DRAFT DIOXIN-LIKE POLYCHLORINATED BIPHENYL (PCB) CONGENERS STUDY WORKPLAN (Revision 1)

Prepared for:

WASTE MANAGEMENT

Chemical Waste Management, Inc.
Kettleman Hills Facility (KHF)
Kings County, California

Prepared by:

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January 2009
(Rev. March 2009)

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Wenck File #0742-816

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List of Acronyms

95% UCL	95th percentile upper confidence limit on the mean
AAMP	Ambient Air Monitoring Program
AUF	area use factor
BTAG	Biological Technical Assistance Group
BW	body weight
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CCR	California Code of Regulations
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
CWMI	Chemical Waste Management, Inc.
cy	cubic yard
DMS	downwind monitoring station
DTSC	Department of Toxic Substances Control
DQO	data quality objectives
EDS	Environmental Disposal Services
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
ERA	ecological risk assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESV	Ecological Screening Value
FSU	final stabilization unit
GPS	Global Positioning System
HHRA	human health risk assessment
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectrometry
HQ	hazard quotient
IRIS	Integrated Risk Information System
KHF	Kettleman Hills Facility
LOAEL	lowest-observed-adverse-effect level
m	meter
m/s	meters per second
msl	mean sea level
mph	miles per hour
MSP	meteorological station pad
MSW	municipal solid waste
$\mu g/m^3$	micrograms per cubic meter

List of Acronyms (cont.)

mg/kg-day	milligrams per kilogram per day
NFA	No Further Action
NOAEL	no-observed-adverse-effect level
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RME	reasonable maximum exposure
SESD	Science and Ecosystem Support Division
SF	slope factor
SLERA	screening-level ecological risk assessment
SMDP	scientific/management decision point
SOP	Standard Operating Procedures
TCDD	tetrachlorodibenzo-p-dioxin
TEC	toxicity equivalence concentration
TEF	toxicity equivalence/equivalency factor
TEQ	toxicity equivalence
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
UCL	upper confidence limit
UMS	upwind monitoring station
US EPA	United States Environmental Protection Agency
USEPA-IX	United States Environmental Protection Agency Region 9
WHO	World Health Organization

1.0 Program Overview

The Chemical Waste Management, Inc. (CWMI) - Kettleman Hills Facility (KHF) is a commercial Class I/II hazardous waste/designated waste treatment, storage, and disposal facility (TSDF), and Class II/III designated waste/municipal solid waste (MSW) disposal facility owned and operated by Waste Management, Inc. (US EPA Facility Identification Number CAT 000646117). In April and July 1997, KHF submitted requests to United States Environmental Protection Agency Region IX (USEPA-IX) to renew the existing KHF Approvals to Operate for landfill B-18 and the Polychlorinated Biphenyl (PCB) Flushing/Storage Unit for continued handling and disposal of PCBs regulated by the Toxic Substances Control Act (TSCA). During the lengthy renewal process, at the request of USEPA-IX, in October 2003 KHF requested a Coordinated Approval, using the (then) recently renewed June 2003 Hazardous Waste Facility "Part B" Permit as the basis for the Coordinated Approval. After another lengthy renewal process, the Draft Coordinated Approval was issued by USEPA-IX February 2007.

Based on public comments on the Draft Coordinated Approval submitted by community stakeholders and environmental activists concerned with the potential impacts of the facility's PCB handling on the surrounding community, USEPA-IX sent a letter to KHF requesting more information prior to making a decision on the coordinated approval. In the letter dated December 2, 2008 (Appendix A) and corresponding attachment, USEPA-IX requested that KHF sample air, soil, and vegetation for PCB congeners with the objective of providing sufficient data to assess the magnitude of potential human and ecological impact to off-site receptors from PCB disposal activities at KHF (hereby referred to as the "Congener Study"). The overall purpose of this Congener Study is to characterize and quantify the potential human and ecological risk posed by the current and accumulated impact from the management, storage, and disposal of PCB contaminated waste at KHF. As determined in several conference calls with USEPA-IX, this study will only focus on the 12 World Health Organization (WHO) Dioxin-Like PCB Congeners due to the risk these compounds pose relative to the other congener species.

This *Draft* Dioxin-Like PCB Congener Study Workplan (Workplan) presents the context within which the study is being directed and includes the following information:

- Discussion of Facility Operations (historic and current);
- Discussion of Surrounding Area land use (historic and current);
- Site Description;
- Topography;
- Climate;
- Results from Previous PCB Studies; and
- 12 WHO Dioxin-Like PCB Congener Study;
    - Sample/Data Acquisition Procedures;
        - Air,
        - Soil,
        - Vegetation (both green and dry phases),
        - Meteorology,
    - Data Analysis;
    - Data Quality Assurance/Quality Control (QA/QC); and
    - Risk Assessment (RA).

The goal of the Congener Study is to provide accurate and defensible data to support the RA, which will determine if past and present storage and disposal of PCB contaminated waste at KHF result in unacceptable risks to human health and the environment. During the first three months of air sampling, KHF will collect and analyze green vegetative tissue and surficial soil samples from the surrounding facility property line. The air, soil, and green vegetation sampling results will be used to conduct the RA (both human health and ecological). After completing the RA, a report will be submitted to USEPA-IX presenting the sampling results and outcome of the RA. Air sampling will continue for a total monitoring period of one year. Several months after the green vegetative and soil sample takes place another round of dry vegetation sampling will be performed. KHF will re-submit a RA update if detected concentrations of PCB congeners are higher than those used to compute the RA after the first quarter of the one year monitoring cycle.

2.0 Facility Background

KHF is located in Kings County, California southeast of the intersection of Interstate 5 and Highway 41, which is approximately 3.5 miles southwest of Kettleman City and five miles southeast of Avenal (Figure 1). The facility owns and occupies 1,600 acres of property, of which 499 acres are located inside the conditional use permit boundary which is permitted for waste management operations (Figure 2).

2.1 SURROUNDING AREA LAND USE

The KHF is surrounded by general agriculture and grazing lands for several miles in all directions. KHF is also located at the southeastern end of the Kettleman Hills, an extensive area that has been active for decades in the production of natural gas and oil.

2.2 FACILITY HISTORY

In 1975, the McKay Trucking Company began disposal operations at KHF when they were issued a permit to use a 60-acre portion of the site as a petroleum waste disposal facility. Environmental Disposal Services (EDS) purchased McKay trucking Company in 1978 and expanded both the size and operations at KHF making it a Class I disposal site. In April 1979, CWMI purchased and began operating the KHF site. At that time, it was a 1,280-acre facility that was authorized as a treatment, storage, and disposal facility for designated wastes. Also in 1979, CWMI obtained authorization to operate the site as a hazardous waste management facility, and hazardous wastes were permitted for treatment, storage, and disposal at KHF. Operations consisted of landfilling solid waste, and use of evaporation ponds/tanks for liquid waste.

In the early 90s a project was undertaken to combine closure of a number of landfills and evaporation ponds. The Combined Closure Area was completed in 1996, and under the 69-acre closure cap it includes landfill units B-1, B-4, B-5, B-6, B-7, B-8, B-9 with expansions, B-10, and B-11; ponds P-5, P-12, P-12A, P-13, and P-17; and spreading area S-3. There are no PCB disposal units located in the combined closure area.

In April and July 1997, KHF submitted timely applications to renew existing TSCA Approvals, which included the currently operating PCB Flushing/Storage Unit, and the B-18 Landfill Unit. In October 2003, during a thorough and comprehensive permit renewal process, KHF requested a Coordinated Approval as per the recommendation of USEPA-IX TSCA Group. In February 2007, USEPA-IX released a Draft Coordinated Approval, along with a Draft Refined Environmental Justice Assessment. At this time, the Coordinated Approval has not been finalized. KHF understands that USEPA-IX plans to complete the Coordinated Approval process, including the proposed B-18 Expansion, in 2009.

At KHF, PCB waste processing and storage is conducted in the PCB Flushing/Storage Unit, which began operations in 1983. The PCB Flushing/Storage Unit is a containment building with an epoxy-coated concrete containment slab encompassing indoor PCB storage and processing areas, including a 10,000-gallon aboveground storage tank. Processing includes the draining of PCB liquids from transformers into the tank, then flushing the transformer with diesel, which also goes into the tank. Liquids collected in the tank are sent off-site via tanker for final disposal.

TSCA landfill units that previously received TSCA PCB waste include:

- B-14, 0.8 acres, capacity 6,000 cubic yards (cy), operated from 1982 to 1984, TSCA waste only, closed in 1985.
- B-16, 5 acres, capacity 290,000 cy, operated from 1983 to 1987, approximately 230,000 cy of TSCA waste only. In 2004, 60,000 cy non-hazardous waste was disposed of in B-16 to bring the unit up to final grade, and the unit was closed.
- B-19, 40 acres, capacity 3,000,000 cy, 1987 to 1991, TSCA, Resource Conservation and Recovery Act (RCRA), non-RCRA, and non-hazardous wastes, closed 2006.

2.3 CURRENT WASTE DISPOSAL & TREATMENT OPERATIONS

The active waste treatment, handling, and disposal units at KHF include:

- B-17 Landfill - (active landfill for disposal of Class II/III designated waste/municipal solid waste)
- B-18 Landfill - (active landfill for disposal of Class I/II hazardous waste/designated waste)
- B-19 Landfill - (active for disposal of Class II/III, designated waste/municipal solid waste. Class I/II portion completed Closure in 2006)
- Final Stabilization Unit (FSU) and adjacent Bulk Stabilization Units (I & II)
- Surface Impoundments P-9, P-14, P-16
- Drum Storage Unit
- PCB Storage/Flushing Unit

Figure 2 shows the site layout along with identification of the active waste treatment and disposal units and major facility structures located on the property.

At KHF, the only active TSCA landfill unit is B-18 which has a footprint of 53 acres and a permitted capacity 10,700,000 cy. From 1991 to the present the landfill has received TSCA, RCRA, non-RCRA, and non-hazardous wastes. The only other unit that actively handles TSCA regulated waste containing PCBs is the PCB Storage/Flushing Unit.

The overall waste stream accepted by KHF consists of RCRA, non-RCRA, non-hazardous, and TSCA designated waste. The total annual volumes of each fluctuate from year-to-year. However, from 2006 forward the total annual volume disposed in B-18 has been around 536,000 cy (750,000 tons). Of this, only about 50,000 cy has been TSCA designated waste.

2.4 TOPOGRAPHY

KHF is located on the western slope of the Kettleman Hills, a low range of steep hills bordering the western margin of the San Joaquin Valley. The sloping topography in the vicinity of the facility includes arroyos and other erosional features, but there are no perennial surface water bodies within one mile of the facility. The vegetation community of the area consists mainly of sparse grasses and low shrubs.

The surface elevation of KHF ranges from approximately 700 feet above mean sea level (msl) to 1100 feet above msl. The site generally slopes from the northwest to the southeast. The highest point surrounding the facility is Cerro Ultimo (approximate elevation 1144 feet above msl) adjacent to the northern property line.

2.5 CLIMATE

The climate of the region is semiarid and characterized by extremely low rainfall. Average annual precipitation is 6.12 inches, with 90 percent of the rainfall occurring between November and April. The estimated 100-year, 24-hour storm would result in 2.31 inches of precipitation. Mean annual evaporation is 102.94 inches (pan measurement). The mean annual temperature is 65 degrees Fahrenheit (18 degrees Celsius (^{o}C)). Seasonal average temperatures range from the low 50s in the winter to the high 90s in the summer.

As shown in Appendix B, historic average winds of 5.8 meters per second (m/s) (13 miles per hour (mph)) are predominantly from the north-northwest and winds are rarely calm. Winter conditions include variable winds and dense valley fog.

2.6 PREVIOUS PCB STUDIES

Throughout the years KHF has been in operation, numerous environmental sampling studies and on-going compliance monitoring has been conducted to measure potential off-site impacts to air, groundwater, stormwater runoff, soil, human health, and ecological receptors. These monitoring programs, sampling studies, and impacts analyses have either been voluntarily performed or required by the numerous State and Federal regulations to which KHF is subject. Two such studies, which included monitoring for PCB impacts, were performed as a result of compliance requirements related to KHF's RCRA Part B permit. These include the (1) 1994 Topographical, Meteorological and Airborne Contaminant Characterization at Kettleman Hills Facility; and the (2) currently ongoing Ambient Air Monitoring Program (AAMP).

2.6.1 1994 Topographical, Meteorological and Airborne Contaminant Characterization Study

In 1994, KHF conducted the Topographical, Meteorological and Airborne Contaminant Characterization Study to estimate releases of chemicals from the active treatment and disposal units at the facility. The study was designed to measure on-site emissions and potential releases of regulated chemical species and, through the use of air dispersion modeling, predict ambient air concentrations at the fenceline and in the buffer zone surrounding the facility. To determine emission rates from KHF's waste treatment and disposal units, environmental sampling was performed at or near the sources. This included sampling soil and soil pore-gas emissions from the uncapped landfills, liquids from the surface impoundments, breathing zone air downwind of the waste treatment and disposal units, and stack emissions from the FSU. The report entitled "1994 Topographical, Meteorological, and Airborne Contaminant Characterization at Kettleman Hills Facility" (KHF 1994 Emission Characterization Study) was submitted to the DTSC on April 28, 1995. The report summary is attached in Appendix C. Due to the size, the voluminous attachments of laboratory results and field data are not included in Appendix C. However, the tables included in the report summary present all of the detected concentrations of chemicals targeted in the study. Table 5-1, located in the final report in Appendix C, presents the

concentration range of all detected species in each respective matrix. Of all the samples that were collected and analyzed, PCBs were only detected in the liquid hazardous waste contained in the surface impoundments and waste soils collected within the sampled landfill units, but only at extremely low levels (ug/L or parts per billion), orders of magnitude less than TSCA regulatory levels.

2.6.2 AAMP Air Study

On June 16, 2003, the California DTSC issued the RCRA Part B Permit renewal to KHF. Part III, Section 4 - Environmental Monitoring, of the permit requires KHF to implement an AAMP that complies with the Environmental Monitoring and Response Programs for Air and Soil-Pore Gas provisions of the California Code of Regulations, Title 22, Section 66264.700, et seq. (Article 17). A Final AAMP, prepared by Earth Tech, dated February 2006, was developed and approved by DTSC on March 29, 2006. This included identification of the air monitoring locations originally proposed for this PCB congener study. The primary monitoring network design criteria for locating the monitoring sites were: (1) up and downwind of KHF; (2) near the property line; and (3) based on predominant annual wind patterns.

In a letter dated April 10, 2008, DTSC approved the discontinuation of sampling for PCBs because they were not detected in a single sample collected during that time. PCB sampling and analysis was suspended after 18 months of monitoring. The table below shows the targeted PCB aroclors and the number of PCB samples that were collected.

Compound	Samples Collected	Samples Analyzed	Number of Valid* Samples	Detection Limit ($\mu g/m^3$)	# of PCB Detections in Samples Analyzed
Aroclors 1016/1242	144	140	103	0.003	0
Aroclor-1221	165	161	124	0.003	0
Aroclor-1232	165	161	124	0.003	0
Aroclor-1242	21	21	21	0.003	0
Aroclor-1248	165	161	124	0.003	0
Aroclor-1254	165	161	124	0.003	0
Aroclor-1260	165	161	124	0.003	0

*Valid- the sample meets data validation criteria identified in the Quality Assurance Project Plan (QAPP).

3.0 Data Acquisition

The target chemical list for this Congener Study consists of the 12 WHO designated Dioxin–Like PCB congeners. KHF assumes that the basis for targeting these dioxin-like PCB congeners is as follows:

- According to historic and current waste profiles, PCBs are contained in a portion of the wastes handled and disposed of at KHF;
- Due to their toxicity equivalence relative to the other individual PCB congeners, the US EPA requested more information on the potential presence of the 12 WHO dioxin-like congeners;
- Cattle intended for human consumption periodically graze in some of the areas immediately surrounding KHF;
- Offsite impact could pose a potential risk to nearby communities; and
- Approved methods and equipment are available for sampling and detecting low levels of these chemicals in the ambient air, surficial soil, and vegetation.

Data acquisition will involve sampling and analysis of the following 12 WHO designated dioxin-like PCB congeners:

- Congener 77 - 3,3’,4,4’-Tetrachlorobiphenyl (CAS 32598-13-3)
- Congener 81 - 3,4,4',5-Tetrachlorobiphenyl (CAS 70362-50-4)
- Congener 105 - 2,3,3',4,4'-Pentachlorobiphenyl (CAS 32598-14-4)
- Congener 114 - 2,3,4,4',5-Pentachlorobiphenyl (CAS 74472-37-0)
- Congener 118 - 2,3',4,4',5-Pentachlorobiphenyl (CAS 31508-00-6)
- Congener 123 - 2,3',4,4',5'-Pentachlorobiphenyl (CAS 65510-44-3)
- Congener 126 - 3,3',4,4',5-Pentachlorobiphenyl (CAS 57465-28-8)
- Congener 156 - 2,3,3',4,4',5-Hexachlorobiphenyl (CAS 38380-08-4)

- Congener 157 - 2,3,3',4,4',5'-Hexachlorobiphenyl (CAS 69782-90-7)
- Congener 167 - 2,3',4,4',5,5'-Hexachlorobiphenyl (CAS 52663-72-6)
- Congener 169 - 3,3',4,4',5,5'-Hexachlorobiphenyl (CAS 32774-16-6)
- Congener 189 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (CAS 39635-31-9)

BZ/IUPAC Number	IUPAC Prefix	1997 WHO TEFs[1]	
		Humans/Mammals	Birds
PCB-77	3,3′,4,4′-Tetra-	0.0001	0.05
PCB-81	3,4,4′,5-Tetra-	0.0001	0.1
PCB-105	2,3,3′,4,4′-Penta-	0.0001	0.0001
PCB-114	2,3,4,4′,5-Penta-	0.0005	0.0001
PCB-118	2,3′,4,4′,5-Penta-	0.0001	0.00001
PCB-123	2,3′,4,4′,5-Penta-	0.0001	0.00001
PCB-126	3,3′,4,4′,5-Penta-	0.1	0.1
PCB-156	2,3,3′,4,4′,5-Hexa-	0.0005	0.0001
PCB-157	2,3,3′,4,4′,5′-Hexa-	0.0005	0.0001
PCB-167	2,3′,4,4′,5,5′-Hexa-	0.00001	0.00001
PCB-169	3,3′,4,4′,5,5′-Hexa-	0.01	0.001
PCB-189	2,3,3′,4,4′,5,5′-Hepta-	0.0001	0.00001

1 Van den Berg et al., 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environmental Health Perspectives, 106 (12), 775-792.

To assess the potential off-site risk associated with current and cumulative impacts of handling and disposal of PCB contaminated waste at KHF, various types of media will be sampled for the identified congeners at or near the KHF property line. These include:

- ambient air;
- surficial soil; and
- vegetation, both in it's green and dry phases.

Site specific meteorological data will also be continuously recorded to verify suitability of sample locations for determination of KHF impact and background areas in the buffer zone.

The buffer zone is the area immediately outside the facility property line to which the general public has access. The buffer zone around the KHF is privately owned and currently is open range used for periodically grazing cattle (Section 1.1). To avoid any access and/or legal issues associated with sampling on non KHF property, for the purpose of this Congener Study the buffer zone is being defined as the area near the property line, inside the fire break around the facility property line. This area is outside the permitted conditional use boundary and is

undisturbed and similar to the area outside the facility property line. Redefining the buffer zone inside the property boundary brings a level of conservatism to the Congener Study because the area is closer to the source of potential PCB emissions and would be expected to be higher in deposited PCB congener concentrations than those areas further away.

The mode of transport of PCBs contained in the waste at KHF to the buffer zone primarily consists of PCBs adhering to wind-blown resuspended dust originating inside the facility. However, since PCBs can also volatilize, the transport mechanism can also include wind dispersion of PCBs in the volatile phase. PCB bound particulates have the potential to deposit on the surficial soil in the buffer zone and be taken up by the vegetation. Since PCBs have the potential to bioaccumulate over time, the impact to human and ecological receptors can possibly increase with accumulation of PCBs in the vegetation which can be taken up by animal species and further consumed by humans (cattle grazing). The sampling strategy for air, surficial soil, and vegetation has been designed with these factors in mind for collecting the appropriate analytical data to be used in the RA. An accredited laboratory will use the following method, as specified by USEPA-IX, to quantify specific congeners targeted by this Study:

- US EPA Method 1668A Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by High Resolution Gas Chromatography / High Resolution Mass Spectrometry (HRGC / HRMS), Revision A, December 1999.

The following sections describe the sampling plan for each media. All sampling is designed in accordance with industry standards, US EPA guidance -- *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA QA/G-4HW), January 2000, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* (US EPA Region 4 EISOPQAM), November 2001 -- and good engineering and scientific practice to provide accurate, defensible, representative, and conservative data on which to base the RA. While the Study has been designed within the context of Data Quality Objectives (DQO) Guidance, many elements of the process were outlined by USEPA-IX in their letter dated December 2, 2008 (e.g. statement of problem, identified the inputs to the decision, defined the boundaries of the study). Therefore, many of the steps in the process have not been explicitly listed. However, this data

acquisition section does rely upon Chapters 4 and 7 of the EPA QA/G-4HW guidance to further define the boundaries and optimize the study.

3.1 AIR SAMPLING

The air sampling strategy has been designed to capture PCB congeners in both the volatile and particulate bound phase. While PCB congeners potentially measured in the buffer zone ambient air may have originated from accumulated on-site deposition, (re-suspension of crustal particulates), the air sampling is primarily reflective of "current" potential impacts to the buffer zone from handling PCB contaminated waste during the Congener Study.

Based on historic and current meteorological conditions (wind direction), the air sampling strategy has been designed to measure both facility impacted and background ambient air. This is discussed further in the following section and well as Section 1.5 – Climate.

3.1.1 Sampling Locations

The strategy for assessing off-site impacts from dioxin-like PCB congeners at KHF is to monitor ambient air upwind (background) and downwind (impact) from the facility. As discussed earlier and supported by the data presented in Appendix B, the predominant wind direction at KHF originates from the northwest and blows to the southeast. This predominant wind pattern was the basis for the monitoring network design currently used by the AAMP. With the exception of a new monitoring location to be specifically used for this Congener Study, this Congener Study will utilize two of the existing AAMP sampling network air monitoring locations.

Considering that winds predominantly come from the north-northwest (as shown in Appendix B), the two impact monitoring locations will consist of: (1) one stationary monitoring site located downwind of the B-18 landfill (current downwind monitoring station 1 (DMS-1) located southeast of B-18 near the property line); and (2) one new site located at the existing meteorological station pad (MSP), northeast of B-18, southeast of B-19, and north of the

administration building. A third stationary monitoring site will be located near the property line in the north-northwest section of the facility to measure background ambient air entering the facility property. This site will be the upwind monitoring site 1 (UMS-1) currently in use by the AAMP. A mobile station will be used to collect duplicate samples used for quality control as discussed in the QAPP (Appendix E). The proposed monitoring locations are identified in Figure 3.

The names chosen to identify the AAMP site locations, also used in this Congener Study, were selected based on prevailing wind patterns at KHF. However, it is anticipated that wind directions will vary during each month-long sampling event for the Congener Study. Therefore, proposed monitoring locations named upwind/downwind (UMS/DMS) are not meant to identify wind directions during a sampling event, but rather be reflective of annual wind directions used to identify impact and background locations.

The existing on-site meteorological station has been continuously collecting hourly wind speed, wind direction, precipitation, and temperature since 1986. Figure 3 illustrates the locations of the three proposed monitoring stations, and the meteorological station, on a 2004 aerial photograph. A portable met station has been used to identify a new site for permanently relocating the met station to a location not impacted by obstructions growing in elevation such as the B-19 landfill. The hill to the west of landfill B-18 has been selected, and KHF is currently constructing a pad, installing fencing, and installing power and communication to this new location. Once these steps have been completed, KHF will have the met station relocated, which will include siting and recalibrating the meteorological monitoring sensors in accordance with the manufacturer's guidelines and US EPA requirements. Data collected from the met station is discussed in more detail in Section 3.4.

The monitoring locations, used in the AAMP network, were sited based on predominant annual wind direction, proximity to waste treatment and disposal units, and the availability of power at the site. As specified in California Code of Regulations (CCR), Title 22, Section 66264.705 of Article 17, monitoring locations shall be suitable for sampling substances that may have

migrated from the regulated unit, and shall be located close enough to the regulated unit to provide an early indication of contaminant migration. As the definition of "regulated unit" is a "hazardous waste facility" (22 CCR 66260.10), placing monitors near the facility property line will give the earliest possible indication of any airborne contaminant migration moving off property that may cause adverse impacts to human health.

As shown in Figure 3, the proposed air monitoring locations are all located within the KHF property line and buffer zone and, therefore, closer to the emission units with the potential to emit PCB congeners. The design for this Congener Study is conservative. If any PCB congeners are detected, they should be at a higher concentration than within the buffer zone because the transported congeners would have less distance of travel, deposit, and disperse, thus lowering the concentration.

On December 9, 2008, four technical staff from USEPA-IX visited KHF to gain a better understanding of the operations, facility layout, and potential sampling locations. During a follow-up teleconference on December 16, 2009, USEPA-IX technical staff indicated they were comfortable with using UMS-1 as a background location and DMS-1 as an impact location. They recommended not using AAMP DMS-2 as an impact location for the Congener Study and made several recommendations for a new location closer to the B-18 landfill. The newly proposed monitoring site at the meteorological station pad (MSP) is proposed to satisfy USEPA-IX concerns and to conservatively capture potential PCB emissions migrating from the B-18 landfill in the direction of Kettleman City. USEPA-IX technical staff observed the buffer zone during the site visit on December 9, 2009. During the December 12, 2009 teleconference they approved the concept of redefining the buffer zone for this Congener Study as the on-site area inside the fire break near the KHF property line.

Three stationary monitoring locations (one background and two KHF impacted) should sufficiently collect representative data because:

1) The winds predominantly come from the north-northwest,
2) The long-term nature of the study (one year) allows the Congener Study to take advantage not only of the prevailing winds, but of *all* wind directions, and
3) The impact location represents aggregate facility-impacted air from "all" the potential sources of airborne toxic releases and is, therefore, a worst case representation of facility impacts to human health.

A fourth mobile monitoring station will be used for QA/QC purposes (e.g., duplicate samples). It may also be used at the discretion of KHF for the purpose of collecting information from potential sources of interest.

At the request of USEPA-IX, this fourth piece of monitoring equipment will also be used to collect a month-long air sample at a location near the administration building at KHF. The purpose of the sample will be to compare the results to those measured at the met station pad (MSP) as a means to confirm that the MSP location is not being adversely impacted by the presence of the B-19 Landfill. If the measured concentrations of PCB congeners from a location near the administration building are significantly higher than those measured at the MSP, then KHF will consider permanently relocating the MSP sampler to the site near the administration building for the remainder of the congener study. The sample collected near the administration building will be collected within the first five months of the study.

KHF and its consultant will work with USEPA-IX to obtain an approved air dispersion modeling protocol, perform the necessary modeling, and provide a report to USEPA-IX summarizing the modeling results as they relate to the appropriateness to the siting of the proposed monitoring locations. Based on discussions with USEPA-IX, it is anticipated that this information will be used, along with field observations and site knowledge, to verify that the proposed sampling locations are acceptably located to meet the study objectives.

3.1.2 Sampling Frequency

KHF will sample ambient air for a period of one-year collecting (12) 1-month samples at each of the monitoring sites. Each month-long sample will consist of four 5-day sampling segments, each separated by 24 hours, giving 25 days to complete the sample collection time within each month. Sampling of the first segment will begin at 0001 hours near the beginning of every month. Sample collection will continuously proceed until 23:59 hours of the 5th day. The 24-hour period between segments will be used to remove the top filter collecting PCBs in the particulate phase, perform a calibration check, and adjust the sampling flow rate, if necessary. The polyurethane foam (PUF) plug used to capture PCBs in the vapor phase will remain in the sampler during the entire month-long sampling event. Sampling will resume at 0001 hours after the down day and the cycle continue for each of the four segments. The month-long sample is collected in this manner to ensure air is collected at the design flow rate throughout the 20 days and that particulate buildup on the top filter does not create pressure drop and impede the desired sample collection flow rate. At the end of the fourth segment, the PUF plug and four respective top filters will be combined and sent to the lab and digested and analyzed as one sample.

After the fourth sampling segment is completed each month, depending on the number of days in the month, there will be several days of down time before the next month sample is initiated. This period will be used to perform any required maintenance and recalibration, complete all required documentation and recordkeeping, and generally prepare for the next scheduled sampling event.

The first sampling event began on January 6, 2009. Sampling will continue for one year with the final sample being collected in December 2009. The proposed sampling schedule is provided in Appendix D.

3.1.3 Sampling and Analytical Methods

Air sampling will follow the protocol laid out in US EPA Compendium Method TO-9A (1999) and the Standard Operating Procedures (SOP) included in Appendix F. Filter analysis will follow analytical procedures identified in US EPA Method 1668A (2003). General sampling procedures are discussed in the previous section and the specifics are documented in Method TO-9A, as well as the SOP located in Appendix F. All sampling activities will be recorded and maintained on-site in either a log book or data sheets. Chain-of-custody documentation will accompany the samples from the time they are collected until they are received by the laboratory. A QAPP (Appendix E) has been developed to ensure that all data is accurate, defensible, and appropriate for the purposes of this Congener Study.

3.2 SURFACE SOIL SAMPLING

The soil sampling strategy has been designed to capture PCB congeners that may have deposited and accumulated in the surface soil around the facility and is more reflective of the historic potential impacts to the buffer zone from handling PCB contaminated waste at KHF.

The soil sampling design has been developed using EPA's DQO Process for Hazardous Waste Investigations (US EPA QA/G-4HW, 2000), US EPA Region 9 Laboratory Field Sampling Guidance Document #1205 Soil Sampling (US EPA Region 9 Soil Sampling, 1999), and US EPA Region 4 Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures, Operating Procedure for Soil Sampling (SESDPROC-300-R1, 2007) and Operating Procedure for Field Sampling Quality Control (SESDPROC-011-R2, 2007), which are based on USEPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM, 2001). While the DQO process has not been stated step-by-step, the basic elements of the DQO process have been considered and sampling is designed in the context of the DQOs (p. 5-5, EISOPQAM). Specific references are included in the following sampling approach discussion.

3.2.1 Sampling Locations

The spatial boundaries have been defined following Chapter 4 of US EPA QA/G-4HW (pp. 27-29, 2000) and in consideration of Chapter 5 of US EPA Region 4 EISOPQAM. Sampling locations were developed with a combination probabilistic and authoritative (non-probabilistic) approach. The majority of samples are based on a probabilistic approach using a systematic grid along the property boundary in order to minimize statistical bias while providing a representative characterization of the site. However, representatives from USEPA-IX have also established an authoritative sampling area, B-18 adjacent sampling area, using a biased sampling approach in order to obtain a worst-case scenario (p 5-6, EISOPQAM).

With the exception of one area immediately adjacent to the B-18 landfill (and well within the property boundary), surficial soil samples (0-2" below ground surface) will be collected within the redefined buffer zone for the Congener Study. In order to provide a conservative measure of potential risk to human health and the ecological receptors, and as discussed with USEPA-IX technical staff, the buffer zone for this study will be defined as the area immediately inside the property boundary, access road, and perimeter fire break. Although this buffer zone does not include areas that pose actual risk to human health (i.e., cattle do not graze in this buffer area and the public does not have access to this buffer zone), the samples from within this buffer zone will provide a conservative analysis from which to characterize the potential risk to human health.

Since other animal species not intended for human consumption do have access to the property inside the property boundary, the potential risk to ecological receptors will be evaluated by including a sample composited from an area immediately adjacent to the B-18 landfill (biased sampling location referenced above), in addition to the buffer zone samples. The samples from this area are intended to provide an extremely high level of conservatism for the ecological risk assessment. The area from which the sample will be composited includes a valley that serves as a drainage pathway near the B-18 landfill, as well as hillsides immediately in the path of potential particle deposition from the B-18 landfill. While the ecological risk is the primary objective with this sample, USEPA-IX intends for the data to represent a worst-case potential for air dispersion

and erosion impacts to off-site drainages. Since air samples are also being collected and no parts of the active portion of the conditional use permit area drain to off-site areas, the level of conservatism from the proximity of the sampling area and the subsequent effect on representativeness will be considered when using the data in the ecological risk assessment.

After defining the boundaries and buffer zone, the site was divided into probable impact and background locations based on the site history, specific location of PCB-related activities, and prevalent meteorological conditions. This resulted in the Southern half of the property being identified for impact sampling while the Northern half will establish background.

The systematic grid was established by multiplying the desired number of increments for each composite sample by the total desired number of composite samples for each area, impact and background, and then dividing the area by their respective number of samples. In this study, it was determined that ten increments will be collected per composite. The number of increments was determined based on discussions with USEPA-IX representatives, site history, and site characteristics while considering the framework set forth in the DQO and sampling design section of the guidance. Guidance and discussions suggested that composite samples consisting of equally distributed increments (a systematic grid) will minimize variability while providing more representative data (pp 55-58 QA/G-4HW, pp 5-10 – 5-13 EISOPQAM). Therefore, the site boundary, within the context of the design guidance, will be divided into seven sampling areas, four background areas and three impact areas. Figure 4 shows the resulting grid on the property boundary along with the respective discrete increment sampling locations. The seven composite sample areas result in an approximate grid spacing of 525’ along the property line.

Another area on Figure 4 displays the location of the eighth sampling area with an approximate 100’ spacing in the area adjacent to B-18. This authoritative sampling area is biased (from the context of DQO and EISOPQAM sampling design terminology) based on USEPA-IX knowledge of the site and their intent to address potential for differential (elevated) concentration of PCBs in sediment in the runoff swale in that area as well as PCBs in soils deposited from air transport. Five of the ten increments will be collected from the low-lying areas in that swale and, to the

extent feasible, comprise sediment that appears to have been deposited during stormwater runoff events. The other five samples will be collected from the hillside facing B-18 to the south for use primarily in the ecological risk assessment. Additionally, the samples will also provide a maximum risk posed to offsite receptors based on air transport mechanisms and runoff scenarios. However, this worst-case risk to offsite receptors will be examined within the framework of other sampling results and site characteristics (i.e., the fact that stormwater runoff from conditional use permit area does not drain to offsite areas).

A total of eight composite samples, not including QA/QC samples, will be analyzed from the targeted sampling areas. Discrete increment surficial sample locations will be composited by the laboratory to form the eight samples characterizing each area. The eight samples that will be analyzed and their respective discrete increment samples for compositing are listed in the following table:

Sample Area (Associated Labeling Designator)	**Samples for Analysis (Potential Purpose)**	**Discrete Increment Samples per Composite**
(1) Northern Half of Eastern Property Line (NE)	1 (Background)	10
(2) Northern Property Line (N)	1 (Background)	10
(3) Northwest Corner of Property Line (NW)	1 (Background)	10
(4) Northern Portion of Western Property Line (W)	1 (Background)	10
(5) Southern Portion of Western Property Line (SW)	1 (Impact)	10
(6) Southern Property Line (S)	1 (Impact)	10
(7) Southern Half of Eastern Property Line (SE)	1 (Impact)	10
(8) B-18 Adjacent Area (ERA ONLY)	1 (Impact – ERA ONLY)	10
TOTAL	8 analyzed	80

3.2.2 Sampling Frequency

Frequency is considered in the context of the DQO process and setting of boundaries (p. 30 QA/G-4HW). Soil samples will only be collected one time during the Congener Study and will be taken during the first three months of air sampling. These eight samples will be analyzed and the data used in the RA. Each discrete increment sample will be sent to the laboratory which will then perform the compositing and hold the increment samples and combined composites for the duration of the Congener Study in case additional analysis is necessary.

3.2.3 Sampling and Analytical Methods

Soil sampling and analysis will follow US EPA Method 1668A requirements, US EPA soil sampling guidance (US EPA QA/G-4HW Final, Region 9 Soil Sampling, SESDPROC-300-R1, SESDPROC-011-R2, EISOPQAM), the QAPP (Appendix E), and the SOP (Appendix G). Soil will be collected from sample locations described in the previous section.

3.3 VEGETATION SAMPLING

The vegetation sampling strategy has been designed to capture PCB congeners that may have deposited around the facility, accumulated in the surface soil, and taken up by the vegetation. This is more reflective of the historic potential impacts to the buffer zone from handling PCB contaminated waste at KHF.

3.3.1 Sampling Locations

Data from vegetation will also provide information on potential historical impact of PCB handling at KHF. Vegetation types will be collected from the buffer zone areas, as well as the area adjacent to the B-18 landfill, and in the respective frequency as listed in Section 3.2.1. Similar to the soil sampling in the area adjacent to the B-18 landfill, the vegetation data will be used only in the ecological risk assessment. Vegetation will include a biased sampling (described

in Section 3.3.3 and Appendix G) of plant material in the immediate area of each discrete sampling location. Vegetation sampling locations will mirror soil sampling locations with variances for capturing appropriate vegetation types (see Section 3.3.3 and Appendix G). The approximate proposed sample locations are displayed on Figure 4.

3.3.2 Sampling Frequency

Vegetation will be sampled twice. The first sampling event will take place during the green (or wet) season and at the same time as the collection of soil samples. Typically, the green season occurs between February and April; however, site conditions will be monitored to determine optimal sampling conditions. Sampling during the green season will provide a level of conservativeness based on the increased uptake of substances in the soil during this time. The second event will take place during the dry season. Results from the dry season will be compared with those of the green season to determine effects on any potential risk.

3.3.3 Sampling and Analytical Methods

Vegetation sampling will also be conducted in accordance with US EPA Method 1668A requirements, US EPA Emergency Response Team (ERT) vegetation sampling guidance, the QAPP (Appendix E), and the SOP (Appendix G). Vegetation will be collected from sample locations described in the previous section.

The vegetation to be sampled will consist of plant tissue types that potentially would be consumed by herbivores such as those to be evaluated as representative receptors in the ERA (see Section 5.4.2.2). The mammalian receptor (a rodent) may consume a variety of vegetation, such as seeds, fruit, grasses, forbs, and the leaves of shrubs; the avian receptor likely would consume mainly seeds and fruit. Based on discussions with personnel at the site, larger mammals (i.e., cattle) have been observed to consume a variety of fresh vegetation such as grasses, saltbrush, and other leafy plants of various sizes. Therefore, a variety of green vegetation (not woody material), seeds, and fruit found to be present at each sample location will be collected

and combined in a sample container to provide a representation of the plant material on which herbivorous receptors in the area may feed.

The vegetation to be sampled reflects the feeding habits of the endangered species found in the area:

- San Joaquin kit fox – carnivorous; feeds principally on rabbits and rodents (such as kangaroo rats and ground squirrels).
- blunt-nosed leopard lizard – carnivorous; feeds on insects (which would consume leafy plants) and small lizards.

3.4 METEOROLOGY

Meteorological data including wind speed, wind direction, temperature, barometric pressure, and rainfall will be collected using the onsite meteorological station. Horizontal wind speed and horizontal wind direction sensors are installed at 10 meters (m) above the ground surface on top of a telescopic met tower. An ambient temperature sensor is installed about 1.7 m above the ground surface. At ground level, the meteorological station includes components for measuring barometric pressure. Calibration and maintenance of the meteorological station is conducted semiannually by AMEC Geomatrix, Inc. in the second and fourth quarters in general accordance with *US EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods*. Performance audits are conducted quarterly by AMEC Geomatrix, Inc. Copies of the most recent calibration and audit reports are included in Appendix B along with the meteorological wind data previously discussed.

Figure 3, shows the location of the existing met station near the administration building. A wind rose will be developed from the averaged, hourly data for each of the monthly sampling events. The provided wind roses will be temporally matched to each air sampling interval. A portable met station has shown that the permanent met station is not representing the actual meteorological conditions affecting the overall facility. As discussed earlier, the KHF met station is being relocated to a more suitable location.

4.0 Data Management

Collected data must meet the QAPP criteria for accuracy, precision, completeness, and representativeness.

4.1 DOCUMENTATION AND RECORDING

For this Congener Study the following data will be recorded and maintained at KHF:

- Meteorological conditions;
- Instrument operating variables (temperatures, flow rates, volumes collected, etc.);
- Upset conditions (releases at the facility, unusual meteorological events, fires, or any other event that may cause an impact to the ambient air);
- Calibration or maintenance data and procedures;
- GPS readings for increment soil/vegetation sampling locations;
- Vegetation types;
- Field notebooks and data sheets;
- Copies of chain-of-custody forms; and
- Analytical data from the laboratories.

4.2 DATA REDUCTION

The laboratories will provide KHF with the analytical results in hard copy and electronic format. Field data will be recorded in a logbook in addition to compiled into a recordkeeping spreadsheet. The laboratory results and field data will be compiled into a database with sample concentrations of any detected PCB congeners. Section 5.2 describes data collection and evaluation procedures that will be used in the RA.

4.3 DATA VALIDATION

Data validation is the systematic review of measurement data for outlier identification and error detection.

A complete discussion of the data validation process that will be used for this study is located in the QAPP located in Appendix E.

4.4 DATA REPORTING

The facility will submit a data report, including the results of the RA, after the first quarter of sampling to USEPA-IX within 90-days after the third month of air sampling has been completed. Another data report encompassing the entire year of sampling will be submitted to US EPA within 90-days of the termination of the year's sampling. The report will summarize the cumulative meteorological data and analytical results.
The reports will contain:

- Monthly average concentration for any detected 12 dioxin-like PCB congeners,
- Summary wind roses that are temporally matched to each air sampling interval,
- Data recovery summaries,
- List of detected 12 dioxin-like PCB congener concentrations,
- Number of collected samples,
- Detection limits, and
- Summary of any rejected data due to non compliance with QAPP criteria, if applicable.

The results will be reported in their respective units for each matrix sampled. The report will provide a narrative discussion and conclusion of the data set and data quality.

5.0 Risk Assessment

5.1 INTRODUCTION

The following section presents the proposed approach and methodology to be used in the RA for dioxin-like PCB congeners at KHF. The RA will include both a human health risk assessment (HHRA) and an ecological risk assessment (ERA).

The objective of the RA is to assess the magnitude of potential impacts to on-site and off-site ecological receptors and off-site human receptors from current and historical PCB disposal activities at KHF. The RA for PCB congeners at KHF will assess off-site risks under current and potential future conditions based on data collected through ambient air monitoring, surficial soil sampling, vegetation sampling, as well as bioaccumulation modeling.

The RA will be used to determine whether current and/or historical airborne emissions of dioxin-like PCB congeners from KHF are likely to pose an unacceptable risk to human or ecological receptors. The 12 dioxin-like PCB congeners have been identified by USEPA-IX as the human health chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) for this RA. COPCs and COPECs are those chemicals that warrant a detailed assessment of the risks they may pose. If the PCB congeners collectively are identified as likely to pose a significant risk, PCB congeners will be classified as a chemical of concern (COC). COCs are those chemicals at a site that need to be addressed through the risk management process. The information from the RA will support risk management decisions regarding the need for and selection of remedial actions to reduce risk to human and ecological receptors from PCB congeners originating at the facility.

The scope of the RA for KHF is to estimate potential risks to human health and ecological receptors based on site-specific PCB congener data. In accordance with US EPA guidance for

baseline risk assessment (US EPA 1989), the HHRA will assess impacts to the off-site area around KHF that could occur under both current and future land use conditions. The current land use scenario will reflect existing land use and activity patterns in the area adjacent to KHF. The future land use scenario will address the reasonably foreseeable potential future land use, assuming that land use in the area adjacent to KHF is consistent with local land use plans. Contaminant concentrations in environmental media under the future exposure scenario will be assumed to remain the same as those concentrations measured under current conditions.

The ERA will identify potential ecological receptors at the site, potential media and pathways for receptor exposures, and the PCB congeners that would be identified as chemicals of potential concern for ecological receptors. The results of the ERA will be used to determine the magnitude of potential risk to ecological receptors.

The RA report will be organized according to guidelines provided in the US EPA *Risk Assessment Guidance for Superfund* (RAGS) publication (US EPA 1989).

- Section 1.0, Introduction, will provide an overview of the PCB congener impact analysis program and a brief background description of the site, and will define the scope of the RA.

- Section 2.0, Data Collection and Evaluation, will review the data collected during the PCB congener investigations and will describe the data evaluation and analysis procedures.

- Section 3.0 of the RA report, Human Health Risk Assessment, will include four main subsections:

    - Section 3.1, Identification of Human Health Chemicals of Potential Concern, will describe the rationale and criteria for selecting the 12 dioxin-like PCB congeners as COPCs for evaluation in the HHRA.

- Section 3.2, Exposure Assessment, will describe the exposure setting (those features of the site that are relevant to the HHRA, especially with regard to possible receptors and contaminant fate-and-transport processes) and the potential pathways by which human receptors could be exposed to the COPCs. This section will include the calculation of exposure point concentrations and will provide equations for estimating intakes and doses.

- Section 3.3, Toxicity Assessment, will provide an overview of the toxicity equivalence methodology that will be used to evaluate human health toxicity associated with the 12 PCB congeners, which will be represented by a toxicity equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). World Health Organization (WHO)/2005 toxic equivalency factors (TEFs) will be identified for each of the congeners. Toxicological information will be presented for 2,3,7,8-TCDD, including oral and inhalation cancer slope factors.

- Section 3.4, Risk Characterization, will present risk estimates for each exposure pathway, discuss uncertainty in the assessment, and identify whether PCB congeners are a human health COC for the site based on calculated risk levels and US EPA guidance.

- Section 4.0 of the RA report will contain the ERA, which will comprise subsections addressing Problem Formulation, Exposure Assessment, Toxicity Assessment, and Risk Characterization, including uncertainty analysis. The ERA will be performed in accordance with the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (US EPA June 1997).

- Section 5.0, Conclusions, will summarize and interpret the results of the HHRA and ERA.

5.2 DATA COLLECTION AND EVALUATION

5.2.1 Data Collection

The PCB congener data to be used in this RA will be collected as part of the investigation activities at KHF described in Section 3.0 of this work plan. The media to be sampled are ambient air, surface soil, and vegetation. KHF will collect the data using the sampling and analytical methods discussed in Section 3.0, manage the data as discussed in Section 4.0, and ensure sampling, analytical, and data quality using the QA/QC procedures described in Appendix E. Detection limits used in sample analyses are based on DQOs, as described in the QAPP (Appendix E). Chemical-specific detection limits ideally should be lower than the applicable risk-based screening values. As shown in the QAPP (Worksheet #15 located in QAPP Appendix A), detection limits for the 12 dioxin-like PCB congeners are less than the US EPA Region 9 Regional Screening Levels (US EPA September 2008a).

Ambient air monitoring data for the 12 dioxin-like PCB congeners collected under the California Ambient Dioxin Air Monitoring Program (CARB 2007) also will be used in the RA to represent background concentrations. Surface soil and vegetation samples collected from locations not impacted by emissions from KHF, as described in Section 3.0 of this Workplan, will be used to represent background concentrations for those media. The background data will be used in the uncertainty discussions in the final report to evaluate the relative contribution of KHF to PCB congener concentrations detected in ambient air, surface soil, and vegetation.

5.2.2 Data Evaluation

The goal of data evaluation is to select those chemical data that are potentially site-related and are valid for use in the RA. This includes primary field samples with no associated qualifiers, data with qualifiers that indicate uncertainties in concentration but not in constituent identification (e.g., J-qualified data), and data detected at levels significantly elevated above concentrations detected in associated sample blanks. All laboratory QC data (such as matrix

spikes and surrogate data) and all field QC data (such as equipment blanks) will be eliminated from the data set used for the RA.

The initial steps involving evaluation and aggregation of data are common to both the human health and ecological risk assessments. These steps are described below.

Step 1. Sort the data into exposure groups.

The principal area of concern for this PCB congener risk assessment is the buffer zone adjacent to the KHF property. Surface soil and vegetation samples will be collected mainly from areas along the KHF property line, areas that are considered to conservatively represent concentrations in the buffer zone. Samples also will be collected within the facility boundary adjacent to and southeast of the B-18 landfill to assess potential ecological risk in that area. Data from air, surface soil, and vegetation will be grouped into medium-specific exposure groups for the site based on potential exposures of receptors. In aggregating the data into exposure groups, each air sampling location will be evaluated separately. The surface soil and vegetation samples will be aggregated into exposure groups according to location. Thus, the samples collected along the southwest, south, and southeastern areas of the property line, as described in Sections 3.2 and 3.3 and shown in Figure 4, will respectively represent three exposure areas for evaluation of ecological and human health risk. In addition, the area adjacent to B-18 will represent an exposure area only for ecological receptors. The discrete soil samples collected from each location within each of these exposure areas will be composited at the laboratory, resulting in a composite sample for analysis that is representative of each exposure area. Similarly, the vegetation samples will be collected at these same locations and composited for each exposure area.

Step 2. Evaluate the analytical data on the basis of quality.

The analytical data will be evaluated with respect to sample quantitation limits and data qualifiers and codes. Laboratory qualifiers and data validation qualifiers will be evaluated. If contradictory, data validation qualifiers will take precedence over laboratory data qualifiers. Data

with no associated qualifiers and data with qualifiers that indicate uncertainties in concentration but not in chemical identification (e.g., J-qualified data) will be selected for use in the RA; data flagged with an "R" qualifier (rejected) during data validation will not be included.

Step 3. Address PCB congeners using toxicity equivalence methodology.

The 12 dioxin-like PCB congeners will be analyzed using congener-specific methods. These PCB congeners appear to share a common mode of action with 2,3,7,8-TCDD, and TEFs have been developed that relate their toxicity to that of 2,3,7,8-TCDD (US EPA 2000). To evaluate PCB congeners in the HHRA and ERA, the concentration of each individual congener will be multiplied by its corresponding TEF, as per US EPA 2000 and June 2008), to express the concentration as a 2,3,7,8-TCDD toxicity equivalence (TEQ). The TEFs to be used are the 2005 values recommended for humans and other mammals by the WHO (US EPA, June 2008 and November 2008; Van den Berg et al., 2006). For each location where one or more PCB congeners are detected, the individual TEQs for each congener at the location will be summed to obtain the total TEQ for the location.

5.3 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

This section presents the methods for assessing risks to human health. The HHRA will be conducted in accordance with the following guidance:

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final* (US EPA 1989);
- *RAGS, Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Final* (US EPA 2001); and
- *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Final* (US EPA September 2005).

5.3.1 Identification of Human Health COPCs

The selection of COPCs process is not required for the HHRA. The sampling and analysis activities to be performed for the PCB congener investigation, as described in Section 3.0 of this work plan, is focused on the 12 dioxin-like PCB congeners. Therefore, those compounds will be considered the COPCs for the HHRA. If a chemical is selected as a COPC, it does not imply that the chemical poses a health risk or that it will contribute to a significant risk in an environmental medium. COPCs are merely those chemicals that need to be further evaluated for their potential effects.

The COPCs will be presented in tables according to exposure group. These tables will list the analytes detected in the exposure group, their occurrence (maximum and minimum detected concentrations, location of maximum concentration), frequency of detection, and range of detection limits.

Risk associated with the combined PCB congeners (summed to obtain the total TEQ for the location) will be estimated in the HHRA, and PCB congeners that collectively have the potential to pose unacceptable risk (as defined later in Section 5.3.4) to human health will be identified as a COC for that location.

5.3.2 Exposure Assessment

This section of the HHRA will address the environmental fate and transport of the COPCs (i.e., the PCB congeners addressed in the RA) and the potential pathways by which human populations could be exposed to those compounds. The exposure assessment also will describe exposure scenarios, develop information on exposure pathways, estimate the concentrations of COPCs at points of human exposure, and calculate receptor intakes.

5.3.2.1 Characterization of Exposure Setting

The exposure setting will be described briefly in terms of the natural environment and local land use and demographics. The purpose of this discussion is to provide information pertinent to the identification of exposure pathways and the estimation of exposure factors for human receptors. The physical features to be addressed include: topography, climate, ecological resources, geology, and soil type.

The HHRA will evaluate land use and demographic information to identify populations that may potentially be exposed to airborne and deposited PCB congeners in the buffer zone around KHF. KHF is surrounded by agricultural land for several miles in all directions (TRCES 1997). These agricultural properties are primarily used for livestock grazing. The closest non-agricultural areas, and the nearest permanent residents, are located in Kettleman City, 3.5 miles to the northeast. There are no sensitive receptors such as schools, hospitals or daycare centers in close proximity to the KHF facility property line. There are no perennial surface water bodies within one mile of the facility.

Based on site and COPC characteristics, the potential receptors most likely to exist under current conditions are the ranchers who raise cattle near KHF. For the purposes of the HHRA, the ranchers who visit the area on an occasional basis to tend to the cattle are assumed to also consume beef from those cattle.

The future land use of the area is expected to remain primarily open space and agricultural based on the Kings County General Plan (TRCES 1997). However, in order to represent the most conservative potential exposure scenario, a hypothetical rancher receptor is assumed to reside adjacent to the KHF property. These ranchers are assumed to be long-term residents and to consume all of their beef from the cattle they raise. This resident rancher scenario will be evaluated for both an adult and child receptor.

5.3.2.2 Identification of Human Health Exposure Pathways

Potential human exposure pathways will be identified in the context of the current and potential future land uses. A complete pathway includes: a chemical source and release mechanism, a

transport or retention medium, an exposure point where human contact with the contaminated medium occurs, and a route of intake for the contaminant into the body at the exposure point. If any of these elements is missing, the pathway is incomplete and is not considered further in the HHRA. A preliminary conceptual site model (CSM) has been developed to illustrate the potential exposure pathways for the site. It is presented in Figure 5. In the CSM diagram, the potentially complete pathways to be quantitatively evaluated in the HHRA are indicated by an "X" in a box. A box without an "X" indicates an incomplete pathway (which occurs when at least one of the pathway elements is missing) or an insignificant pathway.

Under current land use conditions, ranchers are assumed to be the human receptors for direct and indirect exposure to PCB congeners in ambient air and surface soil, and for indirect exposure to PCB congeners in beef tissue from cattle that graze near KHF. The potential direct exposure route for the rancher is inhalation of particulate PCB congeners. Potential indirect exposure routes for the ranchers are incidental ingestion of PCB congeners in surface soil, assuming that particulate PCB congeners deposit on the soil surface, and consumption of tissue from the cattle, assuming PCB congeners have been taken up by plants and the cattle then may ingest the PCB congeners through grazing and incidental ingestion of soil.

Resident ranchers are assumed to be the future receptors for direct and indirect exposure to PCB congeners in ambient air and surface soil, and in beef tissue from cattle, through the same intake routes described above for current conditions. Due to the longer duration of their exposure and their greater consumption of beef from cattle raised near KHF, the future resident rancher would have a greater potential exposure to PCB congeners than the current rancher. In addition, exposure of an infant to PBC congeners via ingestion of human breast milk will be evaluated.

Overall risk from dermal exposure to soils impacted from aerial deposition of contaminants is typically small relative to contributions resulting from exposures via the food chain (US EPA September 2005). Therefore, the dermal exposure pathway for the current rancher and hypothetical future rancher receptors is considered insignificant and will not be evaluated in the HHRA.

Ingestion of homegrown produce by resident ranchers, in which vegetables or other produce may take up contaminants and transfer them to edible portions, is a potentially complete exposure pathway. However, the characteristics of the KHF facility and the nature of the 12 dioxin-like PCB congeners that are the subject of this study combine to limit the potential significance of the produce ingestion exposure pathway for the resident rancher evaluated in this HHRA. In this work plan, identification of exposure pathways for the resident rancher is based on the farmer exposure scenario presented in *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Final* (US EPA September 2005). This guidance was developed to address a broad suite of combustion products, many of which tend to bioaccumulate in produce at greater rates than do PCBs, which are the only COPCs identified for evaluation in this HHRA. Given the physicochemical characteristics of PCBs, particularly their lipophilicity (affinity for lipids, or fats), the bioaccumulation of PCBs in cattle tissue is the primary release mechanism/exposure medium for the resident rancher. In organisms, PCBs tend to remain stored in lipids (fats), where they are highly soluble (ATSDR 2000), and long term storage of PCBs in mammals occurs primarily in fatty tissue (US NLM 2009). Therefore, ingestion of PCBs in beef tissue is considered the primary exposure route for the KHF facility. Accordingly, the homegrown produce ingestion pathway for the hypothetical future rancher is not considered to be potentially significant and will not be evaluated in the HHRA. This impact of excluding this pathway from the quantitative risk assessment will be addressed in the HHRA uncertainty analysis.

Ingestion of milk from homegrown cows is also a potentially complete exposure pathway for the resident rancher, based on the farmer scenario presented by US EPA (September 2005). However, the arid climate in the KHF area is not suited to the raising of dairy cattle, and cattle ranching in the area consist of beef cattle grazed on the local rangelands. Therefore, the ingestion of milk from homegrown cows will not be evaluated in the HHRA. The exclusion of this potential pathway from the quantitative risk assessment will be addressed in the HHRA uncertainty analysis.

5.3.2.3 Exposure Point Concentrations

Exposure point concentrations will be reasonable maximum exposure (RME) concentrations for each potentially complete pathway. The RME is the maximum exposure that is reasonably expected to occur at a site and, although it is a conservative exposure case, it is still within the range of possible exposures (US EPA 1989). Sampling data collected from characterization investigations at KHF will be used to calculate exposure point concentrations. Air modeling will not be performed.

Because of the uncertainty associated with any estimate of exposure point concentration, the 95 percent upper confidence limit on the arithmetic mean (95% UCL) is generally used as the RME concentration (US EPA 1989). However, the number of samples available for statistical analysis will not be adequate to support UCL calculations. Therefore, the detected concentration of each dioxin-like PCB congener in the composite soil and vegetation samples from each of the three "impact" areas will be used as the exposure point concentration for that area. Air monitoring data will be collected during month-long sampling events. Three months of analytical data from each of the two "impact" locations will be available for use in the RA. For each dioxin-like PCB congener, the mean of the three concentrations for each location will be calculated. The mean concentration will be used as the exposure point concentration for that location. Exposure point concentrations for the background locations will be calculated following the same procedures used for data from the "impact" locations.

Analytical data will not be available for one potential exposure point that involves the transfer of contaminants from one medium to another: beef tissue. An appropriate modeling technique will be used to estimate environmental concentrations for this exposure point, such as provided in *Human Health Risk Assessment Protocol* (US EPA September 2005). Measured on-site surface soil and vegetation concentrations will be used as input to this modeling.

5.3.2.4 Development of Chemical Intakes

Chemical-specific intakes will be calculated for the receptors and exposure pathways identified for quantitative evaluation in the CSM for KHF. The development of chemical intakes will be based on US EPA methodology presented in RAGS (US EPA 1989) and Office of Solid Waste and Emergency Response Directive 9285.6-03 (US EPA March 1991).

An RME estimate of intake will be developed for each exposure pathway. The RME estimate is the highest exposure that is reasonably expected to occur in a small but definable "high-end" segment of a potentially exposed population. It is derived using upper-bound values for a few of the most sensitive exposure parameters (e.g., contact rate, exposure frequency and duration) and average values for the remaining parameters (US EPA March 1991).

The estimates of chemical intake will be based on the exposure point concentrations for COPCs and on site-specific exposure assumptions developed using US EPA guidance such as RAGS (US EPA 1989), *Exposure Factors Handbook* (US EPA August 1997), and *Human Health Risk Assessment Protocol* (US EPA September 2005). Intake equations obtained from RAGS (US EPA 1989) will be used to calculate intake from inhalation of vapor and particulates in air, incidental ingestion of soil, and ingestion of beef tissue. The intake equations will be modified as recommended by US EPA (1989 and March 1991) to apportion intake between the resident rancher as a young child aged 0 to 6 years and as an older child and adult based on their differing exposure factors, in particular contact rates, body weights, and exposure durations.

5.3.3 Toxicity Assessment

This section will provide an overview of the human health effects and toxicity of the COPCs, i.e., the 12 dioxin-like PCB congeners evaluated in the HHRA.

