	**40**	**40**	
bis(2-Ethylhexyl)phthalate ug/Kg	**1/9**										**420**	**420**	**40**	**40**	
Cadmium MG/KG	**1/10**										**0.02**	**0.02**	**0.01**	**0**	
Chromium MG/KG	**10/10**	**0.427**	**0.1207363**	**0.282754915**	**0.3521668**	**0.5018332**	**0.345**	**0.415**	**0.5475**	**0.2025**	**0.24**	**0.61**			ln(y) = -0.887720044344035 + 0.345043664645906*Z
Copper MG/KG	**10/10**	**11.99**	**1.4944468**	**0.124641103**	**11.063732**	**12.916268**	**11.45**	**12.3**	**12.775**	**1.325**	**8.8**	**14**			ln(y) = 2.47737106833984 + 0.13698019235508*Z
Diethyl Phthalate ug/Kg	**1/10**										**12**	**12**	**40**	**40**	
Iron MG/KG	**10/10**	**35.07**	**16.903475**	**0.481992446**	**24.593118**	**45.546882**	**24.25**	**27.95**	**50.15**	**25.9**	**19.4**	**68.2**			ln(y) = 3.4730014518981 + 0.476996422088942*Z
Lead MG/KG	**10/10**	**1.14**	**0.493287**	**0.432707925**	**0.8342575**	**1.4457425**	**0.975**	**1.2**	**1.375**	**0.4**	**0.08**	**1.8**			ln(y) = -6.45920264195057E-02 + 0.779581973932714*Z
Mercury MG/KG	**9/10**	0.008409	0.001446	0.171952774	0.0075128	0.0093052	**0.007**	**0.0085**	**0.01**	**0.003**	**0.007**	**0.01**	**0.002**	**0.002**	ln(y) = -4.7882794155311 + 0.190121738202075*Z
Naphthalene ug/Kg	**1/10**										**12**	**12**	**40**	**0**	
OCDD PG/G	**3/4**	4.4608447	6.8308168	1.531283269	-2.233356	11.155045	**2.4475**	**2.7**	**9.725**	**7.2775**	**2.5**	**12**	**2.43**	**2.43**	ln(y) = 0.952358583943411 + 1.53480077085304*Z
OCDF PG/G	**1/4**										**5.02**	**5.02**	**0.622**	**2.43**	
PCB-105 ng/kg	**3/4**	126.89547	260.80926	2.055307814	-128.6976	382.48854	**-36.4**	**36.95**	**317.625**	**354.025**	**34.4**	**411**	**36.4**	**36.4**	
PCB-108 ng/kg	**4/4**	**51.825**	**89.817403**	**1.733090265**	**-36.19605**	**139.84605**	**16.2**	**20.15**	**119.125**	**102.925**	**16**	**151**			
PCB-114 ng/kg	**2/4**										**2.53**	**22.2**	**23.7**	**0**	
PCB-118 ng/kg	**4/4**	**734.75**	**1534.7623**	**2.088822454**	**-769.3171**	**2238.8171**	**159.5**	**191.5**	**1853.25**	**1693.75**	**156**	**2400**			
PCB-15 ng/kg	**1/4**										**13**	**13**	**22.1**	**0**	
PCB-156 ng/kg	**4/4**	**45.05**	**78.209868**	**1.736068108**	**-31.59567**	**121.69567**	**14.125**	**17.95**	**103.075**	**88.95**	**13.3**	**131**			
PCB-157 ng/kg	**3/4**	14.345843	22.894158	1.595873987	-8.090432	36.782119	**-33.2**	**-33.2**	**37.85**	**71.05**	**5.41**	**39.4**	**33.2**	**33.2**	
PCB-162 ng/kg	**4/4**	**85.675**	**141.44809**	**1.650984472**	**-52.94413**	**224.29413**	**31.85**	**35.5**	**189.675**	**157.825**	**31.7**	**240**			
PCB-167 ng/kg	**4/4**	**29.775**	**42.620458**	**1.431417565**	**-11.99305**	**71.543049**	**12.55**	**14.9**	**61.875**	**49.325**	**12.3**	**77**			
PCB-189 ng/kg	**1/4**										**8.13**	**8.13**	**22.1**	**0**	
PCB-37 ng/kg	**3/4**	7.2574207	3.6147042	0.498070085	3.7150107	10.799831	**-33.2**	**-33.2**	**-33.2**	**0**	**4.83**	**11.1**	**33.2**	**33.2**	
PCB-58 ng/kg	**1/4**										**4.68**	**4.68**	**22.1**	**33.2**	
PCB-60 ng/kg	**1/4**										**66.4**	**66.4**	**22.1**	**33.2**	
PCB-61/70 ng/kg	**2/4**										**76.7**	**871**	**44.2**	**33.2**	
PCB-66 ng/kg	**3/4**	209.58246	411.69628	1.964364162	-193.8799	613.04481	**67.55**	**83**	**523.025**	**455.475**	**71.9**	**666**	**66.1**	**66.1**	
PCB-77 ng/kg	**3/4**	8.2003605	8.7479284	1.066773638	-0.372609	16.77333	**-33.2**	**-33.2**	**-33.2**	**0**	**4.03**	**17.1**	**33.2**	**33.2**	
PCB-79 ng/kg	**4/4**	**11.7925**	**21.848202**	**1.852720156**	**-9.618738**	**33.203738**	**3.19**	**4.165**	**28.0225**	**24.8325**	**3.04**	**35.8**			
PCB-81 ng/kg	**1/4**										**9.59**	**9.59**	**22.1**	**0**	
Percent Lipids %	**10/10**	**1.52**	**0.631035**	**0.415154622**	**1.1288804**	**1.9111196**	**0.775**	**1.7**	**2.025**	**1.25**	**0.5**	**2.2**			ln(y) = 0.312369022738318 + 0.577578841246427*Z
Selenium MG/KG	**10/10**	**0.422**	**0.1720578**	**0.407719935**	**0.3153575**	**0.5286425**	**0.235**	**0.435**	**0.595**	**0.36**	**0.22**	**0.64**			ln(y) = -0.946039892791627 + 0.505003479077827*Z
Silver MG/KG	**9/10**	0.0355295	0.0197387	0.555558848	0.0232953	0.0477637	**-0.04**	**0.045**	**0.05**	**0.09**	**0.01**	**0.06**	**0.04**	**0.04**	ln(y) = -3.5339101383459 + 0.768102067238565*Z
Total HpCDD PG/G	**3/4**	1.2112282	0.3394641	0.280264324	0.8785534	1.543903	**0.7865**	**1.245**	**1.48**	**0.6935**	**1.1**	**1.51**	**0.682**	**0.682**	ln(y) = 0.174672469630069 + 0.298316766214943*Z
Total HxCDD PG/G	**3/4**	1.3188876	1.163653	0.882298846	0.1785076	2.4592675	**0.72775**	**1.25**	**2.2875**	**1.55975**	**0.79**	**2.48**	**0.707**	**0.707**	ln(y) = 2.51580311378858E-02 + 1.08139411964011*Z
Total PeCDD PG/G	**2/4**										**0.365**	**0.403**	**0.34**	**0.707**	
Total PeCDF PG/G	**2/4**										**1.5**	**1.54**	**0.39**	**0.707**	
Total TCDF PG/G	**4/4**	**2.041**	**1.0282116**	**0.503778362**	**1.0333526**	**3.0486474**	**1.1155**	**1.995**	**3.0125**	**1.897**	**0.994**	**3.18**			ln(y) = 0.61579699134656 + 0.720274311368113*Z
Zinc MG/KG	**10/10**	**11.05**	**3.4495026**	**0.312172183**	**8.9119761**	**13.188024**	**9.65**	**10.75**	**11.2**	**1.55**	**7.8**	**18.8**			ln(y) = 2.37689261510234 + 0.240371962252435*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

CDM

Table H-50
Reference Area
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
2,3,7,8-TCDD Equivalent PG/G	**2/2**										**0.9557605**	**1.30736615**			
2,3,7,8-TCDF PG/G	**2/2**										**1.25**	**2.18**			
4-Methylphenol ug/Kg	**1/7**										**37**	**37**	**40**	**0**	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**29.4**	**29.4**			
Antimony MG/KG	**3/8**	**0.0198577**	**0.0274815**	**1.383919536**	**0.000814**	**0.0389015**	**0.0035**	**0.01022**	**0.02977**	**0.02627**	**0.02**	**0.07**	**0.02**	**1**	**ln(y) = -4.583869798602 + 1.58665415934995*Z**
Arsenic MG/KG	**7/8**	**0.5845117**	**0.1201347**	**0.205529986**	**0.5012626**	**0.6677608**	**0.5125**	**0.6**	**0.6675**	**0.155**	**0.41**	**0.73**	**0.49**	**0.49**	**ln(y) = -0.551273377610751 + 0.2224833333218721*Z**
Barium MG/KG	**1/1**										**10300.0%**	**10300.0%**			
Benzaldehyde ug/Kg	**6/7**	233.09317	147.13888	0.631244927	124.09116	342.09518	**150**	**230**	**280**	**130**	**150**	**490**	**40**	**40**	ln(y) = 5.33396334131793 + 0.635608624356592*Z
Cadmium MG/KG	**7/8**	0.0323971	**0.0145216**	0.44823703	**0.0223342**	**0.0424601**	-0.5	**-0.5**	**-0.5**	**0**	0.01	**0.05**	**0.5**	0.5	**ln(y) = -3.53437847971891 + 0.681336080311321*Z**
Calcium Metal MG/KG	**1/1**										47900	**47900**			
Chromium MG/KG	**7/8**	0.1380814	**0.0338486**	0.245134816	**0.1146256**	**0.1615373**	-1	**-1**	**-1**	**0**	0.1	**0.19**	**1**	1	**ln(y) = -2.00506560262599 + 0.312488732333146*Z**
Copper MG/KG	**8/8**	7.375	**1.1097316**	0.150472085	**6.6059952**	**8.1440048**	6.5	**7.3**	**8.425**	**1.925**	5.8	**8.9**			**ln(y) = 1.98840936151153 + 0.182423708530517*Z**
Iron MG/KG	**8/8**	13.6	**21.336663**	1.568872281	**-1.185553**	**28.385553**	4.3	**6.6**	**16.75**	**12.45**	3.7	**55.1**			**ln(y) = 2.14636838368429 + 1.02718064910637*Z**
Lead MG/KG	**7/8**	**0.2591887**	**0.431428**	**1.664532386**	**-0.039776**	**0.558153**	**0.0575**	**0.13**	**0.3325**	**0.275**	**0.05**	**1.1**	**0.02**	**0.02**	**ln(y) = -2.0240445357439 + 1.48609793122361*Z**
Magnesium MG/KG	**1/1**										**2250**	**2250**			
Manganese MG/KG	**1/1**										**172**	**172**			
Mercury MG/KG	**8/8**	**0.0418625**	**0.0170206**	**0.406582485**	**0.0300679**	**0.0536571**	**0.036**	**0.045**	**0.05025**	**0.01425**	**0.0089**	**0.061**			**ln(y) = -3.28559191560916 + 0.596058291750559*Z**
Nickel MG/KG	**7/8**	**0.0911742**	**0.0198115**	**0.217293077**	**0.0774455**	**0.1049029**	**-4**	**-4**	**-4**	**0**	**0.06**	**0.12**	**4**	**4**	**ln(y) = -2.4147053080589 + 0.288174470784191*Z**
OCDD PG/G	**2/2**										**1.65**	**3.36**			
PCB-105 ng/kg	**2/2**										**320**	**851**			
PCB-108 ng/kg	**2/2**										**7.17**	**122**			
PCB-114 ng/kg	**2/2**										**24.6**	**48**			
PCB-118 ng/kg	**2/2**										**1870**	**4660**			
PCB-126 ng/kg	**2/2**										**8.15**	**17**			
PCB-127 ng/kg	**2/2**										**1.84**	**3.17**			
PCB-15 ng/kg	**2/2**										**21.1**	**57.5**			
PCB-156 ng/kg	**2/2**										**166**	**323**			
PCB-157 ng/kg	**2/2**										**47.8**	**101**			
PCB-162 ng/kg	**2/2**										**303**	**607**			
PCB-167 ng/kg	**2/2**										**127**	**237**			
PCB-189 ng/kg	**2/2**										**19.7**	**28**			
PCB-37 ng/kg	**2/2**										**18.2**	**53.8**			
PCB-58 ng/kg	**2/2**										**4.17**	**9.38**			
PCB-60 ng/kg	**2/2**										**59.9**	**155**			
PCB-61/70 ng/kg	**2/2**										**48.9**	**83**			
PCB-66 ng/kg	**2/2**										**570**	**1560**			
PCB-77 ng/kg	**2/2**										**25.3**	**66.5**			
PCB-79 ng/kg	**2/2**										**45.6**	**156**			
PCB-80 ng/kg	**2/2**										**2.61**	**2.65**			
PCB-81 ng/kg	**2/2**										**2.45**	**5.74**			
Percent Lipids %	**8/8**	**4.69**	**2.6306593**	**0.560908176**	**2.8670461**	**6.5129539**	**3.625**	**4.25**	**6.5**	**2.875**	**0.52**	**9**			ln(y) = 1.3285094073663 + 0.90442911071136*Z
Phenol ug/Kg	**3/8**	39.456634	8.2502314	0.209096178	33.739516	45.173753	30.6081	38.2313	47.7533	17.1452	**34**	**61**	**40**	**2000**	ln(y) = 3.64365577833974 + 0.329865462591323*Z
Potassium MG/KG	**1/1**										**1930**	**1930**			
Selenium MG/KG	**8/8**	**0.6425**	**0.1177038**	**0.183196561**	**0.5609354**	**0.7240646**	**0.53**	**0.68**	**0.7425**	**0.2125**	**0.46**	**0.77**			**ln(y) = -0.457637235094507 + 0.225799284862517*Z**
Silver MG/KG	**7/8**	**0.0897905**	**0.0209073**	**0.232845057**	**0.0753025**	**0.1042785**	**-1**	**-1**	**-1**	**0**	**0.07**	**0.13**	**1**	**1**	**ln(y) = -2.42674250000429 + 0.239475281648308*Z**
Sodium MG/KG	**1/1**										4720	4720			
Total HpCDD PG/G	**2/2**										**0.807**	**1.67**			

CDM

Table H-50
Reference Area
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total HxCDD PG/G	**2/2**										**2.15**	**4.67**			
Total HxCDF PG/G	**2/2**										**0.966**	**0.966**	**0.266**	**0.1**	
Total PeCDF PG/G	**2/2**										**5.96**	**8.68**			
Total TCDD PG/G	**2/2**										**3.19**	**4.44**			
Total TCDF PG/G	**2/2**										**17.9**	**30.2**			
Zinc MG/KG	**8/8**	**20.7125**	**5.7526082**	**0.277736062**	**16.726146**	**24.698854**	**16.1**	**20.3**	**26.6**	**10.5**	**12.6**	**28.5**			**ln(y) = 2.99675351473734 + 0.345796336931118*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-51
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	4/27										1.13	1.49	0.368	1.55	
1,2,3,4,6,7,8-HpCDF PG/G	25/27	2.6346025	2.6851291	1.019178072	1.621766	3.647439	0.61827	1.49401	3.61018	2.99191	0.0793	9.51	0.822	1.23	ln(y) = 0.401463578831656 + 1.30867381518314*Z
1,2,3,4,7,8,9-HpCDF PG/G	4/24										0.646	1.06	0.0389	1.23	
1,2,3,4,7,8-HxCDD PG/G	1/27										0.152	0.152	0.0746	1.23	
1,2,3,4,7,8-HxCDF PG/G	13/27	1.4784867	2.0787191	1.405977558	0.6943893	2.262584	0.15028	0.49645	1.64002	1.48974	0.229	7.23	0.0455	0.34	ln(y) = -0.70026282936174 + 1.77245985491767*Z
1,2,3,6,7,8-HxCDD PG/G	7/27	0.149108	0.0550809	0.369403062	0.1283313	0.1698846	0.11418	0.1428	0.17859	0.06441	0.152	0.342	0.124	0.412	ln(y) = -1.94632118308114 + 0.33175405214982*Z
1,2,3,6,7,8-HxCDF PG/G	21/27	5.5108951	8.299316	1.505983302	2.3803751	8.6414152	0.35614	1.43735	5.80106	5.44492	0.114	27.6	0.147	0.42	ln(y) = 0.362803310275575 + 2.06950470259128*Z
1,2,3,7,8,9-HxCDD PG/G	3/27										0.117	0.162	0.0767	0.42	
1,2,3,7,8,9-HxCDF PG/G	7/27	0.1185741	0.1398217	1.179191831	0.0658331	0.1713152	0.03654	0.07647	0.16006	0.12352	0.101	0.505	0.0255	4.72	ln(y) = -2.57080998108868 + 1.09554939779384*Z
1,2,3,7,8-PeCDD PG/G	24/27	0.2324159	0.1042885	0.448714903	0.1930781	0.2717538	0.15001	0.20999	0.29395	0.14394	0.0792	0.448	0.162	0.173	ln(y) = -1.56070144741438 + 0.498897377603551*Z
1,2,3,7,8-PeCDF PG/G	21/27	1.7263471	2.1267382	1.231929679	0.9241368	2.5285574	0.16252	0.55088	1.86729	1.70477	0.0817	6.38	0.0995	0.413	ln(y) = -0.596238650099378 + 1.81065737366784*Z
2,2'-oxybis(1-Chloropropane) ug/Kg	**1/17**										**29**	**29**	**50**	**800**	
2,3,4,6,7,8-HxCDF PG/G	13/27	0.1902841	0.2068008	1.086800334	0.1122784	0.2682898	0.04769	0.10876	0.24804	0.20035	0.0479	0.736	0.0357	0.158	ln(y) = -2.21861242865997 + 1.22287424046299*Z
2,3,4,7,8-PeCDF PG/G	18/27	3.3913587	3.984293	1.17483677	1.8884748	4.8942427	0.37528	1.21984	3.96501	3.58972	0.337	11.4	0.156	0.627	ln(y) = 0.198715912110107 + 1.74845843213863*Z
2,3,7,8-TCDD Equivalent PG/G	**27/27**	**3.524162**	**3.8176413**	**1.083276337**	**2.0841394**	**4.9641846**	**0.52536**	**1.62853**	**4.56207**	**4.03671**	**0.2521357**	**12.2224**			ln(y) = 0.573021634440492 + 1.37167391639174*Z
2,3,7,8-TCDD PG/G	18/27	0.2358899	0.2842028	1.204811336	0.128688	0.3430918	0.06528	0.13948	0.298	0.23271	0.0902	1.1	0.0448	0.143	ln(y) = -1.96983992920625 + 1.12604654424438*Z
2,3,7,8-TCDF PG/G	**27/27**	**4.895963**	**5.8719452**	**1.199344276**	**2.6810525**	**7.1108735**	**0.735**	**1.74**	**5.97**	**5.235**	**0.139**	**17.6**			ln(y) = 0.719736770925674 + 1.62205078629575*Z
2-Methylphenol ug/Kg	**15/124**										**64**	**340**	**40**	**1000**	
4,4'-DDT ug/Kg	1/128										81	81	10	10	
4-Methylphenol ug/Kg	**25/124**	270.28881	990.81404	3.665760497	95.892463	444.68515	1.40021	9.9052	70.0703	68.67	**56**	**6300**	**40**	**1000**	ln(y) = 2.29305975021089 + 2.90191360664671*Z
Acetophenone ug/Kg	**2/123**										**290**	**350**	**40**	**1000**	
Antimony MG/KG	**4/129**										**0.03**	**0.04**	**0.02**	**1000**	
Aroclor-1254 ug/Kg	**80/128**	84.817036	144.71759	1.70623256	59.745993	109.88808	12.9176	**41**	**82.25**	69.3324	**12**	**820**	**10**	**10**	ln(y) = 3.52397244017649 + 1.43191474798931*Z
Aroclor-1260 ug/Kg	**32/127**	13.920724	13.674735	0.982329307	11.542389	16.29906	5.43398	9.74852	17.4888	12.0548	**12**	**90**	**10**	**50**	ln(y) = 2.27711511472252 + 0.866884083796557*Z
Arsenic MG/KG	**115/129**	0.2393139	0.1057617	0.44193722	0.2210627	0.257565	0.16724	0.22037	0.29036	0.12312	**0.08**	**0.91**	**0.06**	**0.28**	ln(y) = -1.51246464285088 + 0.409132681400171*Z
Benzaldehyde ug/Kg	**81/124**	640.18775	1118.6361	1.747356305	443.29304	837.08247	107.664	270.048	677.35	569.687	**28**	**6400**	**40**	**800**	ln(y) = 5.59859966488472 + 1.36399263513218*Z
Benzyl Butyl Phthalate ug/Kg	**4/120**										**110**	**2000**	**40**	**800**	
beta-BHC ug/Kg	6/128										11	20	10	10	
bis(2-Ethylhexyl)phthalate ug/Kg	**2/120**										**67**	**400**	**40**	**800**	
Cadmium MG/KG	**12/129**										**0.003**	**0.03**	**0.003**	**0.28**	
Chromium MG/KG	**129/129**	**0.3612403**	**0.1992317**	**0.551521272**	**0.3268592**	**0.3956214**	**0.29**	**0.33**	**0.39**	**0.1**	**0.19**	**2.1**			ln(y) = -1.06735978682722 + 0.251673735063304*Z
Copper MG/KG	**129/129**	**3.1582171**	**2.4364922**	**0.771477111**	**2.7377556**	**3.5786786**	**1.6**	**2.1**	**4.25**	**2.65**	**0.91**	**17.4**			ln(y) = 0.943694498069863 + 0.611599987288413*Z
Diethyl Phthalate ug/Kg	**3/123**										**32**	**42**	**40**	**800**	
Di-n-butylphthalate ug/Kg	**9/123**										**140**	**11000**	**40**	**800**	
Endosulfan Sulfate ug/Kg	4/104										13	30	10	10	
Hexachloro-1,3-butadiene ug/Kg	**2/123**										**19**	**29**	**40**	**800**	
Iron MG/KG	**129/129**	**23.445736**	**13.520451**	**0.576669928**	**21.112534**	**25.778939**	**14.8**	**18.8**	**26.1**	**11.3**	**10.2**	**79.7**			ln(y) = 3.0397836526912 + 0.444412881376715*Z
Lead MG/KG	**98/129**	0.2779776	0.4879601	1.75539379	0.1937711	0.3621841	0.04782	0.12158	0.30909	0.26127	**0.02**	**4.3**	**0.02**	**0.21**	ln(y) = -2.10716511869711 + 1.38395356046865*Z
Mercury MG/KG	**129/129**	**0.1458992**	**0.1465422**	**1.004406853**	**0.1206107**	**0.1711878**	**0.0465**	**0.081**	**0.255**	**0.2085**	**0.011**	**0.65**			ln(y) = -2.39169721921914 + 0.994317829750934*Z
Naphthalene ug/Kg	11/123										25	90	40	1000	
Nickel MG/KG	**105/129**	0.0790328	0.0781765	0.989165762	0.065542	0.0925236	0.04195	0.06353	0.09621	0.05427	**0.03**	**0.63**	**0.03**	**0.19**	ln(y) = -2.75624669457955 + 0.615664451071882*Z
OCDD PG/G	14/27	8.3837672	6.37766	0.760715301	5.9781	10.789434	3.64372	6.36533	11.1198	7.47607	5.04	23.7	2.26	6.68	ln(y) = 1.85086618503217 + 0.827454047116367*Z
OCDF PG/G	12/27	6.0466543	12.777526	2.11315636	1.2269437	10.866365	0.14998	0.80873	4.36087	4.21089	1.17	51.4	0.36	1.29	ln(y) = -0.212286121181957 + 2.49923491316342*Z
PCB-105 ng/kg	**27/27**	**3733.0741**	**2494.9063**	**0.668324889**	**2791.99**	**4674.1582**	**2280**	**2940**	**5210**	**2930**	**385**	**8530**			ln(y) = 7.94833125439635 + 0.89455887521678*Z
PCB-108 ng/kg	**27/27**	**1242.4815**	**723.21079**	**0.582069671**	**969.6848**	**1515.2782**	**671**	**1320**	**1620**	**949**	**126**	**2850**			ln(y) = 6.88299867486976 + 0.84023576429757*Z
PCB-114 ng/kg	**27/27**	**230.98519**	**114.99216**	**0.497833468**	**187.60989**	**274.36048**	**142**	**246**	**331**	**189**	**21.3**	**396**			ln(y) = 5.21673330815854 + 0.810318678852483*Z
PCB-118 ng/kg	**27/27**	**14589.259**	**8961.4698**	**0.614251187**	**11208.973**	**17969.545**	**9160**	**13200**	**21200**	**12040**	**1570**	**35400**			ln(y) = 9.34541810215129 + 0.840905760489629*Z
PCB-126 ng/kg	**27/27**	**97.096296**	**57.490226**	**0.592094943**	**75.410858**	**118.78173**	**50.4**	**87.9**	**150**	**99.6**	**12.5**	**206**			ln(y) = 4.35245632728564 + 0.801288281030098*Z

CDM

Table H-51
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 1

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-15 ng/kg	**13/27**	35.898645	39.040491	1.087519901	21.172487	50.624803	9.46154	20.8493	45.9432	36.4817	**20.6**	**126**	**19.5**	**30.1**	ln(y) = 3.03732110131002 + 1.17190530774552*Z
PCB-156 ng/kg	**27/27**	**1923.6667**	**1092.3125**	**0.567828379**	**1511.644**	**2335.6893**	**1280**	**1830**	**2540**	**1260**	**266**	**4330**			ln(y) = 7.35076291146636 + 0.777153603618423*Z
PCB-157 ng/kg	**27/27**	**574.75556**	**370.02395**	**0.64379361**	**435.18172**	**714.3294**	**332**	**494**	**849**	**517**	**76.4**	**1460**			ln(y) = 6.10833278458362 + 0.837559559989901*Z
PCB-162 ng/kg	**27/27**	**3468.4815**	**2494.3577**	**0.719149779**	**2527.6043**	**4409.3586**	**1920**	**2490**	**5670**	**3750**	**431**	**9240**			ln(y) = 7.87108582450137 + 0.879356089170501*Z
PCB-167 ng/kg	**27/27**	**1350.2593**	**710.18452**	**0.525961597**	**1082.3761**	**1618.1424**	**862**	**1380**	**1670**	**808**	**194**	**3010**			ln(y) = 7.01794476736708 + 0.731374214695619*Z
PCB-169 ng/kg	**1/24**										**3.29**	**3.29**	**19.2**	**33.3**	
PCB-189 ng/kg	**27/27**	**218.75556**	**129.1146**	**0.590223185**	**170.05325**	**267.45786**	**146**	**167**	**314**	**168**	**30.8**	**481**			ln(y) = 5.17162767969049 + 0.776507348665483*Z
PCB-37 ng/kg	**26/27**	33.227263	28.2158	0.84917618	22.584201	43.870324	**-21.2**	**-21.2**	**53.7**	**74.9**	**4.55**	**87.4**	**21.2**	**21.2**	ln(y) = 3.10529718589455 + 1.01036820148001*Z
PCB-58 ng/kg	**24/27**	13.411586	8.6060549	0.641688077	10.165363	16.657809	5.44885	9.98895	18.312	12.8631	**1.1**	**32.8**	**19.9**	**30.1**	ln(y) = 2.30147992190765 + 0.898970581362032*Z
PCB-60 ng/kg	**27/27**	**321.39259**	**155.48936**	**0.483798835**	**262.74167**	**380.04352**	**188**	**366**	**429**	**241**	**33.3**	**634**			ln(y) = 5.56669954726466 + 0.76327453564566*Z
PCB-61/70 ng/kg	**27/27**	**1480.7185**	**986.12445**	**0.665976982**	**1108.7502**	**1852.6868**	**778**	**1590**	**1730**	**952**	**99.4**	**3760**			ln(y) = 6.97164097744951 + 0.999117876898143*Z
PCB-66 ng/kg	**27/27**	**3275.4815**	**1774.8544**	**0.541860619**	**2606.0025**	**3944.9604**	**2110**	**3080**	**4770**	**2660**	**262**	**6490**			ln(y) = 7.84807150514448 + 0.858825522183574*Z
PCB-77 ng/kg	**27/27**	**83.128148**	**61.353015**	**0.738053432**	**59.985657**	**106.27064**	**41.6**	**78.7**	**110**	**68.4**	**5.99**	**227**			ln(y) = 4.04208097839427 + 1.07612177059895*Z
PCB-79 ng/kg	**27/27**	**149.34444**	**82.233609**	**0.55063052**	**118.32575**	**180.36314**	**86**	**155**	**190**	**104**	**23.6**	**330**			ln(y) = 4.816479022044 + 0.73156377377663*Z
PCB-81 ng/kg	**27/27**	**135.37556**	**109.91665**	**0.81193871**	**93.914755**	**176.83636**	**53.3**	**99.1**	**240**	**186.7**	**8.74**	**356**			ln(y) = 4.4839169657326 + 1.13448862405908*Z
Phenol ug/Kg	**78/124**	869.0095	1155.875	1.330106324	665.56024	1072.4588	178.794	426.714	1018.41	839.615	**110**	**8200**	**40**	**1000**	ln(y) = 6.05611512960686 + 1.29026308128707*Z
Selenium MG/KG	**127/129**	0.4906186	0.2898546	0.590794005	0.4405989	0.5406384	**0.35**	**0.46**	**0.59**	**0.24**	**0.13**	**2.9**	**0.06**	**0.06**	ln(y) = -0.80226211038477 + 0.410505016025946*Z
Total HpCDD PG/G	11/27	1.6885156	1.1987643	0.70995158	1.2363391	2.1406921	0.84202	1.35744	2.18837	1.34635	1.65	5.07	0.629	2.34	ln(y) = 0.305601557450569 + 0.70834019424651*Z
Total HpCDF PG/G	23/27	3.1014166	3.238819	1.044303104	1.879727	4.3231062	0.66912	1.67467	4.19134	3.52222	0.0793	12.3	0.822	1.47	ln(y) = 0.515618438239786 + 1.36075034723936*Z
Total HxCDD PG/G	11/27	0.3828391	0.414721	1.083277453	0.2264055	0.5392728	0.10976	0.23549	0.50523	0.39547	0.13	1.37	0.117	0.365	ln(y) = -1.44608529195313 + 1.13224259038687*Z
Total HxCDF PG/G	19/27	33.305251	48.244131	1.448544282	15.10746	51.503042	2.26988	8.9009	34.9032	32.6333	1.25	162	1.43	3.51	ln(y) = 2.18615224038967 + 2.0267688444827*Z
Total PeCDD PG/G	24/27	0.2324159	0.1042885	0.448714903	0.1930781	0.2717538	0.15001	0.20999	0.29395	0.14394	0.0792	0.448	0.162	0.173	ln(y) = -1.56070144741438 + 0.498897377603551*Z
Total PeCDF PG/G	**27/27**	**29.453333**	**38.251801**	**1.298725685**	**15.024671**	**43.881996**	**2.35**	**4.92**	**55.7**	**53.35**	**1.33**	**121**			ln(y) = 2.32536218986621 + 1.6774328977166*Z
Total TCDD PG/G	21/27	0.2902539	0.2778598	0.957299261	0.1854446	0.3950632	0.10175	0.19787	0.38478	0.28302	0.0939	1.1	0.0448	0.105	ln(y) = -1.62015515249559 + 0.986462209344311*Z
Total TCDF PG/G	**27/27**	**21.811111**	**25.772992**	**1.181645059**	**12.089483**	**31.53274**	**3.13**	**6.42**	**38**	**34.87**	**1.29**	**73.6**			ln(y) = 2.24833811004161 + 1.49172969541635*Z
Zinc MG/KG	**129/129**	**35.183721**	**17.579217**	**0.499640642**	**32.150104**	**38.217338**	**31.5**	**34.4**	**37.2**	**5.7**	**19**	**188**			ln(y) = 3.52934212391417 + 0.176246379837343*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-52
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**6/6**	**3.649**	**2.2083395**	**0.605190337**	**1.8819603**	**5.4160397**	**0.87**	**4.875**	**5.1625**	**4.2925**	**0.861**	**5.29**			ln(y) = 1.03009769622271 + 0.988950764368135*Z
1,2,3,4,6,7,8-HpCDF PG/G	**6/6**	**51.040667**	**32.189836**	**0.63067036**	**25.283434**	**76.7979**	**37.661**	**53.1**	**65.8**	**28.139**	**0.944**	**92.2**			ln(y) = 3.39349545759745 + 1.67084094512626*Z
1,2,3,4,7,8,9-HpCDF PG/G	4/5	3.7698146	3.5545842	0.942906899	0.6540842	6.885545	0.865	5.22	5.715	4.85	1.36	6.1	0.37	0.37	ln(y) = 1.07827897954143 + 0.97816059362102*Z
1,2,3,4,7,8-HxCDF PG/G	**6/6**	**10.185667**	**6.8583285**	**0.673331336**	**4.6978609**	**15.673472**	**3.8685**	**11.09**	**16.25**	**12.3815**	**0.864**	**17.3**			ln(y) = 1.95900288723624 + 1.33722854996913*Z
1,2,3,6,7,8-HxCDD PG/G	4/6	0.7415122	0.0987181	0.133130813	0.6625213	0.8205032	0.65901	0.73616	0.82235	0.16334	0.708	0.869	0.204	0.362	ln(y) = -0.3063017329794 + 0.164214504335495*Z
1,2,3,6,7,8-HxCDF PG/G	5/6	8.8965242	2.4247747	0.272553041	6.9563003	10.836748	5.6335	8.82	11.15	5.5165	7.36	11.9	0.454	0.454	ln(y) = 2.1621704592462 + 0.3203618112579*Z
1,2,3,7,8,9-HxCDF PG/G	3/6										2.45	2.56	0.0453	0.454	
1,2,3,7,8-PeCDD PG/G	5/6	0.8055476	0.4964971	0.616347334	0.4082672	1.202828	0.35	0.726	1.315	0.965	0.431	1.45	0.107	0.107	ln(y) = -0.374094025112782 + 0.791147736599046*Z
1,2,3,7,8-PeCDF PG/G	**6/6**	**11.149667**	**10.243377**	**0.918715985**	**2.953258**	**19.346075**	**1.377**	**10.495**	**20.4**	**19.023**	**0.408**	**24.9**			ln(y) = 1.70532302524452 + 1.99004742024918*Z
2,3,4,6,7,8-HxCDF PG/G	4/6	1.4991878	1.4010356	0.934529742	0.3781259	2.6202498	0.68382	1.20728	2.13142	1.4476	0.787	2.47	0.22	0.295	ln(y) = 0.188365764468532 + 0.843123320314872*Z
2,3,4,7,8-PeCDF PG/G	**6/6**	**12.824667**	**12.329364**	**0.961378908**	**2.9591208**	**22.690213**	**1.357**	**11.41**	**24.15**	**22.793**	**0.178**	**30**			ln(y) = 1.66201772198322 + 2.37512102325527*Z
2,3,7,8-TCDD Equivalent PG/G	**6/6**	**12.058343**	**9.5650938**	**0.793234526**	**4.4046737**	**19.712012**	**3.62089**	**11.5755**	**20.6845**	**17.0636**	**0.3913265**	**24.79634**			ln(y) = 1.92738992322817 + 1.79344745333298*Z
2,3,7,8-TCDD PG/G	5/6	0.5050427	0.2934359	0.581012049	0.2702451	0.7398402	0.24548	0.45	0.78475	0.53928	0.302	0.922	0.0759	0.0759	ln(y) = -0.810850594339016 + 0.706590974375714*Z
2,3,7,8-TCDF PG/G	6/6	10.568	7.7342681	0.731857319	4.3792966	16.756703	4.5545	10.445	16.725	12.1705	0.218	21			ln(y) = 1.77494967060714 + 1.84678765003799*Z
2,6-Dinitrotoluene ug/Kg	1/13										1200	1200	50	50	
2-Methylphenol ug/Kg	2/17										41	2700	50	2000	
4,4'-DDE ug/Kg	1/34										2.4	2.4	10	10	
Aldrin ug/Kg	1/34										3.6	3.6	10	10	
alpha-Chlordane ug/Kg	1/34										2.3	2.3	10	10	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**207**	**207**			
Antimony MG/KG	2/34										0.03	0.03	0.03	50	
Aroclor-1254 ug/Kg	21/34	40.116203	25.694817	0.640509713	31.479218	48.753187	19.452	31.7385	51.7854	32.3334	14	100	10	100	ln(y) = 3.45752982963708 + 0.726173525099878*Z
Aroclor-1260 ug/Kg	7/34	10.871748	21.212084	1.951119947	3.7415767	18.001919	0.86535	2.99175	10.3433	9.47793	12	90	10	100	ln(y) = 1.09585769269391 + 1.83995721864427*Z
Arsenic MG/KG	33/34	0.4226776	0.1238406	0.292990766	0.3810501	0.464305	-0.75	-0.75	-0.75	0	0.15	0.81	0.75	0.75	ln(y) = -0.90279944113319 + 0.296518618808612*Z
Barium MG/KG	**1/1**										**7**	**7**			
Benzaldehyde ug/Kg	30/31	9757.3824	12635.659	1.294984466	5309.2971	14205.468	1700	3300	16000	14300	330	39000	50	50	ln(y) = 8.29287075828844 + 1.56863463686075*Z
beta-BHC ug/Kg	3/34										11	33	6	10	
Cadmium MG/KG	19/34	0.0124208	0.0066356	0.534234342	0.0101903	0.0146512	0.0074	0.01081	0.01577	0.00837	0.01	0.03	0.003	0.5	ln(y) = -4.52769402037192 + 0.560933295522422*Z
Calcium Metal MG/KG	**1/1**										**18600**	**18600**			
Chromium MG/KG	**34/34**	**0.7458824**	**0.3594706**	**0.481940014**	**0.6250509**	**0.8667138**	**0.43**	**0.75**	**1**	**0.57**	**0.25**	**1.4**			ln(y) = -0.422872990728589 + 0.573478843634917*Z
Copper MG/KG	**34/34**	**1.8532353**	**0.9699706**	**0.523393125**	**1.5271921**	**2.1792785**	**1.175**	**1.8**	**2.2**	**1.025**	**0.47**	**4.4**			ln(y) = 0.476434735648376 + 0.596775367727331*Z
Dieldrin ug/Kg	1/34										1.7	1.7	10	10	
Di-n-butylphthalate ug/Kg	2/32										280	3600	50	50	
Di-n-octylphthalate ug/Kg	1/29										750	750	40	50	
Heptachlor ug/Kg	1/34										4.8	4.8	10	10	
Iron MG/KG	**34/34**	**156.67059**	**85.244349**	**0.544099245**	**128.01679**	**185.32439**	**79.925**	**167.5**	**216.5**	**136.575**	**12.3**	**353**			ln(y) = 4.84087508204061 + 0.776963815446648*Z
Lead MG/KG	**34/34**	**0.7067647**	**0.4366038**	**0.617749875**	**0.5600059**	**0.8535235**	**0.435**	**0.695**	**0.8725**	**0.4375**	**0.06**	**1.7**			ln(y) = -0.62926752482195 + 0.902410776433905*Z
Magnesium MG/KG	**1/1**										**573**	**573**			
Manganese MG/KG	**1/1**										**10.1**	**10.1**			
Mercury MG/KG	**34/34**	**0.0863824**	**0.0690456**	**0.799302401**	**0.0631735**	**0.1095912**	**0.039**	**0.0645**	**0.11025**	**0.07125**	**0.013**	**0.275**			ln(y) = -2.73088271356328 + 0.834465474442673*Z
Naphthalene ug/Kg	6/32										25	110	40	2000	
Nickel MG/KG	33/34	0.256054	0.1215988	0.474895095	0.2151802	0.2969279	-4	-4	-4	0	0.06	0.53	4	4	ln(y) = -1.48793999747502 + 0.582201281224744*Z
OCDD PG/G	**6/6**	**54.383333**	**34.822404**	**0.64031389**	**26.519607**	**82.247059**	**10.975**	**71.8**	**78.7**	**67.725**	**10.6**	**84.1**			ln(y) = 3.68113573620777 + 1.11481209203114*Z
OCDF PG/G	4/6	111.02755	110.73305	0.997347446	22.422663	199.63245	40.4156	81.5543	164.568	124.152	51.6	205	1.23	1.4	ln(y) = 4.40126889756946 + 1.04132813221905*Z
PCB-105 ng/kg	**6/6**	**5039**	**2648.7247**	**0.525644918**	**2919.5788**	**7158.4212**	**3113.5**	**5600**	**6745**	**3631.5**	**874**	**7960**			ln(y) = 8.33655243032951 + 0.896544439010077*Z
PCB-108 ng/kg	**6/6**	**2083.1667**	**967.36977**	**0.46437464**	**1309.1096**	**2857.2237**	**1464.75**	**2255**	**2777.5**	**1312.75**	**519**	**2980**			ln(y) = 7.51261870406198 + 0.714920094929359*Z
PCB-114 ng/kg	**6/6**	**352.86667**	**198.91796**	**0.56371989**	**193.69915**	**512.03418**	**194.05**	**392**	**478.75**	**284.7**	**53.2**	**601**			ln(y) = 5.64690085197055 + 0.98410672677433*Z