Research on PCB congeners has found that some of the moderately chlorinated PCB congeners can have dioxin-like effects for carcinogenic risks. Because the combined effects of these compounds were shown to be dose-additive, US EPA generally recommends estimating risks

from those dioxin-like PCB congeners by computing a TEQ for the PCB mixture and then applying a slope factor for dioxin (US EPA 2000, September 2005, November 2008). As described in Section 5.2.2, the concentration of each individual PCB congener will be multiplied by its corresponding TEF, as per US EPA (2000 and June 2008), to express the concentration as a 2,3,7,8-TCDD TEQ. The TEFs to be used are the 2005 values recommended for humans and other mammals by the WHO (US EPA, November 2008, Van den Berg et al. 2006). For each location where one or more PCB congeners are detected, the individual TEQs for each congener at the location will be summed to obtain the total TEQ for the location.

As previously discussed, the TEFs relate the toxicity of the dioxin-like PCB congeners to that of 2,3,7,8-TCDD. The toxicity criteria for carcinogens are the slope factor (SF) and inhalation unit risk. SFs are defined as the "plausible upper-bound estimate of the probability of a response (i.e., cancer) per unit intake of a chemical over a lifetime" and unit risks are "expressed in terms of risk per unit concentration of the substance in the medium where human contact occurs" (US EPA 1989). Slope factor values are specific to the route of exposure (i.e., inhalation or ingestion).

The primary source of toxicity values for HHRA is the US EPA Integrated Risk Information System (IRIS). However, the IRIS data base does not include toxicity values for 2,3,7,8-TCDD. Therefore, the toxicity values developed for 2,3,7,8-TCDD by the California Environment Protection Agency (CalEPA) will be used in the HHRA, including an oral SF of 1.3E+5 $(mg/kg\text{-}day)^{-1}$ and an inhalation SF of 1.3E+5 $(mg/kg\text{-}day)^{-1}$ and inhalation unit risk of 3.8E+1 $(\mu g/m^3)^{-1}$ (CalEPA 2008). The CalEPA toxicity values were derived using methodologies very similar to those used by US EPA's IRIS (US EPA September 2008b).

The noncancer health effects to an infant from exposure to PCB congeners in human breast milk will be evaluated separately from the other exposure pathways. In accordance with US EPA (September 2005), the estimated exposure to KHF-related PCB emissions in breast milk will be compared to national average background breast milk exposure levels. If exposures due to the facility's emissions are low compared to background exposures, then the emissions will not be considered to cause an increase in noncancer effects for the infant.

5.3.4 Risk Characterization

This section of the HHRA will present risk estimates for human receptors under the current and future land use scenarios. Cancer risk estimates will be calculated for the 12 dioxin-like PCB congeners combined, the significance of the calculated risks will be characterized, and the uncertainties associated with these estimates will be described.

Cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to carcinogenic chemicals. The risk estimate is the lifetime average daily intake multiplied by the carcinogenic slope factor. US EPA has generally indicated that risks falling within the range of 1E-6 to 1E-4 should be evaluated to determine if risk reduction is feasible (US EPA December 1991). Risk levels less than one excess cancer in one million people (1E-6) generally is considered acceptable. Risks greater than 1E-4 generally are considered significant. According to the facility's RCRA Part B permit, risk estimates are to be evaluated against a cumulative cancer risk of 1E-6. Thus, those COPCs (i.e., the 12 dioxin-like PCB congeners combined) identified during the risk characterization as contributing significantly (cancer risk of 1E-6 or greater) to a pathway with a cancer risk greater than 1E-6 will be identified as human health COCs.

5.3.4.1 Uncertainty

The evaluation of chemical risks to human health will necessarily be based on a number of assumptions. In addition, many uncertainties are inherent in the risk assessment process. The key site-related variables and major assumptions used in the HHRA and their associated uncertainties will be discussed, and their potential effects on the results will be addressed. Uncertainty will be qualitatively evaluated for each component of the HHRA, including identification of COPCs, exposure assessment, toxicity assessment, and risk characterization.

5.4 ECOLOGICAL RISK ASSESSMENT

5.4.1 The ERA Approach

The purpose of the ERA will be to focus on evaluating the potential for adverse ecological effects from site-related PCB congeners. The overall approach for performing the ERA will be consistent with the current US EPA guidance for conducting ecological risk assessment, as described in the *Ecological Risk Assessment Guidance for Superfund* (ERAGS)*: Process for Designing and Conducting Ecological Risk Assessments* (US EPA June 1997), as well as the *Guidelines for Ecological Risk Assessment* (US EPA April 1998) and *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments* (US EPA, June 2001). The approach also will be based on guidance specific to the assessment of risk from PCB congeners provided in the *Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment* (US EPA June 2008).

The eight steps of the ERA process presented in the ERAGS document are as follows:

Screening-Level Ecological Risk Assessment (SLERA)

Step 1. Screening-Level Problem Formulation and Effects Evaluation

Step 2. Screening-Level Exposure Estimate and Risk Calculation

Baseline Ecological Risk Assessment

Step 3. Problem Formulation

- Selection of site-specific assessment endpoints
- Refined assessment of exposure and toxicity
- Risk characterization and uncertainty analysis

Step 4. Study Design and Data Quality Objectives Process

Step 5. Field Verification of Sampling Design

Step 6. Site Investigation and Data Analysis

Step 7. Risk Characterization

Step 8. Risk Management

In conjunction with these steps, the ERAGS process also requires interim decisions and deliverables following several steps in the process. These scientific/management decision points (SMDPs) are defined as points in the process at which the risk managers and the risk assessment team evaluate the work completed to a given step and either approve the work and the planned approach or redirect additional work (i.e., decide whether or not the ERA should continue to the next step in the process). Up to six SMDPs potentially may be incorporated into the eight-step ERAGS process, depending on the number of ERA steps required at a particular site and circumstances specific to the site. SMDPs typically occur after Steps 2, 3, 4, and 7 of the ERAGS process, with a possible SMDP within Step 3 and another after Step 5 if approval is required for needed changes to the sampling design.

Because the purpose of this ERA is to provide a focused evaluation of ecological risks associated with the potential for PCB congener contamination at the site, performance of each step in the process will not be necessary. For example, the preliminary phase of the process, the SLERA, will not be included because PCB congeners already have been determined by US EPA to be the COPECs, which warrant a detailed assessment of the risks they may pose to site-specific receptors through the potentially complete exposure pathways at the site. The approach generally will correspond to that used in the steps of a Baseline ERA.

5.4.2 Problem Formulation

Problem Formulation establishes the goals, breadth, and focus of the ERA. It includes a characterization of the ecological setting at the site, the identification and evaluation of assessment endpoints, and a CSM identifying exposure pathways potentially linking contaminants to assessment endpoints.

5.4.2.1 Ecological Setting

The KHF is located in the southern part of the Kettleman Hills on the western side of the San Joaquin Valley. The San Joaquin Valley is surrounded on three sides (east, south, and west) by mountains. The facility covers 1600 acres, including approximately 499 acres within the Conditional Use Permit Boundary (approved for hazardous waste activity by various agencies). The topography and climate are discussed in Sections 2.4 and 2.5 of this Workplan. There are no perennial surface water bodies within one mile of the facility. The vegetation community of the area consists mainly of sparse grasses and low shrubs.

Information on the ecological setting will be gathered from sources such as natural resources surveys that have been conducted for the area, maps, aerial photos, natural resource databases, historical information, interviews, and site visits. Current and potential future land uses in the vicinity of the site will be discussed. Both abiotic and biotic components of the ecological setting will be described. Abiotic components include the nonliving aspects of the natural environment (topography, climate, hydrology, geology, hydrogeology, and soil types) as well as man-made structures. Biotic components to be addressed include ecological communities and examples of common species they comprise, rare species, and potentially sensitive environments.

5.4.2.2 Conceptual Site Model

An ecological CSM will be developed to evaluate the potential migration and exposure pathways through which ecological receptors may be exposed to PCB congeners at the site. A complete exposure pathway consists of a source and mechanism of contaminant release, a transport mechanism for the released contaminants, a point of contact between the contaminant and the receptor (i.e., an exposure medium), and a route of contaminant entry into the receptor (i.e., an exposure route). If any of these elements is missing, the pathway is considered to be incomplete. A preliminary CSM diagram for the site based on generic receptors is presented in Figure 5.

The source of potential PCB congener contamination at KHF is the historical handling and disposal of PCB wastes. Migration of contaminants from the initially contaminated media (PCB

wastes being disposed of in TSCA-approved landfills, PCB wastes being processed and stored in TSCA-approved PCB Building) to exposure media (media to which ecological receptors may be exposed within or beyond the facility boundary) may involve multiple release mechanisms, exposure media, and exposure routes. Principle pathways for exposure of ecological receptors to PCB congeners at this site likely result from the release of PCBs from soil to the surrounding environment via suspension of contaminated soil particulates (dust) by wind, followed by deposition onto downwind soils and foliage, as well as via volatilization of PCBs followed by uptake of the airborne vapors by aerial plant parts. Subsequently, PCBs that have been deposited on plant surfaces or have been absorbed by plants in the vapor phase may be taken up by the animals that consume these plants and transferred through food chains. PCBs are hydrophobic, lipophilic compounds that tend to be taken up by organisms from their environment and through their diet (bioaccumulation). Lower-trophic-level organisms, such as plants and soil-dwelling invertebrates that have bioaccumulated PCBs may be consumed by higher-trophic-level consumers, such as predators. As these compounds are bioaccumulated by organisms at higher trophic levels, their concentrations may increase as they move up the food chain (biomagnification).

Ingestion pathways for animals may include incidental ingestion of surface soil as well as ingestion of food. Animal exposure pathways based on inhalation of soil particulates or vapors and absorption through dermal contact with contaminated soil also are potentially complete, but these pathways usually are negligible compared to ingestion pathways (US EPA 2005), are difficult to quantify (US EPA 2005), and, therefore, will not be evaluated.

In order to evaluate risks to ecological receptors at multiple trophic levels within the food chain, multiple mammalian and avian receptors will be selected such that they are representative of risks to both primary consumers (herbivores) and secondary consumers (predators), which may be at greatest risk from biomagnification. Mammalian receptors to be evaluated are expected to include a rodent, such as the San Joaquin pocket mouse (*Perognathus inornatus*), and a predator, such as the San Joaquin kit fox (*Vulpes macrotis mutica*). Avian receptors to be evaluated are expected to include a granivore/insectivore, such as the western meadowlark (*Sturnella neglecta*), and a predator, such as the burrowing owl (*Athene cunicularia*). These species were

identified based on factors such as life history and position in the food chain, potential occurrence in habitats in the vicinity of the study area, and/or status as sensitive species. Soil invertebrates are not considered to warrant identification as assessment endpoints for this ERA; thus, they will not be evaluated as representative receptors. However, soil invertebrates are a component of the diet of lower-trophic-level receptors such as the pocket mouse and meadowlark, and their contribution to dietary intake for these receptors will be modeled and evaluated accordingly.

5.4.2.3 Identification and Evaluation of Ecological Endpoints

An ecological endpoint is a characteristic (such as reproduction) of an ecological component (such as a population) that may be affected by exposure to a stressor (such as a chemical contaminant). Ecological endpoints are identified in order to determine whether environmental management goals for the protection of environmental resources/values in the study area are being met currently and will continue to be met in the future. Assessment endpoints are selected to reflect these management goals.

5.4.2.3.1 <u>Assessment Endpoints</u>

Assessment endpoints are explicit expressions of the environmental value(s) to be protected at a site. Their operational definition includes two components: an ecological entity and certain attributes of the entity that are amenable to measurement (US EPA 1998). The minimum level of ecological concern in an ERA usually is the population; therefore, assessment endpoints generally refer to characteristics of populations or higher levels of ecological organization, such as communities. Risk to an individual usually is of concern only if the species is legally protected under the Federal Endangered Species Act or State laws.

As prescribed by US EPA (1998), three principal criteria are used to identify ecological values that may be appropriate for assessment endpoints: (1) ecological relevance, (2) susceptibility to known or potential stressors (contaminants), and (3) relevance to management goals. ERAGS (US EPA 1997) also describes four factors of particular importance in evaluating potential

assessment endpoints: (1) the contaminants present and their concentrations; (2) the mechanisms of contaminant toxicity to potential ecological receptors; (3) the species potentially exposed to site-related contaminants; and (4) the potentially complete exposure pathways. These factors will be considered in conjunction with the three criteria above in identifying assessment endpoints for the ERA.

A suite of assessment endpoints representing the values to be protected in the study area will be identified for evaluation in the ERA. Examples of values to be protected include terrestrial populations of wildlife and plants in the study area (the facility and adjacent buffer zone). Protection of such endpoints would maintain the existing biodiversity of the ecological community in the study area and would achieve the management goal of protecting the biological integrity of ecological communities. In addition, if any threatened or endangered species are found to inhabit the study area, they will be identified as assessment endpoints in conformity with federal and/or state management goals of protecting rare species.

According to US EPA (1998), an assessment endpoint is defined by two elements: (1) the identification of the specific valued ecological entity and (2) a characteristic of the entity that is important to protect and potentially at risk. The following examples illustrate the types of assessment endpoints that will be considered for possible evaluation at the site:

- Abundance and production of populations of small mammals and birds in the study area,
- Abundance and production of populations of predatory mammals and birds at the top of the food web in the study area,
- Survival and reproduction of individuals of threatened or endangered species in the study area.

5.4.2.3.2 Representative Receptors

In order to evaluate effects on assessment endpoints, representative receptors (also referred to as endpoint species) will be selected. Receptors will be selected to represent assessment endpoints based on considerations such as the following:

- Presence of the receptor at the site and its importance in the community food web;
- Susceptibility of the receptor to the contaminants at the site, including bioaccumulation/ biomagnification effects;
- Amount of available data describing the receptor's potential for exposure;
- Amount of available data describing toxicological effects that may result from exposure;
- Susceptibility of the receptor to the same exposure pathway(s) as the assessment endpoint being represented;
- Representation by the receptor of the species, life stage, population, or community most affected by the chemicals being studied;
- Possession by the receptor of physiological, behavioral, or life history characteristics that make it a sensitive representative of the assessment endpoint, including similar sensitivities to contaminants and similar spatial scales of exposure;
- Well-defined relationship between the receptor and the assessment endpoint;
- Ability to attribute receptor responses to the chemicals being studied; and
- Availability of an information database relevant to the receptor and sufficient to facilitate comparisons and develop models.

The basis for selection will be identified for each of the receptors chosen as representatives of each assessment endpoint. Although a receptor does not need to satisfy all of the criteria listed above in order to be selected, generally, the more criteria that are met the more satisfactory the receptor will be as a representative of the assessment endpoint. The representative receptors preliminarily identified for use in evaluating risk to the assessment endpoints at the site are described above in Section 5.4.2.2. A food chain diagram will be developed to illustrate the relationships of the representative receptors to the food chains in the study area.

5.4.2.3.3 Measurement Endpoints

Measurement endpoints (i.e., measures of exposure and measures of effect [US EPA 1998]), are measurable responses or parameters that can be used to evaluate the response of an assessment endpoint to contaminant exposure. The measurement endpoints used to predict effects on each of the assessment endpoints will be identified. Examples of measurement endpoints that will be used are measured PCB congener levels in soil and biota samples.

5.4.3 Exposure Assessment

The Exposure Assessment will estimate the exposures of the representative receptors to the dioxin-like PCB congeners detected at the site. Avian and mammalian wildlife will be evaluated, and their exposures will be based on dosage: mass of chemical intake per unit body weight per day. Exposure pathway analysis based on the site CSM will be used to determine which exposure pathways should be quantitatively evaluated for each receptor. For avian and mammalian receptors, exposure through the food chain and direct exposure through incidental ingestion of soil will be estimated. Exposures via ingestion of PCB congeners through these pathways will be calculated based on the measured concentrations in the composite samples from each exposure area. Concentrations of PCB congeners detected in samples of vegetation in each exposure area will be used to estimate food chain exposures of herbivores in each area.

Food chain modeling will be employed to estimate exposure concentrations of the PCB congeners in the tissues of prey animals consumed by predators and in birds. Food chain models will use biotransfer factors (e.g., bioconcentration factors, bioaccumulation factors, food chain multipliers) and concentrations in soil or vegetation to estimate concentrations in the food chain components that are consumed by specific receptors. The methodology used will be similar to that described in US EPA (1999).

The modeled concentrations will be used in conjunction with multiple species-specific exposure factors to calculate the daily exposure dose that may be received by each receptor. These factors include body weight, food ingestion rate, dietary composition, and home range. Exposure factors will be identified for both adults and juveniles of each receptor species in order to calculate

intakes that encompass the range of potential exposures. Values for receptor-specific exposure factors will be obtained from US EPA (1993), US EPA (1999), or other sources. In addition, information on the proportion of diet composed of incidentally ingested soil is available for a range of species in US EPA (1993). This information will be used to estimate the intake of PCB congeners via direct ingestion of soil in conjunction with feeding, burrowing, grooming, and/or preening activities. Species-specific area use factors (AUFs) will be applied as appropriate to adjust exposures based on the degree to which areas of contamination and receptor habitats overlap. An AUF is used to modify estimated exposures based on the expected use of a contaminated area by a receptor. This factor is calculated by dividing the exposure area by the receptor's home range or foraging area. The AUF cannot exceed a value of 1; therefore, if the exposure area is larger than the receptor's home range, the AUF will equal 1 and will not reduce the calculated exposure dose.

For evaluation of risk to developmental stages of avian receptors, tissue concentrations (body burdens) in female birds will be estimated from dietary intakes using bioaccumulation factors, then tissue concentrations in embryos (eggs) will be estimated based on transfer rates from mother to egg (fraction of body burden).

If terrestrial plants are selected as receptors for evaluation, exposures of plants will be based on concentrations in soil, consistent with the expression of terrestrial plant toxicity data as soil concentrations.

5.4.4 Toxicity Assessment

The Toxicity Assessment will estimate the toxicity of the dioxin-like PCB congeners detected at the site to the representative receptors selected for evaluation. Assessment of the potential for these dioxin-like PCB congeners to cause toxicity in birds and mammals will utilize the toxicity equivalence methodology adopted by US EPA (US EPA June 2008). This methodology is based on the relative potency of each of the PCB congeners in comparison to the toxicity of 2,3,7,8-TCDD. It involves the use of TEFs that are numerical estimates of the potency of individual PCB congeners relative to 2,3,7,8-TCDD. The TEFs that have been derived for the 12 dioxin-like

PCB congeners for mammals and birds and are provided in Table 2 of US EPA (June 2008) will be used in this assessment.

The congener concentration will be multiplied by the congener-specific TEF to calculate a toxicity equivalence concentration (TEC). However, TECs should be based on concentrations in the tissues of organisms, or their diet (e.g., prey tissue concentrations), rather than in abiotic media such as soil (US EPA June 2008). Therefore, food chain modeling, as described above, will be used as appropriate to estimate PCB congener concentrations in receptor tissue or diet, which will then be multiplied by TEFs to calculate TECs.

The TEFs for mammals were based on administered dose (US EPA June 2008); hence, congener concentrations in the diet of mammalian receptors will be estimated prior to multiplication by mammalian TEFs to calculate mammalian TECs. The TECs for all the PCB congeners will then be summed, and the total TEC will be used in calculating the receptor's dietary intake (dose). This dose will then be compared to mammalian toxicity reference values (TRVs) based on administered dose of 2,3,7,8-TCDD in diet.

In contrast, the TEFs for birds were based on the concentrations of dioxin-like PCB congeners within the tissues of birds, principally embryo concentrations from administered doses in egg injection studies (US EPA June 2008). It would be preferable to utilize avian TRVs based on these dose metrics so that the exposure and effects assessment are consistent. However, avian TRVs based on tissue residues in adult birds have not been identified. Therefore, avian TRVs based on administered dose in diet will be used, and congener concentrations in the diet of avian receptors will be estimated prior to multiplication by avian TEFs to calculate avian TECs. In addition, tissue concentrations in embryos (eggs) will be modeled because developmental and lethal effects on embryos are the most common test endpoints for effects of dioxin-like chemicals on birds and appear to be the most important sensitive effects of such chemicals (US EPA April 2003). Hence, congener concentrations in embryos/eggs will be estimated prior to multiplication by avian TEFs to calculate avian embryo TECs, which will be compared to avian TRVs based on egg concentrations of 2,3,7,8-TCDD.

The toxicity equivalence methodology requires the identification and use of TRVs for 2,3,7,8-TCDD that are as relevant as possible to the receptors being evaluated. In accordance with guidance from the US EPA Region 9 Biological Technical Assistance Group (BTAG), TRVs for 2,3,7,8-TCDD that are representative of both no-effect levels (TRV-Low) and mid-range adverse effect levels (TRV-High) will be identified for each receptor (California DTSC 2000). TRVs based on administered dose are expressed as the amount of chemical ingested per unit body weight (BW) per day. TRVs based on body burden are expressed as the concentration of chemical in tissue.

The mammalian TRVs will be 0.001 µg /kg BW-day (TRV-Low) and 0.01 µg /kg BW-day (TRV-High), which are based on a no-observed-adverse-effect level (NOAEL) and a lowest-observed-adverse-effect level (LOAEL) for reproductive effects from a chronic study in the rat (US EPA 1999; Sample et al. 1996). The avian dietary TRVs will be 0.01 µg /kg BW-day (TRV-Low) and 0.1 µg /kg BW-day (TRV-High), which is based on a NOAEL and a LOAEL for reproductive effects from a chronic study in the ring-necked pheasant (US EPA 1999; Sample et al. 1996). The avian embryo TRVs (µg /kg egg) will be selected from the NOAELs and LOAELs for embryo mortality in laboratory studies of a variety of birds provided in Tables 2-2 and 3-1 of US EPA (April 2003).

If terrestrial plants are evaluated as receptors, their toxicity assessment will be based on TRVs expressed as concentrations in soil. In order to allow for consideration of a range of effects levels, plant TRVs will be identified if possible based on both a no-observed-effect concentration and a lowest-observed-effect concentration in soil. Plant TRVs for total PCB congeners (plant TRVs specific to the dioxin-like PCB congeners are not available) may be obtained from sources such as *US EPA Region 5 RCRA Ecological Screening Levels* for soil (US EPA August 2003) or *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* (Efroymson et al. 1997).

5.4.5 Risk Characterization

As described above, PCB congener concentrations detected in the composite samples representing each of the four ecological exposure areas will be used to calculate exposures for

adults and juveniles of each wildlife receptor, which then will be compared to both TRV-Low and TRV-High dose values. These comparisons will be performed by calculating hazard quotients (HQs). The TECs for each detected PCB congener to which a given receptor is exposed will be summed to calculate a total TEC for that receptor in that exposure area. The total TEC will be used in conjunction with other receptor-specific exposure factors to calculate a dietary dose, which will be divided by the TRV to calculate an HQ. The combinations of two exposure estimates (adult and juvenile TECs) and two TRVs will result in four HQs that provide a range indicative of the range of potential risks posed to each receptor in each exposure area. Thus, there will be four HQs calculated for dioxin-like PCB congeners for each representative receptor in each area, based on the following combinations of variables:

- $HQ_{adult\ low}$: adult intake / TRV-Low
- $HQ_{adult\ high}$: adult intake / TRV-High
- $HQ_{juvenile\ low}$: juvenile intake / TRV-Low
- $HQ_{juvenile\ high}$: juvenile intake / TRV-High

For avian receptors, in addition to dietary TRVs, TRVs based on tissue concentrations in eggs or embryos will be used to assess this sensitive life stage. In this analysis, the TEC calculated for the PCB congeners in eggs in each exposure area will be divided by a TRV-Low and a TRV-High based on egg concentrations to calculate two avian embryo HQs for each representative avian receptor in each exposure area.

A PCB congener with one or more HQs that are greater than or equal to 1 for a given receptor will be identified as a preliminary COPEC for that receptor. The range of HQs, as well as background data and other information, will provide lines of evidence for determining if the preliminary COPECs warrant identification as final COPECs, which are COPECs with a sufficient potential to pose risk that they require further assessment.

If no final COPECs are identified in a given exposure group (i.e., soil or vegetation in a given exposure area), that exposure group will not require further evaluation. If no exposure groups are identified as likely to pose risk to ecological receptors, the ERA can end at this point in the

process. However, if PCB congeners are identified as final COPECs for a given receptor in a given exposure area based on analysis of the available lines of evidence and the amount of uncertainty in the assessment, then further evaluation of the potential risk from PCB congeners to the receptor(s) in that exposure area may be warranted in the subsequent steps of the Baseline ERA process. This risk management decision will be made by US EPA at the SMDP.

Interpretation of the range of HQs for receptors in each exposure area will be based on the following rationale. If none of the HQs equal or exceed 1.0, the dioxin-like PCB congeners will be considered not to warrant classification as final COPECs. A combination of an $HQ_{juvenile\ low}$ greater than or equal to 1.0 with an $HQ_{adult\ low}$ less than 1.0 or an $HQ_{adult\ low}$ greater than or equal to 1.0 with an $HQ_{juvenile\ low}$ less than 1.0 will indicate the need for further evaluation of the ecological significance of the potential effects. For example, additional lines of evidence available for characterizing risk will be considered in determining the potential for significant impacts on individuals of threatened or endangered species or on populations of other species. If either the $HQ_{adult\ high}$ or $HQ_{juvenile\ high}$ is greater than or equal to 1.0, the potential for the dioxin-like PCB congeners to pose risk will be considered of concern for that receptor in that exposure area, and they will warrant classification as final COPECs and further evaluation in subsequent steps of the ERA process (California DTSC 1999).

For avian receptors, there will also be two embryo HQs for each exposure area: an HQ_{high} and an HQ_{low}. An HQ_{low} that is greater than or equal to 1.0 will indicate the need for further evaluation of the ecological significance of the potential effects. If an HQ_{high} is greater than or equal to 1.0, the potential for the dioxin-like PCB congeners to pose risk to that receptor in that exposure area will be considered of concern, and they will warrant classification as final COPECs and further evaluation in subsequent steps of the ERA process.

The risk estimation provided by the range of HQs will be considered in conjunction with other lines of evidence in a risk description that will put in context the extent, magnitude, and ecological significance of the potential risks identified. In addition, a discussion of uncertainty in the ERA will be included in the Risk Characterization.

5.4.6 Scientific/Management Decision Point

If the risk characterization determines that there are no final COPECs and USEPA-IX agrees, the ERA process will end at this point. If it is determined that final COPECs are present, USEPA-IX will decide whether the ecological risks they may pose have been sufficiently characterized or the risks warrant further evaluation.

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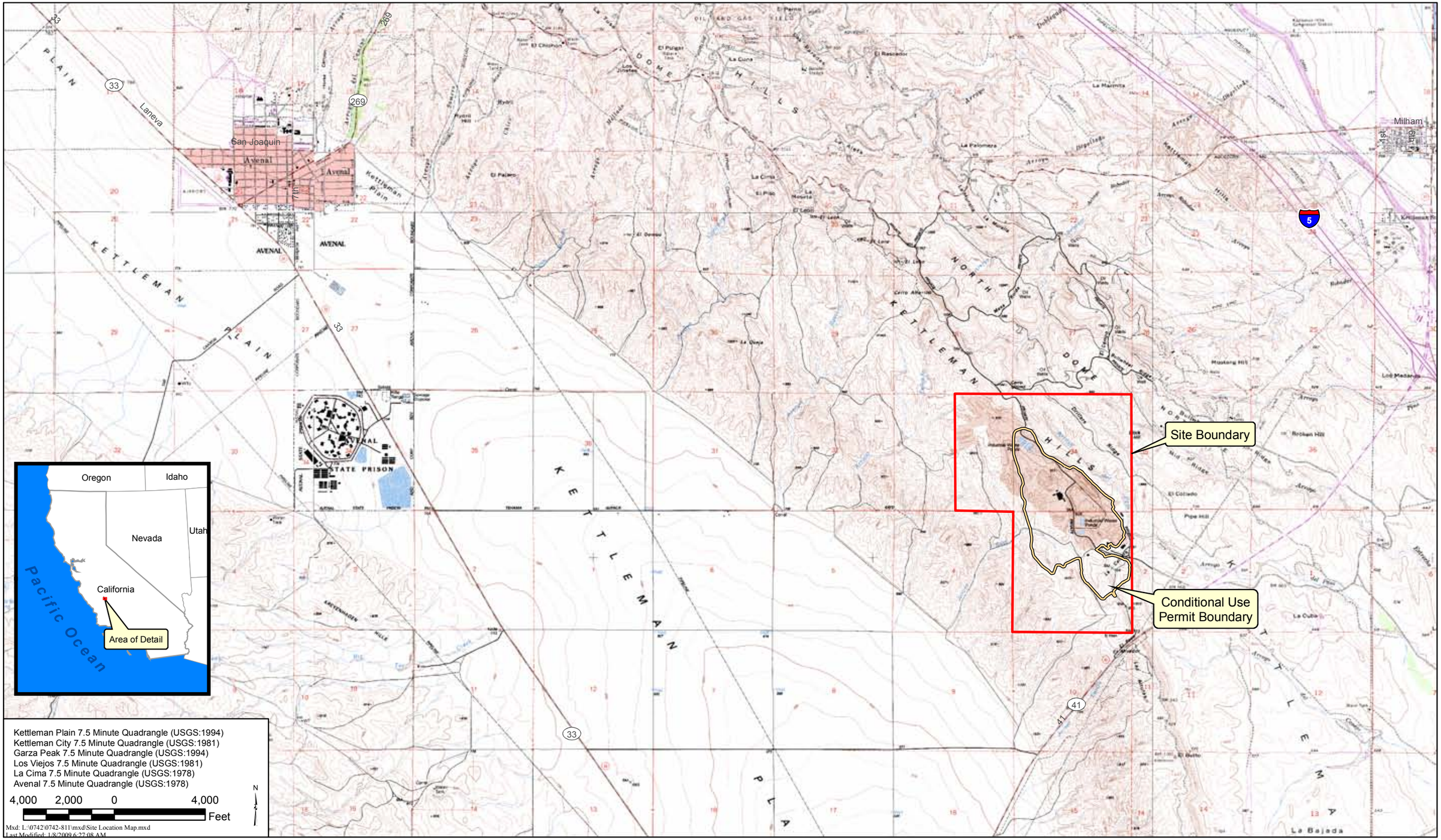
Figures



CHEMICAL WASTE MANAGEMENT, INC. - KETTLEMAN HILLS FACILITY

Site Location Map

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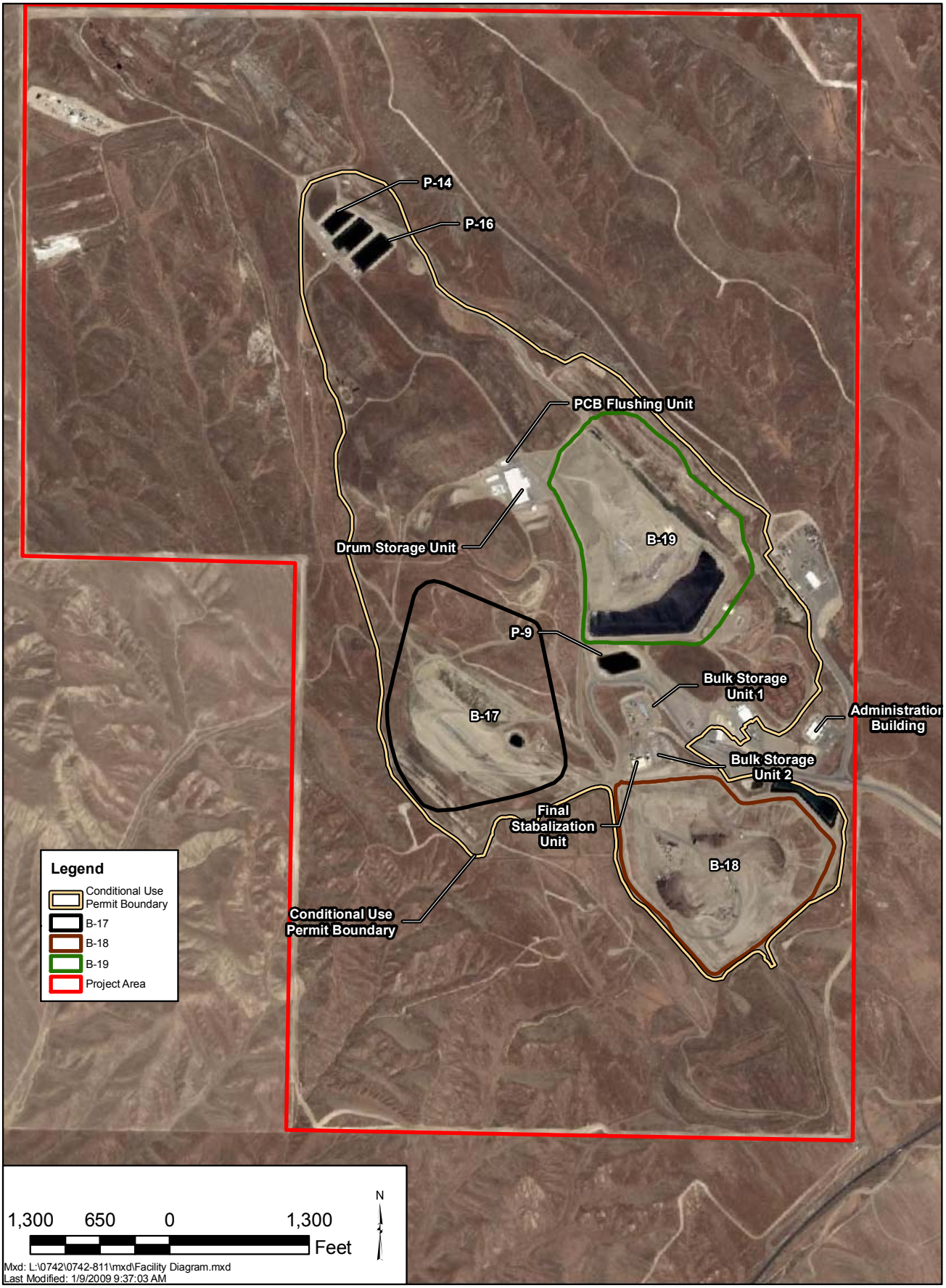
Wenck Associates, Inc. Environmental Engineers

1800 Pioneer Creek Center
Maple Plain, MN 55359-0429

JAN 2009

Figure 1



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Facility Diagram

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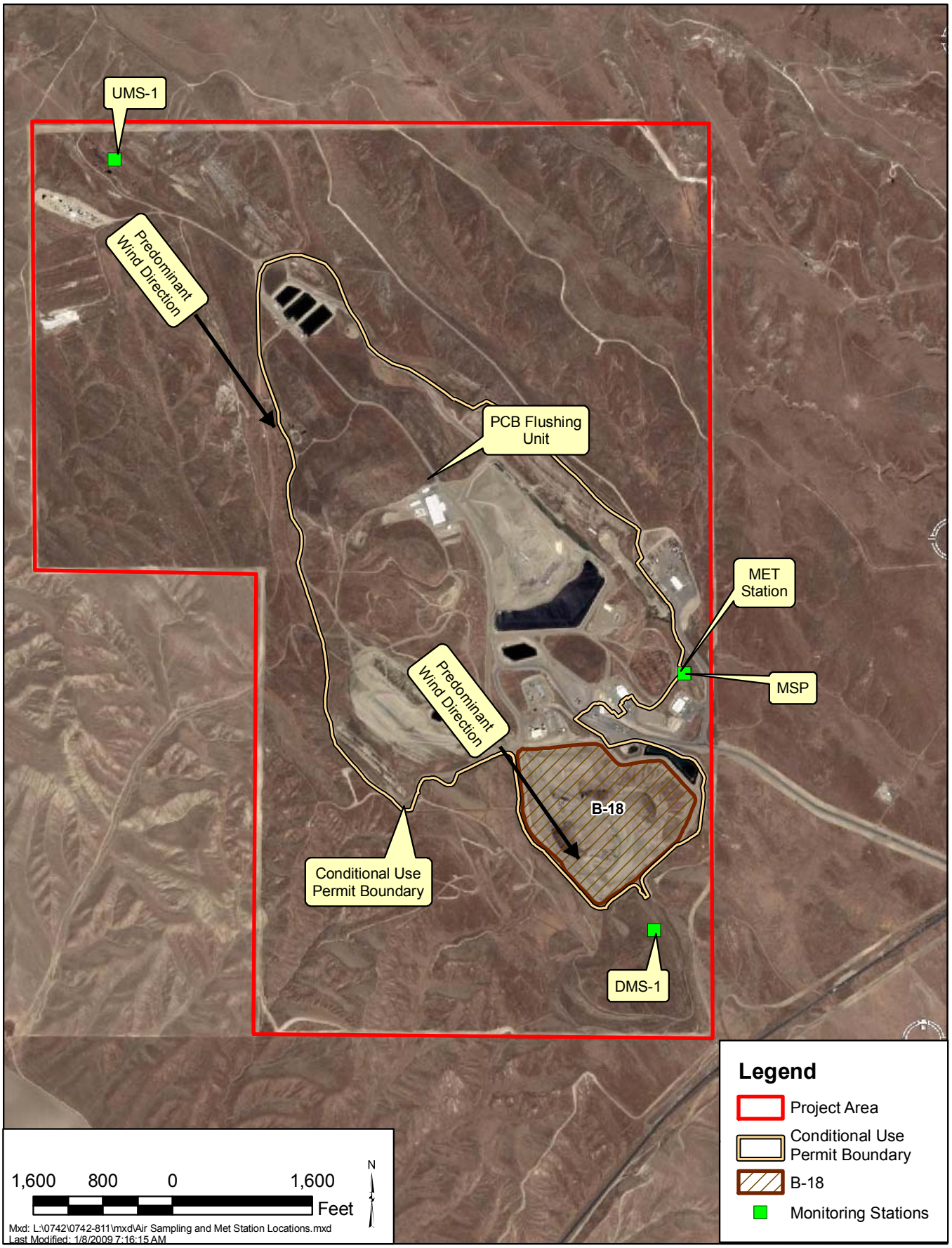
Figure 2



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Air Sampling and Met Station Locations

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Environmental Engineers Maple Plain, MN 55359-0429

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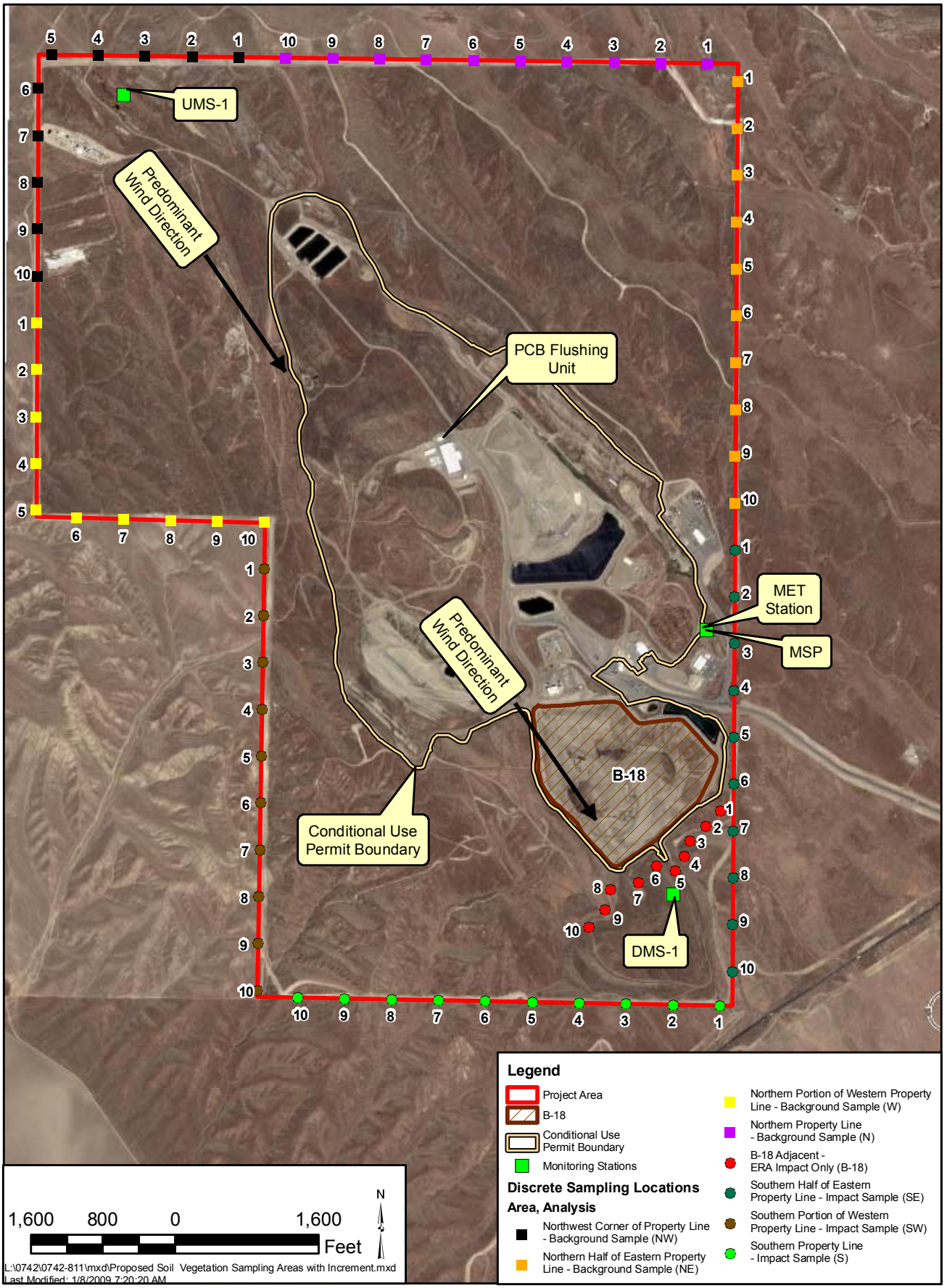
Figure 3



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Proposed Soils and Vegetation Sampling Locations

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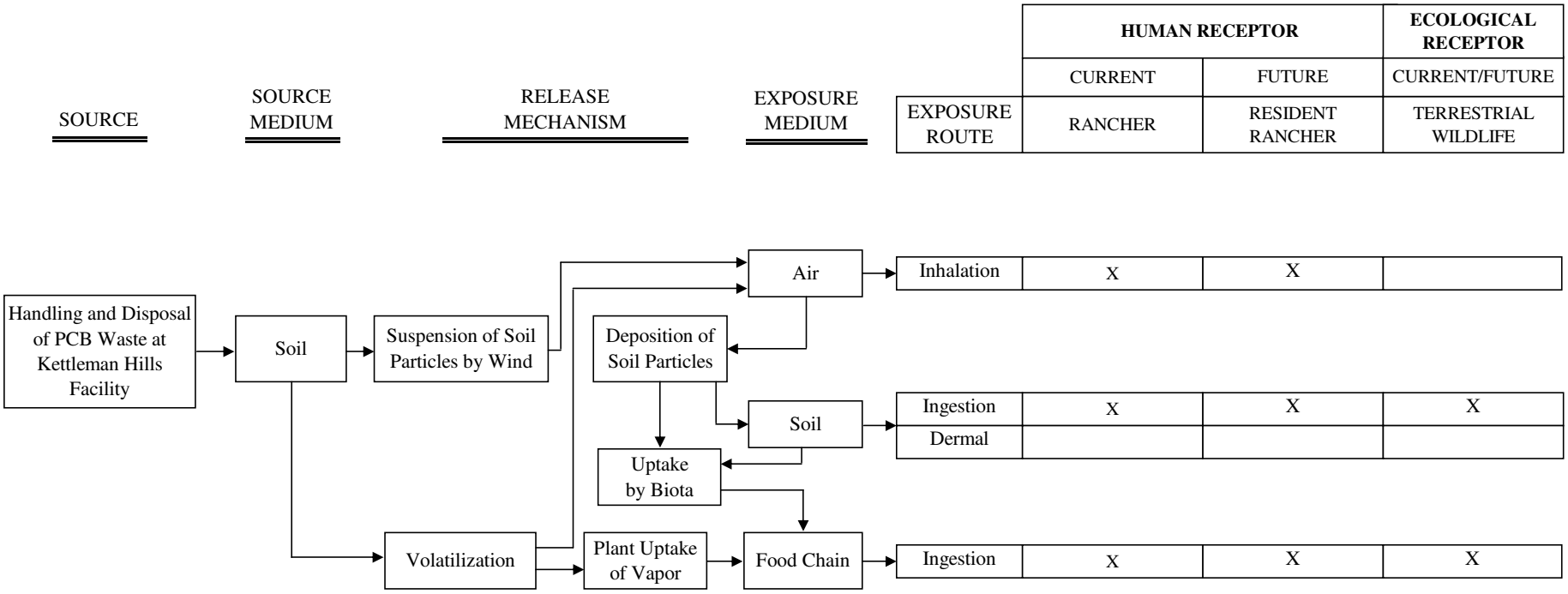
Figure 4



LEGEND
X = Potentially complete exposure pathway to be evaluated.
Empty Block = Incomplete pathway or insignificant pathway not to be evaluated.

Figure 5
Conceptual Site Model
Kettleman Hills Facility
Kettleman City, California

Appendix A

EPA Letter Request for Additional Sampling

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

RECEIVED 12/15/08

December 2, 2008

Paul Turek
Environmental Manager
Waste Management Kettleman Hills Facility
35251 Old Skyline Road
P.O. Box 471
Kettleman City, CA 93239

RE: Request for Additional Sampling of Air, Soil, and Biota/Vegetation and Analysis for PCB Congeners

Dear Mr. Turek,

U.S. Environmental Protection Agency Region IX (EPA) requests that Chemical Waste Management (CWM) conduct additional sampling of air, soil, and biota/vegetation samples and analyze these samples for PCB congeners. We are making this request to address specific public comments on the Draft PCB Coordinated Approval we proposed on February 20, 2007.

Attached to this letter is an outline of the specific information we are requesting. Our technical team is available to meet with you to clarify and discuss our needs. Additionally, we request a meeting at your facility during the first or second week of December to identify and select sampling locations. Please submit a draft work plan for these sampling and analysis tasks as soon as possible, but no later than January 15, 2009. To ensure technical consistency during your development of this work plan, CWM shall follow appropriate and applicable EPA guidance and protocols. EPA must approve your work plan prior to any implementation. Before we provide final approval of your work plan, EPA will also be meeting with and seeking input from those individuals who have raised specific risk concerns and have suggested PCB congener analyses. We will ensure that their feedback is shared with CWM so that your work plan can incorporate their input.

In addition, once your first quarter of sampling is completed and analytical data has been collected and validated, CWM shall meet with EPA to discuss how to evaluate this data for possible risk concerns. EPA intends to review and use this additional information in making a final PCB permit decision.

If you should have any technical questions or comments, please contact Patrick Wilson at (415) 972-3354. For all other questions, please contact Kevin Wong at (415) 972-3334.

Sincerely,

Cheryl Nelson
Manager
RCRA Facilities Management Office (WST-4)

Attachment

cc: Bob Henry
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Kettleman City, CA 93239

Carol Carollo
Chemical Waste Management
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Helen Luibel
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Waste Management
Greater Los Angeles Market Area
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California Air Resources Board
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Bill Zumwalt
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Enrique Manzanilla, EPA
Clancy Tenley, EPA
Lily Lee, EPA
Kevin Wong, EPA
Luis Garcia-Bakarich, EPA
Mary Simms, EPA
Ivan Lieben, EPA
Patrick Wilson, EPA
John Beach, EPA
Matthew Plate, EPA

Kettleman Hills Facility - PCB Disposal Activity Impact Analysis
A site-specific, multi-media investigational framework.

Issue: The Chemical Waste Management, Inc. - Kettleman Hills Hazardous Waste Landfill Facility is seeking a regulatory permit(s). A Hazardous Waste Permit modification is under consideration by California's Department of Toxic Substances Control (DTSC), and may be combined with a TSCA PCB permit renewal and modification subject to evaluation by U.S. EPA. A coordinated analysis and approval may be considered by the two regulatory agencies.

Community stakeholders and environmental activists have submitted official comments on the administrative record suggesting that retrospective and current facility operations have adversely impacted the health and welfare of the proximate residential community and ecosystem directly adjacent to the facility.

Objective: Collect sufficient data to assess the magnitude of potential human and ecological impact to off-site receptors from PCB disposal activities at the Kettleman Hills Facility. Several lines of multi-media and complementary scientific evidence should be pursued to better characterize the degree of potential impact.

I. Ambient Air Monitoring Strategy

The Kettleman Hills Facility has been participating with DTSC in an existing ambient air and depositional monitoring program for PCB releases to air. Three stationary air monitoring stations and one mobile monitoring station have been collecting air samples over the past two years and subjecting the samples for PCB Aroclor analysis. To date, all sample results have been non-detect for PCB Aroclors.

A technical review of the methods and results of that analysis have revealed a number of potentially significant data gaps and uncertainties in the air monitoring approach. These data gaps principally involve the ability of the sampling devices to collect and allow detection of the most-relevant suite of PCBs mixtures or congeners at limits of detection germane to adverse health impacts, and the siting or location of the sampling devices relative to on-site operational disposal activity. Therefore, additional studies should be conducted to collect sufficient air monitoring and depositional data to assess the degree of off-site impact.

a) Obtain sufficient data for assessment of PCB airborne and depositional impacts from landfill disposal activities. To the extent that investigational activities can characterize the degree of potential impact to the buffer-zone immediately adjacent to the facility, a sound rationale can be developed and shared with the community and stakeholders that more distant human and ecological receptors are then subject to a relatively *de minimus* level of impact from PCB disposal activities at the landfill.

   i) <u>Human Health Assessment</u>
   Collect additional air samples from a limited number of high-volume sampling devices specifically located in the facility's buffer zone to assess the degree of

PCB depositional impact associated with landfill disposal activities. These samples should be collected over a 1 year window of time, with 12 sampling events occurring throughout that time period. While the sampling devices will collect air samples over the entire month, contaminant analysis will occur but once a month. Sampling devices should be located in generally upwind and downwind locations based, in part, upon historical on-site meteorological patterns. In addition, the releases from on-site landfill disposal activities should be subjected to analysis by an air dispersion & transport model to better predict the potential locations of maximum depositional impact. Air monitoring devices siting and location should remain considerate of these results. Finally, any available retrospective or more-recent buffer zone surficial soil sample results should also be reviewed and considered when selecting the location of the air sampling devices to maximize the likelihood of detecting impacts.

ii) Ecological Assessment

The results from the air sampling approach described above will also be used to assess the degree of impact to ecological receptors. Although direct inhalation impacts are not an exposure pathway currently considered in ecological risk assessments, the depositional impacts on soil and vegetation supporting the food web of ecological receptors remains a indirect pathway of contaminant exposure which should be characterized.

iii) Analytical Framework

PCB samples should be subjected to high-resolution analysis to provide specific data regarding the prevalence of the dioxin-like or co-planar PCB congeners (EPA Method 1668a). In addition, the concentration of total PCBs should be reported from analysis of these samples and, where pattern matches can be made, Aroclors should be specifically identified.

II. Surficial Soil Sampling Strategy

a) A series of composite soil samples should be collected from the facility buffer zone to characterize the degree of PCBs potentially impacting off-site receptors.

i) Human Health Assessment

A composite soil sampling plan should be developed to assess the degree of PCB impact in the off-site buffer zone. Results from this sampling and analysis effort will be used to assess the magnitude of human health impact from the direct pathways of human exposure. All composited samples should be retained following analysis such that the specific-contribution from any discrete sample can be retrospectively assessed. A composite sampling approach enjoys the advantage of expanding the areal extent of buffer zone characterization while also minimizing resource allocations. Soil sample locations should be informed by results from the

air dispersion and modeling results, proximity to disposal activity and TBD based upon a site visit reconnaissance. Samples should be collected from the surficial lens of soil to characterize the pathways of direct exposure. A limited effort should also be made to characterize potential impacts from soil run-off pathways. Results from surficial soil samples should also be used to assess potential impacts to the food-chain by characterizing the exposure potential and uptake into livestock grazing in the buffer zone. The bioaccumulation and resultant health impacts posed by consumption of impacted livestock can be modeled via algorithms developed to support the indirect pathways of human exposure. Finally, a limited number of background or non-impacted locations should be sampled for purposes of comparison with sampling results from potentially impacted locations.

ii) Ecological Assessment

The results from the surficial soil sampling approach described above will also be used to support characterization of potential impacts to ecological receptors and habitat.

iii) Analytical Framework

PCB samples should be submitted for high-resolution analysis to provide specific data regarding the prevalence of the dioxin-like or co-planar PCB congeners (EPA Method 1668a). In addition, the concentration of total PCBs should be reported from analysis of these samples and, where pattern matches can be made, aroclors should be specifically identified.

III. Biota/Vegetation Sampling Strategy

a) A limited number of vegetative cover samples, and a limited number of biota samples should be collected and analyzed to assess the degree of direct and indirect ecological impact in both the buffer zone and discrete on-site locations. In addition to the direct pathway of ecological exposure via ingestion, results from this sampling effort will be used to model impacts to higher trophic-level organisms via the food chain.

Limited on-site vegetative cover and limited on-site biota samples (lower trophic-level prey animals) will allow more robust characterization of potential impacts to site-specific ecological receptors (threatened or endangered). The number of on-site and off-site or buffer zone vegetative and biota samples, their location, and the type of biota sampled is TBD based upon a site visit reconnaissance.

i) Analytical Framework

PCB samples should be submitted for high-resolution analysis to provide specific data regarding the prevalence of the dioxin-like or co-planar PCB congeners (EPA Method 1668a). In addition, the concentration of total

PCBs should be reported from analysis of these samples and, where pattern matches can be made, aroclors should be specifically identified.

Appendix B

Meteorological Data

Appendix B Meteorological Data

On-site meteorological data has been collected at KHF since 1986. Recorded data show a predominate annual and seasonal wind direction from North-Northwest (NNW). As shown in the following annual windroses from 2000-2008, a very distinct trend NNW exists until 2007. Beginning in 2007 and continuing forward, wind direction recorded on site began to show a variable wind pattern with virtually no winds coming from the North. The recorded wind conditions conflicted with what was observed on-site by KHF staff. With the exception of weather changes and other frontal movements, the predominant wind direction observed on-site is still NNW, even when the meteorological station records variable wind direction. This anomaly appears to be attributed to the increasing height of the B19 landfill in recent years which is located immediately to the NNW of the on-site met station. As the elevation of the B-19 landfill has grown, the met station is now below grade of the B-19 landfill. KHF is currently researching a more suitable location for the met station.

To ensure the change in wind direction is in fact being influenced by the B-19 landfill and not some other climatic change or event in the San Joaquin Valley, wind data from the surrounding area was also analyzed. Data from the Fresno Yosemite International Airport (FAT) located Fresno, California located about 60 miles to the Northeast of KHF. Data from the Fresno airport was collected and is presented for comparison with the data from KHF. At the Fresno airport, the predominate Northwest wind direction is evident and consistent each year indicating that no climatic event has been occurring over the last eight years in the area.

As such, data collected from 2000-2006 will be used as an indicator of historic wind patterns at KHF. Once a suitable location for the met station is established, the met station will be re-located to ensure accurate meteorological data is recorded for this Study.

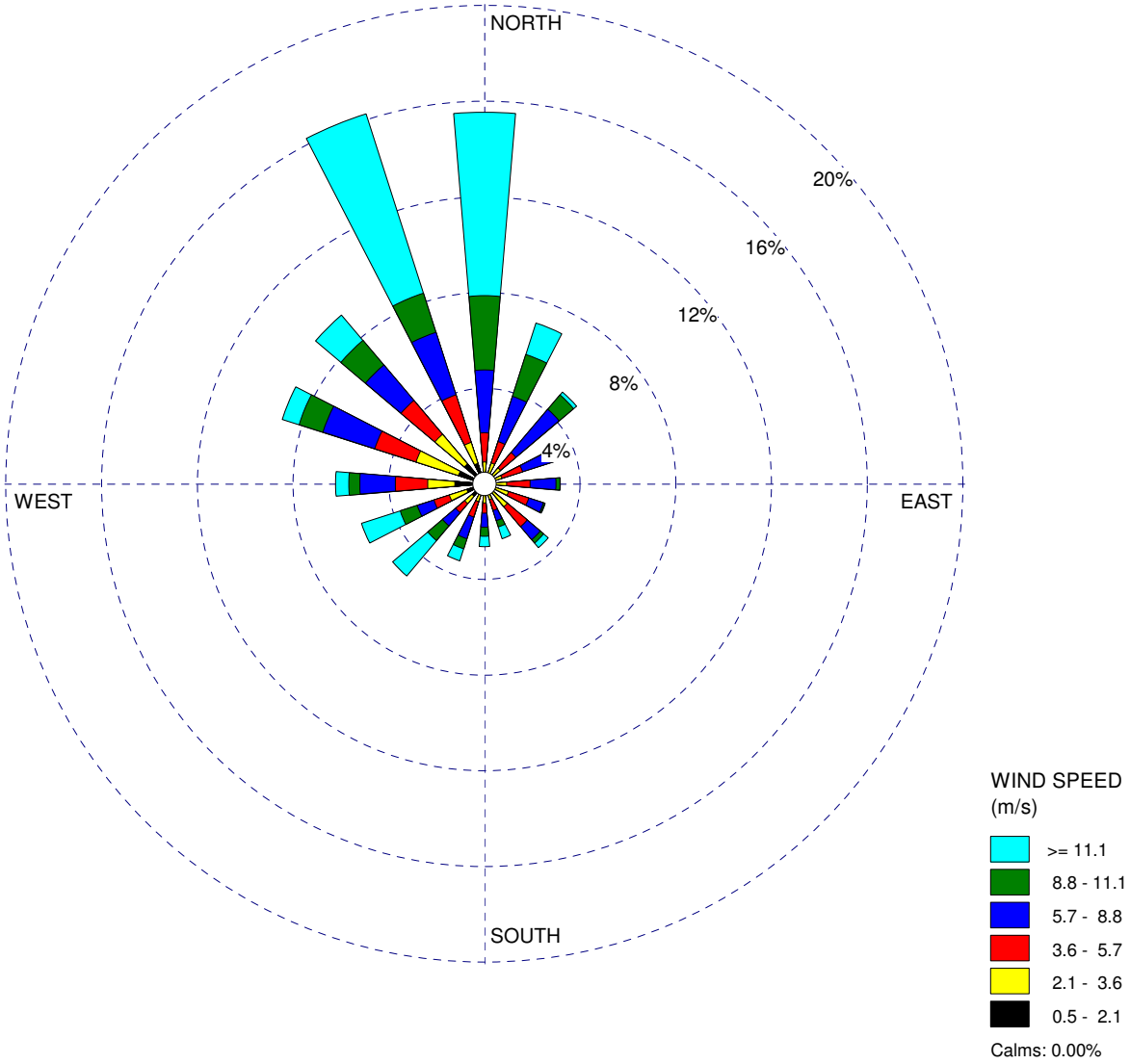
Copies of the most recent calibration and audit reports, prepared by AMEC Geomatrix, Inc., containing information on the specific sensors used, their operating ranges, siting, and general quality control are also included in this appendix.

WIND ROSE PLOT:

2000 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2000** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **8766 hrs.**	
	AVG. WIND SPEED: **8.13 m/s**	DATE: **12/30/2008**	PROJECT NO.: **0742-811**

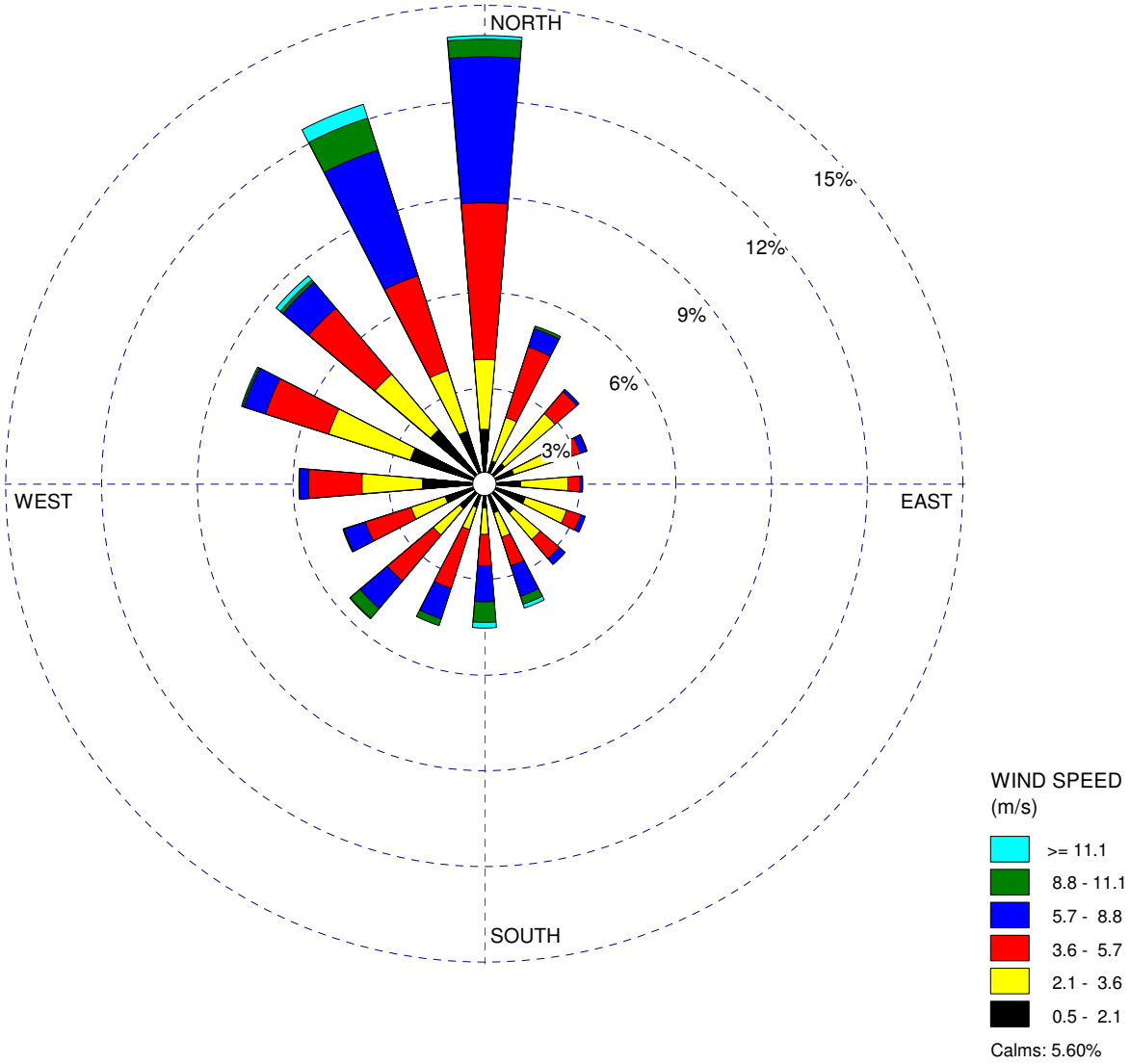
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2001 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2001** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **5.60%**	TOTAL COUNT: **7959 hrs.**	
	AVG. WIND SPEED: **3.89 m/s**	DATE: **12/30/2008**	PROJECT NO.: **0742-811**

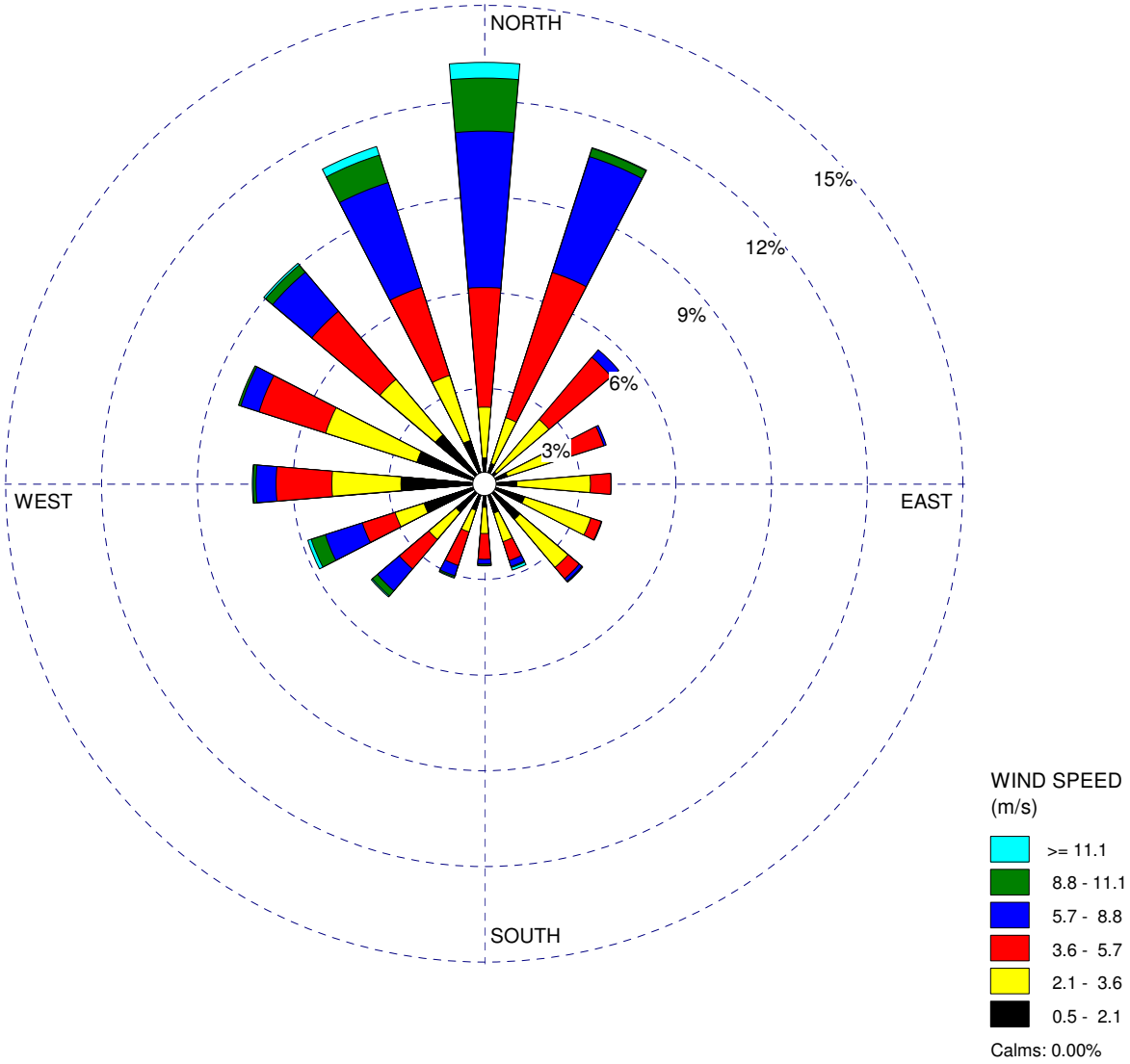
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2002 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2002** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **8721 hrs.**	
	AVG. WIND SPEED: **4.17 m/s**	DATE: **12/30/2008**	PROJECT NO.: **0742-811**

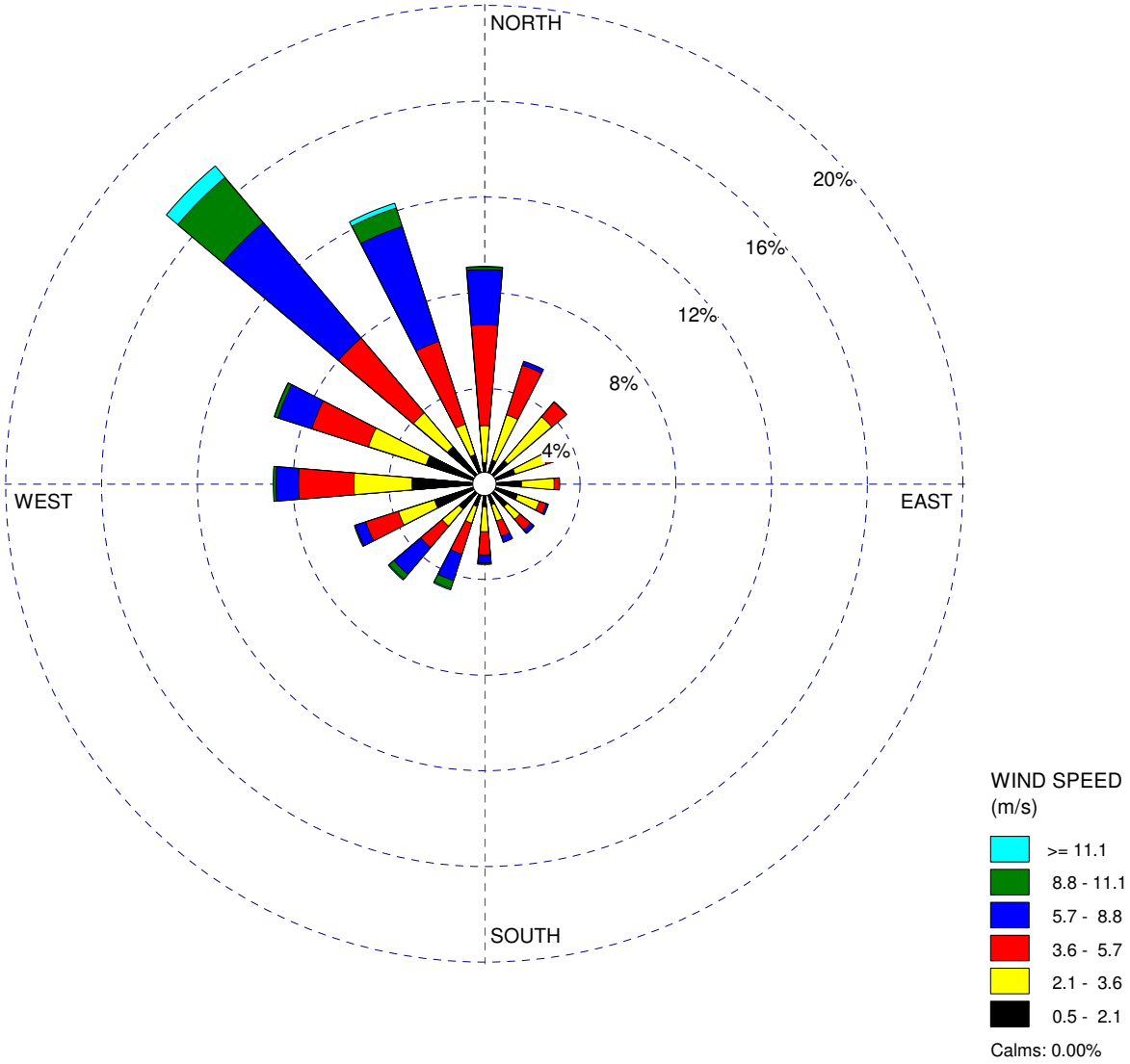
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2003 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2003** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **8557 hrs.**	
	AVG. WIND SPEED: **4.16 m/s**	DATE: **1/6/2009**	PROJECT NO.: **0742-811**

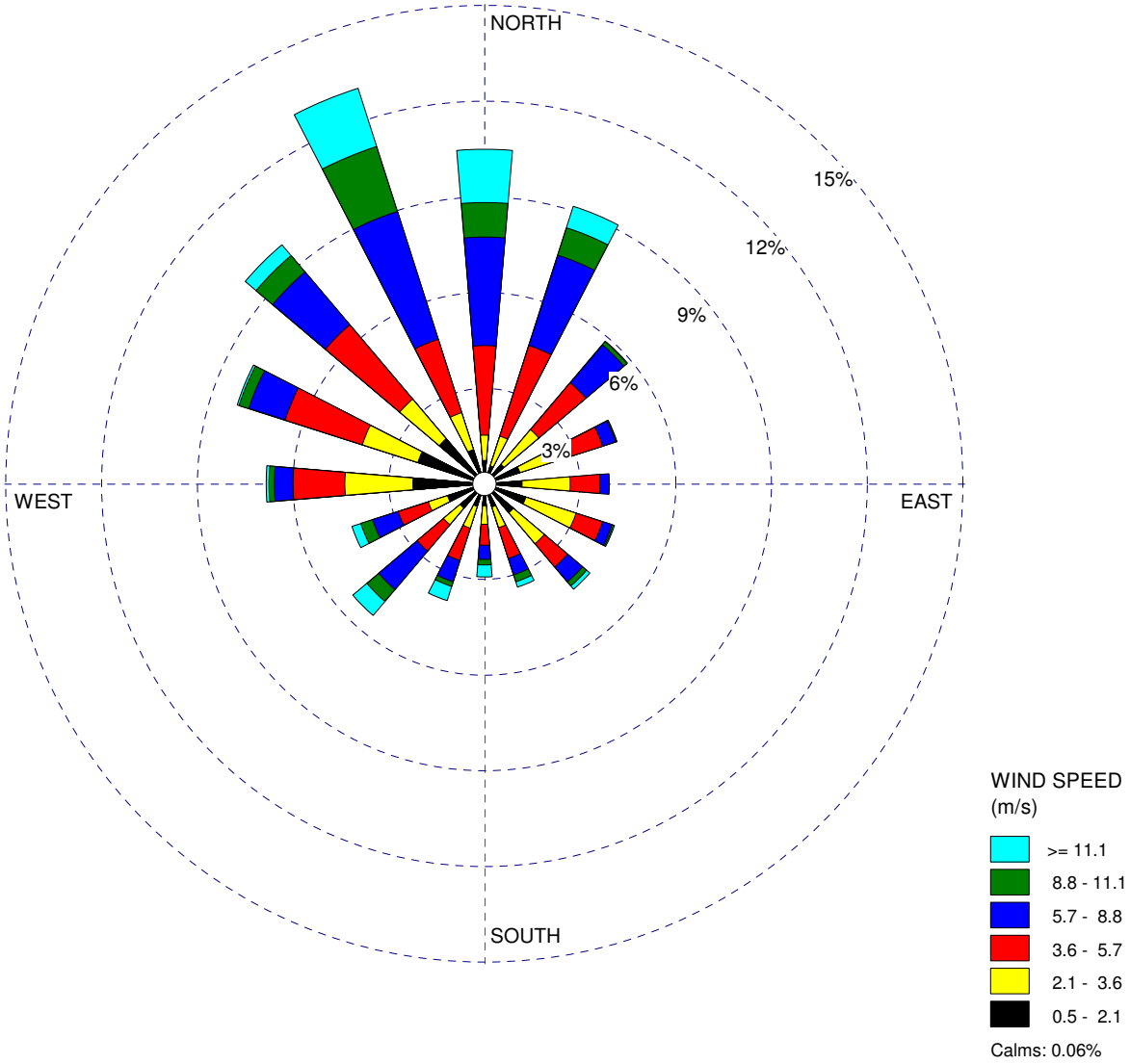
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2004 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2004** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.06%**	TOTAL COUNT: **8568 hrs.**	
	AVG. WIND SPEED: **5.24 m/s**	DATE: **12/18/2008**	PROJECT NO.: **0742-811**

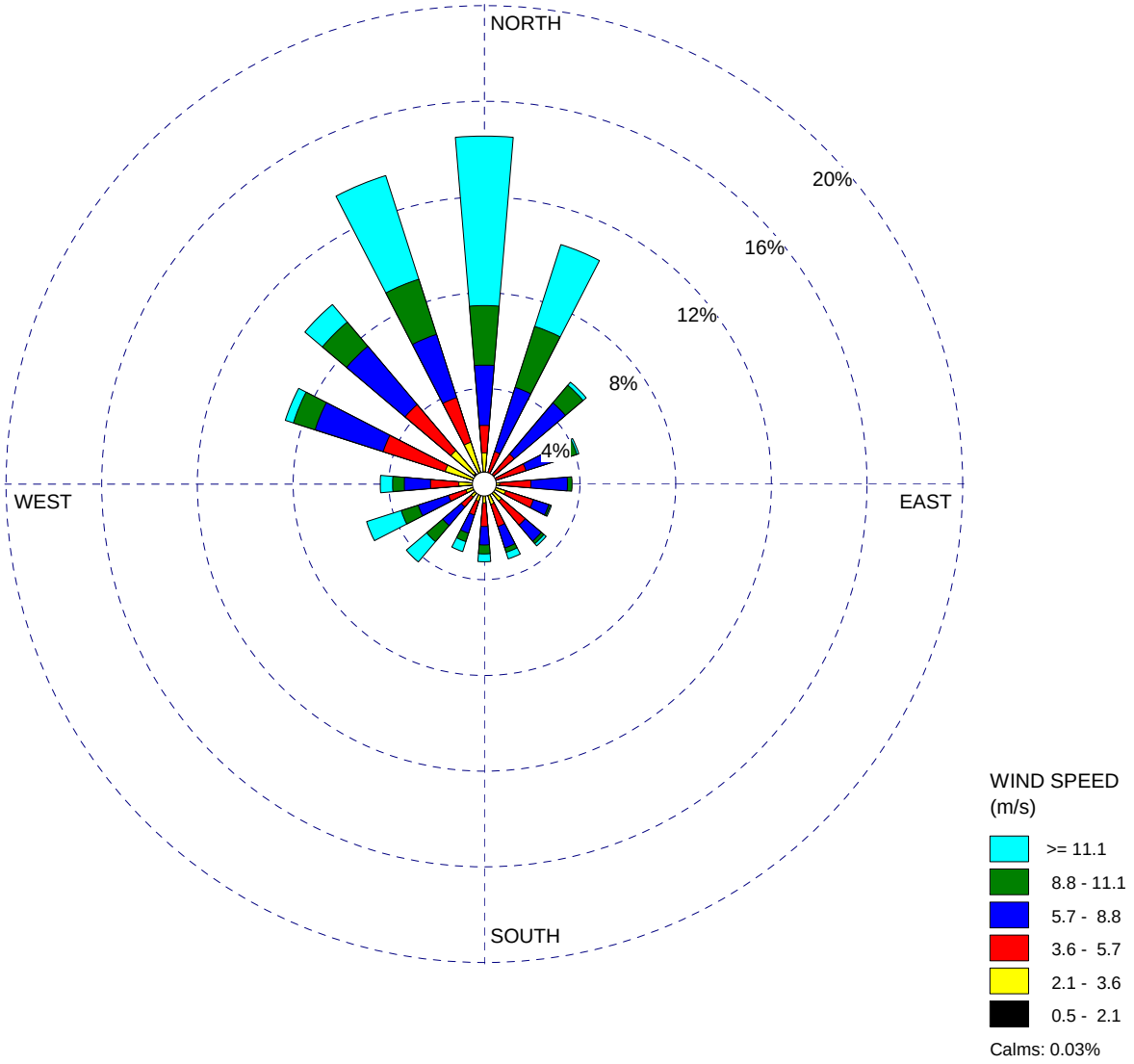
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2005 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2005** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.03%**	TOTAL COUNT: **8746 hrs.**	
	AVG. WIND SPEED: **7.88 m/s**	DATE: **12/18/2008**	PROJECT NO.: **0742-811**

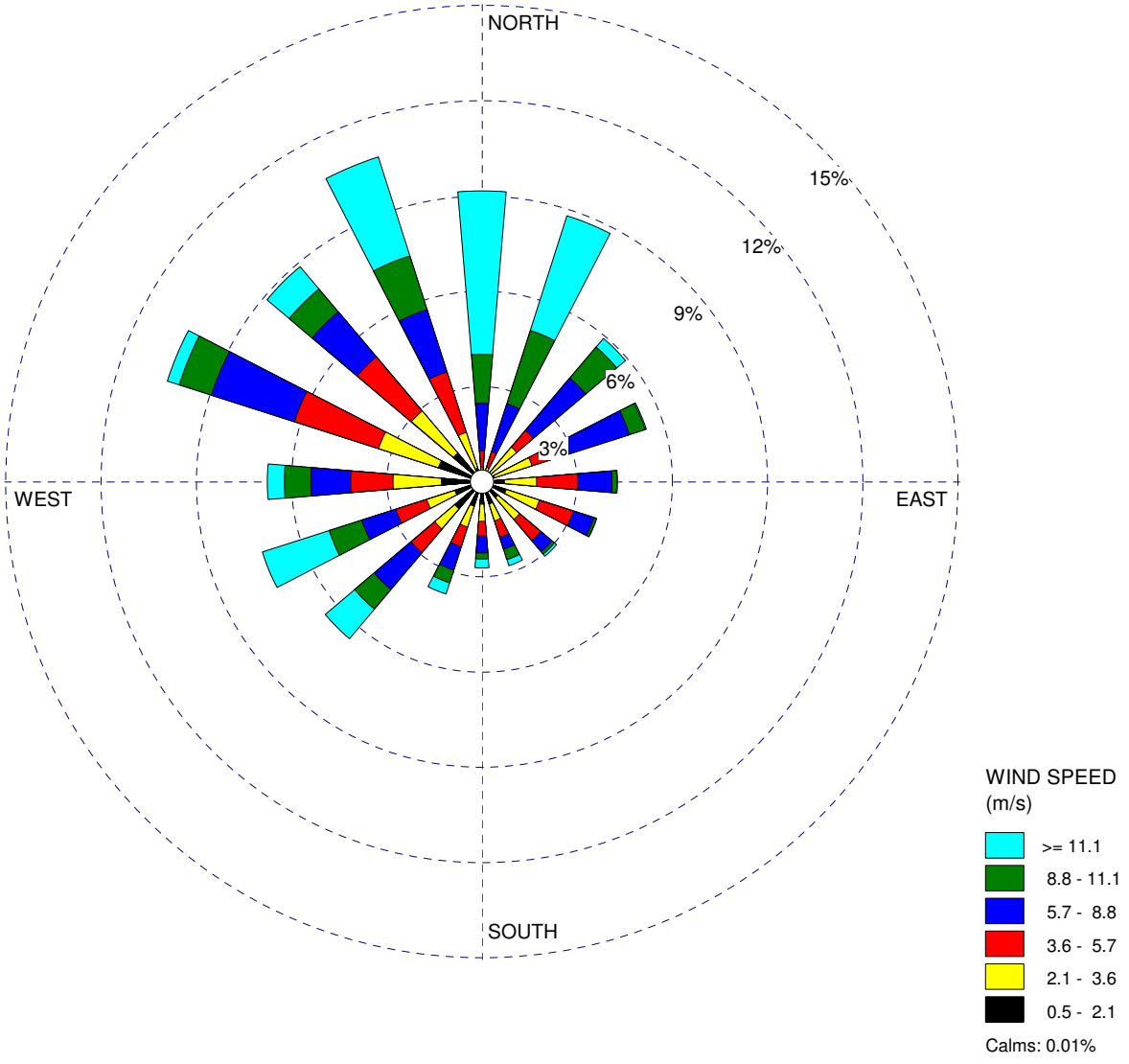
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2006 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2006** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **0.01%**	TOTAL COUNT: **8466 hrs.**	
	AVG. WIND SPEED: **7.11 m/s**	DATE: **12/19/2008**	PROJECT NO.: **0742-811**

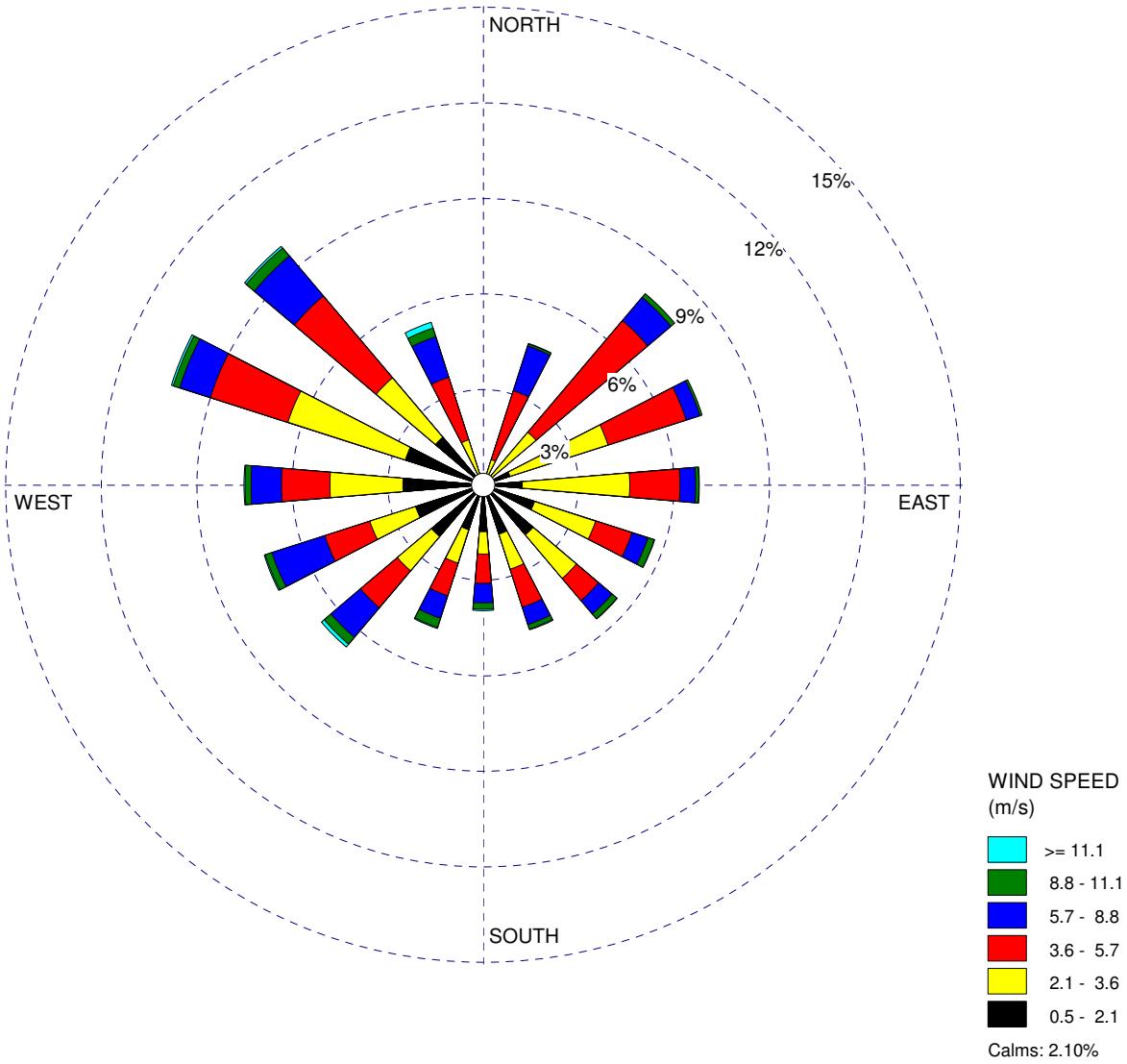
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2007 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were variable with no distinct pattern.	**2007** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **2.10%**	TOTAL COUNT: **8570 hrs.**	
	AVG. WIND SPEED: **3.82 m/s**	DATE: **12/22/2008**	PROJECT NO.: **0742-811**

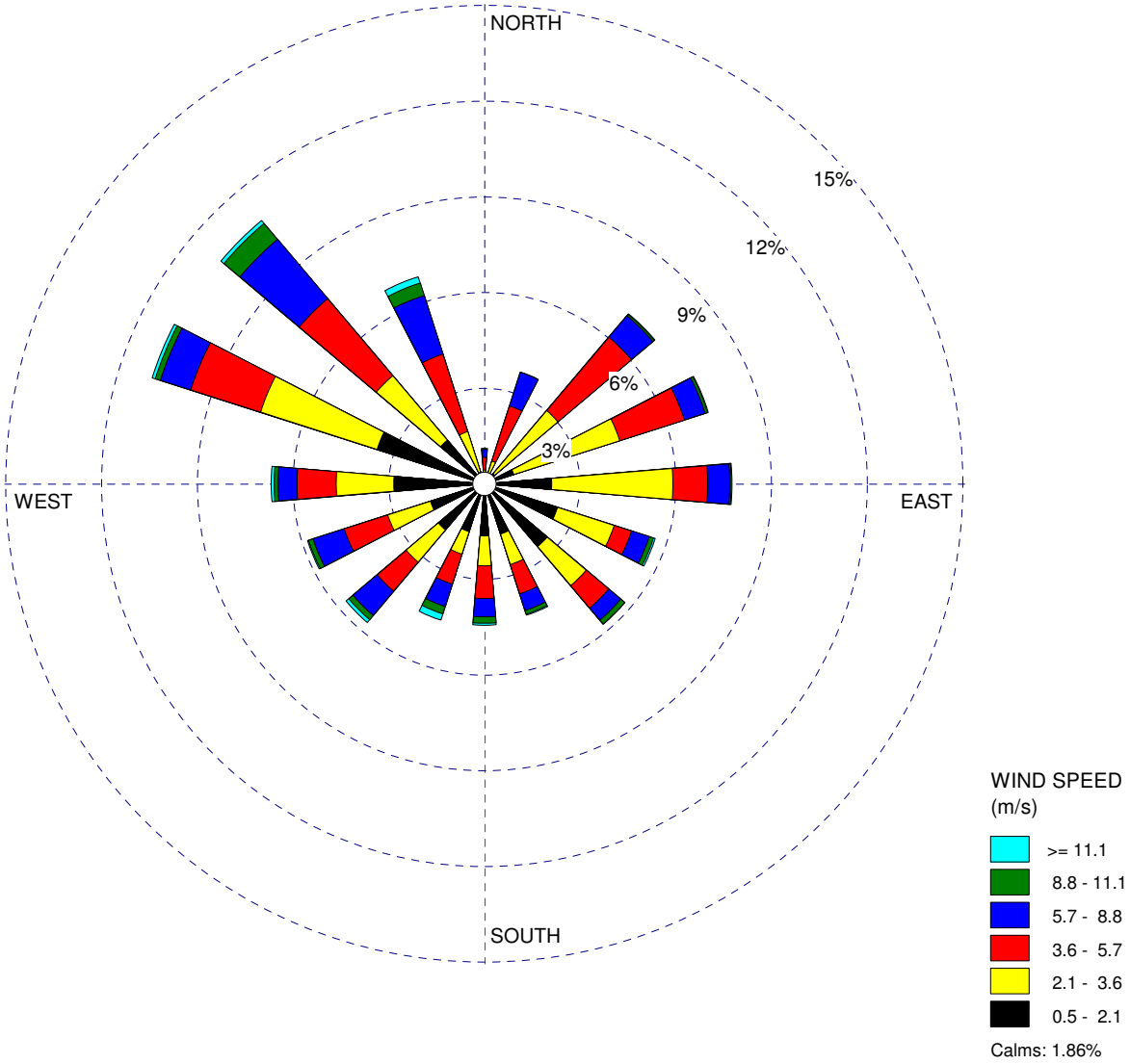
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2008 Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were variable with no distinct pattern.	**2008** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **1.86%**	TOTAL COUNT: **8771 hrs.**	
	AVG. WIND SPEED: **3.76 m/s**	DATE: **1/6/2009**	PROJECT NO.: **0742-811**

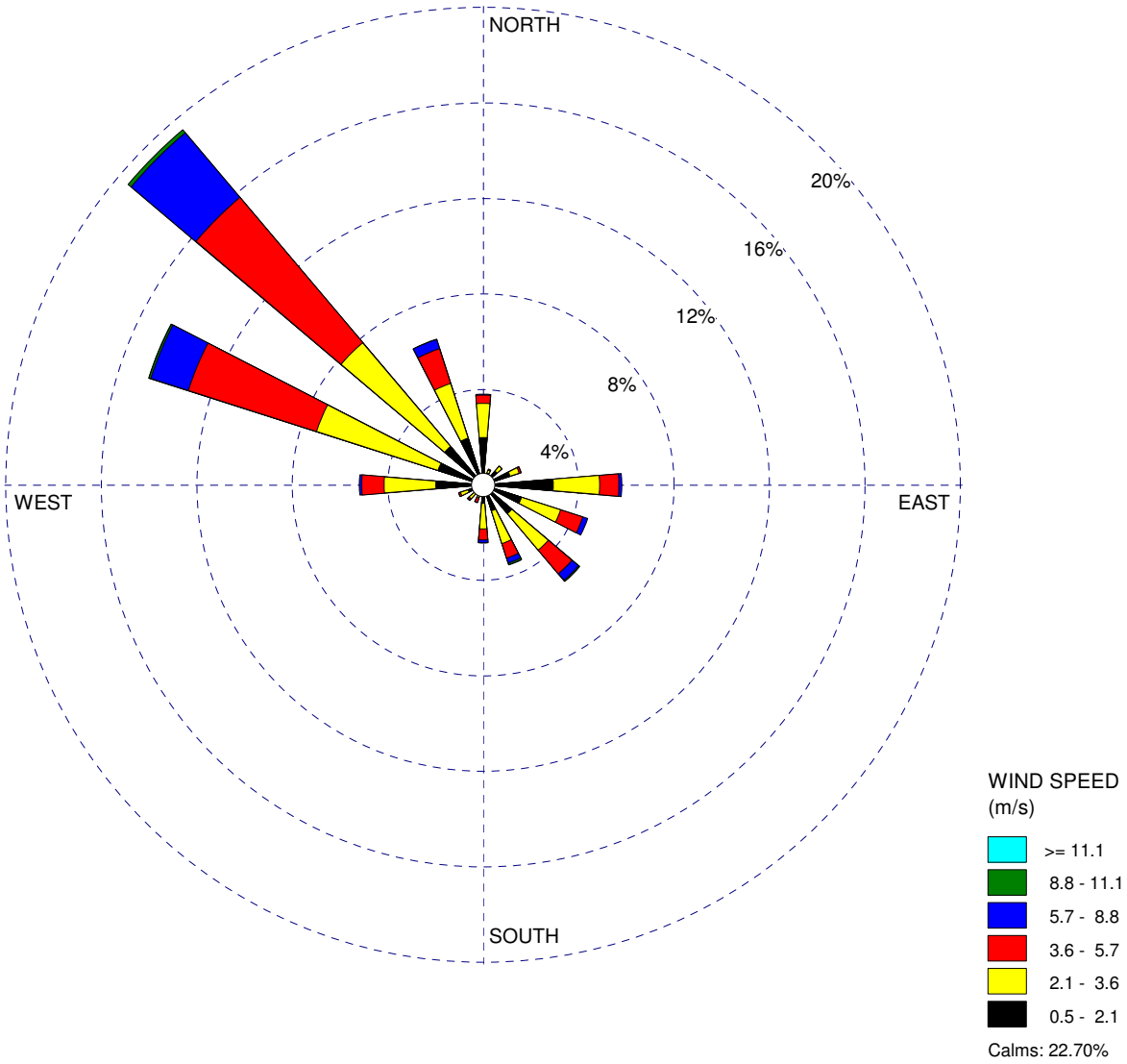
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2000 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2000** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **22.70%**	TOTAL COUNT: **8107 hrs.**	
	AVG. WIND SPEED: **2.74 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

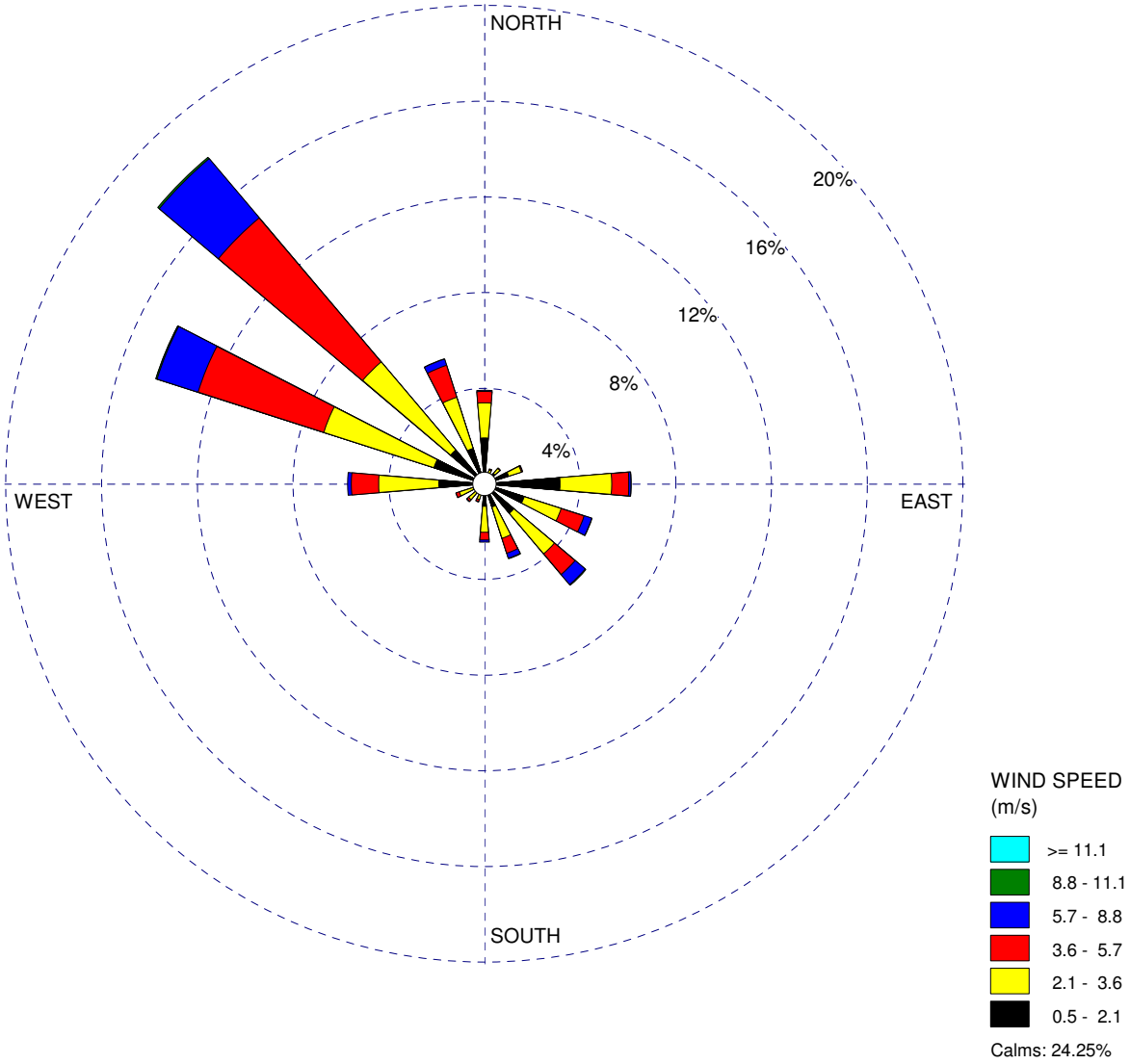
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2001 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2001** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **24.25%**	TOTAL COUNT: **8082 hrs.**	
	AVG. WIND SPEED: **2.68 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

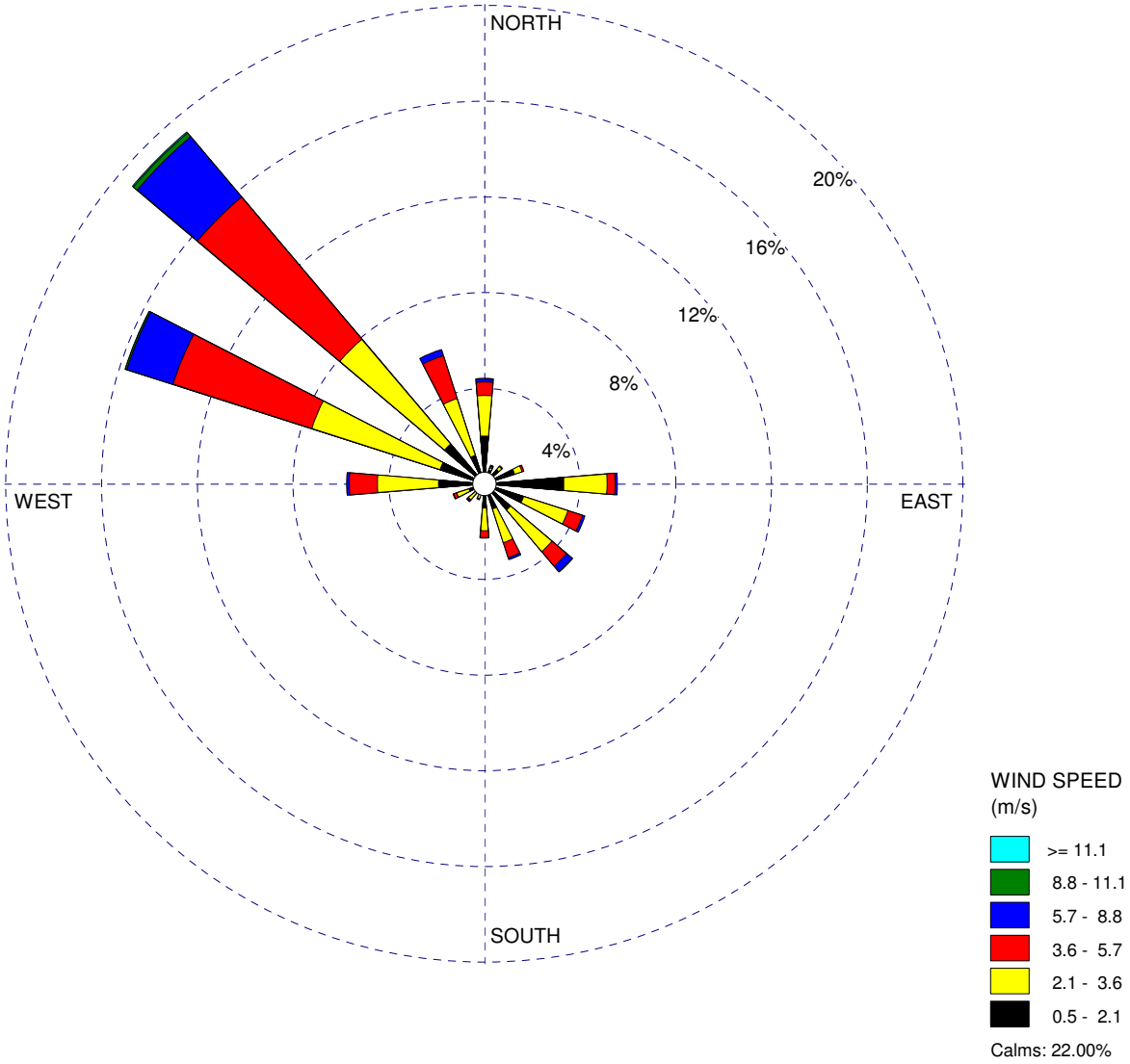
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2002 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2002** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **22.00%**	TOTAL COUNT: **7965 hrs.**	
	AVG. WIND SPEED: **2.73 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

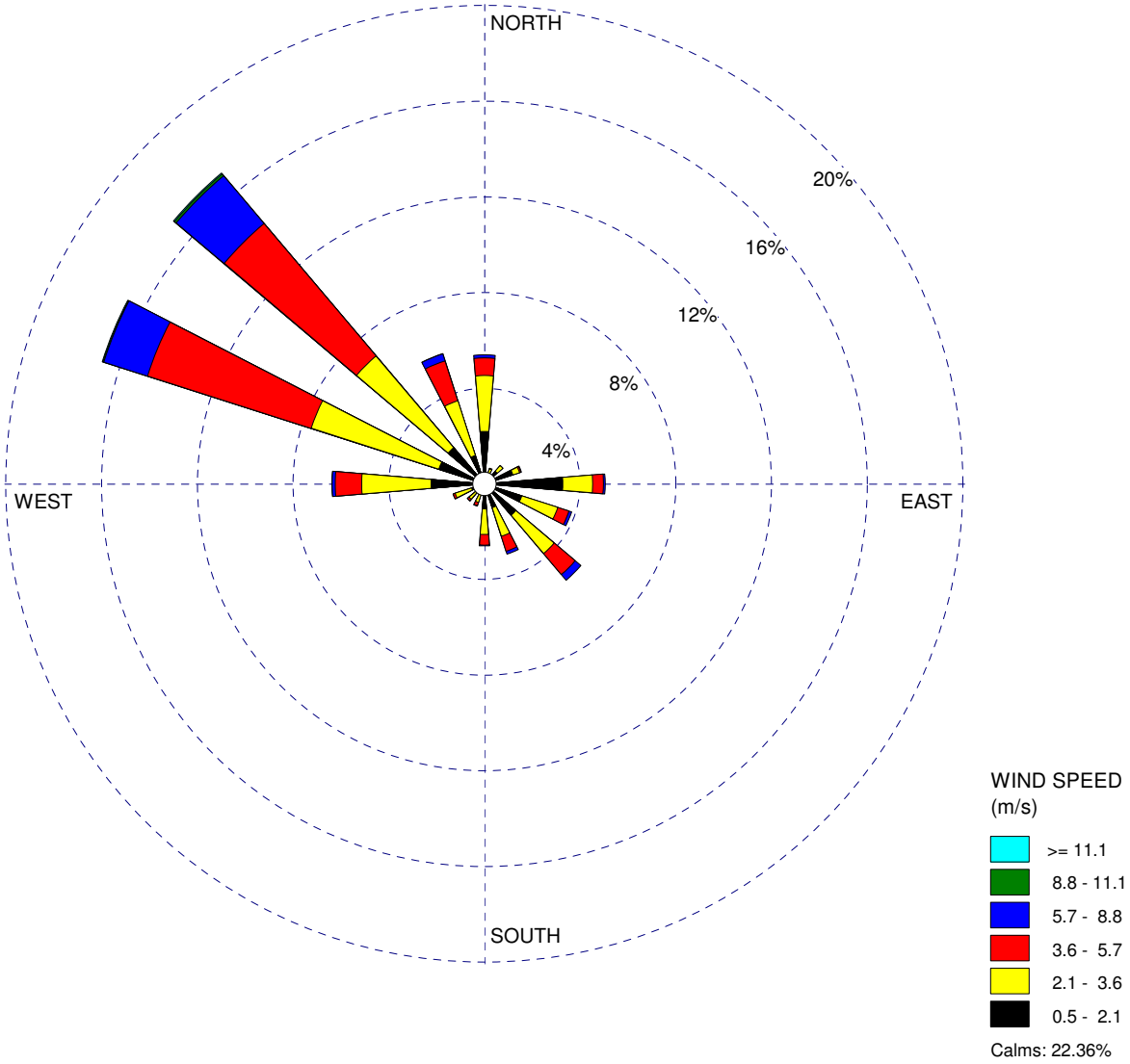
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2003 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2003** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **22.36%**	TOTAL COUNT: **7933 hrs.**	
	AVG. WIND SPEED: **2.70 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

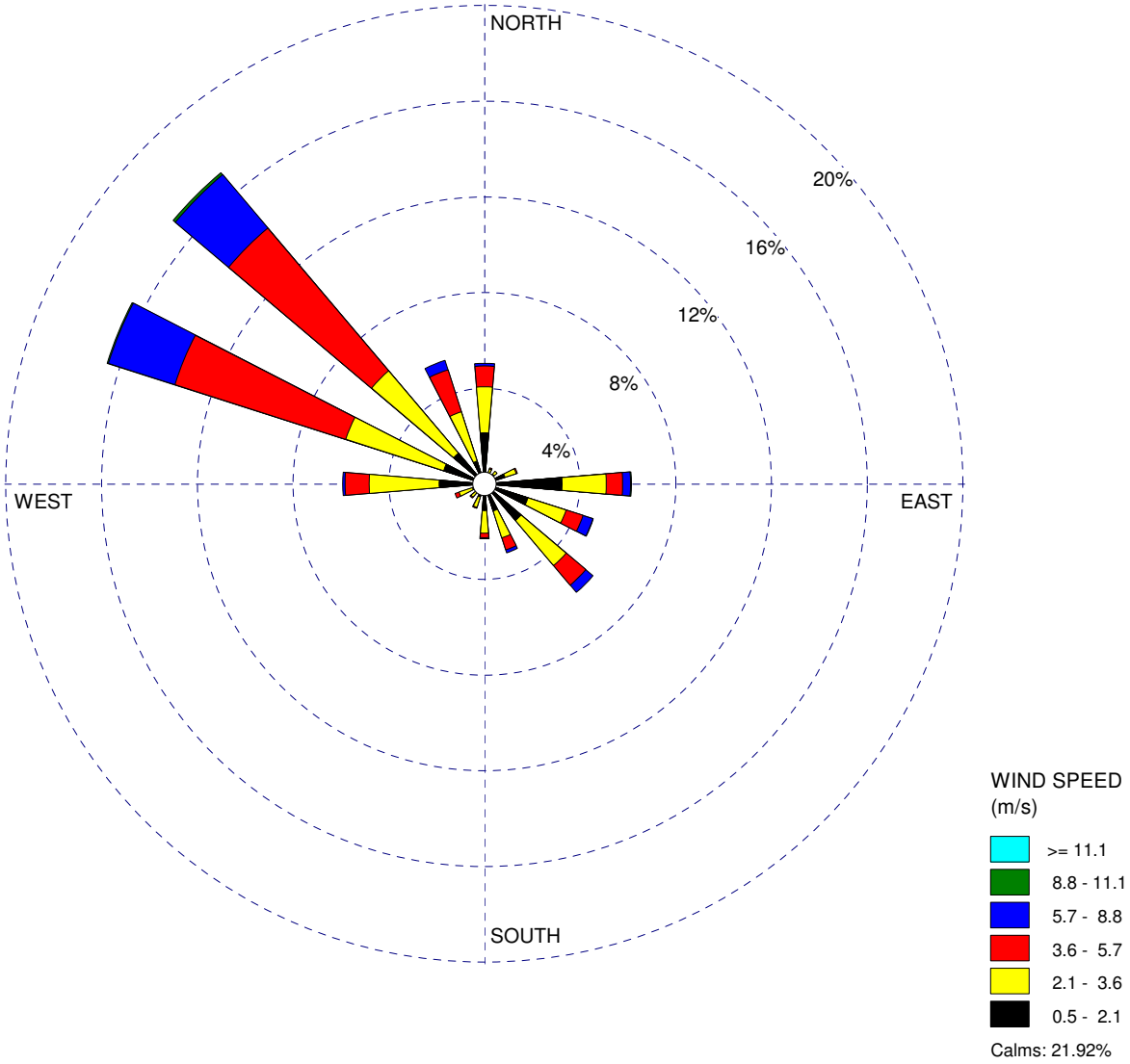
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2004 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2004** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **21.92%**	TOTAL COUNT: **7961 hrs.**	
	AVG. WIND SPEED: **2.83 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

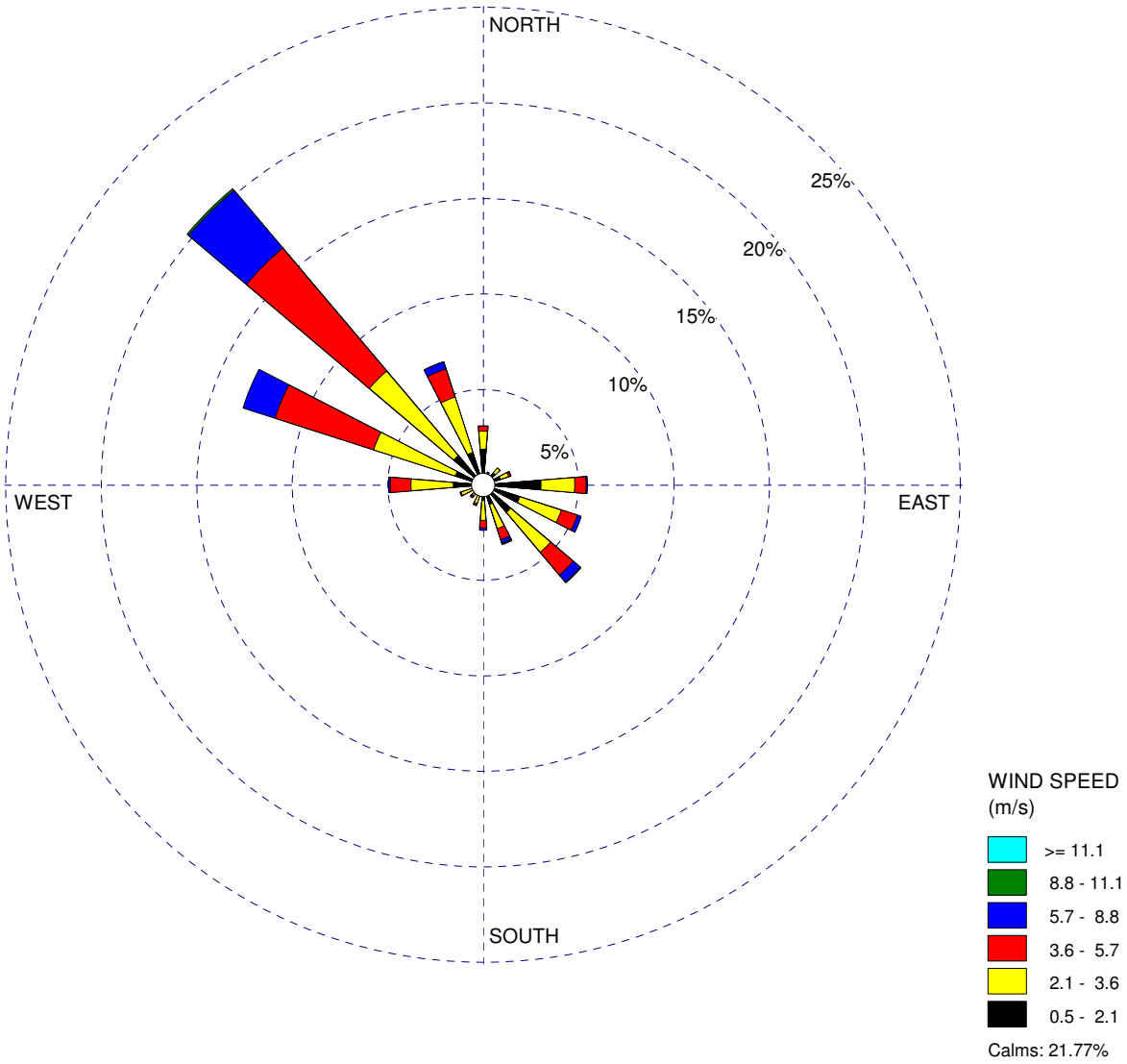
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2005 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2005** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **21.77%**	TOTAL COUNT: **8104 hrs.**	
	AVG. WIND SPEED: **2.78 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

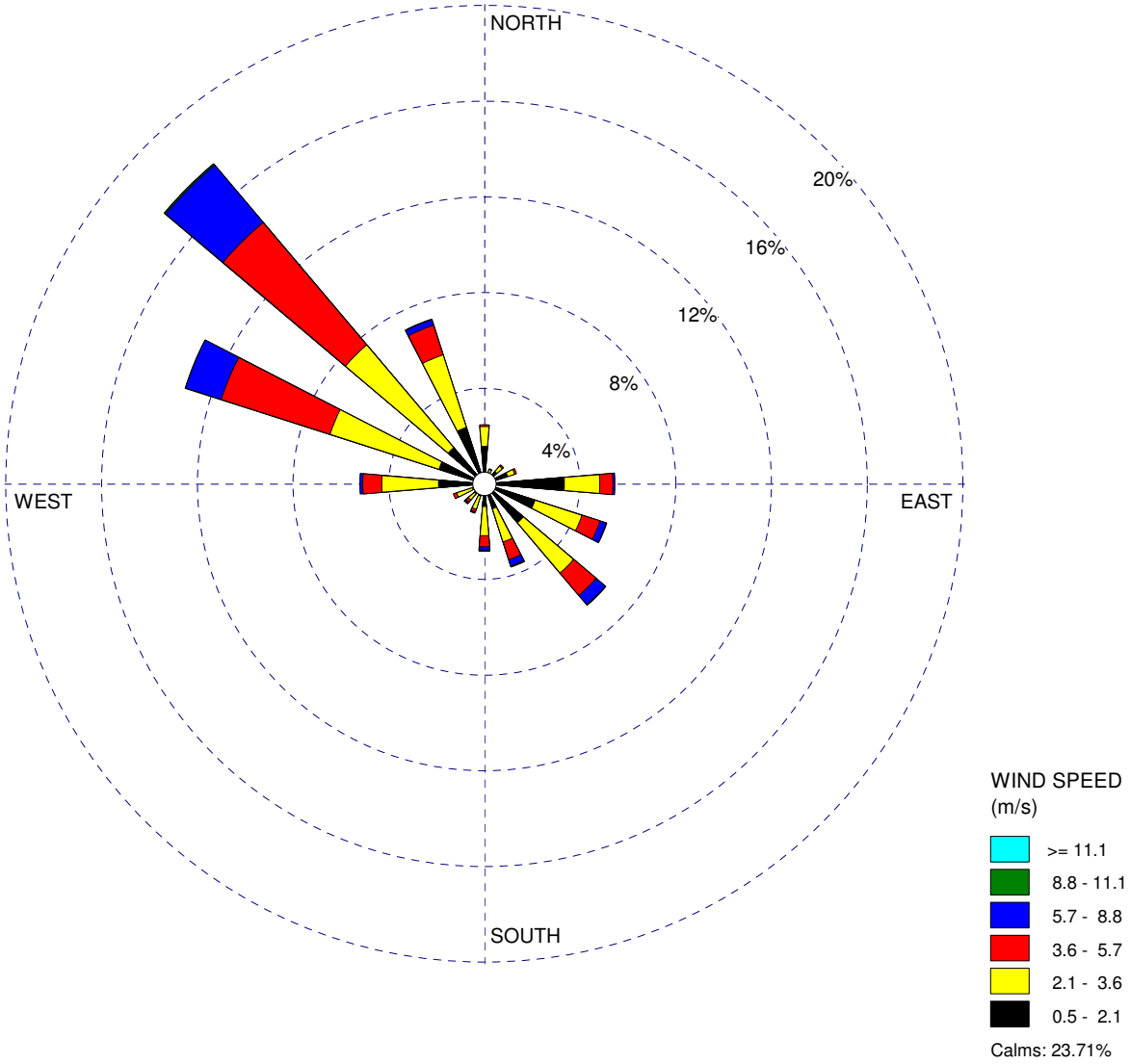
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2006 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2006** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **23.71%**	TOTAL COUNT: **8118 hrs.**	
	AVG. WIND SPEED: **2.61 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

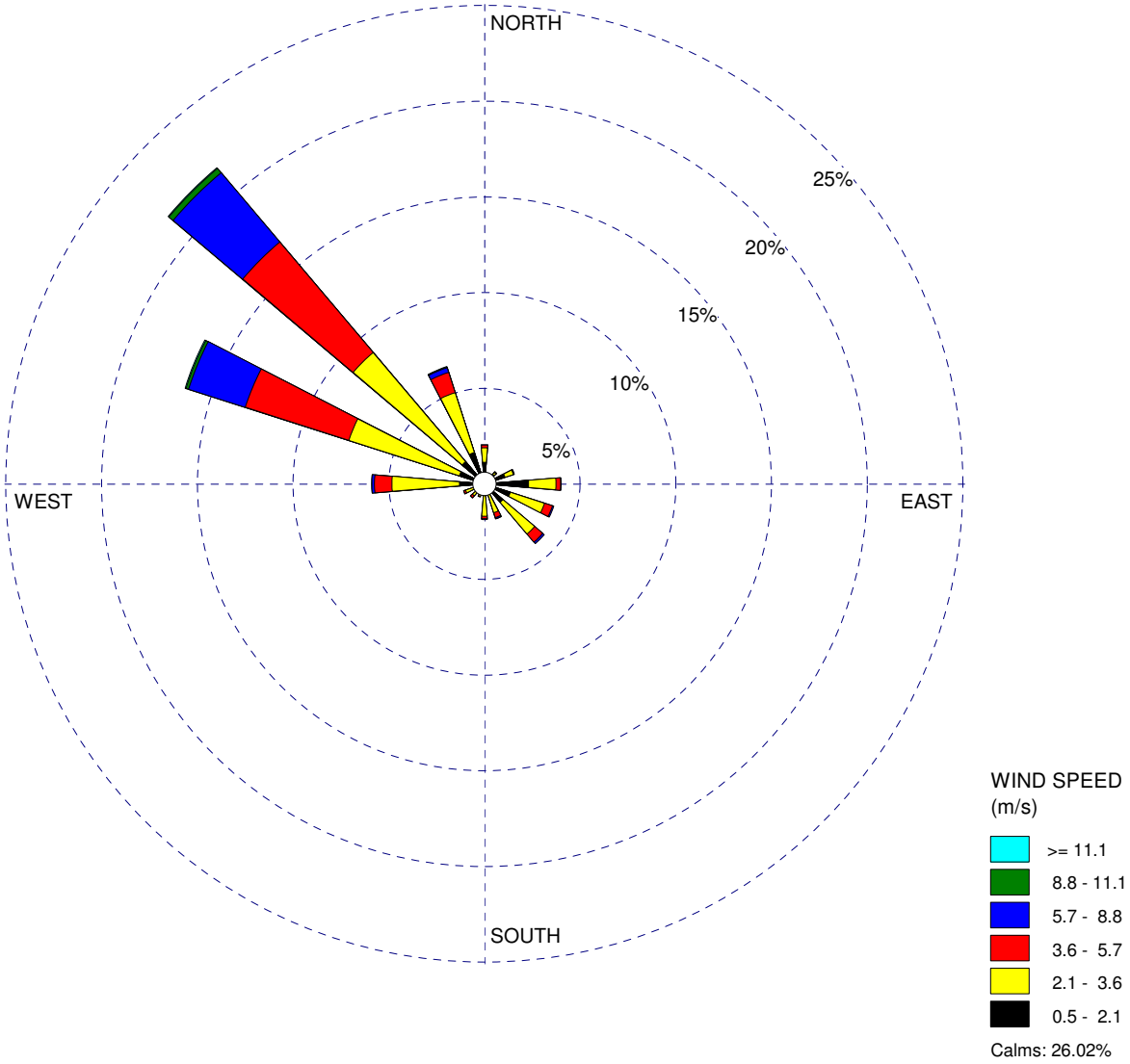
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2007 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2007** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **26.02%**	TOTAL COUNT: **8294 hrs.**	
	AVG. WIND SPEED: **2.59 m/s**	DATE: **1/8/2009**	PROJECT NO.: **0742-816**

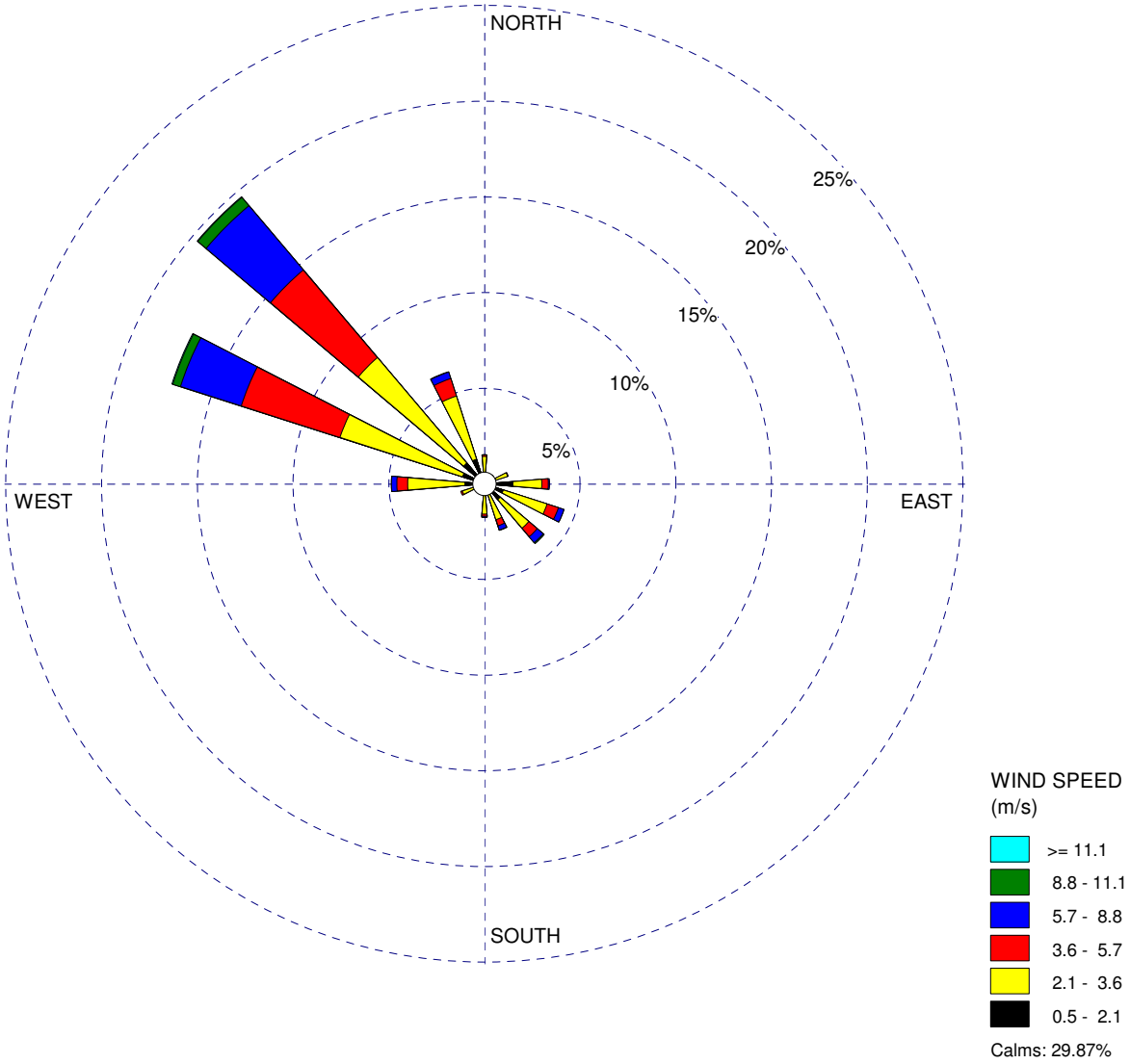
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

2008 Meteorological Data
Fresno, CA

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Winds were predominately from the Northwest.	**2008** **Jan 1 - Dec 31** **00:00 - 23:00**	**Chemical Waste Management - Kettleman Hills Facility**	
		MODELER: **Wenck Associates, Inc.**	
	CALM WINDS: **29.87%**	TOTAL COUNT: **8376 hrs.**	
	AVG. WIND SPEED: **2.47 m/s**	DATE: **1/9/2009**	PROJECT NO.: **0742-816**

WRPLOT View - Lakes Environmental Software

amec

01/05/09
pt

SECOND SEMIANNUAL 2008 METEOROLOGICAL STATION CALIBRATION REPORT

Kettleman Hills Facility
Kings County, CA

Submitted to:
Chemical Waste Management, Inc., Kings County, CA

Submitted by:
AMEC Geomatrix, Inc., Fresno, CA

December 30, 2008

Project 8151.005

amec

December 30, 2008

Project 8151.005

Mr. Paul Turek
Chemical Waste Management, Inc.
35251 Old Skyline Road
Kettleman City, California 93239

Subject: **Second Semiannual 2008 Meteorological Station Calibration Report**
Kettleman Hills Facility, Kings County, California

Dear Mr. Turek:

AMEC Geomatrix, Inc. (AMEC), is pleased to submit the enclosed Second Semiannual 2008 Meteorological Station Calibration Report for the Chemical Waste Management, Inc., Kettleman Hills facility in Kings County, California. This report documents the weather station calibration and maintenance performed by AMEC on November 26, 2008. The field calibration was completed in general accordance with U.S. Environmental Protection Agency and equipment manufacturer guidelines.