CDM

Table H-52
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 2A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-118 ng/kg	**6/6**	**20275**	**9985.438**	**0.492500024**	**12284.986**	**28265.014**	**13637.5**	**21900**	**26275**	**12637.5**	**4750**	**32200**			ln(y) = 9.77322537773988 + 0.769125475111196*Z
PCB-126 ng/kg	**6/6**	**158.13333**	**91.067942**	**0.575893393**	**85.263803**	**231.00286**	**103.45**	**174**	**215.75**	**112.3**	**11.8**	**251**			ln(y) = 4.75112723251141 + 1.19099127751103*Z
PCB-127 ng/kg	3/6	28.301554	13.721134	0.484819088	17.322361	39.280748	17.6698	25.7017	37.3847	19.7149	31	49.1	20	25.3	ln(y) = 3.24655878650629 + 0.555783529291514*Z
PCB-15 ng/kg	5/6	265.51215	195.97998	0.738120556	108.69551	422.32879	84.325	267.5	447.5	363.175	104	464	25.3	25.3	ln(y) = 5.30095240987797 + 1.032533127027*Z
PCB-156 ng/kg	**6/6**	**2534.5**	**1310.7631**	**0.517168319**	**1485.6711**	**3583.3289**	**1411.75**	**2990**	**3445**	**2033.25**	**457**	**3670**			ln(y) = 7.65150744607197 + 0.882673647652892*Z
PCB-157 ng/kg	**6/6**	**717.66667**	**374.41518**	**0.521711821**	**418.07212**	**1017.2612**	**419**	**837.5**	**974.75**	**555.75**	**119**	**1040**			ln(y) = 6.38103117943232 + 0.904191548689597*Z
PCB-162 ng/kg	**6/6**	**4605.6667**	**2617.0571**	**0.568225477**	**2511.5848**	**6699.7485**	**2413.5**	**4900**	**6555**	**4141.5**	**834**	**7980**			ln(y) = 8.23316776798651 + 0.954159109762128*Z
PCB-167 ng/kg	**6/6**	**1693.1667**	**893.58257**	**0.527758187**	**978.1517**	**2408.1816**	**1062.25**	**2035**	**2255**	**1192.75**	**229**	**2270**			ln(y) = 7.21930815793611 + 0.922797363379491*Z
PCB-169 ng/kg	3/5	16.820264	10.359087	0.615869476	7.7401235	25.900403	11.1977	15.5685	21.6455	10.4478	11.7	25	19.8	20	ln(y) = 2.74525186528149 + 0.488800809571001*Z
PCB-189 ng/kg	**6/6**	**440.06667**	**344.11715**	**0.781965952**	**164.7156**	**715.41773**	**71**	**475.5**	**708.75**	**637.75**	**56.6**	**918**			ln(y) = 5.66133637781138 + 1.41098876442946*Z
PCB-37 ng/kg	**6/6**	**115.805**	**68.639872**	**0.592719415**	**60.881664**	**170.72834**	**79.9575**	**118.5**	**160.5**	**80.5425**	**7.83**	**198**			ln(y) = 4.42258368298668 + 1.22825625710844*Z
PCB-58 ng/kg	**6/6**	**109.12333**	**123.69388**	**1.133523626**	**10.147619**	**208.09905**	**56.935**	**87.2**	**144**	**87.065**	**9.64**	**309**			ln(y) = 4.28507108679932 + 1.28076534707355*Z
PCB-60 ng/kg	**6/6**	**1628.6667**	**1346.0009**	**0.826443481**	**551.6416**	**2705.6917**	**353.5**	**1515**	**2890**	**2536.5**	**106**	**3520**			ln(y) = 6.90673003775019 + 1.60743897162597*Z
PCB-61/70 ng/kg	**6/6**	**6717**	**4824.4863**	**0.718250154**	**2856.607**	**10577.393**	**1278**	**8345**	**10130**	**8852**	**402**	**12200**			ln(y) = 8.32727641192393 + 1.57448920844612*Z
PCB-66 ng/kg	**6/6**	**8158.3333**	**4923.1815**	**0.603454323**	**4218.9677**	**12097.699**	**4735**	**7785**	**12375**	**7640**	**1150**	**14700**			ln(y) = 8.76823651809366 + 1.04034431377293*Z
PCB-77 ng/kg	**6/6**	**329.75833**	**203.19282**	**0.616187055**	**167.17022**	**492.34645**	**232.638**	**347**	**444.5**	**211.863**	**6.55**	**566**			ln(y) = 5.27299959753352 + 1.65906876679406*Z
PCB-79 ng/kg	**6/6**	**257.98333**	**121.22323**	**0.469887837**	**160.98455**	**354.98212**	**184.975**	**283.5**	**331.75**	**146.775**	**61.9**	**376**			ln(y) = 5.41942463709451 + 0.723059058406798*Z
PCB-80 ng/kg	4/6	49.637943	20.896182	0.420971962	32.917515	66.358371	36.6098	47.4211	61.4252	24.8153	49.9	79.8	25.3	27.4	ln(y) = 3.85906827903608 + 0.383796340452852*Z
PCB-81 ng/kg	**6/6**	**242.18333**	**157.07051**	**0.648560368**	**116.50075**	**367.86592**	**70.875**	**292**	**362.5**	**291.625**	**24.9**	**412**			ln(y) = 5.14825012570638 + 1.27406020117653*Z
Phenol ug/Kg	1/32										100	100	40	50	
Potassium MG/KG	1/1										2670	2670			
Selenium MG/KG	**34/34**	**0.6770588**	**0.1458027**	**0.215347226**	**0.6280491**	**0.7260686**	**0.5975**	**0.675**	**0.7425**	**0.145**	**0.23**	**1.1**			ln(y) = -0.415724128718921 + 0.23390139216138*Z
Silver MG/KG	6/34										0.01	0.02	0.01	1	
Sodium MG/KG	1/1										1410	1410			
2,3,7,8-TCDD Equivalent PG/G	**6/6**	**12.058343**	**9.5650938**	**0.793234526**	**4.4046737**	**19.712012**	**3.62089**	**11.5755**	**20.6845**	**17.0636**	**0.3913265**	**24.79634**			ln(y) = 1.92738992322817 + 1.79344745333298*Z
Total HpCDD PG/G	5/6	7.4244667	7.1394136	0.961606244	1.7117461	13.137187	1.33575	10.125	10.65	9.31425	1.49	10.8	0.873	0.873	ln(y) = 1.70913351538459 + 0.988854427211907*Z
Total HpCDF PG/G	5/6	69.395207	20.880413	0.300891284	52.687397	86.103017	42.161	70.2	83.325	41.164	55.9	99	0.944	0.944	ln(y) = 4.21453952261737 + 0.328222771896554*Z
Total HxCDD PG/G	5/6	1.7464165	1.4359612	0.822232931	0.5974083	2.8954248	-0.324	1.785	3.0975	3.4215	0.265	3.21	0.324	0.324	ln(y) = 0.194688994357199 + 1.21932303291125*Z
Total HxCDF PG/G	**6/6**	**58.8**	**34.502794**	**0.586782203**	**31.192015**	**86.407985**	**42.05**	**67.2**	**79.15**	**37.1**	**2.6**	**82.6**			ln(y) = 3.69208657842328 + 1.30350601676046*Z
Total PeCDD PG/G	4/6	0.8095427	0.4755297	0.587405354	0.4290397	1.1900457	0.42484	0.69663	1.1423	0.71746	0.623	1.45	0.107	0.431	ln(y) = -0.361506505727714 + 0.73354373179484*Z
Total PeCDF PG/G	**6/6**	**50.603333**	**33.527864**	**0.662562354**	**23.775455**	**77.431212**	**26.105**	**50.7**	**79.4**	**53.295**	**1.52**	**90.8**			ln(y) = 3.43280576549217 + 1.63822197646973*Z
Total TCDD PG/G	**6/6**	**0.5598333**	**0.3201955**	**0.571947939**	**0.3036236**	**0.8160431**	**0.25525**	**0.585**	**0.868**	**0.61275**	**0.115**	**0.922**			ln(y) = -0.779502015180629 + 0.944436349714878*Z
Total TCDF PG/G	**6/6**	**40.213333**	**25.980486**	**0.646066467**	**19.424615**	**61.002052**	**19.145**	**43.25**	**59.6**	**40.455**	**1.88**	**72.8**			ln(y) = 3.27897124091923 + 1.46766128776555*Z
Vanadium (Fume Or Dust) MG/KG	1/1										0.46	0.46			
Zinc MG/KG	**34/34**	**23.573529**	**6.031627**	**0.255864404**	**21.546075**	**25.600984**	**20.3**	**22.35**	**26.2**	**5.9**	**9.1**	**37.8**			ln(y) = 3.12776829153721 + 0.269362954520026*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-53
Estuary Combined
Fish Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	2/4										0.535	0.759	0.727	0.98	
1,2,3,4,6,7,8-HpCDF PG/G	**4/4**	**9.8375**	**6.0247981**	**0.612431824**	**3.9331979**	**15.741802**	**5.4275**	**8.61**	**15.475**	**10.0475**	**4.93**	**17.2**			**ln(y) = 2.17670200918479 + 0.746127785602531*Z**
1,2,3,4,7,8,9-HpCDF PG/G	1/3										1	1	0.265	0.341	
1,2,3,4,7,8-HxCDF PG/G	**4/4**	**2.47675**	**2.031124**	**0.820076294**	**0.4862485**	**4.4672515**	**0.65525**	**2.37**	**4.405**	**3.74975**	**0.487**	**4.68**			**ln(y) = 0.561897439890222 + 1.41775302465787*Z**
1,2,3,6,7,8-HxCDD PG/G	3/4	0.4114581	0.1665693	0.404826826	0.2482202	0.574696	-0.667	-0.667	-0.667	0	0.278	0.59	0.667	0.667	ln(y) = -0.924240937076436 + 0.558078867275124*Z
1,2,3,6,7,8-HxCDF PG/G	**4/4**	**2.525**	**1.3940927**	**0.552115925**	**1.1587891**	**3.8912109**	**1.465**	**2.345**	**3.765**	**2.3**	**1.21**	**4.2**			**ln(y) = 0.831966955078568 + 0.694272267371241*Z**
1,2,3,7,8-PeCDD PG/G	**4/4**	**0.473**	**0.218447**	**0.461832907**	**0.258922**	**0.687078**	**0.289**	**0.445**	**0.685**	**0.396**	**0.278**	**0.724**			**ln(y) = -0.825483911396659 + 0.614601275592962*Z**
1,2,3,7,8-PeCDF PG/G	**4/4**	**4.72**	**3.8132547**	**0.80789294**	**0.9830104**	**8.4569896**	**1.4025**	**4.54**	**8.2175**	**6.815**	**1.36**	**8.44**			**ln(y) = 1.22182057675528 + 1.25632614897055*Z**
2,3,4,6,7,8-HxCDF PG/G	1/4										0.734	0.734	0.0666	0.558	
2,3,4,7,8-PeCDF PG/G	**4/4**	**8.6025**	**7.2364122**	**0.841198744**	**1.510816**	**15.694184**	**2.1025**	**8.78**	**14.925**	**12.8225**	**1.85**	**15**			**ln(y) = 1.76547623970222 + 1.40870713157945*Z**
2,3,7,8-TCDD Equivalent PG/G	**4/4**	**6.3540951**	**4.5950654**	**0.723165968**	**1.8509311**	**10.857259**	**2.23259**	**6.43117**	**10.3985**	**8.16594**	**2.0771915**	**10.476856**			**ln(y) = 1.59794906830242 + 1.09905499134873*Z**
2,3,7,8-TCDD PG/G	**4/4**	**0.36175**	**0.1161712**	**0.321136831**	**0.2479022**	**0.4755978**	**0.2615**	**0.351**	**0.47275**	**0.21125**	**0.258**	**0.487**			**ln(y) = -1.05505253323518 + 0.421243316581951*Z**
2,3,7,8-TCDF PG/G	**4/4**	**2.68025**	**1.5776068**	**0.588604353**	**1.1341953**	**4.2263047**	**1.14575**	**2.92**	**3.975**	**2.82925**	**0.881**	**4**			**ln(y) = 0.820815308571193 + 0.938919317642852*Z**
2-Methylnaphthalene ug/Kg	**3/3**										**40**	**46**	**50**	**200**	
2-Methylphenol ug/Kg	3/21										48	160	40	200	
4,4'-DDE ug/Kg	4/24										10	13	10	200	
Acetophenone ug/Kg	1/21										48	48	40	200	
alpha-Chlordane ug/Kg	2/24										13	14	10	200	
Antimony MG/KG	1/22										0.03	0.03	0.03	0.03	
Aroclor-1254 ug/Kg	23/24	65.430306	48.958431	0.748253119	45.842855	85.017758	28	42.5	105	77	22	180	10	10	ln(y) = 3.93175516345546 + 0.783871255715584*Z
Aroclor-1260 ug/Kg	22/24	40.602122	27.4895	0.677045903	29.604031	51.600213	18.75	31.5	63.25	44.5	12	110	10	10	ln(y) = 3.47586799533644 + 0.784703700697862*Z
Arsenic MG/KG	**22/22**	**0.4004545**	**0.1039006**	**0.259456667**	**0.3570372**	**0.4438718**	**0.31**	**0.41**	**0.48**	**0.17**	**0.2**	**0.63**			**ln(y) = -0.949659218750017 + 0.300276141754247*Z**
Benzaldehyde ug/Kg	**21/21**	**462.38095**	**508.14178**	**1.098967808**	**245.04512**	**679.71678**	**255**	**350**	**490**	**235**	**150**	**2200**			ln(y) = 5.90662842713391 + 0.668311072479973*Z
beta-BHC ug/Kg	16/24	28.219126	32.692112	1.158508994	15.139558	41.298695	6.30787	14	48.75	42.4421	10	130	10	10	ln(y) = 2.71687659519781 + 1.29797297500405*Z
Chromium MG/KG	**22/22**	**0.3304545**	**0.1059035**	**0.320478377**	**0.2862003**	**0.3747088**	**0.26**	**0.305**	**0.3525**	**0.0925**	**0.22**	**0.62**			**ln(y) = -1.14508354449701 + 0.285481504750342*Z**
Copper MG/KG	**22/22**	**1.2177273**	**2.343494**	**1.924481832**	**0.2384435**	**2.1970111**	**0.5925**	**0.835**	**1.025**	**0.4325**	**0.55**	**9**			**ln(y) = -0.112680582844043 + 0.558379472287273*Z**
Diethyl Phthalate ug/Kg	1/21										27	27	50	200	
Endosulfan Sulfate ug/Kg	2/24										16	32	10	10	
Endrin Ketone ug/Kg	1/24										12	12	10	10	
Heptachlor Epoxide ug/Kg	1/24										19	19	10	10	
Hexachloro-1,3-butadiene ug/Kg	3/21										26	68	40	200	
Hexachlorobenzene ug/Kg	1/17										94	94	40	200	
Iron MG/KG	**22/22**	**40.572727**	**27.146758**	**0.669088804**	**29.228819**	**51.916635**	**19.7**	**31.4**	**50.875**	**31.175**	**15.6**	**111**			**ln(y) = 3.52563626748476 + 0.648139573996056*Z**
Lead MG/KG	21/22	0.1840974	0.1720868	0.934759747	0.1121869	0.2560079	0.11	0.13	0.195	0.085	0.1	0.78	0.04	0.04	ln(y) = -1.87359810004452 + 0.559399748963152*Z
Mercury MG/KG	**22/22**	**0.0616818**	**0.0373539**	**0.605589543**	**0.0460726**	**0.077291**	**0.0385**	**0.05**	**0.09125**	**0.05275**	**0.018**	**0.163**			**ln(y) = -2.93031726022355 + 0.584922671087445*Z**
Naphthalene ug/Kg	**9/9**	**68.317697**	**10.735118**	**0.157135239**	**63.726211**	**72.909183**	**60.3602**	**67.6539**	**75.8289**	**15.4687**	**61**	**97**	**50**	**200**	**ln(y) = 4.21440468493886 + 0.16920292645188*Z**
Nickel MG/KG	18/22	0.1105995	0.0674747	0.61008176	0.0824036	0.1387954	0.06789	0.09681	0.13806	0.07018	0.05	0.31	0.08	0.11	ln(y) = -2.33496981840856 + 0.526464777899313*Z
OCDD PG/G	**4/4**	**7.76**	**3.3775144**	**0.435246695**	**4.4500359**	**11.069964**	**5.8725**	**6.74**	**10.6675**	**4.795**	**5.76**	**11.8**			**ln(y) = 2.00723854841756 + 0.416645992156334*Z**
OCDF PG/G	3/4	9.1107124	16.117293	1.769048568	-6.684234	24.905659	1.595	4.185	22.24	20.645	2.81	27.8	1.19	1.19	ln(y) = 1.25036113003853 + 2.21585286510625*Z
PCB-105 ng/kg	**4/4**	**4957.5**	**5432.4215**	**1.095798585**	**-366.2731**	**10281.273**	**1935**	**3220**	**9717.5**	**7782.5**	**1890**	**11500**			**ln(y) = 8.22806414918852 + 1.10648854361862*Z**
PCB-108 ng/kg	**4/4**	**2084.75**	**1570.5224**	**0.753338476**	**545.63806**	**3623.8619**	**969.25**	**1720**	**3565**	**2595.75**	**889**	**4010**			**ln(y) = 7.47369406471487 + 0.921117305198287*Z**
PCB-114 ng/kg	**4/4**	**319.75**	**255.35094**	**0.798595603**	**69.506075**	**569.99393**	**121**	**269**	**569.25**	**448.25**	**120**	**621**			**ln(y) = 5.51624259103647 + 1.09332782883776*Z**
PCB-118 ng/kg	**4/4**	**20852.5**	**19909.541**	**0.954779577**	**1341.1497**	**40363.85**	**10307.5**	**14650**	**37600**	**27292.5**	**9710**	**44400**			**ln(y) = 9.75888292602302 + 0.886009172096016*Z**
PCB-126 ng/kg	**4/4**	**131**	**155.99171**	**1.190776416**	**-21.87188**	**283.87188**	**39.8**	**85.7**	**267.5**	**227.7**	**33.6**	**319**			**ln(y) = 4.51860521957513 + 1.334666824309*Z**
PCB-15 ng/kg	2/4										70.1	274	20	24	
PCB-156 ng/kg	**4/4**	**2402.5**	**2202.6917**	**0.916833178**	**243.86212**	**4561.1379**	**1082.5**	**1725**	**4400**	**3317.5**	**1070**	**5090**			**ln(y) = 7.57128863696235 + 0.969940323174096*Z**
PCB-157 ng/kg	**4/4**	**626.5**	**575.94394**	**0.919303976**	**62.074938**	**1190.9251**	**281.25**	**447.5**	**1150.75**	**869.5**	**281**	**1330**			**ln(y) = 6.22289022435597 + 0.974388214909418*Z**

Table H-53
Estuary Combined
Fish Whole Body - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-162 ng/kg	**4/4**	**4410**	**5316.3472**	**1.205520916**	**-800.0203**	**9620.0203**	**2017.5**	**2570**	**8642.5**	**6625**	**2000**	**10500**			**ln(y) = 8.13119243063209 + 0.968243363543164*Z**
PCB-167 ng/kg	**4/4**	**1582.5**	**1302.7085**	**0.823196526**	**305.84567**	**2859.1543**	**768.5**	**1191.5**	**2787.5**	**2019**	**767**	**3180**			**ln(y) = 7.18534794592685 + 0.895215701191734*Z**
PCB-169 ng/kg	1/3										11	11	24.6	25.7	
PCB-189 ng/kg	**4/4**	**367.5**	**209.14744**	**0.569108685**	**162.53551**	**572.46449**	**178**	**363**	**561.5**	**383.5**	**165**	**579**			**ln(y) = 5.76989833039114 + 0.823786531028511*Z**
PCB-37 ng/kg	**4/4**	**52.525**	**38.802322**	**0.738740061**	**14.498725**	**90.551275**	**24.4**	**43.3**	**89.875**	**65.475**	**23.6**	**99.9**			**ln(y) = 3.78620598653987 + 0.917822010515125*Z**
PCB-58 ng/kg	**4/4**	**46.45**	**21.839974**	**0.470182427**	**25.046826**	**67.853174**	**30.6**	**41.15**	**67.6**	**37**	**30.5**	**73**			**ln(y) = 3.76964512028164 + 0.558971809387078*Z**
PCB-60 ng/kg	**4/4**	**685**	**371.0697**	**0.541707586**	**321.3517**	**1048.6483**	**380**	**629**	**1046**	**666**	**362**	**1120**			**ln(y) = 6.4249858100312 + 0.720531894123102*Z**
PCB-61/70 ng/kg	**4/4**	**1810**	**1201.5808**	**0.663856791**	**632.45082**	**2987.5492**	**1275**	**1415**	**2740**	**1465**	**1240**	**3170**			**ln(y) = 7.42337778475907 + 0.519622940087938*Z**
PCB-66 ng/kg	**4/4**	**6512.5**	**3448.0158**	**0.529445809**	**3133.4445**	**9891.5555**	**3660**	**6145**	**9732.5**	**6072.5**	**3160**	**10600**			**ln(y) = 8.68692373964127 + 0.712536906444733*Z**
PCB-77 ng/kg	**4/4**	**99.625**	**104.71214**	**1.051062902**	**-2.992899**	**202.2429**	**44.075**	**69.5**	**185.3**	**141.225**	**36.5**	**223**			**ln(y) = 4.37140678962249 + 0.999048875739143*Z**
PCB-79 ng/kg	**4/4**	**271.5**	**221.43045**	**0.815581774**	**54.498158**	**488.50184**	**165**	**200.5**	**449**	**284**	**158**	**527**			**ln(y) = 5.4815450708523 + 0.680205776548313*Z**
PCB-81 ng/kg	**4/4**	**147.5**	**177.05507**	**1.200373375**	**-26.01397**	**321.01397**	**59.95**	**89.8**	**292.75**	**232.8**	**56.4**	**354**			**ln(y) = 4.71253602459153 + 1.07215777878684*Z**
Phenol ug/Kg	2/21										370	6800	40	200	
Selenium MG/KG	**22/22**	**0.5863636**	**0.1291016**	**0.220173243**	**0.5324155**	**0.6403118**	**0.4775**	**0.585**	**0.715**	**0.2375**	**0.38**	**0.77**			**ln(y) = -0.558054355066349 + 0.24894232117792*Z**
Silver MG/KG	1/22										0.03	0.03	0.01	0.01	
Total HpCDF PG/G	**4/4**	**10.81**	**7.5655586**	**0.699866659**	**3.3957526**	**18.224247**	**6.245**	**8.61**	**17.575**	**11.33**	**6.02**	**20**			**ln(y) = 2.26434479943497 + 0.719465041610333*Z**
Total HxCDD PG/G	3/4	0.4502845	0.2810533	0.624168316	0.1748522	0.7257167	-0.564	0.577	0.6305	1.1945	0.278	0.644	0.564	0.564	ln(y) = -0.878784551840822 + 0.53704020673867*Z
Total HxCDF PG/G	**4/4**	**18.225**	**8.814766**	**0.483663431**	**9.5865293**	**26.863471**	**11.75**	**16.4**	**26.525**	**14.775**	**11.1**	**29**			**ln(y) = 2.83533127654786 + 0.577793338479227*Z**
Total PeCDD PG/G	**4/4**	**0.473**	**0.218447**	**0.461832907**	**0.258922**	**0.687078**	**0.289**	**0.445**	**0.685**	**0.396**	**0.278**	**0.724**			**ln(y) = -0.825483911396659 + 0.614601275592962*Z**
Total PeCDF PG/G	**4/4**	**19.885**	**12.678713**	**0.637601879**	**7.4598609**	**32.310139**	**8.355**	**19.5**	**31.8**	**23.445**	**7.24**	**33.3**			**ln(y) = 2.81291353684466 + 0.970382930052208*Z**
Total TCDD PG/G	**4/4**	**0.36175**	**0.1161712**	**0.321136831**	**0.2479022**	**0.4755978**	**0.2615**	**0.351**	**0.47275**	**0.21125**	**0.258**	**0.487**			**ln(y) = -1.05505253323518 + 0.421243316581951*Z**
Total TCDF PG/G	**4/4**	**9.9925**	**4.2264622**	**0.422963445**	**5.850567**	**14.134433**	**6.7625**	**9.365**	**13.85**	**7.0875**	**6.14**	**15.1**			**ln(y) = 2.24932485373062 + 0.516166011490367*Z**
Zinc MG/KG	**22/22**	**17.109091**	**4.9594879**	**0.289874426**	**15.036653**	**19.181529**	**14.775**	**15.55**	**17.375**	**2.6**	**10.4**	**31.1**			**ln(y) = 2.80809557776503 + 0.256710470893102*Z**

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-54
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/36										11	11	10	400	
1,2,3,4,6,7,8-HpCDF PG/G	**6/6**	**110.81667**	**82.045122**	**0.740368075**	**45.166896**	**176.46644**	**43.525**	**98.2**	**177.75**	**134.225**	**23.2**	**237**			ln(y) = 4.45946928778465 + 1.06049425168468*Z
1,2,3,4,7,8,9-HpCDF PG/G	1/6										1.7	1.7	0.288	1.14	
1,2,3,4,7,8-HxCDF PG/G	**6/6**	**6.2976667**	**5.6397411**	**0.895528681**	**1.7849339**	**10.810399**	**2.6715**	**3.53**	**13.2**	**10.5285**	**0.846**	**13.5**			ln(y) = 1.45254832605328 + 1.26037462552707*Z
1,2,3,6,7,8-HxCDD PG/G	2/6										0.759	0.935	0.509	1.57	
1,2,3,6,7,8-HxCDF PG/G	**6/6**	**31.398333**	**17.03241**	**0.542462226**	**17.769567**	**45.0271**	**18.6475**	**31.65**	**41.675**	**23.0275**	**9.79**	**57.2**			ln(y) = 3.31744595147588 + 0.73730068534294*Z
1,2,3,7,8,9-HxCDF PG/G	1/6										1.15	1.15	0.383	0.822	
1,2,3,7,8-PeCDD PG/G	5/6	1.1144493	0.8471634	0.760163259	0.4365774	1.7923212	0.63825	0.781	1.905	1.26675	0.693	2.43	0.474	0.474	ln(y) = -0.10100800578723 + 0.869025678979088*Z
1,2,3,7,8-PeCDF PG/G	**6/6**	**11.505667**	**11.657651**	**1.013209535**	**2.177603**	**20.83373**	**3.946**	**5.675**	**25.225**	**21.279**	**0.784**	**27.4**			ln(y) = 1.8890063257678 + 1.58676001476959*Z
2,3,4,6,7,8-HxCDF PG/G	4/6	0.9298201	0.8654328	0.930752886	0.2373297	1.6223106	0.2659	0.60887	1.39424	1.12834	0.59	2.06	0.245	0.354	ln(y) = -0.496144602034361 + 1.22887585458279*Z
2,3,4,7,8-PeCDF PG/G	**6/6**	**22.875**	**21.165983**	**0.925288858**	**5.9386866**	**39.811313**	**9.5125**	**13.8**	**44.95**	**35.4375**	**1.45**	**54.1**			ln(y) = 2.64098006676431 + 1.53494324852484*Z
2,3,7,8-TCDD Equivalent PG/G	**6/6**	**12.058343**	**9.5650938**	**0.793234526**	**4.4046737**	**19.712012**	**3.62089**	**11.5755**	**20.6845**	**17.0636**	**0.3913265**	**24.79634**			ln(y) = 1.92738992322817 + 1.79344745333298*Z
2,3,7,8-TCDD PG/G	5/6	0.9253361	0.6664469	0.720221465	0.3920675	1.4586046	0.5125	0.711	1.4275	0.915	0.626	1.99	0.172	0.172	ln(y) = -0.239283724749456 + 0.762911342751385*Z
2,3,7,8-TCDF PG/G	**6/6**	**47.963333**	**50.186068**	**1.046342379**	**7.8061152**	**88.120551**	**11.845**	**25.9**	**105.25**	**93.405**	**1.78**	**118**			ln(y) = 3.19184257548661 + 1.88409734043757*Z
2-Methylnaphthalene ug/Kg	7/35	45.025493	22.600573	0.501950603	37.537913	52.513074	28.0904	40.723	59.0366	30.9462	26	100	40	400	ln(y) = 3.70679363312025 + 0.550831410636532*Z
2-Methylphenol ug/Kg	3/35										55	260	40	10	
4,4'-DDE ug/Kg	12/36	11.090408	14.393227	1.29780856	6.3886208	15.792196	2.31236	5.54345	13.75	11.4376	11	57	10	10	ln(y) = 1.71261704240923 + 1.29689169254813*Z
4-Nitrophenol ug/Kg	4/20	604.41366	1461.1206	2.417418147	-35.95066	1244.778	40.6576	153.484	579.407	538.749	1200	5300	100	1000	ln(y) = 5.03359557872181 + 1.97037996435353*Z
Aldrin ug/Kg	8/36	6.9523669	5.1460813	0.74019127	5.2713137	8.6334201	3.44851	5.57215	9.00357	5.55506	11	24	10	10	ln(y) = 1.71778127745797 + 0.711728682464728*Z
alpha-Chlordane ug/Kg	3/36										10	18	10	10	
Aroclor-1254 ug/Kg	**36/36**	**330.91874**	**558.8873**	**1.688895888**	**148.34889**	**513.48859**	**68.25**	**160**	**402.5**	**334.25**	**25**	**2800**	**10**	**10**	ln(y) = 5.06510815583019 + 1.3200124082171*Z
Aroclor-1260 ug/Kg	**36/36**	**159.85075**	**215.6657**	**1.349169085**	**89.39996**	**230.30155**	**46.25**	**98**	**235**	**188.75**	**19**	**1100**	**10**	**10**	ln(y) = 4.56089936330675 + 1.10972195302391*Z
Arsenic MG/KG	**36/36**	**0.5991667**	**0.2004811**	**0.334599835**	**0.5336762**	**0.6646571**	**0.4425**	**0.56**	**0.735**	**0.2925**	**0.28**	**1.1**			ln(y) = -0.566128041972226 + 0.360255461515122*Z
Benzaldehyde ug/Kg	34/36	1077.9587	830.02001	0.769992388	806.81885	1349.0986	495	710	1775	1280	66	3000	50	50	ln(y) = 6.65958705156091 + 0.909859795343386*Z
beta-BHC ug/Kg	26/36	84.169201	104.61794	1.242948007	49.994007	118.3444	15.5662	41.5	127.5	111.934	13	440	10	10	ln(y) = 3.69510832696235 + 1.40910904003988*Z
Cadmium MG/KG	16/35	0.0065539	0.004907	0.748723382	0.0049282	0.0081796	0.00316	0.00514	0.00837	0.0052	0.003	0.02	0.003	0.01	ln(y) = -5.26996127583453 + 0.721356838232378*Z
Chromium MG/KG	35/36	0.5535166	0.3349283	0.60509165	0.4441067	0.6629265	0.3175	0.565	0.64	0.3225	0.21	1.9	0.19	0.19	ln(y) = -0.721767883433809 + 0.54446710854213*Z
Copper MG/KG	**36/36**	**5.9919444**	**3.4716186**	**0.57938097**	**4.8578824**	**7.1260065**	**2.925**	**5.35**	**8.675**	**5.75**	**0.86**	**14.2**			ln(y) = 1.58352702003452 + 0.748653114894591*Z
Dieldrin ug/Kg	4/36										11	55	10	10	
Di-n-butylphthalate ug/Kg	1/36										7200	7200	50	50	
Endosulfan II ug/Kg	1/36										14	14	10	10	
Endosulfan Sulfate ug/Kg	6/36										12	30	10	10	
gamma-Chlordane ug/Kg	8/36	9.1716676	11.978199	1.306000076	5.2587894	13.084546	2.16331	4.90179	11.1068	8.94353	12	47	10	21	ln(y) = 1.58959956291393 + 1.21325174636439*Z
Hexachloro-1,3-butadiene ug/Kg	18/36	263.40649	370.74047	1.407484164	142.29794	384.51505	51.4989	128.349	319.88	268.381	22	1800	80	400	ln(y) = 4.85475270995927 + 1.35450386616742*Z
Iron MG/KG	**36/36**	**109.13611**	**97.714616**	**0.895346321**	**77.216003**	**141.05622**	**28.6**	**76.3**	**159.25**	**130.65**	**14.3**	**388**			ln(y) = 4.29700645186869 + 1.01104295141539*Z
Lead MG/KG	**36/36**	**0.62**	**0.4037629**	**0.651230495**	**0.4881041**	**0.7518959**	**0.2925**	**0.525**	**0.9025**	**0.61**	**0.04**	**1.5**			ln(y) = -0.736181618548384 + 0.852240887068896*Z
Mercury MG/KG	**37/37**	**0.0765135**	**0.0604971**	**0.790672043**	**0.05702**	**0.096007**	**0.026**	**0.059**	**0.115**	**0.089**	**0.01**	**0.244**			ln(y) = -2.90027925506778 + 0.921067358825314*Z
Naphthalene ug/Kg	6/35										58	280	40	400	
Nickel MG/KG	23/36	0.2294274	0.2142962	0.934048144	0.1594239	0.2994308	0.09441	0.16742	0.29691	0.20251	0.07	1.1	0.07	0.32	ln(y) = -1.78722954839225 + 0.849776714175237*Z
OCDD PG/G	4/6	12.434923	11.336151	0.911638187	3.3641134	21.505733	5.12607	9.64128	18.1336	13.0076	6.42	21.8	2.22	4.04	ln(y) = 2.26605375569081 + 0.936999777618993*Z
OCDF PG/G	4/6	14.525824	26.484476	1.823268459	-6.666171	35.717818	2.13592	6.0096	16.9085	14.7726	2.82	57.7	3.28	3.91	ln(y) = 1.79335802946874 + 1.53437837185972*Z
PCB-105 ng/kg	**6/6**	**15075**	**12511.66**	**0.829960836**	**5063.5873**	**25086.413**	**4977.5**	**12050**	**29225**	**24247.5**	**1220**	**29900**			ln(y) = 9.16641515140631 + 1.49356070540298*Z
PCB-108 ng/kg	**6/6**	**6035**	**4737.3097**	**0.784972603**	**2244.3628**	**9825.6372**	**1962.5**	**5360**	**11125**	**9162.5**	**560**	**11500**			ln(y) = 8.29022065073439 + 1.42388835324297*Z
PCB-114 ng/kg	**6/6**	**1132.5833**	**911.10073**	**0.804444763**	**403.55091**	**1861.6158**	**487.875**	**881**	**2022.5**	**1534.63**	**79.5**	**2450**			ln(y) = 6.61396314673679 + 1.45757341284153*Z
PCB-118 ng/kg	**6/6**	**58788.333**	**46391.132**	**0.789121402**	**21667.697**	**95908.97**	**19032.5**	**52300**	**108250**	**89217.5**	**5630**	**112000**			ln(y) = 10.5648683173003 + 1.41845228842752*Z
PCB-126 ng/kg	**6/6**	**382.98333**	**296.71704**	**0.774751832**	**145.56025**	**620.40641**	**132.225**	**348.5**	**698**	**565.775**	**36.9**	**704**			ln(y) = 5.53877659286155 + 1.39477363172712*Z

Table H-54
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 3A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-15 ng/kg	**6/6**	**711.88535**	**1434.9165**	**2.015656805**	**-436.287**	**1860.0577**	**30.95**	**156.7**	**1425.75**	**1394.8**	**34.5**	**3030**	**20.3**	**20.3**	ln(y) = 4.90849795784315 + 2.91202416133997*Z
PCB-156 ng/kg	**6/6**	**6879.1667**	**5352.2891**	**0.77804323**	**2596.4435**	**11161.89**	**2436.25**	**5995**	**12150**	**9713.75**	**655**	**14100**			ln(y) = 8.44831878390997 + 1.39175210423697*Z
PCB-157 ng/kg	**6/6**	**1871**	**1495.3999**	**0.799251674**	**674.43089**	**3067.5691**	**615.5**	**1630**	**3317.5**	**2702**	**173**	**3910**			ln(y) = 7.12661150442782 + 1.42820765534274*Z
PCB-162 ng/kg	**6/6**	**11483.333**	**9225.3937**	**0.803372454**	**4101.481**	**18865.186**	**3482.5**	**10175**	**21300**	**17817.5**	**1060**	**22200**			ln(y) = 8.91514146726142 + 1.45146992429535*Z
PCB-167 ng/kg	**6/6**	**4731.8333**	**3584.0525**	**0.757434232**	**1863.994**	**7599.6727**	**1760.25**	**4100**	**8367.5**	**6607.25**	**501**	**9530**			ln(y) = 8.10337146786989 + 1.33141974742221*Z
PCB-189 ng/kg	**6/6**	**1286.3333**	**1099.7527**	**0.854951545**	**406.34792**	**2166.3187**	**599**	**1028**	**2072.5**	**1473.5**	**110**	**3040**			ln(y) = 6.78193161488804 + 1.35125968852374*Z
PCB-37 ng/kg	**6/6**	**373.26667**	**786.18237**	**2.106221751**	**-255.8102**	**1002.3436**	**32.75**	**90.5**	**696**	**663.25**	**10.4**	**1620**			ln(y) = 4.73281886207115 + 2.23907423286893*Z
PCB-58 ng/kg	**6/6**	**392.10513**	**513.51768**	**1.309642852**	**-18.79459**	**803.00484**	**-24.2**	**145.2**	**928.5**	**952.7**	**23.8**	**1170**	**24.2**	**24.2**	ln(y) = 4.97034465044391 + 2.01920361273236*Z
PCB-60 ng/kg	**6/6**	**4037**	**3612.2955**	**0.894797012**	**1146.5616**	**6927.4384**	**1703**	**2405**	**8445**	**6742**	**272**	**8550**			ln(y) = 7.82556382044929 + 1.49329934969223*Z
PCB-61/70 ng/kg	**6/6**	**19430**	**16040.872**	**0.82557239**	**6594.6296**	**32265.37**	**7205**	**14900**	**36550**	**29345**	**1460**	**41200**			ln(y) = 9.43819271801078 + 1.48484293435393*Z
PCB-66 ng/kg	**6/6**	**21375**	**16842.984**	**0.787975851**	**7897.8061**	**34852.194**	**9012.5**	**16800**	**38350**	**29337.5**	**1850**	**45400**			ln(y) = 9.58800130072568 + 1.37452578818688*Z
PCB-77 ng/kg	**6/6**	**735.5**	**1009.1816**	**1.372102739**	**-72.01343**	**1543.0134**	**202.5**	**307.5**	**1437.5**	**1235**	**27**	**2390**			ln(y) = 5.85079540246488 + 1.89372612385933*Z
PCB-79 ng/kg	**6/6**	**705.88333**	**577.90296**	**0.818694719**	**243.46466**	**1168.302**	**230.075**	**578.5**	**1305**	**1074.93**	**77.3**	**1470**			ln(y) = 6.15626656740198 + 1.3905231853816*Z
PCB-80 ng/kg	**6/6**	**84.458333**	**61.090631**	**0.723322714**	**35.575648**	**133.34102**	**46.0875**	**66.9**	**144**	**97.9125**	**8.25**	**171**			ln(y) = 4.10527569104739 + 1.25043086218861*Z
PCB-81 ng/kg	**6/6**	**793.7**	**726.20532**	**0.914961974**	**212.61472**	**1374.7853**	**226.8**	**569.5**	**1572.5**	**1345.7**	**46.2**	**1790**			ln(y) = 6.13437752247013 + 1.67361268396027*Z
Selenium MG/KG	**36/36**	**0.5772222**	**0.1398215**	**0.24223171**	**0.5315472**	**0.6228973**	**0.48**	**0.57**	**0.68**	**0.2**	**0.3**	**0.89**			ln(y) = -0.579485972085883 + 0.27006687935989*Z
Silver MG/KG	27/34	0.0295362	0.0246993	0.83623849	0.0212338	0.0378386	-0.01	0.02	0.04	0.05	0.01	0.11	0.01	0.01	ln(y) = -3.8061198571538 + 0.81758924208761 6*Z
Total HpCDD PG/G	3/6	1.9343196	1.3436738	0.694649322	0.8591566	3.0094826	0.96864	1.62166	2.71492	1.74628	2.12	3.98	0.674	2.09	ln(y) = 0.483450342799078 + 0.764345482418298*Z
Total HpCDF PG/G	**6/6**	**111.98333**	**82.45563**	**0.73632055**	**46.005088**	**177.96158**	**43.525**	**98.2**	**183**	**139.475**	**23.2**	**237**			ln(y) = 4.46669436126358 + 1.06871120656234*Z
Total HxCDD PG/G	2/6										0.759	0.935	0.458	1.41	
Total HxCDF PG/G	**6/6**	**175.36667**	**115.83237**	**0.660515324**	**82.681467**	**268.05187**	**97.8**	**158**	**253.75**	**155.95**	**43.2**	**358**			ln(y) = 4.9856775375095 + 0.878604491872786*Z
Total PeCDD PG/G	5/6	1.1144493	0.8471634	0.760163259	0.4365774	1.7923212	0.63825	0.781	1.905	1.26675	0.693	2.43	0.474	0.474	ln(y) = -0.10100800578723 + 0.869025678979088*Z
Total PeCDF PG/G	**6/6**	**153.86667**	**92.202595**	**0.59923697**	**80.089225**	**227.64411**	**87.8**	**131**	**241**	**153.2**	**45.2**	**289**			ln(y) = 4.87812642050379 + 0.815622268489274*Z
Total TCDD PG/G	5/6	1.045147	0.7812964	0.747546918	0.4199797	1.6703144	0.5125	0.711	1.9	1.3875	0.626	2.17	0.172	0.172	ln(y) = -0.178725784414026 + 0.893886829512237*Z
Total TCDF PG/G	**6/6**	**137.85**	**96.714959**	**0.70159564**	**60.461915**	**215.23808**	**75.25**	**89.95**	**254.5**	**179.25**	**46.3**	**265**			ln(y) = 4.73004242007648 + 0.830540129377003*Z
Zinc MG/KG	**36/36**	**18.833333**	**4.3587674**	**0.231438978**	**17.409469**	**20.257197**	**16.425**	**18.45**	**21.675**	**5.25**	**9.1**	**29.7**			ln(y) = 2.90826175402867 + 0.256472238070938*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-55
Entire Estuary
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	5/69										6.2	22	4.2	0.44	
1,2,3,4,6,7,8-HpCDF PG/G	12/15	9.5589945	11.174938	1.169049503	3.9036957	15.214293	2.10516	5.26458	13.1656	11.0605	2	38.6	0.23	1.2	ln(y) = 1.66100139161463 + 1.35957214327641*Z
1,2,3,4,7,8-HxCDF PG/G	9/15	1.2209836	1.8427836	1.509261456	0.2884065	2.1535608	0.31479	0.70051	1.55888	1.24409	0.682	6.4	0.222	0.832	ln(y) = -0.355942841286494 + 1.1864776443318*Z
1,2,3,6,7,8-HxCDD PG/G	5/15	0.2491016	0.0954948	0.383356919	0.2007746	0.2974287	0.1674	0.23576	0.33202	0.16462	0.161	0.457	0.109	2.37	ln(y) = -1.44495103622203 + 0.507860798584911*Z
1,2,3,6,7,8-HxCDF PG/G	9/15	2.619377	3.8811257	1.48169804	0.6552564	4.5834976	0.42128	1.14708	3.12334	2.70206	0.864	11.4	0.333	2.3	ln(y) = 0.137218219518831 + 1.48576266900421*Z
1,2,3,7,8,9-HxCDD PG/G	2/15										0.0878	0.155	0.0889	2.3	
1,2,3,7,8,9-HxCDF PG/G	1/15										0.291	0.291	0.0714	2.3	
1,2,3,7,8-PeCDD PG/G	1/15										0.413	0.413	0.0603	2.3	
1,2,3,7,8-PeCDF PG/G	13/15	2.8925783	2.5926671	0.896316985	1.5805078	4.2046489	0.94708	1.96627	4.08223	3.13515	0.477	9.2	0.58	0.78	ln(y) = 0.676136908292694 + 1.08353521136529*Z
2,3,4,6,7,8-HxCDF PG/G	1/15										0.397	0.397	0.0456	0.78	
2,3,4,7,8-PeCDF PG/G	12/15	1.0071203	1.3454287	1.335916565	0.3262394	1.6880012	0.24144	0.55579	1.27943	1.03799	0.0646	4.52	0.29	1.45	ln(y) = -0.587365955535736 + 1.23671692399635*Z
2,3,7,8-TCDD Equivalent PG/G	**15/15**	**1.7442224**	**1.2779148**	**0.732655898**	**1.0975083**	**2.3909365**	**0.86375**	**1.4878**	**2.19131**	**1.32756**	**0.2161312**	**4.0789**			ln(y) = 0.299286346925748 + 0.876623304574987*Z
2,3,7,8-TCDD PG/G	2/15										0.0946	0.282	0.026	1.45	
2,3,7,8-TCDF PG/G	13/15	1.3765262	1.3426071	0.9753589	0.6970733	2.0559791	0.47242	0.92469	1.80992	1.3375	0.186	4.28	0.44	2.35	ln(y) = -7.83017124522166E-02 + 0.996137438638082*Z
2,4,5-Trichlorophenol ug/Kg	1/23										110	110	50	21	
2,4-Dimethylphenol ug/Kg	1/23										50	50	50	21	
2-Methylnaphthalene ug/Kg	4/69										25	66	50	0.44	
2-Methylphenol ug/Kg	21/69	78.041582	148.14613	1.898297344	43.085574	112.99759	20.8353	43.5075	90.8508	70.0155	31	990	50	2000	ln(y) = 3.77293379144691 + 1.09210445710343*Z
4,4'-DDD ug/Kg	4/69										0.71	1.9	1	0.44	
4,4'-DDE ug/Kg	8/69										2.6	19	1	0.44	
4,4'-DDT ug/Kg	7/69										1.4	33	6	0.44	
Aldrin ug/Kg	7/69										2.3	41	6	0.44	
alpha-BHC ug/Kg	9/69										0.62	5.8	1	0.44	
alpha-Chlordane ug/Kg	11/69										1.1	19	6	0.44	
Aluminum (Fume Or Dust) MG/KG	7/13	7.4744914	3.409624	0.456168034	5.6209987	9.3279841	5.09633	6.83334	9.16237	4.06604	5.1	15.8	6.2	14.7	ln(y) = 1.92181336832136 + 0.435029106592194*Z
Antimony MG/KG	3/69										0.03	0.03	0.03	14.7	
Aroclor-1254 ug/Kg	41/71	92.87989	126.32962	1.360139638	63.494457	122.26532	18.4331	44.8713	109.23	90.7965	19	730	10	100	ln(y) = 3.8037992501463 + 1.3195885736559*Z
Aroclor-1260 ug/Kg	46/71	56.147736	72.727052	1.295280231	39.230754	73.064718	12.9448	29.4418	66.9629	54.0181	12	360	10	100	ln(y) = 3.38241708792814 + 1.21883030495203*Z
Arsenic MG/KG	60/69	0.3465666	0.2160557	0.623417569	0.2955869	0.3975463	0.20747	0.30023	0.43446	0.22698	0.13	1.5	0.04	1	ln(y) = -1.20320558202283 + 0.548131801940483*Z
Barium MG/KG	9/13	2.8097347	2.1534115	0.766410984	1.6391268	3.9803425	1.21272	2.16667	3.87103	2.6583	1	7.5	0.69	2.8	ln(y) = 0.773193691570726 + 0.860776467057131*Z
Benzaldehyde ug/Kg	53/58	598.02062	418.64229	0.700046577	490.27859	705.76266	270	495	762.5	492.5	170	1900	50	50	ln(y) = 6.16413334928262 + 0.73833881885018*Z
beta-BHC ug/Kg	27/60	16.043225	23.803478	1.483709039	10.020114	22.066336	4.24345	9.06949	19.3842	15.1407	10	150	4.4	10	ln(y) = 2.20491653971188 + 1.12659716923762*Z
bis(2-Ethylhexyl)phthalate ug/Kg	6/70										220	530	50	50	
Calcium Metal MG/KG	13/13	14961.538	7921.6613	0.529468361	10655.274	19267.803	9205	12800	21800	12595	4710	29400			ln(y) = 9.47432459723193 + 0.656644822655318*Z
Chromium MG/KG	61/69	0.2665941	0.1281107	0.480545788	0.2363656	0.2968226	0.17561	0.24189	0.3332	0.1576	0.08	0.78	0.01	1	ln(y) = -1.41925780356617 + 0.475020626468969*Z
Copper MG/KG	62/69	0.8119292	0.9720111	1.197162332	0.5825771	1.0412813	0.48407	0.67994	0.95505	0.47098	0.28	7	0.05	1.3	ln(y) = -0.385755217166649 + 0.503962701076477*Z
delta-BHC ug/Kg	1/22										5.4	5.4	1	10	
Dieldrin ug/Kg	9/69										1.8	17	1	10	
Diethyl Phthalate ug/Kg	9/69										29	80	50	50	
Di-n-octylphthalate ug/Kg	1/68										8600	8600	50	50	
Endosulfan I ug/Kg	3/69										0.99	17	1	10	
Endosulfan II ug/Kg	3/69										1.4	4.3	6	10	
Endosulfan Sulfate ug/Kg	3/60										14	36	6	10	
Endrin Aldehyde ug/Kg	11/69										0.9	26	1	10	
Endrin Ketone ug/Kg	2/69										0.79	11	1	10	
Endrin ug/Kg	2/69										22	24	6	10	

Table H-55
Entire Estuary
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
gamma-BHC (Lindane) ug/Kg	5/69										1.1	4	1	10	
gamma-Chlordane ug/Kg	6/69										2.1	29	6	10	
Heptachlor Epoxide ug/Kg	8/69										0.88	12	1	10	
Heptachlor ug/Kg	5/69										1.8	11	1	10	
Hexachloro-1,3-butadiene ug/Kg	29/71	81.830103	127.80202	1.56179715	52.102176	111.55803	29.9803	54.1985	97.9802	67.9999	27	880	50	2000	ln(y) = 3.99265337031664 + 0.878258680411818*Z
Hexachlorobenzene ug/Kg	1/45										58	58	50	2000	
Iron MG/KG	61/69	15.055881	8.6236122	0.57277368	13.021085	17.090676	9.52814	13.2625	18.4603	8.9322	7.6	45.3	0.11	26.6	ln(y) = 2.58493677520955 + 0.490496642092824*Z
Lead MG/KG	34/69	0.0886397	0.095589	1.078399195	0.0660849	0.1111945	0.02702	0.0554	0.11358	0.08655	0.05	0.52	0.04	0.8	ln(y) = -2.89314822260731 + 1.06480963196399*Z
Magnesium MG/KG	**13/13**	**422.15385**	**117.85777**	**0.279182038**	**358.08563**	**486.22206**	**327.5**	**387**	**537.5**	**210**	**235**	**623**			ln(y) = 6.00963264823127 + 0.322548580627124*Z
Manganese MG/KG	12/13	5.9892454	4.3365988	0.724064303	3.6318434	8.3466474	3.9	4.4	7.05	3.15	2.1	15.8	1.9	1.9	ln(y) = 1.60774797971027 + 0.694758758513549*Z
Mercury MG/KG	64/70	0.080148	0.0510746	0.637253034	0.068183	0.092113	0.04103	0.06518	0.10355	0.06252	0.015	0.251	0.018	0.13	ln(y) = -2.73056261318669 + 0.686513445778588*Z
Naphthalene ug/Kg	1/69										40	40	50	0.44	
Nickel MG/KG	47/69	0.0855797	0.1428067	1.668698101	0.0518836	0.1192758	0.0395	0.06372	0.10279	0.06329	0.03	0.98	0.03	4	ln(y) = -2.75328545025899 + 0.709299367367574*Z
OCDD PG/G	4/15	1.9001226	3.4170805	1.798347382	0.1708413	3.6294039	0.52197	1.15131	2.53944	2.01746	2.08	10.9	0.626	12.6	ln(y) = 0.140902254421577 + 1.17331981694019*Z
OCDF PG/G	3/15	0.7910794	1.7098313	2.161390324	-0.074215	1.6563734	0.23345	0.50744	1.103	0.86955	1.28	3.03	0.267	13.9	ln(y) = -0.678373573455923 + 1.15161799888369*Z
PCB-105 ng/kg	**12/12**	**4699.25**	**3250.4815**	**0.691702189**	**2860.117**	**6538.383**	**1855**	**4515**	**5517.5**	**3662.5**	**951**	**11800**			ln(y) = 8.23244837405384 + 0.842378980567073*Z
PCB-108 ng/kg	**12/12**	**1750.0833**	**1175.1928**	**0.671506793**	**1085.1554**	**2415.0113**	**762.5**	**1840**	**1992.5**	**1230**	**380**	**4370**			ln(y) = 7.24112707748296 + 0.850121711396439*Z
PCB-114 ng/kg	**12/12**	**250.71667**	**147.79154**	**0.589476327**	**167.09573**	**334.3376**	**111.525**	**255**	**314.5**	**202.975**	**59.9**	**563**			ln(y) = 5.34706162801914 + 0.754445864715856*Z
PCB-118 ng/kg	**12/12**	**19264.167**	**12353.17**	**0.641251197**	**12274.703**	**26253.631**	**8220**	**19450**	**22300**	**14080**	**3990**	**45200**			ln(y) = 9.65841826914265 + 0.816864471705644*Z
PCB-126 ng/kg	10/12	91.490501	73.582701	0.804266025	49.857168	133.12383	32.3376	65.2571	131.689	99.3512	14.5	254	19.8	23.8	ln(y) = 4.17833559689321 + 1.04140732008621*Z
PCB-127 ng/kg	3/12	10.559041	2.421745	0.229352735	9.1888102	11.929273	7.51031	10.4245	14.4694	6.9591	7.63	14.7	19.8	23.8	ln(y) = 2.34415692097609 + 0.486332105888114*Z
PCB-15 ng/kg	8/12	65.23434	52.34105	0.802354255	35.619603	94.849077	23.6028	46.5211	91.6931	68.0904	25.1	146	19.8	20.3	ln(y) = 3.83990532307715 + 1.00645650587668*Z
PCB-156 ng/kg	**12/12**	**2297.8333**	**1628.5378**	**0.708727567**	**1376.4013**	**3219.2654**	**1020**	**2175**	**2635**	**1615**	**455**	**5950**			ln(y) = 7.51336496603275 + 0.851731333441485*Z
PCB-157 ng/kg	**12/12**	**635**	**475.02508**	**0.748070995**	**366.22926**	**903.77074**	**297.75**	**582.5**	**705.25**	**407.5**	**129**	**1730**			ln(y) = 6.22844483451844 + 0.832201551869452*Z
PCB-162 ng/kg	**12/12**	**4219.3333**	**3115.2645**	**0.738330968**	**2456.7065**	**5981.9601**	**1780**	**4045**	**4450**	**2670**	**842**	**11300**			ln(y) = 8.11444201458508 + 0.847230542080165*Z
PCB-167 ng/kg	**12/12**	**1326.5833**	**796.93239**	**0.600740543**	**875.67639**	**1777.4903**	**580.75**	**1310**	**1745**	**1164.25**	**278**	**2660**			ln(y) = 6.97291390893337 + 0.851327757554686*Z
PCB-169 ng/kg	4/9	10.552566	2.8683979	0.27181994	8.6785462	12.426586	7.63268	10.3256	13.9685	6.33585	7.28	15.2	19.9	23.8	ln(y) = 2.33462288487789 + 0.448218142638064*Z
PCB-189 ng/kg	**12/12**	**246.45833**	**148.34165**	**0.601893404**	**162.52615**	**330.39052**	**91.725**	**264**	**360.5**	**268.775**	**47.4**	**502**			ln(y) = 5.27646425785265 + 0.884032620165656*Z
PCB-37 ng/kg	11/12	40.174181	24.764822	0.616436265	26.162164	54.186199	-19.8	44.25	67.65	87.45	5.96	71.8	19.8	19.8	ln(y) = 3.45003825024453 + 0.881296990285338*Z
PCB-58 ng/kg	**12/12**	**41.769167**	**28.52509**	**0.682922172**	**25.629578**	**57.908756**	**21.225**	**34.3**	**64.675**	**43.45**	**2.67**	**96**			ln(y) = 3.41195253847942 + 1.09332951627845*Z
PCB-60 ng/kg	**12/12**	**602.01667**	**335.56627**	**0.557403625**	**412.15217**	**791.88116**	**307.5**	**615**	**837.5**	**530**	**64.2**	**1160**			ln(y) = 6.16131180148684 + 0.921386612909073*Z
PCB-61/70 ng/kg	**12/12**	**3605.8333**	**2699.0458**	**0.748522062**	**2078.7044**	**5132.9623**	**1240**	**3435**	**5105**	**3865**	**118**	**8420**			ln(y) = 7.76005964913554 + 1.31399833185727*Z
PCB-66 ng/kg	**12/12**	**4578.3333**	**2605.6367**	**0.569123409**	**3104.0556**	**6052.6111**	**2175**	**4625**	**6690**	**4515**	**674**	**8600**			ln(y) = 8.19250133050972 + 0.900795952634061*Z
PCB-77 ng/kg	**12/12**	**113.1275**	**106.21616**	**0.93890664**	**53.030049**	**173.22495**	**44.3**	**104.85**	**137.25**	**92.95**	**4.53**	**376**			ln(y) = 4.32849507387035 + 1.20742556378436*Z
PCB-79 ng/kg	**12/12**	**235.36667**	**168.15695**	**0.714446735**	**140.22292**	**330.51042**	**105.3**	**254.5**	**269**	**163.7**	**48.7**	**633**			ln(y) = 5.23353093376061 + 0.847210669924665*Z
PCB-80 ng/kg	5/12	10.399171	0.9697215	0.093249887	9.8504991	10.947842	9.41598	10.3729	11.4271	2.01113	9.4	12.4	19.8	26.5	ln(y) = 2.33919872076049 + 0.143565399208268*Z
PCB-81 ng/kg	**12/12**	**154.70833**	**127.34673**	**0.823140734**	**82.655137**	**226.76153**	**63.075**	**150**	**185.75**	**122.675**	**15.8**	**452**			ln(y) = 4.70472856777972 + 1.08655712537509*Z
Pentachlorophenol ug/Kg	1/23										150	150	120	2000	
Potassium MG/KG	**13/13**	**2992.3077**	**391.87728**	**0.13096156**	**2779.2808**	**3205.3346**	**2845**	**2940**	**3100**	**255**	**2420**	**3960**			ln(y) = 7.99735358786759 + 0.126387309371423*Z
Selenium MG/KG	62/69	0.6724079	0.3547847	0.527633165	0.5886943	0.7561216	0.43738	0.6019	0.82832	0.39094	0.25	2	0.06	1.5	ln(y) = -0.507658313924342 + 0.473610114395083*Z
Silver MG/KG	2/69										0.02	0.02	0.01	1.5	
Sodium MG/KG	7/13	1248.854	310.38777	0.248538075	1080.1253	1417.5827	1030.06	1214.82	1432.71	402.655	843	1610	1070	1730	ln(y) = 7.10234817589692 + 0.244704779197523*Z
Total HpCDF PG/G	12/15	9.9119452	11.162951	1.126211917	4.2627126	15.561178	2.1994	5.49924	13.7499	11.5505	2	38.6	0.3	1.6	ln(y) = 1.70461053743651 + 1.35929775257571*Z
Total HxCDD PG/G	5/15	0.2843573	0.2269181	0.798003399	0.1695209	0.3991937	0.14762	0.24577	0.40918	0.26156	0.161	0.901	0.0967	2.13	ln(y) = -1.40337581376716 + 0.756120186936281*Z
Total HxCDF PG/G	13/15	15.937269	22.54438	1.414569801	4.5282389	27.346299	2.77694	7.54577	20.5041	17.7272	1.86	68.5	0.5	0.74	ln(y) = 2.02098739709852 + 1.48272794642214*Z
Total PeCDD PG/G	1/15										0.413	0.413	0.0603	0.74	
Total PeCDF PG/G	13/15	14.452815	19.014169	1.315603177	4.8303177	24.075312	3.04464	7.63103	19.1263	16.0816	1.57	61.2	0.58	0.78	ln(y) = 2.03222306514916 + 1.36287997088045*Z

Table H-55
Entire Estuary
Fish Whole Body - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total TCDD PG/G	2/15										0.0946	0.282	0.026	0.78	
Total TCDF PG/G	14/15	12.9699	25.060323	1.932190981	0.2876263	25.652173	2.46	5.46	9.9	7.44	0.65	84	0.44	0.44	ln(y) = 1.69478062010913 + 1.51446482530768*Z
Zinc MG/KG	68/69	14.519646	4.5467391	0.313143939	13.446814	15.592478	11.65	13.3	16.9	5.25	8.5	29.9	0.04	0.04	ln(y) = 2.63323433675336 + 0.301721365471173*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.

Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-56
Entire Estuary
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	2/44										10	13	10	24	
1,2,3,4,6,7,8-HpCDD PG/G	8/9	5.0808152	3.7547605	0.739007506	2.6277049	7.5339254	2.645	4.12	6.93	4.285	2.36	12.7	0.813	0.813	ln(y) = 1.44373267723897 + 0.767290961490681*Z
1,2,3,4,6,7,8-HpCDF PG/G	**9/9**	**22.432**	**31.600673**	**1.408731859**	**1.7862269**	**43.077773**	**2.815**	**14.1**	**33.95**	**31.135**	**0.378**	**88.3**			ln(y) = 2.19006059317099 + 2.02876474891455*Z
1,2,3,4,7,8,9-HpCDF PG/G	1/6										1.68	1.68	0.14	1.2	
1,2,3,4,7,8-HxCDD PG/G	4/9	0.3150143	0.1888878	0.599616605	0.1916076	0.438421	0.16942	0.27672	0.45197	0.28255	0.316	0.689	0.137	1.69	ln(y) = -1.28476119442631 + 0.727706448756751*Z
1,2,3,4,7,8-HxCDF PG/G	7/9	7.4740959	10.196763	1.36428047	0.8122107	14.135981	0.67763	2.59102	9.90719	9.22956	1.24	26.5	0.44	0.884	ln(y) = 0.952052304079158 + 1.989364592183*Z
1,2,3,6,7,8-HxCDD PG/G	**9/9**	**2.4886667**	**2.1407742**	**0.860209285**	**1.0900275**	**3.8873058**	**1.095**	**2.38**	**2.94**	**1.845**	**0.288**	**6.93**			ln(y) = 0.549100020447755 + 1.15318353858798*Z
1,2,3,6,7,8-HxCDF PG/G	8/9	6.4552123	6.7714338	1.048987001	2.0312089	10.879216	1.2065	3.94	12.55	11.3435	0.873	18.7	0.502	0.502	ln(y) = 1.26928578709497 + 1.5039134042952*Z
1,2,3,7,8,9-HxCDD PG/G	5/9	0.8013958	0.23853	0.297643231	0.6455562	0.9572355	0.61869	0.77136	0.9617	0.34301	0.712	1.27	0.141	1.64	ln(y) = -0.259602756010643 + 0.327132763128688*Z
1,2,3,7,8,9-HxCDF PG/G	3/9	0.6994053	0.7897191	1.129129346	0.1834555	1.2153551	0.21338	0.46019	0.9925	0.77912	0.944	2.15	0.0634	0.334	ln(y) = -0.776111139438426 + 1.14000894286748*Z
1,2,3,7,8-PeCDD PG/G	5/9	1.0037471	0.9483401	0.944799816	0.3841649	1.6233293	0.39352	0.73036	1.35552	0.96201	0.764	3.02	0.235	2.4	ln(y) = -0.314224418759423 + 0.917265721637904*Z
1,2,3,7,8-PeCDF PG/G	**9/9**	**24.614444**	**38.710886**	**1.572689813**	**-0.676668**	**49.905557**	**2.1**	**5.66**	**48.4**	**46.3**	**0.95**	**104**			ln(y) = 2.07620195254986 + 1.94369406226768*Z
2,3,4,6,7,8-HxCDF PG/G	4/9	1.3807813	2.0896456	1.51337917	0.0155461	2.7460164	0.17221	0.55352	1.77916	1.60695	0.633	4.88	0.295	0.762	ln(y) = -0.591449253107883 + 1.73184362745723*Z
2,3,4,7,8-PeCDF PG/G	**9/9**	**12.446778**	**19.326699**	**1.552747185**	**-0.179999**	**25.073555**	**1.14**	**2.91**	**24.25**	**23.11**	**0.881**	**52.1**			ln(y) = 1.49363554381613 + 1.77136144883034*Z
2,3,7,8-TCDD Equivalent PG/G	**9/9**	**15.739161**	**20.812986**	**1.322369528**	**2.1413428**	**29.336978**	**2.57256**	**5.66074**	**30.5856**	**28.013**	**1.0179727**	**57.354057**			ln(y) = 1.97377347912982 + 1.65114682860457*Z
2,3,7,8-TCDD PG/G	7/9	0.6859002	0.4612026	0.672404835	0.3845811	0.9872192	0.31485	0.55428	0.9758	0.66095	0.387	1.44	0.0769	0.0853	ln(y) = -0.590078040076971 + 0.838906319890383*Z
2,3,7,8-TCDF PG/G	**9/9**	**43.802222**	**57.714617**	**1.317618467**	**6.0953392**	**81.509105**	**6.17**	**14.7**	**87.75**	**81.58**	**2.28**	**158**			ln(y) = 2.92934886368193 + 1.76670140289914*Z
2-Methylphenol ug/Kg	8/44										29	320	50	10	
4,4'-DDD ug/Kg	4/44										10	34	6	24	
4,4'-DDE ug/Kg	19/44	12.999348	8.9923722	0.691755652	10.342271	15.656424	6.60237	10.5115	16.7353	10.1329	9.2	39	6	24	ln(y) = 2.35247403771247 + 0.689784200760416*Z
4,4'-DDT ug/Kg	5/44										3.1	180	6	24	
4-Methylphenol ug/Kg	11/41	382.96945	1114.7859	2.91090039	41.732841	724.20607	1.20891	11.6387	70.5	69.2911	66	5300	50	50	ln(y) = 2.45433728899365 + 3.35902910172375*Z
Acenaphthene ug/Kg	1/34										26	26	50	2000	
Acetophenone ug/Kg	1/41										100	100	50	50	
Aldrin ug/Kg	16/44	12.183636	15.604067	1.280739743	7.5729288	16.794343	2.58628	6.14118	14.5823	11.9961	10	59	6	10	ln(y) = 1.81501644695152 + 1.28271917899102*Z
alpha-BHC ug/Kg	2/44										1.2	6.8	10	10	
alpha-Chlordane ug/Kg	19/44	13.654438	12.323575	0.902532584	10.013054	17.295821	4.78634	9.22285	17.7716	12.9853	4.1	46	6	10	ln(y) = 2.22168376019241 + 0.972899447233347*Z
Aluminum (Fume Or Dust) MG/KG	2/3										5.1	10	28.6	28.6	
Antimony MG/KG	3/41										0.35	0.45	0.03	1	
Aroclor-1254 ug/Kg	37/43	506.1076	592.22354	1.17015343	329.09364	683.12155	80.3699	225.139	630.678	550.308	12	2300	10	100	ln(y) = 5.41671725642029 + 1.52787644458123*Z
Aroclor-1260 ug/Kg	36/43	293.75262	447.20656	1.522391716	160.08383	427.42141	42.3412	118.612	332.27	289.929	14	2000	7.8	100	ln(y) = 4.77585452953848 + 1.52790067383189*Z
Arsenic MG/KG	40/41	0.3902702	0.1879087	0.481483684	0.3327512	0.4477891	-0.58	-0.58	-0.58	0	0.18	1	0.58	0.58	ln(y) = -1.03707844046746 + 0.446231585530913*Z
Barium MG/KG	**3/3**	**5.9**	**4.5540028**	**0.771864876**	**0.7466607**	**11.053339**	**3.2**	**4.4**	**10.1**	**6.9**	**3.2**	**10.1**			ln(y) = 1.65243025819237 + 0.85242000393128*Z
Benzaldehyde ug/Kg	33/41	600.34962	773.98846	1.289229528	363.43131	837.26793	165	360	795	630	140	4200	50	50	ln(y) = 5.9332036379409 + 1.03773880885543*Z
beta-BHC ug/Kg	28/43	55.182158	75.519226	1.368544272	32.609673	77.754643	7.13011	21.0113	61.9171	54.787	6	300	10	24	ln(y) = 3.04506134047071 + 1.60301497795468*Z
bis(2-Ethylhexyl)phthalate ug/Kg	10/43	200.79415	171.47066	0.853962409	149.54205	252.04625	90.3116	154.428	264.063	173.751	190	880	50	2000	ln(y) = 5.03972685122252 + 0.795712211833876*Z
Cadmium MG/KG	19/41	0.005255	0.0032224	0.613207451	0.0042686	0.0062414	0.00281	0.00436	0.00676	0.00395	0.003	0.01	0.003	0.5	ln(y) = -5.43589735912809 + 0.650819923876308*Z
Calcium Metal MG/KG	3/3	12823.333	16740.336	1.305459014	-6120.14	31766.807	5510	5860	27100	21590	5510	27100			ln(y) = 9.1658379305286 + 1.18139629527293*Z
Chromium MG/KG	40/41	0.5414692	0.3898015	0.719895938	0.4221507	0.6607877	-1	-1	-1	0	0.1	1.5	1	1	ln(y) = -0.840954408750821 + 0.709197256433766*Z
Copper MG/KG	**41/41**	**4.7863415**	**6.1703826**	**1.289164732**	**2.8975838**	**6.6750991**	**1.045**	**1.9**	**5.9**	**4.855**	**0.35**	**25.5**			ln(y) = 0.933297113634663 + 1.18620361314613*Z
Dieldrin ug/Kg	6/44										8.9	30	6	24	
Diethyl Phthalate ug/Kg	11/44	46.971143	18.278862	0.389150888	41.570084	52.372201	33.8766	43.9036	56.8984	23.0218	42	110	50	4000	ln(y) = 3.78199523560043 + 0.38456760114934*Z
Endosulfan I ug/Kg	2/44										12	18	6	24	
Endosulfan II ug/Kg	10/44	8.990855	7.2081142	0.801716206	6.8609934	11.120717	4.37028	7.09854	11.53	7.15972	9	30	6	24	ln(y) = 1.9598889346389 + 0.719475927914257*Z
Endosulfan Sulfate ug/Kg	15/35	18.431579	17.393086	0.943656823	12.669242	24.193917	5.91099	11.8231	23.6484	17.7375	11	57	6	24	ln(y) = 2.47005539578249 + 1.0282604988887*Z
Endrin Aldehyde ug/Kg	11/36	8.7817395	16.697189	1.901353251	3.3273245	14.236155	1.98184	4.45921	10.0334	8.05155	3	84	6	24	ln(y) = 1.49497079951767 + 1.20284823421711*Z

Table H-56
Entire Estuary
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Endrin Ketone ug/Kg	2/42										11	29	6	24	
Endrin ug/Kg	5/44										10	24	6	24	
gamma-Chlordane ug/Kg	16/44	12.052409	12.292254	1.019900129	8.4202805	15.684538	3.92718	7.74857	15.2884	11.3613	10	56	6	24	ln(y) = 2.04750870332111 + 1.00800735911773*Z
Heptachlor Epoxide ug/Kg	3/44										1.7	30	10	24	
Heptachlor ug/Kg	1/44										26	26	6	24	
Hexachloro-1,3-butadiene ug/Kg	27/44	113.42153	196.10255	1.728971039	55.476934	171.36613	33.5789	67.2704	134.767	101.188	26	1100	50	2000	ln(y) = 4.2087210559725 + 1.03060762513284*Z
Hexachlorobenzene ug/Kg	3/22										140	280	50	2000	
Iron MG/KG	**41/41**	**115.76585**	**118.77849**	**1.02602352**	**79.40769**	**152.12402**	**30.15**	**69.6**	**164.5**	**134.35**	**14**	**539**			ln(y) = 4.28346536781374 + 1.05897327294559*Z
Lead MG/KG	40/41	1.3629371	8.1065525	5.94785526	-1.118483	3.8443574	-0.8	-0.8	-0.8	0	0.05	37.2	0.8	0.8	ln(y) = -1.08525051794556 + 1.20876729481405*Z
Magnesium MG/KG	**3/3**	**434.33333**	**268.5513**	**0.618306904**	**130.43893**	**738.22774**	**314**	**324**	**665**	**351**	**314**	**665**			ln(y) = 6.00997451411881 + 0.556515976139417*Z
Manganese MG/KG	**3/3**	**9**	**6.7830722**	**0.753674692**	**1.3242312**	**16.675769**	**3.5**	**8.1**	**15.4**	**11.9**	**3.5**	**15.4**			ln(y) = 2.02633151319778 + 1.09880481079021*Z
Mercury MG/KG	41/44	0.0532384	0.0440541	0.827487362	0.0402212	0.0662555	0.02448	0.04122	0.0694	0.04492	0.012	0.229	0.009	0.014	ln(y) = -3.18884820685631 + 0.772796005998051*Z
Naphthalene ug/Kg	2/44										29	73	50	2000	
Nickel MG/KG	38/41	0.2515401	0.1822509	0.724540052	0.195753	0.3073273	-4	-4	-4	0	0.04	0.76	4	4	ln(y) = -1.647502373041 + 0.853680065625521*Z
OCDD PG/G	8/9	55.997485	55.9753	0.999603831	19.426955	92.568014	23.7	34.2	85.95	62.25	22.4	171	4.62	4.62	ln(y) = 3.69879687875644 + 1.00242823305133*Z
OCDF PG/G	8/9	8.7139837	7.4078917	0.850115395	3.8741611	13.553806	2.0745	8.57	13.6	11.5255	0.539	21.4	0.483	0.483	ln(y) = 1.65711069284395 + 1.41864071536862*Z
PCB-105 ng/kg	**9/9**	**9573.4444**	**9356.5328**	**0.977342364**	**3460.5097**	**15686.379**	**3050**	**4780**	**21400**	**18350**	**411**	**22400**			ln(y) = 8.58946425233136 + 1.49461532616332*Z
PCB-108 ng/kg	**9/9**	**3820.5556**	**3487.1738**	**0.912739984**	**1542.2687**	**6098.8424**	**1293**	**2190**	**8205**	**6912**	**159**	**8520**			ln(y) = 7.70681182455156 + 1.48994866692798*Z
PCB-114 ng/kg	**9/9**	**644**	**644.72466**	**1.001125255**	**222.77989**	**1065.2201**	**170.2**	**331**	**1440**	**1269.8**	**26.6**	**1560**			ln(y) = 5.83643568867004 + 1.58938631943181*Z
PCB-118 ng/kg	**9/9**	**41214.444**	**38297.27**	**0.929219606**	**16193.561**	**66235.327**	**14180**	**24200**	**87350**	**73170**	**1770**	**96900**			ln(y) = 10.0825075155387 + 1.48045037564173*Z
PCB-126 ng/kg	**9/9**	**287.96667**	**336.8426**	**1.169727755**	**67.896166**	**508.03717**	**63.7**	**113**	**636.5**	**572.8**	**13.3**	**842**			ln(y) = 4.95079738208139 + 1.61451159230711*Z
PCB-127 ng/kg	6/9	26.167058	25.063412	0.957823084	9.7922955	42.541821	10.5669	19.455	35.8192	25.2523	9.57	78.8	19.9	21.3	ln(y) = 2.96810307701793 + 0.905353960849461*Z
PCB-15 ng/kg	6/9	115.81239	102.66403	0.886468418	48.738561	182.88623	34.9471	76.8787	169.123	134.175	49	271	19.8	21.1	ln(y) = 4.34222939401332 + 1.16939602520837*Z
PCB-156 ng/kg	**9/9**	**4900.3333**	**4924.5039**	**1.004932432**	**1682.9908**	**8117.6759**	**1449**	**2810**	**9680**	**8231**	**225**	**13600**			ln(y) = 7.91481990994285 + 1.54122161998203*Z
PCB-157 ng/kg	**9/9**	**1282.9444**	**1226.4243**	**0.955945**	**481.68055**	**2084.2083**	**418**	**717**	**2610**	**2192**	**56.5**	**3290**			ln(y) = 6.60682326730714 + 1.49447969928883*Z
PCB-162 ng/kg	**9/9**	**8317.2222**	**8025.848**	**0.964967365**	**3073.6682**	**13560.776**	**2830**	**4310**	**16350**	**13520**	**355**	**22200**			ln(y) = 8.48437126091495 + 1.48481545943346*Z
PCB-167 ng/kg	**9/9**	**3244.5556**	**3133.0794**	**0.965642074**	**1197.6104**	**5291.5007**	**988.5**	**1930**	**6545**	**5556.5**	**164**	**8410**			ln(y) = 7.53100392420189 + 1.50175297570296*Z
PCB-189 ng/kg	**9/9**	**953.72222**	**1019.8329**	**1.069318638**	**287.43136**	**1620.0131**	**240.75**	**543**	**1820**	**1579.25**	**61**	**2860**			ln(y) = 6.24076541162028 + 1.56891589066206*Z
PCB-37 ng/kg	**9/9**	**147.66667**	**130.0489**	**0.880692353**	**62.701383**	**232.63195**	**72.7**	**89**	**243.5**	**170.8**	**12.1**	**397**			ln(y) = 4.62877657880714 + 1.16343109427687*Z
PCB-58 ng/kg	**9/9**	**181.69222**	**153.02572**	**0.842224949**	**81.715417**	**281.66903**	**41.45**	**105**	**333.5**	**292.05**	**8.13**	**383**			ln(y) = 4.59710916183111 + 1.633894051384*Z
PCB-60 ng/kg	**9/9**	**3037.2222**	**2515.367**	**0.828180106**	**1393.8491**	**4680.5953**	**692.5**	**2380**	**5945**	**5252.5**	**160**	**6270**			ln(y) = 7.47403917800022 + 1.54309288305876*Z
PCB-61/70 ng/kg	**9/9**	**15630.889**	**14504.707**	**0.927951524**	**6154.4802**	**25107.298**	**4150**	**9780**	**34000**	**29850**	**758**	**34600**			ln(y) = 9.05612491423827 + 1.58696485797933*Z
PCB-66 ng/kg	**9/9**	**14493.667**	**12355.085**	**0.85244718**	**6421.6776**	**22565.656**	**4185**	**10400**	**29600**	**25415**	**663**	**31000**			ln(y) = 9.05892005566351 + 1.49662938857357*Z
PCB-77 ng/kg	**9/9**	**378.66667**	**353.23192**	**0.932830787**	**147.88848**	**609.44486**	**101.75**	**253**	**624**	**522.25**	**13.5**	**1050**			ln(y) = 5.35310922673522 + 1.62685874966323*Z
PCB-79 ng/kg	**9/9**	**620.26667**	**524.95077**	**0.846330779**	**277.29883**	**963.2345**	**237.5**	**416**	**1235**	**997.5**	**24.4**	**1370**			ln(y) = 5.91849608510117 + 1.47646345599618*Z
PCB-80 ng/kg	6/9	37.543415	35.777945	0.952975245	14.168491	60.918339	11.9105	24.6943	51.1993	39.2888	10.8	94.1	19.8	21.3	ln(y) = 3.20657103872112 + 1.08152857769468*Z
PCB-81 ng/kg	**9/9**	**399.88889**	**428.44689**	**1.071414843**	**119.97025**	**679.80752**	**104.35**	**167**	**915.5**	**811.15**	**16.3**	**1040**			ln(y) = 5.32360543906055 + 1.58716606492969*Z
Phenol ug/Kg	2/44										98	860	50	2000	
Potassium MG/KG	3/3	2960	193.39252	0.065335312	2741.1558	3178.8442	2840	2900	3140	300	2840	3140			ln(y) = 7.99200114201071 + 7.44737209357865E-02*Z
Selenium MG/KG	40/41	0.5633741	0.2519802	0.447269755	0.4862428	0.6405054	-2	-2	-2	0	0.24	1.6	2	2	ln(y) = -0.638020712993053 + 0.351911926471633*Z
Silver MG/KG	13/41	0.0252964	0.0570002	2.253289699	0.0078486	0.0427442	0.00103	0.00454	0.01995	0.01892	0.01	0.29	0.01	1	ln(y) = -5.394943869179 + 2.19610730498611*Z
Sodium MG/KG	2/3										1260	1370	1070	1	
Total HpCDD PG/G	8/9	13.784232	19.509492	1.415348418	1.0380313	26.530434	4.79	6	19.45	14.66	4.5	55	1.21	1.21	ln(y) = 2.11249415243298 + 1.20184433521196*Z
Total HpCDF PG/G	8/9	24.895696	35.771791	1.43686649	1.5247923	48.266599	3.52	14.5	36	32.48	0.378	100	1.81	1.81	ln(y) = 2.24876193082545 + 2.06337385221294*Z
Total HxCDD PG/G	**9/9**	**6.0788889**	**7.2576521**	**1.193910965**	**1.3372229**	**10.820555**	**2.455**	**4.1**	**7.165**	**4.71**	**0.33**	**21.4**			ln(y) = 1.35208912530464 + 1.30246418727328*Z
Total HxCDF PG/G	**9/9**	**40.823333**	**40.008484**	**0.980039628**	**14.684457**	**66.96221**	**8.65**	**25.3**	**81.6**	**72.95**	**3.61**	**108**			ln(y) = 3.1742707540069 + 1.44195938553591*Z
Total PeCDD PG/G	5/9	1.003802	0.9502744	0.946675189	0.382956	1.624648	0.39352	0.73036	1.35552	0.96201	0.764	3.02	0.235	2.4	ln(y) = -0.314224418759423 + 0.917265721637904*Z

Table H-56
Entire Estuary
Fish Whole Body - Group 4A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Total PeCDF PG/G	**9/9**	**59.887778**	**72.902339**	**1.217315807**	**12.25825**	**107.51731**	**12.005**	**25.6**	**119.15**	**107.145**	**4.28**	**198**			ln(y) = 3.38340872002074 + 1.60055706101551*Z
Total TCDD PG/G	8/9	1.2254117	1.0224396	0.834364172	0.5574178	1.8934056	0.4525	0.977	1.71	1.2575	0.419	3.29	0.0769	0.0769	ln(y) = -6.25087765274822E-02 + 0.950045917095803*Z
Total TCDF PG/G	**9/9**	**67.361111**	**71.826848**	**1.06629548**	**20.434237**	**114.28799**	**19.67**	**32.1**	**128.5**	**108.83**	**4.61**	**203**			ln(y) = 3.63138411825283 + 1.48122923587183*Z
Vanadium (Fume Or Dust) MG/KG	1/3										0.57	0.57	1	1	

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-57
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	6/52										10	26	10	11	
1,2,3,4,6,7,8-HpCDF PG/G	7/9	11.429272	16.028023	1.402366088	0.95763	21.900914	0.13456	1.30473	12.651	12.5165	0.104	40.8	0.0758	0.142	ln(y) = 0.265999707413803 + 3.36958849362949*Z
1,2,3,4,7,8-HxCDF PG/G	8/9	0.712414	1.0218478	1.434345432	0.0448068	1.3800213	0.1725	0.396	0.9205	0.748	0.161	2.87	0.041	0.041	ln(y) = -0.905397932332815 + 1.3542333141672*Z
1,2,3,6,7,8-HxCDD PG/G	4/9	0.2353676	0.2375669	1.009344042	0.0801572	0.3905779	0.09217	0.17135	0.31854	0.22638	0.122	0.757	0.146	0.421	ln(y) = -1.76407216052752 + 0.919734326784203*Z
1,2,3,6,7,8-HxCDF PG/G	8/9	2.3726571	2.4027968	1.012702914	0.8028299	3.9424843	0.3925	1.2	4.845	4.4525	0.228	6.17	0.0405	0.0405	ln(y) = 0.172622047309622 + 1.66331419789193*Z
1,2,3,7,8-PeCDD PG/G	1/9										0.39	0.39	0.0702	0.0405	
1,2,3,7,8-PeCDF PG/G	**9/9**	**3.4327778**	**6.4408838**	**1.876289191**	**-0.775266**	**7.6408219**	**0.6885**	**1.19**	**4.245**	**3.5565**	**0.291**	**16.9**			ln(y) = 0.477408000107266 + 1.47233829712042*Z
2,3,4,6,7,8-HxCDF PG/G	4/9	0.1653712	0.1474744	0.891778172	0.0690212	0.2617211	0.07119	0.12804	0.23026	0.15907	0.179	0.445	0.0435	0.107	ln(y) = -2.05544131843542 + 0.870534974485334*Z
2,3,4,7,8-PeCDF PG/G	4/9	1.1985058	4.4995618	3.754309533	-1.741208	4.1382195	0.03667	0.14761	0.59418	0.5575	0.0994	9.67	0.106	0.361	ln(y) = -1.91314989401201 + 2.06554595030083*Z
2,3,7,8-TCDD Equivalent PG/G	**9/9**	**1.8773148**	**4.2454329**	**2.26143906**	**-0.896368**	**4.6509976**	**0.32843**	**0.7208**	**1.6868**	**1.35838**	**0.2692781**	**10.4524861**			ln(y) = -0.164652102283484 + 1.35132552525007*Z
2,3,7,8-TCDD PG/G	1/9										0.245	0.245	0.0301	0.361	
2,3,7,8-TCDF PG/G	**9/9**	**4.2428889**	**13.623444**	**3.21088859**	**-4.657761**	**13.143539**	**0.2695**	**0.53**	**2.41**	**2.1405**	**0.194**	**30.8**			ln(y) = -0.132518253776854 + 1.81107339480258*Z
2-Methylphenol ug/Kg	6/50										32	360	50	24	
4,4'-DDD ug/Kg	1/52										5.3	5.3	6	10	
4,4'-DDE ug/Kg	4/52										7	17	6	10	
4,4'-DDT ug/Kg	3/52										1.4	66	10	10	
Acetophenone ug/Kg	3/50										39	45	40	24	
Aldrin ug/Kg	2/52										9.1	17	6	10	
alpha-BHC ug/Kg	2/52										1.7	2.4	10	0	
alpha-Chlordane ug/Kg	2/52										3.7	3.8	10	10	
Aluminum (Fume Or Dust) MG/KG	2/2										5.4	11.1			
Antimony MG/KG	3/52										0.03	0.03	0.02	1000	
Aroclor-1254 ug/Kg	39/52	78.271477	187.08077	2.390152533	27.422345	129.12061	13.8108	33.3341	80.4559	66.6451	12	1100	10	100	ln(y) = 3.50658008341133 + 1.30694610049538*Z
Aroclor-1260 ug/Kg	32/52	43.12551	122.54477	2.841584285	9.8174616	76.433558	6.34993	15.9848	40.239	33.889	11	710	10	100	ln(y) = 2.77163980435836 + 1.36934223323722*Z
Arsenic MG/KG	**52/52**	**0.3278846**	**0.2306352**	**0.703403684**	**0.2651972**	**0.390572**	**0.1925**	**0.285**	**0.375**	**0.1825**	**0.11**	**1.5**			ln(y) = -1.25484732098945 + 0.522417015280301*Z
Barium MG/KG	2/2										2.5	4.7			
Benzaldehyde ug/Kg	12/50	52.455825	179.12611	3.414799206	2.8046006	102.10705	8.00468	19.6029	48.0063	40.0016	26	1000	40	76	ln(y) = 2.9756793063807 + 1.32848894625132*Z
Benzyl Butyl Phthalate ug/Kg	1/48										330	330	50	76	
beta-BHC ug/Kg	10/51										10	73	6	10	
bis(2-Ethylhexyl)phthalate ug/Kg	15/51	357.59859	1265.6804	3.539388647	10.22641	704.97077	52.3201	133.398	340.119	287.799	230	7000	40	1000	ln(y) = 4.89333771492 + 1.3882710766085*Z
Cadmium MG/KG	5/52										0.003	0.005	0.003	0.5	
Calcium Metal MG/KG	2/2										16300	34700			
Chromium MG/KG	50/52	0.2147778	0.132547	0.617135459	0.1787511	0.2508044	0.12541	0.18421	0.27058	0.14517	0.08	0.63	0.1	0.11	ln(y) = -1.69167592018321 + 0.570306010472867*Z
Copper MG/KG	**52/52**	**0.7646154**	**0.6203599**	**0.811335845**	**0.5959997**	**0.9332311**	**0.4625**	**0.625**	**0.865**	**0.4025**	**0.24**	**4.1**			ln(y) = -0.412705555798512 + 0.508429831435358*Z
Dieldrin ug/Kg	2/52										10	10	6	10	
Diethyl Phthalate ug/Kg	24/52	40.530891	13.005771	0.320885404	36.995882	44.0659	31.478	38.7303	47.6535	16.1755	25	93	40	2000	ln(y) = 3.65662328153235 + 0.307530369162014*Z
Dimethyl Phthalate ug/Kg	1/42										78	78	40	2000	
Di-n-butylphthalate ug/Kg	14/52	126.48872	118.94638	0.9403715	94.158721	158.81871	50.2207	91.5949	167.055	116.834	36	400	40	1000	ln(y) = 4.51737511834534 + 0.891365047652529*Z
Endosulfan Sulfate ug/Kg	2/10										10	16	6	10	
Endrin Aldehyde ug/Kg	1/36										2.4	2.4	6	10	
gamma-Chlordane ug/Kg	1/52										11	11	6	10	
Heptachlor Epoxide ug/Kg	1/52										4	4	10	22	
Heptachlor ug/Kg	2/52										6.8	19	10	10	
Hexachloro-1,3-butadiene ug/Kg	9/52										30	220	40	1000	
Iron MG/KG	**52/52**	**8.3480769**	**4.4083678**	**0.528069864**	**7.1498689**	**9.546285**	**5.2**	**7.2**	**10.675**	**5.475**	**2.8**	**19.3**			ln(y) = 1.99203834490371 + 0.544547968286595*Z
Lead MG/KG	20/52	0.0430573	0.0829715	1.927000734	0.0205054	0.0656093	0.01304	0.02582	0.05113	0.03809	0.04	0.49	0.02	0.8	ln(y) = -3.65671959392657 + 1.01352297575649*Z