Please call either of the undersigned if you have any questions or if we may provide additional information.

Sincerely yours,
AMEC Geomatrix, Inc.

Martin E. Spongberg, PhD, PE, PG
Senior Engineer

Philip P. Ross, PG
Principal Hydrogeologist

Enclosure

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AMEC Geomatrix, Inc
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Fresno, California
USA 93720-2659
Tel (559) 264-2535
Fax (559) 264-7431
www.amecgeomatrixinc.com

AMEC Geomatrix

amec

SECOND SEMIANNUAL 2008 METEOROLOGICAL STATION CALIBRATION REPORT

Kettleman Hills Facility
Kings County, CA

Submitted to:

Chemical Waste Management, Inc., Kings County, CA

Submitted by:

AMEC Geomatrix, Inc., Fresno, CA

December 30, 2008

Project 8151.005

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FIGURE

Figure 1 Site Location Map

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(Continued)

APPENDIX

Appendix A Calibration Field Records

SECOND SEMIANNUAL 2008
METEOROLOGICAL STATION CALIBRATION REPORT
Kettleman Hills Facility
Kings County, California

1.0 INTRODUCTION

AMEC Geomatrix, Inc. (AMEC), is submitting the enclosed Second Semiannual 2008 Meteorological Station Calibration Report for the Chemical Waste Management, Inc. (CWMI), Kettleman Hills facility (KHF) in Kings County, California. This report documents the meteorological station (MET Station) calibration and maintenance performed by AMEC on November 26, 2008. The calibration of the MET Station was completed in general accordance with U.S. Environmental Protection Agency (EPA) and equipment manufacturer guidelines.

2.0 BACKGROUND

This section presents background information on the KHF and the MET Station.

2.1 SITE LOCATION AND OPERATIONS

The KHF is located in Kings County, California, approximately 3 miles west of Interstate 5, immediately north of State Route 41. The nearest towns are Avenal and Kettleman City, located about 8 miles northwest and 5 miles northeast of the KHF, respectively (Figure 1).

The KHF has been operated by CWMI since it was purchased from Environmental Disposal Services (EDS) in April 1979. Operations conducted by EDS included solar evaporation in surface impoundments, land farming, and waste burial in cells. Current permitted activities at the KHF include solar evaporation in lined surface impoundments, waste stabilization, burial of solid wastes, and drum storage. Active WMUs currently include the drum storage unit, final stabilization unit, and polychlorinated biphenyl flushing/storage unit.

Commencing in November 1998, the site was permitted to accept Class II designated waste and Class III municipal waste in the B-19 WMU. Subsequently, the B-19 WMU received permits to operate as a bioreactor to effect accelerated decomposition of the Class III waste. The active Class II/III B-19 WMU is nearing capacity. CWMI will continue Class II/III waste management activities at the KHF with the construction of the B-17 WMU.

2.2 METEOROLOGICAL STATION COMPONENTS

The MET Station is a multiple component weather station located near the administration building at the KHF. Horizontal wind speed and horizontal wind direction sensors are installed

10 meters (m) above the ground surface on top of a tower. An ambient temperature sensor is installed about 1.7 m above the ground surface. At ground level, the MET Station includes components measuring precipitation and barometric pressure. Manufacturer information for each component is contained in Table 1.

2.3 CALIBRATION, AUDIT, AND MAINTENANCE SCHEDULE

The MET Station is operated and maintained according to equipment manufacturer guidelines (Campbell Scientific, 2004a; 2004b; 2005; and 2006). Calibrations and audits of the system are conducted in general accordance with the guidelines published by the manufacturers and the U.S. EPA (U.S. EPA, 1994a, 1994b, and 1994c).

Calibration and maintenance of the MET Station is conducted semiannually in the second and fourth quarters. Performance audits are conducted quarterly. This report documents the second semiannual 2008 calibration and maintenance event conducted in November.

3.0 CALIBRATION EQUIPMENT, PROCEDURE, AND ACCURACY TOLERANCE LIMITS

Calibration and maintenance are performed by AMEC staff using the equipment described in Section 3.1. Calibration procedures are described in Section 3.2. Calibration accuracy tolerance limits are explained in Section 3.3.

3.1 CALIBRATION EQUIPMENT

Known calibration wind speeds are generated with a R.M. Young Model 18811 selectable-speed anemometer drive. For calibrating the wind direction sensor, a Model 18112 Vane Angle Bench Stand and a Suunto KB-14 precision compass are used. Starting threshold torque of the wind speed and wind direction sensors are measured with a R.M. Young Model 18312 Torque Disc and a R.M. Young Model 18331 Vane Torque Gauge, respectively.

True temperatures are measured with a Control Company Model 4110 Universal digital thermometer with a certification traceable to the National Institute of Standards and Technology. A water bath is used to produce three different calibration temperatures. The rain gauge is calibrated using a graduated cylinder with a control valve.

3.2 CALIBRATION AND MAINTENANCE PROCEDURE

The calibration and maintenance are performed in general accordance with U.S. EPA and equipment manufacturer guidelines.

3.2.1 Wind Speed

Prior to testing the wind speed sensor calibration, the wind speed propeller is inspected to determine that it is secure. Bearings are inspected to make sure the sensor is freely moving. The propeller is removed and threshold torque is measured with a torque gauge. Bearings must be replaced if the starting threshold is greater than 1 gram-centimeters (g-cm).

To test the calibration of the wind speed sensor, an anemometer drive is connected to the propeller shaft. The anemometer drive is operated at speeds ranging from about 300 to 8,000 revolutions per minute, corresponding to calibration wind speeds up to about 90 mph. A manufacturer-supplied equation (mph = 0.01145 x rpm) is used to convert from rotation rate to wind speed. The wind speed sensor response at each calibration wind speed is collected from the data logger for comparison with the calculated wind speed. After calibration, the propeller is secured to the propeller shaft.

The wind speed sensor will be calibrated in the field or returned to the manufacturer for calibration if it does not meet the calibration accuracy tolerance limits. Field calibration consists of adjusting the electronics so that the output speed from the data logger closely matches the input speed produced by the anemometer drive.

3.2.2 Wind Direction

The equipment is inspected to make sure that all connections are secure and the sensor is freely moving. Threshold velocities in the clockwise and counter-clockwise directions are measured with a torque meter pressed against the vane, 10 centimeters from the pivot point, with increasing force until the vane starts to move. The bearings are replaced if the starting threshold is greater than 9 g-cm.

To test the calibration of the direction sensor, the device is secured to a Model 18112 Vane Angle Bench Stand and a precision compass is used to align the wind direction vane alternately to the north, east, south, and west. At each of these orientations, the vane is immobilized and the orientation recorded on the data logger is collected for comparison with the compass reading.

If the vane position and indicator are not within the calibration target (5 degrees), the direction sensor is calibrated in the field (by adjusting the potentiometer coupling inside the main housing) or returned to the manufacturer for calibration.

3.2.3 Ambient Temperature

Calibration of the temperature-sensing system is tested at three temperatures ranging from about freezing to more than 100 degrees Fahrenheit. The lowest temperature is achieved by

adding ice to a water bath. The high temperature is maintained by placing a water-heating coil in the water bath. The middle reading is taken in tap water with a temperature that is approximately equal to the current site temperature. At each calibration temperature, the temperature sensor and the calibration thermometer are immersed in the bath and the readings are recorded.

The temperature sensor cannot be calibrated in the field. If the sensor does not meet the calibration accuracy tolerance limits, it should be replaced or sent to the manufacturer for calibration.

3.2.4 Precipitation

Prior to testing calibration, the precipitation gauge is inspected to make sure the collection funnel is clear of obstructions. Accumulated debris, if present, is removed.

Calibration of the precipitation gauge is tested by adding a known volume of water at a slow, controlled rate into the gauge. A manufacturer-supplied function is used to convert the water volume in milliliters to an equivalent precipitation depth in inches. A volume equivalent to about 1 inch of precipitation is added to the gauge over a period of 45 minutes or greater. The precipitation gauge reading is then collected from the data logger and compared to the measured input volume (converted into rainfall depth).

If the precipitation gauge does not meet the calibration criterion, it is calibrated in the field by making slight adjustments to the calibration screw. After adjustment, another volume of water equivalent to about 1 inch of precipitation is added to the gauge. The procedure is repeated until the difference between the input and measured water volumes meets or exceeds the calibration performance criterion.

3.2.5 Barometric Pressure Sensor

Prior to calibration of the barometric pressure sensor, all connections and the housing are visually inspected to assess whether they are secure and undamaged. The external case is cleaned with a damp cloth.

To check the calibration, the barometric pressure reading on the data logger is recorded for comparison with a nearby official barometer reading. The barometric pressure sensor cannot be field calibrated. If the sensor does not meet the accuracy tolerance limits it will be replaced or sent to the manufacturer for calibration.

3.3 CALIBRATION ACCURACY TOLERANCE LIMITS

For each component of the MET Station system, the calibration inputs are compared with the values measured by each sensor and recorded on the data logger. The accuracy tolerance limits for each calibration parameter are listed in Table 2.

4.0 CALIBRATION RESULTS

Calibration was tested by comparing the readings of the system sensors with known calibration input values. Equipment that does not meet the calibration accuracy tolerance limits should be adjusted and re-tested in the field, replaced, or sent to the manufacturer for recalibration. The equipment was calibrated on November 26, 2008, and the calibration data are summarized in Tables 3 through 5.

4.1 WIND SPEED

Information collected during the wind speed sensor calibration is listed in Table 3. This information includes: the input rotation rate, calculated wind speed, recorded wind speed, and the difference between the calculated and recorded wind speed.

The wind speed sensor was calibrated at seven wind speeds ranging from about 3 to 90 mph. All calibration measurements were within 0.6 mph of the calculated velocity, which meets the manufacturer-recommended accuracy tolerance limit.

Starting threshold torque was 0.4 g-cm in both the clockwise and counter-clockwise directions, which meets the accuracy tolerance limit.

4.2 WIND DIRECTION

Information collected during the wind direction sensor calibration test is listed in Table 4. This information includes: the reference orientation set with a compass, the orientation detected by the sensor, and the difference between these two measurements. The wind direction sensor was operating within the manufacturer-recommended accuracy at each of the calibration points.

Starting threshold torque was measured at 3 g-cm in both the clockwise and counter-clockwise directions, which meets the accuracy tolerance limits.

4.3 AMBIENT TEMPERATURE

Information collected during the temperature sensor calibration test is listed in Table 5. This information includes: the calibration reference temperatures, the temperatures recorded by

the MET Station sensor, and the difference between the two measurements. All measurements were within the manufacturer-recommended accuracy.

4.4 PRECIPITATION

A volume equivalent to 1 inch of precipitation was added to the rain gauge. The data logger recorded 1.01 inches of precipitation, which meets the calibration criterion.

4.5 BAROMETRIC PRESSURE

The reading from the nearby official gauge at Station KHJO indicated a barometric pressure of 29.91 inches of mercury (in Hg) or 1,013 millibars (mb). The barometer reading taken during this audit was 29.89 in Hg (1,012 mb), meeting the accuracy tolerance limit of 2 mb.

5.0 SUMMARY

During the second semiannual 2008 MET Station calibration testing, the wind speed, wind direction, temperature, precipitation, and barometric pressure sensors performed to within the accuracy as specified by the equipment manufacturers.

6.0 REFERENCES

Campbell Scientific, 2004, Instruction Manual, Model 107 Temperature Probe, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2004a).

Campbell Scientific, 2004, Instruction Manual, TE525 Tipping Bucket Rain Gage, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2004b).

Campbell Scientific, 2005, Instruction Manual, CS100 Barometric Pressure Sensor, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2005).

Campbell Scientific, 2006, R.M. Young Wind Monitors, Campbell Scientific (Canada) Corp., (Campbell Scientific, 2006).

U.S. Environmental Protection Agency, 1994, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I, Principles, U.S. EPA Document 600/9-76-005 (U.S. EPA, 1994a).

U.S. Environmental Protection Agency, 1994, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods, U.S. EPA Document 600/4-77/027a (U.S. EPA, 1994b).

U.S. Environmental Protection Agency, 1994, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods, U.S. EPA Document 600/4-82-060 (U.S. EPA, 1994c).

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TABLE 1

METEOROLOGICAL STATION SYSTEM COMPONENTS

Kettleman Hills Facility
Kings County, California

Parameter	Manufactuer	Model Number	Range
Wind Speed	R.M. Young	05305	0 to 90 mph [1]
Wind Direction	R.M. Young	05305	0 to 360 degrees [2]
Temperature	Campbell Scientific	TE525	-31 to 122 °F [3]
Barometric Pressure	Campbell Scientific	CS100	600 to 1100 mb [4]
Precipitation	Campbell Scientific	107	NA [5]

1. Wind speed reported in miles per hour (mph), measured at 10 meters above ground level.
2. Wind direction reported in degrees of rotation from true north, measured at 10 meters above ground level.
3. Temperature measured in degrees Fahrenheit (°F) at 1.7 meters above ground level.
4. Barometric pressure measured in millibars (mb).
5. NA = not applicable.

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TABLE 2

ACCURACY TOLERANCE LIMITS

Kettleman Hills Facility
Kings County, California

Parameter	Accuracy Tolerance Limits
Wind Speed	± 0.6 mph [1]
Wind Direction	± 5 degrees [2]
Wind Sensor Starting Threshold	1 g-cm [3]
Wind Direction Starting Threshold	9 g-cm [3]
Temperature	± 0.4 °F [4]
Barometric Pressure	± 2 mb [5]
Precipitation	± 3 percent of input

1. Wind speed measured in miles per hour (mph). ± = plus or minus.
2. Wind direction measured in degrees of rotation from true north.
3. Starting threshold is the minimum applied torque needed to move the sensors. Torque is measured in gram-centimeters (g-cm).
4. Temperature measured in degrees Fahrenheit (°F).
5. Barometric pressure measured in millibars (mb).

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TABLE 3

HORIZONTAL WIND SPEED CALIBRATION DATA

Kettleman Hills Facility
Kings County, California

Calibration Point [1]	Input Rate [2] (rpm)	Calculated Velocity [3] (mph)	Recorded Velocity [4] (mph)	Difference [5] (mph)
1	300	3.44	3.43	-0.01
2	600	6.87	6.87	0.00
3	1,000	11.45	11.45	0.00
4	1,500	17.18	17.17	-0.01
5	2,500	28.63	28.63	0.00
6	4,000	45.80	45.80	0.00
7	8,000	91.60	91.60	0.00

1. Calibrated on November 26, 2008, beginning at 9:30 a.m.
2. Input rotation rate in revolutions per minute (rpm) by a R.M. Young Model 18811 anemometer drive.
3. Calculated wind velocity in miles per hour (mph) converted from rpm with a manufacturer-supplied function: (Input rate in rpm) * 0.01145 = velocity in mph
4. Wind speed in mph recorded by the sensor.
5. Difference between recorded and calculated wind speed expressed in mph (accuracy tolerance limit is ± 0.6 mph).

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TABLE 4

HORIZONTAL WIND DIRECTION CALIBRATION DATA

Kettleman Hills Facility
Kings County, California

Calibration Point [1]	Reference Orientation [2] (degrees)	Recorded Orientation [3] (degrees)	Difference [4] (degrees)
1	0	0.17	0.17
2	90	87.52	-2.48
3	180	177.85	-2.15
4	270	269.09	-0.91

1. Calibrated on November 26, 2008, beginning at 9:46 a.m.
2. Reference orientation in degrees (measured from true north) measured with a Suunto KB-14 precision compass.
3. Orientation detected by the wind direction sensor (R.M. Young Model 05305) in degrees measured from true north.
4. Difference between recorded and reference orientation in degrees. Accuracy tolerance limit is ± 5 degrees.

Note: Angle of declination is 15 degrees.

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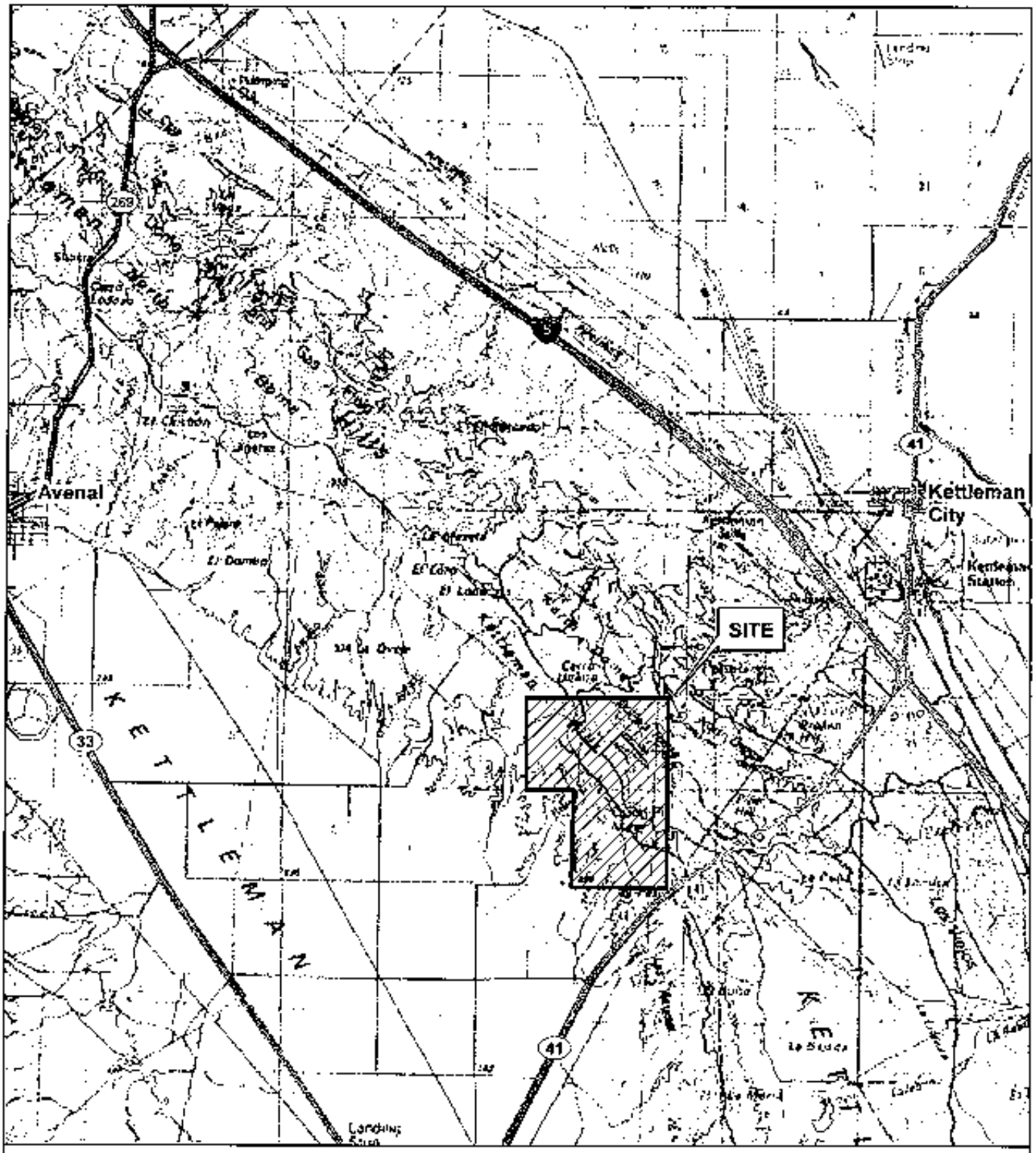
TABLE 5

AMBIENT TEMPERATURE CALIBRATION DATA

Kettleman Hills Facility
Kings County, California

Calibration Point [1]	Reference Temperature [2] (°F)	Recorded Temperature [3] (°F)	Difference [4] (°F)
1	36.0	36.0	0.0
2	55.7	55.7	0.0
3	90.1	90.3	0.2

1. Calibrated on November 26, 2008, beginning at 9:40 a.m.
2. Reference temperature in degrees Fahrenheit (°F) measured with a Control Company Model 4110 Universal digital thermometer.
3. Temperature detected in °F by the temperature sensor (Campbell Scientific Model TE525).
4. Difference between recorded and reference temperature in °F. Accuracy tolerance limit is ± 0.4 °F.



California

N

APPROXIMATE SCALE IN FEET
0 4,000 8,000

0 1,200 2,400
APPROXIMATE SCALE IN METERS

Basemap modified from National Geographic Society TOPO!
(U. S. Geological Survey topographical map mosaic dataset).

SITE LOCATION MAP
Kettleman Hills Facility
Kings County, California

By: SDE	Date: 12/29/2008	Project No. 8151.005
AMEC Geomatrix		Figure 1

N:\8000\8151\gis\maps_SLM.mxd

APPENDIX A

Calibration Field Records

DAILY FIELD RECORD

amec

Project and Task Number: 8151.005-0	Date: 11/26/08
Project Name: WM Kettleman, Met	Field Activity: ~~GW~~ Calibration
Location: Kettleman, CA	Weather:

PERSONNEL: Name	Company	Time In	Time Out
Tim Lewis	Amec	0615	1230
Alex Olsen	Amec	0615	1230

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED
0615	LOAD EQUIPMENT
0637	LEAVE FOR SITE
0752	STOP FOR ICE
0800	SIGN-IN.
0810	START RAIN GAUGE & TAKE MET APART.
—	NO POWER AT STATION. CHECK W/ PAUL TO
—	GET POWER.
0845	WIND DIRECTION TORQUE
	CW - ~~3.0~~ 3.0 gmcm
	CCW - 3.0 gmcm.
0855	WIND SPEED TORQUE
	CW - .4 gmcm
	CCW - .4 gmcm
0930	STEVE ARRIVE W/ INVERTER.
	WIND SPEED RPM MPH RZE
	300 3.43 300
	600 6.87 600

DAILY FIELD RECORD (continued)

amec

Project and Task Number: 8151.0050 | Date: 11/26/08

TIME	DESCRIPTION OF WORK PERFORMED		
	1000	11.45	1000
	1500	17.17	1500
	2500	28.63	2500
	4000	45.80	4000
	8000	91.60	8000
0940	TEMP AUDIT	PANEL	REF
	COLD	36.00	36.00
	HOT	~~55.68~~ 90.23	~~55.7~~ 90.1
	AMBIENT	55.68	55.7
0946	WIND DIRECTION REF	PANEL	
	0	0.17	
	90	87.52	
	180	177.85	
	270	269.09	
1010	BAROMETER READING AT 29.89. PUT STATION		
—	BACK TOGETHER AND MADE STEVE HAS		
—	INVERTER.		
1100	SIGN OUT OF OFFICE AFTER MTG WITH PAUL T.		
	RAIN GUAGE RECORDED AT 1.01".		
1220	ARRIVE AT OFFICE. BAROMETER IN LEMOYNE, GA IS		
	AT 29.89.		
1230	DONE.		

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FOURTH QUARTER 2008
METEOROLOGICAL STATION AUDIT REPORT
Kettleman Hills Facility, Kings County, CA

Submitted to:
Chemical Waste Management, Inc, Kings County, CA

Submitted by:
AMEC Geomatrix, Inc., Fresno, CA

January 15, 2009

Project 8151.005

amec

January 15, 2009

Project 8151.005

Mr. Paul Turek
Chemical Waste Management, Inc.
35251 Old Skyline Road
Kettleman City, California 93239

Subject: **Fourth Quarter 2008 Meteorological Station Audit Report**
Kettleman Hills Facility, Kings County, California

Dear Mr. Turek:

AMEC Geomatrix, Inc. (AMEC), is pleased to submit the enclosed Fourth Quarter 2008 Meteorological Station Audit Report for the Chemical Waste Management, Inc., Kettleman Hills facility in Kings County, California. This report documents the weather station audit performed by AMEC on December 11, 2008. The audit was completed in general accordance with U.S. Environmental Protection Agency and equipment manufacturer guidelines.

Please call either of the undersigned if you have any questions or if we may provide additional information.

Sincerely yours,
AMEC Geomatrix, Inc.

Martin E. Spongberg, PhD, PE, PG
Senior Engineer

Philip P. Ross, PG
Principal Hydrogeologist

Enclosure

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AMEC Geomatrix

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FOURTH QUARTER 2008
METEOROLOGICAL STATION AUDIT REPORT
Kettleman Hills Facility, Kings County, CA

Submitted to:

Chemical Waste Management, Inc, Kings County, CA

Submitted by:

AMEC Geomatrix, Inc., Fresno, CA

January 15, 2009

Project 8151.005

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FIGURES

Figure 1 Site Location Map

APPENDICES

Appendix A Audit Field Records

FOURTH QUARTER 2008
METEOROLOGICAL STATION AUDIT REPORT
Kettleman Hills Facility
Kings County, California

1.0 INTRODUCTION

AMEC Geomatrix, Inc. (AMEC), has prepared this Fourth Quarter 2008 Meteorological Station Audit Report for the Chemical Waste Management, Inc. (CWMI), Kettleman Hills facility (KHF) in Kings County, California. This report documents the meteorological station (MET Station) audit performed by AMEC on December 11, 2008. The audit of the MET Station was completed in general accordance with U.S. Environmental Protection Agency (EPA) and equipment manufacturer guidelines.

2.0 BACKGROUND

This section presents background information on the KHF and the MET Station.

2.1 SITE LOCATION AND OPERATIONS

The KHF is located in Kings County, California, approximately 3 miles west of Interstate 5, immediately north of State Route 41. The nearest towns are Avenal and Kettleman City, located about 8 miles northwest and 5 miles northeast of the KHF, respectively (Figure 1).

The KHF has been operated by CWMI since it was purchased from Environmental Disposal Services (EDS) in April 1979. Operations conducted by EDS included solar evaporation in surface impoundments, land farming, and waste burial in cells. Current permitted activities at the KHF include solar evaporation in lined surface impoundments, waste stabilization, burial of solid wastes, and drum storage. Active waste management units (WMUs) currently include the drum storage unit, final stabilization unit, and polychlorinated biphenyl flushing/storage unit.

Commencing in November 1998, the site was permitted to accept Class II designated waste and Class III municipal waste in the B-19 WMU. Subsequently, the B-19 WMU received permits to operate as a bioreactor to effect accelerated decomposition of the Class III waste. The active Class II/III B-19 WMU is nearing capacity. CWMI will continue Class II/III waste management activities at the KHF with the construction of the B-17 WMU.

2.2 METEOROLOGICAL STATION COMPONENTS

The MET Station is a multiple component weather station located near the administration building at the KHF. Horizontal wind speed and horizontal wind direction sensors are installed 10 meters (m) above the ground surface on top of a tower. An ambient temperature sensor is installed 1.7 m above the ground surface. At ground level, the MET Station includes components measuring precipitation and barometric pressure. Manufacturer information for each component is contained in Table 1.

2.3 CALIBRATION, AUDIT, AND MAINTENANCE SCHEDULE

The MET Station is operated and maintained according to equipment manufacturer guidelines (Campbell Scientific, 2004a; 2004b; 2005; and 2006). Calibrations and audits of the system are conducted in general accordance with the guidelines published by the manufacturers and the U.S. EPA (U.S. EPA, 1994a; 1994b; and 1994c).

Calibration and maintenance of the MET Station is conducted semiannually in the second and fourth quarters. Performance audits are conducted quarterly. This report documents the fourth quarter 2008 audit conducted in December.

3.0 AUDIT EQUIPMENT, PROCEDURE, AND ACCURACY TOLERANCE LIMITS

The audit was performed by AMEC staff with the equipment described in this section.

3.1 AUDIT EQUIPMENT

Known audit wind speeds were generated with a R.M. Young Model 18811 selectable-speed anemometer drive. For auditing the wind direction sensor, a Model 18112 Vane Angle Bench Stand and a Suunto KB-14 precision compass were used. Starting threshold torque of the wind speed and wind direction sensors were measured with a R.M. Young Model 18312 Torque Disc and a R.M. Young Model 18331 Vane Torque Gauge, respectively.

Reference temperatures were measured with a Control Company Model 4110 Universal digital thermometer with a certification traceable to the National Institute of Standards and Technology. A water bath was used to produce three different audit temperatures. The rain gauge was audited using a graduated cylinder with a control valve.

3.2 AUDIT PROCEDURE

MET Station audits are performed in general accordance with equipment manufacturer and U.S. EPA guidelines.

3.2.1 Wind Speed

Before auditing the wind speed sensor, the wind speed propeller is inspected to determine that it is secure. Bearings are inspected to make sure the sensor is freely moving. The propeller is removed and threshold torque is measured with a torque gauge.

An anemometer drive is connected to the propeller shaft. To audit the wind speed sensor, the anemometer drive was operated at speeds ranging from about 300 to 8,000 revolutions per minute (rpm), corresponding to audit wind speeds up to about 90 miles per hour (mph). A manufacturer-supplied equation (mph = 0.01145 x rpm) is used to convert from rotation rate to wind speed. The wind speed sensor response at each audit wind speed is collected from the data logger for comparison with the calculated wind speed.

3.2.2 Wind Direction

The equipment is inspected to make sure that all connections are secure and the sensor is freely moving. Threshold velocity in the clockwise and counter-clockwise directions is measured with a torque meter pressed against the vane 10 centimeters from the pivot point with increasing force until the vane starts to move.

To audit the direction sensor, the device is secured to a Model 18112 Vane Angle Bench Stand and a precision compass is used to align the wind direction vane alternately to the north, east, south, and west. At each of these orientations, the vane is immobilized and the orientation recorded on the data logger is collected for comparison with the compass reading.

After auditing the wind speed and wind direction sensors, the propeller is secured to the propeller shaft.

3.2.3 Ambient Temperature

The temperature-sensing system is audited at three temperatures ranging from about freezing to more than 100 degrees Fahrenheit (°F). The lowest temperature is achieved by adding ice to a water bath. The highest temperature is maintained by placing a water-heating coil in the water bath. The middle reading is taken in tap water with a temperature approximately equal to the ambient temperature. At each audit temperature, the temperature sensor and the audit thermometer are immersed in the bath and the readings for each sensor are recorded for comparison.

3.2.4 Precipitation

Prior to audit testing, the precipitation gauge is inspected to make sure the collection funnel is clear of obstructions. Accumulated debris, if present, is removed.

The precipitation gauge is audited by adding a known volume of water at a slow, controlled rate into the gauge. A manufacturer-supplied function is used to convert the water volume in milliliters to an equivalent precipitation depth in inches. A volume equivalent to about 1 inch of precipitation is added to the gauge over a period of 45 minutes or greater. The precipitation gauge reading is then collected from the data logger and compared to the measured input volume (converted into equivalent rainfall depth).

3.2.5 Barometric Pressure Sensor

Prior to auditing the barometric pressure sensor, all connections and the housing are inspected to assess whether they are secure and undamaged. The external case is cleaned with a damp cloth.

To audit the sensor, the barometric pressure reading on the data logger is recorded for comparison with barometric readings from nearby National Weather Service Station KHJO at the Hanford Municipal Airport.

3.3 Audit Accuracy Tolerance Limits

For each component of the MET Station system, the audit inputs are compared with the values measured by each sensor and recorded on the data logger. Accuracy tolerance limits for audits are listed in Table 2. System components that are not performing within the manufacturer-recommended tolerance limits should be repaired, replaced, or recalibrated.

4.0 PERFORMANCE AUDIT RESULTS

System performance is determined by comparing the readings of the system sensors with known audit input values. The equipment was audited on December 11, 2008, and the collected data are presented in Tables 3 through 5.

4.1 Wind Speed

Information collected during the wind speed sensor audit is listed in Table 3. This information includes: the input rotation rate, calculated wind speed, recorded wind speed, and the difference between the calculated and recorded wind speed.

All audit measurements were within 0.6 mph of the calculated velocity, which meets the manufacturer-recommended accuracy tolerance limit.

Starting threshold torque was less than 1 gram-centimeter (g-cm) in both the clockwise and counter-clockwise directions, which meets the accuracy tolerance limit.

4.2 WIND DIRECTION

Information collected during the wind direction audit is listed in Table 4. This information includes: the reference orientation set with a compass, the orientation detected by the sensor, and the difference between these two measurements. All audit measurements met the accuracy tolerance limit.

Starting threshold torque was measured at 4 g-cm in both the clockwise and counter-clockwise directions, which meets the accuracy tolerance limit.

4.3 AMBIENT TEMPERATURE

Information collected during the temperature sensor audit is listed in Table 5. This information includes: the audit reference temperatures, the temperatures recorded by the MET Station sensor, and the difference between the two measurements. The temperature sensor did not meet the manufacturer-recommended accuracy tolerance limit (0.4 °F) at one of the three audit temperatures. The difference between the recorded and reference temperature was less than 1 °F.

4.4 PRECIPITATION

A volume corresponding to 1 inch of precipitation was added to the rain gauge. The data logger recorded 1.02 inch of precipitation, which meets the accuracy tolerance limit of 0.03 inch (3 percent of the input).

4.5 BAROMETRIC PRESSURE

The barometer reading taken during this audit at 9:40 a.m. was 30.18 inches of mercury (in Hg) or 1,022 millibars (mb). The reading from the nearby official gauge at Station KHJO at 9:53 a.m. indicated a barometric pressure of 30.24 in Hg (1,024 mb). The difference in readings between the site and control barometers was 2 mb, which meets the accuracy tolerance limit.

5.0 SUMMARY

During the fourth quarter 2008 MET Station audit testing, the wind speed, wind direction, precipitation, and barometric pressure components all performed within the accuracy tolerance limits as specified by the equipment manufacturer. The temperature sensor did not meet the accuracy tolerance limit at one of the three audit temperatures. The temperature sensor will be audited again in March 2009 and will be recalibrated or repaired, if necessary.

6.0 REFERENCES

Campbell Scientific, 2004, Instruction Manual, Model 107 Temperature Probe, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2004a).

Campbell Scientific, 2004, Instruction Manual, TE525 Tipping Bucket Rain Gage, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2004b).

Campbell Scientific, 2005, Instruction Manual, CS100 Barometric Pressure Sensor, Campbell Scientific, Inc., Logan, Utah (Campbell Scientific, 2005).

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U.S. Environmental Protection Agency, 1994, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods, U.S. EPA Document 600/4-77/027a (U.S. EPA, 1994b).

U.S. Environmental Protection Agency, 1994, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods, U.S. EPA Document 600/4-82-060 (U.S. EPA, 1994c).

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TABLE 1

METEOROLOGICAL STATION SYSTEM COMPONENTS

Kettleman Hills Facility
Kings County, California

Parameter	Manufactuer	Model Number	Range
Wind Speed	R.M. Young	05305	0 to 90 mph [1]
Wind Direction	R.M. Young	05305	0 to 360 degrees [2]
Temperature	Campbell Scientific	TE525	-31 to 122 °F [3]
Barometric Pressure	Campbell Scientific	CS100	600 to 1100 mb [4]
Precipitation	Campbell Scientific	107	NA [5]

1. Wind speed reported in miles per hour (mph), measured at 10 meters above ground level.
2. Wind direction reported in degrees of rotation from true north, measured at 10 meters above ground level.
3. Temperature measured in degrees Fahrenheit (°F) at 1.7 meters above ground level.
4. Barometric pressure measured in millibars (mb).
5. NA = not applicable.

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TABLE 2

ACCURACY TOLERANCE LIMITS

Kettleman Hills Facility
Kings County, California

Parameter	Accuracy Tolerance Limits
Wind Speed	± 0.6 mph [1]
Wind Direction	± 5 degrees [2]
Wind Speed Starting Threshold Torque	1 g-cm [3]
Wind Direction Starting Threshold Torque	9 g-cm [3]
Temperature	± 0.4 °F [4]
Barometric Pressure	± 2 mb [5]
Precipitation	± 3 percent of input

1. Wind speed measured in miles per hour (mph). "±" = plus or minus;
2. Wind direction measured in degrees of rotation from true north.
3. Starting threshold is the minimum applied torque needed to move the sensors. Torque is measured in gram-centimeters (g-cm).
4. Temperature measured in degrees Fahrenheit (°F).
5. Barometric pressure measured in millibars (mb).

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TABLE 3

HORIZONTAL WIND SPEED AUDIT DATA

Kettleman Hills Facility
Kings County, California

Audit Point [1]	Input Rate [2] (rpm)	Calculated Velocity [3] (mph)	Recorded Velocity [4] (mph)	Difference [5] (mph)
1	300	3.43	3.43	0.00
2	600	6.87	6.87	0.00
3	1,000	11.45	11.22	-0.23
4	1,500	17.17	16.95	-0.22
5	2,500	28.62	28.63	0.01
6	4,000	45.80	45.80	0.00
7	8,000	91.60	91.60	0.00

1. Audited on December 11, 2008, starting at 9:00 a.m.
2. Input rotation rate in revolutions per minute (rpm) by a R.M. Young Model 18811 anemometer drive.
3. Calculated wind velocity in miles per hour (mph) converted from rpm with a manufacturer-supplied function: (Input rate in rpm) * 0.01145 = velocity in mph
4. Wind speed in mph recorded by the sensor.
5. Difference between recorded and calculated wind speed expressed in mph (accuracy tolerance limit is ± 0.6 mph).

TABLE 4

HORIZONTAL WIND DIRECTION AUDIT DATA

Kettleman Hills Facility
Kings County, California

Audit Point [1]	Reference Orientation [2] (degrees)	Recorded Orientation [3] (degrees)	Difference [4] (degrees)
1	0	0.15	0.15
2	90	92.60	2.60
3	180	179.10	-0.90
4	270	268.08	-1.92

1. Audited on December 11, 2008, starting at 9:30 a.m.
2. Reference orientation in degrees (measured from true north) measured with a Suunto KB-14 precision compass.
3. Orientation detected by the wind direction sensor (R.M. Young Model 05305) in degrees measured from true north.
4. Difference between recorded and reference orientation in degrees. Accuracy tolerance limit is ± 5 degrees.

amec

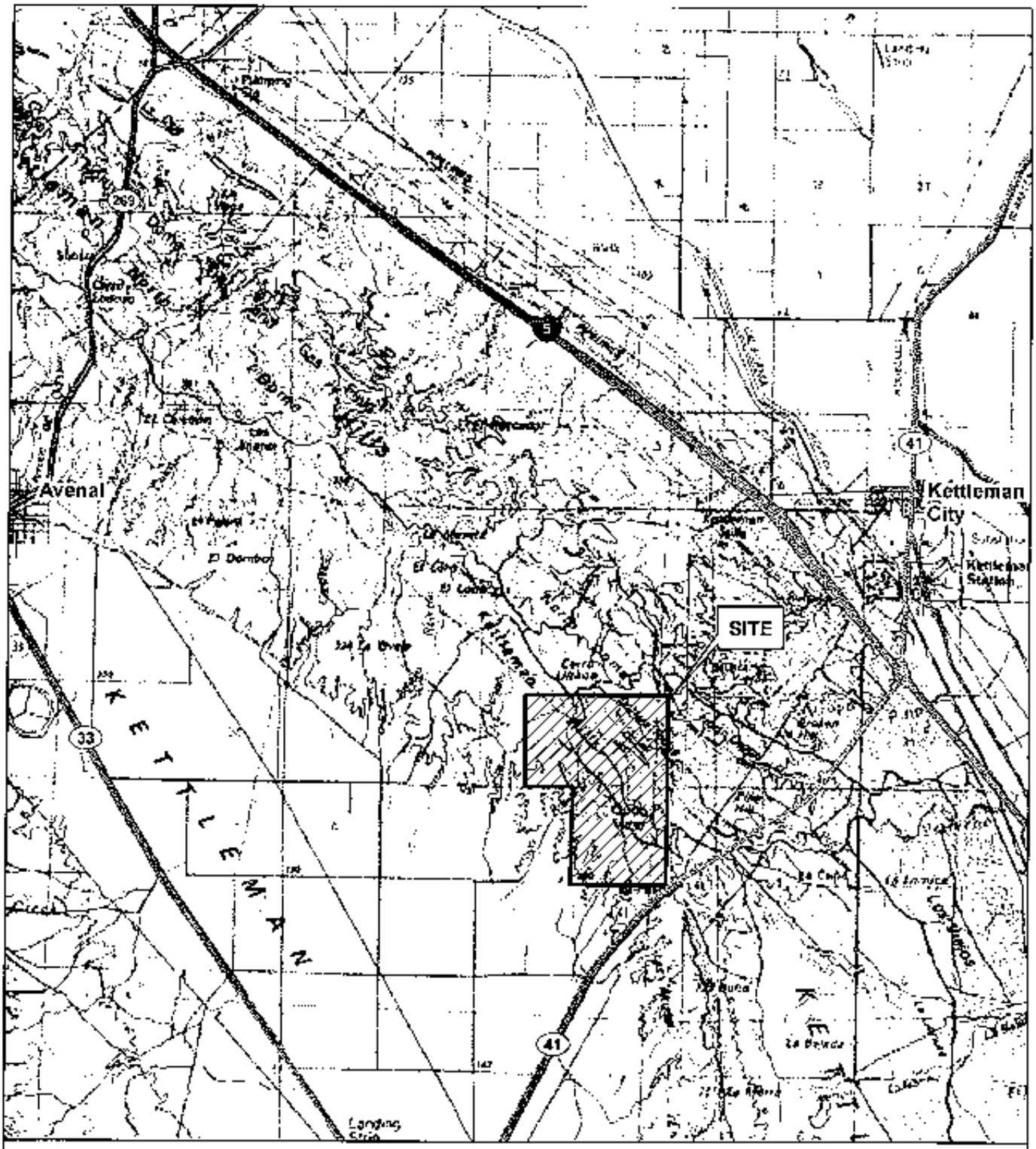
TABLE 5

AMBIENT TEMPERATURE AUDIT DATA

Kettleman Hills Facility
Kings County, California

Audit Point [1]	Reference Temperature [2] (°F)	Recorded Temperature [3] (°F)	Difference [4] (°F)
1	35.7	35.70	0.00
2	49.0	48.20	-0.80
3	126.9	127.01	0.11

1. Audited on December 11, 2008, starting at 9:10 a.m.
2. Reference temperature in degrees Fahrenheit (°F) measured with a Control Company Model 4110 Universal digital thermometer.
3. Temperature detected in °F by the temperature sensor (Campbell Scientific Model TE525).
4. Difference between recorded and reference temperature in °F. Accuracy tolerance limit is ± 0.4 °F.



California

APPROXIMATE SCALE IN FEET
0 4,000 8,000
0 1,200 2,400
APPROXIMATE SCALE IN METERS

Basemap modified from National Geographic Society TOPO!
(U S Geological Survey topographical map mosaic dataset)

SITE LOCATION MAP
Kettleman Hills Facility
Kings County, California

By: SDE	Date: 12/29/2008	Project No. 8151.005
AMEC Geomatrix		Figure 1

N:\8000\8151\gis\maps_SLM.mxd

APPENDIX A

Audit Field Records

DAILY FIELD RECORD

amec

Project and Task Number: 8151.005	Date: 12-11-08
Project Name: WM KETTLEMEN MET	Field Activity: MET AUDIT
Location: KETTLEMEN	Weather:

PERSONNEL: Name	Company	Time In	Time Out
STEVE U.	AMEC	0615	1215
ALEX O.	AMEC	0615	1215

PERSONAL SAFETY CHECKLIST

X	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves	X	Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED
0615	arrive at office, load truck
0640	left for KHF
0800	Sign in
0812	Start cup gauge, take apart MET
0834	WIND DIRECTION TORQUE
	CW - 4.0 gm-cm
	CCW - 4.0 gm-cm
0845	WIND SPEED TORQUE
	CW - .3 gm cm
	CCW - .3 gm cm
0900	WIND SPEED RPM mph REF
	300 3.43 300
	600 6.87 600
	1000 11.22 1000
	1500 16.95 1500
	2500 28.63 2500
	4000 45.80 4000

DAILY FIELD RECORD (continued)

amec

Project and Task Number: 8151.005 | Date: 12-11-08

TIME	DESCRIPTION OF WORK PERFORMED			
		8000	91.60	8000
0910	TEMP AUDIT		PANEL	REF
		COLD	35.7	35.7
	°F	HOT	127.01	126.9
		AMBIENT	48.20	49.0
0930	WIND DIRECTION REF		PANEL	
		0	0.15	
		90	92.6	
		180	179.10	
		270	263.08	
0940	BAROMETER READING - 30.18			
	Put station back together			
1000	signed out left site			
	left Paul Turek A message asking him to			
	send manys. the RAIN GAUGE DATA			
1140	arrive back at the office			
	Un loaded truck			
1200	BAROMETER IN LEMOORE, CA -			
	@ 0956 - 30.24			
1215	done w/ job			

Appendix C

1994 Topographical, Meteorological and Airborne Contaminant Characterization Study

TABLE 5-1[j]
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 1 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
SEMIVOLATILES							
PESTICIDES							
Aldrin	309-00-2	TO-13[e]	ND	608	ND	8080	ND
Chlordane	57-74-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDD	72-54-8	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDE	72-55-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDT	50-29-3	TO-13[e]	ND	608	ND	8080	ND
SVOCs							
Acenaphthylene	208-96-8	TO-13	ND	625	ND	8270	ND
Anthracene	120-12-7	TO-13	ND	625	ND	8270	ND
Benzo(a)anthracene	56-55-3	TO-13	ND	625	ND	8270	ND
Benzo(b)fluoranthene	205-99-2	TO-13	ND	625	ND	8270	ND
Benzo(k)fluoranthene	207-08-9	TO-13	ND	625	ND	8270	ND
Benzo(g,h,i)perylene	191-24-2	TO-13	ND	625	ND	8270	ND
Benzo(a)pyrene	50-32-8	TO-13	ND	625	ND	8270	ND
2-Chloronaphthalene	91-58-7	TO-13	ND	625	ND	8270	ND
Chrysene	218-01-9	TO-13	ND	625	ND	8270	ND
o-Cresol	95-48-7	TO-13[e]	ND	625	ND	8270	NR[f]
p-Cresol	106-14-5	TO-13[e]	ND	625	ND	8270	NR
Cumene	98-82-8	TO-13	ND	625	ND	8270	NR
Dibenzo(a,h)anthracene	53-70-3	TO-13	ND	625	ND	8270	ND
Fluoranthene	206-44-0	TO-13	ND	625	ND	8270	ND
Fluorene	86-73-7	TO-13	ND	625	ND	8270	ND
Indeno(1,2,3-c,d)pyrene	193-39-5	TO-13	ND	625	ND	8270	ND
Naphthalene	91-20-3	TO-13	0.004-0.012	625	ND	8270	ND
Nitrobenzene	98-95-3	TO-13	ND	625	ND	8270	ND

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 2 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
N-Nitrosodimethylamine	62-75-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitrosodiphenylamine	86-30-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitroso-di-n-propylamine	621-64-7	TO-13[e]	ND	625	ND	8270	ND
Phenanthrene	85-01-8	TO-13	ND	625	ND	8270	ND
Pyrene	129-00-0	TO-13	ND	625	ND	8270	ND
Phenol	108-95-2	TO-13[e]	ND	625	ND	8270	ND
PCBs (Total)	1336-36-3	TO-13[e]		8080		8080	
PCB 1016		TO-13[e]	ND	8080	1.8	8080	ND
PCB 1221		TO-13[e]	ND	8080	ND	8080	ND
PCB 1232		TO-13[e]	ND	8080	ND	8080	ND
PCB 1242		TO-13[e]	ND	8080	ND	8080	ND
PCB 1248		TO-13[e]	ND	8080	1.6-2.6	8080	ND
PCB 1254		TO-13[e]	ND	8080	1.8	8080	36-260
PCB 1260		TO-13[e]	ND	8080	0.89-2.5	8080	ND
DIOXINS/FURANS							
Polychlorinated dibenzo-p-dioxins					ng/L[h]		ng/g
1,2,3,4,6,7,8-HpCDD		TO-9[e]	0.021-0.017	8280	0.58-1.9		0.11-0.18
Total HpCdd		TO-9[e]	0.038-0.23	8280	0.58		0.21-0.28
OCDD		TO-9[e]	0.034-1.6	8280	0.51-12		0.055-1.2
VOCs					ug/L		ug/L
Acetaldehyde	75-07-0	TO-11	3.7-88	8315	710-1100	NA	NA
Acetone	67-64-1	TO-14	6.9-120	624	15000	NA	NA
Acrolein	107-02-8	TO-11	ND	624	ND	NA	NA
Acrylonitrile	107-13-1	TO-14	0.76-15	624	ND	NA	NA
Allyl chloride	107-05-1	TO-14	ND	624	ND	NA	NA
Benzaldehyde	100-52-7	TO-11	0.17-8.2	8315	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 3 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
Benzene	71-43-2	TO-14	0.2-1.3	624	ND	NA	NA
Bromoform	75-25-2	TO-14	ND	624	ND	NA	NA
2-Butanal	123-72-8	TO-11	1.1-68	624	ND	NA	NA
Carbon tetrachloride	56-23-5	TO-14	ND	624	ND	NA	NA
Carbonyl chloride (Phosgene)	75-44-5	OSHA Method 61	1	NA	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	ND	624	ND	NA	NA
Chloroform	67-66-3	TO-14	0.28-1.4	624	ND	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	ND	624	ND	NA	NA
1,4-Dichlorobenzene	106-46-7	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	ND	624	ND	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	ND	624	ND	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	ND	624	ND	NA	NA
cis-1,3-Dichloropropene	10061-01-5	TO-14	ND	624	ND	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	ND	624	ND	NA	NA
Ethylbenzene	100-41-4	TO-14	0.21-0.58	624	ND	NA	NA
Formaldehyde	50-00-0	TO-11	2.3-77	8315	ND	NA	NA
n-Heptane	142-82-5	TO-14	0.22-1.0	624	ND	NA	NA
Hexanal	66-25-1	TO-11	0.34-0.53	624	ND	NA	NA
Hexane	110-54-3	TO-14	0.21-11	624	ND	NA	NA
Bromomethane (methyl bromide)	74-83-9	TO-14	ND	624	ND	NA	NA
Methylene chloride	75-09-2	TO-14	0.21-2.7	624	400	NA	NA
2-Butanone (MEK)	78-93-3	TO-14	1.1-12	624	ND	NA	NA
Pentanal	110-62-3	TO-11	0.34-9.7	624	ND	NA	NA
Propanal	123-38-6	TO-11	0.69-23	624	ND	NA	NA
Tetrachloroethene	127-18-4	TO-14	0.26	624	ND	NA	NA
Toluene	108-88-3	TO-14	0.2-20	624	ND	NA	NA
1,1,1-Trichloroethane	71-55-6	TO-14	0.2-0.38	624	ND	NA	NA
Trichloroethene	79-01-6	TO-14	0.5-1.2	624	ND	NA	NA
Vinyl chloride	75-01-4	TO-14	ND	624	ND	NA	NA
Xylenes, total	1330-20-7	TO-14	0.21-1.9	624	ND	NA	NA
Total Volatile Hydrocarbons	-----	EPA Method 25	ND	624	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 4 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ug/m³)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
INORGANICS							
METALS							
Antimony	7440-36-0	PF/6010	ND	NA	NA	6010	ND
Arsenic	7440-38-2	PF/6010	ND	NA	NA	7060	3.3-5.5
Barium	7440-39-3	PF/6010	0.023-0.43	NA	NA	6010	42-97
Berylium	7440-41-7	PF/6010	ND	NA	NA	6010	ND
Cadmium	7440-43-9	PF/6010	0.015	NA	NA	6010	ND
Chromium	7440-47-3	PF/6010	0.058-0.24	NA	NA	6010	23-260
Cobalt	7440-48-4	PF/6010	0.027-0.032	NA	NA	6010	11-17
Copper	7440-50-8	PF/6010	0.042-0.34	NA	NA	6010	8.9-2700
Lead	7439-92-1	PF/6010	0.20-0.23	NA	NA	6010	12-140
Mercury	7439-97-6	PF/6010	0.0011-0.0012	NA	NA	7471	0.055-0.12
Molybdenum	7439-98-7	PF/6010	ND	NA	NA	6010	ND
Nickel	7440-02-0	PF/6010	0.052-0.16	NA	NA	6010	45-150
Selenium	7783-00-8	PF/6010	ND	NA	NA	7740	0.53
Silver	7440-22-4	PF/6010	ND	NA	NA	6010	NA
Thallium	7440-28-0	PF/6010	ND	NA	NA	6010	NA
Vanadium	7440-62-2	PF/6010	0.020-0.14	NA	NA	6010	27-53
Zinc	7440-66-6	PF/6010	0.13-5.5	NA	NA	6010	48-1600

a CAS = Chemical Abstracts Service
b ppbv = Parts per Billion by Volume
c ug/L = Micrograms per Liter
d mg/kg = Milligrams per Kilogram
e Sampling method followed procedure outlined in TO-13. Analytical method utilized modified 8270 procedures (see Section 3.2.3.4 describing approved method modifications).
f NA = Not Applicable
g NR = Not Reported
h ng/L = Nanogram per Liter
i ug/m³ = Micrograms per m³
j Does not include FSU Source Testing Results

1994 Topographical, Meteorological and Airborne Contaminant Characterization at Kettleman Hills Facility

Volume I

Prepared for:

Chemical Waste Management, Inc.
Kettelman Hills Facility
Kettelman City, CA

Prepared by:

Rust Environment & Infrastructure Inc.
Minneapolis, Minnesota 55441

Rust Project No.: 42971.900
April 1995

QUALITY
INTEGRITY
CREATIVITY
RESPONSIVENESS

RUST ENVIRONMENT & INFRASTRUCTURE

Chemical Waste Management, Inc.