Table H-57
Entire Estuary (except Bayou Verdine)
Fish Whole Body - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Magnesium MG/KG	2/2										469	595			
Manganese MG/KG	2/2										2.8	9.4			
Mercury MG/KG	51/52	0.1528485	0.1227545	0.803112166	0.1194834	0.1862135	0.0845	0.1115	0.19675	0.11225	0.016	0.71	0.02	0.02	ln(y) = -2.09941104407812 + 0.694056121710341*Z
Nickel MG/KG	47/52	0.0893137	0.0895318	1.002441905	0.0649787	0.1136487	0.04952	0.07409	0.11085	0.06133	0.03	0.58	0.03	4	ln(y) = -2.60250461726551 + 0.597643390509557*Z
PCB-105 ng/kg	**9/9**	**4391.1111**	**4816.6037**	**1.096898624**	**1244.2633**	**7537.9589**	**864**	**1890**	**8625**	**7761**	**322**	**12500**			ln(y) = 7.78304645551658 + 1.51049587949047*Z
PCB-108 ng/kg	**9/9**	**1617.1111**	**1823.8069**	**1.127817934**	**425.55726**	**2808.665**	**301.5**	**866**	**2980**	**2678.5**	**140**	**5140**			ln(y) = 6.79482005417099 + 1.49046606156313*Z
PCB-114 ng/kg	**9/9**	**284.2**	**342.66379**	**1.205713549**	**60.326323**	**508.07368**	**53.4**	**106**	**450.5**	**397.1**	**19**	**985**			ln(y) = 4.99874008281638 + 1.57371961672338*Z
PCB-118 ng/kg	**9/9**	**17862.222**	**19464.429**	**1.089698047**	**5145.4622**	**30578.982**	**3340**	**8530**	**35350**	**32010**	**1500**	**50600**			ln(y) = 9.19820388449575 + 1.48861423350416*Z
PCB-126 ng/kg	**9/9**	**105.63667**	**153.11266**	**1.449427194**	**5.6030639**	**205.67027**	**18.2**	**28.8**	**201**	**182.8**	**8.13**	**408**			ln(y) = 3.84667363140885 + 1.57271055289426*Z
PCB-127 ng/kg	1/9										33.2	33.2	9.7	19.9	
PCB-15 ng/kg	3/9	24.618998	39.295615	1.596150063	-1.054137	50.292133	3.78721	11.1395	32.7654	28.9782	29	93.5	9.7	19.9	ln(y) = 2.41050110681983 + 1.60025237586039*Z
PCB-156 ng/kg	**9/9**	**2102.8889**	**2186.498**	**1.039759169**	**674.37686**	**3531.4009**	**411**	**1040**	**4050**	**3639**	**170**	**5920**			ln(y) = 7.07880054661086 + 1.49002920627937*Z
PCB-157 ng/kg	**9/9**	**612.73333**	**675.86149**	**1.103027129**	**171.17049**	**1054.2962**	**108.3**	**262**	**1230**	**1121.7**	**47**	**1720**			ln(y) = 5.7889674871066 + 1.54101005916753*Z
PCB-162 ng/kg	**9/9**	**3796.4444**	**4144.5439**	**1.091690912**	**1088.6758**	**6504.2131**	**668.5**	**1830**	**7485**	**6816.5**	**321**	**10900**			ln(y) = 7.63844574345534 + 1.50526043420661*Z
PCB-167 ng/kg	**9/9**	**1340**	**1612.2246**	**1.203152653**	**286.67996**	**2393.32**	**209**	**632**	**2540**	**2331**	**108**	**4490**			ln(y) = 6.53588132499194 + 1.55478864784206*Z
PCB-189 ng/kg	**9/9**	**211.75556**	**211.69846**	**0.999730366**	**73.445896**	**350.06522**	**43.45**	**103**	**428**	**384.55**	**25.7**	**568**			ln(y) = 4.83244465799219 + 1.37619078549487*Z
PCB-37 ng/kg	6/9	31.064681	53.416513	1.71952559	-3.834108	65.96347	6.72012	16.1983	39.0445	32.3244	6.63	143	10	13.4	ln(y) = 2.78490458976359 + 1.30497191792262*Z
PCB-58 ng/kg	**9/9**	**73.068889**	**138.87585**	**1.900615282**	**-17.66333**	**163.80111**	**5.215**	**14.6**	**113.1**	**107.885**	**3.79**	**367**			ln(y) = 3.13824260277332 + 1.91302076534403*Z
PCB-60 ng/kg	**9/9**	**619.67778**	**960.40779**	**1.549850298**	**-7.788644**	**1247.1442**	**98.45**	**278**	**905**	**806.55**	**74.2**	**2650**			ln(y) = 5.74611064579864 + 1.43969230585913*Z
PCB-61/70 ng/kg	8/9	2920.4105	4786.5727	1.639006797	-206.817	6047.638	289.5	992	4740	4450.5	244	13000	78.4	78.4	ln(y) = 6.86990135776052 + 2.06763500677504*Z
PCB-66 ng/kg	**9/9**	**4834.5556**	**6020.3264**	**1.245269882**	**901.27562**	**8767.8355**	**1013**	**2460**	**7825**	**6812**	**385**	**17400**			ln(y) = 7.89809457965452 + 1.46586897834741*Z
PCB-77 ng/kg	**9/9**	**123.82333**	**245.16646**	**1.979969802**	**-36.35209**	**283.99875**	**9.915**	**42.6**	**170**	**160.085**	**6.08**	**640**			ln(y) = 3.69633687698989 + 1.93878409864765*Z
PCB-79 ng/kg	**9/9**	**184.17778**	**189.44645**	**1.028606449**	**60.406097**	**307.94946**	**35.4**	**107**	**345**	**309.6**	**18.6**	**537**			ln(y) = 4.68110822801949 + 1.41629234618938*Z
PCB-80 ng/kg	2/9										6.07	45.8	9.89	19.9	
PCB-81 ng/kg	**9/9**	**134.5**	**185.53181**	**1.37941868**	**13.285883**	**255.71412**	**19.05**	**48.9**	**263.5**	**244.45**	**10**	**497**			ln(y) = 4.09990264116123 + 1.61484136045981*Z
Phenol ug/Kg	1/50										80	80	50	1000	
Potassium MG/KG	2/2										3230	3480			
Selenium MG/KG	**52/52**	**0.6148077**	**0.2536283**	**0.412532762**	**0.5458707**	**0.6837447**	**0.46**	**0.62**	**0.705**	**0.245**	**0.15**	**1.6**			ln(y) = -0.562599744865449 + 0.414210110043508*Z
Silver MG/KG	3/52										0.02	0.02	0.01	1	
Sodium MG/KG	2/2										1460	1710			
Total HpCDD PG/G	1/9										1.42	1.42	0.222	0.713	
Total HpCDF PG/G	7/9	11.429272	16.028023	1.402366088	0.95763	21.900914	0.13456	1.30473	12.651	12.5165	0.104	40.8	0.0952	0.184	ln(y) = 0.265999707413803 + 3.36958849362949*Z
Total HxCDD PG/G	4/9	0.2353676	0.2375669	1.009344042	0.0801572	0.3905779	0.09217	0.17135	0.31854	0.22638	0.122	0.757	0.129	0.39	ln(y) = -1.76407216052752 + 0.919734326784203*Z
Total HxCDF PG/G	**9/9**	**21.392778**	**24.826997**	**1.160531714**	**5.172473**	**37.613083**	**3.05**	**9.87**	**37.4**	**34.35**	**0.575**	**69.7**			ln(y) = 2.24453448051882 + 1.90749925677878*Z
Total PeCDD PG/G	1/9										0.39	0.39	0.0702	0.407	
Total PeCDF PG/G	**9/9**	**14.704444**	**20.121808**	**1.36841674**	**1.5581966**	**27.850692**	**2.745**	**4.69**	**22.85**	**20.105**	**1.04**	**56.9**			ln(y) = 1.96920670450928 + 1.61343154989885*Z
Total TCDD PG/G	2/9										0.0596	0.318	0.0383	0.145	
Total TCDF PG/G	**9/9**	**12.549444**	**20.797428**	**1.657238907**	**-1.038208**	**26.137097**	**2.165**	**3.78**	**16.55**	**14.385**	**0.805**	**56.5**			ln(y) = 1.73388855666494 + 1.65962983443312*Z
Zinc MG/KG	**52/52**	**8.9519231**	**4.2300269**	**0.472527175**	**7.8021887**	**10.101657**	**6.225**	**7.95**	**10.8**	**4.575**	**3.1**	**22.3**			ln(y) = 2.09687179857318 + 0.459143598056233*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-58
Entire Estuary (except Bayou Verdine)
Fish Fillet - Group 3B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/11										15	15	11	6.1	
4,4'-DDD ug/Kg	1/11										22	22	6	6.1	
4,4'-DDE ug/Kg	7/11	3.7636788	8.6658315	2.302489636	-1.3575	8.884858	1.24893	2.26407	4.1043	2.85537	1.4	22	6	14	ln(y) = 0.817162498816791 + 0.882352448942605*Z
4,4'-DDT ug/Kg	1/11										1.7	1.7	6	14	
Aldrin ug/Kg	1/11										2.5	2.5	6	14	
alpha-BHC ug/Kg	2/11										1.3	1.3	6	14	
alpha-Chlordane ug/Kg	6/11	1.4728795	0.6295827	0.427450271	1.1008199	1.8449391	0.93763	1.37777	2.02451	1.08688	0.76	2.5	6	8	ln(y) = 0.320464621939077 + 0.570856234141591*Z
Aluminum (Fume Or Dust) MG/KG	6/10	6.090373	5.8682168	0.963523384	2.4532145	9.7275314	3.74195	5.27677	7.44113	3.69918	4.1	18.2	4.4	10	ln(y) = 1.66331483024448 + 0.509809437566039*Z
Antimony MG/KG	3/10	0.5017221	0.1439824	0.286976282	0.4124809	0.5909633	0.32029	0.46572	-1	-1.3203	0.35	0.74	1	1	ln(y) = -0.764178585713681 + 0.555272242791282*Z
Arsenic MG/KG	8/10	0.6204139	0.1602024	0.258218493	0.5211195	0.7197084	0.48891	0.59944	0.73496	0.24605	0.43	0.91	0.83	3.4	ln(y) = -0.51176051249639 + 0.302321711197226*Z
Barium MG/KG	8/10	0.4881656	0.2894591	0.592952725	0.308757	0.6675742	0.28239	0.42244	0.63195	0.34956	0.16	1.1	0.67	1	ln(y) = -0.861702043456999 + 0.597405284079531*Z
beta-BHC ug/Kg	2/7										3	5.1	0.69	8	
Calcium Metal MG/KG	**10/10**	**2554.3**	**1566.5087**	**0.613282969**	**1583.3679**	**3525.2321**	**1170.75**	**2255**	**4230**	**3059.25**	**410**	**4510**			ln(y) = 7.60643860057061 + 0.934095190241939*Z
Chromium MG/KG	1/10										0.69	0.69	1	1	
Copper MG/KG	8/10	0.823168	0.474552	0.576494768	0.5290376	1.1172984	0.43235	0.6963	1.12139	0.68904	0.3	1.5	0.38	0.54	ln(y) = -0.3619719519034 + 0.706841340625519*Z
Dieldrin ug/Kg	9/11	3.680359	8.4758073	2.302983823	-1.328523	8.689241	1.24017	2.19347	3.87955	2.63938	1.2	22	6	14	ln(y) = 0.785483870407852 + 0.845808251278043*Z
Diethyl Phthalate ug/Kg	1/11										480	480	2000	4000	
Endosulfan II ug/Kg	3/11	3.1963366	1.2867728	0.402577357	2.4359025	3.9567707	2.03736	2.98735	4.38032	2.34296	2	4.3	6	8	ln(y) = 1.09438810491685 + 0.567695173857584*Z
Endrin Aldehyde ug/Kg	1/11										1.6	1.6	6	8	
Endrin Ketone ug/Kg	1/11										0.71	0.71	6	8	
Endrin ug/Kg	3/11	4.7042048	8.9388396	1.900180788	-0.578312	9.9867214	1.35941	2.86506	-6	-7.3594	2.2	22	6	6	ln(y) = 1.05259074098116 + 1.10583374962938*Z
gamma-BHC (Lindane) ug/Kg	4/11	1.3087046	0.5477182	0.418519356	0.9850238	1.6323854	0.85518	1.22498	1.75467	0.89949	0.89	2.3	6	8	ln(y) = 0.202921371620869 + 0.533028485118681*Z
Heptachlor Epoxide ug/Kg	6/11	8.8895866	34.700192	3.90346517	-11.61692	29.39609	0.55365	-22	-22	-22.554	0.7	81	22	22	ln(y) = 0.541194415852505 + 1.67968243690193*Z
Heptachlor ug/Kg	3/11	1.9361104	0.6218374	0.321178706	1.568628	2.3035929	0.65329	1.45019	3.21913	2.56584	0.69	3.4	6	8	ln(y) = 0.371692004899592 + 1.18278315259608*Z
Iron MG/KG	3/10	3.8709039	6.0246829	1.556402076	0.1367668	7.6050411	1.25409	2.54144	5.1503	3.89621	4.4	16.1	3.1	7.4	ln(y) = 0.932731111092515 + 1.04766447249971*Z
Magnesium MG/KG	9/10	322.55777	37.575856	0.116493415	299.26801	345.84753	294.75	314	354.25	59.5	294	375	251	251	ln(y) = 5.77271083593245 + 0.127527557294187*Z
Manganese MG/KG	8/10	0.8995513	0.1919651	0.21340094	0.7805701	1.0185325	-1.4	-1.4	-1.4	0	0.58	1.1	1.4	1.4	ln(y) = -0.125969069177153 + 0.273546697830298*Z
Mercury MG/KG	7/10	0.0480354	0.0330864	0.688792246	0.0275283	0.0685426	0.02151	0.03786	0.06666	0.04515	0.025	0.1	0.017	0.037	ln(y) = -3.27376341442481 + 0.838927633942868*Z
Potassium MG/KG	**10/10**	**3991**	**571.64193**	**0.143232756**	**3636.6927**	**4345.3073**	**3602.5**	**4125**	**4372.5**	**770**	**2930**	**4820**			ln(y) = 8.2825330454439 + 0.168476319197167*Z
Pyrene ug/Kg	1/11										230	230	1000	2000	
Selenium MG/KG	8/10	1.2494339	0.1034826	0.082823584	1.1852948	1.3135731	-1.5	-1.5	-1.5	0	1.1	1.4	1.5	1.5	ln(y) = 0.219988143086258 + 9.79883063454179E-02*Z
Sodium MG/KG	4/10	774.79086	95.280098	0.122975248	715.73564	833.84608	685.975	764.076	851.069	165.094	802	948	425	788	ln(y) = 6.63866687658718 + 0.159934423906131*Z
Zinc MG/KG	8/10	6.6409417	1.2574985	0.189355455	5.861536	7.4203473	5.71944	6.55884	7.52143	1.80199	5.6	8.7	5.3	6.1	ln(y) = 1.88081314388923 + 0.203122114798021*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-59
Entire Estuary (except Bayou Verdine)
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	2/72										3.2	11	10	11	
1,2,3,4,7,8-HxCDF PG/G	2/12										0.533	0.781	0.177	0.493	
1,2,3,6,7,8-HxCDF PG/G	6/12	0.6109439	0.2705066	0.442768233	0.4578904	0.7639974	0.38822	0.5518	0.78429	0.39607	0.572	1.13	0.16	0.399	ln(y) = -0.594575605441167 + 0.521521879769658*Z
1,2,3,7,8-PeCDF PG/G	10/12	0.935193	0.6984954	0.746899819	0.5399819	1.330404	0.40484	0.72339	1.29259	0.88775	0.352	2.4	0.226	0.706	ln(y) = -0.323805074739201 + 0.860962912860994*Z
2,3,7,8-TCDD Equivalent PG/G	**12/12**	**0.6096875**	**0.2034876**	**0.333757227**	**0.4945535**	**0.7248214**	**0.40597**	**0.68643**	**0.70886**	**0.30289**	**0.3601653**	**0.997711**			ln(y) = -0.54649280379404 + 0.382364383223802*Z
2,3,7,8-TCDF PG/G	11/12	0.75682	0.3643493	0.481421335	0.55067	0.96297	0.3645	0.831	1.1075	0.743	0.317	1.17	0.192	0.192	ln(y) = -0.40258527828398 + 0.613980878441769*Z
4,4'-DDD ug/Kg	5/72										0.69	12	6	10	
4,4'-DDE ug/Kg	11/72										1.7	25	6	10	
4,4'-DDT ug/Kg	4/72										1.7	4.5	6	10	
Aldrin ug/Kg	6/72										2.3	49	6	10	
alpha-BHC ug/Kg	6/72										0.88	8.3	6	10	
alpha-Chlordane ug/Kg	12/72										0.95	21	6	10	
Aluminum (Fume Or Dust) MG/KG	6/13	6.6756744	10.612374	1.589708086	0.9067224	12.444626	3.01809	4.93178	8.05889	5.0408	3.2	32.3	4.4	11.4	ln(y) = 1.59569985560235 + 0.728394355675425*Z
Antimony MG/KG	13/72										0.02	0.35	0.02	11.4	
Aroclor-1254 ug/Kg	8/72										24	670	10	7.7	
Aroclor-1260 ug/Kg	2/72										17	360	10	7.7	
Arsenic MG/KG	66/72	0.2959626	0.176242	0.595487508	0.2552528	0.3366724	0.1926	0.26172	0.35564	0.16305	0.13	0.99	0.01	1	ln(y) = -1.34048952113237 + 0.454865777544147*Z
Barium MG/KG	9/13	1.0875112	2.1013147	1.932223523	-0.054776	2.2297988	0.17919	0.45597	1.16025	0.98106	0.14	6.6	0.2	2.7	ln(y) = -0.785321170888047 + 1.38530807385349*Z
Benzaldehyde ug/Kg	41/59	34.071999	15.260288	0.447883541	30.178028	37.965971	24.4418	31.4958	40.5857	16.1439	21	85	40	55	ln(y) = 3.44985432160463 + 0.376097602732589*Z
Benzyl Butyl Phthalate ug/Kg	2/57										26	38	40	55	
beta-BHC ug/Kg	4/64										14	69	2	10	
Cadmium MG/KG	1/72										0.005	0.005	0.003	2.7	
Calcium Metal MG/KG	**13/13**	**5449.2308**	**8895.9845**	**1.632521153**	**613.31851**	**10285.143**	**592**	**1020**	**7710**	**7118**	**337**	**28400**			ln(y) = 7.64369096890343 + 1.65215487970505*Z
Caprolactam ug/Kg	2/21										130	180	40	55	
Chromium MG/KG	31/72	0.1162253	0.1713997	1.474718572	0.076634	0.1558166	0.04696	0.08008	0.13657	0.08961	0.1	1	0.01	1	ln(y) = -2.52470142712917 + 0.791729475429968*Z
Copper MG/KG	67/72	0.4008484	0.3803058	0.948752129	0.3130022	0.4886945	0.23985	0.33801	0.47634	0.23648	0.17	2.8	0.01	0.62	ln(y) = -1.08467573890692 + 0.508832015372104*Z
delta-BHC ug/Kg	2/23										1.1	1.5	10	10	
Dieldrin ug/Kg	10/72										1.3	15	6	10	
Diethyl Phthalate ug/Kg	11/72										24	88	40	55	
Di-n-butylphthalate ug/Kg	47/72	168.08662	149.63888	0.890248644	133.5218	202.65143	59.8033	115.889	224.572	164.769	26	610	40	2000	ln(y) = 4.7526295477894 + 0.981280257396242*Z
Endosulfan I ug/Kg	3/72										0.93	6	6	10	
Endosulfan II ug/Kg	4/72										1.5	8.2	6	10	
Endosulfan Sulfate ug/Kg	1/70										3.6	3.6	6	10	
Endrin Aldehyde ug/Kg	8/72										0.72	2.9	6	10	
Endrin Ketone ug/Kg	1/72										0.69	0.69	6	10	
Endrin ug/Kg	3/72										1.8	4.6	6	10	
gamma-BHC (Lindane) ug/Kg	5/72										0.84	6	6	10	
gamma-Chlordane ug/Kg	3/72										2.6	7.2	6	10	
Heptachlor Epoxide ug/Kg	2/72										6.5	11	10	22	
Heptachlor ug/Kg	5/72										1.2	9.9	6	10	
Hexachloro-1,3-butadiene ug/Kg	1/72										570	570	40	2000	
Iron MG/KG	53/72	4.0441236	3.0741897	0.760162157	3.334022	4.7542251	2.32494	3.40797	4.9955	2.67056	1.9	20.1	0.15	7.8	ln(y) = 1.22611612275417 + 0.567232753540205*Z
Lead MG/KG	30/72	0.0951431	0.1671242	1.7565557	0.0565394	0.1337468	0.01656	0.04122	0.10258	0.08602	0.02	0.8	0.02	0.8	ln(y) = -3.18877549055384 + 1.35229504751089*Z
Magnesium MG/KG	12/13	362.03981	126.08057	0.34825056	293.50163	430.57799	311.5	332	370.5	59	305	679	271	271	ln(y) = 5.85946153824656 + 0.267120681521769*Z
Manganese MG/KG	10/13	1.6021213	2.0463008	1.277244665	0.4897395	2.7145031	0.27896	0.73234	1.9226	1.64364	0.17	5.7	0.23	1.9	ln(y) = -0.311504965491306 + 1.43161790528797*Z
Mercury MG/KG	67/72	0.1353303	0.0876395	0.64759668	0.1150866	0.155574	0.07413	0.11329	0.17312	0.09899	0.027	0.56	0.02	0.11	ln(y) = -2.17784091581229 + 0.629001962078895*Z

Table H-59
Entire Estuary (except Bayou Verdine)
Fish Fillet - Group 4B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Naphthalene ug/Kg	1/72										41	41	40	2000	
Nickel MG/KG	28/72	0.0875731	0.1019095	1.163708229	0.0640332	0.111113	0.01977	0.04639	0.10887	0.0891	0.03	0.48	0.03	4	ln(y) = -3.07071835307028 + 1.26537172003746*Z
OCDD PG/G	3/12	1.0658564	0.7822722	0.733937736	0.6232442	1.5084686	0.55521	0.89514	1.44321	0.88801	1.72	2.7	0.508	1.43	ln(y) = -0.11077179250472 + 0.708470510160295*Z
PCB-105 ng/kg	**12/12**	**1413.5**	**1538.9486**	**1.088750316**	**542.75788**	**2284.2421**	**324.25**	**882.5**	**2032.5**	**1708.25**	**254**	**5050**			ln(y) = 6.79104028606347 + 1.16814365017447*Z
PCB-108 ng/kg	**12/12**	**475.41667**	**453.90439**	**0.95475069**	**218.59608**	**732.23725**	**125**	**334**	**704.75**	**579.75**	**114**	**1510**			ln(y) = 5.78385499838456 + 1.04785920212772*Z
PCB-114 ng/kg	**12/12**	**79.616667**	**75.690585**	**0.950687692**	**36.790687**	**122.44265**	**21.025**	**57.05**	**114**	**92.975**	**15.8**	**257**			ln(y) = 4.01025170024016 + 1.05984288225967*Z
PCB-118 ng/kg	**12/12**	**5656.6667**	**5952.8512**	**1.052360268**	**2288.524**	**9024.8093**	**1342.5**	**3645**	**8252.5**	**6910**	**1170**	**19600**			ln(y) = 8.20191227448826 + 1.12499902296445*Z
PCB-126 ng/kg	**12/12**	**30.965**	**30.406202**	**0.981953878**	**13.761072**	**48.168928**	**8.8275**	**24.9**	**43.125**	**34.2975**	**5.48**	**104**			ln(y) = 3.06700966634327 + 1.05940498080818*Z
PCB-15 ng/kg	9/12	12.86484	8.4692221	0.658323153	8.0729266	17.656754	7.05516	10.9797	17.0874	10.0323	6.65	32	6.11	10.8	ln(y) = 2.39605179373312 + 0.656035508825124*Z
PCB-156 ng/kg	**12/12**	**689**	**753.72734**	**1.093943893**	**262.53861**	**1115.4614**	**152**	**456**	**1025.75**	**873.75**	**131**	**2500**			ln(y) = 6.07881430225829 + 1.15805921837383*Z
PCB-157 ng/kg	**12/12**	**192.63333**	**216.63203**	**1.124582269**	**70.062223**	**315.20444**	**41.35**	**119**	**310.25**	**268.9**	**35.1**	**707**			ln(y) = 4.76819012344556 + 1.19815210082122*Z
PCB-162 ng/kg	**11/12**	**1158.1672**	**1587.0383**	**1.370301572**	**260.21572**	**2056.1186**	**285**	**616.5**	**1525**	**1240**	**280**	**5100**	**1.97**	**1.97**	ln(y) = 6.47891044737271 + 1.28768166949894*Z
PCB-167 ng/kg	**12/12**	**407.5**	**417.04461**	**1.023422357**	**171.5348**	**643.4652**	**102.075**	**293.5**	**579.75**	**477.675**	**90.5**	**1410**			ln(y) = 5.60964271799942 + 1.0761586069541*Z
PCB-169 ng/kg	4/9	2.7615619	1.5786491	0.571650797	1.7301779	3.792946	1.52237	2.51034	4.13948	2.61711	1.26	5.24	3.27	20	ln(y) = 0.9204190096175 + 0.741856196188657*Z
PCB-189 ng/kg	**12/12**	**62.091667**	**41.83887**	**0.673824242**	**38.419097**	**85.764236**	**26.025**	**49.05**	**105.225**	**79.2**	**18.7**	**134**			ln(y) = 3.91218219149476 + 0.806280910706071*Z
PCB-37 ng/kg	4/12	16.314777	7.6749111	0.470426972	11.972287	20.657267	10.5819	14.7861	20.6606	10.0787	18.4	31.8	10.4	23.5	ln(y) = 2.69368836901399 + 0.496211832813354*Z
PCB-58 ng/kg	**12/12**	**14.985833**	**9.7099086**	**0.647939182**	**9.4919354**	**20.479731**	**6.365**	**13.7**	**22.6**	**16.235**	**2.76**	**33.9**			ln(y) = 2.4802188129773 + 0.872725511897081*Z
PCB-60 ng/kg	**12/12**	**220.68333**	**121.22738**	**0.549327291**	**152.09249**	**289.27418**	**110.75**	**187**	**324.75**	**214**	**97.2**	**421**			ln(y) = 5.25986513994049 + 0.625083815705725*Z
PCB-61/70 ng/kg	**12/12**	**1036.3333**	**681.10931**	**0.657229953**	**650.95946**	**1421.7072**	**472.25**	**892.5**	**1630**	**1157.75**	**364**	**2210**			ln(y) = 6.74131676516982 + 0.760662956009065*Z
PCB-66 ng/kg	**12/12**	**1461.1667**	**1265.0182**	**0.865759008**	**745.41524**	**2176.9181**	**498**	**1210**	**2257.5**	**1759.5**	**416**	**4430**			ln(y) = 6.99824915416033 + 0.905313107114586*Z
PCB-77 ng/kg	**12/12**	**68.766667**	**52.689519**	**0.766207253**	**38.954765**	**98.578568**	**25.225**	**59.85**	**109.35**	**84.125**	**19.5**	**185**			ln(y) = 3.97817504186467 + 0.864066650218379*Z
PCB-79 ng/kg	**12/12**	**69.666667**	**73.32417**	**1.052500044**	**28.179612**	**111.15372**	**17.675**	**44.65**	**101.475**	**83.8**	**15.3**	**242**			ln(y) = 3.81765310385752 + 1.0975270579101*Z
PCB-80 ng/kg	2/12										1.53	3.25	1.98	19.6	
Potassium MG/KG	**13/13**	**3961.5385**	**485.16278**	**0.122468274**	**3697.801**	**4225.276**	**3655**	**3950**	**4370**	**715**	**2990**	**4700**			ln(y) = 8.2774817706308 + 0.141495374886022*Z
Selenium MG/KG	67/72	0.839014	0.2684883	0.320004602	0.7769964	0.9010317	0.64754	0.80003	0.98843	0.34089	0.45	1.7	0.03	1.3	ln(y) = -0.223105897339756 + 0.313662529356532*Z
Sodium MG/KG	4/13	716.7204	239.76093	0.334525052	586.38487	847.05592	511.753	671.104	880.072	368.319	868	1240	351	675	ln(y) = 6.50892354157939 + 0.402083969732632*Z
Total HpCDF PG/G	2/12										1.48	1.59	0.298	1.43	
Total HxCDF PG/G	**12/12**	**2.755**	**2.2585476**	**0.819799475**	**1.4771064**	**4.0328936**	**0.80475**	**1.975**	**4.7775**	**3.97275**	**0.437**	**6.66**			ln(y) = 0.618498268239047 + 1.1017118348751*Z
Total PeCDF PG/G	10/12	2.4720855	2.010541	0.813297524	1.3345148	3.6096561	0.786	1.66765	3.53825	2.75225	0.536	6.17	0.229	0.709	ln(y) = 0.511417071202402 + 1.1157331441193*Z
Total TCDF PG/G	**12/12**	**2.2103333**	**1.4261035**	**0.645198376**	**1.4034393**	**3.0172273**	**0.933**	**2.045**	**3.55**	**2.617**	**0.376**	**4.27**			ln(y) = 0.541521290408371 + 0.90391056277003*Z
Zinc MG/KG	67/72	4.3984726	3.0712312	0.698249483	3.6890544	5.1078909	2.97119	3.88357	5.07611	2.10491	2.7	20	0.01	7.7	ln(y) = 1.35675411060325 + 0.39720338667218*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/39										1.2	1.2	10	2000	
1,2,3,4,6,7,8-HpCDD PG/G	6/7	5.1939421	5.0366576	0.969717689	1.462734	8.9251503	1.78	3.05	11	9.22	1.78	13	0.443	0.443	ln(y) = 1.21716645996776 + 1.26685295020692*Z
1,2,3,4,6,7,8-HpCDF PG/G	5/7	6.9383215	16.843234	2.427566089	-5.539321	19.415964	0.65434	2.30127	8.09342	7.43908	2.19	35	0.27	1.9	ln(y) = 0.833460275161807 + 1.86533899377384*Z
1,2,3,4,7,8,9-HpCDF PG/G	2/4										0.79	8.8	0.339	1.9	
1,2,3,4,7,8-HxCDD PG/G	4/7	0.1679695	0.054255	0.323005162	0.1277768	0.2081622	0.1188	0.1636	0.22528	0.10649	0.11	0.255	0.98	1.8	ln(y) = -1.81035817618204 + 0.474594363627857*Z
1,2,3,4,7,8-HxCDF PG/G	5/7	6.3851675	17.859492	2.797028005	-6.84533	19.615665	0.31352	1.35819	5.88372	5.5702	0.762	36	0.262	0.91	ln(y) = 0.306153378061285 + 2.17451799628787*Z
1,2,3,6,7,8-HxCDD PG/G	4/7	0.3629511	0.1573981	0.433662043	0.2463489	0.4795532	0.22628	0.34655	0.53075	0.30447	0.21	0.619	1	1.7	ln(y) = -1.05972081438444 + 0.632259510169588*Z
1,2,3,6,7,8-HxCDF PG/G	3/7	1.5834276	4.2415702	2.678726964	-1.558772	4.7256268	0.07022	0.31778	1.4381	1.36788	0.71	8.7	0.313	1.3	ln(y) = -1.14638183187113 + 2.23929281105238*Z
1,2,3,7,8,9-HxCDD PG/G	4/7	0.2284889	0.0369088	0.161534153	0.2011465	0.2558313	0.18877	0.22647	0.2717	0.08293	0.18	0.272	0.78	1.5	ln(y) = -1.48512454813986 + 0.270072888491236*Z
1,2,3,7,8-PeCDD PG/G	3/7	0.2078639	0.1588887	0.764388196	0.0901575	0.3255702	0.10025	0.185	0.3414	0.24115	0.179	0.454	0.1	0.89	ln(y) = -1.68737440982133 + 0.908773136863458*Z
1,2,3,7,8-PeCDF PG/G	5/7	6.7487757	11.776442	1.744974563	-1.975335	15.472886	0.53505	1.99476	7.43678	6.90173	1.13	28	0.67	1.9	ln(y) = 0.690522390303459 + 1.95184893540737*Z
1,2-Benzphenanthracene ug/Kg	15/31	3.8353852	1.5994821	0.417032977	3.2723253	4.3984451	2.58628	3.57656	4.946	2.35972	1.9	7.8	80	2000	ln(y) = 1.27440062421253 + 0.480842243965097*Z
1-Methylnaphthalene ug/Kg	12/15	0.3394645	0.1229103	0.362071131	0.2772633	0.4016657	-1.7	-1.7	-1.7	0	0.21	0.59	1.7	1.7	ln(y) = -1.12714229342369 + 0.368467557556055*Z
2,3,4,6,7,8-HxCDF PG/G	3/7	0.6693321	1.1923197	1.78135757	-0.213951	1.5526149	0.07585	0.2555	0.86071	0.78486	0.3	2.7	0.295	0.71	ln(y) = -1.36451980847288 + 1.80145595070251*Z
2,3,4,7,8-PeCDF PG/G	5/7	6.2103507	9.3205613	1.500810771	-0.694418	13.115119	0.45283	1.85474	7.59684	7.14402	0.91	21.8	0.74	1.8	ln(y) = 0.617742656074094 + 2.09138680882014*Z
2,3,7,8-TCDD Equivalent PG/G	7/7	6.7164199	8.6614232	1.289589296	0.2999478	13.132892	1.40829	2.26285	17.5587	16.1504	1.40489	20.249			ln(y) = 1.25715767490248 + 1.29519136908273*Z
2,3,7,8-TCDD PG/G	4/7	0.2171365	0.2490736	1.147083397	0.0326201	0.4016528	0.08038	0.15388	0.29461	0.21423	0.0823	0.67	0.1	0.43	ln(y) = -1.87155162225194 + 0.963291797953295*Z
2,3,7,8-TCDF PG/G	6/7	15.149378	20.856618	1.376730961	-0.301421	30.600177	2.14	4.3	43	40.86	2.14	46.2	1.7	1.7	ln(y) = 1.73331187555845 + 1.92765461717743*Z
2-Methylnaphthalene ug/Kg	15/34	0.6234027	0.2338896	0.375182136	0.5447837	0.7020217	0.45338	0.59177	0.77241	0.31904	0.39	1.2	40	2000	ln(y) = -0.524632792942956 + 0.395139213626372*Z
4,4'-DDD ug/Kg	1/39										1.2	1.2	5	2000	
4,4'-DDE ug/Kg	8/39	2.123967	0.9928693	0.467459857	1.8123538	2.4355802	1.32302	1.92242	2.79339	1.47037	1	3.7	5	10	ln(y) = 0.653584241686474 + 0.554250870269157*Z
4,4'-DDT ug/Kg	1/39										1.5	1.5	5	10	
4-Methylphenol ug/Kg	4/32										65	470	40	670	
Acenaphthene ug/Kg	3/30										0.32	0.46	1.7	2000	
Acenaphthylene ug/Kg	10/30	0.6919425	0.4294576	0.620655051	0.538263	0.8456219	0.40684	0.61235	0.92166	0.51482	0.34	2.1	1.7	2000	ln(y) = -0.490451037531585 + 0.606471139502978*Z
alpha-BHC ug/Kg	1/39										1.6	1.6	2.5	10	
alpha-Chlordane ug/Kg	3/39										1.3	1.6	2.5	10	
Aluminum (Fume Or Dust) MG/KG	7/18	33.26262	25.837922	0.776785536	21.326109	45.199131	15.9716	26.6841	44.5816	28.61	23.2	89	21	47	ln(y) = 3.2840666286567 + 0.761290879305297*Z
Anthracene ug/Kg	15/31	1.0918841	0.8084916	0.740455485	0.8072737	1.3764945	0.4913	0.8719	1.54734	1.05605	0.35	2.9	80	2000	ln(y) = -0.137081023579386 + 0.850831188102383*Z
Aroclor-1242 ug/Kg	1/9										13	13	10	9.7	
Aroclor-1254 ug/Kg	8/39	12.50962	16.62155	1.328701402	7.292927	17.726313	3.07079	6.92073	15.5975	12.5267	17	74	10	100	ln(y) = 1.93452157718088 + 1.20528124313089*Z
Aroclor-1260 ug/Kg	4/39										14	31	10	100	
Arsenic MG/KG	22/39	0.3179812	0.103742	0.326252157	0.2854216	0.3505407	0.23637	0.30469	0.39275	0.15638	0.18	0.63	0.5	0.98	ln(y) = -1.1884634472595 + 0.376583191497763*Z
Barium MG/KG	18/18	2.5111111	0.8387911	0.334031844	2.1236094	2.8986128	1.875	2.3	3.1	1.225	1.4	4.1			ln(y) = 0.871414537073007 + 0.357957553013404*Z
Benzaldehyde ug/Kg	21/21	421.71429	617.05886	1.463215452	157.79385	685.63472	79	180	340	261	31	2000			ln(y) = 5.25726093770922 + 1.31695200562984*Z
Benzo(a)anthracene ug/Kg	15/31	1.835635	0.781116	0.42552903	1.5606616	2.1106085	1.19949	1.69676	2.4002	1.20071	0.82	3.3	80	2000	ln(y) = 0.528721970273159 + 0.514438157618307*Z
Benzo(a)pyrene ug/Kg	18/23	20.971124	65.58958	3.127614038	-5.834567	47.776815	0.90288	2.54929	7.19795	6.29507	0.84	240	80	2000	ln(y) = 0.935815869332873 + 1.5395978404326*Z
Benzo(b)fluoranthene ug/Kg	16/22	3.1405683	9.2076069	2.931828227	-0.707046	6.9881824	1.19547	1.92601	3.10299	1.90752	0.99	32	40	2000	ln(y) = 0.655451454912519 + 0.707389652562187*Z
Benzo(g,h,i)perylene ug/Kg	15/18	1.6195053	0.6217811	0.383932719	1.3322571	1.9067535	1.18666	1.53641	1.98925	0.8026	1	3.3	200	2000	ln(y) = 0.429451014929727 + 0.383140342291066*Z
Benzo(k)fluoranthene ug/Kg	16/22	2.1938921	6.5314195	2.977092433	-0.535414	4.9231986	0.69307	1.25763	2.28205	1.58898	0.5	23	40	2000	ln(y) = 0.229225659678622 + 0.883801873307446*Z
Benzyl Butyl Phthalate ug/Kg	3/39										140	150	40	2000	
beta-BHC ug/Kg	2/39										1.2	13	2.5	10	
Cadmium MG/KG	21/39	0.0616181	0.0748058	1.214022103	0.0381403	0.085096	0.02261	0.04185	0.07746	0.05485	0.02	0.37	0.043	0.5	ln(y) = -3.17361624580724 + 0.913210792645401*Z
Calcium Metal MG/KG	6/18	256.80277	194.75038	0.758365582	166.83268	346.77286	140.812	216.843	333.928	193.116	253	780	250	330	ln(y) = 5.37917490558824 + 0.640400487926128*Z
Chromium MG/KG	15/39	0.1141559	0.0447087	0.391645814	0.100124	0.1281877	0.07974	0.10611	0.1412	0.06146	0.091	0.23	0.05	1	ln(y) = -2.24324874448297 + 0.423777261988636*Z
Cobalt MG/KG	15/17	0.2210455	0.0439021	0.19861128	0.2001758	0.2419153	-1	-1	-1	0	0.18	0.35	1	1	ln(y) = -1.52188814486954 + 0.170514655379268*Z

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
Copper MG/KG	25/39	13.640325	36.611056	2.684030987	2.1499022	25.130749	0.54228	1.87751	6.50044	5.95816	0.86	163	0.8	4.2	ln(y) = 0.629945027084903 + 1.8421010092916*Z
Dibenzo(a,h)anthracene ug/Kg	11/18	0.528903	0.1816392	0.343426383	0.44499	0.6128161	0.38264	0.50533	0.66735	0.28471	0.34	0.93	1.7	2000	ln(y) = -0.682549638039387 + 0.412506866426881*Z
Dieldrin ug/Kg	1/39										1.8	1.8	5	10	
Diethyl Phthalate ug/Kg	3/38										24	37	80	4000	
Di-n-octylphthalate ug/Kg	1/22										20	20	40	2000	
Endosulfan I ug/Kg	1/39										1	1	2.5	10	
Endosulfan II ug/Kg	1/39										1.5	1.5	5	10	
Endrin Ketone ug/Kg	1/39										1.2	1.2	5	10	
Fluoranthene ug/Kg	15/31	5.7517244	3.9821545	0.692340968	4.349901	7.1535479	2.68505	4.6914	8.19695	5.51189	1.7	14	80	2000	ln(y) = 1.54573133526775 + 0.827706040120625*Z
Fluorene ug/Kg	10/30	0.431423	0.1119833	0.259567234	0.3913503	0.4714957	0.34195	0.42071	0.51761	0.17566	0.29	0.68	1.7	2000	ln(y) = -0.865820308085329 + 0.307453594581983*Z
gamma-BHC (Lindane) ug/Kg	1/39										1.9	1.9	2.5	10	
Heptachlor Epoxide ug/Kg	1/39										1.1	1.1	2.5	10	
Heptachlor ug/Kg	2/39										0.87	0.9	2.5	10	
Indeno(1,2,3-cd)pyrene ug/Kg	15/18	0.6015308	0.2284403	0.379764898	0.4959967	0.7070648	0.42131	0.56582	0.75989	0.33857	0.34	1.1	200	2000	ln(y) = -0.569484953164143 + 0.437411649143184*Z
Iron MG/KG	39/39	52.746154	29.811856	0.565194878	43.389668	62.10264	37.9	45	64	26.1	15.1	170			ln(y) = 3.83901396204048 + 0.540688640632188*Z
Lead MG/KG	17/39	0.2217432	0.2129249	0.960231749	0.1549165	0.28857	0.12033	0.1851	0.28473	0.16439	0.14	1.2	0.12	0.8	ln(y) = -1.68685859271801 + 0.638745175184411*Z
Magnesium MG/KG	3/18										159	306	110	0.8	
Manganese MG/KG	18/18	1.8555556	0.8848464	0.476863327	1.4467774	2.2643337	1.375	1.6	2.125	0.75	1.1	4.6			ln(y) = 0.555842276736698 + 0.360472423565227*Z
Mercury MG/KG	36/39	0.0395847	0.0618511	1.56249924	0.0201727	0.0589968	0.00946	0.02117	0.04736	0.0379	0.002	0.314	0.002	0.014	ln(y) = -3.85540401182841 + 1.19453169644138*Z
Mercury ng/g	15/15	43.62	21.154389	0.484969954	32.914402	54.325598	28.5	36.7	62.2	33.7	14.4	88			ln(y) = 3.65870301611186 + 0.58834144206129*Z
Methyl Mercury MG/KG	21/21	0.0140476	0.0217421	1.54774472	0.0047484	0.0233469	0.00445	0.0064	0.0083	0.00385	0.0038	0.0797			ln(y) = -4.81302659563639 + 0.847813142263454*Z
Methyl Mercury ng/g	15/15	15.688	8.7104882	0.555232549	11.279885	20.096115	7.98	14.3	23.9	15.92	6.84	29.8			ln(y) = 2.60934222416817 + 0.615626538608687*Z
Naphthalene ug/Kg	15/34	0.506271	0.1300985	0.256974014	0.46254	0.5500019	0.40618	0.4933	0.59911	0.19293	0.37	0.83	40	2000	ln(y) = -0.706627697040288 + 0.288233477015927*Z
Nickel MG/KG	38/39	0.9019029	0.4973905	0.551490132	0.7457963	1.0580095	-4	-4	-4	0	0.25	2.6	4	4	ln(y) = -0.243076328355336 + 0.593262997603934*Z
OCDD PG/G	7/7	65.627143	49.564734	0.755247476	28.909074	102.34521	22.3	69.2	110	87.7	3.69	140			ln(y) = 3.7568906407211 + 1.44761322661383*Z
OCDF PG/G	6/7	31.853847	77.592773	2.435899576	-25.62768	89.335378	7.4	11	20.7	13.3	7.4	160	1.41	1.41	ln(y) = 2.56620171079419 + 1.48496246126887*Z
PCB-1 PG/G	1/1										2.42	2.42			
PCB-10 PG/G	1/1										0.471	0.471			
PCB-103 PG/G	1/1										56.4	56.4			
PCB-104 PG/G	1/1										1.53	1.53			
PCB-105 ng/kg	3/3	1426.6667	2016.4519	1.413400884	-855.1635	3708.4968	220	770	3290	3070	220	3290			ln(y) = 6.71288696831984 + 2.00612494086842*Z
PCB-105 PG/G	1/1										1000	1000			
PCB-107 PG/G	1/1										175	175			
PCB-108 ng/kg	3/3	500.76667	614.15423	1.226427931	-194.2143	1195.7476	87.3	335	1080	992.7	87.3	1080			ln(y) = 5.7560657715963 + 1.86547491488153*Z
PCB-109 PG/G	1/1										415	415			
PCB-11 PG/G	1/1										4.31	4.31			
PCB-110/77 PG/G	1/1										4430	4430			
PCB-111 PG/G	1/1										12	12			
PCB-114 ng/kg	2/3										39.6	180	29.9	29.9	
PCB-114 PG/G	1/1										66.8	66.8			
PCB-118 ng/kg	3/3	5729.3333	7313.1431	1.276438747	-2546.267	14004.934	938	3650	12600	11662	938	12600			ln(y) = 8.16256149617411 + 1.9265381104822*Z
PCB-118 PG/G	1/1										3670	3670			
PCB-12 PG/G	1/1										5.19	5.19			
PCB-120 PG/G	1/1										53.8	53.8			
PCB-121 PG/G	1/1										11.8	11.8			
PCB-122 PG/G	1/1										32.3	32.3			
PCB-123 PG/G	1/1										77.7	77.7			

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-126 ng/kg	2/3										22.8	103	29.9	29.9	
PCB-126 PG/G	1/1										17.1	17.1			
PCB-127 PG/G	1/1										8.02	8.02			
PCB-128 PG/G	1/1										990	990			
PCB-129 PG/G	1/1										6020	6020			
PCB-130 PG/G	1/1										354	354			
PCB-131 PG/G	1/1										54.9	54.9			
PCB-132 PG/G	1/1										1420	1420			
PCB-133 PG/G	1/1										85.9	85.9			
PCB-134 PG/G	1/1										171	171			
PCB-135 PG/G	1/1										1350	1350			
PCB-136 PG/G	1/1										487	487			
PCB-139 PG/G	1/1										124	124			
PCB-14 PG/G	1/1										2.86	2.86			
PCB-141 PG/G	1/1										709	709			
PCB-144 PG/G	1/1										107	107			
PCB-145 PG/G	1/1										1.93	1.93			
PCB-146 PG/G	1/1										962	962			
PCB-147 PG/G	1/1										3670	3670			
PCB-148 PG/G	1/1										20.6	20.6			
PCB-15 ng/kg	3/3	258.13333	388.68207	1.505741507	-181.7018	697.96851	32.4	127	615	582.6	32.4	615			ln(y) = 4.9146559256878 + 2.18296592913015*Z
PCB-15 PG/G	1/1										78.2	78.2			
PCB-150 PG/G	1/1										16.1	16.1			
PCB-152 PG/G	1/1										4.39	4.39			
PCB-153/132 PG/G	1/1										5440	5440			
PCB-155 PG/G	1/1										8.04	8.04			
PCB-156 ng/kg	3/3	276.56667	336.14873	1.215434718	-103.8214	656.95476	84.7	161	584	499.3	84.7	584			ln(y) = 5.2968069831569 + 1.43193153559709*Z
PCB-156 PG/G	1/1										525	525			
PCB-157 ng/kg	3/3	140.56667	203.88441	1.450446332	-90.15026	371.28359	31.9	65.8	324	292.1	31.9	324			ln(y) = 4.47665645463813 + 1.71920412857184*Z
PCB-158 PG/G	1/1										608	608			
PCB-159 PG/G	1/1										24.9	24.9			
PCB-16 PG/G	1/1										18.9	18.9			
PCB-162 ng/kg	3/3	1016	1473.2184	1.450018063	-651.1035	2683.1035	210	488	2350	2140	210	2350			ln(y) = 6.43319784790294 + 1.79108719866473*Z
PCB-162 PG/G	1/1										38.9	38.9			
PCB-164 PG/G	1/1										353	353			
PCB-167 ng/kg	3/3	361.23333	556.91403	1.541701669	-268.9742	991.44089	78.7	149	856	777.3	78.7	856			ln(y) = 5.37395327917019 + 1.76999826826419*Z
PCB-167 PG/G	1/1										289	289			
PCB-169 ng/kg	1/1										8.25	8.25			
PCB-17 PG/G	1/1										41.4	41.4			
PCB-170/190 PG/G	1/1										637	637			
PCB-171 PG/G	1/1										334	334			
PCB-172 PG/G	1/1										109	109			
PCB-174 PG/G	1/1										589	589			
PCB-175 PG/G	1/1										37.4	37.4			
PCB-176 PG/G	1/1										77.9	77.9			
PCB-177 PG/G	1/1										369	369			
PCB-178 PG/G	1/1										143	143			

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-179 PG/G	1/1										251	251			
PCB-18/17 PG/G	1/1										61.8	61.8			
PCB-180 PG/G	1/1										1160	1160			
PCB-181 PG/G	1/1										20.3	20.3			
PCB-182 PG/G	1/1										23.3	23.3			
PCB-183 PG/G	1/1										714	714			
PCB-184 PG/G	1/1										10.3	10.3			
PCB-187 PG/G	1/1										1070	1070			
PCB-188 PG/G	1/1										9.14	9.14			
PCB-189 ng/kg	3/3	24.2	31.778296	1.313152714	-11.76053	60.160527	10.5	10.9	51.2	40.7	10.5	51.2			ln(y) = 2.89195919281468 + 1.175014681177*Z
PCB-189 PG/G	1/1										39.1	39.1			
PCB-19 PG/G	1/1										8.76	8.76			
PCB-190 PG/G	1/1										184	184			
PCB-191 PG/G	1/1										60.7	60.7			
PCB-192 PG/G	1/1										10.3	10.3			
PCB-194 PG/G	1/1										177	177			
PCB-195/208 PG/G	1/1										142	142			
PCB-196 PG/G	1/1										296	296			
PCB-197 PG/G	1/1										132	132			
PCB-198 PG/G	1/1										493	493			
PCB-2 PG/G	1/1										1.23	1.23			
PCB-20 PG/G	1/1										444	444			
PCB-201/157/173 PG/G	1/1										38.8	38.8			
PCB-202 PG/G	1/1										101	101			
PCB-203 PG/G	1/1										409	409			
PCB-204 PG/G	1/1										15.9	15.9			
PCB-205 PG/G	1/1										56	56			
PCB-206 PG/G	1/1										1410	1410			
PCB-207 PG/G	1/1										372	372			
PCB-208 PG/G	1/1										370	370			
PCB-209 PG/G	1/1										3010	3010			
PCB-21 PG/G	1/1										51.8	51.8			
PCB-22 PG/G	1/1										45.1	45.1			
PCB-23 PG/G	1/1										9.78	9.78			
PCB-24 PG/G	1/1										1.24	1.24			
PCB-25 PG/G	1/1										21.9	21.9			
PCB-26 PG/G	1/1										41.9	41.9			
PCB-27 PG/G	1/1										6.52	6.52			
PCB-31 PG/G	1/1										156	156			
PCB-32 PG/G	1/1										38.3	38.3			
PCB-34 PG/G	1/1										3.43	3.43			
PCB-35 PG/G	1/1										5.62	5.62			
PCB-37 ng/kg	3/3	143.4	208.48153	1.453846079	-92.51906	379.31906	24.6	71.6	334	309.4	24.6	334			ln(y) = 4.42832750329387 + 1.93446793719548*Z
PCB-37 PG/G	1/1										52	52			
PCB-39 PG/G	1/1										7.33	7.33			
PCB-4 PG/G	1/1										9.88	9.88			
PCB-40 PG/G	1/1										242	242			

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-42 PG/G	1/1										165	165			
PCB-43 PG/G	1/1										15.2	15.2			
PCB-44 PG/G	1/1										764	764			
PCB-45 PG/G	1/1										64.2	64.2			
PCB-46 PG/G	1/1										19.3	19.3			
PCB-48 PG/G	1/1										48.2	48.2			
PCB-49 PG/G	1/1										731	731			
PCB-50 PG/G	1/1										85.1	85.1			
PCB-52 PG/G	1/1										1170	1170			
PCB-54 PG/G	1/1										1.75	1.75			
PCB-56 PG/G	1/1										163	163			
PCB-57 PG/G	1/1										8.64	8.64			
PCB-58 ng/kg	3/3	23.036667	29.169912	1.266238388	-9.972196	56.045529	4.11	14.6	50.4	46.29	4.11	50.4			ln(y) = 2.67147857743325 + 1.85895025423291*Z
PCB-58 PG/G	1/1										9.19	9.19			
PCB-59 PG/G	1/1										63.2	63.2			
PCB-6 PG/G	1/1										4.4	4.4			
PCB-60 ng/kg	3/3	524.16667	768.17792	1.465522271	-345.1085	1393.4418	76.5	266	1230	1153.5	76.5	1230			ln(y) = 5.67851883266022 + 2.05986609881874*Z
PCB-60 PG/G	1/1										58.3	58.3			
PCB-61/70 ng/kg	3/3	2513.3333	3795.7851	1.510259313	-1782.002	6808.6685	360	1200	5980	5620	360	5980			ln(y) = 7.22411890472364 + 2.08403817904422*Z
PCB-61/70 PG/G	1/1										1460	1460			
PCB-63 PG/G	1/1										41.1	41.1			
PCB-64 PG/G	1/1										203	203			
PCB-66 ng/kg	3/3	2098.6667	2852.621	1.35925399	-1129.378	5326.7113	306	1230	4760	4454	306	4760			ln(y) = 7.1021191658481 + 2.03534711720272*Z
PCB-66 PG/G	1/1										834	834			
PCB-67 PG/G	1/1										16.6	16.6			
PCB-68 PG/G	1/1										40.5	40.5			
PCB-7 PG/G	1/1										4.04	4.04			
PCB-72 PG/G	1/1										49.5	49.5			
PCB-77 ng/kg	3/3	155.86667	244.12495	1.566242205	-120.3867	432.12006	16.9	71.7	379	362.1	16.9	379			ln(y) = 4.34578019153901 + 2.30663948617859*Z
PCB-77 PG/G	1/1										71.9	71.9			
PCB-79 ng/kg	3/3	96.133333	121.69609	1.265909428	-41.57876	233.84543	13.7	63.7	211	197.3	13.7	211			ln(y) = 4.04114617629609 + 2.02796377027543*Z
PCB-79 PG/G	1/1										32.2	32.2			
PCB-80 ng/kg	1/3										33.5	33.5	29.9	0	
PCB-81 ng/kg	3/3	81.8	116.26479	1.421329996	-49.766	213.366	15.8	41.6	188	172.2	15.8	188			ln(y) = 3.9081840233767 + 1.83660035122927*Z
PCB-81 PG/G	1/1										6.29	6.29			
PCB-82 PG/G	1/1										246	246			
PCB-83 PG/G	1/1										3320	3320			
PCB-84 PG/G	1/1										562	562			
PCB-85 PG/G	1/1										578	578			
PCB-86 PG/G	1/1										2180	2180			
PCB-88 PG/G	1/1										556	556			
PCB-89 PG/G	1/1										14.6	14.6			
PCB-9 PG/G	1/1										5.91	5.91			
PCB-90 PG/G	1/1										4550	4550			
PCB-92 PG/G	1/1										893	893			
PCB-93 PG/G	1/1										2420	2420			
PCB-94 PG/G	1/1										17.1	17.1			

Table H-60
Entire Estuary (except Bayou Verdine)
Shellfish - Group 1A

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-96 PG/G	1/1										12.1	12.1			
Phenanthrene ug/Kg	16/38	4.4494162	16.221791	3.64582452	-0.708367	9.6071992	1.27153	2.37842	4.44887	3.17734	1	72	40	2000	ln(y) = 0.866436550111861 + 0.928839967213531*Z
Potassium MG/KG	3/18										736	808	150	4	
Pyrene ug/Kg	15/39	8.1900152	4.3283269	0.528488267	6.8315647	9.5484657	4.8619	7.31148	10.9952	6.13334	3.4	19	40	2000	ln(y) = 1.98944554260287 + 0.605196167318972*Z
Selenium MG/KG	18/39	0.4274171	0.3517611	0.822992554	0.3170164	0.5378177	0.19359	0.33076	0.56513	0.37154	0.22	1.6	0.15	1.3	ln(y) = -1.10636465616927 + 0.794528691154656*Z
Silver MG/KG	11/39	0.0930075	0.0954513	1.026274374	0.0630501	0.122965	0.03365	0.06645	0.13121	0.09756	0.07	0.46	0.01	1	ln(y) = -2.71136406800061 + 1.00923814808957*Z
Sodium MG/KG	3/18										1590	1940	300	1	
Thallium MG/KG	1/6										0.58	0.58	0.93	1	
Total Hepta-Dioxins PG/G	1/1										4.55	4.55			
Total Hepta-Furans PG/G	1/1										7.34	7.34			
Total Hexa-Dioxins PG/G	1/1										0.18	0.18			
Total Hexa-Furans PG/G	1/1										7.35	7.35			
Total HpCDD PG/G	6/6	13.515	10.830256	0.801350792	4.8489904	22.18101	3.5725	11.8	26	22.4275	1.09	26			ln(y) = 2.16413262354955 + 1.49434310450781*Z
Total HpCDF PG/G	4/6	13.500156	34.534154	2.558055982	-14.13292	41.133234	0.60427	3.01302	15.0237	14.4194	3.83	65	0.27	1.9	ln(y) = 1.10294259892502 + 2.38313651444089*Z
Total HxCDD PG/G	6/6	6.2733333	3.2997234	0.525992041	3.6330047	8.913662	4.0275	5.115	9.725	5.6975	2.61	11			ln(y) = 1.72592176510452 + 0.65383388557006*Z
Total HxCDF PG/G	5/6	21.251901	39.885271	1.876786074	-10.66296	53.166764	2.545	8.27	38.275	35.73	2.86	85	1.6	1.6	ln(y) = 2.02423603146052 + 2.10551451013335*Z
Total PeCDD PG/G	3/6	1.5069665	0.9404793	0.62408775	0.7544263	2.2595067	0.95128	1.36391	1.95553	1.00424	1.36	2.92	0.92	2.8	ln(y) = 0.310357418326517 + 0.534422753157577*Z
Total PeCDF PG/G	6/6	56.883333	65.333992	1.148561247	4.6052517	109.16141	14	21.25	132	118	6.2	150			ln(y) = 3.43205608799399 + 1.52840679604132*Z
Total Penta-Dioxins PG/G	1/1										0.21	0.21			
Total Penta-Furans PG/G	1/1										12.8	12.8			
Total TCDD PG/G	6/6	4.0833333	2.1393645	0.52392601	2.3714852	5.7951815	2.025	3.995	6.2025	4.1775	1.5	6.81			ln(y) = 1.27634219847542 + 0.746795056376275*Z
Total TCDF PG/G	6/6	97.366667	118.90926	1.221252208	2.2194452	192.51389	19.1	44.2	199.75	180.65	17	289			ln(y) = 4.02571320239583 + 1.44669512109355*Z
Total Tetra-Dioxins PG/G	1/1										1.07	1.07			
Total Tetra-Furans PG/G	1/1										24.6	24.6			
Vanadium (Fume Or Dust) MG/KG	15/18	0.1247326	0.0386017	0.309475935	0.1068995	0.1425657	-1	-1	-1	0	0.07	0.22	1	1	ln(y) = -2.1215804050717 + 0.348880621465045*Z
Zinc MG/KG	24/39	121.30353	427.50478	3.524256633	-12.86935	255.47641	3.00959	9.19024	28.0638	25.0542	4.4	2080	5.1	9.7	ln(y) = 2.21814254848691 + 1.65582489875174*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-61
Entire Estuary (Except Bayou Verdine)
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	**3/3**	**5.7433333**	**3.2884698**	**0.572571647**	**2.0220794**	**9.4645873**	**2.69**	**5.99**	**8.55**	**5.86**	**2.69**	**8.55**			ln(y) = 1.64185462956326 + 0.857615482548876*Z
1,2,3,4,6,7,8-HpCDF PG/G	**3/3**	**157.6**	**327.44351**	**2.077687236**	**-212.9372**	**528.13721**	**10.6**	**23.2**	**439**	**428.4**	**10.6**	**439**			ln(y) = 3.86316856428849 + 2.76157326690097*Z
1,2,3,4,7,8,9-HpCDF PG/G	**3/3**	**70.786667**	**160.16307**	**2.262616329**	**-110.4549**	**252.02824**	**1.5**	**3.86**	**207**	**205.5**	**1.5**	**207**			ln(y) = 2.36295036161676 + 3.65420724875562*Z
1,2,3,4,7,8-HxCDD PG/G	**3/3**	**0.3533333**	**0.1029145**	**0.291267391**	**0.2368746**	**0.469792**	**0.26**	**0.39**	**0.41**	**0.15**	**0.26**	**0.41**			ln(y) = -1.06009343570295 + 0.33779506493798*Z
1,2,3,4,7,8-HxCDF PG/G	**3/3**	**207.06667**	**452.21561**	**2.183913133**	**-304.6635**	**718.79681**	**14.4**	**16.8**	**590**	**575.6**	**14.4**	**590**			ln(y) = 3.95624320996364 + 2.75359992455475*Z
1,2,3,6,7,8-HxCDD PG/G	**3/3**	**1.0966667**	**0.1687537**	**0.153878746**	**0.9057039**	**1.2876294**	**0.94**	**1.15**	**1.2**	**0.26**	**0.94**	**1.2**			ln(y) = 8.67360318170086E-02 + 0.181104193176675*Z
1,2,3,6,7,8-HxCDF PG/G	**3/3**	**49.176667**	**102.63188**	**2.087003613**	**-66.96224**	**165.31557**	**5.6**	**5.93**	**136**	**130.4**	**5.6**	**136**			ln(y) = 2.8051485654956 + 2.36572209379552*Z
1,2,3,7,8,9-HxCDD PG/G	**3/3**	**0.5933333**	**0.2600604**	**0.438304071**	**0.2990473**	**0.8876194**	**0.39**	**0.55**	**0.84**	**0.45**	**0.39**	**0.84**			ln(y) = -0.571266309252948 + 0.569020699936202*Z
1,2,3,7,8,9-HxCDF PG/G	**3/3**	**1.4233333**	**2.3934566**	**1.681585423**	**-1.285118**	**4.1317844**	**0.23**	**0.5**	**3.54**	**3.31**	**0.23**	**3.54**			ln(y) = -0.299565474491068 + 2.02747458749408*Z
1,2,3,7,8-PeCDD PG/G	**3/3**	**0.5266667**	**0.0897747**	**0.17045837**	**0.425077**	**0.6282564**	**0.45**	**0.52**	**0.61**	**0.16**	**0.45**	**0.61**			ln(y) = -0.648910161813072 + 0.225612781587854*Z
1,2,3,7,8-PeCDF PG/G	**3/3**	**14.366667**	**15.324003**	**1.066635963**	**-2.974076**	**31.707409**	**6.55**	**8.55**	**28**	**21.45**	**6.55**	**28**			ln(y) = 2.45253361425701 + 1.07739755377453*Z
1,2-Benzphenanthracene ug/Kg	7/8	6.5971245	3.348383	0.507551884	4.2768135	8.9174356	-2000	-2000	-2000	0	0.97	10	2000	2000	ln(y) = 1.70601934565817 + 0.907283869565614*Z
1-Methylnaphthalene ug/Kg	**7/7**	**0.4485714**	**0.1306556**	**0.291270471**	**0.3517804**	**0.5453625**	**0.33**	**0.45**	**0.53**	**0.2**	**0.28**	**0.64**			ln(y) = -0.837680524330619 + 0.366184000818168*Z
2,3,4,6,7,8-HxCDF PG/G	**3/3**	**2.4466667**	**2.7709299**	**1.132532653**	**-0.688936**	**5.582269**	**0.92**	**1.46**	**4.96**	**4.04**	**0.92**	**4.96**			ln(y) = 0.63215352250601 + 1.24949161118766*Z
2,3,4,7,8-PeCDF PG/G	**3/3**	**4.5866667**	**1.3869143**	**0.302379561**	**3.0172254**	**6.1561079**	**3.29**	**4.72**	**5.75**	**2.46**	**3.29**	**5.75**			ln(y) = 1.497298739728 + 0.414062061275644*Z
2,3,7,8-TCDD Equivalent PG/G	**3/3**	**32.83807**	**61.956462**	**1.88672665**	**-37.27227**	**102.94841**	**5.48372**	**7.19649**	**85.834**	**80.3503**	**5.48372**	**85.834**			ln(y) = 2.70926410277516 + 2.03995535692304*Z
2,3,7,8-TCDD PG/G	**3/3**	**0.16**	**0.0111438**	**0.06964887**	**0.1473896**	**0.1726104**	**0.15**	**0.16**	**0.17**	**0.02**	**0.15**	**0.17**			ln(y) = -1.83388609685536 + 9.28249474219982E-02*Z
2,3,7,8-TCDF PG/G	**3/3**	**5.58**	**0.8742987**	**0.156684347**	**4.5906379**	**6.5693621**	**4.75**	**5.78**	**6.21**	**1.46**	**4.75**	**6.21**			ln(y) = 1.71290306555874 + 0.198769352678699*Z
2-Methylnaphthalene ug/Kg	7/9	1.9100053	1.2661815	0.662920407	1.0827668	2.7372439	-2000	-2000	-2000	0	0.57	4	2000	2000	ln(y) = 0.457377058698886 + 0.918833423961078*Z
4,4'-DDD ug/Kg	1/9										2	2	5	2000	
4,4'-DDE ug/Kg	2/9										1.2	3.8	5	2000	
Acenaphthene ug/Kg	3/8	0.8886734	0.5424488	0.610402843	0.5127756	1.2645712	0.34392	0.73533	1.5722	1.22828	0.35	1.6	1.7	2000	ln(y) = -0.307436268066573 + 1.12715087167287*Z
Acenaphthylene ug/Kg	5/8	0.6565588	0.1294018	0.197090927	0.566888	0.7462297	0.53456	0.64758	0.7845	0.24994	0.51	0.84	1.7	2000	ln(y) = -0.434505700501588 + 0.28449303851019*Z
alpha-BHC ug/Kg	1/9										1.4	1.4	2.5	2000	
alpha-Chlordane ug/Kg	1/9										0.43	0.43	2.5	2000	
Aluminum (Fume Or Dust) MG/KG	8/9	159.45331	82.833397	0.519483699	105.33549	213.57113	96.5	160	200	103.5	50	290	10	10	ln(y) = 4.94871829497583 + 0.624979418996102*Z
Anthracene ug/Kg	5/8	1.0642979	0.8234835	0.773733989	0.493653	1.6349429	0.61502	0.93342	1.41667	0.80165	0.55	2.6	1.7	2000	ln(y) = -6.88984946995092E-02 + 0.618828895338999*Z
Aroclor-1254 ug/Kg	5/9	26.969865	6.5049631	0.241193762	22.719956	31.219774	20.9711	26.397	33.2268	12.2556	19	34	50	100	ln(y) = 3.27325097692429 + 0.341305726452889*Z
Aroclor-1260 ug/Kg	5/9	26.774864	6.8874925	0.257237253	22.275036	31.274693	20.3782	26.1603	33.5831	13.2048	18	35	50	100	ln(y) = 3.26424386707631 + 0.370486173058109*Z
Arsenic MG/KG	7/9	0.8299299	0.0983549	0.118509834	0.7656714	0.8941884	0.75361	0.82589	0.90511	0.15149	0.8	1	0.79	0.8	ln(y) = -0.191288837614971 + 0.135845177465273*Z
Barium MG/KG	**9/9**	**84.49**	**43.849492**	**0.518990314**	**55.841665**	**113.13833**	**63.9**	**85**	**115**	**51.1**	**0.61**	**140**			ln(y) = 3.95266918310633 + 1.48009564039204*Z
Benzo(a)anthracene ug/Kg	7/8	3.6125203	2.0567788	0.569347344	2.1872453	5.0377953	-2000	-2000	-2000	0	0.68	6.5	2000	2000	ln(y) = 1.10531054813964 + 0.917245597436847*Z
Benzo(a)pyrene ug/Kg	7/9	3.8718061	1.9931317	0.514780859	2.5696267	5.1739854	-2000	-2000	-2000	0	0.81	6.5	2000	2000	ln(y) = 1.21305470076922 + 0.806098553391489*Z
Benzo(b)fluoranthene ug/Kg	7/9	4.293865	2.7317433	0.636196827	2.509126	6.0786039	-2000	-2000	-2000	0	0.62	8.8	2000	2000	ln(y) = 1.24814727431822 + 1.00147351385117*Z
Benzo(g,h,i)perylene ug/Kg	7/8	4.15885	2.2225953	0.534425445	2.6186701	5.69903	-2000	-2000	-2000	0	0.74	7.8	2000	2000	ln(y) = 1.26152456524124 + 0.87080896480329*Z
Benzo(k)fluoranthene ug/Kg	7/9	2.9278214	2.8179173	0.96246216	1.0867821	4.7688608	-2000	-2000	-2000	0	0.39	8.4	2000	2000	ln(y) = 0.728728451482862 + 1.2513472992805*Z
Cadmium MG/KG	6/9	0.0662681	0.012118	0.182862912	0.058351	0.0741852	0.05659	0.06561	0.07607	0.01948	0.053	0.089	0.3	0.5	ln(y) = -2.72403916335623 + 0.219423375910651*Z
Calcium Metal MG/KG	**9/9**	**27045.556**	**11185.252**	**0.413570799**	**19737.858**	**34353.254**	**26000**	**30000**	**30950**	**4950**	**3510**	**37000**			ln(y) = 10.0652176131893 + 0.607175101051648*Z
Chromium MG/KG	3/9	0.6381826	0.5786462	0.906709511	0.2601337	1.0162314	0.35566	0.5481	0.84465	0.48899	0.73	1.3	0.35	1	ln(y) = -0.601304208306482 + 0.64146656137038*Z
Cobalt MG/KG	7/8	0.1478755	0.0527551	0.35675323	0.1113181	0.1844329	-1	-1	-1	0	0.1	0.25	1	1	ln(y) = -1.94488157076208 + 0.338338055508043*Z
Copper MG/KG	**9/9**	**24.215556**	**11.153486**	**0.460591791**	**16.928611**	**31.5025**	**21.15**	**29**	**30**	**8.85**	**0.64**	**33**			ln(y) = 2.87410267243215 + 1.03974287495792*Z
Dibenzo(a,h)anthracene ug/Kg	6/8	1.5022121	0.62775	0.417883726	1.0672035	1.9372206	1.0539	1.41284	1.89404	0.84014	0.9	2.7	1.7	2000	ln(y) = 0.345602592793985 + 0.434758468538094*Z
Dieldrin ug/Kg	2/9										1.2	4.3	5	2000	
Endosulfan II ug/Kg	1/9										8.5	8.5	5	2000	
Endrin Aldehyde ug/Kg	1/9										4.2	4.2	5	2000	
Fluoranthene ug/Kg	7/8	4.5388632	5.3662271	1.18228438	0.8202576	8.2574689	-2000	-2000	-2000	0	0.72	15	2000	2000	ln(y) = 1.12846421548816 + 1.20126217571582*Z
Fluorene ug/Kg	5/8	0.5761807	0.1831197	0.317816484	0.4492852	0.7030762	0.41139	0.55625	0.75212	0.34073	0.39	0.85	1.7	2000	ln(y) = -0.586530932555298 + 0.4474599514095*Z

Table H-61
Entire Estuary (Except Bayou Verdine)
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
gamma-BHC (Lindane) ug/Kg	2/9										0.96	1.2	2.5	2000	
Heptachlor Epoxide ug/Kg	1/9										0.83	0.83	2.5	2000	
Heptachlor ug/Kg	1/9										0.91	0.91	2.5	2000	
Indeno(1,2,3-cd)pyrene ug/Kg	7/8	1.9752008	1.1321775	0.573196171	1.1906418	2.7597598	-2000	-2000	-2000	0	0.36	3.6	2000	2000	ln(y) = 0.495675167297097 + 0.933705215024119*Z
Iron MG/KG	8/9	236.13172	106.26951	0.450043363	166.7023	305.56113	143	257	300	157	86	370	5.7	5.7	ln(y) = 5.37338577072219 + 0.533136188143917*Z
Lead MG/KG	7/9	1.0405676	0.7058513	0.67833296	0.5794114	1.5017238	0.51261	0.85425	1.42359	0.91098	0.47	2.2	0.46	0.8	ln(y) = -0.1575256245366 + 0.757515813840038*Z
Magnesium MG/KG	**9/9**	**1572.5556**	**602.32964**	**0.383025982**	**1179.0335**	**1966.0776**	**1450**	**1600**	**1920**	**470**	**313**	**2200**			ln(y) = 7.25560473986518 + 0.549481228836294*Z
Manganese MG/KG	**9/9**	**20.811111**	**10.573224**	**0.508056676**	**13.903271**	**27.718951**	**13.95**	**24**	**28.5**	**14.55**	**1.4**	**34**			ln(y) = 2.78591111372167 + 0.976299652829321*Z
Mercury MG/KG	**9/9**	**0.0633333**	**0.0366759**	**0.579092601**	**0.0393718**	**0.0872949**	**0.0335**	**0.062**	**0.0975**	**0.064**	**0.011**	**0.12**			ln(y) = -2.96074152943503 + 0.873691870270329*Z
Mercury ng/g	**7/7**	**64.614286**	**27.410967**	**0.424224562**	**44.307957**	**84.920614**	**50**	**55.6**	**88.1**	**38.1**	**25.1**	**103**			ln(y) = 4.08294541676628 + 0.568621170089715*Z
Methyl Mercury ng/g	**7/7**	**50.5**	**25.016471**	**0.495375673**	**31.967539**	**69.032461**	**39.2**	**40.6**	**59.4**	**20.2**	**23.7**	**94.8**			ln(y) = 3.84013981488964 + 0.528875623874565*Z
Naphthalene ug/Kg	7/9	1.0921868	0.3752448	0.343571971	0.8470269	1.3373467	-2000	-2000	-2000	0	0.61	1.6	2000	2000	ln(y) = 3.79712286255679E-02 + 0.468076888021954*Z
Nickel MG/KG	7/9	0.4759294	0.1282318	0.269434453	0.3921513	0.5597075	-4	-4	-4	0	0.3	0.62	4	4	ln(y) = -0.773849764264347 + 0.35686305977136*Z
OCDD PG/G	**3/3**	**67.1**	**44.759871**	**0.667062159**	**16.449438**	**117.75056**	**25.4**	**70.9**	**105**	**79.6**	**25.4**	**105**			ln(y) = 4.04999331924003 + 1.05253191711294*Z
OCDF PG/G	**3/3**	**180.6**	**256.07925**	**1.417936021**	**-109.1809**	**470.38095**	**17.8**	**104**	**420**	**402.2**	**17.8**	**420**			ln(y) = 4.52128135590561 + 2.3443393450214*Z
PCB-1 PG/G	**3/3**	**2.65**	**2.0417679**	**0.770478463**	**0.3395221**	**4.9604779**	**1.53**	**1.92**	**4.5**	**2.97**	**1.53**	**4.5**			ln(y) = 0.860556772740103 + 0.800079382250667*Z
PCB-103 PG/G	**3/3**	**19.353333**	**12.768265**	**0.659744992**	**4.9046816**	**33.801985**	**8.26**	**18.7**	**31.1**	**22.84**	**8.26**	**31.1**			ln(y) = 2.8257186435262 + 0.983242797093351*Z
PCB-104 PG/G	**2/2**										**0.415**	**0.826**			
PCB-105 PG/G	**3/3**	**1576.6667**	**719.80535**	**0.456536163**	**762.13023**	**2391.2031**	**1020**	**1450**	**2260**	**1240**	**1020**	**2260**			ln(y) = 7.30999894465309 + 0.590014091547738*Z
PCB-107 PG/G	**3/3**	**201.33333**	**110.49385**	**0.548810503**	**76.297774**	**326.36889**	**124**	**174**	**306**	**182**	**124**	**306**			ln(y) = 5.23430732225732 + 0.669918486294*Z
PCB-109 PG/G	**3/3**	**562.66667**	**234.89625**	**0.417469633**	**296.85654**	**828.47679**	**371**	**533**	**784**	**413**	**371**	**784**			ln(y) = 6.28637750237456 + 0.554893955793252*Z
PCB-11 PG/G	**2/2**										**3.09**	**6.67**			
PCB-110/77 PG/G	**3/3**	**6506.6667**	**3244.6601**	**0.498667031**	**2834.9881**	**10178.345**	**3470**	**6830**	**9220**	**5750**	**3470**	**9220**			ln(y) = 8.70337338068546 + 0.72473760371381*Z
PCB-111 PG/G	**3/3**	**14.3**	**4.1717556**	**0.291731161**	**9.5792141**	**19.020786**	**10.8**	**13.9**	**18.2**	**7.4**	**10.8**	**18.2**			ln(y) = 2.63761885611652 + 0.387039355097774*Z
PCB-114 PG/G	**3/3**	**74.166667**	**25.265552**	**0.34065913**	**45.576003**	**102.75733**	**50.2**	**78.4**	**93.9**	**43.7**	**50.2**	**93.9**			ln(y) = 4.27335644675609 + 0.46442112630018*Z
PCB-118 PG/G	**3/3**	**5176.6667**	**2590.8114**	**0.500478699**	**2244.8876**	**8108.4458**	**3370**	**4530**	**7630**	**4260**	**3370**	**7630**			ln(y) = 8.49366278870066 + 0.606042913179818*Z
PCB-12 PG/G	**1/1**										**5.4**	**5.4**			
PCB-120 PG/G	**3/3**	**59.733333**	**22.202317**	**0.371690567**	**34.609047**	**84.85762**	**40.1**	**68.3**	**70.8**	**30.7**	**40.1**	**70.8**			ln(y) = 4.05838170052965 + 0.421604734207544*Z
PCB-121 PG/G	**3/3**	**16.093333**	**16.521282**	**1.026591699**	**-2.602258**	**34.788924**	**6.08**	**10.8**	**31.4**	**25.32**	**6.08**	**31.4**			ln(y) = 2.54378624100749 + 1.21761320334428*Z
PCB-122 PG/G	**3/3**	**54.2**	**29.367909**	**0.541843341**	**20.967082**	**87.432918**	**32.7**	**47.8**	**82.1**	**49.4**	**32.7**	**82.1**			ln(y) = 3.920779577953 + 0.68271860512024*Z
PCB-123 PG/G	**3/3**	**113.16667**	**75.509972**	**0.667245704**	**27.719089**	**198.61424**	**75.4**	**84.1**	**180**	**104.6**	**75.4**	**180**			ln(y) = 4.64925689762767 + 0.645330460099367*Z
PCB-126 PG/G	**3/3**	**62.433333**	**35.5889**	**0.570030435**	**22.160702**	**102.70597**	**30**	**63.5**	**93.8**	**63.8**	**30**	**93.8**			ln(y) = 4.03113404785766 + 0.845435951606089*Z
PCB-127 PG/G	**3/3**	**15.766667**	**6.2651468**	**0.397366603**	**8.6769857**	**22.856348**	**10.8**	**14.8**	**21.7**	**10.9**	**10.8**	**21.7**			ln(y) = 2.71716185848222 + 0.517485439153921*Z
PCB-128 PG/G	**3/3**	**1983.3333**	**1111.7036**	**0.560522799**	**725.32234**	**3241.3443**	**1320**	**1620**	**3010**	**1690**	**1320**	**3010**			ln(y) = 7.52842126718326 + 0.611333150597431*Z
PCB-129 PG/G	**3/3**	**11463.333**	**6451.291**	**0.562776181**	**4163.0104**	**18763.656**	**7340**	**9550**	**17500**	**10160**	**7340**	**17500**			ln(y) = 9.27844890499832 + 0.64437558149277*Z
PCB-130 PG/G	**3/3**	**868.33333**	**444.53489**	**0.511940373**	**365.29475**	**1371.3719**	**521**	**794**	**1290**	**769**	**521**	**1290**			ln(y) = 6.69841033345207 + 0.672398442627019*Z
PCB-131 PG/G	**3/3**	**37.166667**	**21.465306**	**0.577541856**	**12.876387**	**61.456947**	**16.8**	**42.2**	**52.5**	**35.7**	**16.8**	**52.5**			ln(y) = 3.50820409234959 + 0.845040520168537*Z
PCB-132 PG/G	**3/3**	**1555.3333**	**979.87099**	**0.630007066**	**446.50492**	**2664.1617**	**656**	**1600**	**2410**	**1754**	**656**	**2410**			ln(y) = 7.21710057455222 + 0.96502684503121*Z
PCB-133 PG/G	**3/3**	**223**	**107.02754**	**0.479944104**	**101.88694**	**344.11306**	**128**	**221**	**320**	**192**	**128**	**320**			ln(y) = 5.33950465374371 + 0.679550201457772*Z
PCB-134 PG/G	**3/3**	**261.66667**	**164.15908**	**0.627359538**	**75.903181**	**447.43015**	**106**	**301**	**378**	**272**	**106**	**378**			ln(y) = 5.43514785149351 + 0.942951336642586*Z
PCB-135 PG/G	**3/3**	**1807.6667**	**1158.3871**	**0.640818989**	**496.82823**	**3118.5051**	**713**	**2110**	**2600**	**1887**	**713**	**2600**			ln(y) = 7.36239712363133 + 0.959512121117935*Z
PCB-136 PG/G	**3/3**	**155.3**	**123.88607**	**0.797721006**	**15.109712**	**295.49029**	**37.9**	**175**	**253**	**215.1**	**37.9**	**253**			ln(y) = 4.77770885824647 + 1.4079419734625*Z
PCB-137 PG/G	**3/3**	**685**	**353.20093**	**0.515621801**	**285.31552**	**1084.6845**	**434**	**601**	**1020**	**586**	**434**	**1020**			ln(y) = 6.46639912497131 + 0.633734156651507*Z
PCB-139 PG/G	**3/3**	**249**	**124.97145**	**0.501893376**	**107.58149**	**390.41851**	**139**	**245**	**363**	**224**	**139**	**363**			ln(y) = 5.44337832598009 + 0.711913648647977*Z
PCB-14 PG/G	1/3										2.49	2.49	0.325	0.336	
PCB-141 PG/G	**3/3**	**1257**	**848.86892**	**0.675313382**	**296.41439**	**2217.5856**	**671**	**1040**	**2060**	**1389**	**671**	**2060**			ln(y) = 7.02873546363024 + 0.831882374091547*Z
PCB-144 PG/G	**3/3**	**159.66667**	**107.94931**	**0.676091698**	**37.510525**	**281.82281**	**60**	**195**	**224**	**164**	**60**	**224**			ln(y) = 4.92633005754696 + 0.976952468819286*Z

Table H-61
Entire Estuary (Except Bayou Verdine)
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-145 PG/G	2/2										1.64	2.25			
PCB-146 PG/G	3/3	2096.6667	1017.6018	0.485342655	945.14187	3248.1915	1160	2150	2980	1820	1160	2980			ln(y) = 7.57635899490719 + 0.699731899670188*Z
PCB-147 PG/G	3/3	4900	3021.4287	0.616618101	1480.9316	8319.0684	2130	5030	7540	5410	2130	7540			ln(y) = 8.37167666093309 + 0.937496710654011*Z
PCB-148 PG/G	3/3	26.7	15.104122	0.565697461	9.6080767	43.791923	12.4	29	38.7	26.3	12.4	38.7			ln(y) = 3.18027730087773 + 0.844082958197472*Z
PCB-15 PG/G	3/3	110.13333	41.508925	0.376897016	63.161563	157.1051	83.5	97.9	149	65.5	83.5	149			ln(y) = 4.67091316244624 + 0.429478643078886*Z
PCB-150 PG/G	3/3	9.2166667	5.8005659	0.629356158	2.6527084	15.780625	3.75	10.8	13.1	9.35	3.75	13.1			ln(y) = 2.0913047347732 + 0.927674680538772*Z
PCB-152 PG/G	3/3	3.237	2.4705917	0.763234995	0.4412623	6.0327377	0.891	3.68	5.14	4.249	0.891	5.14			ln(y) = 0.941518326712195 + 1.2996827054095*Z
PCB-153/132 PG/G	3/3	9330	4817.6369	0.516359795	3878.3306	14781.669	5900	8190	13900	8000	5900	13900			ln(y) = 9.07767364195324 + 0.635531216929655*Z
PCB-155 PG/G	3/3	4.6733333	2.5347231	0.542380111	1.8050242	7.5416425	3.42	3.69	6.91	3.49	3.42	6.91			ln(y) = 1.48941221563551 + 0.521611106535976*Z
PCB-156 PG/G	3/3	1103	484.62055	0.439365869	554.60022	1651.3998	709	1040	1560	851	709	1560			ln(y) = 6.95442420630371 + 0.584840015118599*Z
PCB-158 PG/G	3/3	1141.6667	577.56112	0.50589295	488.09474	1795.2386	725	1010	1690	965	725	1690			ln(y) = 6.97878702420237 + 0.627651873039715*Z
PCB-159 PG/G	3/3	35.333333	19.820253	0.560950559	12.904606	57.762061	17.5	42.6	45.9	28.4	17.5	45.9			ln(y) = 3.48017341709043 + 0.715128870271536*Z
PCB-16 PG/G	2/2										2.87	9.42			
PCB-162 PG/G	2/2										54.8	65.6			
PCB-164 PG/G	3/3	658	445.92905	0.677703725	153.38378	1162.6162	349	545	1080	731	349	1080			ln(y) = 6.38019134566131 + 0.837780031463619*Z
PCB-165 PG/G	2/2										4.06	5.7			
PCB-167 PG/G	3/3	585.66667	266.03214	0.45423815	284.62296	886.71038	414	508	835	421	414	835			ln(y) = 6.32792638208488 + 0.520303360997825*Z
PCB-169 PG/G	1/3										6.82	6.82	2.07	3.83	
PCB-17 PG/G	1/3										35.4	35.4	12	12.6	
PCB-170/190 PG/G	3/3	1112	397.54032	0.357500292	662.14077	1561.8592	736	1170	1430	694	736	1430			ln(y) = 6.97713962325821 + 0.492591444355216*Z
PCB-171 PG/G	3/3	452.66667	207.03612	0.457369925	218.38324	686.95009	256	491	611	355	256	611			ln(y) = 6.05223951048189 + 0.64515983944516*Z
PCB-172 PG/G	3/3	314	136.93263	0.436091167	159.04615	468.95385	186	355	401	215	186	401			ln(y) = 5.69727529683173 + 0.569732370313774*Z
PCB-174 PG/G	3/3	828.33333	481.67256	0.581496048	283.26952	1373.3971	371	914	1200	829	371	1200			ln(y) = 6.60803648994589 + 0.8705826773576*Z
PCB-175 PG/G	3/3	88.866667	46.770399	0.526298567	35.940978	141.79236	48.6	108	110	61.4	48.6	110			ln(y) = 4.42207837460769 + 0.60580687700894*Z
PCB-176 PG/G	2/2										111	123			
PCB-177 PG/G	3/3	1018.6667	414.55545	0.406958884	549.55301	1487.7803	646	1020	1390	744	646	1390			ln(y) = 6.87847214539522 + 0.568282308947385*Z
PCB-178 PG/G	3/3	325	170.92166	0.525912787	131.58394	518.41606	164	372	439	275	164	439			ln(y) = 5.70108656505751 + 0.730234979154151*Z
PCB-179 PG/G	3/3	275.66667	186.61136	0.676945666	64.496039	486.83729	104	338	385	281	104	385			ln(y) = 5.47356004297072 + 0.970686382653923*Z
PCB-18/17 PG/G	3/3	23.6	26.333054	1.11580739	-6.198656	53.398656	12.2	12.6	46	33.8	12.2	46			ln(y) = 2.95459138739525 + 0.984297555330402*Z
PCB-180 PG/G	3/3	3113.3333	1364.8342	0.438383566	1568.8781	4657.7886	1820	3330	4190	2370	1820	4190			ln(y) = 7.98592512532051 + 0.618420101510214*Z
PCB-181 PG/G	3/3	57.866667	29.810816	0.515163873	24.132553	91.600781	30.4	59.5	83.7	53.3	30.4	83.7			ln(y) = 3.97588596615306 + 0.751121835793871*Z
PCB-182 PG/G	3/3	29	14.707878	0.507168197	12.35647	45.64353	16.8	27.4	42.8	26	16.8	42.8			ln(y) = 3.29615333413033 + 0.6935436664839*Z
PCB-183 PG/G	3/3	1080	526.24457	0.487263492	484.49821	1675.5018	580	1180	1480	900	580	1480			ln(y) = 6.91203172925278 + 0.694737728315757*Z
PCB-184 PG/G	3/3	12.6	7.5443192	0.598755489	4.0627992	21.137201	7.6	10.5	19.7	12.1	7.6	19.7			ln(y) = 2.4533807133999 + 0.706382179628748*Z
PCB-187 PG/G	3/3	2140	1095.7462	0.512030938	900.04644	3379.9536	1100	2330	2990	1890	1100	2990			ln(y) = 7.58657255724365 + 0.741604357149705*Z
PCB-188 PG/G	2/2										9.85	16.1			
PCB-189 PG/G	3/3	76.5	25.210812	0.329553103	47.97128	105.02872	52.7	83.2	93.6	40.9	52.7	93.6			ln(y) = 4.30829772895267 + 0.42600428709021*Z
PCB-19 PG/G	3/3	1.1126667	1.0781802	0.969005594	-0.107409	2.3327424	0.588	0.69	2.06	1.472	0.588	2.06			ln(y) = -5.97953432242842E-02 + 0.929809039792934*Z
PCB-190 PG/G	3/3	206.66667	74.35885	0.359800887	122.52171	290.81163	136	222	262	126	136	262			ln(y) = 5.29455892378981 + 0.486280169080532*Z
PCB-191 PG/G	3/3	74.6	29.047073	0.389370948	41.730143	107.46986	47.6	83.7	92.5	44.9	47.6	92.5			ln(y) = 4.27242679441706 + 0.4927221782587*Z
PCB-192 PG/G	2/2										2.18	7.18			
PCB-194 PG/G	3/3	409.66667	153.32785	0.374274661	236.15987	583.17347	265	430	534	269	265	534			ln(y) = 5.97463695787801 + 0.519636086787868*Z
PCB-195/208 PG/G	3/3	122.4	60.568357	0.494839518	53.860452	190.93955	68.2	145	154	85.8	68.2	154			ln(y) = 4.74537696989454 + 0.60406493459082*Z
PCB-196 PG/G	3/3	354.33333	173.17482	0.488734193	158.36758	550.29909	190	384	489	299	190	489			ln(y) = 5.7966763714077 + 0.701092884152398*Z
PCB-197 PG/G	3/3	100.86667	58.937371	0.584309691	34.172753	167.56058	46.6	104	152	105.4	46.6	152			ln(y) = 4.50329065370642 + 0.876816244502778*Z
PCB-198 PG/G	3/3	778.66667	443.13315	0.569092234	277.2143	1280.119	385	771	1180	795	385	1180			ln(y) = 6.55806714177027 + 0.830647007381315*Z
PCB-2 PG/G	3/3	1.0536667	0.4452962	0.422615848	0.5497665	1.5575668	0.802	0.899	1.46	0.658	0.802	1.46			ln(y) = 1.71058400313686E-02 + 0.444298989151158*Z

Table H-61
Entire Estuary (Except Bayou Verdine)
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-20 PG/G	3/3	329.66667	150.17714	0.455542394	159.72523	499.6081	238	282	469	231	238	469			ln(y) = 5.75492683768529 + 0.503072546326704*Z
PCB-201/157/173 PG/G	3/3	94.6	54.909992	0.580443891	32.463495	156.73651	43.9	97.9	142	98.1	43.9	142			ln(y) = 4.44056264240628 + 0.870610832921984*Z
PCB-202 PG/G	3/3	160.76667	97.905978	0.608994267	49.975623	271.55771	73.3	160	249	175.7	73.3	249			ln(y) = 4.96239577353038 + 0.906935617127808*Z
PCB-203 PG/G	3/3	415.33333	219.24956	0.527888177	167.2291	663.43756	207	462	577	370	207	577			ln(y) = 5.9420419836184 + 0.760264006311987*Z
PCB-204 PG/G	3/3	13.476667	12.623203	0.936671018	-0.807832	27.761166	6.33	9.1	25	18.67	6.33	25			ln(y) = 2.42415015818236 + 1.01868712140918*Z
PCB-205 PG/G	3/3	21.3	11.577381	0.543538994	8.1989606	34.401039	12.5	19.1	32.3	19.8	12.5	32.3			ln(y) = 2.98349473652982 + 0.704059535770156*Z
PCB-206 PG/G	3/3	621.66667	608.61013	0.978997534	-67.04053	1310.3739	318	387	1160	842	318	1160			ln(y) = 6.25888378663679 + 0.959763235905199*Z
PCB-207 PG/G	3/3	215	189.88614	0.883191364	0.1236007	429.8764	118	143	384	266	118	384			ln(y) = 5.22805726910443 + 0.875094137563719*Z
PCB-208 PG/G	3/3	258.33333	269.59561	1.043595896	-46.74281	563.40948	119	157	499	380	119	499			ln(y) = 5.34932513140379 + 1.06311605860923*Z
PCB-209 PG/G	3/3	1422.6667	1434.5965	1.008385533	-200.7321	3046.0654	642	906	2720	2078	642	2720			ln(y) = 7.06067158967433 + 1.07076691824739*Z
PCB-21 PG/G	1/3										38.3	38.3	14.1	14.6	
PCB-22 PG/G	3/3	22.333333	15.031181	0.673037964	5.3239506	39.342716	13.7	17.2	36.1	22.4	13.7	36.1			ln(y) = 3.01619936066411 + 0.718564698656007*Z
PCB-23 PG/G	1/1										9.62	9.62			
PCB-24 PG/G	2/2										0.153	0.828			
PCB-25 PG/G	3/3	14.573333	13.078302	0.897413225	-0.226159	29.372825	8.34	9.38	26	17.66	8.34	26			ln(y) = 2.53924650580342 + 0.84325989111733*Z
PCB-26 PG/G	3/3	26.033333	20.38628	0.783083751	2.9640855	49.102581	16	18.1	44	28	16	44			ln(y) = 3.15089676480994 + 0.750235246753964*Z
PCB-27 PG/G	2/2										0.783	3.44			
PCB-3 PG/G	1/3										5.34	5.34	2.71	2.85	
PCB-31 PG/G	3/3	110.46667	66.245494	0.599687639	35.502833	185.4305	72.8	87.6	171	98.2	72.8	171			ln(y) = 4.63405350321588 + 0.633314563065459*Z
PCB-32 PG/G	3/3	21.433333	13.377419	0.624140858	6.2953586	36.571308	15.1	16.1	33.1	18	15.1	33.1			ln(y) = 2.99768243273144 + 0.582061095282336*Z
PCB-34 PG/G	2/2										0.944	3.96			
PCB-35 PG/G	3/3	1.9466667	1.0785907	0.554070545	0.7261264	3.1672069	1.24	1.64	2.96	1.72	1.24	2.96			ln(y) = 0.59833229659634 + 0.645277294635094*Z
PCB-36 PG/G	1/2										0.137	0.137	0.159	0.159	
PCB-37 PG/G	3/3	48.966667	13.011497	0.26572152	34.242772	63.690562	40.4	45.3	61.2	20.8	40.4	61.2			ln(y) = 3.87542800232479 + 0.308012529335975*Z
PCB-39 PG/G	2/2										2.06	5.38			
PCB-4 PG/G	2/3										2.22	2.55	6.26	6.26	
PCB-40 PG/G	3/3	115.5	66.14576	0.572690562	40.649026	190.35097	57.5	113	176	118.5	57.5	176			ln(y) = 4.6498855871846 + 0.829662613048744*Z
PCB-42 PG/G	3/3	103.4	59.444001	0.574893626	36.132781	170.66722	65.5	85.7	159	93.5	65.5	159			ln(y) = 4.56726905682172 + 0.657719033802625*Z
PCB-43 PG/G	2/2										6.5	18.1			
PCB-44 PG/G	3/3	441.33333	163.79874	0.371145178	255.97761	626.68905	335	394	595	260	335	595			ln(y) = 6.05968094888954 + 0.426016112988454*Z
PCB-45 PG/G	3/3	20.506667	16.348406	0.79722397	2.0067035	39.00663	7.62	17.9	36	28.38	7.62	36			ln(y) = 2.83303200700046 + 1.15156302329 18*Z
PCB-46 PG/G	1/1										3.98	3.98			
PCB-48 PG/G	3/3	18.833333	14.640341	0.77736325	2.2662277	35.400439	12.1	12.9	31.5	19.4	12.1	31.5			ln(y) = 2.83347343660064 + 0.709579876329229*Z
PCB-49 PG/G	3/3	416.66667	193.04238	0.463301705	198.21865	635.11468	261	390	599	338	261	599			ln(y) = 5.97530958152061 + 0.61610395469985*Z
PCB-50 PG/G	3/3	10.533333	10.675778	1.013523244	-1.547447	22.614114	4.14	7.06	20.4	16.26	4.14	20.4			ln(y) = 2.13022524673085 + 1.18278315259608*Z
PCB-52 PG/G	3/3	658.33333	287.12857	0.436144658	333.41677	983.24989	404	652	919	515	404	919			ln(y) = 6.4349151874145 + 0.609525721774258*Z
PCB-56 PG/G	3/3	97.5	33.214163	0.34065808	59.914637	135.08536	71.5	92	129	57.5	71.5	129			ln(y) = 4.55043281037023 + 0.43764792371455*Z
PCB-57 PG/G	3/3	3.66	2.4222255	0.661810248	0.9189938	6.4010062	2.63	2.64	5.71	3.08	2.63	5.71			ln(y) = 1.22666059567194 + 0.574938938817998*Z
PCB-58 PG/G	3/3	8.28	1.8207327	0.219895248	6.219647	10.340353	6.55	8.67	9.62	3.07	6.55	9.62			ln(y) = 2.10105936837241 + 0.285067788992981*Z
PCB-59 PG/G	3/3	36.8	13.680807	0.371761048	21.31871	52.28129	26.7	33.9	49.8	23.1	26.7	49.8			ln(y) = 3.57203118794107 + 0.462297137109294*Z
PCB-6 PG/G	2/2										1.49	4.72			
PCB-60 PG/G	3/3	41.266667	6.3364267	0.153548305	34.096325	48.437008	37.2	39.4	47.2	10	37.2	47.2			ln(y) = 3.7148228233915 + 0.176571467242198*Z
PCB-61/70 PG/G	3/3	879	264.79173	0.301242014	579.35995	1178.6401	636	891	1110	474	636	1110			ln(y) = 6.75321942837244 + 0.41302707051205*Z
PCB-63 PG/G	3/3	29.366667	10.918038	0.371783355	17.011744	41.72159	23	25.7	39.4	16.4	23	39.4			ln(y) = 3.35191700804474 + 0.399199251667087*Z
PCB-64 PG/G	3/3	145.33333	54.74528	0.376687708	83.383217	207.28345	101	138	197	96	101	197			ln(y) = 4.94185931024548 + 0.495471650473193*Z
PCB-66 PG/G	3/3	504.66667	139.47499	0.276370521	346.83586	662.49748	396	481	637	241	396	637			ln(y) = 6.2046837123108 + 0.352538639444074*Z
PCB-67 PG/G	3/3	10.296667	6.385724	0.620173907	3.0705397	17.522794	6.99	7.9	16	9.01	6.99	16			ln(y) = 2.26131067931949 + 0.614151220190863*Z