CERTIFIED MAIL-Return Receipt Requested

April 28, 1995

John Papathakis (P 783 228 504)
Department of Toxic Substances Control
Region 1
10151 Croydon Way, Suite 3
Sacramento, California 95827

RE: SUBMITTAL OF THE 1994 TOPOGRAPHICAL, METEOROLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION AT KETTLEMAN HILLS FACILITY, (CAT000646117)

Dear Sir:

The above mentioned report is being submitted in accordance with the California Department of Toxic Substances Control Hazardous Waste Facility Permit, condition V.C.. The air characterization project began January, 1994 with the initial modeling of the meteorological data and ended February, 1995 with the Final Stabilization Unit (FSU) stack testing. The results of this project show that there is no need for continued monitoring of the ambient air at the Kettleman Hills Facility (KHF).

The KHF appreciates all the time spent by you and Anne Ely helping get this project approved by the San Joaquin Valley Unified Air Pollution Control District to meet "Hot Spots" requirements. Your knowledge of stack sampling and air testing methodologies during the FSU stack testing was also very helpful. Please give me a call at the above number to arrange a meeting to discuss this report and other air monitoring issues.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,
Chemical Waste Management, Inc.

Catherine R. Pool

Catherine R. Pool
Assistant Environmental Manager

enclosure

Printed on recycled paper

Courtesy Copy w/Enclosure by Certified Mail: Mailed 7/6/95

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Department of Toxic Substances Control
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William R. Zumwalt — Hand Delivered 7/6/95
Kings County Planning Agency
Government Center
Hanford, CA 93230

Printed on recycled paper

1994 Topographical, Meteorological and Airborne Contaminant Characterization at Kettleman Hills Facility

Volume I

Prepared for:

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Kettelman Hills Facility
Kettelman City, CA

Prepared by:

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April 1995

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Volume VI
K Air Dispersion Modeling Final Report

ABSTRACT

Chemical Waste Management, Inc., Kettleman Hills Facility (CWMI) has performed an emissions characterization study in accordance with the requirements of its Resource Conservation and Recovery Act (RCRA) Part B Permits. The purpose of this study was to identify and quantify hazardous constituents being emitted into the air from the facility and to fully characterize the topography and meteorological conditions at the facility which would affect their transport. These results were then used to develop a proposed list of target compounds for sampling, and to determine the locations for siting ambient air monitoring stations.

Based upon the sampling data, air dispersion modeling, and analysis of predicted property line ambient air concentrations, the results of this study conclude that the potential impact to off-site receptors was not great enough to justify an ambient air monitoring system around the CWMI Kettleman Hills facility.

1.0 INTRODUCTION

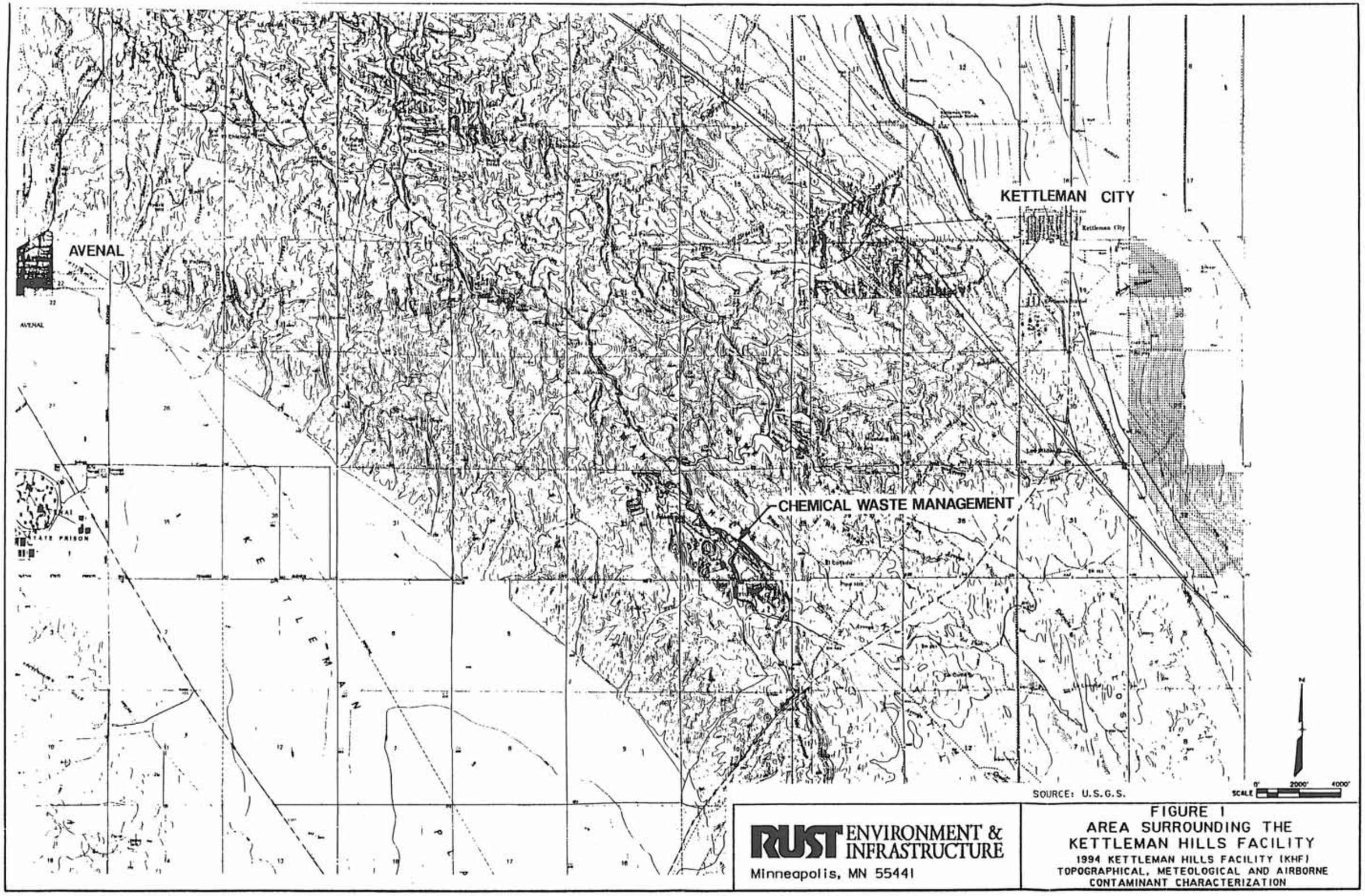
The Kettleman Hills Facility (CWMI) is a Class-I Disposal Site located on the western slope of the Kettleman Hills bordering the western edge of the San Joaquin Valley. The facility is located within U.S. EPA Region IX in Kings County, California, approximately 3.5 miles southwest of Kettleman City and 5 miles southwest of Avenal (See Figure 1).

In February 1988, CWMI was issued a RCRA Part B permit by the U.S. EPA and the State of California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) (formerly the Toxic Substances Control Division of the California Department of Health Services (CDHS)). As required under U.S. EPA condition V.D. and DTSC condition V.C. in the RCRA permits, CWMI must perform the following:

- Fully characterize the topography and meteorological condition that affect the airborne transport of hazardous constituents
- Identify hazardous constituents being emitted into the air from the facility, based on analyses specified in the permits
- Quantify the hazardous constituents through ambient air sampling

In 1991, a workplan was prepared by AeroVironment Inc. entitled "Kettleman Hills Facility Workplan, Topographical and Meteorological Characterization and Airborne Contaminant Identification" (henceforth referred to as the Workplan and included here as Appendix A). This Workplan detailed a strategy to accomplish the emission characterization requirements listed as conditions by the RCRA permits. The Workplan was submitted to the DTSC for review and ultimately obtained approval in a letter dated December 13, 1991 from John A. Papathakis, of DTSC, to Mr. Mark Langowski, the General Manager of CWMI.

In February, 1994, Rust Environment & Infrastructure (Rust) was contracted to carry out the emission characterization project as described in the approved Workplan. From March 15, 1994 through May 04, 1994, Rust collected field samples from each of the active sources of the landfill targeted for this study to determine the presence and quantity of any hazardous constituents. The Final Stabilization Unit (FSU) had subsequent source testing of air emissions performed between January 31, 1995, and February 9, 1995. Once the on-site sampling was complete, air dispersion modeling was performed by combining the hazardous constituent characterization data with the meteorological and topographical data to predict the locations beyond the facility boundaries where maximum impacts from facility emissions were likely to occur. This data was then used to determining the necessity for selecting air monitoring locations to measure the ambient air impacts of facility emissions.



RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

FIGURE 1
AREA SURROUNDING THE KETTLEMAN HILLS FACILITY
1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION

2.0 SITE BACKGROUND/STUDY OBJECTIVES

The objectives of this study were to sample the applicable matrices of all the active sources at the facility and fully characterize their respective hazardous constituent composition. As described in the Workplan, the RCRA permits identify which sources at the facility are potential sources of airborne contaminants. These sources were the surface impoundments, the landfills, and the Hazardous Waste Treatment Units (HWTUs). Figure 2-1 displays the locations of all the CWMI sources and property boundaries. The Workplan went on to further discuss evaporative tanks as a potential source for airborne contaminants. At the time of this study however, no evaporative tanks were active, so these were not included in the sampling. Outlined below is a description of the sources studied at the time of the emission characterization.

2.1 SURFACE IMPOUNDMENTS

The CWMI has had 20 surface impoundments, designated P-1 through P-20. Of these, P-9, P-14, and P-16 were the only active surface impoundments containing aqueous waste during the emissions characterization study.

2.2 LANDFILLS

The CWMI has had 18 landfills, designated B-1 through B-19. Three of the landfills (B-2, B-3, and B-14) have undergone final closure and most of the remaining landfills (B-1 and B-4 through B-11) were undergoing closure activity at the time of this emission characterization study. The proposed landfill B-17 was not in operation at the time of the characterization study. The remaining landfills which were included in this study were:

- B-13 This landfill was awaiting final closure.
- B-15 This landfill was awaiting final closure.
- B-16 This landfill was awaiting final closure.
- B-18 This landfill was divided into two Phases, I & II. At the time of the emissions characterization study, Phase II was actively taking waste and Phase I had interim cover. Samples were collected from both phases of the B-18 landfill.
- B-19 This landfill was divided into four phases (IA, IB, II, and III). At the time of the emissions characterization study, Phases II and III were covered with a geomembrane liner, and Phase IA had been emptied so that a damaged portion of its liner system could be repaired. Therefore, none of these three phases were included in the study. Phase IB, however, had interim cover and samples were collected from this phase of the landfill.

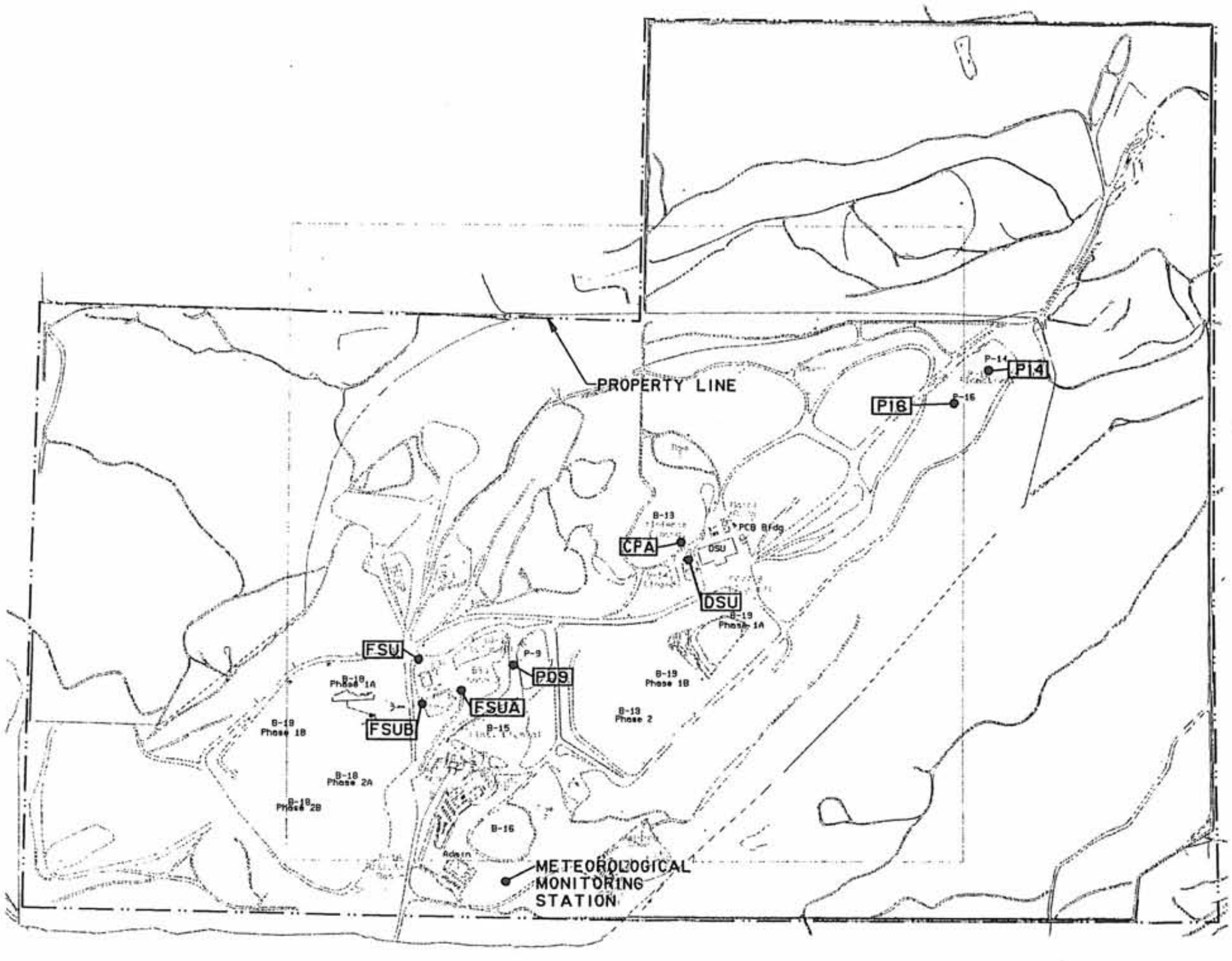
2.3 HAZARDOUS WASTE TREATMENT UNITS

The Workplan describes the HWTUs to be included in the emissions characterization study. These are listed below:

- The Central Processing Area (CPA) units, which include:
  - the Drum Decant Unit (DDU).
  - the Cyanide Treatment Unit (CTU).
  - the PCB Storage/Flushing Unit.
  - the Drum Storage Unit (DSU).
- The Final Stabilization Unit (FSU), along with the two FSU staging areas

2.4 TARGET COMPOUND LIST

The characterization of the hazardous constituents involved collecting samples from the above named sources and analyzing them for the parameters in the approved Target Compound List (TCL). The TCL is the list of compounds identified in the RCRA Permits to be targeted for sampling in the emissions characterization study. The list of compounds was initially presented in Table 5-2 of the Workplan and is included as Appendix B.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2
EXISTING SITE CONDITION AND AIR SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION

DATE=M Sep 12 10:57:50 1994
User i. known

3.0 SAMPLING & ANALYSIS STRATEGIES

3.1 INTRODUCTION

Because of the complexity of air emissions sources at the CWMI, characterization of emissions from CWMI sometimes involved collecting samples from more than one matrix per source. This enabled the most accurate determination of air emission rates. For example, at the surface impoundments, both the impoundment liquid and downwind ambient air were sampled. The landfill sampling involved collection of soil composite samples as well as integrated surface samples (ISS) of soil gas emissions. For the hazardous waste treatment units, only downwind air samples were collected. Figure 2 displays the sampling locations respective to each targeted source.

The approaches for sample collection in each specific matrix are described in detail in the Workplan. These approved sampling methods were followed except as discussed in Section 3.2.

3.1.1 Surface Impoundments

In accordance with the approved Workplan, each of the three surface impoundments were sampled once a week over a six-week period. Appendix E displays the dates of actual sampling events throughout the duration of this emission characterization study along with the targeted compound groups for each source. In addition, each sampling episode included collection of ambient air samples downwind from each impoundment. Each air sample was analyzed for the volatile parameters listed in the approved TCL (Appendix B).

3.1.2 Landfills

As stated in the approved Workplan, only surface soils from the active landfills or landfills not finally closed were to be sampled and analyzed for the required semivolatile and inorganic analytes. The Workplan specified that soil samples be collected from B-16, B-18 Phases I and II, and B-19 Phases IA, IB, II, and III. Between the time of development of the Workplan and authorization of the project, B-19 Phases IA, II and III became inactive and covered with plastic sheeting. Therefore, only the areas B-16, B-18 Phases I and II, and B-19 Phase IB were sampled.

At the targeted landfills, B-13, B-15, B-16, B-18 Phases I and II, and B-19, a soil gas sample was also collected using the integrated surface sampling (ISS) method described in the Workplan.

3.1.3 Hazardous Waste Treatment Units

In order to characterize emissions from the hazardous waste treatment units, ambient air monitoring was performed downwind of the CPA, DSU, FSU and FSU Storage areas. Two downwind sampling locations were chosen to characterize the CPA emissions with one of the two located directly downwind of the DSU. An ambient air sampling station was located downwind of the FSU along with each FSU storage area. Stack Test-Monitoring of the FSU stack was also performed to monitor the stack effluent emissions for presence of the hazardous compound targeted in this study. The Stack Test-Monitoring is discussed in Section 3.2.5 of this report.

3.2 SAMPLING AND ANALYTICAL PROCEDURES

3.2.1 Surface Impoundment Liquid Sampling and Analysis

The Workplan required the impoundment sampling events to take place once a week over a 6-week period. The samples were to be taken every sixth day so as not to bias sample representativeness due to weekly operations.

Overall, the actual sampling was performed in accordance with the intent of the plan. However, the sampling was not scheduled to coincide with discharge of wastes because of the costs and difficulty associated with rescheduling (re-arranging for personnel to be available, deliveries of containers, etc.), and because discharge activities were judged to occur for less than 10% of the time and therefore would bias the findings of the study if only those times were selected.

The Workplan prescribed collection of a discrete liquid sample within three feet of the measured bottom of each sampled surface impoundment (ponds). The purpose of sample collection at depth in the ponds was to better characterize potential sources of airborne contaminants originating within the impoundments, as samples collected closer to the surface could be more VOC depleted. Several options for suspending a sampler over the impoundment surface and collecting a discrete sample 3 feet above the bottom of the pond were eliminated for safety and cost reasons. Collecting samples with a pump was not considered good sampling technique because the analyses required volatile organic compound testing and a pump would lead to more VOC losses. Instead, a 2-inch PVC pipe with a slotted end section was slid down the side of each pond to reach areas to be sampled. Using as-built data provided by the CWMI Engineering Department, the required pipe length was calculated using the slope and depth of each pond.

The locations for collecting the discrete samples were chosen to be approximately midway along the length of each pond. This location was determined as reasonably representative of the total pond mixture. The calculated length of pipe was pushed into the pond to the position calculated from the as-built data. This method of placement was used because the heel of the side slope meeting the bottom could not be determined during pipe placement. Following placement, the pipe location was surveyed.

As specified in the Workplan, sampling equipment was dedicated to each surface impoundment. Preceding and following each sampling event, the equipment was rinsed with deionized water. All equipment associated with each pond was wrapped in visqueen and stored adjacent to the pond. All sampling equipment was disposed of at the facility. Equipment blanks and duplicates were also collected as specified in the Workplan.

The Workplan required the surface impoundment samples to be analyzed for volatile and semi-volatile organic compounds. The methods specified for each compound group were those generally used for wastewater and hazardous waste characterization. However, the detection limits required by the DTSC were closer to those more commonly associated with drinking water analyses. Each liquid sample was analyzed by the chemical analysis methods listed below:

EPA Method 624 for volatile organic compounds (VOCs) including allyl chloride, 2-butanol, 1,2-dibromoethane, n-heptane, hexanal, hexane, pentanal, propanal, acrolein, acrylonitrile, and total volatile hydrocarbons (TVH);

EPA Method 8315 for aldehydes;

EPA Method 8080 for polychlorinated biphenyls (PCBs);

EPA Method 608 organochlorine pesticides (pesticides);

EPA Method 8280 for isomer-specific polychlorinated dioxins (dioxins); and

EPA Method 625 for semi-volatile organic compounds (SVOCs) including cumene and n-nitrosodimethylamine.

One modification to the Workplan was to have acrolein and acrylonitrile analyzed by Method 624 instead of the specified Method 603. This modification was made because the analytical laboratory contracted to perform the Method 624 analysis was not EPA-accredited for Method 603 analysis. Because of the need for additional sample handling to forward the samples to a Chemical Waste Management, Inc. (CWM) approved laboratory, a decision was made to have the analysis of acrolein and acrylonitrile included in the Method 624 analysis. A second modification was to have xylenes reported as total xylenes rather than by speciated isomers.

The targeted practical quantitation limits (PQLs) were those specified in the Workplan. These PQLs reflect the detection limits required by the CWMI RCRA Part B permits. Several of the detection limits identified in the Workplan were listed as "to be determined" (TBD). When no detection limits were specified, the analytical laboratory assigned a detection limit similar to other PQLs in the same analyte group.

The (TVH) analysis was performed under Method 624 by quantifying the area associated with the top ten detected peaks selected from the Method 624 sample analysis. This area was then integrated and correlated to the concentration of an associated standard.

EPA Method 607 was the requested analytical method for liquid analysis of n-nitrosodimethylamine, n-nitrosodiphenylamine, and n-nitroso-n-propylamine. These compounds were included with the Method 625 analysis for SVOCs because the analytical lab satisfactorily demonstrated the ability to analyze these compounds with this method. As with the discussed volatiles, the analytical laboratory assigned a PQL to cumene similar to others in the same compound group.

3.2.2 Landfill Soil Sampling and Analysis

The purpose of investigating the landfill soil surface was to characterize the nature of this area as a potential source of air contaminants. In order to accomplish this characterization at each landfill unit or (in the case of B-18 and B-19, each phase) ten sub-samples were collected and lab-composited into one sample for analysis. The composite samples were then analyzed for the targeted semi-volatile organic compounds by EPA Methods 8270 (Semivolatiles), 8080 (Organochlorine Pesticides and PCBs) and 8280 (Dioxins), and selected metals by EPA Methods 6010 and 7471 (CAM Metals).

3.2.3 HWTU and Surface Impoundment Ambient Air Sampling and Analysis

The strategy for collecting ambient air samples followed the procedures outlined in the Workplan except for the specific method modifications described in sections 3.2.3.1 through 3.2.3.5.

All of the locations for placement of sampling equipment followed the prescribed siting requirements stated in the Workplan. For sampling around the HWTUs, two sampling locations for the CPA, one of which specifically targeted the DSU, were selected, along with one station for the FSU, and one station for each of the FSU storage area. The samplers were placed at locations downwind of the specific HWTU based upon current prevailing wind directions.

All of the analytical methodologies described in the Workplan were followed unless specifically discussed in the following sections.

3.2.3.1 VOCs - TO-14 and Total Volatile Hydrocarbons

Ambient air samples were collected in electropolished stainless steel cylinders using the instrumentation and sampling procedures described in the Workplan and EPA Method TO-14 (EPA, 1988). A XonTech model 911A directional sampling system was used with a 12-volt diaphragm pump with an all stainless steel and Teflon construction. Air flow was controlled by a back pressure flow controller.

Several minor modifications to the workplan were proposed to improve the quality of data collected. These proposed modifications were presented to the DTSC and were ultimately approved for incorporation into the Workplan. The first approved modification proposed the addition of acetone and methyl ethyl ketone to the method TO-14 target analytes instead of being sampled and analyzed by method TO-11. The second approved modification proposed the use of directional sampling for VOCs. (The Workplan did not address the use of directional sampling techniques.)

The purpose of directional sampling was to avoid diluting the sample with air which did not come from the source when the wind direction changed during a sampling event. The directional sampling for TO-14 VOCs utilized a wind vane mounted eight feet from the ground surface and located with each VOC sampler (see Figure 3-1). The wind vane activated a solenoid switch which routed the sampled air stream either to or away from the canister. The wind vane was programmed to collect air samples (in-sector) inside of a 180° window. If the wind changed and came from a direction outside of this 180° window (out-sector), the solenoid switch would route the sampled air stream out to vent. During a scheduled sampling event the samplers would be located downwind of the source with the center of the 180° in-sector window directed at the source.

3.2.3.2 VOCs - Carbonyls

Formaldehyde and other carbonyl compounds in air were sampled and analyzed following the procedures discussed in the Workplan. These procedures utilized a method based on EPA Method TO-11 [from the EPA Publication Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, (May, 1988)].

Although not required by the method, two cartridges were used in series to increase the collection capacity of the media and to be able to detect overloading or "breakthrough" of the collection media. Air was pulled through the media using Neuberger pumps with inert Viton diaphragms. The airflow rates were adjusted using needle valve flow controllers. Sampling train airflow calibrations were performed periodically using a precision rotometer calibrated against a primary standard. All direct connections to the SepPak cartridges involved stainless steel luer fittings. Sampling media were handled only with polyethylene or nitrile gloves

The carbonyl samples were collected at airflow rates of approximately 0.3 liters of air per minute (L/min) for eight-hour period sampling, or higher rates of airflow for shorter sampling periods. Flow calibration was done before sampling, periodically during sampling, and after sampling using a precision rotometer calibrated quarterly against a primary volume standard.

3.2.3.3 VOCs - Carbonyl Chloride (Phosgene)

Although the original Workplan called for use of EPA Method TO-6, ambient air samples for phosgene (carbonyl chloride) in air were collected and analyzed according to OSHA Salt Lake City Analytical Laboratory Method No. 61. The modification to use OSHA Method 61 instead of TO-11 was approved by the DTSC in the December 13, 1991, letter from John A. Papathakis of DTSC. This method uses personal air sampling pumps to pull air through solid adsorbent tubes containing XAD-2 adsorbent media treated with 2-(hydroxymethyl) piperidine (2-HMP). 2-HMP reacts with phosgene to form a stable and unique derivative.

This method was used instead of EPA Method TO-6 for several reasons. Method TO-6 uses midget impingers with an aniline in toluene solution. The hazards of handling and shipping this volatile mixture are avoided using OSHA Method No. 61, which uses a solid adsorbent medium. Also, the risk of cross-contamination of other volatile organic compound (VOC) samples with toluene vapors is eliminated using 2-HMP coated solid sorbet media.

SKC Model 224-PCRX7 personal air sampling pumps with variable orifice tube holder (THVO) controllers were used to provide a sampling rate of between 0.5 and 0.7 liters of air per minute. Flow calibration was done before and after sampling using a precision rotometer calibrated quarterly against a primary volume standard. When duplicate samples were collected, two identical sampling trains were used and identical sample airflow collection rates were targeted.

The samples were removed form the sampling train after the sampling period (usually eight hours) and were capped using a polypropylene end cap. Samples were shipped overnight in insulated coolers. Reduced temperatures were not used because the method reports that samples are stable for over two weeks at ambient temperatures.

2-HMP reacts with phosgene to form a stable and unique derivative. The derivative was analyzed by gas chromatography with a nitrogen-phosphorous detector (GC-NPD).

3.2.3.4 Semivolatile Organic Compounds (SVOCs)

The methodologies listed in the Workplan to sample and analyze for SVOCs in air include U.S. EPA methods TO-4 (pesticides and PCBs), TO-7 (nitrosamines), TO-8 (phenols and cresols), TO-9 (dioxins), and TO-13 (polynuclear aromatic hydrocarbons). Method TO-7 uses an adsorption cartridge for the detection of nitrosamines, and Method TO-8 uses an impinger sampling train for collection of phenols and cresols. The sample collection method for TO-4, TO-9, and TO-13 involve a modified high volume sampler with a sample collection cartridge consisting of a small glass fiber filter followed by a polyurethane foam (PUF) plug. Once a sample is collected, the filter and PUF plug undergo extraction and analysis for the compounds in the above lists. This sampling method is often modified to include a layer of XAD-2 adsorbent resin sandwiched within the PUF plug to allow for greater capture of gas phase volatiles. An approved modification to the Workplan included the utilization of such a PUF/XAD-2 cartridge.

Another modification to the procedures described in the Workplan involved the sampling of all the SVOCs by Method TO-13 sampling techniques. The laboratory chosen for the analysis of SVOCs demonstrated the ability to detect and quantify compounds beyond the TO-13 list after the extraction of a filter and PUF/XAD-2 cartridge. This expanded compound list was very similar to the 8270 compound list for soil analysis and included the target phenols and nitrosamines. Furthermore, once the sample was extracted, pesticides and PCBs could also be analyzed from the extract, as well as dioxins, by shipping an aliquot of the sample extract to an approved dioxin laboratory. By following the sampling procedures in TO-13, all of the required detection limits were achievable based on a sample volume of approximately 100 m^3 of air. Therefore, because of the demonstrated ability to collect and analyze all of the targeted SVOCs to the required detection limits, the DTSC approved the modification to utilize a single sample collection method (TO-13) to identify all of the SVOCs on the TCL.

The procedure for sampling SVOCs involved drawing air through a quartz filter and PUF/XAD-2 cartridge at approximately 0.214 m^3/min for an eight hour sampling period in order to collect the minimum required sample volumes. The quartz filter was used to collect particulate matter, including any SVOCs in particulate form. Vapor phase SVOCs are drawn into the PUF/XAD-2 plug and chemically react with the PUF/XAD-2 to remain bound to this media until chemically extracted in the laboratory.

3.2.3.5 Inorganic Metals

To characterize particulate and metals emissions from the HWTUs, the Workplan described the collection method of taking the small glass fiber filter from the TO-13 sampling apparatus and cutting it in half, using one half for SVOC analysis and the other half for metals analysis. An alternative procedure was approved by the DTSC, which used a separate high volume particulate sampler to be located along with the other sampling equipment at the designated sampling locations. The high volume sampler would operate over the course of a working day and collect particulate onto an 8 by 10 inch quartz fiber filter. Once the sample was collected, the filter was removed, measured for total particulate matter, and then analyzed for the metal compounds listed on the TCL.

Sampling techniques followed the protocol outlined in 40 CFR, Part 50 Appendix J, as well as the EPA Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II Ambient Air Specific Methods; Section 2.2, January, 1983. The advantage to using a separate sampling apparatus for particulate/metals sample collection was that the TO-13 filter would not have to be cut in half. Cutting the filter in half raises detection limits and increases the potential for inaccurate weighing of collected particulates.

3.2.4 Landfill Integrated Surface Sampling (ISS) and Analysis

In order to characterize gas emissions from the surface of the landfills, an integrated surface sample (ISS) was collected from each of the landfills targeted by this study. These landfills included B-13, B-15, B-16, B-18, Phases I and II, and B-19, Phases IA, IB, II, and III. As described in Section 3.1.2, only B-19 Phase IB of the B-19 phases could be sampled at the time of the study.

To collect the ISS samples, a portable sampling device was required that enabled multiple sampling apparatus to be attached. This allowed more than one type of sample to be collected simultaneously. As stated in the Workplan, the strategy was to walk a 50,000 ft^2 grid, for 25 minutes, with a sample probe located two to three inches above the surface of the landfill and collect a time-integrated soil gas emissions sample. Once collected, this sample would be analyzed for the VOCs on the TCL.

The Workplan briefly described the ISS sampling apparatus as a backpack equipped with an internal power source, 12-volt pump with an unlubricated Viton rubber diaphragm, Teflon tubing sample line with a six inch diameter, 316 stainless steel funnel, Tedlar bag sample containers for TO-14 VOCs, along with other sampling media, pumps and impingers for the carbonyls and phosgene. Several modifications to the sampling apparatus and sampling methodologies were proposed to DTSC in order to improve the likelihood of maintaining sample integrity while logistically carrying such a sampling apparatus. These modifications which were approved by DTSC included:

- Substitution of OSHA Method 61 in place of the impinger method for phosgene collection. This modification was previously described in the ambient air sample collection section.

- Substitution of an electropolished stainless steel canister in place of the Tedlar bag. Canisters maintain sample integrity longer and are easier to ship and handle.

- Substitution of the backpack with the sampling equipment being placed on a small dolly. This dolly was wheeled around the landfill surface, collecting samples according to the procedures described in the Workplan. Figure 3-2 displays the modified sample collection device.

3.2.5 Final Stabilization Unit (FSU) Stack Sampling

To determine if any target analytes were being discharged from the FSU building, source testing was performed. Due to the effort and expense associated with stack testing for the number of analytes targeted in this study, CWMI decided to use the stack testing data for emission inventory reporting to the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD). This data was used to help comply with the "Hot Spots" reporting requirements regulated by the SJVUAPCD. As a result of using this data for "Hot Spots" the source testing methods were selected and modified to meet the sampling requirements of both DTSC and the SJVUAPCD.

Parsons Engineering Science, Inc. (PES) from Irwindale, California was selected to perform the required stack sampling. PES, CWMI and Rust composed the source testing protocol (STP) which described sampling and analytical methods, along with a general approach for testing the stack emissions from the FSU. The STP was submitted to the SJVUAPCD and the California Air Resources Board (CARB) for review. The STP went through several modifications in order to meet the requirements of the "Hot Spots" program while still meeting the objectives of the emissions characterization study regulated by DTSC. A copy of the STP, along with a summary of the final approved modifications, is located with the FSU source testing report in Appendix J.

Figure 3-1

VOC SAMPLING PHOTOS

Figure 3-2

ISS SAMPLING PHOTOS

4.0 SAMPLING OPERATIONS

4.1 LANDFILL SOIL SAMPLING

In order to determine the specific locations where soil samples were to be taken, Rust obtained topographic maps of the appropriate landfills and landfill phases from the CWMI Engineering Department, divided each into 10 approximately equal subareas and randomly identified a sample location in each subarea. The preliminary locations were reviewed by CWMI and suggestions were made for repositioning several sample collection points to avoid sampling on steep slopes or through deep cover material. As a result of the suggestions made by CWMI, several sample locations were moved to more accessible points where cover was estimated to be 1-2 feet rather than 6-8 feet thick. The CWMI survey team identified the sampling locations with flagged stakes, and then surveyed and plotted the locations. The figures found in Appendix C identify the final sampling locations by their respective survey points and sample identification.

Additionally, CWMI requested that two additional sets of 10 samples be collected in Phases I and II of B-18. It was agreed that an "A" and "B" sample would be collected at different locations in two sets of subareas within the phases. Also, one set of 10 samples (B-18-II-1A through 10A) was split by the laboratory to generate a replicate. The split samples were designated as COMP A and COMP B for separate laboratory analysis.

A stainless steel slide-hammer device fitted with a stainless steel sample sleeve was used for the collection of the 10 samples from each landfill area. The sampling technicians collected the samples from 0-6 inches below ground surface immediately adjacent to each staked sample location. All 10 samples were then sent to the laboratory where composite samples were prepared to be analyzed as representative of each landfill area.

Sample equipment coming into contact with the soil was rinsed using deionized water between collection of each sample in each subarea. The equipment was washed with deionized water and non-phosphate detergent and further rinsed with deionized water between collection of samples from different phases or landfills. Equipment was sun dried after rinsing.

In order to meet the project start date agreed with DTSC, the soil samples were collected on March 15 and 16, 1994. The tables found in Appendix E indicate the sample collection date along with the required analysis for all of the landfill soil samples.

4.2 LANDFILL INTEGRATED SURFACE SAMPLING

4.2.1 VOCs

The ISS sampling for VOCs followed the procedures described in the Workplan and any approved modifications discussed in Section 3.0

In order to establish the exact grid locations, an approximate position of the grid was located by Rust. After the general area was agreed upon, the CWMI survey team surveyed and plotted the locations of the four corners of each landfill grid. The target grid size was approximately 50,000 quare feet, with the exact grid area determined by surveying. The figures found in Appendix D,

display the surveyed ISS exact grid area respective to each sampled landfill. Appendix E lists the sampling dates and the required analysis for all ISS sampling.

In order to lower compound detection limits without significantly modifying the approved collection procedures, the duration of sample collection was increased from 25 to 30 minutes at each site.

4.2.1.1 TO-14

All TO-14 sampling was done in accordance to the Workplan and any approved modifications. No significant problems were encountered with the TO-14 and TVH sampling and analysis.

4.2.1.2 Carbonyl Chloride (Phosgene)

The airflow rates for phosgene samples were increased to the extent possible in order to maximize the sensitivity of the method (OSHA Method 61 for carbonyl chloride [phosgene]), Because of the maximum sample time consideration for other samples, however, it was not possible to extend the sample collection period. Thus, the airflow rate was critical in determining airborne detection limits. The highest flow rates which the pumps could maintain were used.

Limitations of the sampling pumps' ability to overcome the back-pressure of the sampling media made it impossible to achieve the same airborne detection limits as with the eight-hour samples collected at the surface impoundments and hazardous waste treatment units. In order to improve the detection limits of collected samples, ISS samples which were collected on or before April 20, 1994 at less than 0.8 L/min were re-sampled at 1.3 to 1.5 L/min from May 2 - 5, 1994. The actual method detection limits are shown in Table 4-1.

4.2.1.3 Carbonyls

As with Phosgene, in order to obtain the lowest achievable detection limits, the air sampling rates for the ISS samples collected by EPA Method TO-11 were increased to maximize sensitivity. Due to the large back-pressure across the treated SepPak sampling media cartridges, however, it was not possible to collect samples at significantly higher flow rates. Most of the actual flow rates used were below 1.5 L/min. Lower flow rate increases were necessary in some cases, due in part to the high back pressure on the cartridges or related Neuberger pump limitations.

The initial results of carbonyl sample analysis indicated higher levels of aldehydes in the secondary cartridge than the primary cartridge. Once it was verified that the primary and secondary cartridges had not been placed in reverse order, it was hypothesized that the sampling train might be contributing contaminants to the secondary tube. Amber latex tubing was used upstream of the sampling media in the original sampling train configuration. This was replaced with polytetrafluoroethylene (PTFE)-lined Tygon tubing. Additionally, three instead of two cartridges were used in series to further investigate the possibility of sampling media breakthrough. The results are discussed in Section 5.1.

4.3 SURFACE IMPOUNDMENT LIQUID SAMPLING

For sample collection, a standard 2-inch, single-ball PTFE bailer was pushed down the inside of the PVC pipe to a distance of 3 feet vertically above the base of the pond. Surface impoundment liquid sampling followed all of the discussed procedures and no significant problems were encountered.

4.4 HAZARDOUS WASTE TREATMENT UNIT AND SURFACE IMPOUNDMENT AMBIENT AIR SAMPLING

The techniques and sampling procedures for collecting ambient air downwind of the targeted surface impoundments and HWTUs were the same for each source type. Therefore, they will be discussed together in the following sections.

For each surface impoundment and hazardous waste treatment unit, a reference location was identified to serve as a benchmark for locating the sampling equipment. This location was surveyed and plotted by the CWMI survey team. Figure 2-1 displays the general locations for locating the ambient air sample equipment at each of these sources. During each sampling event, the exact placement of the sample trailer was referenced to each source's respective benchmark and was generally within 20 feet of the surveyed benchmark..

The locations for placement of the ambient air sampling equipment downwind of the surface impoundments and HWTUs were dependent upon the wind direction at the time of sampling. Therefore, the sampling equipment had to be portable. To accommodate this portability requirement, the sampling equipment was placed upon open-top trailers which could be moved from about the site and adjusted for specific wind conditions. Figure 4-1 displays the equipment/trailer setup. Each trailer was configured with the equipment needed to collect all target compounds at a specific site during a scheduled sampling event, including the required duplicates. Three trailers were setup with sampling equipment and used throughout the project.

The VOC sampling equipment was battery powered so it did not require continuous 110 volt power supply. However, the high volume (Hi-Vol) air samplers, utilized at the HWTUs to collect the metals and SVOCs, required 110 volt continuous power supplied to the units for the entire duration of sample collection. Because the exact sampling locations were wind direction dependent, 110 volt receptacles with extension cords could not be used. To obtain the required power for sampling, a diesel-powered generator was used at each site. The generators were placed at least 50 feet downwind of the sampling location and moved if the wind direction changed enough for the collected samples to be impacted by the generators. Figure 4-1 displays the generator placement relative to the respective sample trailer.

4.4.1 VOCs

4.4.1.1 TO-14

Canister sampling for TO-14 VOCs and TVHs utilized the directionally controlled Xontech Model 911A sampler. The inlet consisted of a stainless steel inverted cone connected to stainless

steel and/or Teflon tubing and fittings which routed the air through a viton sealed pump and into the canister. The inlet was placed approximately five feet above the ground surface and was gently packed with silanized glass wool for particulate filtration. Because the units were directionally controlled and had the potential for sample interruption, air collection flow rates were adjusted to collect approximately 12 liters of air over the eight hour sampling event. The minimum required sample volume was approximately six liters.

The Workplan specified equipment blanks and duplicate samples to be collected. Because the Workplan did not discuss how these QA/QC samples should be taken, a discussion is provided in the following paragraphs.

Duplicate samples were collected by splitting the metered flow exhaust from the sampler between two canisters. The duplicates were rotated between the three sample locations and collected at a rate of one per sampling event. When a duplicate sample was taken, flow rates were doubled to accommodate the required increase in collected volume.

Equipment blanks were collected by attaching a zero air supply to the sampler inlet and collecting an air sample through the system. An in-line activated charcoal filter was placed between the zero air supply and the sampler to further scrub the clean air source. Sample flow rates were increased so that blanks could be collected in one to two hours. Once an equipment blank was taken, the sampler was sealed until the next sampling event. Most of the blanks collected immediately prior to a scheduled sampling event with the equipment blank sampling rotated between the three samplers each sampling event. One equipment blank was collected during each sampling event as required by the Workplan.

All of the sampling procedures followed the protocol discussed in the Workplan and any approved method modifications. The only problems encountered with the TO-14 and TVH sampling occurred on May 2, 1994, at FSU-A and on May 3, 1994, at Surface Impoundment P-9. On both of these days the sampling equipment malfunctioned midway through the sampling event. As a result the samples were voided and both recollected on May 4, 1994. No further problems with the sampling or analysis were encountered.

4.4.1.2 Phosgene

Phosgene samples were collected as described in Section 3.2. The only modification in field sampling protocol was the increase of the sampling rate from 0.5 to 0.7 L/min to up to 1.3 to 1.5 L/min.

4.4.1.3 Carbonyls

As discussed previously, the results of analysis of initial rounds of carbonyl samples indicated higher levels of aldehydes in the secondary cartridge than the primary section. Although this may have indicated breakthrough, further investigation found fairly good agreement between duplicate samples. This would not be expected if significant breakthrough occurred. This is discussed further in 5.1.2. No further problems were encountered with the carbonyl sampling.

4.4.2 SVOCs

Sample collection and analysis of all SVOCs followed the sampling procedures described in the Workplan and any approved modifications. To collect the required 100 m^3 of ambient air, the sample collection flow rates were adjusted to approximated 0.214 m^3/min for the eight hour sampling event.

Field blanks were collected by identifying a clean filter as the designated blank sample for a given sampling event. This filter accompanied the sample filters to the respective sampling site and remained with these filters throughout the sampling process and shipment to the laboratory. The field blank was analyzed and reported identically as the associated sampled filters.

No problems were encountered with the SVOC sampling by Method TO-13.

4.4.3 Metals

Sample collection and analysis of the inorganic metals followed the approved modification to the sampling and analysis procedures described in Section 3.2.3.5.

Field blanks were collected by identifying a clean filter as the designated blank sample for a given sampling event. This filter accompanied the sample filters to the respective sampling site and remained with these filters throughout the sampling process and shipment to the laboratory. The field blank was analyzed and reported identically as the associated sampled filters.

No problems were encountered with the sampling and analysis of inorganic metals by the approved procedures.

4.5 FINAL STABILIZATION UNIT STACK SAMPLING

Once final approval of the FSU - STP was obtained from both CARB and SJVUAPCD, all subsequent sampling and analysis followed the STP and approved modifications.

One week prior to performing the required FSU stack testing, all of the pre-test calculations were submitted to the SJVUAPCD for review and approval. The pre-test calculations included the method practical quantitation limits (PQLs) and estimated source concentrations (ESCs). The PQLs were calculated using the targeted sample volumes along with background contaminant concentrations found in the sampling media batches to be used for the testing. The PQLs were compared to the ESCs to verify that the approved sampling methods were capable of detecting the target analyte concentrations estimated to be present in the exhaust gas. All of the approved pre-test calculations are included with the FSU source testing report located in Appendix J.

All of the FSU source testing was performed between January 31, 1995, and February 9, 1995. The FSU source testing report describes the sampling operations occurring during the testing period.

Figure 4-1

POWER GENERATION PLACEMENT PHOTOS

TABLE 4-1

VOLATILE ORGANIC COMPOUND AIR MONITORING
AIRBORNE DETECTION LIMITS FOR PHOSGENE
Page 1 of 2

SAMPLE NUMBER	PHOSGENE (ppbv)	Comment
B13 - 050294	< 51.89	See Note 4
B15 - 050294	< 46.03	See Note 4
B16 -050494	< 44.12	See Note 4
B18 PHI - 050194	< 50.33	B18 Phase I - See Note 3
B18 PHII - 050194	< 41.74	B18 Phase II - See Note 3
B18 PHII - 050194-D	< 43.42	B18 Phase II - See Note 3
B19 -050494	< 43.02	See Note 4
CPA -041494	< 6.15	
CPA -042094	< 5.49	
CPA -050194	< 3.14	
DSU -041494	< 6.09	
DSU -042094	< 5.13	
DSU -042094D	< 5.57	
DSU -050194	< 2.98	
FSU -041394	< 5.94	
FSU -041394D	< 6.02	
FSU -041994	< 6.07	
FSU -050294	< 3.60	
FSUA -041394	< 6.00	
FSUA -041994	< 6.06	
FSUA -050294	< 3.09	
FSUA -050294D	< 3.49	
FSUB -041394	< 6.16	
FSUB -041994	< 6.30	
FSUB -041994D	< 6.20	
FSUB -050294	< 3.32	
P 9 -033194	< 9.28	
P 9 -040694	< 5.26	
P 9 -040694D	< 5.11	
P 9 -041294	< 5.41	
P 9 -041894	< 6.23	

TABLE 4-1

VOLATILE ORGANIC COMPOUND AIR MONITORING
AIRBORNE DETECTION LIMITS FOR PHOSGENE
Page 2 of 2

SAMPLE NUMBER	PHOSGENE (ppbv)	Comment
P 9 -043094	< 3.88	
P 9 -043094D	< 3.19	
P 9 -050394	< 4.37	
P14 -033194	< 7.83	
P14 -040694	< 6.23	
P14 -041294	< 5.69	
P14 -041294D	< 5.69	
P14 -041894	< 6.28	
P14 -043094	< 4.59	
P14 -050394	< 4.43	
P14 -050394D	< 4.15	
P16 -033194	< 5.19	
P16 -033194D	< 5.19	
P16 -040694	< 5.80	
P16 -041294	< 5.98	
P16 -041894	< 6.04	
P16 -041894D	< 6.22	
P16 -043094	< 3.81	
P16 -050394	< 4.07	
NOTES:		
1) "ppbv" means parts per billion by volume in air		
2) "<" means less than stated value (airborne detection limit)		
3) The analytical detection limit was 8 micrograms (μg) per sample		
4) Based on method and flow rate constraints, this was the best detection limit possible within the time allowed		

Table displays positively detected sampling results only.

5.0 ANALYSIS OF SAMPLES

5.1 DISCUSSION OF RESULTS

All analyses were performed by either California Laboratory Services (CLS), Enseco California Analytical Laboratory (Enseco, a CLS subcontractor), Air Toxics LTD., Ross Analytical Services, Inc. (Ross), West Coast Analytical Service, Inc. (an Air Toxics LTD subcontractor), and ALTA Analytical (an Air Toxics LTD subcontractor). California Laboratory Services had been identified during the project approval process to perform the soils and liquids sample analyses by methods for which they have approval. Ross performed all analysis of inorganic metal samples, WCAS performed the phosgene analysis and Air Toxics LTD, along with their subcontractors, performed all remaining analysis of collected air samples.

Table 5-1 shows the detected concentration ranges of all analytes for each sampled matrix. This table summarizes the data from all the analyses performed and readily allows correlation between matrices when more than one matrix per source was sampled for the same compound. For example, Acetone was detected in the liquid samples collected from the surface impoundments at 15,000 ug/L. Acetone was also detected in the air collected downwind of the surface impoundments from 6.9 - 120 ppbv. The following sections, 5.1.1 - 5.1.5, discuss the results from each targeted source and contain tables of detected hits for each compound group.

5.1.1 Landfill Soil Sampling

The analysis of landfill soil samples followed the Methods specified in the Workplan. However, the required Method Detection Limits (MDLs) listed in the Workplan were generally lower than those achieved by CLS and similar laboratories. It was agreed in a telephone conversation between CWMI, Rust and DTSC personnel (March 15, 1994) that the higher CLS detection limits would be used for EPA Method 6010, EPA Method 8270 and EPA Method 8080.

Of the parameters analyzed in the soil samples collected at sources B-16, B-18 Phase I and IA, B-18 Phase II and IIB, and B-19 Phase IB, many were not detected including all SVOCs (EPA Method 8270), all pesticides (EPA Method 8080) and a number of metals including antimony, beryllium, cadmium, molybdenum and silver, thallium. Mercury and selenium were detected in several samples. The metals results are shown in Table 5-2. Finally, other SVOC parameter groups including PCBs (EPA Method 8080) and polychlorinated dioxins/furans (EPA Method 8280) had sporadic detections of some of the analytes. These are shown in Table 5-3.

5.1.2 Landfill Integrated Surface Sampling

5.1.2.1 VOCs

<u>TO-14</u>

The analysis for TO-14 VOCs indicated the presence of ten target compounds. These results are

shown in Table 5-4. Acetone, methylene chloride and hexane are common laboratory solvents and detected hits are often attributed to laboratory contamination.

Phosgene

No phosgene was detected at or above the airborne detection limit in any of the integrated surface samples collected at landfill sites B13, B15, B16, B18 (Phase I and II), and B19 Phase IB. However, since these air sample volumes were much lower than for the eight-hour samples (integrated surface sample periods were only 30 minutes in duration, as required by the work plan), the airborne detection limits were higher. The laboratory also reported an overlap of chromatographic peaks which were reported as co-eluting compounds. This resulted in a higher analytical method detection limit than anticipated, based on the OSHA Salt Lake City Analytical Laboratory Method and telephone conversations with Warren Hendricks, an OSHA chemist and developer of the method. The actual airborne detection limits are as shown in Table 4-1.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein, benzaldehyde, or hexanal were detected in any of the integrated surface samples.

The TO-11 samples were collected with two or three SepPak cartridges in series. Generally, more carbonyls were found in the second cartridge than the first cartridge. The results shown in Table 5-5 are based on the total amounts of each compound reported for the sampling train.

The results of the carbonyl analysis by method TO-11, performed on each individual SepPak cartridge, were added together per species to form a total result per sample. For many of the TO-11 samples, the second (or third in some cases) SepPak cartridge results were higher than those found in the first cartridge. This phenomena would indicate that the first cartridge was saturated with analyte and breakthrough to the backup cartridges was occurring. However, because the results in the backup cartridges were higher, in some cases, than those in the preceding cartridges, it also appeared that the front cartridge was not saturated with a given analyte. If breakthrough of analyte between SepPak cartridges was occurring, the possibility for compound loss would probably yield erratic results with poor sampling precision between samples. Table 5-6 displays the sample and associated duplicate results, along with the calculated percent difference, for all TO-11 duplicate sampling. In most cases the percent difference between the sample results and associated duplicate were less than 25 %. This would indicate that overall good precision was achieved with the TO-11 sampling. Because of the demonstrated precision of the sampling technique, the results of the carbonyl sampling and analysis probably accurately represent the order of magnitude of carbonyls present in the air directly above the soil surface of the sampled landfills.

5.1.3 Surface Impoundment Liquid Sampling

Tables 5-7 (SVOC Analysis Results) and 5-8 (VOC Analysis Results) display the detected compounds of the liquid analysis from the surface impoundment sampling. As indicated on Table 5-7, the only detected SVOCs were PCBs and dioxins.

The dioxin analysis by Method 8280 indicated low level OCDD concentrations in most of the samples collected ranging from 0.51 - 12 ng/L. The only other detected dioxin was 1,2,3,4,6,7,8-HpCDD which was found in P-9 at 0.58 ng/L and P-16 at 1.9 ng/L.

The PCB analysis by Method 8080 showed Arclors 1016, 1248 and 1254 present in P-16 and Arclor 1260 present in P-9 and P-14. The low level concentrations of detected PCBs ranged from 0.89 - 2.6 ug/L.

No other SVOCs were present in any of the surface impoundment liquid samples.

As indicated on Table 5-8, only acetone, methylene chloride and acetaldehyde were present in the liquid samples analyzed for VOCs. Acetaldehyde was also present at 1.1 mg/L in the P-14 equipment blank collected on March 31, 1994. TVHs were not detected in any of the samples.

5.1.4 Surface Impoundment Ambient Air Sampling (VOCs)

5.1.4.1 VOCs

TO14

The analysis for TO-14 VOCs indicated the presence of 14 compounds in the air sampled downwind of the surface impoundments. Table 5-9 displays the concentrations for all detected TO-14 compounds present in the samples. Acetone, benzene, hexane, 2-butanone, toluene and xylenes were found in most of the samples collected. The equipment blanks collected immediately prior to a scheduled sampling event found acetone present at 6.2 - 89 ppbv, benzene present in one blank at 0.80 ppbv, hexane present at 0.66 - 4.0 ppbv, toluene present at 0.55 - 16 ppbv and xylenes present at 0.28 - 0.41 ppbv. The fact that these compounds were found in most of the samples, as well as most of the collected equipment blanks, indicate the compounds may have been introduced to the sample from the equipment. The other detected compounds were all present at very low levels and only detected sporadically.

Phosgene

No phosgene was detected in any of the samples collected at the surface impoundment ponds. Note that airborne detection limits varied because of varied air sample volumes. Table 4-1 presents the airborne detection limits for this method.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein was detected in any of the surface impoundment air samples. Hexanal was only detected in two of the samples. Low quantities of other carbonyl compounds were reported, as shown in Table 5-5.

As with the ISS sampling for carbonyl compounds, the TO-11 samples were collected with two or three SepPak cartridges in series. As discussed in Section 5.1.2 under Carbonyls, the potential for breakthrough was present, however, the duplicate precision data display in Table 5-6 support the results as shown.

5.1.5 Hazardous Waste Treatment Unit Sampling

5.1.5.1 VOCs

TO14

The analysis for TO-14 VOCs indicated 13 compounds present in the air samples collected downwind of the HWTUs. Table 5-10 displays the resulting concentrations of those detected hits. Acetone, benzene, hexane, 2-butanone, toluene, 1,1,1-trichloroethane and xylenes were present in most of the collected samples. As with the surface impoundment results, acetone (6.8 - 15 ppbv), hexane (0.33 - 1.2 ppbv), benzene (0.95), toluene (2.1 - 12 ppbv), and xylenes (0.24 - 3.1 ppbv) were sporadically present in equipment blanks collected just prior to a scheduled sampling event. Again this would indicate the possibility that these compounds may have been introduced to the sampling equipment from the equipment. No 1,1,1-trichloroethane was detected in any of the equipment blanks. The other detected VOCs were all present at low levels and only periodically detected.

Phosgene

No phosgene was detected in any of the samples collected at the Hazardous Waste Treatment Units. Note that airborne detection limits varied, because of varied air sample volumes. Table 4-1 presents the airborne detection limits for this method.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein was detected in any of the Hazardous Waste Treatment Unit air samples. Low quantities of other carbonyl compounds were reported, as shown in Table 5-5.

The discussion on breakthrough, as presented in Sections 5.1.2 and 5.1.4, applies here as well.

5.1.5.2 SVOCs

The analysis for SVOCs indicated two dioxins as well as napthalene and phenol present in the air samples collected downwind of the HWTUs. Table 5-11 displays the resulting concentrations of these detected hits. OCDD was present in all but one of the samples with a concentration ranging from 33E-06 - 1500E-06 pptv. 1,2,3,4,6,7,8-HpCdd was detected at the CPA on April 14, 1994, at

21E-06 pptv and at the FSU on April 13, 1994, at 100E-06 pptv. Napthalene was present in many of the samples with a concentration ranging from 0.004 - 0.012 ppbv. Phenol was detected only once. No SVOCs were found in the collected field blanks.

5.1.5.3 Metals

The analysis for inorganic metals indicated ten metals present in the air samples collected downwind of the HWTUs. Table 5-12 displays the resulting concentrations of the detected hits of metals. Barium, copper and zinc were present in almost all of the samples ranging from 0.023 - 0.43 ug/m^3, 0.042 - 0.34 ug/m^3, and 0.10 - 5.5 ug/m^3 respectively. Chromium, nickel and vanadium were present in many of the samples collected near the FSU. Cadmium, cobalt, lead and mercury were only present in several of the HWTU air samples.

5.1.6 Final Stabilization Unit Stack Sampling

A complete discussion of the stack sampling and analysis of the final stabilization unit is located in Appendix J.

TABLE 5-1[j]
CONCENTRATION RANGE OF TARGETED COMPOUNDS
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	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
SEMIVOLATILES							
PESTICIDES							
Aldrin	309-00-2	TO-13[e]	ND	608	ND	8080	ND
Chlordane	57-74-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDD	72-54-8	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDE	72-55-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDT	50-29-3	TO-13[e]	ND	608	ND	8080	ND
SVOCs							
Acenaphthylene	208-96-8	TO-13	ND	625	ND	8270	ND
Anthracene	120-12-7	TO-13	ND	625	ND	8270	ND
Benzo(a)anthracene	56-55-3	TO-13	ND	625	ND	8270	ND
Benzo(b)fluoranthene	205-99-2	TO-13	ND	625	ND	8270	ND
Benzo(k)fluoranthene	207-08-9	TO-13	ND	625	ND	8270	ND
Benzo(g,h,i)perylene	191-24-2	TO-13	ND	625	ND	8270	ND
Benzo(a)pyrene	50-32-8	TO-13	ND	625	ND	8270	ND
2-Chloronaphthalene	91-58-7	TO-13	ND	625	ND	8270	ND
Chrysene	218-01-9	TO-13	ND	625	ND	8270	ND
o-Cresol	95-48-7	TO-13[e]	ND	625	ND	8270	NR[g]
p-Cresol	106-14-5	TO-13[e]	ND	625	ND	8270	NR
Cumene	98-82-8	TO-13	ND	625	ND	8270	NR
Dibenzo(a,h)anthracene	53-70-3	TO-13	ND	625	ND	8270	ND
Fluoranthene	206-44-0	TO-13	ND	625	ND	8270	ND
Fluorene	86-73-7	TO-13	ND	625	ND	8270	ND
Indeno(1,2,3-c,d)pyrene	193-39-5	TO-13	ND	625	ND	8270	ND
Naphthalene	91-20-3	TO-13	0.004-0.012	625	ND	8270	ND
Nitrobenzene	98-95-3	TO-13	ND	625	ND	8270	ND

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
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	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
N-Nitrosodimethylamine	62-75-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitrosodiphenylamine	86-30-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitroso-di-n-propylamine	621-64-7	TO-13[e]	ND	625	ND	8270	ND
Phenanthrene	85-01-8	TO-13	ND	625	ND	8270	ND
Pyrene	129-00-0	TO-13	ND	625	ND	8270	ND
Phenol	108-95-2	TO-13[e]	ND	625	ND	8270	ND
PCBs (Total)	1336-36-3	TO-13[e]		8080		8080	
PCB 1016		TO-13[e]	ND	8080	1.8	8080	ND
PCB 1221		TO-13[e]	ND	8080	ND	8080	ND
PCB 1232		TO-13[e]	ND	8080	ND	8080	ND
PCB 1242		TO-13[e]	ND	8080	ND	8080	ND
PCB 1248		TO-13[e]	ND	8080	1.6-2.6	8080	ND
PCB 1254		TO-13[e]	ND	8080	1.8	8080	36-260
PCB 1260		TO-13[e]	ND	8080	0.89-2.5	8080	ND
DIOXINS/FURANS							
Polychlorinated dibenzo-p-dioxins					ng/L[h]		ng/g
1,2,3,4,6,7,8-HpCDD		TO-9[e]	0.021-0.017	8280	0.58-1.9		0.11-0.18
Total HpCdd		TO-9[e]	0.038-0.23	8280	0.58		0.21-0.28
OCDD		TO-9[e]	0.034-1.6	8280	0.51-12		0.055-1.2
VOCs					ug/L		ug/L
Acetaldehyde	75-07-0	TO-11	3.7-88	8315	710-1100	NA	NA
Acetone	67-64-1	TO-14	6.9-120	624	15000	NA	NA
Acrolein	107-02-8	TO-11	ND	624	ND	NA	NA
Acrylonitrile	107-13-1	TO-14	0.76-15	624	ND	NA	NA
Allyl chloride	107-05-1	TO-14	ND	624	ND	NA	NA
Benzaldehyde	100-52-7	TO-11	0.17-8.2	8315	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
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	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
Benzene	71-43-2	TO-14	0.2-1.3	624	ND	NA	NA
Bromoform	75-25-2	TO-14	ND	624	ND	NA	NA
2-Butanal	123-72-8	TO-11	1.1-68	624	ND	NA	NA
Carbon tetrachloride	56-23-5	TO-14	ND	624	ND	NA	NA
Carbonyl chloride (Phosgene)	75-44-5	OSHA Method 61	1	NA	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	ND	624	ND	NA	NA
Chloroform	67-66-3	TO-14	0.28-1.4	624	ND	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	ND	624	ND	NA	NA
1,4-Dichlorobenzene	106-46-7	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	ND	624	ND	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	ND	624	ND	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	ND	624	ND	NA	NA
cis-1,3-Dichloropropene	10061-01-5	TO-14	ND	624	ND	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	ND	624	ND	NA	NA
Ethylbenzene	100-41-4	TO-14	0.21-0.58	624	ND	NA	NA
Formaldehyde	50-00-0	TO-11	2.3-77	8315	ND	NA	NA
n-Heptane	142-82-5	TO-14	0.22-1.0	624	ND	NA	NA
Hexanal	66-25-1	TO-11	0.34-0.53	624	ND	NA	NA
Hexane	110-54-3	TO-14	0.21-11	624	ND	NA	NA
Bromomethane (methyl bromide)	74-83-9	TO-14	ND	624	ND	NA	NA
Methylene chloride	75-09-2	TO-14	0.21-2.7	624	400	NA	NA
2-Butanone (MEK)	78-93-3	TO-14	1.1-12	624	ND	NA	NA
Pentanal	110-62-3	TO-11	0.34-9.7	624	ND	NA	NA
Propanal	123-38-6	TO-11	0.69-23	624	ND	NA	NA
Tetrachloroethene	127-18-4	TO-14	0.26	624	ND	NA	NA
Toluene	108-88-3	TO-14	0.2-20	624	ND	NA	NA
1,1,1-Trichloroethane	71-55-6	TO-14	0.2-0.38	624	ND	NA	NA
Trichloroethene	79-01-6	TO-14	0.5-1.2	624	ND	NA	NA
Vinyl chloride	75-01-4	TO-14	ND	624	ND	NA	NA
Xylenes, total	1330-20-7	TO-14	0.21-1.9	624	ND	NA	NA
Total Volatile Hydrocarbons	-----	EPA Method 25	ND	624	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 4 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ug/m³)[h]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
INORGANICS							
METALS							
Antimony	7440-36-0	PF/6010	ND	NA	NA	6010	ND
Arsenic	7440-38-2	PF/6010	ND	NA	NA	7060	3.3-5.5
Barium	7440-39-3	PF/6010	0.023-0.43	NA	NA	6010	42-97
Berylium	7440-41-7	PF/6010	ND	NA	NA	6010	ND
Cadmium	7440-43-9	PF/6010	0.015	NA	NA	6010	ND
Chromium	7440-47-3	PF/6010	0.058-0.24	NA	NA	6010	23-260
Cobalt	7440-48-4	PF/6010	0.027-0.032	NA	NA	6010	11-17
Copper	7440-50-8	PF/6010	0.042-0.34	NA	NA	6010	8.9-2700
Lead	7439-92-1	PF/6010	0.20-0.23	NA	NA	6010	12-140
Mercury	7439-97-6	PF/6010	0.0011-0.0012	NA	NA	7471	0.055-0.12
Molybdenum	7439-98-7	PF/6010	ND	NA	NA	6010	ND
Nickel	7440-02-0	PF/6010	0.052-0.16	NA	NA	6010	45-150
Selenium	7783-00-8	PF/6010	ND	NA	NA	7740	0.53
Silver	7440-22-4	PF/6010	ND	NA	NA	6010	NA
Thallium	7440-28-0	PF/6010	ND	NA	NA	6010	NA
Vanadium	7440-62-2	PF/6010	0.020-0.14	NA	NA	6010	27-53
Zinc	7440-66-6	PF/6010	0.13-5.5	NA	NA	6010	48-1600

a CAS = Chemical Abstracts Service
b ppbv = Parts per Billion by Volume
c ug/L = Micrograms per Liter
d mg/kg = Milligrams per Kilogram
e Sampling method followed procedure outlined in TO-13. Analytical method utilized modified 8270 procedures (see Section 3.2.3.4 describing approved method modifications).
f NA = Not Applicable
g NR = Not Reported
h ng/L = Nanogram per Liter
i ug/m³ = Micrograms per m³
j Does not include FSU Source Testing Results

TABLE 5-2
SOIL MONITORING DATA
METALS ANALYSIS RESULTS

SAMPLE NUMBER	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
B16	3.3	46	30	11	17	15		49		32	48
B18-IA	4.4	67	50	13	8.9	23		55		53	77
B18-IB	4.7	79	38	16	13	21		54	0.53	38	75
B18-IIA COMP A	4	95	41	11	2700	140	0.12	55		29	1600
B18-IIA COMP B	5.5	97	32	11	47	51	0.12	53		29	240
B18-IIB	5.3	69	260	17	32	55	0.055	150		39	130
B19-IB	4.2	42	23	13	18	12		45		27	48

Table displays positively detected sampling results only.

TABLE 5-3
SOIL MONITORING DATA
SVOC ANALYSIS RESULTS

SAMPLE NUMBER	OCDD (ug/kg)	1,2,3,4,6,7,8-HpCDD (ug/kg)	Total HpCDD (ug/kg)	AROCLOR 1254 (ug/kg)
B16-I	0.36	0.11	0.21	
B18-IA	1.2	0.15	0.28	
B18-IB	0.055			
B18-IIA COMP A				220
B18-IIA COMP B				260
B18-IIB				36
B19-IB	0.4	0.13	0.26	

Table displays positively detected sampling results only.

TABLE 5-4
ISS MONITORING DATA
VOC RESULTS (TO-14 ANALYSIS, ppbv)

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Hexane	Methylene Chloride	2-Butanone (MEK)	Toluene	1,1,1-Trichloroethane	m,p-Xylene
B13-041494	120			1.40	0.53		9.3	1.6	0.34	0.33
B13-041494LD	120		0.31	1.40	0.65		7.3	1.6	0.37	0.32
B15-042094	34	15	0.34		11	0.49	7.0	0.50		
B16-042094		4.9	0.32		0.84	0.51	2.5	1.3		0.30
B18PHI-050194	40									
B18PHII-050194	44					2.3				
B18PHII-050194D	29				3.5	2.1				
B18PHII-050194LD	44					2.7				
B19-042094	17				0.60		1.6			

D = Duplicate Sample
LD = Laboratory Duplicate

Table displays positively detected sampling results only.

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 1 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal* (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
B13-041494	6.00		4.58	6.90			2.41
B15-042094	12.77		20.81	9.02		2.90	2.15
B16-042094	16.66		32.85	16.77			5.70
B18 PHI050194-1/-2/-3	9.94		8.19	10.48			2.23
B18 PHII050194-1/-2/-3	87.56		48.16	69.86		5.60	15.36
B18 PHII050194-1/-2/-3D	86.45		67.93	76.90		9.67	15.98
B18 PH1050194B			0.3 ug				
B19-042094	10.26		25.81	10.04			3.37
CPA-041494	4.64		1.73	2.44		0.34	1.09
CPA-042094	12.96		4.42	6.52		0.85	1.74
CPA-050194-1/-2/-3	25.38	0.84	8.23	15.71		0.93	3.61
CPA-050194B	0.1 ug		0.23 ug				
DSU-041494	4.39		2.53	2.52		0.39	0.97
DSU-042094	12.02	0.23	3.33	6.22		0.92	1.80
DSU-042094D	15.05	0.81	3.74	10.27		0.77	2.15
DSU-042094DL	11.90	0.35	3.52	5.65		0.95	1.73
DSU-050194-1/-2/-3	21.91	0.77	6.89	13.30		1.10	2.69
FSU-041394	3.77		1.75	2.71		0.91	0.69
FSU-041994	14.69		3.33	8.38		0.92	1.92
FSU-050294-1/-2/-3	23.12	0.17	5.24	11.12		1.65	2.64
FSUA-041394	16.08	0.70	3.76	9.87		0.90	2.81
FSUA-041994	12.71		2.80	7.93			1.76

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 2 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal* (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
FSUA-050294-1/-2/-3	23.03		5.55	11.83		2.16	2.80
FSUA-050294-1/-2/-3D	24.25	0.22	5.72	11.12		1.07	2.87
FSUB-041394	3.73		1.13	2.30		0.86	0.93
FSUB-041994	14.37		3.56	6.66		1.16	1.84
FSUB-041994D	11.38		2.54	5.39			1.36
FSUB-050294-1/-2/-3	22.83	0.50	5.41	11.53		1.42	2.64
FSUB-050294-1/-2/-3D	22.83	0.50	5.65	11.53		1.53	2.61
P 9-033194	13.87	8.18	4.36	9.64		1.49	2.69
P 9-040694	18.26		3.57	10.72		0.98	2.25
P 9-040694D	12.24	1.54	3.03	7.07		0.68	1.66
P 9-041294	20.60	1.36	14.17	13.11		1.17	2.86
P9-041294B	0.26 ug		0.25 ug	0.14 ug			
P 9-041894	19.17		6.61	13.78		3.08	23.37
P 9-043094-1/-2/-3	29.40	0.77	8.05	16.70		1.60	3.49
P 9-043094-1/-2/-3D	30.25	0.59	7.67	15.03		1.35	3.40
P 9-050394-1/-2	17.33	0.28	4.70	7.51		0.70	1.82
P14-033194	18.17	0.35	4.82	6.52	0.34	1.47	2.27
P14-033194D	18.58	0.35	4.82	6.52	0.34	1.61	2.36
P14-033194B			0.48 ug				
P14-040694	13.64		3.33	6.67		0.41	2.01
P14-040694D	14.02		2.62	6.67		0.87	1.84
P14-041294	15.57	1.28	2.96	10.09		0.93	2.55

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 3 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal* (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
P14-041294D	17.36	1.32	3.48	11.38		0.94	3.08
P14-041894	18.30	0.91	19.56	9.67		1.57	2.30
P14-041894B			0.19 ug				
P14-043094-1/-2/-3	25.47	0.86	5.89	15.94		1.17	2.84
P14-050394-1/-2	21.29		4.76	9.72		0.85	2.44
P14-050394-1/-2D	21.23		5.08	9.64		1.06	2.57
P16-033194	15.34	0.40	4.47	6.59		1.61	2.10
P16-033194D	15.03	0.35	4.12	7.35		1.48	2.19
P16-040694	12.91		2.23	6.84		0.64	1.58
P16-041294	19.12	0.84	3.37	11.22		1.35	2.87
P16-041294DL	19.50	0.95	3.12	11.22		2.15	2.90
P16-041894	22.18		5.15	9.90	0.53	2.05	2.89
P16-041894D	20.69		3.25	11.04			2.53
P16-043094-1/-2/-3	19.35		4.73	9.46		1.45	2.20
P16-043094B	0.11 ug		0.2 ug				
P16-050394-1/-2	16.42	0.32	3.67	7.50		1.03	1.77

* Lab blanks analyzed on 04/30/94 and 05/09/94 contained 0.19 ug and 0.17 ug respectively

Table displays positively detected sampling results only.

TABLE 5-6
DUPLICATE PRECISION RESULTS - VOLATILE RESULTS (TO-11 ANALYSIS)

SAMPLE NUMBER/ DUPLICATE SAMPLE NUMBER	FORMALDEHYDE (ug)	ACETALDEHYDE (ug)	PROPANAL (ug)	BENZALDEHYDE (ug)	PENTANAL (ug)	2-BUTANAL (ug)
B18 PHII- 050194-1/-2/-3/	0.87	1.60	**0.37**		0.20	1.40
B18 PHII- 050194-1/-2/-3D	0.97	1.60	**0.39**		0.35	2.00
% Difference	**11%**	**0%**	**5%**		**75%**	**43%**
DSU - 042094/	**1.20**	3.40	0.67	0.16	0.51	1.50
DSU - 042094D	**2.00**	4.30	0.81	0.56	0.43	1.70
% Difference	**67%**	**26%**	**21%**	**250%**	**-16%**	**13%**
FSUA - 050294-1/-2/-3/	2.10	6.00	0.96		1.10	2.30
FSUA - 050294-1/-2/-3D	2.00	6.40	1.00	0.14	0.55	2.40
% Difference	**-5%**	**7%**	**4%**	**100%**	**-50%**	**4%**
FSUB - 041994/	1.20	3.80	0.64		0.60	1.50
FSUB - 041994D	1.00	3.10	0.49			1.10
% Difference	**-17%**	**-18%**	**-23%**		**-100%**	**-27%**
P9 - 040694/	1.80	4.50	0.73		0.47	1.40
P9 - 040694D	1.30	3.30	0.59	1.00	0.36	1.30
% Difference	**-28%**	**-27%**	**-19%**	**100%**	**-23%**	**-7%**
P9 - 043094-1/-2/-3/	2.40	6.20	0.97	0.39	0.66	2.70
P9 - 043094-1/-2/-3D	2.10	6.20	0.92	0.29	0.54	2.50
% Difference	**-13%**	**0%**	**-5%**	**-26%**	**-18%**	**-7%**
P14 - 041294/	1.90	4.30	0.93	0.85	0.50	1.30
P14 - 041294D	2.10	4.70	1.10	0.86	0.50	1.50
% Difference	**11%**	**9%**	**18%**	**1%**	**0%**	**15%**
P14 - 050394-1/-2	1.40	4.50	0.68		0.35	1.60
P14 - 050394-1/-2D	1.30	4.20	0.67		0.41	1.60
% Difference	**-7%**	**-7%**	**-1%**		**17%**	**0%**
P16 - 033194/	1.20	4.10	0.74	0.26	0.84	1.90
P16 - 033194D	1.30	3.90	0.75	0.22	0.75	1.70
% Difference	**8%**	**-5%**	**1%**	**-15%**	**-11%**	**-11%**
P16 - 041894/	1.40	4.60	0.79		0.83	1.70
P16 - 041894D	1.60	4.40	0.71			1.10
% Difference	**14%**	**-4%**	**-10%**		**-100%**	**-35%**
Average Absolute % Difference	**18%**	**10%**	**11%**	**82%**	**41%**	**16%**

Table displays positively detected sampling results only.

TABLE 5-7
WATER MONITORING DATA
SVOC ANALYSIS RESULTS

		8080 PCB ug/L	8080 PCB ug/L	8080 PCB ug/L	8080 PCB ug/L	8280 Diox. ng/L	8280 Diox. ng/L
		PCB-1016	PCB-1248	PCB-1254	PCB-1260	1,2,3,4,6,7,8-HpCDD	OCDD
P9	3/31/94				1	0.58	4.5
P9	4/06/94				2.5		11
P9	4/06/94D				2.5		12
P9	4/18/94				0.89		11
P9	4/30/94D						1.1
P9	5/03/94						2.5
P14	3/31/94				1.2		
P16	3/31/94					1.9	
P16	3/31/94D						1.5
P16	4/06/94	1.8		1.8			1.9
P16	4/18/94		2.6				0.51
P16	4/18/94D		1.6				1.1
P16	5/03/94						3.2

Table displays positively detected sampling results only.

TABLE 5-8
WATER MONITORING DATA
VOC ANALYSIS RESULTS

		624 Volatiles ug/L	624 Volatiles ug/L	8315 Aldehydes mg/L
		Acetone	Methylene Chloride	Acetaldehyde
P9	3/31/94		400	1.1
P16	3/31/94			1.1
P16	3/31/94D			0.71
P16	4/12/94	15000		

Table displays positively detected sampling results only.

TABLE 5-9
AIR MONITORING DATA SURFACE IMPOUNDMENTS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 1 of 2

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Ethyl-benzene	n-Heptane	Hexane
P9-033194	18		0.32		0.21		0.21
P9-040694	46						0.46
P9-040694-D	67		0.20				0.68
P9-041294	84	1.8	0.28				0.60
P9-041294B	89		0.80	0.81		0.87	4.0
P9-041894	93		0.28				0.55
P9-043094	16		0.63	0.28	0.3		
P9-043094-D	7.6		0.65	0.3	0.28		
P9-050494	20						
P9-050494B	21						
P14-033194	72		0.27				1.3
P14-040694	97		0.21				1.1
P14-041294	15	3.7	0.36				0.43
P14-041294-D	27	11	0.78		0.46	0.22	0.36
P14-041894	11						
P14-041894B	6.2						0.73
P14-043094	37						
P14-043094B							26
P14-050394	11						
P14-050394-D	7.6						
P16-033194	31		0.21				5.1
P16-033194-D	35		0.23				4.3
P16-040694	19		0.24				
P16-040694B	9.8						1.3
P16-040694B-Dup	10						1.3
P16-041294	71	1.0	0.29			0.74	0.32
P16-041894	28			0.31			0.24
P16-041894-D	38		0.85		0.58	0.99	0.72
P16-043094	7.7						
P16-043094B							0.66
P16-043094B-Dup							0.65
P16-050394	22						

Table displays positively detected sampling results only.

TABLE 5-9
AIR MONITORING DATA SURFACE IMPOUNDMENTS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 2 of 2

SAMPLE NUMBER	Methylene Chloride	2-Butanone (MEK)	Tetrachloro-ethene	Toluene	1,1,1-Trichloroethane	Trichloro-ethene	Xylene (Total)
P9-033194	0.24	1.7	0.26	20	0.26		1.3
P9-040694		4.8		0.54	0.26		
P9-040694-D		4.9		1.1	0.30		0.53
P9-041294		12		1.6			0.99
P9-041294B		8.6		12			
P9-041894		6.4		1.6			0.75
P9-043094		1.9		2.4		0.96	1.2
P9-043094-D		1.7		2.2		0.99	1.2
P9-050494		2.7					
P9-050494B	1.2			0.55		1.6	
P14-033194		6.5		1.0			0.34
P14-040694		6.4		0.51			0.22
P14-041294		1.8		0.54			0.21
P14-041294-D		3.8		3.9			2.6
P14-041894				0.56			
P14-041894B	0.24			4.0			0.28
P14-043094		3.0		5.6			
P14-043094B				5.4			
P14-050394							
P14-050394-D							
P16-033194		2.2		0.34			
P16-033194-D		1.2		0.20			
P16-040694		1.1		0.95			0.35
P16-040694B				16			0.41
P16-040694B-Dup				16			0.4
P16-041294		5.3		0.99			0.50
P16-041894		2.3		0.41			0.33
P16-041894-D		3.0		5.8			2.3
P16-043094				0.33			
P16-043094B				3.7			0.41
P16-043094B-Dup				3.6			0.39
P16-050394				0.88		1.2	

Table displays positively detected sampling results only.

TABLE 5-10
AIR MONITORING DATA HAZARDOUS WASTE UNITS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 1 of 2

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Ethylbenzene	n-Heptane	Hexane
CPA-041494	47		0.35	1.00			0.29
CPA-042094	34		0.27				0.67
CPA-050194	11						
CPA-050194B						0.21	0.66
DSU-041494	13	0.84	1.3		0.34	1.0	1.6
DSU-042094	12		0.48		0.37		0.52
DSU-042094D	12		0.46		0.39		0.61
DSU-050194	36						
FSU-041394	17		0.96			0.85	1.5
FSU-041394D	15		0.46		0.33	0.22	0.33
FSU-041994	38	0.76					
FSU-041994B	6.8	6.1					0.33
FSU-050294	74						
FSUA-041394	46	1.0	0.32	1.10			0.84
FSUA-041394B	15	0.99	0.95		0.78	1.2	1.2
FSUA-041994	42	14					0.42
FSUA-050494		0.96					
FSUB-041394	66		0.43		0.37	0.30	0.64
FSUB-041994	9.9						
FSUB-041994D	7.2		0.20				0.23
FSUB-041994DL	6.9		0.24				0.23
FSUB-050294	9.8						

Table displays positively detected sampling results only.

TABLE 5-10
AIR MONITORING DATA HAZARDOUS WASTE UNITS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 2 of 2

SAMPLE NUMBER	Methylene Chloride	2-Butanone (MEK)	Toluene	1,1,1-Tri-chloroethane	Trichloro-ethene	Xylenes
CPA-041494		4.2		0.32		0.55
CPA-042094		2.9	1.0	0.28		0.52
CPA-050194			0.88			
CPA-050194B	1.7		2.1		3.6	0.9
DSU-041494	0.46	2.3	2.3	0.37		1.7
DSU-042094	0.24		2.2	0.38		1.7
DSU-042094D	0.22		2.2	0.38		1.7
DSU-050194			0.51		0.5	
FSU-041394		1.7	0.42	0.20		0.32
FSU-041394D		1.7	2.4	0.20		1.3
FSU-041994		3.0	2.1			0.68
FSU-041994B			2.7			0.24
FSU-050294		11	0.94			
FSUA-041394		5.2	0.77			
FSUA-041394B		2.4	12			3.1
FSUA-041994		2.9	0.50			0.26
FSUA-050494			0.27			0.25
FSUB-041394		5.3	2.0	0.27		1.7
FSUB-041994			1.2	0.26		0.23
FSUB-041994D			1.8			0.74
FSUB-041994DL	0.21		1.8			0.83
FSUB-050294						

Table displays positively detected sampling results only.

TABLE 5-11
AIR MONITORING DATA-HAZARDOUS WASTE TREATMENT UNITS
PCDD/SVOCs RESULTS
(MOD. TO-9/TO-13 ANALYSES)

SAMPLE NUMBER	OCDD (pptv)	1,2,3,4,6,7,8-HpCDD (pptv)	Napthalene (ppbv)	Phenol (ppbv)
CPA-041494	180 E-06	21 E-06	0.004	
CPA-042094	95 E-06			
CPA-042094D	75 E-06			
CPA-050194	33 E-06			
CPA-050194B	63pg			
DSU-041494	60 E-06		0.012	0.005
DSU-042094	59 E-06		0.009	
DSU-050194	64 E-06			
FSU-041394	1500 E-06	100 E-06	0.008	
FSU-041394D	58 E-06		0.009	
FSU-041994	56 E-06		0.007	
FSU-050294	68 E-06		0.007	
FSU-050294D	130 E-06		0.010	
FSU-050294D-Dup			0.010	
FSU-050294B	58 pg			
FSUA-041394	33 E-06			
FSUA-041994	74 E-06			
FSUA-041994D	60 E-06			
FSUA-050294	56 E-06			
FSUB-041394	39 E-06		0.008	
FSUB-041994	240 E-06			
FSUB-050294	74 E-06			

Table displays positively detected sampling results only.

TABLE 5-12
AIR MONITORING DATA-HAZARDOUS WASTE TREATMENT UNITS
METALS ANALYSIS RESULTS

SAMPLE NUMBER	Barium (μg/m³)	Cadmium (μg/m³)	Chromium (μg/m³)	Cobalt (μg/m³)	Copper (μg/m³)	Lead (μg/m³)	Mercury (μg/m³)	Nickel (μg/m³)	Vanadium (μg/m³)	Zinc (μg/m³)
CPA-041494	0.06				0.042					
CPA-042094	0.15				0.093					0.17
CPA-050194	0.034				0.099					0.15
CPA-050194B	3.8 ug			48 ug						66 ug
DSU-041494	0.076				0.17					0.17
DSU-042094	0.092				0.18			0.052		0.10
DSU-042094D	0.09				0.18					
DSU-050194	0.023				0.23					0.24
FSU-041394	0.25	0.015	0.24		0.28	0.23	0.0011	0.16	0.069	0.30
FSU-041394D	0.24		0.23		0.34	0.20	0.0012	0.16	0.065	0.27
FSU-041994	0.2		0.13		0.14	0.20		0.13	0.055	0.20
FSU-050294	0.43		0.14	0.032	0.20			0.13	0.078	5.50
FSU-050294B	2.5 ug									
FSUA-041394	0.073			0.027	0.15					0.22
FSUA-041994	0.15		0.058		0.13			0.064		0.15
FSUA-050294	0.11				0.14					0.20
FSUA-050294D	0.11				0.15				0.14	
FSUB-041394	0.059				0.19					
FSUB-041994	0.15		0.071		0.12			0.066	0.025	0.12
FSUB-041994D	0.15		0.059		0.10			0.066	0.020	0.15
FSUB-050294	0.064				0.096					0.17

Table displays positively detected sampling results only.

6.0 AIR DISPERSION MODELING

Using the combined results of all on-site soil, liquid, ambient air, soil gas, and FSU stack sampling performed at the KHF, air dispersion modeling was performed to determine where maximum property line impacts from facility emissions were likely to occur. Air dispersion modeling was performed only for compounds which were positively quantified by soil, liquid, and ambient air sampling. Results less than the sampling and analytical detection limits were assumed to be not present and were not modeled.

In order to complete the air dispersion modeling a number of preparatory tasks were required. The first step involved processing all of the meteorological data collected at the facility into a format which was compatible with the model. All of the receptor and source elevations needed to be determined and input into model in order to complete the topographical and meteorological characterization.

The next step involved calculating emission rates for all of the compounds detected in the field samples collected at the facility. Target analyte concentrations were measured from samples collected at each of the active sources at the facility. In order to predict the ambient air concentration of target analytes at the facility property boundary, the measured concentration for all compounds detected above the target detection limit were converted into an air emission rate. Emission rates from the FSU were determined by measuring the concentration of all the targeted pollutants using approved source testing methods. These concentrations were converted to FSU stack emission rates using the measured volumetric flow rate through the FSU stack.

Once all of the required modeling parameters were determined and entered into the model, ambient air concentrations were calculated at the facility property boundary.

A copy of the air dispersion modeling protocol complete with a summary of the methods and calculations used to perform the concentration conversions, tables of modeled emission rates, discussion of the modeling information, along with a report of the modeling results is located in Appendix K.

7.0 DISCUSSION OF RESULTS

The air dispersion modeling predicted the ambient air concentration for each of the 54 modeled compounds at the facility property line. The predicted maximum annual average concentration for each compound was then analyzed to determine if the concentrations were high enough to justify routine ambient air monitoring at the facility property line. This analysis compared the predicted maximum property line concentrations to the DTSC approved ambient air detection limits for the study, California approved risk assessment guidelines, and field blank data collected during the sampling phase of this study.

The maximum annual property line concentrations were compared to the DTSC approved ambient air sampling detection limits (Tables 7.1A - 7.1C). This comparison was made to determine if the predicted concentrations were high enough to have been reported in the ambient air samples collected during this study. The purpose of this comparison was to eliminate any compound from consideration for ambient monitoring if the predicted property line concentration was below the ambient air monitoring detection limits established for this study. The rationale being that the predicted maximum annual concentrations below the ambient air detection limits would not be observed if fenceline monitoring was required. All but nine of the 54 compounds modeled were eliminated for further consideration because the predicted concentrations were below the DTSC approved ambient air detection limits for this study. These nine compounds include:

2-Butanal	Formaldehyde
2-Butanone	Hexane
Acetaldehyde	Toluene
Acetone	Xylenes
Acrylonitrile	

The nine compounds which the model showed to have property line concentrations greater than the approved ambient air detection limits were then compared to a concentration value associated with a cancer risk. The California Air Pollution Control Officers Association (CAPCOA), Air Toxics "Hot Spots" Program, Risk Assessment Guidelines, January 1992, were used to determine a chronic (annual) exposure risk concentration. For the compounds in which CAPCOA has determined a cancer potency unit risk factor, this value was converted to a chronic exposure risk concentration associated with a cancer risk of 10^{-6}. Table 7.2 compares the predicted annual property line concentration for each compound to the calculated chronic exposure risk concentration.

The risk exposure comparison was used to conclude that, if the maximum annual property line concentration was less than an associated chronic risk exposure concentration, ambient air monitoring at the property line would not be required for the given compound. Of the nine compounds with predicted property line concentrations greater than the DTSC approved ambient air detection limits, only acrylonitrile and formaldehyde exceeded the chronic exposure risk concentration. Chronic risk exposure concentrations are currently unavailable for 2-butanal and acetone. Based on this comparison, 2-butanone, acetaldehyde, hexane, toluene, and xylenes were eliminated from any further consideration for ambient air monitoring at the property line.

Predicted property line concentrations for acrylonitrile, formaldehyde, 2-butanal and acetone were compared to the sampling quality assurance data to determine if the predicted concentrations

originated from the facility or were introduced to the samples by another means. As shown in the tables of sampling results located in section 5.0, many of the compounds detected in the collected air samples were also detected in associated field blanks. Table 5-5 shows that 2-butanal was detected in all six field blanks, as well as being detected in two associated lab blanks. Tables 5-9 and 5-10 show acetone and acrylonitrile being detected in multiple field blanks at concentrations the same order of magnitude as the associated samples. Because these compounds are detected in numerous field blanks, it cannot be concluded that the detected results originated from the facility. Therefore, the data for these compounds is too inconclusive to determine that routine ambient air monitoring at the property line is required.

Formaldehyde was the only compound to have a predicted property line concentration high enough to consider for routine ambient air monitoring. However, the California Air Resources Board ambient air monitoring site in Fresno routinely detected formaldehyde ranging in concentration from 0.5 - 5.3 ppbv. This data, which has been collected from November 2, 1991 - present, shows that formaldehyde may be indicative of background ambient air in the central San Joaquin Valley.

TABLE 7.1-A

METALS

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMITS

Compound	Maximum Annual – Property Line Concentrations (ug/m^3)	DTSC Approved Ambient Air Detection Limit (ug/m^3)	Exceeds Detection Limit
Antimony	6.5E-06	5.0	No
Aresnic	1.6E-03	3.1	No
Barium	7.0E-02	5.6	No
Cadmium	6.9E-05	4.6	No
Chromium	1.2E-02	2.1	No
Cobalt	1.7E-03	2.4	No
Copper	1.0E-01	2.6	No
Lead	6.9E-03	8.5	No
Mercury	6.5E-06	8.2	No
Nickel	1.2E-02	2.4	No
Selenium	1.1E-05	3.2	No
Silver	2.5E-05	4.4	No
Vanadium	8.7E-03	2.1	No
Zinc	9.9E-02	2.7	No

TABLE 7.1-B

SEMI VOLATILE ORGANIC COMPOUNDS (SVOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMIT

Compound	Maximum Annual Property Line Concentrations (ppbv)	DTSC Approved Ambient Air Detection Limit (ppbv)	Exceeds Detection Limit
Acenaphthylene	6.4E-08	1.0	No
Anthracene	2.0E-07	1.0	No
Benzo(a)anthracene	1.5E-08	1.0	No
Benzo(a)pyrene	6.0E-09	1.0	No
Benzo(b)fluoranthene	7.0E-09	1.0	No
Benzo(g,h,i)perylene	1.0E-09	1.0	No
Benzo(k)fluoranthene	2.0E-09	1.0	No
Crysene	6.4E-08	1.0	No
Cumene	2.0E-04	1.0	No
Dioxin (OCDD)	1.6E-08	1.0	No
Dioxin (HpCDD)	3.4E-09	1.0	No
Fluoranthene	3.4E-07	1.0	No
Fluorene	1.0E-07	1.0	No
Naphthalene	4.4E-04	1.0	No
PCBs (total)	1.5E-06	1.0	No
Phenanthrene	1.1E-06	1.0	No
Phenol	2.6E-05	1.0	No
Pyrene	4.4E-07	1.0	No

TABLE 7.1-C

VOLATILE ORGANIC COMPOUNDS (VOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMITS

Compound	Maximum Annual Property Line Concentrations (ppbv)	DTSC Approved Ambient Air Detection Limit (ppbv)	Exceeds Detection Limits
2-Butanal	5.2	1.0	Yes
2-Butanone (MEK)	1.1	1.0	Yes
1,1,1 Trichloroethane	2.9E-02	0.20	No
1,4, Dichlorobenzene	4.8E-05	0.20	No
Acetaldehyde	4.5	1.0	Yes
Acetone	16	1.0	Yes
Acrylonitrile	1.7	0.20	Yes
Benzaldehyde	2.5E-01	1.0	No
Benzene	1.3E-01	0.20	No
Chloroform	7.9E-02	0.20	No
Ethyl Benzene	7.6E-02	0.20	No
Formaldehyde	2.9	1.0	Yes
Hexanal	5.6E-02	1.0	No
Hexane	2.6E-01	0.20	Yes
Methylene Chloride	6.6E-03	1.5	No
n-Heptane	4.6E-02	0.20	No
Pentanal	2.8E-01	1.0	No
Phosgene (Carbonyl Chloride)	1.5E-05	1.0	No
Propanal	7.9E-01	1.0	No
Tetrachloroethene	3.9E-03	0.20	No
Toluene	9.3E-01	0.20	Yes
Trichloroethylene	2.2E-02	0.20	No
Xylenes (total)	4.4E-01	0.20	Yes

TABLE 7.2

VOLATILE ORGANIC COMPOUNDS (VOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS RISK CONCENTRATIONS FOR CHRONIC EXPOSURE

Compound	Maximum Annual Property Line Concentrations	Chronic Exposure Risk Concentrations	Carcinogen (C) or Non-Carcinogen (NC)	Exceeds Chronic Risk Concentration
	ug/m³	ug/m³		
2-Butanal	1.5	(a)		
2-Butanone (MEK)	3.3	1000 (b)	NC	No
Acetaldehyde	8.1	9.0	NC	No
Acetone	38	(a)	NC	
Acrylonitrile	3.7	3.4E-03	C	Yes
Formaldehyde	3.5	7.7E-02	C	Yes
Hexane	9.0E-01	200 (b)	NC	No
Toluene	3.5	200	NC	No
Xylenes	1.9	300	NC	No

[a] No California values have been determined
[b] Criteria shown represents U.S. EPA chronic RfC (IRIS; HEAST)

8.0 CONCLUSIONS

After comparing the predicted property line ambient air concentrations to the approved DTSC detection limits, CAPCOA approved chronic risk exposure concentrations and the sampling field blank data, only formaldehyde has a concentration high enough (2.9 ppbv) to potentially justify ambient air monitoring at the property line. However, because the predicted maximum annual property line concentration for formaldehyde was only 3.5 times higher than the DTSC approved ambient air detection limit, and the CWMI Kettleman Hills facility is over two miles from nearest resident, routine ambient air monitor at the facility property line should not be required.

Appendix A
Workplan

AV-R-91/9183
AV Project 19107D

KETTLEMAN HILLS FACILITY WORK PLAN
TOPOGRAPHICAL AND METEOROLOGICAL CHARACTERIZATION AND AIRBORNE CONTAMINANT IDENTIFICATION

Prepared for

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Newark, CA

By

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October 1991

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Section 1

EXECUTIVE SUMMARY

In accordance with the requirements of its Resource Conservation and Recovery Act (RCRA) Part B permits, Chemical Waste Management, Inc. (CWMI) is submitting this work plan for its Kettleman Hills Facility (KHF). The guidelines in this work plan will be used to

- fully characterize the topography and meteorological conditions at the KHF that affect the airborne transport of hazardous constituents
- identify hazardous constituents being emitted into the air from the KHF, based on analyses specified in the permits

Hazardous constituent identification will include

- sampling liquid wastes from active surface impoundments and evaporative tanks and analyzing them for volatile and semivolatile compounds
- sampling ambient air downwind from each active impoundment and analyzing it for volatile compounds
- compositing surface soil samples from active landfills and analyzing them for semivolatile and inorganic analytes
- collecting integrated surface samples of landfill gas from active and inactive landfills that have not undergone final closure and analyzing them for volatile compounds
- sampling ambient air downwind from major hazardous waste treatment units and their support storage areas and analyzing it for volatile, semivolatile, and inorganic analytes

The data obtained during this characterization study will be used to develop a list of compounds for CWMI to include in an ambient air sampling plan, in which the hazardous constituents will be quantified.

Section 2

INTRODUCTION

In February 1988, the U.S. Environmental Protection Agency, Region IX (U.S. EPA) and the California Department of Health Services (CDHS) issued RCRA Part B permits to CWMI for the KHF. The facility, located near Kettleman City in Kings County, California, provides commercial hazardous waste treatment, storage, and disposal (TSD) services. Under U.S. EPA permit condition V.D. and CDHS permit condition V.C., which deal with air monitoring, CWMI is required to

- fully characterize the topography and meteorological conditions at the KHF that affect the airborne transport of hazardous constituents
- identify hazardous constituents being emitted into the air from the KHF, based on analyses specified in the permits
- quantify the hazardous constituents through ambient air sampling

This work plan, prepared by AeroVironment Inc. (AV), deals with topographical and meteorological characterization and hazardous constituent identification at the KHF. After reviewing the data obtained during this initial phase of work, the U.S. EPA and the California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) (formerly the Toxic Substances Control Division of the CDHS) will issue a list of compounds for CWMI to include in an ambient air sampling plan. As required in the RCRA permits, CWMI will submit a work plan for ambient air sampling to the agencies no later than 180 calendar days after receiving the list of analytes.

Section 3

SITE BACKGROUND AND SETTING

3.1 SITE DESCRIPTION

3.1.1 Facility Description

The KHF is a commercial hazardous waste TSD facility owned and operated by CWMI (U.S. EPA Facility Identification Number CAT 000646117). It is located within U.S. EPA Region IX in Kings County, California, in a rural area approximately 3.5 miles southwest of Kettleman City and 5 miles southeast of Avenal (Figure 3-1).

The facility occupies 1,600 acres, of which 499 acres are permitted for waste management operations. Figure 3-2 shows the layout of the site. KHF waste management units of concern in this study include

- surface impoundments, where aqueous wastes are treated by solar evaporation and chemical precipitation
- evaporative tanks, proposed structures that would serve a purpose similar to that of the surface impoundments
- landfills, where wastes are buried and covered with clean fill
- waste treatment units, where hazardous substances are treated by stabilization or other methods

Some of the waste management units shown in the figure are inactive. While active, they employed methods no longer in use at the KHF. These include

- spreading areas, where bulk liquids were applied to the open ground surface
- mud ponds, which received non-RCRA drilling muds, drilling waters, and sand

Appendix A contains a description of the waste management units noted above.

3.1.2 Facility History

Formal disposal operations have been conducted at the KHF since 1975, when McKay Trucking Company was issued a permit to use a 60-acre portion of the current site as a petroleum waste disposal facility. Environmental Disposal Services (EDS) absorbed McKay Trucking Company in 1978. EDS expanded both the size of the facility and the scope of operations, making the KHF a Class-I Disposal Site. CWMI acquired the site in April 1979 (A.T. Kearney Inc., 1987).

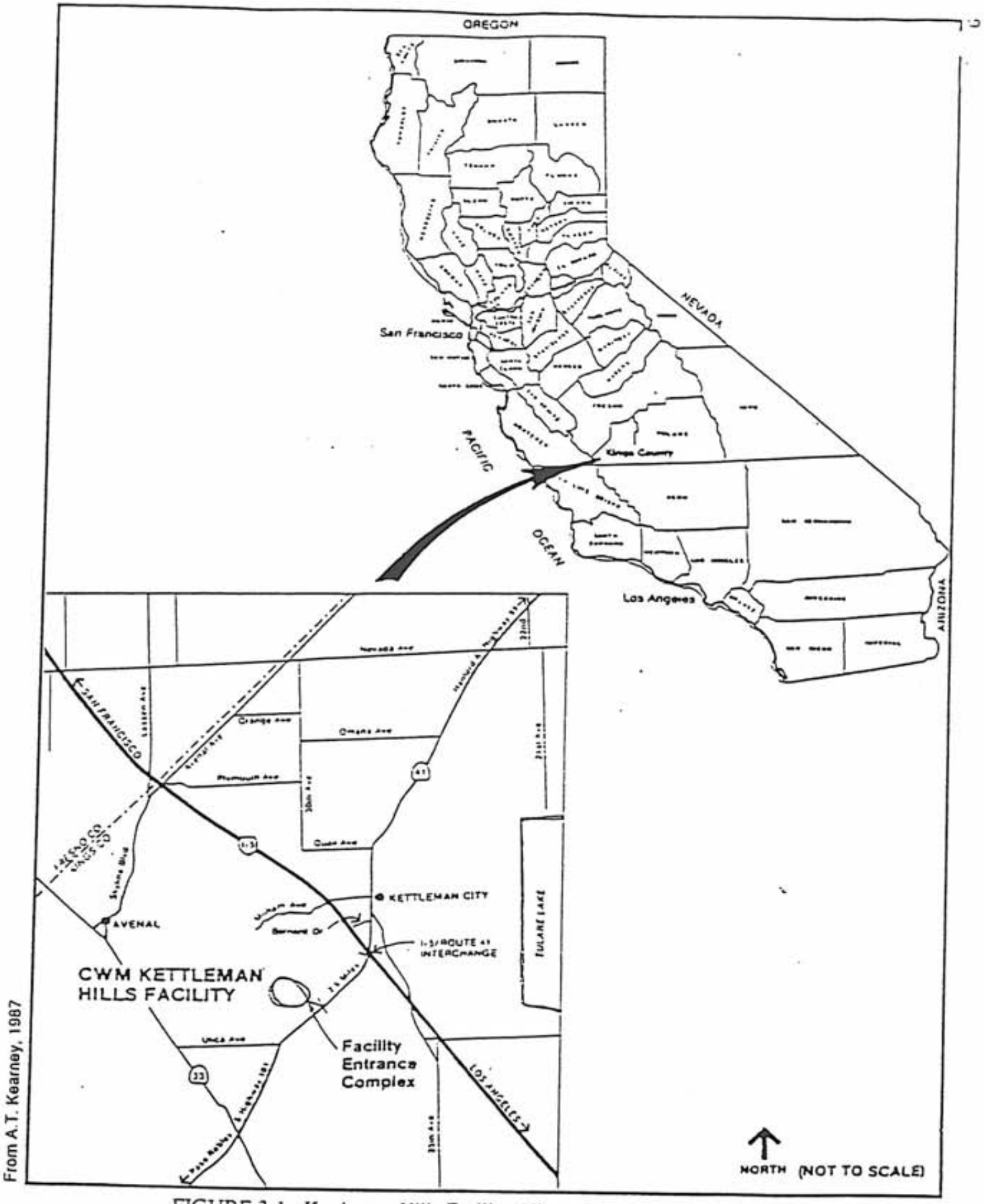
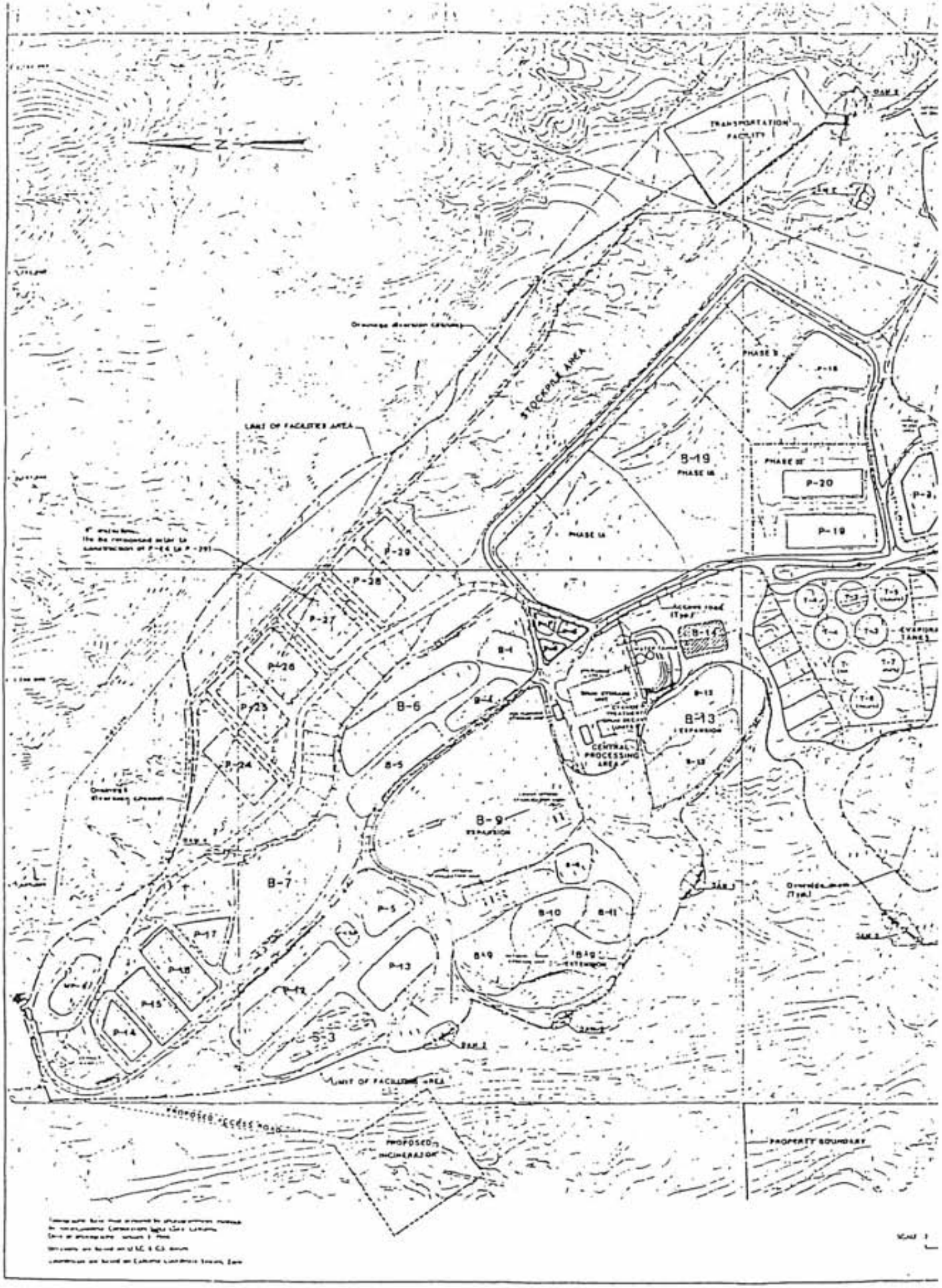


FIGURE 3-1. Kettleman Hills Facility, Kings County, California
Prepared for Chemical Waste Management, Inc.
by AeroVironment Inc.


TRANSPORTATION FACILITY
STOCKPILE AREA
LIMIT OF FACILITIES AREA
PHASE 3
PHASE 2
PHASE 1A
B-19
P-20
P-19
P-29
P-28
P-27
P-26
P-23
P-24
B-6
B-5
B-4
B-14
B-13
CENTRAL PROCESSING AREA
B-9
B-7
B-10
B-11
P-5
P-17
P-16
P-15
P-14
P-13
P-12
B-3
PROPOSED ACCESS ROAD
PROPOSED INCINERATOR
PROPERTY BOUNDARY

3.1.3 Topographical Setting

The KHF is located on the crest and western slope of the Kettleman Hills, a low range of steep hills bordering the western margin of the San Joaquin Valley. Arroyos and other erosional features of an arid to semiarid climate characterize these sparsely vegetated slopes. There are no perennial surface water bodies within one mile of the facility (A.T. Kearney Inc., 1987).

The surface elevation of the KHF ranges from about 775 feet above mean sea level (amsl) at the southeastern edge of the active area to about 950 feet amsl at the northwestern end. The general trend in elevation is downslope to the southeast. The highest terrain point in the vicinity is Cerro Ultimo (approximate elevation 1125 feet amsl), which is located less than 1.3 miles northwest of the center of the facility (ENSR, 1989).

3.1.4 Meteorological Setting

The region is characterized by a semiarid climate and an extremely low rainfall. Average annual precipitation is 6.12 inches, with 90 percent of the rainfall occurring from November through April. The estimated 100-year, 24-hour storm would result in 2.31 inches of precipitation. Mean annual evaporation in the area is 102.94 inches (pan measurement). The mean annual temperature is 65 degrees Fahrenheit. Seasonal average temperatures range from the low 50s in winter to the high 90s in the summer.

Winds at the KHF are predominantly from the north-northwest. Conditions are rarely calm (less than 0.5 percent of the time); the average wind speed is approximately 8 miles per hour (mph). Winter conditions include variable winds and dense valley fog (A.T. Kearney Inc., 1987; ENSR, 1989.)

3.2 PERMIT STATUS

The KHF has operated under interim status since 19 November 1980, in accordance with the RCRA. The most recent revision to the RCRA Part B permit application for the facility was filed with the U.S. EPA and the CDHS in December 1986. KHF has received and is currently operating under a CDHS Part B permit that was issued on 19 February 1988. The U.S. EPA permit, originally issued on 22 February 1988, was subsequently modified; the revised version became effective on 25 April 1989.

3.3 PREVIOUS AND ONGOING STUDIES

The RCRA Part B permit application that CWMI submitted to the U.S. EPA and CDHS contains numerous documents and reports that discuss studies conducted at the facility, agency-required plans developed for the facility, and sampling and monitoring programs. Of these, the Potential Release Report and the RCRA Facility Assessment conducted by A.T. Kearney, Inc. (1987) were the principal sources of information for this work plan.

Extensive studies have been conducted at the facility on air emissions and their off-site impacts. Most of these studies dealt with units other than those included in this work plan. However, the various unit emissions studies agreed that the previously studied evaporation ponds were the major source of fugitive volatile organic compounds (VOCs) (ENSR, 1989).

3.3.1 California Air Resources Board Study

In the summer of 1983, the California Air Resources Board (ARB) conducted a sampling program at the facility in coordination with the Kings County Health Department, the Kings County Air Pollution Control District (APCD), CDHS, Air and Industrial Hygiene Laboratory (AIHL), and the Haagen-Smit Laboratory of the ARB. The program included monitoring for chlorinated hydrocarbons and pesticides, organic hydrocarbons, sulfur dioxide and other sulfurous compounds, and particulate matter. Seven stations were operated at the facility: three were stationary and the other four were moved to test various units. The ARB concluded that the data were insufficient to adequately assess the total emissions from the facility. In order to determine the emissions associated with temporary storage of solvents in the KHF Central Processing Area, the ARB also conducted an ambient air sampling survey of the Drum Decant Unit and the Polychlorinated Biphenyl (PCB) Flushing/Storage Area. No emissions were detected (ENSR, 1984).

3.3.2 KHF Air Monitoring Program

CWMI has an ongoing air monitoring program to characterize ambient levels of selected VOCs at the KHF. This program, which provides data for evaluating the potential for off-site transport of air emissions from the KHF, includes on-site and off-site ambient monitoring for a select set of indicator compounds. The program was initiated on 1 April 1986, in accordance with the agency-approved KHF Air Monitoring Technical Work Plan and associated Standard Operatin Procedures (NUS, 1986).

The indicator compounds for this program were selected based on the ARB's listing of Level-I VOCs and the VOCs that CWMI considered to be primary constituents of potential KHF air emissions. These indicator compounds are

- Benzene
- Chloroform
- Ethylene dichloride
- Methyl chloroform
- Methylene chloride
- Trichloroethene
- Total hydrocarbons

The air monitoring program focuses on the characterization of site boundary concentrations at the KHF. Three stationary air monitoring stations have been installed near the site boundary to provide monitoring coverage of the site. Station sites were selected based on predominant wind directions and the location of local population centers. An on-site meteorological station provides data that facilitate interpretation of air sampling results. Off-site air monitoring and meteorological data are collected at stations situated at the nearest population centers of Kettleman City and Avenal. Figure 3-3 shows the layout of the monitoring stations contributing data to this program.

The on-site air sampling stations are operated 24 hours a day year-round. The off-site air sampling stations at Avenal and Kettleman City are operated every sixth day and are designed also begin sampling automatically in the event of a 15-minute average wind direction from the KHF.

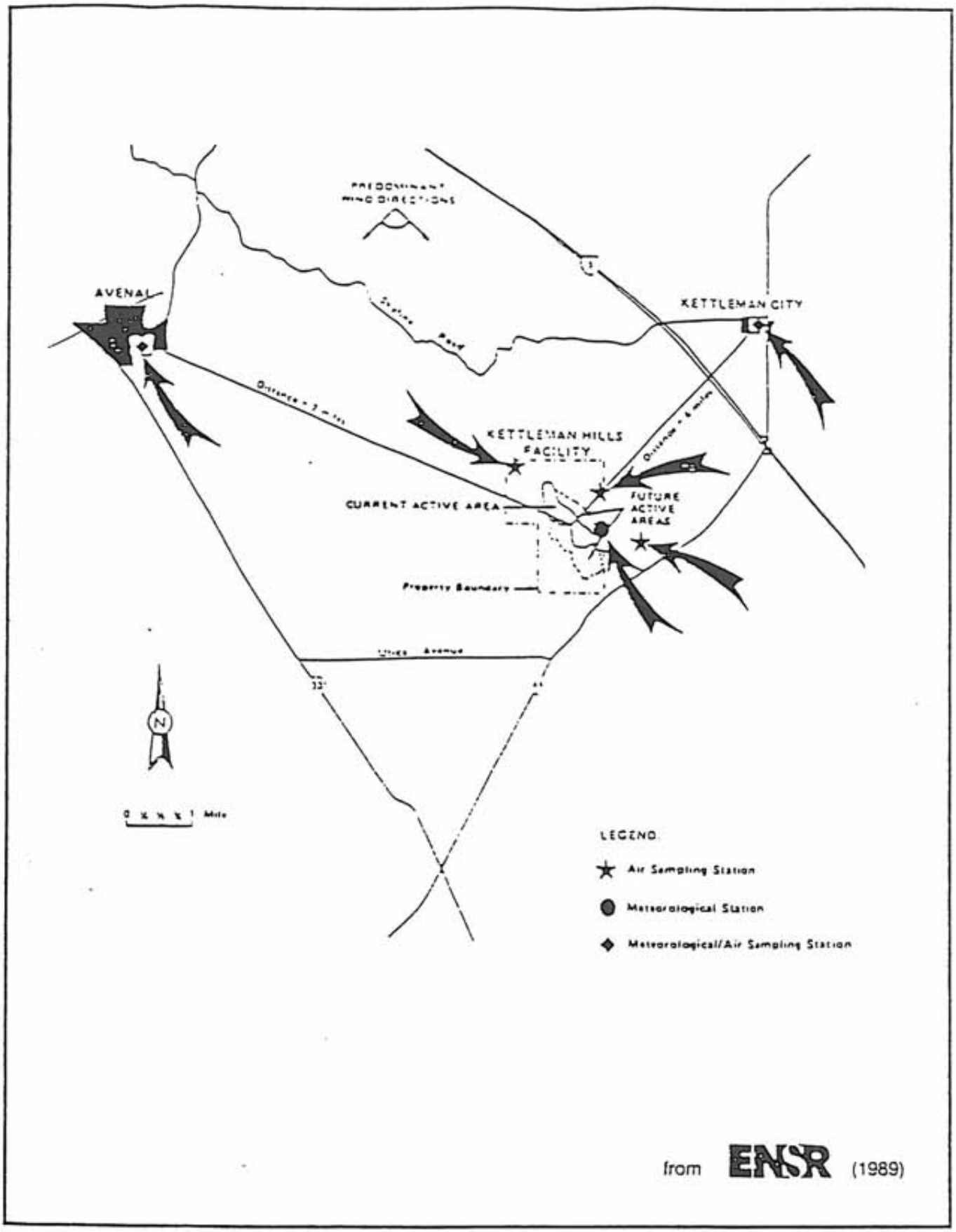


FIGURE 3-3. Kettleman Hills Facility Onsite/Offsite Air Monitoring Network, Kings County, California Prepared for Chemical Waste Management, Inc. by AeroVironment Inc.

All three meteorological stations operate 24 hours a day year-round. At each of these stations, sensors atop a 10-meter tower monitor wind speed, wind direction, and temperature. The standard deviation of wind direction (sigma theta) is also routinely calculated by the data acquisition system. Appendix B includes a typical meteorological data comparison between the KHF and the towns of Avenal and Kettleman City.

In addition to the tower measurements, precipitation and evaporation are also measured on site. Evaporation is measured as the change in water level in a Class A evaporation pan, and precipitation is measured as the level of accumulated water in a standard rain gauge.

The program results continue to show that the KHF has no discernible impact on air quality in the neighboring communities of Avenal and Kettleman City (ENSR, 1989). Appendix B includes a typical summary of VOC concentrations on site, in the nearby communities, and in the San Joaquin Valley.

Section 4

PLANNED CHARACTERIZATION STUDY

4.1 PURPOSE

The characterization study described in this work plan is required by the KHF's RCRA permits. This study must (1) fully characterize the topography and meteorological conditions at the facility that affect the airborne transport of hazardous constituents and (2) identify hazardous constituents being emitted into the air from the facility. The results of this study will be used in designing the facility's ambient air sampling plan, which will describe how the KHF will conduct ambient monitoring to determine whether air emissions from the facility may impact off-site receptors. Appendix C includes the RCRA permit sections that detail the requirements for the characterization study and subsequent ambient air monitoring.

Characterizing the site topography and meteorology will enable CWMI to select locations where and conditions under which ambient air samples that are representative of facility emissions can be collected. Identifying the hazardous vapors or particulates the facility emits into the air will enable CWMI to create a list of proposed analytes for ambient air monitoring. Initial characterization of the hazardous constituents will involve collecting samples from surface impoundments and evaporative tanks, landfills, and treatment units at the facility and analyzing them for the parameters listed in the RCRA permits. The U.S. EPA and DTSC, after reviewing the characterization study data and CWMI's proposed list, will issue a final list of analytes to be included in the ambient monitoring program.

4.2 PROJECT DESCRIPTION

Sections V.D. and V.C. of the U.S. EPA and CDHS RCRA permits (Appendix C) outline the general approach CWMI will take in conducting its characterization study. The following text provides a more detailed description of the project.

4.2.1 Characterization of Topography and Meteorology

CWMI will characterize the topography of the facility using the KHF master plan map (Figure 3-2) and aerial photographs of the facility. The topography of the general Kettleman Hills area will also be described based on 7.5-minute series maps obtained from the United States Geological Survey.

To characterize meteorological conditions at the facility, CWMI will use extant meteorological data from the facility's on-site monitoring station (as described in Section 3.3.2). This characterization will include a review of a minimum of one year's on-site meteorological data. Monthly and annual summary reports will be generated from these data. As required in the RCRA permits, the reports will include temperature averages and extremes, wind frequency distributions (wind roses), stability frequency distributions, and barometric pressure data.

From a pollutant transport/dispersion perspective, the primary meteorological parameters concern are wind speed, wind direction, and temperature. The standard deviation of wi. direction, commonly referred to as sigma-theta, is also important because it can be used to assign an atmospheric stability class, which is an indication of the dispersive potential of the atmosphere. All of these data are generated by the on-site monitoring station. While barometric pressure is not measured on site, barometric pressure data is a permit requirement. Barometric pressure data from the U.S. Weather Bureau station in Fresno, California, can be used, since barometric pressure and trends in barometric pressure will vary little over the region. Relative humidity and solar radiation are not included in this study, as these parameters are not necessary to meet the objectives of this work plan and are not a RCRA permit requirement.

The on-site meteorological data can be analyzed in conjunction with the topographical data and information regarding sources of contaminants to determine the locations beyond the facility boundaries where maximum impacts would be expected to occur. This knowledge would then be used in selecting sites for air monitoring of contaminants.