Table H-61
Entire Estuary (Except Bayou Verdine)
Shellfish - Group 1B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-68 PG/G	**3/3**	**39.366667**	**15.102181**	**0.38362865**	**22.27694**	**56.456393**	**25.9**	**39.2**	**53**	**27.1**	**25.9**	**53**			ln(y) = 3.63107054301801 + 0.531044555835344*Z
PCB-7 PG/G	**3/3**	**3.35**	**4.2650076**	**1.273136594**	**-1.47631**	**8.1763104**	**1.5**	**1.57**	**6.98**	**5.48**	**1.5**	**6.98**			ln(y) = 0.933196548080887 + 1.14032080713087*Z
PCB-72 PG/G	**3/3**	**44.733333**	**15.202279**	**0.339842305**	**27.530335**	**61.936332**	**31.7**	**51**	**51.5**	**19.8**	**31.7**	**51.5**			ln(y) = 3.77657470709242 + 0.359887973540539*Z
PCB-73 PG/G	1/3										4.17	4.17	0.182	0.201	
PCB-77 PG/G	**3/3**	**199**	**91.891156**	**0.461764601**	**95.015368**	**302.98463**	**126**	**185**	**286**	**160**	**126**	**286**			ln(y) = 5.23754318094988 + 0.607922803247549*Z
PCB-79 PG/G	**2/2**										**21.3**	**26.4**			
PCB-8/5 PG/G	1/3										34.4	34.4	11	11.6	
PCB-81 PG/G	**3/3**	**6.0966667**	**1.3710065**	**0.224878046**	**4.5452268**	**7.6481066**	**4.85**	**6.58**	**6.86**	**2.01**	**4.85**	**6.86**			ln(y) = 1.79624029734147 + 0.257145002933543*Z
PCB-82 PG/G	**3/3**	**231.66667**	**107.20146**	**0.462740104**	**110.3568**	**352.97654**	**136**	**272**	**287**	**151**	**136**	**287**			ln(y) = 5.39264638926389 + 0.553870780220211*Z
PCB-83 PG/G	**3/3**	**4923.3333**	**2503.9912**	**0.508596717**	**2089.8006**	**7756.8661**	**2870**	**4620**	**7280**	**4410**	**2870**	**7280**			ln(y) = 8.43103447800673 + 0.690324700556034*Z
PCB-84 PG/G	**3/3**	**185.56667**	**127.03983**	**0.684604814**	**41.807562**	**329.32577**	**68.7**	**228**	**260**	**191.3**	**68.7**	**260**			ln(y) = 5.07325881973276 + 0.987061606852427*Z
PCB-85 PG/G	**3/3**	**1059**	**537.76116**	**0.507800906**	**450.46596**	**1667.534**	**662**	**945**	**1570**	**908**	**662**	**1570**			ln(y) = 6.90176046059104 + 0.640447384208726*Z
PCB-86 PG/G	**3/3**	**2023.3333**	**918.94591**	**0.454174257**	**983.44814**	**3063.2185**	**1150**	**2210**	**2710**	**1560**	**1150**	**2710**			ln(y) = 7.55098964324761 + 0.635716775607938*Z
PCB-88 PG/G	**3/3**	**545.66667**	**340.48678**	**0.623983105**	**160.3696**	**930.96373**	**224**	**635**	**778**	**554**	**224**	**778**			ln(y) = 6.17399919164204 + 0.923391077052469*Z
PCB-89 PG/G	**3/3**	**4.98**	**3.173776**	**0.637304418**	**1.3885344**	**8.5714656**	**2.3**	**4.7**	**7.94**	**5.64**	**2.3**	**7.94**			ln(y) = 1.48412830230339 + 0.918884685864515*Z
PCB-9 PG/G	**3/3**	**4.22**	**6.1868959**	**1.466089073**	**-2.781132**	**11.221132**	**1.6**	**1.61**	**9.45**	**7.85**	**1.6**	**9.45**			ln(y) = 1.06408418324925 + 1.31714604016449*Z
PCB-90 PG/G	**3/3**	**4783.3333**	**2362.8047**	**0.493966133**	**2109.5681**	**7457.0985**	**2600**	**4930**	**6820**	**4220**	**2600**	**6820**			ln(y) = 8.39799191396127 + 0.715191012099346*Z
PCB-92 PG/G	**3/3**	**1115.6667**	**594.7871**	**0.533122588**	**442.6017**	**1788.7316**	**567**	**1150**	**1630**	**1063**	**567**	**1630**			ln(y) = 6.92807060629529 + 0.783145209076796*Z
PCB-93 PG/G	**3/3**	**841**	**620.44744**	**0.737749633**	**138.89763**	**1543.1024**	**313**	**1100**	**1110**	**797**	**313**	**1110**			ln(y) = 6.587127981211 + 0.938840474117466*Z
PCB-94 PG/G	**3/3**	**8.7466667**	**6.344005**	**0.725305455**	**1.5677491**	**15.925584**	**3.12**	**8.62**	**14.5**	**11.38**	**3.12**	**14.5**			ln(y) = 1.98868891197451 + 1.13938029875891*Z
PCB-96 PG/G	**2/2**										**2.55**	**3.4**			
Phenanthrene ug/Kg	7/9	3.9368057	2.3133141	0.587611945	2.4254405	5.4481709	-2000	-2000	-2000	0	0.79	7.8	2000	2000	ln(y) = 1.19862517188769 + 0.905853448512536*Z
Potassium MG/KG	2/9										1820	3710	1300	4	
Pyrene ug/Kg	7/9	6.927185	4.6098178	0.665467694	3.9154374	9.9389327	-2000	-2000	-2000	0	1.2	15	2000	2000	ln(y) = 1.72972981537465 + 1.00283105213098*Z
Selenium MG/KG	2/9										0.83	1.3	0.84	4	
Sodium MG/KG	6/9	1966.2814	881.29532	0.448204074	1390.5018	2542.061	1369.3	1838.18	2467.62	1098.31	1130	3030	2000	2200	ln(y) = 7.51653249598668 + 0.436784860282342*Z
Total Dichloro Biphenyls PG/G	**1/1**										**226**	**226**			
Total Heptachloro Biphenyls PG/G	**1/1**										**12300**	**12300**			
Total Hepta-Dioxins PG/G	**3/3**	**13.436667**	**8.3528945**	**0.621649307**	**3.9844767**	**22.888857**	**5.91**	**13.5**	**20.9**	**14.99**	**5.91**	**20.9**			ln(y) = 2.47302822527772 + 0.936757396797881*Z
Total Hepta-Furans PG/G	**3/3**	**255.5**	**524.80764**	**2.054041656**	**-338.3758**	**849.37575**	**17.1**	**41.4**	**708**	**690.9**	**17.1**	**708**			ln(y) = 4.37493447934453 + 2.76136577188553*Z
Total Hexachloro Biphenyls PG/G	**1/1**										**37200**	**37200**			
Total Hexa-Dioxins PG/G	**3/3**	**7.3666667**	**4.8134961**	**0.653415766**	**1.919683**	**12.81365**	**4.16**	**6.04**	**11.9**	**7.74**	**4.16**	**11.9**			ln(y) = 1.90015249544579 + 0.779472156564836*Z
Total Hexa-Furans PG/G	**3/3**	**303.33333**	**611.25732**	**2.015134012**	**-388.3694**	**995.0361**	**33.8**	**50.2**	**826**	**792.2**	**33.8**	**826**			ln(y) = 4.71769020090254 + 2.37035408997144*Z
Total Monochloro Biphenyls PG/G	**1/1**										**11.3**	**11.3**			
Total Nonachloro Biphenyls PG/G	**1/1**										**2050**	**2050**			
Total Octachloro Biphenyls PG/G	**1/1**										**3530**	**3530**			
Total Pentachloro Biphenyls PG/G	**1/1**										**30100**	**30100**			
Total Penta-Dioxins PG/G	**3/3**	**1.1933333**	**0.7633565**	**0.639684232**	**0.3295141**	**2.0571526**	**0.53**	**1.5**	**1.55**	**1.02**	**0.53**	**1.55**			ln(y) = 6.96139222011167E-02 + 0.79586954137097*Z
Total Penta-Furans PG/G	**3/3**	**44.3**	**19.511968**	**0.440450751**	**22.220129**	**66.379871**	**27**	**43.9**	**62**	**35**	**27**	**62**			ln(y) = 3.73496185704352 + 0.616516545332777*Z
Total Tetrachloro Biphenyls PG/G	**1/1**										**5060**	**5060**			
Total Tetra-Dioxins PG/G	**3/3**	**0.3066667**	**0.1929563**	**0.629205465**	**0.088316**	**0.5250173**	**0.16**	**0.27**	**0.49**	**0.33**	**0.16**	**0.49**			ln(y) = -1.28508822386985 + 0.830057553136302*Z
Total Tetra-Furans PG/G	**3/3**	**21.533333**	**7.059455**	**0.327838469**	**13.544808**	**29.521859**	**15**	**22**	**27.6**	**12.6**	**15**	**27.6**			ln(y) = 3.03896947572788 + 0.452221443066939*Z
Total Trichloro Biphenyls PG/G	**1/1**										**997**	**997**			
Vanadium (Fume Or Dust) MG/KG	8/9	0.5173288	0.1788207	0.34566156	0.4004993	0.6341583	-1	-1	-1	0	0.19	0.78	1	1	ln(y) = -0.721630247677697 + 0.492281366443191*Z
Zinc MG/KG	2/9										6.8	19.1	16	1	

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

CDM

Table H-62
Entire Estuary (except Bayou Verdine)
Shellfish - Group 2a

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,2,3,4,6,7,8-HpCDD PG/G	6/7	1.7779326	0.9417825	0.529706517	1.0802504	2.4756148	-1.35	1.36	2.54	3.89	1.2	3.46	1.35	1.35	ln(y) = 0.487354440899798 + 0.444117189298426*Z
1,2,3,4,6,7,8-HpCDF PG/G	6/7	1.6836181	1.1230635	0.667053555	0.8516411	2.5155952	0.646	1.29	2.61	1.964	0.646	3.18	0.635	0.635	ln(y) = 0.308766022157405 + 0.890361496643429*Z
1,2,3,4,7,8,9-HpCDF PG/G	1/5										0.52	0.52	0.0903	0.635	
1,2,3,4,7,8-HxCDD PG/G	1/7										0.326	0.326	0.12	0.635	
1,2,3,4,7,8-HxCDF PG/G	**7/7**	**1.5617143**	**0.6442972**	**0.412557697**	**1.0844122**	**2.0390164**	**1.58**	**1.63**	**1.88**	**0.3**	**0.402**	**2.11**			ln(y) = 0.347368702226161 + 0.543244571906899*Z
1,2,3,6,7,8-HxCDD PG/G	3/7	0.2743252	0.1303744	0.475254838	0.1777425	0.3709079	0.19352	0.26234	0.35565	0.16214	0.215	0.469	0.244	1.08	ln(y) = -1.33810077806643 + 0.451351730494045*Z
1,2,3,6,7,8-HxCDF PG/G	5/7	0.5873802	0.1925296	0.327776876	0.4447522	0.7300081	0.44679	0.56303	0.70951	0.26272	0.39	0.808	0.437	0.633	ln(y) = -0.574421200479266 + 0.342991137142032*Z
1,2,3,7,8,9-HxCDD PG/G	1/7										0.394	0.394	0.125	0.633	
1,2,3,7,8,9-HxCDF PG/G	1/7										0.473	0.473	0.0744	0.633	
1,2,3,7,8-PeCDD PG/G	3/7	0.2059986	0.0979238	0.475361272	0.1334557	0.2785416	0.13289	0.19421	0.28383	0.15094	0.125	0.358	0.262	0.799	ln(y) = -1.63882406482344 + 0.562794905582642*Z
1,2,3,7,8-PeCDF PG/G	**7/7**	**2.2494286**	**1.0791781**	**0.479756563**	**1.4499622**	**3.0488949**	**2.3**	**2.51**	**2.73**	**0.43**	**0.356**	**2.88**			ln(y) = 0.657474304376049 + 0.675075837320331*Z
2,3,4,6,7,8-HxCDF PG/G	1/7										0.373	0.373	0.154	0.704	
2,3,4,7,8-PeCDF PG/G	**7/7**	**2.201**	**0.9532148**	**0.433082601**	**1.4948486**	**2.9071514**	**2.29**	**2.36**	**2.65**	**0.36**	**0.517**	**2.81**			ln(y) = 0.682424813013748 + 0.549318285010945*Z
2,3,7,8-TCDD Equivalent PG/G	**7/7**	**2.3463165**	**0.6664964**	**0.284060738**	**1.8525691**	**2.8400639**	**2.19281**	**2.64181**	**2.74733**	**0.55452**	**1.139019**	**2.789836**			ln(y) = 0.816476853865662 + 0.327458801043616*Z
2,3,7,8-TCDD PG/G	2/7										0.106	0.146	0.0854	0.434	
2,3,7,8-TCDF PG/G	**7/7**	**3.7675714**	**1.8281694**	**0.485238147**	**2.4132446**	**5.1218983**	**3.45**	**4.02**	**5.15**	**1.7**	**0.493**	**5.53**			ln(y) = 1.13793511938105 + 0.8287201104819*Z
2-Methylnaphthalene ug/Kg	1/49										41	41	40	610	
3,5,5-Trimethyl-2-cyclohexene-1-one ug/Kg	8/37	33.27879	16.030325	0.481697968	28.113466	38.444113	21.4505	30.5226	43.4318	21.9813	17	78	40	610	ln(y) = 3.4184687404421 + 0.523179803340065*Z
4-Chloro-3-methylphenol ug/Kg	1/13										150	150	40	610	
4-Methylphenol ug/Kg	1/50										260	260	40	610	
4-Nitrophenol ug/Kg	1/25										40	40	100	610	
Aroclor-1254 ug/Kg	10/52										20	82	10	670	
Aroclor-1260 ug/Kg	1/52										49	49	10	670	
Arsenic MG/KG	50/52	0.3795386	0.0982024	0.258741527	0.3528469	0.4062303	-0.37	0.385	0.44	0.81	0.13	0.6	0.37	0.37	ln(y) = -1.00878514941983 + 0.297933963953271*Z
Benzaldehyde ug/Kg	43/51	110.27672	75.227554	0.682170777	89.630146	130.92329	49.9792	85.8804	147.57	97.5912	16	310	40	610	ln(y) = 4.45295563356729 + 0.802963497942771*Z
bis(2-Ethylhexyl)phthalate ug/Kg	5/51										290	250000	40	610	
Cadmium MG/KG	3/50										0.01	0.01	0.01	0.37	
Chromium MG/KG	42/52	0.4148022	0.3228011	0.778204988	0.3270639	0.5025406	0.1768	0.30995	0.54338	0.36658	0.16	1.4	0.1	0.15	ln(y) = -1.17133602067589 + 0.832700656115893*Z
Copper MG/KG	**52/52**	**14.844231**	**2.8213608**	**0.190064464**	**14.077376**	**15.611085**	**13.1**	**14.7**	**16.275**	**3.175**	**8.8**	**24.2**			ln(y) = 2.68013505761057 + 0.198071820754766*Z
Diethyl Phthalate ug/Kg	1/49										47	47	40	610	
Di-n-butylphthalate ug/Kg	1/51										12000	12000	40	610	
Di-n-octylphthalate ug/Kg	1/26										120	120	40	610	
Iron MG/KG	**52/52**	**48.571154**	**24.81647**	**0.510930218**	**41.82596**	**55.316347**	**33.65**	**47.9**	**56.625**	**22.975**	**14.5**	**140**			ln(y) = 3.77161486911466 + 0.501430950351273*Z
Lead MG/KG	33/52	0.2074016	0.3274043	1.578600166	0.1184121	0.2963911	0.06499	0.12259	0.23121	0.16622	0.08	1.7	0.04	0.23	ln(y) = -2.09893185130354 + 0.941156159059847*Z
Mercury MG/KG	**52/52**	**0.0277308**	**0.0092352**	**0.333030442**	**0.0252206**	**0.0302409**	**0.02025**	**0.0295**	**0.034**	**0.01375**	**0.006**	**0.049**			ln(y) = -3.65678061357617 + 0.412058929470694*Z
Methyl Mercury MG/KG	**31/31**	**0.0251355**	**0.0074929**	**0.298101056**	**0.0224978**	**0.0277732**	**0.02**	**0.0263**	**0.0312**	**0.0112**	**0.0094**	**0.0375**			ln(y) = -3.73506672483138 + 0.359658933642701*Z
Nickel MG/KG	16/52	0.1734087	0.112508	0.648802398	0.1428287	0.2039887	0.0908	0.1425	0.22366	0.13286	0.18	0.47	0.08	0.33	ln(y) = -1.94838088427847 + 0.668561101198956*Z
OCDD PG/G	**7/7**	**22.914286**	**7.1205717**	**0.310748143**	**17.639292**	**28.189279**	**20**	**21.3**	**31**	**11**	**13.2**	**33.1**			ln(y) = 3.09231553404876 + 0.366483356182182*Z
OCDF PG/G	6/7	4.104519	2.8988766	0.706264627	1.9570012	6.2520369	-2.4	3.11	6.95	9.35	1.39	8.46	2.4	2.4	ln(y) = 1.18203693007796 + 0.867219566412421*Z
PCB-105 ng/kg	**7/7**	**1009.5714**	**749.81915**	**0.742710354**	**454.09763**	**1565.0452**	**484**	**780**	**1870**	**1386**	**323**	**2190**			ln(y) = 6.70528115623556 + 0.861374793018962*Z
PCB-108 ng/kg	**7/7**	**420.28571**	**314.50879**	**0.748321385**	**187.29434**	**653.27708**	**223**	**313**	**845**	**622**	**112**	**866**			ln(y) = 5.81419992503467 + 0.892256929814761*Z
PCB-114 ng/kg	**7/7**	**53.428571**	**33.835824**	**0.633290832**	**28.362642**	**78.494501**	**32.7**	**45.3**	**89.4**	**56.7**	**17.1**	**107**			ln(y) = 3.81584832010851 + 0.77302898646263*Z
PCB-118 ng/kg	**7/7**	**4467.1429**	**3252.8115**	**0.728163749**	**2057.4264**	**6876.8593**	**2250**	**3460**	**7970**	**5720**	**1350**	**9710**			ln(y) = 8.19994827048592 + 0.856121495853393*Z
PCB-126 ng/kg	**7/7**	**26.524286**	**23.202676**	**0.87477101**	**9.3355026**	**43.713069**	**11.3**	**16**	**51.9**	**40.6**	**8.57**	**64.7**			ln(y) = 3.01168068328234 + 0.899348324621527*Z
PCB-15 ng/kg	5/7	90.716773	73.016287	0.804881884	36.625551	144.808	32.4362	66.1081	134.735	102.298	47.7	199	28.1	28.2	ln(y) = 4.1912909834567 + 1.05610738751604*Z
PCB-156 ng/kg	**7/7**	**437.85714**	**279.07977**	**0.63737631**	**231.11196**	**644.60233**	**248**	**356**	**702**	**454**	**137**	**895**			ln(y) = 5.91884830057359 + 0.784311326583066*Z
PCB-157 ng/kg	**7/7**	**110.54286**	**80.51669**	**0.728375332**	**50.895258**	**170.19046**	**61.5**	**80.7**	**186**	**124.5**	**32.2**	**246**			ln(y) = 4.5074766006739 + 0.841631213654642*Z

Table H-62
Entire Estuary (except Bayou Verdine)
Shellfish - Group 2a

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-162 ng/kg	**7/7**	**714.85714**	**588.49675**	**0.823236865**	**278.89265**	**1150.8216**	**322**	**497**	**1390**	**1068**	**180**	**1650**			ln(y) = 6.30911466421722 + 0.961829217686532*Z
PCB-167 ng/kg	**7/7**	**261.24286**	**156.34238**	**0.598456095**	**145.4228**	**377.06291**	**161**	**218**	**426**	**265**	**77.7**	**503**			ln(y) = 5.40958565878803 + 0.774378018304875*Z
PCB-189 ng/kg	**7/7**	**44.814286**	**18.448277**	**0.411660628**	**31.147611**	**58.480961**	**37.3**	**44.7**	**59.1**	**21.8**	**12.5**	**63.6**			ln(y) = 3.70200112311907 + 0.601503790343514*Z
PCB-37 ng/kg	**7/7**	**71.142857**	**101.94413**	**1.432949608**	**-4.378411**	**146.66412**	**28.6**	**29.6**	**75.9**	**47.3**	**17.8**	**252**			ln(y) = 3.86142588345977 + 1.05303931371972*Z
PCB-58 ng/kg	**7/7**	**10.361429**	**7.9863162**	**0.770773658**	**4.4450827**	**16.277774**	**5.68**	**7.21**	**18.9**	**13.22**	**2.71**	**23.3**			ln(y) = 2.10640865985922 + 0.910480199498143*Z
PCB-60 ng/kg	**7/7**	**245.08571**	**252.9664**	**1.032154802**	**57.685585**	**432.48584**	**95.8**	**118**	**368**	**272.2**	**80.8**	**702**			ln(y) = 5.19741472005584 + 0.967313302674996*Z
PCB-61/70 ng/kg	**7/7**	**1402.1429**	**989.3135**	**0.705572541**	**669.24916**	**2135.0366**	**589**	**888**	**2340**	**1751**	**369**	**2760**			ln(y) = 7.00145303094143 + 0.956073737264831*Z
PCB-66 ng/kg	**7/7**	**1221.5714**	**684.11249**	**0.560026597**	**714.7738**	**1728.3691**	**684**	**920**	**1940**	**1256**	**417**	**2080**			ln(y) = 6.95771644875335 + 0.74790101798832*Z
PCB-77 ng/kg	**7/7**	**96.171429**	**76.967034**	**0.80031081**	**39.153452**	**153.18941**	**37.2**	**49.3**	**178**	**140.8**	**27.4**	**210**			ln(y) = 4.27743769816484 + 1.0012411044605*Z
PCB-79 ng/kg	**7/7**	**51.857143**	**37.300627**	**0.719295829**	**24.224452**	**79.489834**	**20.6**	**43.1**	**99.8**	**79.2**	**12.3**	**104**			ln(y) = 3.71037296740975 + 0.965638292997738*Z
PCB-80 ng/kg	2/7										3.64	3.98	22.6	30.6	
PCB-81 ng/kg	**7/7**	**22.547143**	**24.817397**	**1.100689219**	**4.1621578**	**40.932128**	**5.59**	**11.2**	**46.6**	**41.01**	**4.44**	**64.8**			ln(y) = 2.66727021539921 + 1.23353722804538*Z
Pyrene ug/Kg	1/49										120	120	40	610	
Selenium MG/KG	**52/52**	**0.5355769**	**0.1741559**	**0.325174407**	**0.4882408**	**0.582913**	**0.41**	**0.47**	**0.665**	**0.255**	**0.17**	**0.96**			ln(y) = -0.677841222163726 + 0.34930256638957*Z
Silver MG/KG	27/52	0.0277777	0.0155715	0.560573063	0.0235454	0.0320101	0.0161	0.02383	0.03526	0.01916	0.02	0.07	0.01	0.04	ln(y) = -3.73683919174584 + 0.581324137472935*Z
Total HpCDD PG/G	**7/7**	**4.1614286**	**2.3606338**	**0.567265245**	**2.4126466**	**5.9102106**	**3.1**	**3.43**	**6.44**	**3.34**	**1.2**	**7.91**			ln(y) = 1.28402345849487 + 0.724014577364869*Z
Total HpCDF PG/G	5/7	2.1756897	1.6795193	0.771947973	0.9314844	3.419895	0.81741	1.61231	3.18022	2.36281	1.17	4.24	0.755	1.17	ln(y) = 0.47766753574832 + 1.00755667063335*Z
Total HxCDD PG/G	**7/7**	**2.3585714**	**0.8880049**	**0.37650115**	**1.7007282**	**3.0164146**	**1.84**	**2.03**	**3.13**	**1.29**	**1.64**	**3.9**			ln(y) = 0.811921698140448 + 0.368559239577752*Z
Total HxCDF PG/G	**7/7**	**6.4142857**	**1.9537121**	**0.304587631**	**4.9669555**	**7.8616159**	**5.34**	**6.45**	**7.79**	**2.45**	**3.12**	**8.8**			ln(y) = 1.81473362928019 + 0.398031468561957*Z
Total PeCDD PG/G	4/7	0.545248	0.4644182	0.851755869	0.2012022	0.8892938	0.24274	0.42917	0.75877	0.51604	0.224	1.11	0.569	0.799	ln(y) = -0.84591136827007 + 0.845252665607877*Z
Total PeCDF PG/G	**7/7**	**20.752857**	**8.3924714**	**0.404400769**	**14.535627**	**26.970087**	**18.1**	**22.5**	**26.7**	**8.6**	**5.57**	**27.1**			ln(y) = 2.93588820916206 + 0.555867307917859*Z
Total TCDD PG/G	4/7	0.1764622	0.1049056	0.594493383	0.098747	0.2541774	0.09693	0.15403	0.24477	0.14783	0.127	0.338	0.0907	0.434	ln(y) = -1.87059191526342 + 0.686959420488048*Z
Total TCDF PG/G	**7/7**	**26.025714**	**11.750151**	**0.451482348**	**17.321081**	**34.730348**	**23.9**	**25.2**	**37.7**	**13.8**	**5.78**	**38.8**			ln(y) = 3.13027786216927 + 0.669210763429684*Z
Zinc MG/KG	**52/52**	**11.75**	**4.9919015**	**0.424842681**	**10.393186**	**13.106814**	**9.825**	**10.9**	**12.075**	**2.25**	**6.7**	**37.3**			ln(y) = 2.41753001391387 + 0.258619611435501*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Table H-63
Entire Estuary (except Bayou Verdine)
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
1,1,1-Trichloro-2,2-bis (p-methoxphenyl)-ethane ug/Kg	1/22										25	25	10	11	
1,2,3,4,6,7,8-HpCDD PG/G	3/5	0.7442973	0.1706228	0.229240102	0.5947398	0.8938547	0.61804	0.725	0.85047	0.23243	0.64	1.01	0.683	0.825	ln(y) = -0.321589295017941 + 0.236759739563994*Z
1,2,3,4,6,7,8-HpCDF PG/G	**5/5**	**2.6556**	**2.1275634**	**0.801161106**	**0.7907084**	**4.5204916**	**0.744**	**2.54**	**4.625**	**3.881**	**0.555**	**5.48**			ln(y) = 0.660441388015959 + 1.25609821523487*Z
1,2,3,4,7,8-HxCDF PG/G	**5/5**	**8.1946**	**6.1619875**	**0.751957082**	**2.7933798**	**13.59582**	**1.6865**	**10.9**	**13.35**	**11.6635**	**0.893**	**14**			ln(y) = 1.67290239487723 + 1.5010655920336*Z
1,2,3,6,7,8-HxCDF PG/G	3/5	3.4437999	0.3616609	0.105017978	3.1267901	3.7608097	3.16661	3.4298	3.71487	0.54826	3.53	3.92	0.546	0.841	ln(y) = 1.2325023405184 + 0.118425286991548*Z
1,2,3,7,8-PeCDF PG/G	**5/5**	**14.22**	**10.4597**	**0.735562593**	**5.0516686**	**23.388331**	**3.05**	**20.1**	**22.45**	**19.4**	**1.92**	**23.8**			ln(y) = 2.26046297376017 + 1.39696182628448*Z
2,3,4,6,7,8-HxCDF PG/G	4/5	2.439978	1.6704737	0.684626536	0.9757433	3.9042128	0.949	2.96	3.585	2.636	1.28	4.03	0.618	0.618	ln(y) = 0.746459404738363 + 0.766402954489309*Z
2,3,4,7,8-PeCDF PG/G	**5/5**	**14.792**	**10.606937**	**0.71707257**	**5.4946094**	**24.089391**	**3.63**	**20.5**	**23.1**	**19.47**	**2.07**	**25.3**			ln(y) = 2.33305214906074 + 1.34750918785988*Z
2,3,7,8-TCDD Equivalent PG/G	**5/5**	**14.70011**	**10.070748**	**0.685079781**	**5.8727099**	**23.527509**	**4.08541**	**19.9993**	**22.6652**	**18.5798**	**2.716479**	**24.676273**			ln(y) = 2.38504082659079 + 1.20765697658768*Z
2,3,7,8-TCDD PG/G	2/5										0.478	0.491	0.285	0.616	
2,3,7,8-TCDF PG/G	**5/5**	**41.392**	**29.858945**	**0.721369947**	**15.219481**	**67.564519**	**9.88**	**57.9**	**64.65**	**54.77**	**4.96**	**69.7**			ln(y) = 3.33732123958473 + 1.40772202342848*Z
4,4'-DDD ug/Kg	4/22										14	29	6	10	
4,4'-DDE ug/Kg	1/22										2.1	2.1	10	10	
4,4'-DDT ug/Kg	5/22	9.7523586	13.242621	1.357889091	4.2186193	15.286098	1.88997	4.7218	11.7967	9.9067	14	43	6	10	ln(y) = 1.55218945753992 + 1.35811675835698*Z
4-Methylphenol ug/Kg	6/20	40.014494	47.291165	1.181850877	19.288227	60.740761	18.4626	30.3708	49.9596	31.4969	34	200	40	400	ln(y) = 3.41348127683335 + 0.738268850984318*Z
Aldrin ug/Kg	3/22										10	10	6	10	
alpha-Chlordane ug/Kg	1/22										1.9	1.9	10	10	
Aluminum (Fume Or Dust) MG/KG	**1/1**										**56.4**	**56.4**			
Aroclor-1254 ug/Kg	19/22	77.854661	84.707008	1.088014608	42.457855	113.25147	21.4126	46.6673	101.708	80.2957	13	330	10	100	ln(y) = 3.8430446453385 + 1.15555742753096*Z
Arsenic MG/KG	21/22	0.5295372	0.2020849	0.38162544	0.4450913	0.6139831	-0.62	-0.62	0.6375	1.2575	0.25	0.97	0.62	0.62	ln(y) = -0.705601102592159 + 0.401520618269196*Z
Barium MG/KG	**1/1**										**97.6**	**97.6**			
Benzaldehyde ug/Kg	21/21	149.95238	150.45774	1.003370105	85.600544	214.30422	71.5	130	155	83.5	38	660			ln(y) = 4.77339375480555 + 0.711572441402918*Z
beta-BHC ug/Kg	8/22	14.3717	14.981615	1.042438652	8.1112812	20.632118	4.41071	9.11139	18.8218	14.4111	10	56	6	10	ln(y) = 2.20952538792121 + 1.07609059586771*Z
Cadmium MG/KG	20/22	0.039057	0.0290535	0.743876384	0.0269162	0.0511977	0.0194	0.03181	0.05214	0.03274	0.01	0.12	0.01	0.5	ln(y) = -3.44798749992774 + 0.733118330314954*Z
Calcium Metal MG/KG	**1/1**										**59400**	**59400**			
Chromium MG/KG	4/22										0.13	0.81	0.08	0.5	
Copper MG/KG	**22/22**	**8.9863636**	**2.3297836**	**0.25925766**	**8.012809**	**9.9599182**	**7.15**	**8.65**	**10.1**	**2.95**	**6.2**	**15.6**			ln(y) = 2.16838479877107 + 0.255982677662032*Z
Dieldrin ug/Kg	1/22										2	2	10	10	
Di-n-butylphthalate ug/Kg	1/22										1700	1700	40	2000	
Endosulfan Sulfate ug/Kg	2/22										11	11	6	10	
Endrin Aldehyde ug/Kg	1/22										14	14	6	10	
Endrin ug/Kg	3/22										13	25	6	10	
gamma-Chlordane ug/Kg	1/22										15	15	6	10	
Heptachlor ug/Kg	1/22										0.68	0.68	10	10	
Hexachlorobenzene ug/Kg	3/15	24.785345	4.8709163	0.196524044	22.320322	27.250369	20.6375	24.4186	28.8925	8.25499	20	28	40	2000	ln(y) = 3.19534444058356 + 0.249538457857386*Z
Iron MG/KG	20/22	13.003366	40.111828	3.084726449	-3.7583	29.765032	3.13927	6.15558	12.0701	8.93082	2.8	146	1.9	2.5	ln(y) = 1.8173593842489 + 0.99878591982642*Z
Lead MG/KG	13/22	0.0909027	0.1660617	1.826807887	0.0215099	0.1602954	0.0169	0.05	0.1225	0.1056	0.03	0.67	0.02	0.02	ln(y) = -3.15034157590263 + 1.37999684243326*Z
Magnesium MG/KG	**1/1**										**3290**	**3290**			
Manganese MG/KG	**1/1**										**176**	**176**			
Mercury MG/KG	**22/22**	**0.1201364**	**0.0765716**	**0.637372077**	**0.0881391**	**0.1521336**	**0.07075**	**0.0955**	**0.159**	**0.08825**	**0.04**	**0.302**			ln(y) = -2.27676478470134 + 0.61072256745916*Z
Nickel MG/KG	21/22	0.0988575	0.0342072	0.346025196	0.0845632	0.1131518	-4	-4	-4	0	0.06	0.21	4	4	ln(y) = -2.35530142580814 + 0.311338587739868*Z
OCDD PG/G	**5/5**	**3.28**	**2.5046729**	**0.763619778**	**1.0845574**	**5.4754426**	**1.815**	**2.89**	**4.94**	**3.125**	**1.74**	**6.85**			ln(y) = 1.05690594324355 + 0.681895308368582*Z
OCDF PG/G	1/5										1.44	1.44	0.715	1.91	
PCB-105 ng/kg	**5/5**	**7166**	**4557.0216**	**0.635922634**	**3171.5945**	**11160.406**	**2585**	**8640**	**11010**	**8425**	**1500**	**12100**			ln(y) = 8.63771882436015 + 1.09170125039563*Z
PCB-108 ng/kg	**5/5**	**2275.6**	**1428.4915**	**0.627742809**	**1023.472**	**3527.728**	**799**	**3100**	**3340**	**2541**	**408**	**3550**			ln(y) = 7.47112486339733 + 1.11912722311088*Z
PCB-114 ng/kg	**5/5**	**558.62**	**381.72004**	**0.683326848**	**224.02763**	**893.21237**	**159.05**	**765**	**855**	**695.95**	**82.1**	**922**			ln(y) = 6.001537793745 + 1.27502521358207*Z
PCB-118 ng/kg	**5/5**	**30642**	**18753.757**	**0.612027823**	**14203.608**	**47080.392**	**11305**	**39100**	**45750**	**34445**	**6910**	**49100**			ln(y) = 10.1065073218148 + 1.03679796813429*Z

Table H-63
Entire Estuary (except Bayou Verdine)
Shellfish - Group 2B

Constituents	Detected Value Frequency	Mean	Standard Deviation	Coefficient of Variation	95% Confidence Limit about the		Percentiles				Range of Detected Values		Reporting Limit		Regression Equation
					Lower	Upper	25th	Median	75th	IQR	Minimum	Maximum	Minimum	Maximum	
PCB-126 ng/kg	**5/5**	**182.8**	**128.67037**	**0.703886044**	**70.015449**	**295.58455**	**50**	**223**	**295.5**	**245.5**	**25.3**	**304**			ln(y) = 4.86559323529964 + 1.33113633628355*Z
PCB-127 ng/kg	**3/5**	**31.296003**	**16.882285**	**0.539439007**	**16.498028**	**46.093978**	**21.8713**	**28.6**	**43.75**	**21.8787**	**28.6**	**43.8**	**19.8**	**19.8**	ln(y) = 3.3860324050059 + 0.446248083534973*Z
PCB-15 ng/kg	**5/5**	**653**	**537.34334**	**0.822884131**	**181.9978**	**1124.0022**	**156**	**777**	**1088**	**932**	**120**	**1370**			ln(y) = 6.12301544530125 + 1.3260683893539*Z
PCB-156 ng/kg	**5/5**	**3479**	**2178.6212**	**0.626220528**	**1569.3543**	**5388.6457**	**1257.5**	**4580**	**5150**	**3892.5**	**615**	**5530**			ln(y) = 7.89774607769361 + 1.12437536474777*Z
PCB-157 ng/kg	**5/5**	**947.8**	**606.73285**	**0.640148609**	**415.97521**	**1479.6248**	**324.5**	**1250**	**1420**	**1095.5**	**186**	**1570**			ln(y) = 6.59999512717815 + 1.11408524772374*Z
PCB-162 ng/kg	**5/5**	**4788**	**2974.3027**	**0.621199385**	**2180.9088**	**7395.0912**	**1820**	**5810**	**7245**	**5425**	**1040**	**8030**			ln(y) = 8.24838059394168 + 1.0566427879304*Z
PCB-167 ng/kg	**5/5**	**2430.6**	**1532.0869**	**0.630332795**	**1087.6666**	**3773.5334**	**846.5**	**3160**	**3650**	**2803.5**	**493**	**3930**			ln(y) = 7.54959520892189 + 1.09392353824339*Z
PCB-169 ng/kg	2/4										23.1	25.4	19.8	19.9	
PCB-189 ng/kg	**5/5**	**338.92**	**203.34045**	**0.599965912**	**160.68424**	**517.15576**	**144.3**	**418**	**494**	**349.7**	**64.6**	**551**			ln(y) = 5.60140197988337 + 1.05318569614038*Z
PCB-37 ng/kg	**5/5**	**330.76**	**259.40883**	**0.784281135**	**103.37814**	**558.14186**	**90.4**	**369**	**552**	**461.6**	**72.8**	**675**			ln(y) = 5.49136268723359 + 1.22567714207153*Z
PCB-58 ng/kg	**5/5**	**36.22**	**12.641639**	**0.349023708**	**25.139115**	**47.300885**	**25.1**	**37.6**	**46.65**	**21.55**	**18.5**	**47.6**			ln(y) = 3.53720450450018 + 0.477995549097335*Z
PCB-60 ng/kg	**5/5**	**594.6**	**338.62691**	**0.56950371**	**297.78043**	**891.41957**	**259**	**678**	**888.5**	**629.5**	**214**	**1000**			ln(y) = 6.23306932674365 + 0.845383137024114*Z
PCB-61/70 ng/kg	**5/5**	**449.2**	**436.19847**	**0.971056262**	**66.855181**	**831.54482**	**170.5**	**238**	**833.5**	**663**	**164**	**1080**			ln(y) = 5.82160559480317 + 1.04340790103309*Z
PCB-66 ng/kg	**5/5**	**8324**	**4899.05**	**0.588545175**	**4029.7933**	**12618.207**	**3360**	**10200**	**12350**	**8990**	**2440**	**13800**			ln(y) = 8.8441093090996 + 0.927060351655619*Z
PCB-77 ng/kg	**5/5**	**565.2**	**375.7535**	**0.664815113**	**235.83753**	**894.56247**	**195.5**	**640**	**897.5**	**702**	**131**	**1010**			ln(y) = 6.09614729163762 + 1.09341945248456*Z
PCB-79 ng/kg	**5/5**	**614.6**	**357.625**	**0.581882525**	**301.12787**	**928.07213**	**268.5**	**688**	**924**	**655.5**	**219**	**1060**			ln(y) = 6.2640868454988 + 0.854616823057376*Z
PCB-80 ng/kg	**5/5**	**45.97**	**30.434837**	**0.662058665**	**19.292689**	**72.647311**	**15.325**	**57.1**	**71.05**	**55.725**	**9.25**	**80.3**			ln(y) = 3.56849831512609 + 1.13607208460283*Z
PCB-81 ng/kg	**5/5**	**55.094**	**38.016801**	**0.690035233**	**21.770805**	**88.417195**	**15.485**	**68.3**	**88.1**	**72.615**	**9.47**	**91.3**			ln(y) = 3.69914329796531 + 1.24138303975142*Z
Phenol ug/Kg	2/21										16	440	40	2000	
Potassium MG/KG	**1/1**										**2350**	**2350**			
Selenium MG/KG	**22/22**	**0.8736364**	**0.2947386**	**0.337369886**	**0.7504729**	**0.9967998**	**0.64**	**0.88**	**1.025**	**0.385**	**0.36**	**1.6**			ln(y) = -0.190307874297868 + 0.380919439087505*Z
Silver MG/KG	21/22	0.096453	0.0840921	0.871845152	0.0613132	0.1315929	-1	-1	-1	0	0.03	0.3	1	1	ln(y) = -2.63154662593968 + 0.836961334484357*Z
Sodium MG/KG	**1/1**										**5090**	**5090**			
Total HpCDD PG/G	4/5	1.4070495	0.6909015	0.491028552	0.8014477	2.0126514	0.893	1.43	2.015	1.122	0.961	2.12	0.825	0.825	ln(y) = 0.26075630358955 + 0.583675399745593*Z
Total HpCDF PG/G	**5/5**	**2.6556**	**2.1275634**	**0.801161106**	**0.7907084**	**4.5204916**	**0.744**	**2.54**	**4.625**	**3.881**	**0.555**	**5.48**			ln(y) = 0.660441388015959 + 1.25609821523487*Z
Total HxCDD PG/G	3/5	1.9551295	0.8671085	0.443504397	1.1950754	2.7151837	1.34257	1.82725	2.4869	1.14433	1.76	3.13	0.48	2.08	ln(y) = 0.602809954397822 + 0.457181985952438*Z
Total HxCDF PG/G	**5/5**	**39.944**	**28.501637**	**0.713539868**	**14.961214**	**64.926786**	**9.76**	**57.6**	**61.3**	**51.54**	**4.12**	**64**			ln(y) = 3.2866722040851 + 1.44009796155408*Z
Total PeCDF PG/G	**5/5**	**123.08**	**68.888115**	**0.559701939**	**62.696905**	**183.46309**	**56.2**	**159**	**172**	**115.8**	**26.6**	**179**			ln(y) = 4.61903314084863 + 0.948145218270883*Z
Total TCDD PG/G	**5/5**	**3.164**	**0.9382899**	**0.296551792**	**2.3415527**	**3.9864473**	**2.28**	**3.08**	**4.09**	**1.81**	**2.26**	**4.3**			ln(y) = 1.1175307419079 + 0.377926323488206*Z
Total TCDF PG/G	**5/5**	**220.6**	**122.65419**	**0.556002675**	**113.08886**	**328.11114**	**101.5**	**274**	**313**	**211.5**	**50**	**324**			ln(y) = 5.20935191327517 + 0.936856783697193*Z
Zinc MG/KG	**22/22**	**28.513636**	**4.7852658**	**0.167823766**	**26.514001**	**30.513272**	**24**	**29.3**	**32.025**	**8.025**	**20.3**	**36.2**			ln(y) = 3.33644852622209 + 0.188895480819972*Z

Bolded values are exact calculations. Unbolded values are estimated using regression on ordered statistics (ROS). Estimates of distribution parameters become less accurate as the percent detected data decreases, and may be unacceptable below a 40% detection threshold.
Only general summary statistics are provided for data at or below the 20% detection threshold.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST001-NSD-	00BI2-ST002-NSD-	00BI2-ST003-NSD-	00BI2-ST004-NSD-	00BI2-ST005-
Microbial Community								
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	0.64 (T)	2.1 (NT)	0.26 (T)	4.3 (NT)	0.44 (T)
Aquatic Plant Community								
Ulva fasciata	96-h	Germination (%)	100% PW	NR	51.4 (T)	NR	76.6 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	1.44 (NT)	NR	4.26 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	12.73 (T)	NR	32.90 (NT)	NR
		Overall (G or G)	100% PW	NR	T	NR	NT	NR
	96-h	Germination (%)	50% PW	NR	95.2 (NT)	NR	94 (NT)	NR
	96-h	Germling Cell Number	50% PW	NR	6.60 (NT)	NR	8.58 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	47.35 (NT)	NR	57.29 (NT)	NR
		Overall (G or G)	50% PW	NR	NT	NR	NT	NR
	96-h	Germination (%)	25% PW	NR	96.8 (NT)	NR	95.2 (NT)	NR
	96-h	Germling Cell Number	25% PW	NR	9.40 (NT)	NR	6.98 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	66.06 (NT)	NR	57.29 (NT)	NR
		Overall (G or G)	25% PW	NR	NT	NR	NT	NR
Benthic Invertebrate Community								
Ampelisca abdita	10-d	Survival (%)	WS	51 (T)	45 (T)	21 (T)	51 (T)	35 (T)
Hyalella azteca	10-d	Survival (%)	WS	90 (NT)	85 (NT)	88 (NT)	70 (T)	78 (NT)
	10-d	Growth (mm)	WS	2.36 (NT)	3.08 (NT)	2.31 (NT)	2.59 (NT)	2.74 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT	T	NT

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST001-NSD-	00BI2-ST002-NSD-	00BI2-ST003-NSD-	00BI2-ST004-NSD-	00BI2-ST005-
Benthic Invertebrate Community **(cont.)**							***Benthic Invertebrate Community*** **(cont.)**	
Arbacia punctulata	28-d	Survival (%)	WS	93 (NT)	85 (NT)	78 (T)	*ılella azteca* (cc	76 (T)
	28-d	Growth (mm)	WS	4.18 (NT)	5.10 (NT)	4.61 (NT)	3.32 (NT)	4.19 (NT)
	28-d	Overall (S or G)	WS	NT	NT	T	NT	T
	30-m	Fertilization (%EF)	100% PW	NR	37.8 (NT)	NR	90 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	54.4 (T)	NR	46.8 (T)	NR
	48-h	Development (%NP)	50% PW	NR	0.0 (T)	NR	0.0 (T)	NR
		Overall (F or D)	50% PW	NR	T	NR	T	NR
	30-m	Total Abundance (#/35.4 cm^2)	25% PW	NR	87.4 (T)	NR	71.6 (T)	NR
	48-h	Development (%NP)	25% PW	NR	0.0 (T)	NR	3.4 (T)	NR
		Overall (F or D)	25% PW	NR	T	NR	T	NR
Community Structure	LT	Normalized Index	WS	0.345	0.245	0.248	0.243	0.245
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0.6	0.4	0.2	4.8	0.4
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	3	1	1	1	1
	LT	Total Abundance (#/35.4 cm^2)	WS	1	0.4	0.2	4.8	0.4
	LT	Overall	WS	I	I	I	I	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR	91 (NT)	90 (T)

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST001-NSD-	00BI2-ST002-NSD-	00BI2-ST003-NSD-	00BI2-ST004-NSD-	00BI2-ST005-
Fish Community								
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	50% PW	NR	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	10 (NT)	NR	28 (NT)	NR
	48-h	Survival (%)	25% PW	NR	0 (T)	NR	8 (NT)	NR
		Overall (H or S)	25% PW	NR	T	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST006-NSD-010	00BI2-ST007-NSD-010	00BI2-ST008-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	4.7 (NT)	13 (NT)	10 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	95.6 (NT)	NR	83.2 (NT)
	96-h	Germling Cell Number	100% PW	8.06 (NT)	NR	6.14 (NT)
	96-h	Germling Length (µm)	100% PW	52.98 (NT)	NR	46.24 (NT)
		Overall (G or G)	100% PW	NT	NR	NT
	96-h	Germination (%)	50% PW	96.6 (NT)	NR	93.6 (NT)
	96-h	Germling Cell Number	50% PW	10.68 (NT)	NR	9.56 (NT)
	96-h	Germling Length (µm)	50% PW	67.43 (NT)	NR	65.20 (NT)
		Overall (G or G)	50% PW	NT	NR	NT
	96-h	Germination (%)	25% PW	95.2 (NT)	NR	92.6 (NT)
	96-h	Germling Cell Number	25% PW	11.16 (NT)	NR	7.66 (NT)
	96-h	Germling Length (µm)	25% PW	70.47 (NT)	NR	67.03 (NT)
		Overall (G or G)	25% PW	NT	NR	NT
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	27 (T)	53 (T)	52 (T)
Hyalella azteca	10-d	Survival (%)	WS	100 (NT)	98 (NT)	90 (NT)
	10-d	Growth (mm)	WS	2.40 (NT)	2.71 (NT)	2.46 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST006-NSD-010	00BI2-ST007-NSD-010	00BI2-ST008-NSD-010
Benthic Invertebrate Community **(cont.)**						
Arbacia punctulata	28-d	Survival (%)	WS	96 (NT)	98 (NT)	90 (NT)
	28-d	Growth (mm)	WS	2.93 (T)	3.57 (NT)	3.49 (NT)
	28-d	Overall (S or G)	WS	T	NT	NT
	30-m	Fertilization (%EF)	100% PW	83.6 (NT)	NR	30.2 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	88 (NT)	NR	52.6 (T)
	48-h	Development (%NP)	50% PW	0.0 (T)	NR	0.0 (T)
		Overall (F or D)	50% PW	T	NR	T
	30-m	Fertilization (%EF)	25% PW	94.8 (NT)	NR	86.4 (T)
	48-h	Development (%NP)	25% PW	83.8 (NT)	NR	0.0 (T)
		Overall (F or D)	25% PW	NT	NR	T
Community Structure	LT	Normalized Index	WS	0.573	0.235	0.325
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	2.8	3.8	3
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.2	0	0
	LT	Richness (# species/35.4 cm^2)	WS	6	1	3
	LT	Total Abundance (#/35.4 cm^2)	WS	3.2	3.8	3
	LT	Overall	WS	NI	I	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST006-NSD-010	00BI2-ST007-NSD-010	00BI2-ST008-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	72 (NT)	NR	80 (NT)
	48-h	Survival (%)	25% PW	54 (NT)	NR	42 (NT)
		Overall (H or S)	25% PW	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST010-NSD-010	00BI2-ST041-NSD-010
Microbial Community				
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	6.4 (NT)	1.0 (T)
Aquatic Plant Community				
Ulva fasciata	96-h	Germination (%)	40.8 (T)	NR
	96-h	Germling Cell Number	1.40 (NT)	NR
	96-h	Germling Length (µm)	13.08 (T)	NR
		Overall (G or G)	T	NR
	96-h	Germination (%)	92.2 (NT)	NR
	96-h	Germling Cell Number	7.28 (NT)	NR
	96-h	Germling Length (µm)	55.36 (NT)	NR
		Overall (G or G)	NT	NR
	96-h	Germination (%)	93.2 (NT)	NR
	96-h	Germling Cell Number	7.36 (NT)	NR
	96-h	Germling Length (µm)	60.03 (NT)	NR
		Overall (G or G)	NT	NR
Benthic Invertebrate Community				
Ampelisca abdita	10-d	Survival (%)	67 (NT)	54 (T)
Hyalella azteca	10-d	Survival (%)	95 (NT)	98 (NT)
	10-d	Growth (mm)	2.58 (NT)	2.50 (NT)
	10-d	Overall (S or G)	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST010-NSD-010	00BI2-ST041-NSD-010
Benthic Invertebrate Community **(cont.)**				
Hyalella azteca (cont.)	28-d	Survival (%)	90 (NT)	98 (NT)
	28-d	Growth (mm)	4.10 (NT)	3.70 (NT)
	28-d	Overall (S or G)	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	1.4 (T)	NR
	48-h	Development (%NP)	0.0 (NT)	NR
		Overall (F or D)	T	NR
	30-m	Fertilization (%EF)	27.8 (T)	NR
	48-h	Development (%NP)	0.0 (T)	NR
		Overall (F or D)	T	NR
	30-m	Fertilization (%EF)	47.8 (T)	NR
	48-h	Development (%NP)	0.0 (T)	NR
		Overall (F or D)	T	NR
Community Structure	LT	Normalized Index	0.243	0.248
	LT	Pollution Indicator Species (#/35.4 cm^2)	0.6	0.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	0
	LT	Richness (# species/35.4 cm^2)	1	1
	LT	Total Abundance (#/35.4 cm^2)	0.6	0.2
	LT	Overall	I	I
Nereis virens	28-d	Survival (%)	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Middle Bayou d'Inde.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST010-NSD-010	00BI2-ST041-NSD-010
Fish Community				
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	0 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	66 (NT)	NR
	48-h	Survival (%)	2 (NT)	NR
		Overall (H or S)	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Main stem.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST024-NSD-010	00BI2-ST025-NSD-010	00BI2-ST026-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	11 (NT)	29 (NT)	11 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	87.4 (NT)	NR	88.4 (NT)
	96-h	Germling Cell Number	100% PW	6.92 (NT)	NR	9.08 (NT)
	96-h	Germling Length (µm)	100% PW	53.64 (NT)	NR	60.84 (NT)
		Overall (G or G)	100% PW	NT	NR	NT
	96-h	Germination (%)	50% PW	92.4 (NT)	NR	95.2 (NT)
	96-h	Germling Cell Number	50% PW	9.82 (NT)	NR	9.86 (NT)
	96-h	Germling Length (µm)	50% PW	65.91 (NT)	NR	67.23 (NT)
		Overall (G or G)	50% PW	NT	NR	NT
	96-h	Germination (%)	25% PW	91.2 (T)	NR	91.2 (T)
	96-h	Germling Cell Number	25% PW	9.40 (NT)	NR	7.88 (NT)
	96-h	Germling Length (µm)	25% PW	67.63 (NT)	NR	67.63 (NT)
		Overall (G or G)	25% PW	T	NR	T
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	0 (T)	22 (T)	0 (T)
Hyalella azteca	10-d	Survival (%)	WS	63 (T)	75 (NT)	68 (T)
	10-d	Growth (mm)	WS	2.29 (NT)	2.22 (T)	2.04 (T)
	10-d	Overall (S or G)	WS	T	T	T