4.2.2 Hazardous Constituent Identification

The KHF waste management units designated as potential sources of airborne contaminants in the RCRA permits will be monitored for the parameters listed in the permits (Appendix C). These units include surface impoundments, landfills, and hazardous waste treatment units Evaporative tanks, which are similar in principal to surface impoundments, are a propos addition to the facility; while not mentioned in the RCRA permits, they would be a poten contaminant source and are therefore addressed in this work plan. Former spreading areas and mud ponds will not be monitored; the reason for their exclusion is explained below.

CWMI has selected the units to be included in the characterization study based on their anticipated status at the time the project begins. Many of the units are inactive, and some have been closed, dismantled, or assimilated into another unit. A major closure effort, known as "Bigfoot," will affect several inactive units in the northwest portion of the facility (Figure 4-1) and is expected to be in progress during the characterization study. Table 4-1 summarizes the current status of the facility's units, the units to be included in the study, and the matrices to be sampled.

4.2.2.1 Surface Impoundments

The KHF has had 20 surface impoundments, designated P-1 through P-20 (see Figure 3-2). Of these, P-9, P-14, and P-16 are currently active; these units are the only surface impoundments expected to contain aqueous waste during the project.

- P-9 has a surface area of 1.9 acres and a capacity of 4,000,000 gallons. As of September 1991, P-9 contained approximately 3,200,000 gallons of waste.

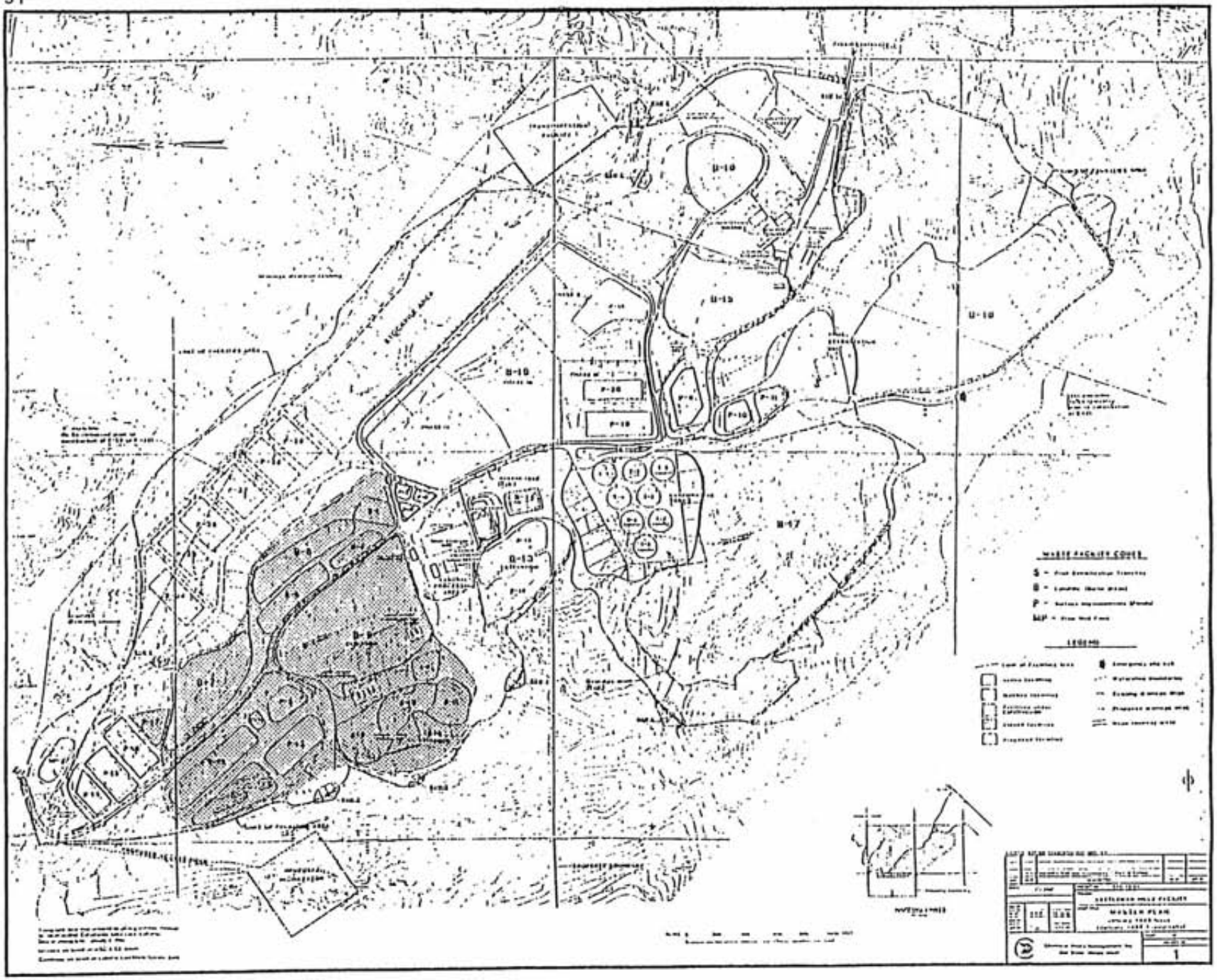


FIGURE 4-1. "Bigfoot" closure area.
Prepared for Chemical Waste Management Inc. by AeroVironment Inc.

TABLE 4-1. Waste management unit status summary.

Waste Management Unit	Unit Area (acres)[a]	Status[b]	Matrix to be Sampled[c]	Comments
Surface Impoundments				
P-1	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-2	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-3	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-4	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-5	1.0	I	N	Constructed over old S-2 site; part of scheduled "Bigfoot" closure. Backfilled in mid-1980s.
P-6	0.3	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-7	0.2	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-8	0.4	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-9	1.9	A	L/AA	Currently accepting RCRA liquid wastes.
P-10	1.0	I	N	Completed 10/86.
P-11	0.7	I	N	Completed 10/86.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
P-12/12A	2.9	I	N	Constructed over old S-2 site; part of scheduled "Bigfoot" closure. Completed in 1985.
P-13	3.8	I	N	Completed in 1985. Part of scheduled "Bigfoot" closure.
P-14	1.3	A	L/AA	Constructed over old S-4 site. Currently accepting RCRA liquid wastes.
P-15	1.7	I	N	Constructed over old S-4 site. Unit completed in mid-1991.
P-16	1.8	A	L/AA	Constructed over old S-4 site. Currently accepting RCRA liquid wastes.
P-17	0.7	I	N	Completed in 1984, wastes removed to B-16. Part of scheduled "Bigfoot" closure.
P-18	3.0	I	N	Constructed over old S-6 site. Completed 6/85; wastes stockpiled B-13 (expansion). Within B-19 (Phase II).
P-19	2.3	I	N	Constructed over old S-6 site. Completed in 1985; wastes landfilled. Within B-19 (Phase III).
P-20	1.6	I	N	Constructed over old S-6 site. Completed in early 1988; wastes removed to B-19 (Phase IB). Within B-19 (Phase III).
Evaporative Tanks				
T-1	--	P	L	Will be sampled if active during this project
T-2	--	P	L	Will be sampled if active during this project
T-3	--	P	L	Will be sampled if active during this project
T-4		P	L	Will be sampled if active during this project

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
Landfills				
B-1	0.7	I	N	Completed in mid-1978. Now under section of Central Process Area access road. Part of scheduled "Bigfoot" closure.
B-2	0.2	C	N	Completed late 1978; closure certified 8/88. Waste & contaminated soil moved to B-13.
B-3	0.2	C	N	Completed late 1978; closure certified 8/88. Waste & contaminated soil moved to B-13.
B-4	0.5	I	N	Completed in mid-1980. Part of scheduled "Bigfoot" closure.
B-5	1.8	I	N	Completed in mid-1980. Part of scheduled "Bigfoot" closure.
B-6	3.0	I	N	Completed 8/83. Part of scheduled "Bigfoot" closure.
B-7	5.6	I	N	Completed in late 1979. Part of scheduled "Bigfoot" closure.
B-8	NA	I	N	Completed 5/79. Within B-9 (extension). Part of scheduled "Bigfoot" closure.
B-9	NA	I	N	Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-9 (extension)	NA	I	N	Incorporates B-8, B-10, B-11, P-1, P-2, P-3, P-4. Part of scheduled "Bigfoot" closure.
B-9 (expansion)	38.3	I	N	Incorporates S-1, B-9 (extension). Part of scheduled "Bigfoot" closure.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
B-10	2.0	I	N	Completed 10/80. Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-11	1.6	I	N	Completed 10/80. Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-12	2.8	I	N	Completed in mid-1980. Within B-13 (expansion).
B-13 (expansion)	5.0	A	LG	Completed in 1987. Incorporates B-12 and original B-13.
B-14	0.8	C	N	Closed with clay cap in 1984.
B-15	7.2	I	LG	Completed 5/85; currently used as heavy equipment parking lot. Will be sampled if scheduled closure is not completed before project startup.
B-16	4.7	A	S/LG	Currently accepting bulk & containerized PCB solids.
B-17	NA	P	N	Proposed landfill; will not be active during this project.
B-18 ph.I Phase II	29.4	P	S/LG	Proposed landfill currently under construction; will be sampled if active during this project.
TOS B-19 (Phase 1A)	11.7	A	S/LG	Incorporates S-5. Damaged liner 1988, repaired 1991. Expected to be active during project.
B-19 (Phase 1B)	12.8	A	S/LG	Incorporates S-5. Currently accepting solid RCRA wastes.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
B-19 (Phase II)	11.5	A	S/LG	Incorporates P-18. Currently accepting solid RCRA wastes. Includes wastes from damaged B-19 (Ph.1A).
B-19 (Phase III)	6.5	A	S/LG	Incorporates P-19 & P-20. Currently accepting solid RCRA wastes. Includes wastes from damaged B-19 (Ph.1A).
<u>Spreading Areas</u>				
S-1	13.7	I	N	Within B-9 (expansion) -- southern edge current site of Central Processing Area. Part of scheduled "Bigfoot" closure. Completed in 1983; contaminated soil moved to B-11.
S-2	8.0	I	N	Completed in mid-1980; contaminated soil removed to B-9 of B-11. Current site of P-5 and P-12/12A -- part of scheduled "Bigfoot" closure.
S-3	2.7	I	N	Completed in mid-1981; wastes removed to B-15. Part of scheduled "Bigfoot" closure.
S-4	4.8 (approx)	I	N	Completed in mid-1982; wastes removed to B-9. Current site of P-14, P-15, and P-16. Part of scheduled "Bigfoot" closure.
S-5	10.2	I	N	Completed 5/85; wastes removed to B-9 (expansion). Within current B-19 (Phase 1A and 1B).
S-6	6.0 (approx)	I	N	Completed 12/83; wastes removed to S-5. P-18, P-19, and P-20 constructed at this site -- current location of B-19 (Phase II and III).

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
Mud Ponds				
MP-1	0.7	I	N	Drilling muds excavated in early 1980s and used as liner material for B-16.
MP-E	--	I	N	South of Central Processing Area. Drilling muds excavated in late 1970s and used as liner material for B-6.
Treatment Units				
Central Processing Area	--	A	AA	Includes Drum Decant Unit, Cyanide Treatment Unit, PCB Storage/Flushing Unit, and Drum Storage Unit
Final Stabilization Unit	--	A	AA	Includes associated storage areas
Interim Stabilization Units (upper & lower)	--	I	N	These unit and associated interim storage areas have been removed. Located within B-9 (expansion) -- part of scheduled "Bigfoot" closure

a NA = Not available

b A = Active
I = Inactive
C = Closed

c AA = Ambient Air
LG = Landfill Gas
S = Soil
L = Liquid
N = No sampling

- P-14 has a surface area of 1.3 acres and a capacity of 2,100,000 gallons. As of September 1991, P-14 contained approximately 890,000 gallons of waste.

- P-16 has a surface area of 1.8 acres and a capacity of 3,900,000 gallons. As of September 1991, P-16 contained approximately 2,400,000 gallons of waste.

Each of these impoundments is a slope-sided structure with a double composite liner and a leachate-collection system. Vacuum trucks empty wastes into the impoundment from an adjacent concrete discharge pad. Discharge pipes extend from the pad and along the side and bottom of the impoundment, emptying at the bottom of the impoundment near its center.

The impoundments receive aqueous wastes that are shown to be compatible by the Liquid Waste Compatibility Test and that are not generally restricted from discharge to surface impoundments by the conditions of the Part B permit. Wastes include heavy metal solutions, scrubber wastes, brines, pesticides, and aqueous organic solutions. The liquids discharged to the impoundments contain less than one percent each of total organics and oil and grease, and less than 0.1 percent halogenated organics by volume. As of September 1991, the impoundments contained a total of almost 6,500,000 million gallons of aqueous waste and were receiving approximately 150,000 gallons per month.

In accordance with the RCRA permits (see Appendix C), each of the three surface impoundments will be sampled once a week over a six-week period. A liquid sample will be collected at depth from each impoundment and analyzed for the volatile and semivolatile organics listed in permits. Because the structure of the impoundments makes it difficult to collect a liquid sam, at or near the discharge point without compromising worker safety or sample integrity, the liquid sample will be collected at depth from the edge of each impoundment. In addition, each sampling episode will include an ambient air sample collected downwind from each impoundment. The air samples will be analyzed for the volatile parameters specified in the permits. The air monitoring data will supplement the liquid analysis data.

4.2.2.2 Evaporative Tanks

Four evaporative tanks, designated T-1 through T-4, are scheduled for construction in the near future and may be active during the project. While Tanks T-5 through T-8 may be added at a later date, these four tanks will not be in use by the time this project begins. Figure 3-2 shows the proposed locations of these structures.

Each open-topped tank will be 10 feet high and 115 feet in diameter, and will have a capacity of 1,000,000 gallons. Liquid wastes with a total organics content of up to 0.05 percent by volume will be discharged to the tanks for solar evaporation and chemical precipitation.

To sample the evaporative tanks, CWMI will use the approach outlined in the RCRA permits for surface impoundments. Liquid from each of the four tanks will be sampled once a week over a six-week period. The samples will be collected at depth and analyzed for volatile and semivolatile organics.

4.2.2.3 Landfills

The KHF has had 19 landfills, designated B-1 through B-19 (see Figure 3-2). Three of the landfills (B-2, B-3, and B-14) have undergone final closure, and most of the remaining landfills (B-1 and B-4 through B-11) will be closed during the upcoming "Bigfoot" operation. The proposed landfill B-17 will not be in operation at the time of the characterization study. The remaining landfills, which will be included in this work plan, are

- The B-13 expansion, an inactive landfill that incorporated B-12, B-13, and the natural ravine between the units. Until 1987, this 5.0-acre burial unit received empty crushed acid drums, acid-contaminated soil, and animal rendering wastes excavated from other discontinued units. The original B-12 and B-13 received drummed acids and oxidizers. While the B-13 expansion is scheduled for final closure, the closure is not expected to be under way during the characterization study.

- B-15, an inactive landfill that currently serves as a heavy-equipment parking lot for the KHF. The 7.2-acre landfill was 47 feet deep and had a capacity of 290,000 cubic yards (yd^3). Wastes buried in the landfill include containerized liquids, paint sludge, solidified alkaline corrosives, PCB wastes, empty crushed drums, solidified sulfide wastes, and contaminated soil. The unit has been inactive since May 1985. A final closure operation is scheduled for B-15; however, the closure may not be under way by the time the characterization study commences.

- B-16, an active landfill excavated below grade. Its area is 4.7 acres and its capacity is 166,000 yd^3. It has a three-foot-thick clay liner with a leachate collection and removal system and a vadose zone monitoring system. Since it opened in 1983, the unit has accepted bulk and containerized hazardous solids and sludges and PCB solids. B-16 is the only active PCB disposal unit on site.

- B-18, a proposed 55-acre landfill that may be active during the characterization study. This landfill will be divided into two phases and will have a total capacity of 9,000,000 yd^3. B-18 is scheduled to receive all types of solid RCRA wastes, as described in Part IV of the Part B permit. Phase I & II.

- B-19, an active landfill divided into four phases (~~IA~~, IB, II, and ~~III~~). It has a surface area of 41.5 acres and a capacity of 6,800,000 yd^3. As of September 1991, Phase IA was inactive, having recently been emptied so that a damaged portion of its liner system could be repaired. All four phases of the unit are expected to be active during

the project. B-19 has a double composite liner with vadose zone monitoring. Since it opened in 1987, the unit has accepted all types of solid RCRA wastes, as describe Part IV of the Part B permit.

As described in the RCRA permits (see Appendix C), surface soils from the active landfills will be analyzed for the required semivolatile and inorganic analytes. At each landfill unit or (in the case of B-18 and B-19) each phase, ten subsamples will be composited into one sample for analysis. At active and inactive burial areas, a landfill gas sample will also be collected from each unit or phase, using an integrated surface sampling (ISS) method.

B-18 and B-19 are the site of a scheduled landfill cover study. In this study, a mixture of wood pulp and chemical binder known as ConCover will be sprayed over the active landfill in place of the usual soil cover. This study should not interfere with hazardous component characterization efforts, provided it does not precede or coincide with the project described in this work plan. Once the cover is emplaced, however, it will be impossible to collect a surface soil sample from the covered unit. The presence of this experimental cover could also hinder landfill gas sampling operations, since ISS methods require personnel to walk a grid pattern across the landfill. The field crew would run the risk of rupturing the cover by walking over it and thereby exposing themselves to the landfilled wastes. Should the ConCover study schedule conflict with the characterization study, CWMI and the DTSC will determine at that time how landfill monitoring is to proceed.

4.2.2.4 Spreading Areas and Mud Ponds

Six spreading areas (S-1 through S-6) and numerous mud ponds were used during past operations at the KHF and are currently inactive. With the exception of Spreading Area S-3 and Mud Pond MP-1, these sites are now occupied by other waste management units (Table 4-1). S-1 through S-4 and MP-1 are included in the planned "Bigfoot" closure, and S-5 and S-6 are within landfill B-19. None of the former spreading areas or mud ponds will be monitored during this investigation.

4.2.2.5 Hazardous Waste Treatment Units

The KHF hazardous waste treatment units to be addressed in this study are as follows:

- the Central Processing Area units, which include

  - the Drum Decant Unit, where aqueous organic and solvent wastes are transferred from individual drums to bulk storage tanks. Drums are moved on a conveyor to the decant station. An extraction wand is inserted into the bunghole of the drum and free liquids are pumped out of the drum into one of the 700-gallon surge tanks. Accumulated liquids are then pumped into the storage tanks for phase separation, then stabilized and landfilled. This unit may receive a wide variety of organic solvents, gasoline, diesel sludge, and oils; however, these materials are commonly recycled now, so that use of the Drum Decant Unit has dropped sharply. As of September 1991, this unit had not been used all year.

- the Cyanide Treatment Unit, where waste cyanides are mixed with sulfur compounds to form the less reactive and less toxic thiocyanate complex. Cyanide wastes thus treated are transferred to the Final Stabilization Unit (FSU). Stabilized thiocyanate residues are disposed of in a secure, on-site landfill. As of September 1991, this unit was being used about once every quarter.

- the PCB Storage/Flushing Unit, an enclosed unit where PCB-contaminated electrical equipment and drums are drained and flushed into a 10,000-gallon storage tank. Liquids with a PCB concentration of under 50 parts per million (ppm) may be transported off site for incineration or (less frequently) solidified for on-site disposal, while PCB-contaminated solids are landfilled on site.

- the Drum Storage Unit, where drummed wastes are held pending treatment or disposal. Wastes are segregated so that drums targeted for a particular treatment unit are placed in the same storage module.

– the FSU, which in 1989 replaced the Upper and Lower Interim Stabilization Units described in earlier drafts of this work plan.

The FSU is an enclosed unit consisting of four rectangular, subsurface open-top steel tanks. Each tank is 14 feet by 28 feet by 12 feet deep, with a capacity of 10,000 gallons. Secondary containment is provided by external synthetic liners. Wastes amenable to the stabilization process are mixed with a stabilization material in the tanks. When the stabilization reaction has been completed, the mixture is removed to a landfill for final disposal.

- Up to two support storage areas may be established near the FSU. These areas would be used for the temporary containerized storage of wastes requiring stabilization or of stabilized wastes awaiting burial.

Figure 3-2 shows the locations of these units.

In accordance with the RCRA permits (see Appendix C), CWMI will collect representative samples of air emissions resulting from operations at these units. Samples will be collected downwind from each unit over three separate workdays, with sampling episodes scheduled to coincide with unit operating periods. Two air sampling stations will be installed to monitor the Central Processing Area. One station will be installed downwind from the FSU; an additional station will be installed for each FSU storage area. A stack-monitoring test of the FSU stack may also be added, if the unit's extended effluent stack has been constructed and is in use by the time this study begins.

Section 5

SAMPLING PROCEDURES

This section of the work plan outlines the procedures that the field team will follow to collect water, soil and air samples at the KHF. Table 5-1 summarizes the number and type of samples to be collected at each waste management unit. Table 5-2 lists the analytes, analysis methods, and detection limits for each matrix, and Table 5-3 summarizes container requirements, preservation methods, and holding times for the various analyses.

5.1 SURFACE IMPOUNDMENTS

Surface impoundments P-9, P-14, and P-16 will be sampled once a week over a six-week period. Sampling will be scheduled for every sixth day; however, this schedule will be modified to allow sample collection during periods of waste discharge to the impoundments. CWMI's records of wastes discharged will be compared with the analysis data.

5.1.1 Liquid Sample Collection Method

A discrete liquid sampling device will be used to obtain liquid samples from the surface impoundments. The sampling device will be constructed of stainless steel and Teflon attached to stainless steel extension rods, materials that will not be degraded by the chemicals in the impoundments. One sampling device will be assigned to each impoundment.

Before an impoundment sample is collected, field personnel will measure the depth to liquid and to the bottom of the impoundment using a rod or weighted tape. The sampling device will be washed in a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. It will then be lowered into the impoundment, and a liquid sample will be collected within three feet of the measured bottom of the impoundment.

Samples for purgeable organics analysis (EPA Method 624) and aldehydes analysis (EPA Method 8315) will be collected in 40 milliliter (ml) glass vials with Teflon-lined septa fitted into the screw caps. To hold the vial steady and minimize aeration during sampling, the vial will be held in a clamp mounted on a bunsen stand while the sampling device's bottoming dump valve is used to transfer water from the sampling device to the vial. The vial will be carefully filled until a meniscus forms at its mouth. The container will then be capped, inverted, and tapped to check for air bubbles. If no bubbles are present, the sample has been taken correctly; otherwise, the vial must be discarded for a fresh vial and a sample without bubbles must be collected. Two vials for each analysis method (a total of four 40-ml vials) will be collected per sample.

Samples for acrolein and acrylonitrile analysis (EPA Method 603) will be collected in a 500-ml glass bottle, using the collection method outlined above. One container will be filled per sample.

TABLE 5-1. Sampling plan summary.

Waste Management Unit	Ambient Air		Landfill Gas		Soil		Liquid	
	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameter[a]	No. of Samples[b]
LANDFILLS								
B-13 (expansion)	--	--	VO	1+1D	--	--	--	--
B-15	--	--	VO	1	--	--	--	--
B-16	--	--	VO	1	SVO, IO	1	--	--
B-18 (Phase I)	--	--	VO	1+1B	SVO, IO	1	--	--
B-18 (Phase II)	--	--	VO	1	SVO, IO	1	--	--
B-19 (Phase IB)	--	--	VO	1	SVO, IO	1	--	--
B-19 (Phase II)	--	--	VO	1	SVO, IO	1	--	--
B-19 (Phase III)	--	--	VO	1	SVO, IO	1+1R	--	--
SURFACE IMPOUNDMENTS[d]								
P-9	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
P-14	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
P-16	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
EVAPORATIVE TANKS[e]								
T-1	--	--	--	--	--	--	VO, SVO	6+2D+1B
T-2	--	--	--	--	--	--	VO, SVO	6+1D+2B
T-3	--	--	--	--	--	--	VO, SVO	6+2D+1B
T-4	--	--	--	--	--	--	VO, SVO	6+1D+2B
TREATMENT UNITS[f]								
Central Processing Area	VO, SVO, IO	6+1D+1B	--	--	--	--	--	--
Final Stabilization Unit (FSU)	VO, SVO, IO	3+1D+1B	--	--	--	--	--	--
FSU Storage Area	VO, SVO, IO	3+1D	--	--	--	--	--	--
Auxiliary FSU Storage Area	VO, SVO, IO	3+1B	--	--	--	--	--	--

TABLE 5-1. (continued)

a VO = volatile organics; SVO = semivolatile organics; IO = inorganics.

b Landfill gas samples will be collected by integrated surface sampling. For landfill soils, each sample will be composited from 10 subsamples.

c D = duplicate, R = replicate, B = (equipment) blank. One trip blank will also accompany every sample shipment scheduled for VOC analysis.

d Surface impoundments will be sampled once a week over a six week period. Each sampling episode will include one downwind ambient air sample collected over a six- to eight-hour daytime period and one liquid sample obtained from the impoundment at depth.

e One liquid sample will be collected from each evaporative tank every week over a six-week period.

f Downwind ambient air samples will be collected for each of the treatment units and their storage areas. In the Central Processing Area, two sampling locations will be used. collection will be during transport conditions under ten miles per hour over a six- to eight-hour daytime period.

TABLE 5-2. Analysis methods and detection limits for required analytes.

Analyte	CAS[a] No.	Air	Detection Limit (ppbv)[b]	Water	Detection Limit (µg/L)[c]	Soil	Detection Limit (mg/kg)[d]
VOLATILES							
Acetaldehyde	75-07-0	TO-11	1	8315	TBD[e]	NA[f]	NA
Acetone	67-64-1	TO-11	1	624	10	NA	NA
Acrolein	107-02-8	TO-11	1	603	1	NA	NA
Acrylonitrile	107-13-1	TO-14	0.20	603	1	NA	NA
Allyl chloride	107-05-1	TO-14	0.20	624	TBD	NA	NA
Benzaldehyde	100-52-7	TO-11	1	8315	TBD	NA	NA
Benzene	71-43-2	TO-14	0.20	624	1	NA	NA
Bromoform	75-25-2	TO-14	0.20	624	1	NA	NA
2 Butanal	123-73-8	TO-11	1	624	TBD	NA	NA
Carbon tetrachloride	56-23-5	TO-14	0.20	624	1	NA	NA
Carbonyl chloride	75-44-5	TO-6	1	NA[g]	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	0.20	624	1	NA	NA
Chloroform	67-66-3	TO-14	0.20	624	1	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	0.20	624	1	NA	NA
1,4-Dichlorobenzene	106-46-7	TO-14	0.20	624	1	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	0.20	624	1	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	0.20	624	1	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	0.20	624	1	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	0.20	624	1	NA	NA
cis-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	1	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	1	NA	NA
Ethylbenzene	100-41-4	TO-14	0.20	624	1	NA	NA
Formaldehyde	50-00-0	TO-11	1	8315	TBD	NA	NA
n-Heptane	142-82-5	TO-14	0.20	624	TBD	NA	NA
Hexanal	66-25-1	TO-11	1	624	TBD	NA	NA
Hexane	110-54-3	TO-14	0.20	624	TBD	NA	NA

Analysis ...s and detectio.. lim.. quired analytes (Continued).

Analyte	CAS No.	Air	Detection Limit (ppbv)	Water	Detection Limit (µg/L)	Soil	Detection Limit (mg/kg)	
VOLATILES								
Methyl bromide	74-83-9	TO-14	0.20	624	1	NA	NA	
Methylene chloride	75-09-2	TO-14	1.50	624	1	NA	NA	
Methyl ethyl ketone	78-93-3	TO-11	1	624	5	NA	NA	
Pentanal	110-62-3	TO-11	1	624	TBD	NA	NA	
Propanal	123-38-6	TO-11	1	624	TBD	NA	NA	
Tetrachloroethene	127-18-4	TO-14	0.20	624	1	NA	NA	
Toluene	108-88-3	TO-14	0.20	624	1	NA	NA	
1,1,1-Trichlorethane	71-55-6	TO-14	0.20	624	1	NA	NA	
Trichloroethene	79-01-6	TO-14	0.20	624	1	NA	NA	
Vinyl chloride	75-01-4	TO-14	0.20	624	1	NA	NA	
m-Xylene	108-38-3	TO-14	0.20	624	1	NA	NA	
o-Xylene	95-47-6	TO-14	0.20	624	1	NA	NA	
p-Xylene	106-42-3	TO-14	0.20	624	1	NA	NA	
Total volatile hydrocarbons		--	25	--	624	--	NA	NA
SEMIVOLATILES								
Acenaphthylene	208-96-8	TO-13	1	625	5	8270	0.2	
Aldrin	309-00-2	TO-14	1	608	0.03	8080	0.001	
Anthracene	120-12-7	TO-13	1	625	5	8270	0.2	
Benzo (a) anthracene	56-55-3	TO-13	1	625	5	8270	0.2	
Benzo (b) fluoranthene	205-99-2	TO-13	1	625	5	8270	0.2	
Benzo (k) fluoranthene	207-08-9	TO-13	1	625	5	8270	0.2	
Benzo (g,h,i) perylene	191-24-2	TO-13	1	625	5	8270	0.2	
Benzo (a) pyrene	50-32-8	TO-13	1	625	5	8270	0.2	

Analysis methods and detection limits for required analytes (Continued).

Analyte	CAS No.	Air	Detection Limit (ppbv)	Water	Detection Limit (µg/L)	Soil	Detection Limit (mg/kg)	
SEMIVOLATILES								
Chlordane	57-74-9	TO-4	1	608	0.3	8080	0.01	
2-Chloronaphthalene	91-58-7	TO-13	1	625	10	8270	0.4	
Chrysene	218-01-9	TO-13	1	625	5	8270	0.2	
o-Cresol	95-48-7	TO-8	1	625	5	8270	0.2	
p-Cresol	106-44-5	TO-8	1	625	5	8270	0.2	
Cumene	98-82-8	TO-13	1	625	TBD	8270	TBD	
4,4'-DDD	72-54-8	TO-4	1	608	0.03	8080	0.001	
4,4'-DDE	72-55-9	TO-4	1	608	0.03	8080	0.001	
4,4'-DDT	50-29-3	TO-4	1	608	0.03	8080	0.001	
Dibenzo (a,h) anthracene	53-70-3	TO-13	1	625	5	8270	0.2	
1,4-Dichlorobenzene	106-46-7	TO-14	0.02	625	5	8270	0.2	
Fluoranthene	206-44-0	TO-13	1	625	5	8270	0.2	
Fluorene	86-73-7	TO-13	1	625	5	8270	0.2	
Ideno (1,2,3-c,d)pyrene	193-39-5	TO-13	1	625	5	8270	0.2	
Naphthalene	91-20-3	TO-13	1	625	5	8270	0.2	
Nitrobenzene	98-95-3	TO-13	1	625	5	8270	0.2	
n-Nitrosodimethylamine	62-75-9	TO-7	1	607	1	8270	0.2	
n-Nitrosodiphenylamine	86-30-6	TO-7	1	607	1	8270	0.2	
n-Nitrosodi-n-propylamine	621-64-7	TO-7	1	607	1	8270	0.4	
Phenanthrene	85-01-8	TO-13	1	625	5	8270	0.2	
Phenol	108-95-2	TO-8	1	625	5	8270	0.2	
PCB (total)	-	TO-4	1	608	.06	8080	0.01	
Polychlorinated dibenzo-p-dioxins	1746-01-6	TO-9	1	8270	0.002	8270	0.2	
Pyrene	129-00-0	TO-13	1	625	10	8270	0.4	

TABLE 5-2. Analysis methods and detection is for required analytes (Continued).

Analyte	CAS[a] No.	Air	Detection Limit (ppbv)[b]	Water	Detection Limit (µg/L)[c]	Soil	Detection Limit (mg/kg)[d]
INORGANICS							
Antimony	7440-36-0	PF/6010[h]	1	NA	NA	6010	1
Arsenic	7440-38-2	PF/6010	1	NA	NA	6010	1
Barium	7440-39-3	PF/6010	1	NA	NA	6010	1
Beryllium	7440-41-7	PF/6010	1	NA	NA	6010	1
Cadmium	7440-43-9	PF/6010	1	NA	NA	6010	1
Chromium	7440-47-3	PF/6010	1	NA	NA	6010	1
Cobalt	7440-48-4	PF/6010	1	NA	NA	6010	1
Copper	7440-50-8	PF/6010	1	NA	NA	6010	1
Lead	7439-92-1	PF/6010	1	NA	NA	6010	1
Mercury	7439-97-6	PF/7471	1	NA	NA	7471	1
Molybdenum	7439-98-7	PF/6010	1	NA	NA	6010	1
Nickel	7440-02-0	PF/6010	1	NA	NA	6010	1
Selenium	7782-49-2	PF/6010	1	NA	NA	6010	1
Silver	7440-22-4	PF/6010	1	NA	NA	6010	1
Thallium	7440-28-0	PF/6010	1	NA	NA	6010	1
Vanadium		PF/6010	1	NA	NA	6010	1
Zinc	7440-66-6	PF/6010	1	NA	NA	6010	1

a CAS = Chemical Abstracts Service
b ppbv = parts per billion by volume
c µg/L = micrograms per liter
d mg/kg = milligrams per kilogram
e TBD = to be determined
f NA = not applicable
g There is no recommended analysis method for carbonyl chloride (phosgene) in aqueous wastes, since the compound decomposes in water. The only matrix that will be analyzed for carbonyl chloride is air.
h PF = particulate filter

TABLE 5-3. Sample containers, preservation, and holding times.

Matrix	EPA Analysis Method	No. of Containers Per Sample	Container Volume	Container Type	Preservation	Molding Time
Water	603	1	500 ml	Glass bottle[a]	cool to 4°C	3 days
	607	1	1L	Amber glass bottle[a]	cool to 4°C	7 days (extraction)
	608	1	1L	Amber glass bottle[a]	cool to 4°C	7 days (extraction)
	624	2	40 ml	Glass vial w/Teflon septa	cool to 4°C	14 days
	625	1	1L	Amber glass bottle[a]	cool to 4°C	7 days (extraction)
	8280	1	1L	Amber glass bottle[a]	cool to 4°C	7 days (extraction)
	8315	2	40 ml	Glass vial w/Teflon septa	cool to 4°C	14 days
Soil	6010	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
	7471	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
	8070	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
	8080	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
	8270	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
	8280	10	19 in^3	stainless steel sleeve	cool to 4°C	28 days
Air	25	1	6L	stainless steel canister	cool to 4°C	14 days
	6010	1	--	particulate filter	--	28 days
	7471	1	--	particulate filter	--	28 days
	TO-4	1	--	particulate filter/PUF[2] cartridge	cool to 4°C	7 days (extraction)
	TO-6	1	20 ml	glass vial[a]	cool to 4°C	28 days
	TO-7	1	--	absorption cartridge	--	7 days
	TO-8	1	25 ml	glass vial[a]	cool to 4°C	48 hours
	TO-9	1	--	particulate filter/PUF cartridge	cool to 4°C	28 days
	TO-11	1	--	absorption cartridge	cool to 4°C	30 days
	TO-13	1	--	particulate filter/ adsorption cartridge	cool to 4°C	28 days
	TO-14	1	6L	stainless steel canister	ship under positive pressure	7 days

[a] with Teflon-lined screwcap
ml = liters, L = liters, in^3 = cubic inches

Samples being analyzed for nitrosamines (EPA Method 607), organochlorine pesticides and PCBs (EPA Method 608), base/neutral and acid extractables (EPA Method 625), and dioxins (EPA Method 8280) will be taken in one-liter amber glass bottles with Teflon-lined screw caps. Each sample container will be dedicated to only one analysis method; hence, a total of four amber glass containers per sample will be filled. A headspace is permissible for these samples.

One duplicate sample will be collected from a surface impoundment during every sampling round. The duplicate sampling location will be rotated, so that two duplicates will be obtained from each impoundment over the course of the study. The duplicate will be analyzed for the same suite of impoundment analytes.

An equipment blank will also be collected at every sampling round. Before one of the impoundment samples is collected and after the dedicated sampling device for that impoundment has been decontaminated, ultrapure deionized distilled (ASTM Type II) water will be poured into the device. This water will be decanted from the device into the same suite of containers as is used for impoundment sampling. The equipment blank will be analyzed as an impoundment sample. The equipment blank sampling will be rotated, so that over the course of the study two blanks will be collected from each impoundment's dedicated sampler.

All containers will be labeled and an accompanying chain-of-custody form filled out, following the procedures outlined in Section 5.5.8. After labeling, the samples will be kept at 4 degrees Centigrade (^{o}C) in an ice chest until they are transported to the laboratory for the required analyses. Sample preservation methods and holding times are summarized in Table 5-3. (A trip blank will be kept in the cooler with the samples and will be analyzed by EPA Method 624.)

After use, the sampling and depth-measurement equipment will be decontaminated with a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. The equipment will be stored at the KHF.

5.1.2 Ambient Air Sample Collection Method

The ambient air downwind of each of the three active surface impoundments will be sampled to determine volatile emissions. The sampling will be performed at the same frequency as the liquid sampling at these impoundments, as described above.

The sampling periods will be selected when the wind conditions will be relatively constant during an eight-hour sampling period. The meteorological criteria will be further restricted to include the same criteria as specified for monitoring for VOC emissions from landfills by the ARB (ARB, 1986) for compliance with Calderon (AB3525 and AB3374). Specifically, sampling will only be performed (or samples will only be considered valid) if the wind speed is

10 mph or less and it is not currently raining or has not rained during the 72 hours before sample collection. Three sampling devices and sampling media will be used to collect the samples.

5.1.2.1 VOCs – Total Air

Ambient air samples will be collected in electropolished stainless steel cylinders using the sample train shown in Figure 5-1. The instrumentation for sampling and analysis is described in detail in EPA Method TO-14 (EPA, 1988). The parts of the ambient air sampling system that come in contact with the sample air are constructed entirely of stainless steel and Teflon to prevent contaminant adsorption and offgassing and to minimize the potential for cross contamination. The sampling system uses a 12-volt diaphragm pump with an all stainless steel and Teflon construction. Air flow is controlled by a back pressure flow controller. The pump is protected from dust by an in-line filter.

A purge tee connects the system to the sampling container. It is used to flush the valve dead space and to act as a bypass valve for flow measurement.

The sample canisters are shipped to the site under vacuum. The laboratory cleans and leak tests the canisters before use. In addition, the laboratory assigns each canister a unique number while it is in service and documents its leak test results and usage information in a logbook.

The sample canisters are cleaned by placing them in an oven heated to 110°C for four hours. While the canisters are in the oven, they are under a 10-micron vacuum (10^{-3} torr) provided by a two-stage vacuum pump. The pump is equipped with a cold trap to prevent back diffusion of pump oil into the container. After cleaning, new canisters are tested for remnant contamination by filling them with zero air and analyzing a sample of it by gas chromatography using an electron capture detector.

When sampling is complete, the final pressure of the sampling canister is recorded and the canisters are shipped back to the laboratory under positive pressure. When the canisters arrive at the laboratory, the pressure is checked and compared with the pressure before shipment to check sample integrity. As required by EPA Method TO-14, samples collected in the stainless steel canisters are analyzed within 14 days of collection. In order to quantify acrylonitrile and allyl chloride (additional compounds on the VOC target list that are not part of the EPA list of TO-14 compounds), the hold time will be further restricted to seven days to assure that these more reactive VOCs are not degraded by the allowable hold for the less reactive TO-14 compounds. Any sample held for over 7 days will be considered invalid.

Parafin, olefin, aromatic and halogenated volatile organic compounds will be determined from samples collected in stainless steel canisters using a gas chromatograph with a mass spectrometer detector (GC/MS). The procedures are consistent with EPA Method TO-14.

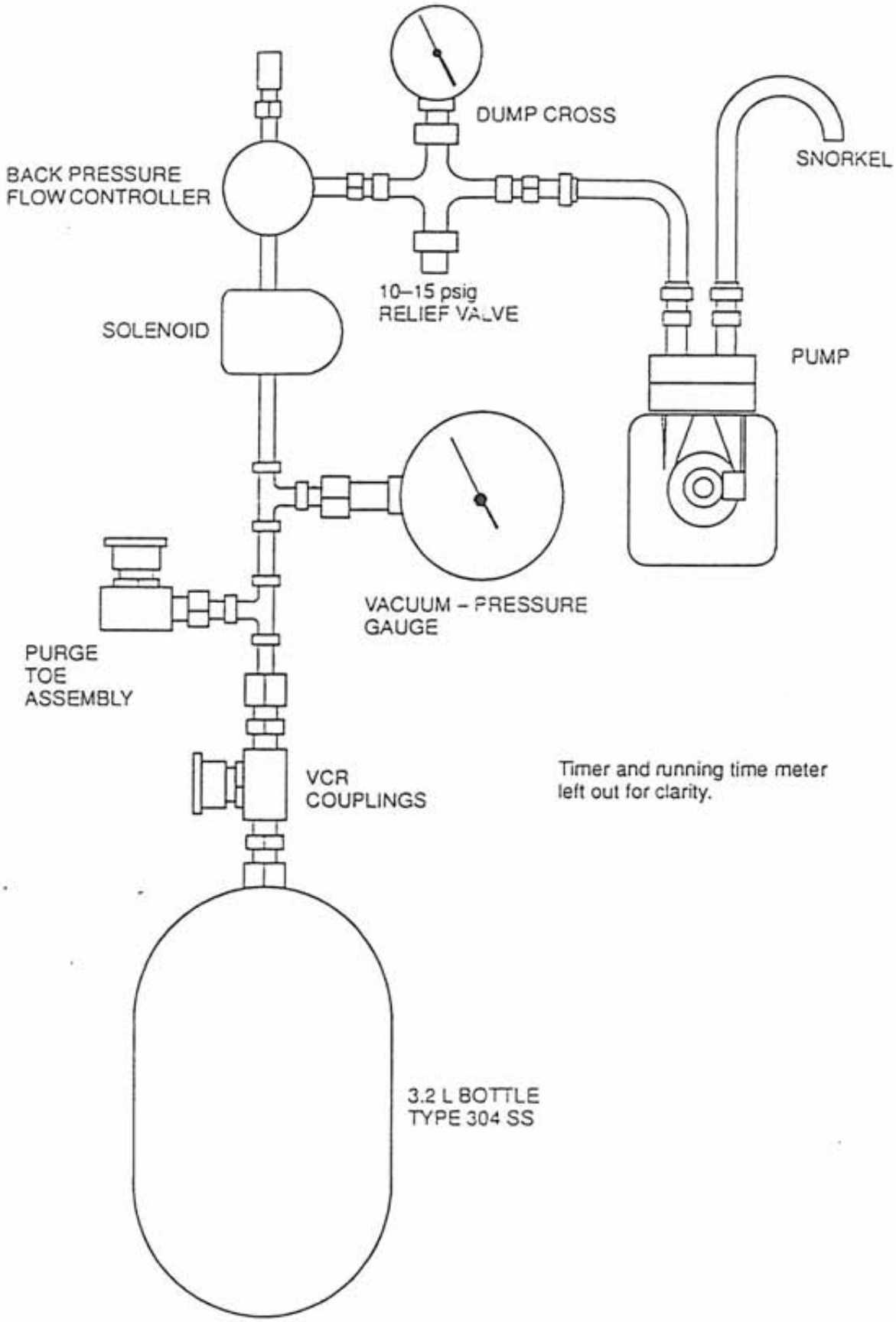


FIGURE 5–1. Sampling train for VOCs (TO–14)
Prepared for Chemical Waste Mangement, Inc. by AeroVironment Inc.

The analytical method includes opening the stainless steel sample cylinder and allowing 500 ml of sample to pass through a short piece of tubing that is bent in a "U" shape and submerged in liquid oxygen "cryotrap." The organic compounds of interest condense in the loop due to the extremely cold temperature maintained by the liquid oxygen bath. The oxygen bath is removed and the concentrated organic species volatilize and pass into the GC/MS, where they are detected and quantified. A computer connected to the GC/MS stores the data and compares the information to calibration data to speciate and quantify the sample.

5.1.2.2 VOCs Carbonyls

Ambient air samples will be collected by adsorption cartridges using the sample train shown in Figure 5-2. The instrumentation for sampling and analysis is described in detail elsewhere (Lipari and Swarin, 1985; Fung and Wright, 1990) and is similar to EPA Method TO-11 (EPA, 1988); however, the collection media substrate is Waters Sep-PAK C_{18} instead of silica gel. This alternate substrate has improved quantification of carbonyls that have a greater molecular weight than formaldehyde. Ambient air is drawn through a Teflon sample line to a cartridge packed with 2,4-dinitrophenolhydrazine (DNPH), on the Sep-PAK for carbonyl collection. A differential pressure flow controller and diaphragm pump are both downstream of the sampling cartridge.

When sampling is complete, the final flow rate of the sampler is recorded and the cartridges are shipped back to the laboratory using a cold shipping protocol (sufficient cold packs to maintain the samples below 25°C during transit). When the samples arrive at the laboratory, the temperature inside the shipping box is checked for compliance with the cold shipping protocol. The samples are refrigerated (below 20°C) until analyzed. Studies have shown (Fung and Wright, 1990), that samples collected in these cartridges are stable for at least a year after collection, if stored at or below 20°C.

Carbonyls will be determined from samples collected in these cartridges using high performance liquid chromatography (HPLC). The procedures are consistent with EPA Method TO-11. The analytical method includes chemically extracting the carbonyl/DNPH derivatives using acetonitrile. An aliquot of the extract is injected into the HPLC where the carbonyl derivatives are chromatographically separated and detected using an ultraviolet detector set for 360 nm. A computer connected to the HPLC stores the data and compares the information with calibration data to speciate and quantify the sample.

5.1.2.3 VOCs – Phosgene

Phosgene (carbonyl chloride) will be collected using an impinger sample train. Ambient air samples will be collected by an impinger using the sample train shown in Figure 5-3. The sampling and analysis will be performed according to EPA Method TO-6 (EPA, 1988). Ambient air is drawn through a Teflon sample line to the impinger. Phosgene will react with an aniline/toluene solution in the impinger. Sample will be drawn through the impingers via a downstream diaphram pump. Sample flow will be maintained at 100cc/min by a differential pressure flow controller connected to the sample pump.

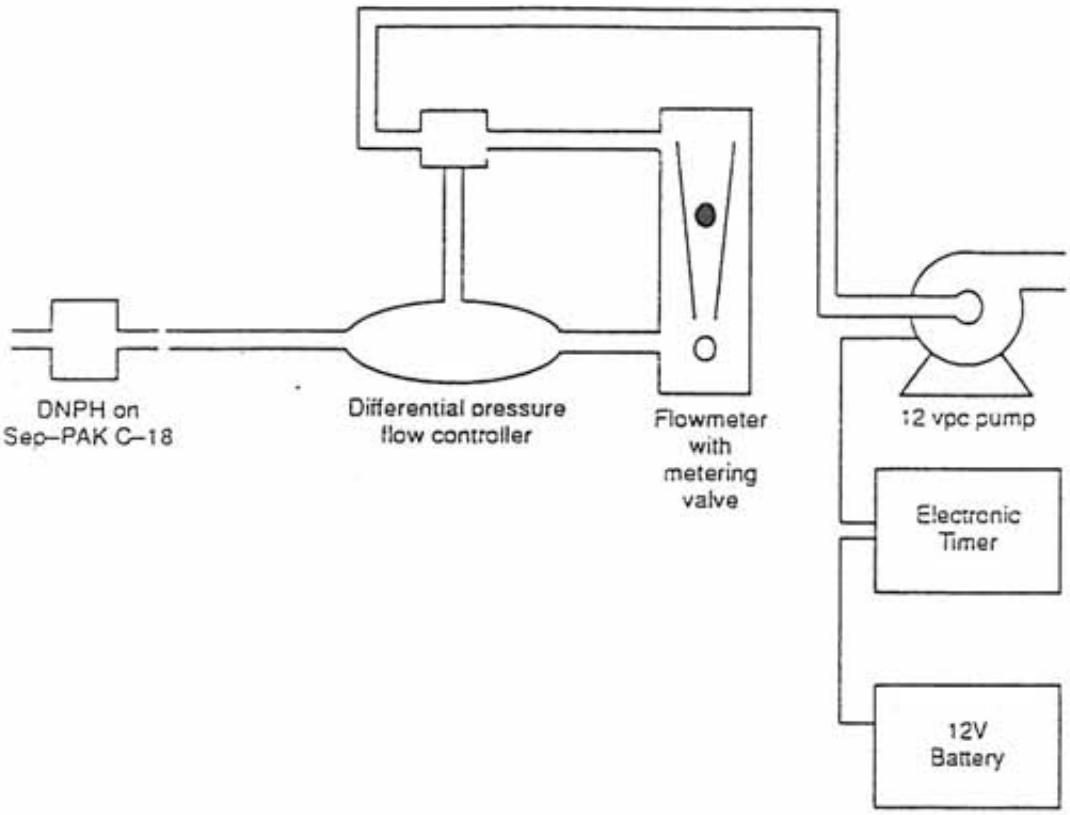
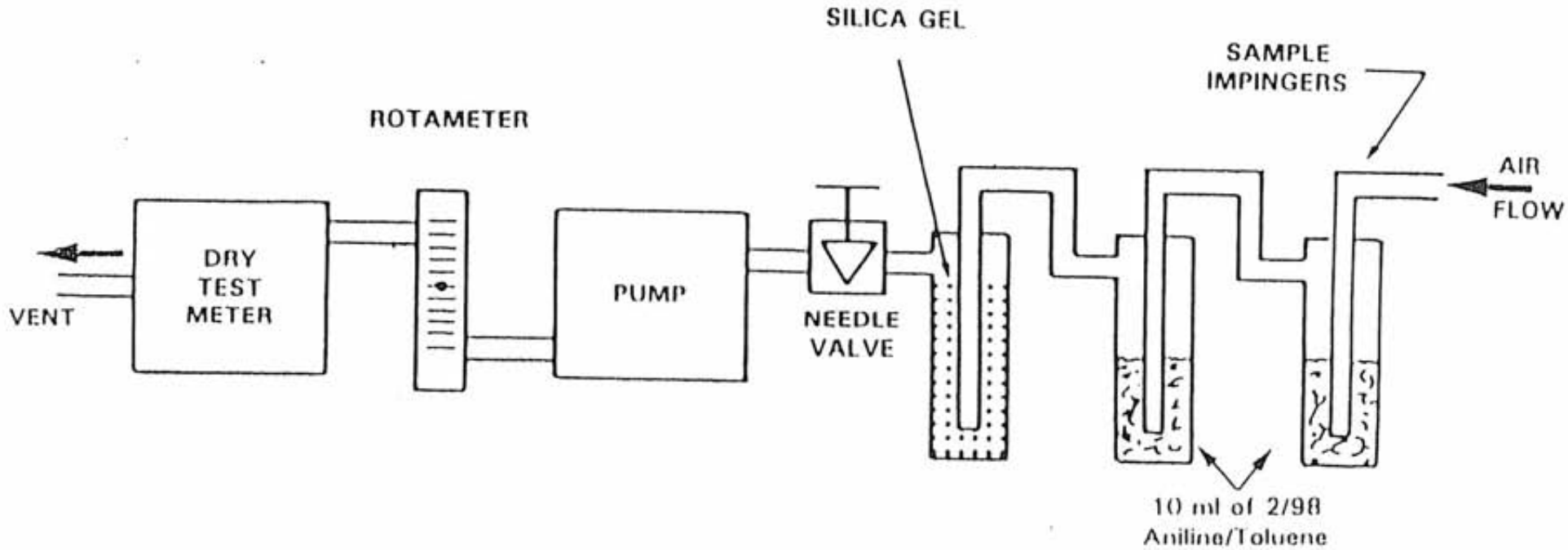


FIGURE 5-2. Sampling train for carbonyls (TO-11).
Prepared for Chemical Waste Management, Inc.,
by AeroVironment Inc.



from EPA (1986)

FIGURE 5-3. Sampling train for phosgene (TO-6.)
Prepared for Chemical Waste Mangement, Inc. AeroVironment Inc.

The impinger sample train will be included with the backpack sampler. In order to avoid disturbing the impinger sampling, the operator will take care not to tip or bounce the backpack during sampling.

When sampling is complete, the final flow rate of the sampler is recorded and the impinger solutions will be transferred to sample vial and the impingers are washed with additional toluene, which is added to the sample vial. The samples will be shipped under the same cold shipping protocol as described previously for the carbonyl samples.

An aliquot of sample will be analyzed by HPLC for phosgene.

5.1.2.4 Total Volatile Hydrocarbons

Total volatile hydrocarbons will be determined using EPA Method 25 (40 CFR, Part 60, 1989), modified for use with stainless steel sample canisters. An aliquot from the VOC sample canisters will be used to determine methane (CH_4), and total nonmethane hydrocarbons (NMHC) using the EPA Method 25 analysis protocol.

An aliquot from each sample canister will be injected onto a gas chromatographic column, where the species of interest are separated, and the NMHC is converted to methane via a hydrogenated catalyst. The original CH_4 plus the converted NMHC individually elute from the column and are detected by a flame ionization detector (FID).

5.2 EVAPORATIVE TANKS

Evaporative tanks T-1, T-2, T-3, and T-4 will be sampled once a week over a six-week period. Sampling will be scheduled for every sixth day; however, this schedule will be modified to allow sample collection during periods of waste discharge to the tanks. CWMI's records of wastes discharged will be compared with the analysis data.

A discrete sampling device (as described in Section 5.1.1) attached to a chemical-resistant rope, cord, or extension rod will be used to collect liquid samples from the evaporative tanks. One sampling device will be assigned to each tank.

Before a tank sample is collected, field personnel will measure the depth to liquid and to the bottom of the tank using a weighted tape. The sampling device will be washed in a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. It then will be lowered into the tank, and a liquid sample will be collected within three feet of the measured bottom of the tank.

Sample collection, handling, and analysis for volatiles and semivolatiles will follow the procedures described in Section 5.1.1. One duplicate and one equipment blank will be collected per sampling round; the location of these samples will rotate so that over the course of the study at least one duplicate and one blank will be collected from each tank.

5.3 LANDFILLS

Landfill sampling will include active units B-16, B-18, and B-19 and inactive units B-13 and B-15. Composited surface soil sampling will be restricted to active units, while integrated surface sampling (ISS) of landfill gas will be conducted across each of the aforementioned sites.

5.3.1 Soil Sample Collection Method

Surface soil samples will be laboratory-composited from ten subsamples collected within a landfill (B-16) or phase (B-18 and B-19). Each landfill or phase will be divided into ten subareas of roughly equal area, and a sample will be collected from a random point within each subarea. A stainless steel slide hammer device fitted with a stainless steel sample sleeve (6 inches long by 2 inches in diameter; approximate volume 19 cubic inches) will be driven into the surface soil to a depth of approximately six inches below ground surface. The sampler then will be withdrawn and the sample sleeve removed from the device. The ends of the sleeve will be covered with Teflon sheeting and sealed with plastic caps. The caps will then be attached to the sample sleeve with duct tape. A label with a unique sample number will be affixed to the sleeve, and the sleeve will be place in an insulated cooler. Samples will be kept at 4°C until they are transported to the laboratory under chain of custody (as described in Section 5.5.8) for the required semivolatiles (EPA Methods 8080, 8270, and 8280) and inorganics (EPA Methods 6010 and 7471) analyses.

Before initial use and between samples, sampling equipment will be washed in a solution of tap water and nonphosphate detergent, rinsed in tap water, and rinsed a final time in deionized water. A replicate sample will be composited from the subsamples from one landfill phase or unit. The replicate will be analyzed for the same suite of analytes as the other landfill soil samples.

5.3.2 Landfill Gas Sample Collection Method

The ISS sample will be collected using a portable, backpack-type self-contained unit with an internal power source. Landfill emissions are drawn through a six-inch diameter 316 stainless steel funnel by a 12-volt pump with an unlubricated Viton rubber diaphragm. The sample will be drawn up to the backpack through Teflon tubing by a purge pump connected to the exhaust of this sample line. The purge flow is controlled to 200 cc/min by a metering valve mounted in a rotameter and attached to the purge pump. A manifold upstream of the pump will allow multiple sample lines, one each for total air, carbonyls, phosgene and total volatile hydrocarbon sample collection to draw a sample from the purge line. It may be necessary to have two or more ISS samplers to house all of these sample methods. In this case, the ISS sampler technicians would walk together during sampling. The carbonyl sample and phosgene streams and subsequent analyses will be the same as described in Section 5.1.2.2 and Section 5.1.2.3, respectively, except the samplers will be installed in the backpack. Because of weight restraints, the VOC samples will be collected in a Tedlar bag as opposed to using the stainless steel canister sample train

described in Section 5.1.2.1. The Tedlar bag will be filled just 3/4 full to avoid overpressurization and bursting during shipment to the analysis laboratory. Sample extraction, cryotrapping and GC/MS analysis of the Tedlar bag sample will be the same as described previously for VOC analysis of the stainless steel canisters for total air and hydrocarbons.

The complete systems will be vacuum leak tested before being sent to the field. Between uses, the samplers will be decontaminated by flushing the systems with ambient air for five minutes followed by zero air for five minutes. Immediately before sampling, the sampler lines will be purged with ambient air from over the landfill so that the sample will not be diluted by zero air.

The samples will be collected two to three inches above the landfill surface while a technician walks a 50,000-square-foot grid in approximately 25 minutes. If two ISS backpaks are necessary to house all of these sampling systems, the two technicians will walk together during sampling. The sample flow rate will be maintained at 333 milliliters per minute. Sampling will proceed only when the ten-minute average wind speed is 5 mph or less, as determined by a hand-held anemometer, and the other wind speed and rain criteria described previously are met.

Sample custody will follow procedures detailed in Section 5.5.8.

The landfill gas samples will be analyzed for volatile organic compounds, phosgene, carbonyls and total hydrocarbons, using the methods described in Sections 5.1.2.1 and 5.1.2.2, 5.1.2.3, and 5.1.2.4, respectively.

A duplicate ISS sample will be collected from one of the landfill units or phases. These QC samples will be collected, handled, and analyzed the same way as the primary samples. After half of the landfills have completed ISS sampling, a field system blank will also be collected from zero air pumped through the sampling system.

5.4 HAZARDOUS WASTE TREATMENT UNITS

The hazardous waste treatment units of concern in this study are those located in the CPA (the Drum Decant Unit, the Cyanide Treatment Unit, the PCB Storage/Flushing Unit, and the Drum Storage Unit) and the FSU and its support storage area(s). Two sampling stations for the CPA and one station each for the FSU and its storage area(s) will be set up at downwind locations, and ambient air samples will be collected and analyzed for volatile, semivolatile, and inorganic components. If the new air stack for the FSU has been constructed and is in use during this characterization study, stack samples will also be collected and analyzed for these parameters.

On three separate days, samples will be collected over eight-hour periods (conforming to appropriate wind direction conditions). The sampling periods will be selected to coincide with unit operations and times when the wind conditions will be relatively constant during the sampling period, using the same criteria described above in Section 5.1.2. Samplers will be placed at locations to be determined based on current meteorological and topographical data.

Samples will be collected to determine VOC, carbonyl, semivolatile organic carbon (SVOC), and selected particulate metal emissions. The sampling and analysis protocol for VOCs, carbonyls, phosgene, and total hydrocarbons will be the same as described in Sections 5.1.2.1, 5.1.2.2, 5.1.2.3 and 5.1.2.4, respectively. The SVOCs will be collected using a sampling train consisting of a particulate filter upstream of an adsorbent sponge. The selected particulate metals will be collected on the same particulate filter as the SVOCs.

5.4.1 SVOCs – Hydrocarbons and Chlorocarbons

Ambient air samples will be collected on quartz fiber prefilters and polyurethane foam (PUF) sponges using the sample train shown in Figure 5-4. The instrumentation for sampling and analysis is described in detail in EPA Methods TO-4 (EPA, 1988). The system consists of a medium-volume sampler operating at a flow rate of approximately 300 liters per minute. A prefired quartz filter is used to collect particulate matter, including SVOCs. SVOCs, which may be in the vapor phase or which may volatilize off the particulate filter during the sampling, are drawn to the PUF sponge. These vapor-phase SVOCs chemically react with the PUF and will remain bound to this collection media for subsequent laboratory extraction and analysis.