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Main stem.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST024-NSD-010	00BI2-ST025-NSD-010	00BI2-ST026-NSD-010
Benthic Invertebrate Community **(cont.)**						
Arbacia punctulata	28-d	Survival (%)	WS	73 (T)	88 (NT)	33 (T)
	28-d	Growth (mm)	WS	2.78 (T)	3.89 (NT)	2.63 (T)
	28-d	Overall (S or G)	WS	T	NT	T
	30-m	Fertilization (%EF)	100% PW	52 (NT)	NR	94.6 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	94.2 (NT)	NR	96 (NT)
	48-h	Development (%NP)	50% PW	0.0 (T)	NR	0.0 (T)
		Overall (F or D)	50% PW	T	NR	T
	30-m	Fertilization (%EF)	25% PW	95.6 (NT)	NR	96.8 (NT)
	48-h	Development (%NP)	25% PW	12.6 (T)	NR	86.6 (NT)
		Overall (F or D)	25% PW	T	NR	NT
Community Structure	LT	Normalized Index	WS	0.568	0.36	0.418
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	1.6	1.6	3
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.2	0	0
	LT	Richness (# species/35.4 cm^2)	WS	5	4	7
	LT	Total Abundance (#/35.4 cm^2)	WS	2	1.8	3.4
	LT	Overall	WS	NI	I	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Main stem.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST024-NSD-010	00BI2-ST025-NSD-010	00BI2-ST026-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	66 (NT)	NR	34 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	14 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	70 (NT)	NR	92 (NT)
	48-h	Survival (%)	25% PW	54 (NT)	NR	72 (NT)
		Overall (H or S)	25% PW	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from PPG Canal.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST027-NSD-010	00BI2-ST028-NSD-010	00BI2-ST029-NSD-010	00BI2-ST030-NSD-010	00BI2-ST031-NSD-010
Microbial Community								
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	3.0 (NT)	22 (NT)	22 (NT)	16 (NT)	9.1 (NT)
Aquatic Plant Community								
Ulva fasciata	96-h	Germination (%)	100% PW	NR	92.6 (NT)	NR	79.4 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	12.54 (NT)	NR	2.10 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	81.53 (NT)	NR	20.38 (NT)	NR
		Overall (G or G)	100% PW	NR	NT	NR	NT	NR
	96-h	Germination (%)	50% PW	NR	93 (NT)	NR	90.2 (T)	NR
	96-h	Germling Cell Number	50% PW	NR	10.82 (NT)	NR	2.92 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	73.62 (NT)	NR	30.07 (NT)	NR
		Overall (G or G)	50% PW	NR	NT	NR	T	NR
	96-h	Germination (%)	25% PW	NR	92.4 (NT)	NR	89.8 (T)	NR
	96-h	Germling Cell Number	25% PW	NR	3.80 (NT)	NR	2.78 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	39.55 (NT)	NR	30.32 (T)	NR
		Overall (G or G)	25% PW	NR	NT	NR	T	NR
Benthic Invertebrate Community								
Ampelisca abdita	10-d	Survival (%)	WS	14 (T)	63 (NT)	1 (T)	3 (T)	67 (NT)
Hyalella azteca	10-d	Survival (%)	WS	78 (NT)	95 (NT)	93 (NT)	100 (NT)	98 (NT)
	10-d	Growth (mm)	WS	2.11 (T)	2.63 (NT)	2.57 (NT)	2.70 (NT)	2.51 (NT)
	10-d	Overall (S or G)	WS	T	NT	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from PPG Canal.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST027-NSD-010	00BI2-ST028-NSD-010	00BI2-ST029-NSD-010	00BI2-ST030-NSD-010	00BI2-ST031-NSD-010
Benthic Invertebrate Community **(cont.)**								
Hyalella azteca (cont.)	28-d	Survival (%)	WS	68 (T)	93 (NT)	93 (NT)	85 (NT)	93 (NT)
	28-d	Growth (mm)	WS	4.29 (NT)	3.76 (NT)	3.44 (NT)	3.31 (NT)	3.69 (NT)
	28-d	Overall (S or G)	WS	T	NT	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	82.8 (NT)	NR	85 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR	2.8 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	95.4 (NT)	NR	94.4 (NT)	NR
	48-h	Development (%NP)	50% PW	NR	86.6 (NT)	NR	85.8 (NT)	NR
		Overall (F or D)	50% PW	NR	NT	NR	NT	NR
	30-m	Fertilization (%EF)	25% PW	NR	94.6 (NT)	NR	96 (NT)	NR
	48-h	Development (%NP)	25% PW	NR	86.6 (NT)	NR	83.8 (NT)	NR
		Overall (F or D)	25% PW	NR	NT	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.255	0.245	0.248	0.3	0.3
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0	0.4	0.8	1.8	2.4
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	0	1	1	2	2
	LT	Total Abundance (#/35.4 cm^2)	WS	0	0.4	0.8	1.8	2.4
	LT	Overall	WS	I	I	I	I	I
Nereis virens	28-d	Survival (%)	WS	93 (NT)	NR	NR	87 (NT)	NR

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from PPG Canal.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST027-NSD-010	00BI2-ST028-NSD-010	00BI2-ST029-NSD-010	00BI2-ST030-NSD-010	00BI2-ST031-NSD-010
Fish Community								
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	82 (NT)	NR	62 (NT)	NR
	48-h	Survival (%)	100% PW	NR	58 (NT)	NR	22 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	96 (NT)	NR	92 (NT)	NR
	48-h	Survival (%)	50% PW	NR	84 (NT)	NR	84.2 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	90 (NT)	NR	86 (NT)	NR
	48-h	Survival (%)	25% PW	NR	74 (NT)	NR	78 (NT)	NR
		Overall (H or S)	25% PW	NR	NT	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST011-NSD-010	00BI2-ST012-NSD-010	00BI2-ST013-NSD-010	00BI2-ST014-NSD-010
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	0.59 (T)	13 (NT)	1.7 (NT)	5.8 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	100% PW	NR	95 (NT)	NR	80.2 (NT)
	96-h	Germling Cell Number	100% PW	NR	6.96 (NT)	NR	8.70 (NT)
	96-h	Germling Length (µm)	100% PW	NR	55.36 (NT)	NR	57.49 (NT)
		Overall (G or G)	100% PW	NR	NT	NR	NT
	96-h	Germination (%)	50% PW	NR	94.8 (NT)	NR	84.8 (T)
	96-h	Germling Cell Number	50% PW	NR	7.32 (NT)	NR	10.08 (NT)
	96-h	Germling Length (µm)	50% PW	NR	61.55 (NT)	NR	68.34 (NT)
		Overall (G or G)	50% PW	NR	NT	NR	T
	96-h	Germination (%)	25% PW	NR	93.6 (NT)	NR	87 (T)
	96-h	Germling Cell Number	25% PW	NR	6.66 (NT)	NR	10.66 (NT)
	96-h	Germling Length (µm)	25% PW	NR	58.71 (NT)	NR	72.91 (NT)
		Overall (G or G)	25% PW	NR	NT	NR	T
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	WS	37 (T)	23 (T)	7 (T)	0 (T)
Hyalella azteca	10-d	Survival (%)	WS	53 (T)	90 (NT)	70 (T)	10 (T)
	10-d	Growth (mm)	WS	2.07 (T)	2.29 (NT)	2.14 (T)	2.13 (T)
	10-d	Overall (S or G)	WS	T	NT	T	T

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST011-NSD-010	00BI2-ST012-NSD-010	00BI2-ST013-NSD-010	00BI2-ST014-NSD-010
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	WS	68 (T)	78 (T)	56 (T)	23 (T)
	28-d	Growth (mm)	WS	3.37 (NT)	3.28 (NT)	2.79 (T)	4.60 (NT)
	28-d	Overall (S or G)	WS	T	T	T	T
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	66 (NT)	NR	23 (T)
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NR	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	NR	88.6 (NT)	NR	66 (T)
	48-h	Development (%NP)	50% PW	NR	4.8 (NT)	NR	0.0 (T)
		Overall (F or D)	50% PW	NR	NT	NR	T
	30-m	Fertilization (%EF)	25% PW	NR	93.6 (NT)	NR	90.8 (T)
	48-h	Development (%NP)	25% PW	NR	84.2 (NT)	NR	81.0 (T)
		Overall (F or D)	25% PW	NR	NT	NR	T
Community Structure	LT	Normalized Index	WS	0.31	0.31	0.34	0.243
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0.2	0.6	4	0.6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	2	2	4	1
	LT	Total Abundance (#/35.4 cm^2)	WS	0.4	0.8	4	0.6
	LT	Overall	WS	I	I	I	I
Nereis virens	28-d	Survival (%)	WS	88 (T)	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BI2-ST011-NSD-010	00BI2-ST012-NSD-010	00BI2-ST013-NSD-010	00BI2-ST014-NSD-010
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	NR	90 (NT)	NR	90 (NT)
	48-h	Survival (%)	50% PW	NR	62 (NT)	NR	38 (NT)
		Overall (H or S)	50% PW	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	NR	88 (NT)	NR	86 (NT)
	48-h	Survival (%)	25% PW	NR	76 (NT)	NR	48 (NT)
		Overall (H or S)	25% PW	NR	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST015-NSD-010	00BI2-ST016-NSD-010	00BI2-ST017-NSD-010	00BI2-ST018-NSD-010	00BI2-ST019-NSD-010
				NR	NR	NR	NR
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	3.9 (NT)	9.8 (NT)	5.9 (NT)	17 (NT)	13 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	NR	27.8 (T)	NR	85.6 (NT)	NR
	96-h	Germling Cell Number	NR	3.92 (NT)	NR	9.30 (NT)	NR
	96-h	Germling Length (µm)	NR	32.45 (NT)	NR	59.83 (NT)	NR
		Overall (G or G)	NR	T	NR	NT	NR
	96-h	Germination (%)	NR	80.6 (T)	NR	91 (NT)	NR
	96-h	Germling Cell Number	NR	11.00 (NT)	NR	11.28 (NT)	NR
	96-h	Germling Length (µm)	NR	73.01 (NT)	NR	71.39 (NT)	NR
		Overall (G or G)	NR	T	NR	NT	NR
	96-h	Germination (%)	NR	88 (T)	NR	93.6 (NT)	NR
	96-h	Germling Cell Number	NR	11.32 (NT)	NR	11.80 (NT)	NR
	96-h	Germling Length (µm)	NR	75.04 (NT)	NR	74.12 (NT)	NR
		Overall (G or G)	NR	T	NR	NT	NR
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	29 (T)	0 (T)	0 (T)	0 (T)	10 (T)
Hyalella azteca	10-d	Survival (%)	73 (NT)	20 (T)	18 (T)	25 (T)	53 (T)
	10-d	Growth (mm)	2.53 (NT)	2.29 (NT)	2.20 (T)	2.14 (T)	2.60 (NT)
	10-d	Overall (S or G)	NT	T	T	T	T

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST015-NSD-010	00BI2-ST016-NSD-010	00BI2-ST017-NSD-010	00BI2-ST018-NSD-010	00BI2-ST019-NSD-010
				NR	NR	NR	NR
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	80 (T)	20 (T)	30 (T)	45 (T)	33 (T)
	28-d	Growth (mm)	4.13 (NT)	3.87 (NT)	3.63 (NT)	2.82 (T)	3.11 (T)
	28-d	Overall (S or G)	T	T	T	T	T
Arbacia punctulata	30-m	Fertilization (%EF)	NR	8.8 (T)	NR	71.2 (NT)	NR
	48-h	Development (%NP)	NR	0.0 (NT)	NR	0.0 (NT)	NR
		Overall (F or D)	NR	T	NR	NT	NR
	30-m	Fertilization (%EF)	NR	42.4 (T)	NR	90.8 (NT)	NR
	48-h	Development (%NP)	NR	0.0 (T)	NR	0.0 (T)	NR
		Overall (F or D)	NR	T	NR	T	NR
	30-m	Fertilization (%EF)	NR	71 (T)	NR	96.4 (NT)	NR
	48-h	Development (%NP)	NR	40.6 (T)	NR	71.6 (T)	NR
		Overall (F or D)	NR	T	NR	T	NR
Community Structure	LT	Normalized Index	0.348	0.243	0.248	0.248	0.353
	LT	Pollution Indicator Species (#/35.4 cm^2)	1.8	0.6	0.2	0.8	3.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	0	0	0	0
	LT	Richness (# species/35.4 cm^2)	4	1	1	1	4
	LT	Total Abundance (#/35.4 cm^2)	1.8	0.6	0.2	0.8	3.4
	LT	Overall	I	I	I	I	I
Nereis virens	28-d	Survival (%)	NR	NR	NR	NR	91 (NT)

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST015-NSD-010	00BI2-ST016-NSD-010	00BI2-ST017-NSD-010	00BI2-ST018-NSD-010	00BI2-ST019-NSD-010
				NR	NR	NR	NR
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	NR	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	NR	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	NR	92 (NT)	NR	84 (NT)	NR
	48-h	Survival (%)	NR	8 (NT)	NR	44 (NT)	NR
		Overall (H or S)	NR	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	NR	90 (NT)	NR	80 (NT)	NR
	48-h	Survival (%)	NR	88 (NT)	NR	66 (NT)	NR
		Overall (H or S)	NR	NT	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST020-NSD-010	00BI2-ST021-NSD-010	00BI2-ST022-NSD-010	00BI2-ST023-NSD-010
			NR	NR	NR	NR
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	4.2 (NT)	8.9 (NT)	19 (NT)	11 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	38.2 (T)	NR	69.4 (NT)	NR
	96-h	Germling Cell Number	2.70 (NT)	NR	5.00 (NT)	NR
	96-h	Germling Length (µm)	22.31 (NT)	NR	38.02 (NT)	NR
		Overall (G or G)	T	NR	NT	NR
	96-h	Germination (%)	84.8 (T)	NR	89.6 (T)	NR
	96-h	Germling Cell Number	9.96 (NT)	NR	9.00 (NT)	NR
	96-h	Germling Length (µm)	66.52 (NT)	NR	66.62 (NT)	NR
		Overall (G or G)	T	NR	T	NR
	96-h	Germination (%)	92.4 (NT)	NR	93.4 (NT)	NR
	96-h	Germling Cell Number	10.54 (NT)	NR	8.88 (NT)	NR
	96-h	Germling Length (µm)	74.43 (NT)	NR	70.78 (NT)	NR
		Overall (G or G)	NT	NR	NT	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	41 (T)	30 (T)	52 (T)	51 (T)
Hyalella azteca	10-d	Survival (%)	75 (NT)	60 (T)	88 (NT)	90 (NT)
	10-d	Growth (mm)	2.43 (NT)	2.74 (NT)	2.36 (NT)	2.53 (NT)
	10-d	Overall (S or G)	NT	T	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST020-NSD-010	00BI2-ST021-NSD-010	00BI2-ST022-NSD-010	00BI2-ST023-NSD-010
			NR	NR	NR	NR
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	90 (NT)	43 (T)	88 (NT)	98 (NT)
	28-d	Growth (mm)	4.53 (NT)	4.16 (NT)	3.23 (NT)	4.01 (NT)
	28-d	Overall (S or G)	NT	T	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	31 (NT)	NR	35.4 (NT)	NR
	48-h	Development (%NP)	0.0 (NT)	NR	0.0 (NT)	NR
		Overall (F or D)	NT	NR	NT	NR
	30-m	Fertilization (%EF)	52 (T)	NR	88 (NT)	NR
	48-h	Development (%NP)	0.0 (T)	NR	0.0 (T)	NR
		Overall (F or D)	T	NR	T	NR
	30-m	Fertilization (%EF)	67.4 (T)	NR	96.6 (NT)	NR
	48-h	Development (%NP)	0.0 (T)	NR	11.2 (T)	NR
		Overall (F or D)	T	NR	T	NR
Community Structure	LT	Normalized Index	0.295	0.79	0.63	0.675
	LT	Pollution Indicator Species (#/35.4 cm^2)	2	8.4	8	2.6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	20.2	0.4	0.8
	LT	Richness (# species/35.4 cm^2)	2	15	8	8
	LT	Total Abundance (#/35.4 cm^2)	2	30.2	9.4	4
	LT	Overall	I	NI	NI	NI
Nereis virens	28-d	Survival (%)	NR	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou d'Inde - Lockport Marsh.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BI2-ST020-NSD-010	00BI2-ST021-NSD-010	00BI2-ST022-NSD-010	00BI2-ST023-NSD-010
			NR	NR	NR	NR
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	84 (NT)	NR	82 (NT)	NR
	48-h	Survival (%)	60 (NT)	NR	76 (NT)	NR
		Overall (H or S)	NT	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST001-NSD-010	00UC2-ST003-NSD-010	00UC2-ST004-NSD-010	00UC2-ST005-NSD-010
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	17 (NT)	0.4 (T)	2.8 (NT)	19 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	100% PW	88.6 (NT)	43.8 (T)	NR	89.2 (NT)
	96-h	Germling Cell Number	100% PW	11.34 (NT)	1.66 (NT)	NR	12.26 (NT)
	96-h	Germling Length (µm)	100% PW	77.47 (NT)	15.31 (T)	NR	75.75 (NT)
		Overall (G or G)	100% PW	NT	T	NR	NT
	96-h	Germination (%)	50% PW	92.6 (NT)	86.4 (T)	NR	93.2 (NT)
	96-h	Germling Cell Number	50% PW	10.88 (NT)	8.32 (NT)	NR	11.18 (NT)
	96-h	Germling Length (µm)	50% PW	76.56 (NT)	60.94 (NT)	NR	70.68 (NT)
		Overall (G or G)	50% PW	NT	T	NR	NT
	96-h	Germination (%)	25% PW	92.6 (NT)	93.8 (NT)	NR	92 (NT)
	96-h	Germling Cell Number	25% PW	8.16 (NT)	10.10 (NT)	NR	10.22 (NT)
	96-h	Germling Length (µm)	25% PW	68.55 (NT)	67.43 (NT)	NR	69.36 (NT)
		Overall (G or G)	25% PW	NT	NT	NR	NT
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	WS	64 (NT)	71 (NT)	52 (T)	36 (T)
Hyalella azteca	10-d	Survival (%)	WS	83 (NT)	90 (NT)	95 (NT)	70 (T)
	10-d	Growth (mm)	WS	2.43 (NT)	2.83 (NT)	2.58 (NT)	2.40 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT	T

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST001-NSD-010	00UC2-ST003-NSD-010	00UC2-ST004-NSD-010	00UC2-ST005-NSD-010
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	WS	78 (T)	95 (NT)	88 (NT)	60(T)
	28-d	Growth (mm)	WS	2.82 (T)	4.25 (NT)	3.35 (NT)	3.12 (T)
	28-d	Overall (S or G)	WS	T	NT	NT	T
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	95.8 (NT)	1.2 (T)	NR	60 (T)
	48-h	Development (%NP)	100% PW	50.2 (NT)	0.0 (NT)	NR	84.4 (NT)
		Overall (F or D)	100% PW	NT	T	NR	NT
	30-m	Fertilization (%EF)	50% PW	97 (NT)	24.4 (T)	NR	96.2 (NT)
	48-h	Development (%NP)	50% PW	87.6 (NT)	0.0 (T)	NR	84.2 (NT)
		Overall (F or D)	50% PW	NT	T	NR	NT
	30-m	Fertilization (%EF)	25% PW	97.4 (NT)	41.2 (T)	NR	96.4 (NT)
	48-h	Development (%NP)	25% PW	89.6 (NT)	0.0 (T)	NR	87.0 (NT)
		Overall (F or D)	25% PW	NT	T	NR	NT
Community Structure	LT	Normalized Index	WS	0.485	0.258	0.388	0.395
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	3.2	1.2	12.8	3.4
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	9	1	6	5
	LT	Total Abundance (#/35.4 cm^2)	WS	4.8	1.2	13.4	4.6
	LT	Overall	WS	NI	I	NI	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST001-NSD-010	00UC2-ST003-NSD-010	00UC2-ST004-NSD-010	00UC2-ST005-NSD-010
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	8 (NT)	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	22 (NT)	40 (NT)	NR	48 (NT)
	48-h	Survival (%)	50% PW	6 (NT)	0 (NT)	NR	2 (NT)
		Overall (H or S)	50% PW	NT	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	76 (NT)	74 (NT)	NR	86 (NT)
	48-h	Survival (%)	25% PW	48 (NT)	60 (NT)	NR	66 (NT)
		Overall (H or S)	25% PW	NT	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST013-NSD-010	00UC2-ST014-NSD-010	00UC2-ST030-NSD-010	00UC2-ST031-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	19 (NT)	7.9 (NT)	7.2 (NT)	6.7 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	94 (NT)	NR	NR	NR
	96-h	Germling Cell Number	10.48 (NT)	NR	NR	NR
	96-h	Germling Length (µm)	70.47 (NT)	NR	NR	NR
		Overall (G or G)	NT	NR	NR	NR
	96-h	Germination (%)	94.4 (NT)	NR	NR	NR
	96-h	Germling Cell Number	9.12 (NT)	NR	NR	NR
	96-h	Germling Length (µm)	68.55 (NT)	NR	NR	NR
		Overall (G or G)	NT	NR	NR	NR
	96-h	Germination (%)	96 (NT)	NR	NR	NR
	96-h	Germling Cell Number	7.36 (NT)	NR	NR	NR
	96-h	Germling Length (µm)	67.13 (NT)	NR	NR	NR
		Overall (G or G)	NT	NR	NR	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	57 (T)	66 (NT)	75 (NT)	72 (NT)
Hyalella azteca	10-d	Survival (%)	70 (T)	98 (NT)	90 (NT)	93 (NT)
	10-d	Growth (mm)	2.46 (NT)	2.98 (NT)	2.97 (NT)	3.34 (NT)
	10-d	Overall (S or G)	T	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST013-NSD-010	00UC2-ST014-NSD-010	00UC2-ST030-NSD-010	00UC2-ST031-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	78 (T)	88 (NT)	100 (NT)	95 (NT)
	28-d	Growth (mm)	3.51 (NT)	4.02 (NT)	3.86 (NT)	4.64 (NT)
	28-d	Overall (S or G)	T	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	91.4 (NT)	NR	NR	NR
	48-h	Development (%NP)	0.0 (NT)	NR	NR	NR
		Overall (F or D)	NT	NR	NR	NR
	30-m	Fertilization (%EF)	93.4 (NT)	NR	NR	NR
	48-h	Development (%NP)	13.6 (NT)	NR	NR	NR
		Overall (F or D)	NT	NR	NR	NR
	30-m	Fertilization (%EF)	96.8 (NT)	NR	NR	NR
	48-h	Development (%NP)	82.6 (NT)	NR	NR	NR
		Overall (F or D)	NT	NR	NR	NR
Community Structure	LT	Normalized Index	0.663	0.77	0.395	0.345
	LT	Pollution Indicator Species (#/35.4 cm^2)	3.8	10	2.8	8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	1.2	11.2	0	0
	LT	Richness (# species/35.4 cm^2)	7	20	6	4
	LT	Total Abundance (#/35.4 cm^2)	6.4	22.8	3.2	8.2
	LT	Overall	NI	NI	NI	NI
Nereis virens	28-d	Survival (%)	NR	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Calcasieu River.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST013-NSD-010	00UC2-ST014-NSD-010	00UC2-ST030-NSD-010	00UC2-ST031-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR	NR	NR
	48-h	Survival (%)	0 (NT)	NR	NR	NR
		Overall (H or S)	NT	NR	NR	NR
	24-h	Hatch/Survival (%)	82 (NT)	NR	NR	NR
	48-h	Survival (%)	36 (NT)	NR	NR	NR
		Overall (H or S)	NT	NR	NR	NR
	24-h	Hatch/Survival (%)	92 (NT)	NR	NR	NR
	48-h	Survival (%)	82 (NT)	NR	NR	NR
		Overall (H or S)	NT	NR	NR	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST007-NSD-010	00UC2-ST008-NSD-010	00UC2-ST010-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	18 (NT)	15 (NT)	5.9 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	89 (NT)	NR	NR
	96-h	Germling Cell Number	100% PW	9.30 (NT)	NR	NR
	96-h	Germling Length (µm)	100% PW	63.88 (NT)	NR	NR
		Overall (G or G)	100% PW	NT	NR	NR
	96-h	Germination (%)	50% PW	92.8 (NT)	NR	NR
	96-h	Germling Cell Number	50% PW	9.04 (NT)	NR	NR
	96-h	Germling Length (µm)	50% PW	63.98 (NT)	NR	NR
		Overall (G or G)	50% PW	NT	NR	NR
	96-h	Germination (%)	25% PW	93.6 (NT)	NR	NR
	96-h	Germling Cell Number	25% PW	6.62 (NT)	NR	NR
	96-h	Germling Length (µm)	25% PW	58.61 (NT)	NR	NR
		Overall (G or G)	25% PW	NT	NR	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	31 (T)	45 (T)	53 (T)
Hyalella azteca	10-d	Survival (%)	WS	80 (NT)	80 (NT)	75 (NT)
	10-d	Growth (mm)	WS	2.55 (NT)	2.51 (NT)	2.53 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST007-NSD-010	00UC2-ST008-NSD-010	00UC2-ST010-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	85 (NT)	90 (NT)	93 (NT)
	28-d	Growth (mm)	WS	3.73 (NT)	3.54 (NT)	3.36 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	89.4 (NT)	NR	NR
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	NR
		Overall (F or D)	100% PW	NT	NR	NR
	30-m	Fertilization (%EF)	50% PW	95.8 (NT)	NR	NR
	48-h	Development (%NP)	50% PW	0.0 (T)	NR	NR
		Overall (F or D)	50% PW	T	NR	NR
	30-m	Fertilization (%EF)	25% PW	96.4 (NT)	NR	NR
	48-h	Development (%NP)	25% PW	85.8 (NT)	NR	NR
		Overall (F or D)	25% PW	NT	NR	NR
Community Structure	LT	Normalized Index	WS	0.385	0.398	0.695
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	2.2	2	6.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0.6
	LT	Richness (# species/35.4 cm^2)	WS	5	6	9
	LT	Total Abundance (#/35.4 cm^2)	WS	2.4	2.4	10.6
	LT	Overall	WS	I	I	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST007-NSD-010	00UC2-ST008-NSD-010	00UC2-ST010-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	NR
	48-h	Survival (%)	100% PW	0 (NT)	NR	NR
		Overall (H or S)	100% PW	NT	NR	NR
	24-h	Hatch/Survival (%)	50% PW	0 (NT)	NR	NR
	48-h	Survival (%)	50% PW	0 (NT)	NR	NR
		Overall (H or S)	50% PW	NT	NR	NR
	24-h	Hatch/Survival (%)	25% PW	80 (NT)	NR	NR
	48-h	Survival (%)	25% PW	72 (NT)	NR	NR
		Overall (H or S)	25% PW	NT	NR	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST011-NSD-010	00UC2-ST012-NSD-010	00UC2-ST037-NSD-010
					NR
Microbial Community					
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	11 (NT)	0.18 (T)	1.6 (NT)
Aquatic Plant Community					
Ulva fasciata	96-h	Germination (%)	89.4 (NT)	NR	91.8 (NT)
	96-h	Germling Cell Number	5.32 (NT)	NR	11.74 (NT)
	96-h	Germling Length (µm)	44.82 (NT)	NR	76.15 (NT)
		Overall (G or G)	NT	NR	NT
	96-h	Germination (%)	93.2 (NT)	NR	95.2 (NT)
	96-h	Germling Cell Number	4.88 (NT)	NR	11.10 (NT)
	96-h	Germling Length (µm)	41.98 (NT)	NR	79.29 (NT)
		Overall (G or G)	NT	NR	NT
	96-h	Germination (%)	94.6 (NT)	NR	93.8 (NT)
	96-h	Germling Cell Number	3.70 (NT)	NR	7.74 (NT)
	96-h	Germling Length (µm)	36.91 (NT)	NR	66.52 (NT)
		Overall (G or G)	NT	NR	NT
Benthic Invertebrate Community					
Ampelisca abdita	10-d	Survival (%)	52 (T)	28 (T)	38 (T)
Hyalella azteca	10-d	Survival (%)	96 (NT)	73 (NT)	90 (NT)
	10-d	Growth (mm)	2.26 (T)	2.27 (NT)	2.38 (NT)
	10-d	Overall (S or G)	T	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST011-NSD-010	00UC2-ST012-NSD-010	00UC2-ST037-NSD-010
					NR
Benthic Invertebrate Community **(cont.)**					
Hyalella azteca (cont.)	28-d	Survival (%)	78 (T)	53 (T)	78 (T)
	28-d	Growth (mm)	3.38 (NT)	3.45 (NT)	3.48 (NT)
	28-d	Overall (S or G)	T	T	T
Arbacia punctulata	30-m	Fertilization (%EF)	88.2 (NT)	NR	96.2 (NT)
	48-h	Development (%NP)	85.4 (NT)	NR	79.2 (NT)
		Overall (F or D)	NT	NR	NT
	30-m	Fertilization (%EF)	91 (NT)	NR	99 (NT)
	48-h	Development (%NP)	86.4 (NT)	NR	85.2 (NT)
		Overall (F or D)	NT	NR	NT
	30-m	Fertilization (%EF)	92.4 (T)	NR	96.4 (NT)
	48-h	Development (%NP)	85.6 (NT)	NR	87.2 (NT)
		Overall (F or D)	T	NR	NT
Community Structure	LT	Normalized Index	0.43	0.408	0.763
	LT	Pollution Indicator Species (#/35.4 cm^2)	13	12.8	8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	0	5.8
	LT	Richness (# species/35.4 cm^2)	8	7	15
	LT	Total Abundance (#/35.4 cm^2)	14.2	13.4	15.2
	LT	Overall	NI	NI	NI
Nereis virens	28-d	Survival (%)	93 (NT)	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Clooney Island Loop.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST011-NSD-010	00UC2-ST012-NSD-010	00UC2-ST037-NSD-010
					NR
Fish Community					
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR	76 (NT)
	48-h	Survival (%)	0 (NT)	NR	36 (NT)
		Overall (H or S)	NT	NR	NT
	24-h	Hatch/Survival (%)	68 (NT)	NR	90 (NT)
	48-h	Survival (%)	10 (NT)	NR	60 (NT)
		Overall (H or S)	NT	NR	NT
	24-h	Hatch/Survival (%)	98 (NT)	NR	94 (NT)
	48-h	Survival (%)	86 (NT)	NR	56 (NT)
		Overall (H or S)	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST021-NSD-010	00UC2-ST022-NSD-010	00UC2-ST023-NSD-010	00UC2-ST024-NSD-010
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	0.24 (T)	2.3 (NT)	20 (NT)	29 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	100% PW	48.8 (T)	NR	93 (NT)	NR
	96-h	Germling Cell Number	100% PW	1.02 (T)	NR	10.26 (NT)	NR
	96-h	Germling Length (µm)	100% PW	9.38 (T)	NR	70.02 (NT)	NR
		Overall (G or G)	100% PW	T	NR	NT	NR
	96-h	Germination (%)	50% PW	81.2 (T)	NR	94.8 (NT)	NR
	96-h	Germling Cell Number	50% PW	1.90 (NT)	NR	10.38 (NT)	NR
	96-h	Germling Length (µm)	50% PW	18.66 (T)	NR	72.15 (NT)	NR
		Overall (G or G)	50% PW	T	NR	NT	NR
	96-h	Germination (%)	25% PW	91.2 (T)	NR	95.6 (NT)	NR
	96-h	Germling Cell Number	25% PW	2.22 (NT)	NR	10.18 (NT)	NR
	96-h	Germling Length (µm)	25% PW	20.99 (T)	NR	71.69 (NT)	NR
		Overall (G or G)	25% PW	T	NR	NT	NR
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	WS	54 (T)	26 (T)	69 (NT)	71 (NT)
Hyalella azteca	10-d	Survival (%)	WS	90 (NT)	20 (T)	98 (NT)	100 (NT)
	10-d	Growth (mm)	WS	2.34 (NT)	2.37 (NT)	3.30 (NT)	2.74 (NT)
	10-d	Overall (S or G)	WS	NT	T	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST021-NSD-010	00UC2-ST022-NSD-010	00UC2-ST023-NSD-010	00UC2-ST024-NSD-010
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	WS	73 (T)	35 (T)	93 (NT)	93 (NT)
	28-d	Growth (mm)	WS	3.27 (NT)	4.47 (NT)	5.03 (NT)	4.24 (NT)
	28-d	Overall (S or G)	WS	T	T	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	43.8 (NT)	NR	51.8 (NT)	93 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NT	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	89.8 (NT)	NR	87.8 (NT)	NR
	48-h	Development (%NP)	50% PW	81.6 (NT)	NR	85.4 (NT)	NR
		Overall (F or D)	50% PW	NT	NR	NT	NR
	30-m	Fertilization (%EF)	25% PW	94.2 (NT)	NR	96 (NT)	NR
	48-h	Development (%NP)	25% PW	85.6 (NT)	NR	84.2 (NT)	NR
		Overall (F or D)	25% PW	NT	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.633	0.353	0.463	0.665
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	11.2	6	6.2	3.8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.6	0	0	1
	LT	Richness (# species/35.4 cm^2)	WS	8	4	9	8
	LT	Total Abundance (#/35.4 cm^2)	WS	12.4	6.2	6.8	5
	LT	Overall	WS	NI	NI	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR	NR

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST021-NSD-010	00UC2-ST022-NSD-010	00UC2-ST023-NSD-010	00UC2-ST024-NSD-010
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	2 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	60 (NT)	NR	2 (NT)	NR
	48-h	Survival (%)	50% PW	2 (NT)	NR	0 (NT)	NR
		Overall (H or S)	50% PW	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	86 (NT)	NR	92 (NT)	NR
	48-h	Survival (%)	25% PW	80 (NT)	NR	70 (NT)	NR
		Overall (H or S)	25% PW	NT	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST025-NSD-010	00UC2-ST026-NSD-010	00UC2-ST027-NSD-010	00UC2-ST028-NSD-010	00UC2-ST029-NSD-010
				NR	NR	NR	NR
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	2.9 (NT)	18 (NT)	24 (NT)	1.6 (NT)	3.7 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	85.2 (NT)	NR	91.6 (NT)	NR	87.6 (NT)
	96-h	Germling Cell Number	7.22 (NT)	NR	8.76 (NT)	NR	9.78 (NT)
	96-h	Germling Length (µm)	58.81 (NT)	NR	64.79 (NT)	NR	65.71 (NT)
		Overall (G or G)	NT	NR	NT	NR	NT
	96-h	Germination (%)	90.6 (T)	NR	91.4 (NT)	NR	88.2 (T)
	96-h	Germling Cell Number	7.34 (NT)	NR	9.58 (NT)	NR	11.44 (NT)
	96-h	Germling Length (µm)	60.43 (NT)	NR	68.85 (NT)	NR	73.72 (NT)
		Overall (G or G)	T	NR	NT	NR	T
	96-h	Germination (%)	88.6 (T)	NR	93.8 (NT)	NR	92.8 (NT)
	96-h	Germling Cell Number	6.20 (NT)	NR	8.48 (NT)	NR	11.32 (NT)
	96-h	Germling Length (µm)	57.29 (NT)	NR	68.65 (NT)	NR	76.96 (NT)
		Overall (G or G)	T	NR	NT	NR	NT
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	47 (T)	60 (T)	57 (T)	0 (T)	37 (T)
Hyalella azteca	10-d	Survival (%)	83 (NT)	68 (T)	65 (T)	20 (T)	93 (NT)
	10-d	Growth (mm)	2.49 (NT)	2.58 (NT)	2.56 (NT)	2.37 (NT)	2.66 (NT)
	10-d	Overall (S or G)	NT	T	T	T	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST025-NSD-010	00UC2-ST026-NSD-010	00UC2-ST027-NSD-010	00UC2-ST028-NSD-010	00UC2-ST029-NSD-010
				NR	NR	NR	NR
Benthic Invertebrate Community **(cont.)**							
Arbacia punctulata	28-d	Survival (%)	90 (NT)	90 (NT)	93 (NT)	10 (T)	90 (NT)
	28-d	Growth (mm)	3.64 (NT)	3.56 (NT)	4.63 (NT)	4.11 (NT)	4.64 (NT)
	28-d	Overall (S or G)	NT	NT	NT	T	NT
	30-m	Fertilization (%EF)	82.8 (NT)	NR	92.8 (NT)	NR	77.8 (NT)
	48-h	Development (%NP)	0.0 (NT)	NR	8.8 (NT)	NR	0.0 (NT)
		Overall (F or D)	NT	NR	NT	NR	NT
	30-m	Fertilization (%EF)	96.8 (NT)	NR	95.6 (NT)	NR	91.8 (NT)
	48-h	Development (%NP)	86.2 (NT)	NR	87.4 (NT)	NR	44.6 (NT)
		Overall (F or D)	NT	NR	NT	NR	NT
	30-m	Fertilization (%EF)	98.2 (NT)	NR	97.8 (NT)	NR	96.2 (NT)
	48-h	Development (%NP)	85.8 (NT)	NR	85.0 (NT)	NR	87.6 (NT)
		Overall (F or D)	NT	NR	NT	NR	NT
Community Structure	LT	Normalized Index	0.808	0.668	0.583	0.243	0.418
	LT	Pollution Indicator Species (#/35.4 cm^2)	2.4	9	8.4	0.6	1.6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	5	1.8	0.2	0	0
	LT	Richness (# species/35.4 cm^2)	13	8	7	1	6
	LT	Total Abundance (#/35.4 cm^2)	8.8	11.2	9.4	0.6	2.4
	LT	Overall	NI	NI	NI	NI	NI
Nereis virens	28-d	Survival (%)	NR	NR	NR	98 (NT)	NR

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Coon Island.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST025-NSD-010	00UC2-ST026-NSD-010	00UC2-ST027-NSD-010	00UC2-ST028-NSD-010	00UC2-ST029-NSD-010
				NR	NR	NR	NR
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	2 (NT)	NR	0 (NT)	NR	62 (NT)
	48-h	Survival (%)	0 (NT)	NR	0 (NT)	NR	0 (NT)
		Overall (H or S)	NT	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	88 (NT)	NR	30 (NT)	NR	84 (NT)
	48-h	Survival (%)	60 (NT)	NR	10 (NT)	NR	56 (NT)
		Overall (H or S)	NT	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	96 (NT)	NR	82 (NT)	NR	92 (NT)
	48-h	Survival (%)	84 (NT)	NR	66.8 (NT)	NR	66 (NT)
		Overall (H or S)	NT	NR	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST015-NSD-010	00UC2-ST016-NSD-010	00UC2-ST017-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	16 (NT)	24 (NT)	13 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	90.2 (NT)	NR	50.6 (T)
	96-h	Germling Cell Number	100% PW	9.46 (NT)	NR	3.96 (NT)
	96-h	Germling Length (µm)	100% PW	66.21 (NT)	NR	32.14 (NT)
		Overall (G or G)	100% PW	NT	NR	T
	96-h	Germination (%)	50% PW	96 (NT)	NR	84.4 (T)
	96-h	Germling Cell Number	50% PW	9.64 (NT)	NR	10.84 (NT)
	96-h	Germling Length (µm)	50% PW	73.52 (NT)	NR	75.04 (NT)
		Overall (G or G)	50% PW	NT	NR	T
	96-h	Germination (%)	25% PW	96 (NT)	NR	91.8 (T)
	96-h	Germling Cell Number	25% PW	7.48 (NT)	NR	11.28 (NT)
	96-h	Germling Length (µm)	25% PW	69.66 (NT)	NR	80.11 (NT)
		Overall (G or G)	25% PW	NT	NR	T
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	75 (NT)	70 (NT)	65 (NT)
Hyalella azteca	10-d	Survival (%)	WS	90 (NT)	98 (NT)	95 (NT)
	10-d	Growth (mm)	WS	3.30 (NT)	3.20 (NT)	2.44 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST015-NSD-010	00UC2-ST016-NSD-010	00UC2-ST017-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	95 (NT)	100 (NT)	85 (NT)
	28-d	Growth (mm)	WS	3.53 (NT)	4.53 (NT)	3.71 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	46 (NT)	NR	18.4 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	83 (NT)	NR	40.4 (T)
	48-h	Development (%NP)	50% PW	1.6 (NT)	NR	0.0 (T)
		Overall (F or D)	50% PW	NT	NR	T
	30-m	Fertilization (%EF)	25% PW	95.8 (NT)	NR	52 (T)
	48-h	Development (%NP)	25% PW	86.8 (NT)	NR	0.2 (T)
		Overall (F or D)	25% PW	NT	NR	T
Community Structure	LT	Normalized Index	WS	0.248	0.248	0.295
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	6	0.8	0.6
	LT	Richness (# species/35.4 cm^2)	WS	0	0	0
	LT	Total Abundance (#/35.4 cm^2)	WS	1	1	2
	LT	Overall	WS	6	0.8	0.6
	LT		WS	I	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00UC2-ST015-NSD-010	00UC2-ST016-NSD-010	00UC2-ST017-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	10 (NT)	NR	0 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	78 (NT)	NR	38 (NT)
	48-h	Survival (%)	25% PW	58 (NT)	NR	20 (NT)
		Overall (H or S)	25% PW	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST018-NSD-010	00UC2-ST019-NSD-010	00UC2-ST020-NSD-010
Microbial Community					
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	13 (NT)	33 (NT)	17 (NT)
Aquatic Plant Community					
Ulva fasciata	96-h	Germination (%)	NR	92.8 (NT)	NR
	96-h	Germling Cell Number	NR	11.64 (NT)	NR
	96-h	Germling Length (µm)	NR	77.27 (NT)	NR
		Overall (G or G)	NR	NT	NR
	96-h	Germination (%)	NR	95.6 (NT)	NR
	96-h	Germling Cell Number	NR	11.98 (NT)	NR
	96-h	Germling Length (µm)	NR	80.92 (NT)	NR
		Overall (G or G)	NR	NT	NR
	96-h	Germination (%)	NR	93.4 (NT)	NR
	96-h	Germling Cell Number	NR	11.88 (NT)	NR
	96-h	Germling Length (µm)	NR	83.45 (NT)	NR
		Overall (G or G)	NR	NT	NR
Benthic Invertebrate Community					
Ampelisca abdita	10-d	Survival (%)	65 (NT)	66 (NT)	63 (NT)
Hyalella azteca	10-d	Survival (%)	73 (NT)	88 (NT)	95 (NT)
	10-d	Growth (mm)	2.55 (NT)	3.27 (NT)	2.80 (NT)
	10-d	Overall (S or G)	NT	NT	NT

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST018-NSD-010	00UC2-ST019-NSD-010	00UC2-ST020-NSD-010
Benthic Invertebrate Community **(cont.)**					
Hyalella azteca (cont.)	28-d	Survival (%)	93 (NT)	95 (NT)	98 (NT)
	28-d	Growth (mm)	3.71 (NT)	4.47 (NT)	3.90 (NT)
	28-d	Overall (S or G)	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	NR	88.8 (NT)	NR
	48-h	Development (%NP)	NR	0.0 (NT)	NR
		Overall (F or D)	NR	NT	NR
	30-m	Fertilization (%EF)	NR	98 (NT)	NR
	48-h	Development (%NP)	NR	7.2 (NT)	NR
		Overall (F or D)	NR	NT	NR
	30-m	Fertilization (%EF)	NR	97.4 (NT)	NR
	48-h	Development (%NP)	NR	89.8 (NT)	NR
		Overall (F or D)	NR	NT	NR
Community Structure	LT	Normalized Index	0.345	0.31	0.368
	LT	Pollution Indicator Species (#/35.4 cm^2)	4.6	1.2	2
	LT	Richness (# species/35.4 cm^2)	0	0	0
	LT	Total Abundance (#/35.4 cm^2)	4	2	4
	LT	Overall	4.6	1.2	2.8
	LT		NI	NI	NI
Nereis virens	28-d	Survival (%)	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Contraband Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00UC2-ST018-NSD-010	00UC2-ST019-NSD-010	00UC2-ST020-NSD-010
Fish Community					
Sciaenops ocellatus	24-h	Hatch/Survival (%)	NR	20 (NT)	NR
	48-h	Survival (%)	NR	0 (NT)	NR
		Overall (H or S)	NR	NT	NR
	24-h	Hatch/Survival (%)	NR	82 (NT)	NR
	48-h	Survival (%)	NR	30 (NT)	NR
		Overall (H or S)	NR	NT	NR
	24-h	Hatch/Survival (%)	NR	98 (NT)	NR
	48-h	Survival (%)	NR	94 (NT)	NR
		Overall (H or S)	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST008-NSD-010	00LC2-ST009-NSD-010	00LC2-ST010-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	20 (NT)	22 (NT)	13 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	NR	96.4 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	8.62 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	63.58 (NT)	NR
		Overall (G or G)	100% PW	NR	NT	NR
	96-h	Germination (%)	50% PW	NR	96 (NT)	NR
	96-h	Germling Cell Number	50% PW	NR	8.74 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	67.94 (NT)	NR
		Overall (G or G)	50% PW	NR	NT	NR
	96-h	Germination (%)	25% PW	NR	96.2 (NT)	NR
	96-h	Germling Cell Number	25% PW	NR	7.04 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	62.67 (NT)	NR
		Overall (G or G)	25% PW	NR	NT	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	67 (NT)	67 (NT)	55 (T)
Hyalella azteca	10-d	Survival (%)	WS	93 (NT)	93 (NT)	95 (NT)
	10-d	Growth (mm)	WS	3.07 (NT)	2.98 (NT)	3.00 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST008-NSD-010	00LC2-ST009-NSD-010	00LC2-ST010-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	100 (NT)	80 (T)	90 (NT)
	28-d	Growth (mm)	WS	3.78 (NT)	4.05 (NT)	4.10 (NT)
	28-d	Overall (S or G)	WS	NT	T	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	87 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	96.2 (NT)	NR
	48-h	Development (%NP)	50% PW	NR	0.0 (T)	NR
		Overall (F or D)	50% PW	NR	T	NR
	30-m	Fertilization (%EF)	25% PW	NR	95.8 (NT)	NR
	48-h	Development (%NP)	25% PW	NR	85.8 (NT)	NR
		Overall (F or D)	25% PW	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.603	0.585	0.318
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	1.8	3.8	4.8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.2	0.2	0
	LT	Richness (# species/35.4 cm^2)	WS	7	7	3
	LT	Total Abundance (#/35.4 cm^2)	WS	2.2	4.2	4.8
	LT	Overall	WS	NI	NI	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST008-NSD-010	00LC2-ST009-NSD-010	00LC2-ST010-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	48 (NT)	NR
	48-h	Survival (%)	50% PW	NR	4 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	90 (NT)	NR
	48-h	Survival (%)	25% PW	NR	66 (NT)	NR
		Overall (H or S)	25% PW	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00LC2-ST011-NSD-010	00LC2-ST012-NSD-010
Microbial Community				
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	37 (NT)	5.6 (NT)
Aquatic Plant Community				
Ulva fasciata	96-h	Germination (%)	93.8 (NT)	NR
	96-h	Germling Cell Number	10.06 (NT)	NR
	96-h	Germling Length (µm)	66.32 (NT)	NR
		Overall (G or G)	NT	NR
	96-h	Germination (%)	94.2 (NT)	NR
	96-h	Germling Cell Number	10.46 (NT)	NR
	96-h	Germling Length (µm)	71.89 (NT)	NR
		Overall (G or G)	NT	NR
	96-h	Germination (%)	94.8 (NT)	NR
	96-h	Germling Cell Number	10.10 (NT)	NR
	96-h	Germling Length (µm)	74.02 (NT)	NR
		Overall (G or G)	NT	NR
Benthic Invertebrate Community				
Ampelisca abdita	10-d	Survival (%)	60 (T)	72 (NT)
Hyalella azteca	10-d	Survival (%)	95 (NT)	90 (NT)
	10-d	Growth (mm)	2.99 (NT)	2.85 (NT)
	10-d	Overall (S or G)	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00LC2-ST011-NSD-010	00LC2-ST012-NSD-010
Benthic Invertebrate Community **(cont.)**				
Hyalella azteca (cont.)	28-d	Survival (%)	98 (NT)	100 (NT)
	28-d	Growth (mm)	4.26 (NT)	3.52 (NT)
	28-d	Overall (S or G)	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	43.8 (NT)	NR
	48-h	Development (%NP)	0.0 (NT)	NR
		Overall (F or D)	NT	NR
	30-m	Fertilization (%EF)	78.2 (NT)	NR
	48-h	Development (%NP)	83.0 (NT)	NR
		Overall (F or D)	NT	NR
	30-m	Fertilization (%EF)	94 (NT)	NR
	48-h	Development (%NP)	85.8 (NT)	NR
		Overall (F or D)	NT	NR
Community Structure	LT	Normalized Index	0.335	0.238
	LT	Pollution Indicator Species (#/35.4 cm^2)	1.4	9
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	0
	LT	Richness (# species/35.4 cm^2)	3	1
	LT	Total Abundance (#/35.4 cm^2)	1.4	9
	LT	Overall	I	I
Nereis virens	28-d	Survival (%)	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and porewater from Bayou Olsen.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00LC2-ST011-NSD-010	00LC2-ST012-NSD-010
Fish Community				
Sciaenops ocellatus	24-h	Hatch/Survival (%)	12 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	80 (NT)	NR
	48-h	Survival (%)	62 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	82 (NT)	NR
	48-h	Survival (%)	78 (NT)	NR
		Overall (H or S)	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Moss Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST013-NSD-010	00LC2-ST014-NSD-010	00LC2-ST027-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	0.24 (T)	14 (NT)	0.32 (T)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	94.8 (NT)	NR	92.8 (NT)
	96-h	Germling Cell Number	100% PW	9.84 (NT)	NR	7.74 (NT)
	96-h	Germling Length (µm)	100% PW	67.74 (NT)	NR	55.97 (NT)
		Overall (G or G)	100% PW	NT	NR	NT
	96-h	Germination (%)	50% PW	95.2 (NT)	NR	95.2 (NT)
	96-h	Germling Cell Number	50% PW	10.82 (NT)	NR	10.16 (NT)
	96-h	Germling Length (µm)	50% PW	70.57 (NT)	NR	68.24 (NT)
		Overall (G or G)	50% PW	NT	NR	NT
	96-h	Germination (%)	25% PW	96.4 (NT)	NR	97.2 (NT)
	96-h	Germling Cell Number	25% PW	11.38 (NT)	NR	10.54 (NT)
	96-h	Germling Length (µm)	25% PW	79.19 (NT)	NR	70.68 (NT)
		Overall (G or G)	25% PW	NT	NR	NT
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	85 (NT)	53 (T)	93 (NT)
Hyalella azteca	10-d	Survival (%)	WS	88 (NT)	95 (NT)	93 (NT)
	10-d	Growth (mm)	WS	2.86 (NT)	2.74 (NT)	2.85 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Moss Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST013-NSD-010	00LC2-ST014-NSD-010	00LC2-ST027-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	93 (NT)	93 (NT)	95 (NT)
	28-d	Growth (mm)	WS	4.42 (NT)	3.80 (NT)	3.94 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	92.8 (NT)	NR	37.2 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	94.2 (NT)	NR	91.8 (NT)
	48-h	Development (%NP)	50% PW	35.0 (NT)	NR	0.0 (T)
		Overall (F or D)	50% PW	NT	NR	T
	30-m	Fertilization (%EF)	25% PW	91.8 (T)	NR	94.8 (NT)
	48-h	Development (%NP)	25% PW	87.4 (NT)	NR	78.8 (T)
		Overall (F or D)	25% PW	T	NR	T
Community Structure	LT	Normalized Index	WS	0.395	0.688	0.573
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	28.4	7.6	26.8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	3	0.2
	LT	Richness (# species/35.4 cm^2)	WS	6	8	6
	LT	Total Abundance (#/35.4 cm^2)	WS	29	10.6	27.2
	LT	Overall	WS	NI	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Moss Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST013-NSD-010	00LC2-ST014-NSD-010	00LC2-ST027-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	38 (NT)	NR	8 (NT)
	48-h	Survival (%)	25% PW	14 (NT)	NR	0 (T)
		Overall (H or S)	25% PW	NT	NR	T

Duration of exposure: m = minute; h = hour; d = day; LT = long term.
Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.
Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.
T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lake Prien and Upper Old River downstream of Prien Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST001-NSD-010	00LC2-ST002-NSD-010	00LC2-ST003-NSD-010	00LC2-ST004-NSD-010
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	7.2 (NT)	9.6 (NT)	1.8 (NT)	12 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	100% PW	96.6 (NT)	NR	97 (NT)	NR
	96-h	Germling Cell Number	100% PW	6.04 (NT)	NR	9.28 (NT)	NR
	96-h	Germling Length (µm)	100% PW	54.60 (NT)	NR	64.85 (NT)	NR
		Overall (G or G)	100% PW	NT	NR	NT	NR
	96-h	Germination (%)	50% PW	97.4 (NT)	NR	96.4 (NT)	NR
	96-h	Germling Cell Number	50% PW	6.26 (NT)	NR	9.42 (NT)	NR
	96-h	Germling Length (µm)	50% PW	57.90 (NT)	NR	69.46 (NT)	NR
		Overall (G or G)	50% PW	NT	NR	NT	NR
	96-h	Germination (%)	25% PW	95.2 (NT)	NR	97.4 (NT)	NR
	96-h	Germling Cell Number	25% PW	5.78 (NT)	NR	8.88 (NT)	NR
	96-h	Germling Length (µm)	25% PW	54.25 (NT)	NR	70.37 (NT)	NR
		Overall (G or G)	25% PW	NT	NR	NT	NR
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	WS	85 (NT)	53 (T)	29 (T)	66 (NT)
Hyalella azteca	10-d	Survival (%)	WS	100 (NT)	98 (NT)	78 (NT)	88 (NT)
	10-d	Growth (mm)	WS	2.99 (NT)	2.69 (NT)	2.47 (NT)	2.59 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT	NT

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lake Prien and Upper Old River downstream of Prien Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST001-NSD-010	00LC2-ST002-NSD-010	00LC2-ST003-NSD-010	00LC2-ST004-NSD-010
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	WS	98 (NT)	95 (NT)	93 (NT)	95 (NT)
	28-d	Growth (mm)	WS	4.36 (NT)	3.76 (NT)	3.82 (NT)	4.56 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	92.8 (NT)	NR	77.8 (NT)	95 (NT)
	48-h	Development (%NP)	100% PW	17.2 (NT)	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NT	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	96.8 (NT)	NR	97.2 (NT)	NR
	48-h	Development (%NP)	50% PW	84.2 (NT)	NR	81.4 (NT)	NR
		Overall (F or D)	50% PW	NT	NR	NT	NR
	30-m	Fertilization (%EF)	25% PW	95.4 (NT)	NR	94.4 (NT)	NR
	48-h	Development (%NP)	25% PW	82.8 (NT)	NR	84.8 (NT)	NR
		Overall (F or D)	25% PW	NT	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.433	0.75	0.673	0.59
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	6.2	10.6	27.6	3.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	11	0.4	0.4
	LT	Richness (# species/35.4 cm^2)	WS	8	12	10	6
	LT	Total Abundance (#/35.4 cm^2)	WS	6.8	23.8	28.4	3.6
	LT	Overall	WS	NI	NI	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR	NR

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lake Prien and Upper Old River downstream of Prien Lake.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST001-NSD-010	00LC2-ST002-NSD-010	00LC2-ST003-NSD-010	00LC2-ST004-NSD-010
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	0 (NT)	NR	34 (NT)	NR
	48-h	Survival (%)	50% PW	0 (NT)	NR	4 (NT)	NR
		Overall (H or S)	50% PW	NT	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	64 (NT)	NR	90 (NT)	NR
	48-h	Survival (%)	25% PW	32.2 (NT)	NR	72 (NT)	NR
		Overall (H or S)	25% PW	NT	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Indian Wells Lagoon.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST005-NSD-010	00LC2-ST006-NSD-010	00LC2-ST007-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	0.27 (T)	4.9 (NT)	14 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	0 (T)	NR	68.2 (NT)
	96-h	Germling Cell Number	100% PW	0.00 (T)	NR	4.02 (NT)
	96-h	Germling Length (µm)	100% PW	0.00 (T)	NR	31.03 (NT)
		Overall (G or G)	100% PW	T	NR	NT
	96-h	Germination (%)	50% PW	34.8 (T)	NR	91.2 (NT)
	96-h	Germling Cell Number	50% PW	6.46 (NT)	NR	8.24 (NT)
	96-h	Germling Length (µm)	50% PW	44.41 (NT)	NR	55.87 (NT)
		Overall (G or G)	50% PW	T	NR	NT
	96-h	Germination (%)	25% PW	73.4 (T)	NR	94 (NT)
	96-h	Germling Cell Number	25% PW	6.82 (NT)	NR	8.38 (NT)
	96-h	Germling Length (µm)	25% PW	47.25 (NT)	NR	61.45 (NT)
		Overall (G or G)	25% PW	T	NR	NT
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	0 (T)	0 (T)	2 (T)
Hyalella azteca	10-d	Survival (%)	WS	0 (T)	43 (T)	73 (NT)
	10-d	Growth (mm)	WS	NR	2.16 (T)	2.25 (T)
	10-d	Overall (S or G)	WS	T	T	T

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Indian Wells Lagoon.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST005-NSD-010	00LC2-ST006-NSD-010	00LC2-ST007-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	0 (T)	48 (T)	68 (T)
	28-d	Growth (mm)	WS	NR	3.39 (NT)	4.01 (NT)
	28-d	Overall (S or G)	WS	T	T	T
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	0 (T)	NR	5.8 (T)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	T	NR	T
	30-m	Fertilization (%EF)	50% PW	1 (T)	NR	42.2 (T)
	48-h	Development (%NP)	50% PW	72.0 (NT)	NR	0.0 (T)
		Overall (F or D)	50% PW	T	NR	T
	30-m	Fertilization (%EF)	25% PW	5 (T)	NR	84.2 (T)
	48-h	Development (%NP)	25% PW	81.4 (T)	NR	1.0 (T)
		Overall (F or D)	25% PW	T	NR	T
Community Structure	LT	Normalized Index	WS	0.323	0.363	0.313
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0	1	3.8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	2	4	3
	LT	Total Abundance (#/35.4 cm^2)	WS	0.4	1.2	3.8
	LT	Overall	WS	I	I	I
Nereis virens	28-d	Survival (%)	WS	NR	91 (NT)	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Indian Wells Lagoon.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00LC2-ST005-NSD-010	00LC2-ST006-NSD-010	00LC2-ST007-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	44 (NT)	NR	52 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	94 (NT)	NR	66 (NT)
	48-h	Survival (%)	25% PW	0 (T)	NR	18 (NT)
		Overall (H or S)	25% PW	T	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST011-NSD-010	00SN2-ST012-NSD-010	00SN2-ST013-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	2.1 (NT)	1.7 (NT)	7.7 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	NR	92.2 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	8.96 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	62.06 (NT)	NR
		Overall (G or G)	100% PW	NR	NT	NR
	96-h	Germination (%)	50% PW	NR	94.6 (NT)	NR
	96-h	Germling Cell Number	50% PW	NR	10.28 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	71.89 (NT)	NR
		Overall (G or G)	50% PW	NR	NT	NR
	96-h	Germination (%)	25% PW	NR	95.2 (NT)	NR
	96-h	Germling Cell Number	25% PW	NR	10.64 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	73.41 (NT)	NR
		Overall (G or G)	25% PW	NR	NT	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	91 (NT)	71 (NT)	69 (NT)
Hyalella azteca	10-d	Survival (%)	WS	98 (NT)	98 (NT)	100 (NT)
	10-d	Growth (mm)	WS	2.86 (NT)	2.61 (NT)	2.75 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST011-NSD-010	00SN2-ST012-NSD-010	00SN2-ST013-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	93 (NT)	98 (NT)	98 (NT)
	28-d	Growth (mm)	WS	3.78 (NT)	4.00 (NT)	3.87 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	58.4 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	83 (NT)	NR
	48-h	Development (%NP)	50% PW	NR	0.0 (T)	NR
		Overall (F or D)	50% PW	NR	T	NR
	30-m	Fertilization (%EF)	25% PW	NR	95.4 (NT)	NR
	48-h	Development (%NP)	25% PW	NR	83.4 (NT)	NR
		Overall (F or D)	25% PW	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.328	0.32	0.415
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	16.8	14	2.4
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	3	3	7
	LT	Total Abundance (#/35.4 cm^2)	WS	16.8	14	2.6
	LT	Overall	WS	NI	NI	I
Nereis virens	28-d	Survival (%)	WS	93 (NT)	NR	NR

CDM

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST011-NSD-010	00SN2-ST012-NSD-010	00SN2-ST013-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	0 (NT)	NR
	48-h	Survival (%)	50% PW	NR	0 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	68 (NT)	NR
	48-h	Survival (%)	25% PW	NR	50 (NT)	NR
		Overall (H or S)	25% PW	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00SN2-ST014-NSD-010	00SN2-ST015-NSD-010
Microbial Community				
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	5.4 (NT)	2.0 (NT)
Aquatic Plant Community				
Ulva fasciata	96-h	Germination (%)	94.2 (NT)	NR
	96-h	Germling Cell Number	10.30 (NT)	NR
	96-h	Germling Length (µm)	65.91 (NT)	NR
		Overall (G or G)	NT	NR
	96-h	Germination (%)	96.2 (NT)	NR
	96-h	Germling Cell Number	10.40 (NT)	NR
	96-h	Germling Length (µm)	70.47 (NT)	NR
		Overall (G or G)	NT	NR
	96-h	Germination (%)	96.4 (NT)	NR
	96-h	Germling Cell Number	7.70 (NT)	NR
	96-h	Germling Length (µm)	64.59 (NT)	NR
		Overall (G or G)	NT	NR
Benthic Invertebrate Community				
Ampelisca abdita	10-d	Survival (%)	77 (NT)	77 (NT)
Hyalella azteca	10-d	Survival (%)	100 (NT)	93 (NT)
	10-d	Growth (mm)	2.75 (NT)	2.77 (NT)
	10-d	Overall (S or G)	NT	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00SN2-ST014-NSD-010	00SN2-ST015-NSD-010
Benthic Invertebrate Community **(cont.)**				
Hyalella azteca (cont.)	28-d	Survival (%)	98 (NT)	100 (NT)
	28-d	Growth (mm)	4.11 (NT)	4.27 (NT)
	28-d	Overall (S or G)	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	90.6 (NT)	NR
	48-h	Development (%NP)	18.8 (NT)	NR
		Overall (F or D)	NT	NR
	30-m	Fertilization (%EF)	94.4 (NT)	NR
	48-h	Development (%NP)	84.8 (NT)	NR
		Overall (F or D)	NT	NR
	30-m	Fertilization (%EF)	95 (NT)	NR
	48-h	Development (%NP)	82.6 (NT)	NR
		Overall (F or D)	NT	NR
Community Structure	LT	Normalized Index	0.61	0.475
	LT	Pollution Indicator Species (#/35.4 cm^2)	24.2	21.6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0.2	0
	LT	Richness (# species/35.4 cm^2)	8	11
	LT	Total Abundance (#/35.4 cm^2)	24.6	22.4
	LT	Overall	NI	NI
Nereis virens	28-d	Survival (%)	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Choupique.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00SN2-ST014-NSD-010	00SN2-ST015-NSD-010
Fish Community				
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR
	48-h	Survival (%)	0 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	20 (NT)	NR
	48-h	Survival (%)	12 (NT)	NR
		Overall (H or S)	NT	NR
	24-h	Hatch/Survival (%)	92 (NT)	NR
	48-h	Survival (%)	62 (NT)	NR
		Overall (H or S)	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Grand Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST008-NSD-010	00SN2-ST009-NSD-010	00SN2-ST038-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	23 (NT)	4.7 (NT)	8.0 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	89 (NT)	NR	92 (NT)
	96-h	Germling Cell Number	100% PW	7.42 (NT)	NR	8.34 (NT)
	96-h	Germling Length (µm)	100% PW	56.38 (NT)	NR	64.69 (NT)
		Overall (G or G)	100% PW	NT	NR	NT
	96-h	Germination (%)	50% PW	92.4 (NT)	NR	95.8 (NT)
	96-h	Germling Cell Number	50% PW	9.38 (NT)	NR	8.06 (NT)
	96-h	Germling Length (µm)	50% PW	67.13 (NT)	NR	68.45 (NT)
		Overall (G or G)	50% PW	NT	NR	NT
	96-h	Germination (%)	25% PW	93.2 (NT)	NR	94 (NT)
	96-h	Germling Cell Number	25% PW	7.92 (NT)	NR	6.70 (NT)
	96-h	Germling Length (µm)	25% PW	69.46 (NT)	NR	63.88 (NT)
		Overall (G or G)	25% PW	NT	NR	NT
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	76 (NT)	80 (NT)	82 (NT)
Hyalella azteca	10-d	Survival (%)	WS	85 (NT)	90 (NT)	90 (NT)
	10-d	Growth (mm)	WS	2.75 (NT)	2.25 (T)	2.58 (NT)
	10-d	Overall (S or G)	WS	NT	T	NT

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Grand Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST008-NSD-010	00SN2-ST009-NSD-010	00SN2-ST038-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	90 (NT)	90 (NT)	88 (NT)
	28-d	Growth (mm)	WS	3.02 (T)	3.81 (NT)	3.30 (NT)
	28-d	Overall (S or G)	WS	T	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	58.6 (NT)	NR	92.2 (NT)
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	100% PW	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	82.6 (NT)	NR	92.4 (NT)
	48-h	Development (%NP)	50% PW	2.2 (NT)	NR	4.8 (NT)
		Overall (F or D)	50% PW	NT	NR	NT
	30-m	Fertilization (%EF)	25% PW	96.6 (NT)	NR	95.4 (NT)
	48-h	Development (%NP)	25% PW	84.6 (NT)	NR	87.4 (NT)
		Overall (F or D)	25% PW	NT	NR	NT
Community Structure	LT	Normalized Index	WS	0.248	0.343	0.248
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0.8	2	0.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0
	LT	Richness (# species/35.4 cm^2)	WS	1	4	1
	LT	Total Abundance (#/35.4 cm^2)	WS	0.8	2	0.2
	LT	Overall	WS	I	I	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Grand Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST008-NSD-010	00SN2-ST009-NSD-010	00SN2-ST038-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	100% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	100% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	50% PW	0 (NT)	NR	0 (NT)
		Overall (H or S)	50% PW	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	68 (NT)	NR	4 (NT)
	48-h	Survival (%)	25% PW	50 (NT)	NR	0 (T)
		Overall (H or S)	25% PW	NT	NR	T

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Bois Connine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST006-NSD-010	00SN2-ST035-NSD-010
Microbial Community					
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	12 (NT)	14 (NT)
Aquatic Plant Community					
Ulva fasciata	96-h	Germination (%)	100% PW	86.6 (NT)	NR
	96-h	Germling Cell Number	100% PW	4.94 (NT)	NR
	96-h	Germling Length (µm)	100% PW	44.92 (NT)	NR
		Overall (G or G)	100% PW	NT	NR
	96-h	Germination (%)	50% PW	92.8 (NT)	NR
	96-h	Germling Cell Number	50% PW	4.74 (NT)	NR
	96-h	Germling Length (µm)	50% PW	47.25 (NT)	NR
		Overall (G or G)	50% PW	NT	NR
	96-h	Germination (%)	25% PW	93 (NT)	NR
	96-h	Germling Cell Number	25% PW	5.22 (NT)	NR
	96-h	Germling Length (µm)	25% PW	50.40 (NT)	NR
		Overall (G or G)	25% PW	NT	NR
Benthic Invertebrate Community					
Ampelisca abdita	10-d	Survival (%)	WS	75 (NT)	82 (NT)
Hyalella azteca	10-d	Survival (%)	WS	98 (NT)	95 (NT)
	10-d	Growth (mm)	WS	2.33 (NT)	3.17 (NT)
	10-d	Overall (S or G)	WS	NT	NT

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Bois Connine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST006-NSD-010	00SN2-ST035-NSD-010
Benthic Invertebrate Community **(cont.)**					
Hyalella azteca (cont.)	28-d	Survival (%)	WS	90 (NT)	98 (NT)
	28-d	Growth (mm)	WS	3.43 (NT)	3.75 (NT)
	28-d	Overall (S or G)	WS	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	36 (NT)	NR
	48-h	Development (%NP)	100% PW	0.0 (NT)	NR
		Overall (F or D)	100% PW	NT	NR
	30-m	Fertilization (%EF)	50% PW	90.2 (NT)	NR
	48-h	Development (%NP)	50% PW	83.6 (NT)	NR
		Overall (F or D)	50% PW	NT	NR
	30-m	Fertilization (%EF)	25% PW	93.6 (NT)	NR
	48-h	Development (%NP)	25% PW	83.8 (NT)	NR
		Overall (F or D)	25% PW	NT	NR
Community Structure	LT	Normalized Index	WS	0.245	0.52
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	0.4	3.6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0.2
	LT	Richness (# species/35.4 cm^2)	WS	1	4
	LT	Total Abundance (#/35.4 cm^2)	WS	0.4	3.8
	LT	Overall	WS	I	NI
Nereis virens	28-d	Survival (%)	WS	90 (T)	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Bayou Bois Connine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST006-NSD-010	00SN2-ST035-NSD-010
Fish Community					
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	14 (NT)	NR
	48-h	Survival (%)	100% PW	2 (NT)	NR
		Overall (H or S)	100% PW	NT	NR
	24-h	Hatch/Survival (%)	50% PW	32 (NT)	NR
	48-h	Survival (%)	50% PW	18 (NT)	NR
		Overall (H or S)	50% PW	NT	NR
	24-h	Hatch/Survival (%)	25% PW	92 (NT)	NR
	48-h	Survival (%)	25% PW	76 (NT)	NR
		Overall (H or S)	25% PW	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Johnson Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST003-NSD-010	00SN2-ST004-NSD-010	00SN2-ST005-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	9.7 (NT)	3.3 (NT)	3.8 (NT)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	NR	72.4 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	1.54 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	14.50 (T)	NR
		Overall (G or G)	100% PW	NR	T	NR
	96-h	Germination (%)	50% PW	NR	92.2 (NT)	NR
	96-h	Germling Cell Number	50% PW	NR	1.74 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	21.50 (T)	NR
		Overall (G or G)	50% PW	NR	T	NR
	96-h	Germination (%)	25% PW	NR	96 (NT)	NR
	96-h	Germling Cell Number	25% PW	NR	2.78 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	34.48 (NT)	NR
		Overall (G or G)	25% PW	NR	NT	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	79 (NT)	85 (NT)	83 (NT)
Hyalella azteca	10-d	Survival (%)	WS	98 (NT)	100 (NT)	93 (NT)
	10-d	Growth (mm)	WS	2.87 (NT)	2.56 (NT)	2.56 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT

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Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Johnson Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST003-NSD-010	00SN2-ST004-NSD-010	00SN2-ST005-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	95 (NT)	97 (NT)	100 (NT)
	28-d	Growth (mm)	WS	3.67 (NT)	3.62 (NT)	3.94 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	96 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	81.6 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	95 (NT)	NR
	48-h	Development (%NP)	50% PW	NR	82.0 (NT)	NR
		Overall (F or D)	50% PW	NR	NT	NR
	30-m	Fertilization (%EF)	25% PW	NR	96.8 (NT)	NR
	48-h	Development (%NP)	25% PW	NR	84.6 (NT)	NR
		Overall (F or D)	25% PW	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.728	0.72	0.72
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	28.4	6.8	14
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	1.8	1.6	1.8
	LT	Richness (# species/35.4 cm^2)	WS	16	13	16
	LT	Total Abundance (#/35.4 cm^2)	WS	30.6	9.2	16.6
	LT	Overall	WS	NI	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Johnson Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST003-NSD-010	00SN2-ST004-NSD-010	00SN2-ST005-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	12 (NT)	NR
	48-h	Survival (%)	50% PW	NR	6 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	60 (NT)	NR
	48-h	Survival (%)	25% PW	NR	42 (NT)	NR
		Overall (H or S)	25% PW	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Willow Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST001-NSD-010	00SN2-ST002-NSD-010
Microbial Community					
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	22 (NT)	23 (NT)
Aquatic Plant Community					
Ulva fasciata	96-h	Germination (%)	100% PW	NR	93.6 (NT)
	96-h	Germling Cell Number	100% PW	NR	6.22 (NT)
	96-h	Germling Length (µm)	100% PW	NR	57.70 (NT)
		Overall (G or G)	100% PW	NR	NT
	96-h	Germination (%)	50% PW	NR	93.6 (NT)
	96-h	Germling Cell Number	50% PW	NR	5.86 (NT)
	96-h	Germling Length (µm)	50% PW	NR	55.26 (NT)
		Overall (G or G)	50% PW	NR	NT
	96-h	Germination (%)	25% PW	NR	94.4 (NT)
	96-h	Germling Cell Number	25% PW	NR	5.72 (NT)
	96-h	Germling Length (µm)	25% PW	NR	52.12 (NT)
		Overall (G or G)	25% PW	NR	NT
Benthic Invertebrate Community					
Ampelisca abdita	10-d	Survival (%)	WS	67 (NT)	66 (NT)
Hyalella azteca	10-d	Survival (%)	WS	78 (NT)	80 (NT)
	10-d	Growth (mm)	WS	2.85 (NT)	2.61 (NT)
	10-d	Overall (S or G)	WS	NT	NT

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Willow Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST001-NSD-010	00SN2-ST002-NSD-010
Benthic Invertebrate Community **(cont.)**					
Hyalella azteca (cont.)	28-d	Survival (%)	WS	88 (NT)	88 (NT)
	28-d	Growth (mm)	WS	4.22 (NT)	3.79 (NT)
	28-d	Overall (S or G)	WS	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	83.8 (NT)
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)
		Overall (F or D)	100% PW	NR	NT
	30-m	Fertilization (%EF)	50% PW	NR	94 (NT)
	48-h	Development (%NP)	50% PW	NR	84.8 (NT)
		Overall (F or D)	50% PW	NR	NT
	30-m	Fertilization (%EF)	25% PW	NR	94.6 (NT)
	48-h	Development (%NP)	25% PW	NR	84.6 (NT)
		Overall (F or D)	25% PW	NR	NT
Community Structure	LT	Normalized Index	WS	0.663	0.48
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	3.4	8.2
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.4	0
	LT	Richness (# species/35.4 cm^2)	WS	8	11
	LT	Total Abundance (#/35.4 cm^2)	WS	5.2	10.2
	LT	Overall	WS	NI	NI
Nereis virens	28-d	Survival (%)	WS	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Willow Bayou.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00SN2-ST001-NSD-010	00SN2-ST002-NSD-010
Fish Community					
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)
	48-h	Survival (%)	100% PW	NR	0 (NT)
		Overall (H or S)	100% PW	NR	NT
	24-h	Hatch/Survival (%)	50% PW	NR	74 (NT)
	48-h	Survival (%)	50% PW	NR	52 (NT)
		Overall (H or S)	50% PW	NR	NT
	24-h	Hatch/Survival (%)	25% PW	NR	92 (NT)
	48-h	Survival (%)	25% PW	NR	80 (NT)
		Overall (H or S)	25% PW	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST007-NSD-010	00BV2-ST008-NSD-010	00BV2-ST009-NSD-010	00BV2-ST010-NSD-010
Microbial Community							
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	16 (NT)	0.70 (T)	0.90 (T)	3.1 (NT)
Aquatic Plant Community							
Ulva fasciata	96-h	Germination (%)	100% PW	NR	97 (NT)	NR	93.8 (NT)
	96-h	Germling Cell Number	100% PW	NR	6.66 (NT)	NR	3.08 (NT)
	96-h	Germling Length (µm)	100% PW	NR	59.52 (NT)	NR	34.88 (NT)
		Overall (G or G)	100% PW	NR	NT	NR	NT
	96-h	Germination (%)	50% PW	NR	98 (NT)	NR	96.2 (NT)
	96-h	Germling Cell Number	50% PW	NR	5.94 (NT)	NR	2.94 (NT)
	96-h	Germling Length (µm)	50% PW	NR	54.65 (NT)	NR	32.65 (NT)
		Overall (G or G)	50% PW	NR	NT	NR	NT
	96-h	Germination (%)	25% PW	NR	95.6 (NT)	NR	96.8 (NT)
	96-h	Germling Cell Number	25% PW	NR	5.50 (NT)	NR	2.78 (NT)
	96-h	Germling Length (µm)	25% PW	NR	48.67 (NT)	NR	30.52 (T)
		Overall (G or G)	25% PW	NR	NT	NR	T
Benthic Invertebrate Community							
Ampelisca abdita	10-d	Survival (%)	WS	58 (T)	0 (T)	63 (NT)	61 (T)
Hyalella azteca	10-d	Survival (%)	WS	95 (NT)	93 (NT)	100 (NT)	100 (NT)
	10-d	Growth (mm)	WS	3.05 (NT)	2.68 (NT)	3.06 (NT)	2.77 (NT)
	10-d	Overall (S or G)	WS	NT	NT	NT	NT

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Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST007-NSD-010	00BV2-ST008-NSD-010	00BV2-ST009-NSD-010	00BV2-ST010-NSD-010
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	28-d	Survival (%)	WS	95 (NT)	88 (NT)	93 (NT)	100 (NT)
	28-d	Growth (mm)	WS	3.48 (NT)	4.38 (NT)	4.19 (NT)	3.55 (NT)
	28-d	Overall (S or G)	WS	NT	NT	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	89.4 (NT)	NR	100 (NT)
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR	76.2 (NT)
		Overall (F or D)	100% PW	NR	NT	NR	NT
	30-m	Fertilization (%EF)	50% PW	NR	93 (NT)	NR	95 (NT)
	48-h	Development (%NP)	50% PW	NR	82.4 (NT)	NR	79.8 (NT)
		Overall (F or D)	50% PW	NR	NT	NR	NT
	30-m	Fertilization (%EF)	25% PW	NR	88.6 (T)	NR	96.2 (NT)
	48-h	Development (%NP)	25% PW	NR	85.6 (NT)	NR	83.2 (NT)
		Overall (F or D)	25% PW	NR	T	NR	NT
Community Structure	LT	Normalized Index	WS	0.46	0.325	0.685	0.355
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	7	4.4	10.8	5.8
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0	0	0.8	0
	LT	Richness (# species/35.4 cm^2)	WS	9	3	10	4
	LT	Total Abundance (#/35.4 cm^2)	WS	8	4.8	13	6
	LT	Overall	WS	NI	I	NI	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR	NR

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Upper Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST007-NSD-010	00BV2-ST008-NSD-010	00BV2-ST009-NSD-010	00BV2-ST010-NSD-010
Fish Community							
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	24 (NT)	NR	90 (NT)
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR	88 (NT)
		Overall (H or S)	100% PW	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	50% PW	NR	75 (NT)	NR	96 (NT)
	48-h	Survival (%)	50% PW	NR	66 (NT)	NR	96 (NT)
		Overall (H or S)	50% PW	NR	NT	NR	NT
	24-h	Hatch/Survival (%)	25% PW	NR	82 (NT)	NR	94 (NT)
	48-h	Survival (%)	25% PW	NR	62 (NT)	NR	92 (NT)
		Overall (H or S)	25% PW	NR	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST001-NSD-010	00BV2-ST002-NSD-010	00BV2-ST003-NSD-010
Microbial Community						
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	SPT	1.6 (NT)	1.3 (T)	0.61 (T)
Aquatic Plant Community						
Ulva fasciata	96-h	Germination (%)	100% PW	NR	96 (NT)	NR
	96-h	Germling Cell Number	100% PW	NR	7.94 (NT)	NR
	96-h	Germling Length (µm)	100% PW	NR	59.27 (NT)	NR
		Overall (G or G)	100% PW	NR	NT	NR
	96-h	Germination (%)	50% PW	NR	95.6 (NT)	NR
	96-h	Germling Cell Number	50% PW	NR	10.04 (NT)	NR
	96-h	Germling Length (µm)	50% PW	NR	64.85 (NT)	NR
		Overall (G or G)	50% PW	NR	NT	NR
	96-h	Germination (%)	25% PW	NR	96.2 (NT)	NR
	96-h	Germling Cell Number	25% PW	NR	9.42 (NT)	NR
	96-h	Germling Length (µm)	25% PW	NR	63.98 (NT)	NR
		Overall (G or G)	25% PW	NR	NT	NR
Benthic Invertebrate Community						
Ampelisca abdita	10-d	Survival (%)	WS	0 (T)	0 (T)	0 (T)
Hyalella azteca	10-d	Survival (%)	WS	85 (NT)	83 (NT)	10 (T)
	10-d	Growth (mm)	WS	2.65 (NT)	2.03 (T)	2.09 (T)
	10-d	Overall (S or G)	WS	NT	T	T

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST001-NSD-010	00BV2-ST002-NSD-010	00BV2-ST003-NSD-010
Benthic Invertebrate Community **(cont.)**						
Hyalella azteca (cont.)	28-d	Survival (%)	WS	90 (NT)	48 (T)	15 (T)
	28-d	Growth (mm)	WS	3.42 (NT)	3.52 (NT)	3.52 (NT)
	28-d	Overall (S or G)	WS	NT	T	T
Arbacia punctulata	30-m	Fertilization (%EF)	100% PW	NR	88.6 (NT)	NR
	48-h	Development (%NP)	100% PW	NR	0.0 (NT)	NR
		Overall (F or D)	100% PW	NR	NT	NR
	30-m	Fertilization (%EF)	50% PW	NR	97.2 (NT)	NR
	48-h	Development (%NP)	50% PW	NR	0.0 (T)	NR
		Overall (F or D)	50% PW	NR	T	NR
	30-m	Fertilization (%EF)	25% PW	NR	96.2 (NT)	NR
	48-h	Development (%NP)	25% PW	NR	86.4 (NT)	NR
		Overall (F or D)	25% PW	NR	NT	NR
Community Structure	LT	Normalized Index	WS	0.633	0.433	0.335
	LT	Pollution Indicator Species (#/35.4 cm^2)	WS	9.8	6.6	6
	LT	Pollution Sensitive Species (#/35.4 cm^2)	WS	0.6	0	0
	LT	Richness (# species/35.4 cm^2)	WS	8	8	3
	LT	Total Abundance (#/35.4 cm^2)	WS	10.6	7.6	6.8
	LT	Overall	WS	NI	NI	I
Nereis virens	28-d	Survival (%)	WS	NR	NR	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	Medium Tested	00BV2-ST001-NSD-010	00BV2-ST002-NSD-010	00BV2-ST003-NSD-010
Fish Community						
Sciaenops ocellatus	24-h	Hatch/Survival (%)	100% PW	NR	0 (NT)	NR
	48-h	Survival (%)	100% PW	NR	0 (NT)	NR
		Overall (H or S)	100% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	50% PW	NR	80 (NT)	NR
	48-h	Survival (%)	50% PW	NR	44 (NT)	NR
		Overall (H or S)	50% PW	NR	NT	NR
	24-h	Hatch/Survival (%)	25% PW	NR	84 (NT)	NR
	48-h	Survival (%)	25% PW	NR	28 (NT)	NR
		Overall (H or S)	25% PW	NR	NT	NR

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BV2-ST004-NSD-010	00BV2-ST005-NSD-010	00BV2-ST006-NSD-010
					NR
Microbial Community					
Vibrio fisheri (Microtox™)	25-m	Bioluminescence	0.15 (T)	0.31 (T)	1.1 (T)
Aquatic Plant Community					
Ulva fasciata	96-h	Germination (%)	78.6 (NT)	NR	94.8 (NT)
	96-h	Germling Cell Number	2.92 (NT)	NR	8.26 (NT)
	96-h	Germling Length (µm)	29.00 (NT)	NR	63.22 (NT)
		Overall (G or G)	NT	NR	NT
	96-h	Germination (%)	90 (T)	NR	96.4 (NT)
	96-h	Germling Cell Number	2.98 (NT)	NR	8.14 (NT)
	96-h	Germling Length (µm)	37.42 (NT)	NR	62.26 (NT)
		Overall (G or G)	T	NR	NT
	96-h	Germination (%)	94.4 (NT)	NR	96 (NT)
	96-h	Germling Cell Number	3.12 (NT)	NR	6.42 (NT)
	96-h	Germling Length (µm)	37.47 (NT)	NR	56.18 (NT)
		Overall (G or G)	NT	NR	NT
Benthic Invertebrate Community					
Ampelisca abdita	10-d	Survival (%)	0 (T)	0 (T)	2 (T)
Hyalella azteca	10-d	Survival (%)	15 (T)	65 (T)	90 (NT)
	10-d	Growth (mm)	2.11 (T)	2.16 (T)	2.32 (NT)
	10-d	Overall (S or G)	T	T	NT

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BV2-ST004-NSD-010	00BV2-ST005-NSD-010	00BV2-ST006-NSD-010
					NR
Benthic Invertebrate Community **(cont.)**					
Hyalella azteca (cont.)	28-d	Survival (%)	20 (T)	85 (NT)	88 (NT)
	28-d	Growth (mm)	2.94 (T)	3.39 (NT)	4.16 (NT)
	28-d	Overall (S or G)	T	NT	NT
Arbacia punctulata	30-m	Fertilization (%EF)	1.8 (T)	NR	81.8 (NT)
	48-h	Development (%NP)	0.0 (NT)	NR	0.0 (NT)
		Overall (F or D)	T	NR	NT
	30-m	Fertilization (%EF)	73.8 (T)	NR	93.6 (NT)
	48-h	Development (%NP)	0.0 (T)	NR	0.0 (T)
		Overall (F or D)	T	NR	T
	30-m	Fertilization (%EF)	92.8 (NT)	NR	97.8 (NT)
	48-h	Development (%NP)	74.6 (T)	NR	63.2 (T)
		Overall (F or D)	T	NR	T
Community Structure	LT	Normalized Index	0.325	0.325	0.558
	LT	Pollution Indicator Species (#/35.4 cm^2)	0.4	2	3.4
	LT	Pollution Sensitive Species (#/35.4 cm^2)	0	0	0.2
	LT	Richness (# species/35.4 cm^2)	2	3	5
	LT	Total Abundance (#/35.4 cm^2)	0.6	2.2	3.8
	LT	Overall	I	I	NI
Nereis virens	28-d	Survival (%)	NR	97 (NT)	NR

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Lower Bayou Verdine.

Receptor Group/ Species Tested	Duration of Exposure	Endpoint Measured	00BV2-ST004-NSD-010	00BV2-ST005-NSD-010	00BV2-ST006-NSD-010
					NR
Fish Community					
Sciaenops ocellatus	24-h	Hatch/Survival (%)	0 (NT)	NR	0 (NT)
	48-h	Survival (%)	0 (NT)	NR	0 (NT)
		Overall (H or S)	NT	NR	NT
	24-h	Hatch/Survival (%)	58 (NT)	NR	36 (NT)
	48-h	Survival (%)	28 (NT)	NR	20 (NT)
		Overall (H or S)	NT	NR	NT
	24-h	Hatch/Survival (%)	84 (NT)	NR	60 (NT)
	48-h	Survival (%)	52 (NT)	NR	44 (NT)
		Overall (H or S)	NT	NR	NT

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; % = percent; %EF = percent eggs fertilized; %NP = percent normal plutei.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Control.

Receptor Group/ Species Tested	Endpoint Measured	Medium Tested	00CSD01	00CSD02	CERC POND	CONTROL	CONTROL_N
Microbial Community							
Vibrio fisheri (Microtox™)	Bioluminescence	SPT	NR	NR	3.7 (NT)	3.0 (NT)	NR
Aquatic Plant Community							
Ulva fasciata	Germination (%)	100% PW	NR	93.4 (NT)	NR	NR	NR
	Germling Cell Number	100% PW	NR	2.58 (NT)	NR	NR	NR
	Germling Length (µm)	100% PW	NR	25.91 (NT)	NR	NR	NR
	Overall (G or G)	100% PW	NR	NT	NR	NR	NR
	Germination (%)	50% PW	NR	95.4 (NT)	NR	NR	NR
	Germling Cell Number	50% PW	NR	3.20 (NT)	NR	NR	NR
	Germling Length (µm)	50% PW	NR	33.87 (NT)	NR	NR	NR
	Overall (G or G)	50% PW	NR	NT	NR	NR	NR
	Germination (%)	25% PW	NR	93.2 (NT)	NR	NR	NR
	Germling Cell Number	25% PW	NR	3.42 (NT)	NR	NR	NR
	Germling Length (µm)	25% PW	NR	39.44 (NT)	NR	NR	NR
	Overall (G or G)	25% PW	NR	NT	NR	NR	NR
Benthic Invertebrate Community							
Ampelisca abdita [1]	Survival (%)	WS	90-96 (NT)	NR	NR	NR	NR
Hyalella azteca [2]	Survival (%)	WS	NR	95-97 (NT)	NR	NR	NR
	Growth (mm)	WS	NR	2.32-2.65 (NT)	NR	NR	NR
	Overall (S or G)	WS	NR	NT	NR	NR	NR

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Control.

Receptor Group/ Species Tested	Endpoint Measured	Medium Tested	00CSD01	00CSD02	CERC POND	CONTROL	CONTROL_N
Benthic Invertebrate Community **(cont.)**							
Hyalella azteca (cont.)	Survival (%)	WS	NR	92-93 (NT)	NR	NR	NR
	Growth (mm)	WS	NR	3.63-3.66 (NT)	NR	NR	NR
	Overall (S or G)	WS	NR	NT	NR	NR	NR
Arbacia punctulata	Fertilization (%EF)	100% PW	NR	97.6 (NT)	NR	NR	NR
	Development (%NP)	100% PW	NR	85.2-93.4 (NT)	NR	NR	NR
	Overall (F or D)	100% PW	NR	NT	NR	NR	NR
	Fertilization (%EF)	50% PW	NR	96.9 (NT)	NR	NR	NR
	Development (%NP)	50% PW	NR	85.1-92.2 (NT)	NR	NR	NR
	Overall (F or D)	50% PW	NR	NT	NR	NR	NR
	Fertilization (%EF)	25% PW	NR	97 (NT)	NR	NR	NR
	Development (%NP)	25% PW	NR	85.3-93.1 (NT)	NR	NR	NR
	Overall (F or D)	25% PW	NR	NT	NR	NR	NR
Community Structure	Normalized Index	WS	NR	NR	NR	NR	NR
	Pollution Indicator Species (#/35.4 cm^2)	WS	NR	NR	NR	NR	NR
	Pollution Sensitive Species (#/35.4 cm^2)	WS	NR	NR	NR	NR	NR
	Richness (# species/35.4 cm^2)	WS	NR	NR	NR	NR	NR
	Total Abundance (#/35.4 cm^2)	WS	NR	NR	NR	NR	NR
	Overall	WS	NR	NR	NR	NR	NR
Nereis virens	Survival (%)	WS	NR	NR	NR	NR	99 (NT)

Appendix I
Toxicity Testing

Summary of the data on the biological effects associated with exposure to whole sediments and pore water from Control.

Receptor Group/ Species Tested	Endpoint Measured	Medium Tested	00CSD01	00CSD02	CERC POND	CONTROL	CONTROL_N
Fish Community							
Sciaenops ocellatus [1]	Hatch/Survival (%)	100% PW	NR	80-92 (NT)	NR	NR	NR
	Survival (%)	100% PW	NR	72-88 (NT)	NR	NR	NR
	Overall (H or S)	100% PW	NR	NT	NR	NR	NR
	Hatch/Survival (%)	50% PW	NR	84-94 (NT)	NR	NR	NR
	Survival (%)	50% PW	NR	68-92 (NT)	NR	NR	NR
	Overall (H or S)	50% PW	NR	NT	NR	NR	NR
	Hatch/Survival (%)	25% PW	NR	84-92 (NT)	NR	NR	NR
	Survival (%)	25% PW	NR	74-90 (NT)	NR	NR	NR
	Overall (H or S)	25% PW	NR	NT	NR	NR	NR

[1]Control was run in four series.

[2]Control was run in two series.

Duration of exposure: m = minute; h = hour; d = day; LT = long term.

Endpoint measured: F or D = fertilization or development; G or G = germination or growth; H or S = hatch survival or survival; S or G = survival or growth; T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.

Medium tested: SPT = solid phase test; PW = pore water; WS = whole sediment.

T = Toxic; NT = Not Toxic; I = Impacted; NI = Not Impacted; NR = Not Reported.