Laboratory analysis begins by equilibrating the filters in a humidity/temperature controlled environment, then weighing the filters to determine the total particulate loading pursuant to the EPA filter weighing protocol (EPA, 1987b). The filters will then be cut in half: one half to be analyzed to determine particulate SVOCs, the other half to be analyzed for metals as described in the next section.

The filter halves and PUFs will be extracted individually using an ether/hexane solvent and a Soxhlet extractor for 8 to 24 hours followed by extraction with benzene solvent to obtain any remaining aromatics, including dioxins. The extracts will be run through a cleanup column, then an aliquot will be injected into a gas chromatograph with electron capture detection, GC/ECD, for determination of select species shown in Table 5-2 following the procedures in EPA Method TO-4 (EPA, 1988). A second aliquot will be injected into a high resolution gas chromatograph (HRGC) with high resolution mass spectroscopy (HRMS) detection for determination of select species shown in Table 5-2 following the procedures in EPA Method TO-9 (EPA, 1986). A third aliquot will be analyzed by GC/MS to determine the concentration of the lower boiling point polynuclear aromatic hydrocarbons (PAHs) following EPA Method TO-13 (EPA, 1988).

Quartz filters will be used for sample collection. The media will be prepared by baking the filters at 700°C to drive off any organic impurities. The filters will be allowed to equilibrate in a temperature- and humidity-controlled environment and preweighed following the EPA filter weighing protocol (EPA, 1987b). The PUFs will be made of 1.3 lb/ft^3 open cell foam with about 20 ppi (pores per square inch). The PUFs will be precut to fit the sampler (about 3-1/4"-diameter and 3"-long "plugs"). The PUFs will be precleaned for 10–24 hours in a Soxhlet extractor with hexane solvent.

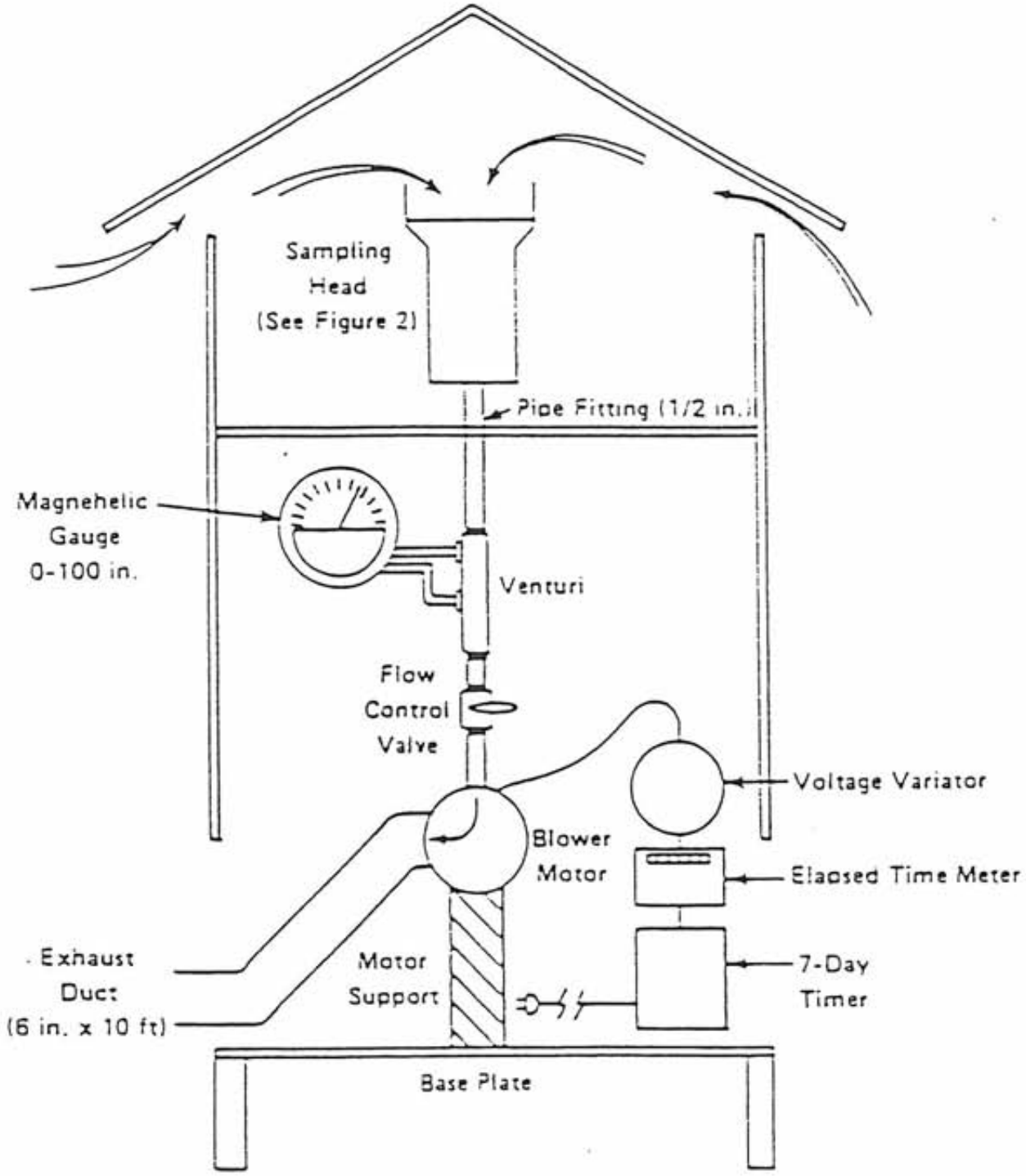


FIGURE 5–4. Particulate/PUF sampler.
Prepared for Chemical Waste Management, Inc. by AeroVironment Inc.

5.4.2 SVOCs – Phenols

Phenols and creosols will be collected using an impinger sample train. Ambient air samples will be collected by a pair of impingers using the sample train shown in Figure 5-5. The sampling and analysis will be performed according to EPA Method TO-8 (EPA, 1988). Ambient air is drawn through a Teflon sample line to two impingers connected in series. Phenols and creosols will be trapped in a sodium hydroxide solution in the impingers. Sample will be drawn through the impingers via a downstream diaphram pump. Sample flow will be maintained at 100cc/min by a differential pressure flow controller connected to the sample pump.

When sampling is complete, the final flowrate of the sampler is recorded and the impinger solutions will be transferred to sample vial and the impingers are washed with additional sampling reagent, which is added to the sample vials. The samples will be shipped under the same cold shipping protocol as described previously for the carbonyl samples. Pursuant to Method TO-8, the samples will be analyzed within 48 hours of collection.

An aliquot of each front and back impinger solution will be analyzed by HPLC for the phenols and creosols shown in Table 5-2.

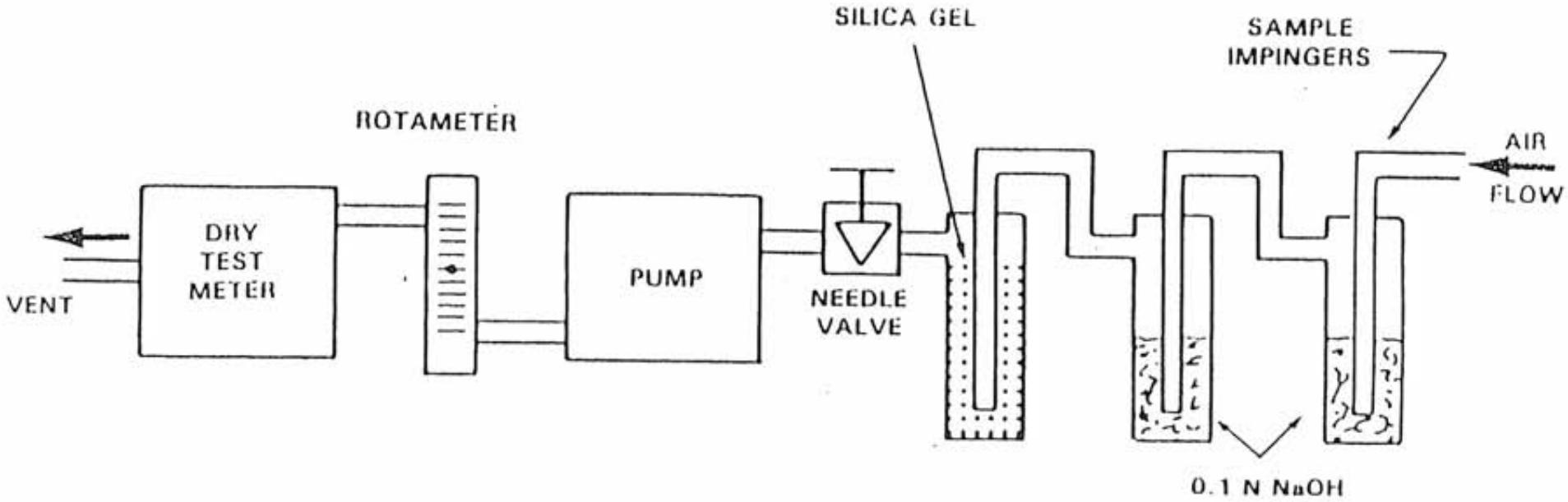
5.4.3 SVOCs – Nitrosamines

Ambient air samples will be collected by adsorption cartridges using the same type of sample train as used for the carbonyl sampling. A Thermosorb/N adsorbent material will be used in a sampling cartridge to trap ambient nitrosamines. The sampling and analysis method is pursuant to EPA Method TO-7 (EPA, 1988). The samples will be shipped under ambient conditions for laboratory analysis. The samples will be analyzed within one week of collection. The nitrosamines will be desorbed using acetone. An aliquot of this extract will be analyzed by GC/MS for the nitrosamines shown in Table 5-2.

5.4.4 Particulate Metals

As presented in the above section, following final weighing of the particulate filters, the filters will be halved, one half for SVOC determination and the second half for determination of selected metals.

The filter halves for metal determination will be extracted using hot nitric acid, then an aliquot will be analyzed using an inductively coupled plasma atomic emission spectrometer (ICP) for the inorganic species shown in Table 5-2. The method is essentially EPA Method 6010 (EPA, 1986), which has had filter extraction added to the straight wastewater extraction and analysis procedures. A second aliquot will be analyzed by atomic adsorption, AA, using cold-vapor technique for mercury determination. The method is essentially EPA Method 7471 (EPA, 1986), which has had filter extraction added to the soil, sediment, sludge type material extraction and analysis method.



from EPA (1988)

FIGURE 5-5. Sampling train for phenols/cresols (TO-8).
Prepared for Chemical Waste Mangement, Inc. AeroVironment Inc.

5.5 QUALITY ASSURANCE PLAN

The principal objective of this quality assurance (QA) plan is to ensure that the environmental monitoring data are collected, analyzed, and documented in accordance with professional standards.

There are five parameters that must be considered in order for an investigation to produce information for intelligent decision-making. They are

- Comparability
- Completeness
- Representativeness
- Accuracy
- Precision

Discussions of each of these parameters follow.

5.5.1 Comparability

The objective of the assessment of comparability is to assure the data developed during the investigation are comparable with applicable hazard criteria and, where appropriate, with data available from previous scientific studies in the area. Hazard criteria applicable to groundwater and surface water quality have been developed, and criteria to assess potential hazards of soil and air contaminants are being developed. In formulating the sampling plan, an attempt has been made to specify analyses and analytical methods consistent with those used in developing the hazard criteria.

Comparability may be maximized through the use of standardized procedures and methodologies. All sample collection techniques employed for this investigation will conform to accepted standard protocols. Sample analyses will be performed using U.S. EPA methods.

5.5.2 Completeness

Completeness will be assessed by comparing the number of valid sample results (these meeting the project QA objectives) with the number of samples collected and the number of samples planned. Analytical completeness is affected when a sample is damaged, when it is analyzed after its holding time has elapsed, or when laboratory analysis results are determined to be invalid and the sample cannot be reanalyzed. Completeness is expressed as a percentage. The objective for completeness is that the investigation provide enough of the planned data that any existing data gaps can be closed.

5.5.3 Representativeness

Data representativeness is defined as the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is expressed in terms of bias and is often described in terms of the standard error of the measurement.

Representative data collection is ensured by good field and analytical protocols as well as thorough documentation of field conditions, observations and measurements. Representativeness for the investigation will be assessed after initial data validation and reduction and will be based only on validated data.

5.5.4 Accuracy and Precision

The laboratory QC limits of accuracy and precision for inorganic and organic analysis of liquid soil and air have been established by B C Analytical and EAS, the laboratories that will be providing analytical services for this project. The control limits should be completely met, without any outliers. If any out-of-control result occurs and the QC coordinator does not believe it necessary to rerun the sample, it will be flagged and a memorandum written to the data user regarding the utility of the data.

Accuracy, as percent recovery, will be determined in the laboratory from both spiked sample analyses and performance audit reviews. Accuracy will be calculated by the following equation:

$$\text{Accuracy} = \frac{A-B}{C} \times 100$$

Where:

A = the analyte determined experimentally from the spiked sample or the control standard

B = the background level determined by a separate analysis of the unspiked sample

C = the amount of the spike added or the control standard

Method precision will be determined in the laboratory from spike duplicate analyses. For a single pair of duplicate samples, precision is calculated as the relative percent difference using the following equation:

$$\text{Precision} = \frac{X_1 - X_2}{\bar{X}} \times 100$$

Where:

X_1 = the larger value and X_2 = the smaller value of two duplicate or replicate values and

$\bar{X}$ = the mean of the two duplicate values

The precision of several pairs of duplicate samples is calculated as the coefficient of variation using the following equation:

$$\text{Precision} = \frac{s}{\bar{X}}$$

Where

s = the standard deviation of the duplicate values

$\bar{X}$ = the mean of the duplicate values

In addition to the analysis of laboratory spike duplicates, which will provide an estimate of the precision of the analytical system, field replicate, or "split," soil samples and duplicate water and air samples will be collected by the field team and submitted "blind" (i.e., not marked as split samples) to the laboratory. The data from field QA/QC samples will be used to assess the precision of the entire measurement system, including sampling, sample handling, shipping, analysis and reporting. Section 5.5.5 discusses field QA/QC samples further.

5.5.5 Field QA/QC

To maintain data quality, AV personnel will adhere to standard sampling techniques and decontamination procedures, as noted in Section 5.5.7. Data quality (precision and bias) for the combined sampling and analytical system will be evaluated through a combination of field replicate samples (soil sampling episodes) and field duplicates, field blanks, and trip blanks (water and air sampling episodes). Table 5-1 shows the number of QA/QC samples to be collected during the study. Field blanks for water samples will consist of ultrapure deionized distilled (ASTM Type II) water.

Replicates (commonly referred to as "splits") are samples that are collected and then subdivided into two equal parts. Soil replicate samples will be composited in the laboratory from the same subsamples as the primary soil sample. Field duplicates are two samples collected independently at a sampling location during a single act of sampling. Soil replicates and water and air duplicates will be collected with an approximate frequency of ten percent per sample matrix type (soil, water, or air) and will be analyzed for the same parameters as the accompanying soil, water, or air samples.

One set of field blanks will be collected for the water sampling. The blank will be ASTM Type II reagent water that is poured through the sampling equipment, transferred to the sample bottle, and then transported to the laboratory. The field blanks will be analyzed for the same parameters as the water samples. One volatile organics analysis (Method 624) trip blank will be included in each cooler containing water samples to monitor whether cross-contamination is occurring during sample transport.

Blanks, duplicates, and replicates will be handled in the same way as the natural samples they accompany. They will be submitted to the laboratory "blind" to ensure that they are not given preferential treatment by the analysis. It will be the responsibility of the field team leader to ensure that the QA/QC samples are obtained.

5.5.6 Laboratory QA/QC Samples

Data quality (accuracy, precision, and bias) is evaluated for the analytical system through the use of laboratory method blanks, duplicate samples, matrix spike samples, surrogate spikes and control standard samples.

5.5.7 Sampling Procedures

The objective of using standard sampling procedures for field measurements is to obtain samples and measurements that are representative and comparable. The use of experienced and well-trained field personnel, good sampling techniques, proper sampling equipment, and adequate decontamination should prevent cross-contamination. Sections 5.1 through 5.4 outline the procedures for field activities. Samples will be preserved and handled following the guidelines in Table 5-3. The inclusion of QA/QC samples, such as field blanks, will provide a check for inadvertent contamination.

Sample containers and preservatives for water sampling will be provided by the laboratory. The containers for organics analysis will be prepared according to U.S. EPA specifications by the manufacturer; the laboratory will not perform any additional cleaning. Plastic containers for metals sampling will be washed with detergent, rinsed with tap water, rinsed again with deionized water, and soaked in nitric acid for approximately 24 hours. The acid-washed bottles will then be rinsed with deionized water.

Before each soil sample is collected, the sampling device will be washed with a solution of detergent approved for laboratory use (such as Alconox), rinsed with tap water, and rinsed again with distilled water. Sample sleeves will be decontaminated in the same fashion as the soil sampling device. Before a liquid sample is collected, the liquid sample device will be washed in

a solution of detergent approved for laboratory use (such as Alconox), rinsed with tap water, and rinsed again with distilled water. An individual sample device will be assigned to each impoundment or tank to avoid cross-contamination between sampling locations.

To ensure that the established procedures and protocols are being carried during the field activities, the AV project manager will conduct periodic spot-audits of field operations.

5.5.8 Sample Custody

The objective of chain-of-custody procedures is to document the history and handling of each sample. Custody records trace a sample from its container's origin (laboratory) and sample collection, through all transfers of custody until it is received by the analytical laboratory. Internal laboratory records then document the custody of the sample through its final disposition. The field sampling team will ensure that custody procedures are followed.

5.5.8.1 Procedures to Ensure Sample Validity

In order to establish sample validity, it is necessary to document measures taken to prevent or detect tampering. Specific such procedures are the following:

- Precleaned sample containers will be received from the laboratory in sealed boxes. On receipt by the AV field team leader, the containers will be inspected for evidence of tampering.

- Sample containers will be stored in a secure area with custody seals until they are issued for sampling. These containers will be kept in locked storage with custody seals or under personal observation at all times. Figure 5-6 shows a sample custody seal.

- An individual sample number will be affixed to each set of containers for a single sample, and a sample label will identify each sample (Figure 5-7). A chain-of-custody form will be filled out for each delivery of samples (Figure 5-8).

- Decontaminated sampling equipment and sample containers will be kept under observation at all times.

CUSTODY SEAL

Signature _____

Date _____

FIGURE 5–6. Custody seal.

AeroVironment Inc.
222 E. Huntington Dr., Monrovia, CA 91016
(818) 357-9983

Nº 3464

Project _____ Project No. _____

Location _____

Date _____ Time _____

Analysis _____

Preservative _____

AV Reference No. _____

One of _____ containers this Sample

Nº 3464

Nº 3464

Nº 3464

Nº 3464

Nº 3464

FIGURE 5–7. Sample label and sample number tags.

AeroVironment Inc.

222 E. Huntington Dr., Monrovia, CA 91016

(818) 357-6003

SAMPLE SUBMITTAL FORM/CHAIN OF CUSTODY RECORD

PLEASE REPORT DATE ANALYZED ( ) WITH ANALYTICAL RESULTS

SITE

AV PROJECT NO.

| DISPOSE OF SAMPLES IMMEDIATELY AFTER REPORTING, MONTHS | SEND RESULTS TO: | | |

- The field team leader is responsible for all samples collected for laboratory analysis and will keep the samples under custody seals or personal observation until they are turned over to the designated carrier in sealed containers.

- The AV project manager is responsible for ensuring that custody procedures are followed and will investigate any indication of tampering. The analytical laboratory maintains standard operating procedures for sample custody and security.

5.5.8.2 Sample Identification and Recordkeeping

Unique, sequential sample identification numbers will be assigned to all samples. An index of sample numbers will be kept in the field log book. The sample numbers are preprinted on the sample labels, along with spaces for recording the following:

- project name and number
- sample location
- date and time of sampling
- type of analysis to be performed
- preservatives used
- number of containers per sample

The sample label will be filled out and affixed to one of the sample containers and covered with clear vinyl tape to protect the label. Corresponding sample number tags will be affixed to any additional containers for this sample. Thus the sample numbers assigned are also the numbers that will be used on the chain-of-custody records for each sample. Figure 5-7 shows an example of a sample label and sample number tags.

Any information appearing on the sample labels and in the sample log notebook will be recorded in the field log book, along with a list of personnel present, a description of any unusual sample characteristics, records of decontamination and calibration procedures, and any other specific considerations pertaining to sample acquisition. Whenever the responsibility of maintaining field logs passes from one person to another, the transfer will be noted in the log book.

5.5.8.3 Sample Transfer Procedure/Chain-of-Custody Records

Once a sample is collected, an adhesive custody seal (Figure 5-6) will be affixed to each sample container in such a way that the container cannot be opened without breaking the seal. The

individual collecting the sample will sign and date the seal before affixing it to the container. An intact seal indicates to the laboratory that the sample was not tampered with during transport.

Chain of custody will be maintained on all samples submitted for laboratory analysis. The field team leader will fill out and sign the chain-of-custody form (Figure 5-8), relinquishing control of the sample to the laboratory employee picking up the samples at the site or receiving the samples at the laboratory. The chain-of-custody form will also serve as a sample analysis request form. Information that will be noted on this form includes

- project number
- four-digit sample identification number (as preprinted on label)
- date and time of sampling
- preservatives used
- holding times
- type of analysis to be performed
- transfer of samples from one party to another

All labels and data recorded in the field will be written legibly in waterproof ink. Errors will be crossed out with a single line, initialed, and dated: they will not be obliterated.

The samples will be placed in chilled coolers, packed with inert packing material, secured, and placed under custody seals for transport to the laboratory. They will be accompanied by the original copy of the chain-of-custody form that has been filled out and signed by the relinquisher. The carbon of this form will be retained by the field team leader.

5.5.9 Analytical Procedures

Table 5-2 gives a summary of the samples to be analyzed, the parameters, and the test methods to be used.

5.5.10 Validation of Laboratory Data

The analysis, validation, and reporting of data received from the laboratory is the responsibility of AV's quality assurance coordinator. Data validation, which consists of data editing, screening, checking, auditing, verification, and review, determines whether data are adequate for their intended use.

Data validation will be accomplished by checking field and laboratory calibration procedures and frequency and by comparing multiple measurements. If measurement data exhibit large variations from these reference data (greater than 20 percent) that cannot be explained by field conditions, then the measurement data will be considered an outlier and will be either rejected as unusable or restricted to limited use. Data validity will be similarly affected if calibration procedures or frequency of calibration checking deviates from standards set in this quality assurance plan.

The data from the laboratory will be reviewed for the following components to evaluate the validity of the analyses:

- analytical results for laboratory blanks and field blanks
- comparison of samples and duplicates/replicates
- surrogate and spike recovery data

The validity of outliers will be determined by reviewing

- field documentation for notations about unusual occurrences that may explain data points outside the expected range

- instrument documentation to identify performance trends and operational quality

- associated data for trends similar to those shown by the outliers

- audit reports for procedural problems

Laboratory data will be invalidated if any of the following occur:

- the sample is not analyzed within its holding time

- the laboratory instrument blank level is too high, causing the detection limit to be in the quantitative area of interest, and the sample cannot be reanalyzed

- the laboratory quality assurance objectives for accuracy and precision are not met

Levels of contaminants in the blanks are expected to be low enough to have little impact on the overall validity of the data. If any contaminants are found above detection limits in the field blank, all of the sample data will be reviewed to determine whether comparable levels are present in some or all samples.

All data, whether validated or not, will be reported. Invalidated data will be footnoted. When possible, the data point may be resampled to verify or correct the original result.

5.5.11 Specific Procedures to Assess Quality Assurance Goals

AV personnel will review all data received from the laboratories and will compare them to previously collected data for reproducibility. Inconsistencies and unusual results will be examined further to determine whether they reflect actual site conditions or are the result of field and/or laboratory procedural errors.

Comparison of results between sampling rounds will indicate the total precision of the measurement system including such factors as sample collection, containerization, preservation, shipping, and analysis.

Reproducibility, together with several other factors, is integral in determining whether a result is significant. For this investigation, the criteria for establishing the significance of analytical finds will take into account the following factors:

- laboratory or field-induced background contamination, identified using laboratory and field blank samples

- the limit of quantitation (LOQ) for the analyte of interest, defined as the lower limit of concentration or amount of substance that must be present before a method is considered to provide quantitative results. The LOQ is equal to two times the standard deviation at the lowest level of measurement (40 CFR, Part 53).

- the reproducibility of the measurements, both within sampling rounds and between rounds

- applicable air and water quality criteria

Results that are not repeatable for at least two sampling rounds are not considered significant unless the criteria are exceeded. Results that are not above the LOQ will be reported and footnoted. Results that are below the detection limit will be reported as not detected (ND). Analytes that are identified as background contaminants based on their presence in the laboratory blanks and/or field blanks are not considered significant if detected in a sample at levels

comparable to those in the blanks. Analytes that are not naturally occurring but that are repeatable and quantifiable (above the LOQ for all sampling rounds) will be considered significant.

Routine assessments of data precision, accuracy, and completeness will be made by the laboratories during the analyses of all samples. Each measurement procedure, system, or instrument has predetermined limits to indicate when corrective action is required. The laboratories will monitor their QC data to ensure that they are within established control limits for the methods, as published by the U.S. EPA.

When analytical data are received from a laboratory, they will be reviewed, and the accuracy and precision achieved will be compared to the control limits established.

Procedures that will contribute to the assessment of field sampling accuracy and precision are the inclusion of one trip blank and one equipment blank (air and water only), one replicate (split) soil sample, and one duplicate sample per water or air sampling round. The blanks will be used to check for compounds inadvertently introduced into the samples during collection, shipment or analysis. The replicate and duplicate samples can be used to measure precision achieved in the field and the laboratory.

5.5.12 Document Control

The purpose of document control is to ensure that all project documents will be accounted for when the project is complete. The project number issued for this project will be recorded on all sample labels, field logbooks, data sheets, chain-of-custody forms, calculation worksheets, and other project records. These documents (except the sample labels) will be retained at AV's Monrovia office in the project files. The project manager will maintain control of all documents passing through project operations.

The field team leader will also function as document control officer for field-generated data and will be responsible for issuing, controlling, and maintaining records of controlled documents. At the conclusion of field activity, all controlled documents and records will be delivered to the project manager for inclusion in an overall project document inventory, which will be maintained and archived in AV's project files.

5.5.13 Quality Assurance Reports to Management

During the sampling, the quality assurance coordinator will confer frequently with the project manager and/or the field team leader to forestall any quality assurance problems. Significant quality assurance problems that arise will be discussed with the project manager immediately.

Upon receipt of data from the laboratory, the quality assurance coordinator or his/her designee will prepare an assessment of data accuracy, precision, and completeness.

Section 6

DATA MANAGEMENT

The data management procedures below will document and track data generated during the characterization study. These data will include information generated in the field, meteorological data, and chemical analysis results.

6.1 FIELD DATA

A daily log will be kept of all field work performed for this project. Field logs will be maintained whenever any matrix is sampled at the surface impoundments, the landfills, or the hazardous waste treatment units. The field team leader will be responsible for recording all pertinent information in the field logbook, including

- names of personnel on site
- the exact locations at which samples are collected
- sample numbers
- sampling dates and times
- duration of air sampling
- wind directions during air sampling
- air sampler flow rates
- observations of other site activities or field conditions that might affect the samples

The chain-of-custody form will also serve as a sampling record. Ultimately, the chain-of-custody form will include AV's sample number and the laboratory's own unique sampling number. The laboratory will include the completed form with its report of analysis results.

Unit-specific maps that include information such as sampling and monitoring locations and ISS sampling grid layouts will be generated. These maps will be part of the characterization report describing the study and its findings.

6.2 METEOROLOGICAL DATA

Data generated by meteorological monitoring will be automatically logged on electronic data recorders connected to the field equipment. Data associated with overall site meteorology will be reported as hourly averages. Data associated with ambient sampling in the vicinity of hazardous waste treatment units will be reported with sufficient time resolution to permit evaluation of the

effectiveness of the directional and wind speed sensitive sampling.

Meteorological data, such as hourly average values of temperature, wind speed, wind direction, sigma-theta, and stability class, will be summarized in tabular form. (Stability class will be determined using the approach specified by the EPA (1987a).) In addition to the hourly data collected during sampling, daily, monthly, and annual historical data summaries will be generated. Summarized data include average, high, and low temperatures, average wind speeds, and maximum instantaneous wind speeds (i.e., gusts).

Frequency distributions of winds by speed and direction classes will be presented in a wind-rose format on a monthly and annual basis. The annual distribution will also be segregated by stability class and a separate wind rose produced for each stability class.

6.3 CHEMICAL ANALYSIS DATA

Separate data tables will be compiled for analysis results from

- surface impoundment liquids
- ambient air downwind from surface impoundments
- evaporative tank liquids
- landfill surface soils
- landfill gases
- ambient air downwind from hazardous waste treatment units

The tables will be used in the development of a proposed list of compounds for subsequent ambient air sampling.

Section 7

SCHEDULE

The work described herein will begin 30 days following award of the contract to conduct the work set forth in the work plan. Contract award will be made after approval of the work plan by the DTSC.

It is estimated that the field work will be completed within 90 days after it begins, with that schedule somewhat flexible due to variable meteorological conditions and the need to schedule sampling operations around site activities.

The surface impoundments, evaporative tanks, and landfills will be sampled concurrently. Impoundment and tank sampling will be conducted over a six-week period, in accordance with permit requirements. The ambient air samples from the hazardous waste treatment units will be collected during acceptable meteorological conditions and during periods of minimal interference from other site activities.

Laboratory results are expected within four weeks of submission of the last samples. Evaluation of the test results will take about 30 days, and composition of a report on site topography, meteorology, and monitoring results is expected to take another 60 days. Therefore, the entire program is expected to take about seven months.

The overall schedule timeline is illustrated in Figure 7-1.

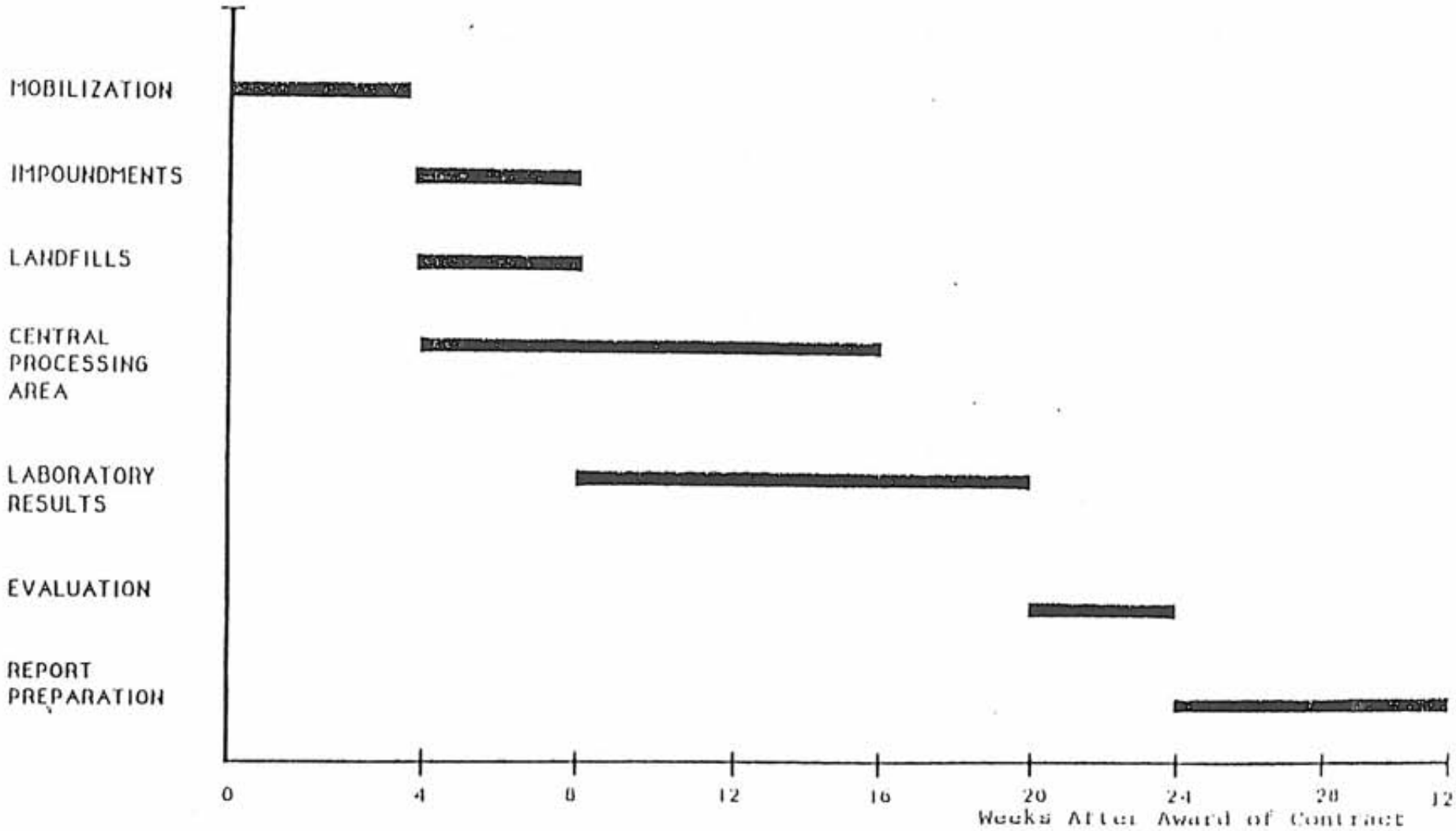


FIGURE 7-1. Schedule for characterization study
Kettleman Hills Facility, Kings County, California

Prepared for Chemical Waste Mana. .ut, Inc. by AeroVironment Inc

Section 8

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Appendix B
Target Compound List

APPENDIX B
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)[b]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
SEMIVOLATILES							
PESTICIDES							
Aldrin	309-00-2	TO-13[e]	1	608	0.050	8080	0.010
Chlordane	57-74-9	TO-13[e]	1	608	0.50	8080	0.10
4,4'-DDD	72-54-8	TO-13[e]	1	608	0.10	8080	0.025
4,4'-DDE	72-55-9	TO-13[e]	1	608	0.10	8080	0.010
4,4'-DDT	50-29-3	TO-13[e]	1	608	0.10	8080	0.025
SVOCs							
Acenaphthylene	208-96-8	TO-13	1	625	10	8270	1
Anthracene	120-12-7	TO-13	1	625	10	8270	1
Benzo(a)anthracene	56-55-3	TO-13	1	625	10	8270	1
Benzo(b)fluoranthene	205-99-2	TO-13	1	625	10	8270	1
Benzo(k)fluoranthene	207-08-9	TO-13	1	625	10	8270	1
Benzo(g,h,i)perylene	191-24-2	TO-13	1	625	10	8270	1
Benzo(a)pyrene	50-32-8	TO-13	1	625	10	8270	1
2-Chloronaphthalene	91-58-7	TO-13	1	625	10	8270	1
Chrysene	218-01-9	TO-13	1	625	10	8270	1
o-Cresol	95-48-7	TO-13[e]	1	625	10	8270	NR[f]
p-Cresol	106-14-5	TO-13[e]	1	625	10	8270	NR
Cumene	98-82-8	TO-13	1	625	10	8270	NR
Dibenzo(a,h)anthracene	53-70-3	TO-13	1	625	10	8270	1
Fluoranthene	206-44-0	TO-13	1	625	10	8270	1
Fluorene	86-73-7	TO-13	1	625	10	8270	1
Indeno(1,2,3-c,d)pyrene	193-39-5	TO-13	1	625	10	8270	1
Naphthalene	91-20-3	TO-13	1	625	10	8270	1
Nitrobenzene	98-95-3	TO-13	1	625	10	8270	1

APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)[b]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
N-Nitrosodimethylamine	62-75-9	TO-13[e]	1	625	10	8270	1
N-Nitrosodiphenylamine	86-30-9	TO-13[e]	1	625	10	8270	1
N-Nitroso-di-n-propylamine	621-64-7	TO-13[e]	1	625	10	8270	1
Phenanthrene	85-01-8	TO-13	1	625	10	8270	1
Pyrene	129-00-0	TO-13	1	625	10	8270	1
Phenol	108-95-2	TO-13[e]	1	625	10	8270	1
PCBs (Total)		TO-13[e]	1	8080	0.5	8080	0.010
DIOXINS/FURANS							
Polychlorinated dibenzo-p-dioxins	1746-01-6	TO-13[e]	1	8280	<0.002	8280	<0.2 mg/kg
VOCs							
Acetaldehyde	75-07-0	TO-11	1	8315	0.010	NA	NA
Acetone	67-64-1	TO-14	1	624	100	NA	NA
Acrolein	107-02-8	TO-11	1	624	2000	NA	NA
Acrylonitrile	107-13-1	TO-14	0.20	624	20	NA	NA
Allyl chloride	107-05-1	TO-14	0.20	624	5.0	NA	NA
Benzaldehyde	100-52-7	TO-11	1	8315	0.010	NA	NA
Benzene	71-43-2	TO-14	0.20	624	5.0	NA	NA
Bromoform	75-25-2	TO-14	0.20	624	5.0	NA	NA
2-Butanal	123-72-8	TO-11	1	624	50	NA	NA
Carbon tetrachloride	56-23-5	TO-14	0.20	624	5.0	NA	NA
Carbonyl chloride (phosgene)	75-44-5	OSHA Method 61	1	NA	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	0.20	624	5.0	NA	NA
Chloroform	67-66-3	TO-14	0.20	624	5.0	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	0.20	624	5.0	NA	NA
1,4-Dichlorobenzene = p-Dichlorobenzene	106-46-7	TO-14	0.20	624	5.0	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	0.20	624	5.0	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	0.20	624	5.0	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	0.20	624	5.0	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	0.20	624	5.0	NA	NA

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APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)[b]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
cis-1,3-Dichloropropene	10061-01-5	TO-14	0.20	624	5.0	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	5.0	NA	NA
Ethylbenzene	100-41-4	TO-14	0.20	624	5.0	NA	NA
Formaldehyde	50-00-0	TO-11	1	8315	0.050	NA	NA
n-Heptane	142-82-5	TO-14	0.20	624	5.0	NA	NA
Hexanal	66-25-1	TO-11	1	624	50	NA	NA
Hexane	110-54-3	TO-14	0.20	624	5.0	NA	NA
Bromomethane	74-83-9	TO-14	0.20	624	10	NA	NA
Methylene chloride	75-09-2	TO-14	1.50	624	5.0	NA	NA
2-Butanone (MEK)	78-93-3	TO-14	1	624	100	NA	NA
Pentanal	110-62-3	TO-11	1	624	50	NA	NA
Propanal	123-38-6	TO-11	1	624	50	NA	NA
Tetrachloroethene	127-18-4	TO-14	0.20	624	5.0	NA	NA
Toluene	108-88-3	TO-14	0.20	624	5.0	NA	NA
1,1,1-Trichloroethane	71-55-6	TO-14	0.20	624	5.0	NA	NA
Trichloroethene	79-01-6	TO-14	0.20	624	5.0	NA	NA
Vinyl chloride	75-01-4	TO-14	0.20	624	10	NA	NA
Xylenes, total	1330-20-7	TO-14	0.20	624	10	NA	NA
Total Volatile Hydrocarbons	—	EPA Method 25	—	624	—	NA	NA
INORGANICS							
METALS							
Antimony	7440-36-0	PF/6010	1	NA	NA	6010	10
Arsenic	7440-38-2	PF/6010	1	NA	NA	7060	0.50
Barium	7440-39-3	PF/6010	1	NA	NA	6010	5.0
Berylium	7440-41-7	PF/6010	1	NA	NA	6010	0.50
Cadmium	7440-43-9	PF/6010	1	NA	NA	6010	1.0
Chromium	7440-47-3	PF/6010	1	NA	NA	6010	5..0
Cobalt	7440-48-4	PF/6010	1	NA	NA	6010	5.0
Copper	7440-50-8	PF/6010	1	NA	NA	6010	5.0

APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
Lead	7439-92-1	PF/6010	1	NA	NA	6010	10
Mercury	7439-97-6	PF/6010	1	NA	NA	7471	0.050
Molybdenum	7439-98-7	PF/6010	1	NA	NA	6010	5.0
Nickel	7440-02-0	PF/6010	1	NA	NA	6010	10
Selenium	7783-00-8	PF/6010	1	NA	NA	7740	0.50
Silver	7440-22-4	PF/6010	1	NA	NA	6010	2.5
Thallium	7440-28-0	PF/6010	1	NA	NA	6010	25
Vanadium	7440-62-2	PF/6010	1	NA	NA	6010	5.0
Zinc	7440-66-6	PF/6010	1	NA	NA	6010	5.0

a CAS = Chemical Abstracts Service
b ppbv = Parts per Billion by Volume
c ug/L = Micrograms per Liter
d mg/kg = Milligrams per Kilogram
e Sampling method followed procedure outlined in TO-13. Analytical method utilized modified 8270 procedures (see Section 3.2.3.4 describing approved method modifications).
f NA = Not Applicable
g NR = Not Reported

Appendix C
Landfill Soil Sampling Location Maps

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SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 PHASE I & II
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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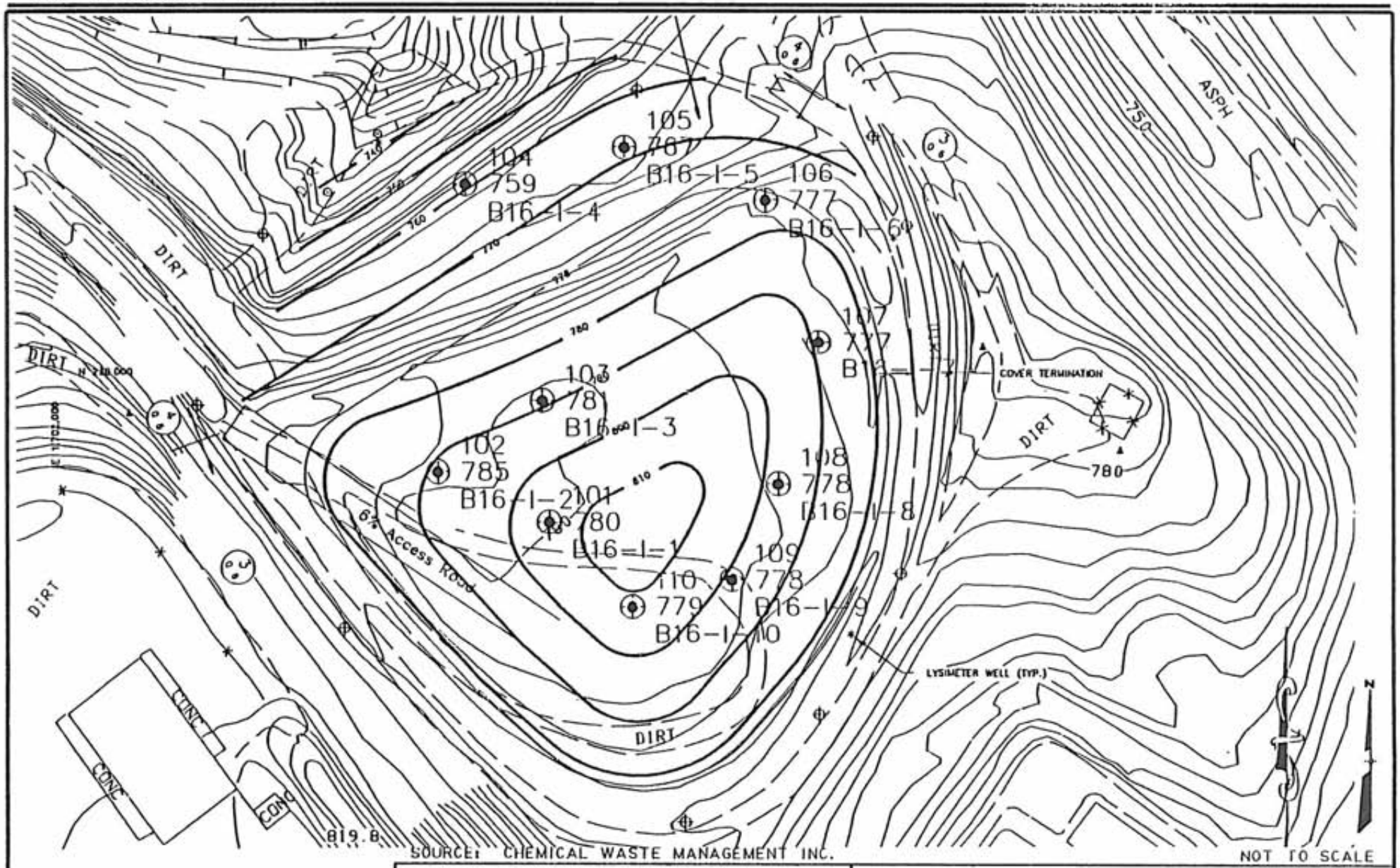

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-16
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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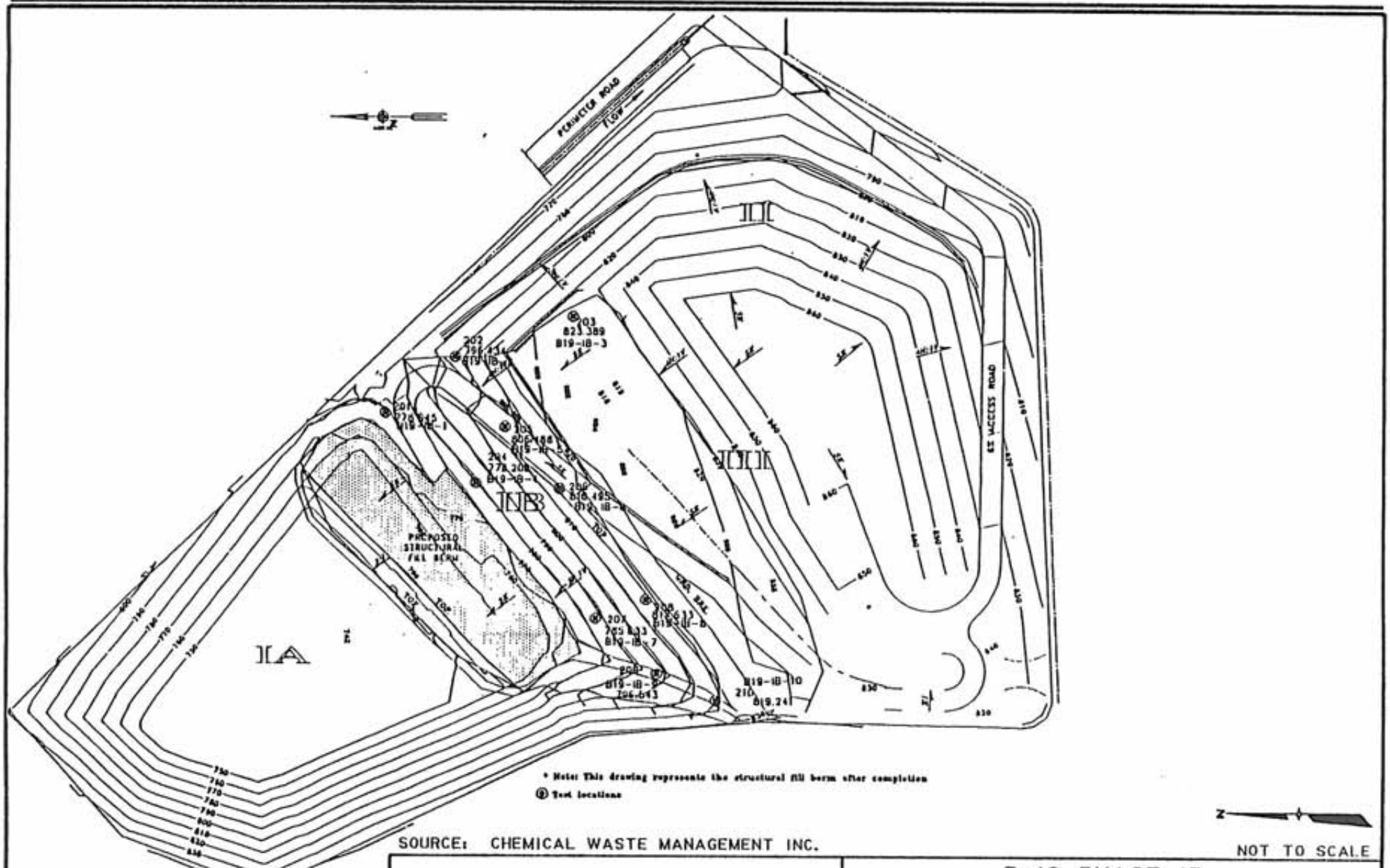


SOURCE: CHEMICAL WASTE MANAGEMENT INC.

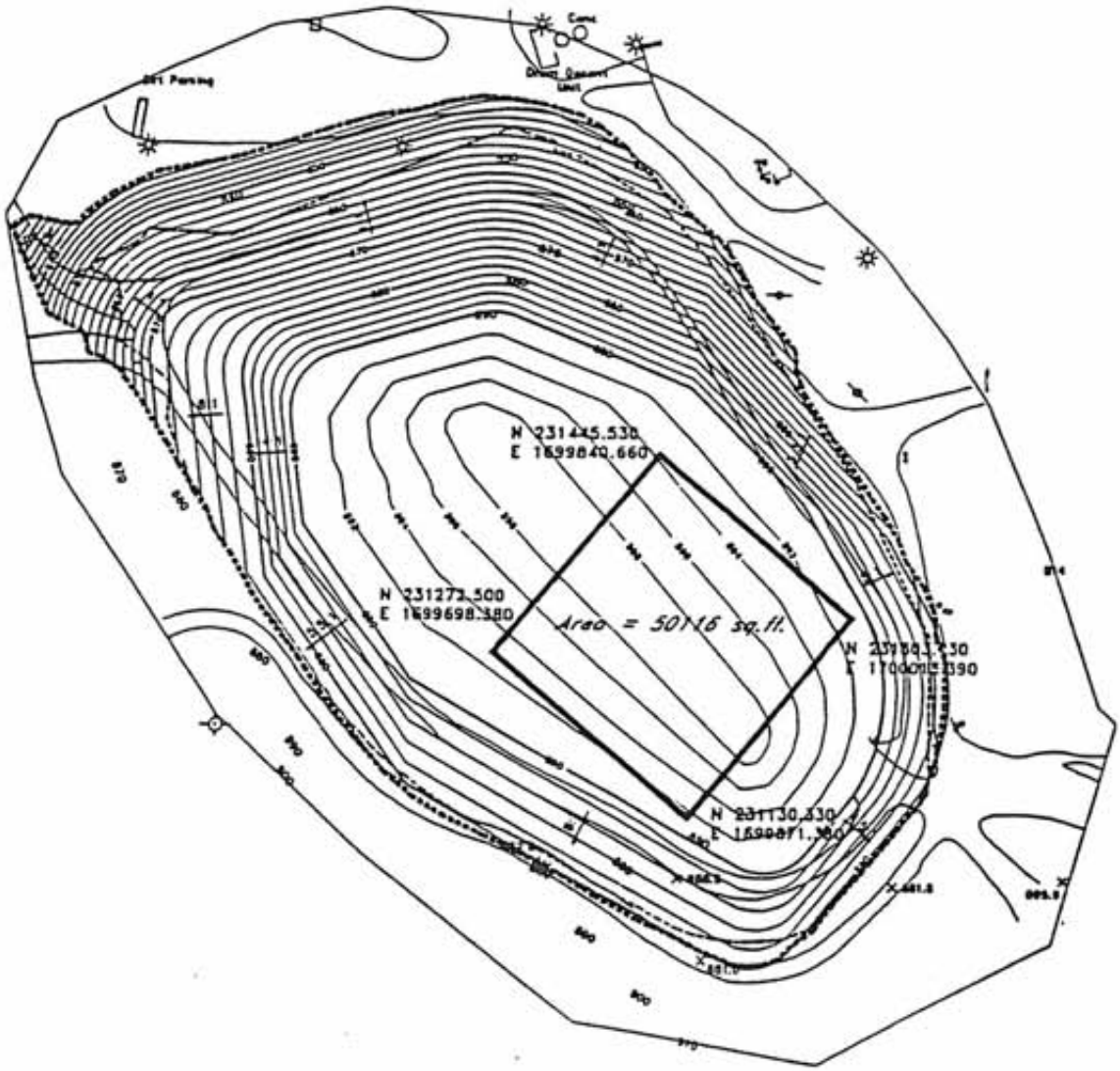
NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-19 PHASE IB
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

Appendix D
ISS Sampling Grid Survey Maps



SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-13 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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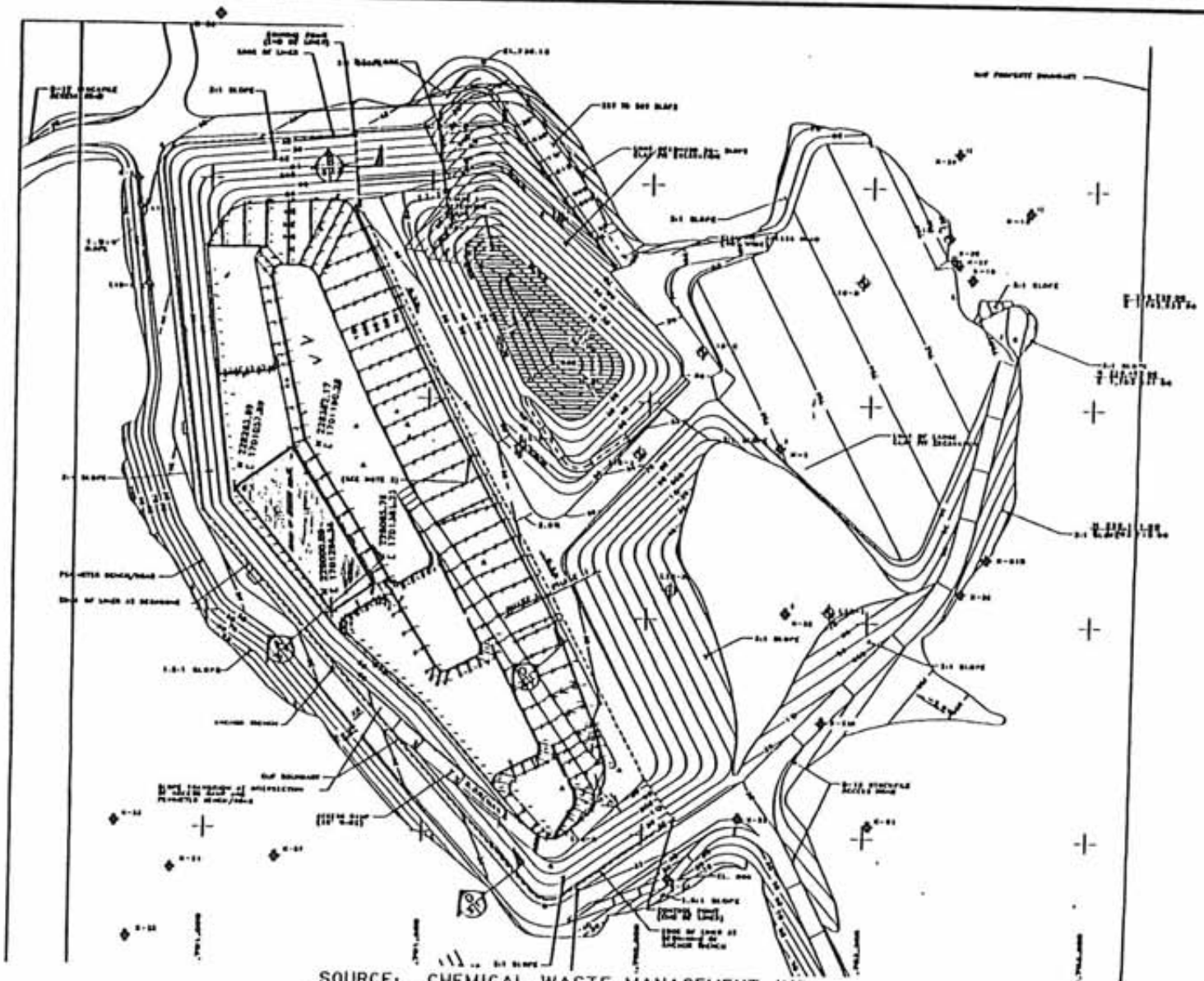


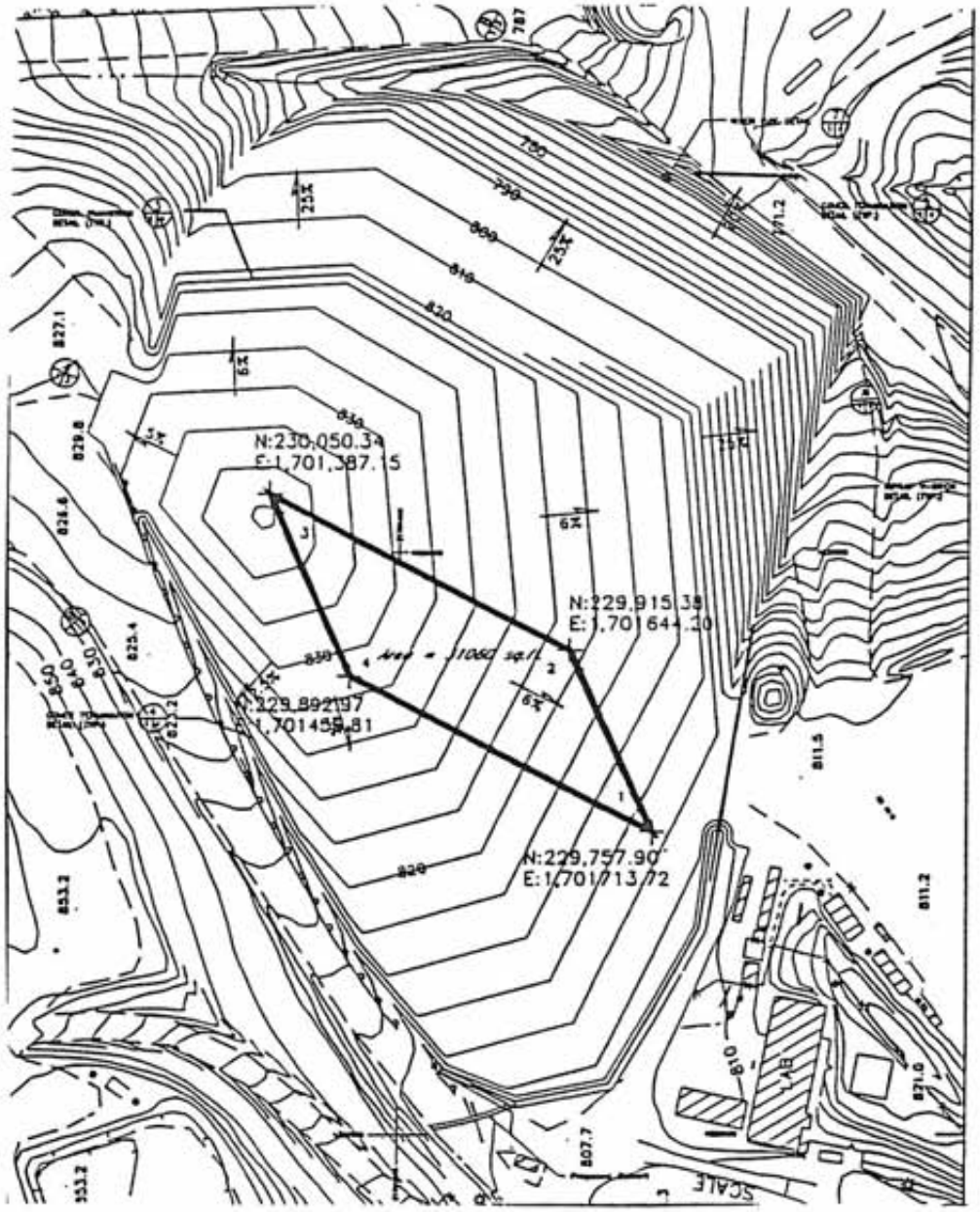
SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION



SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-15 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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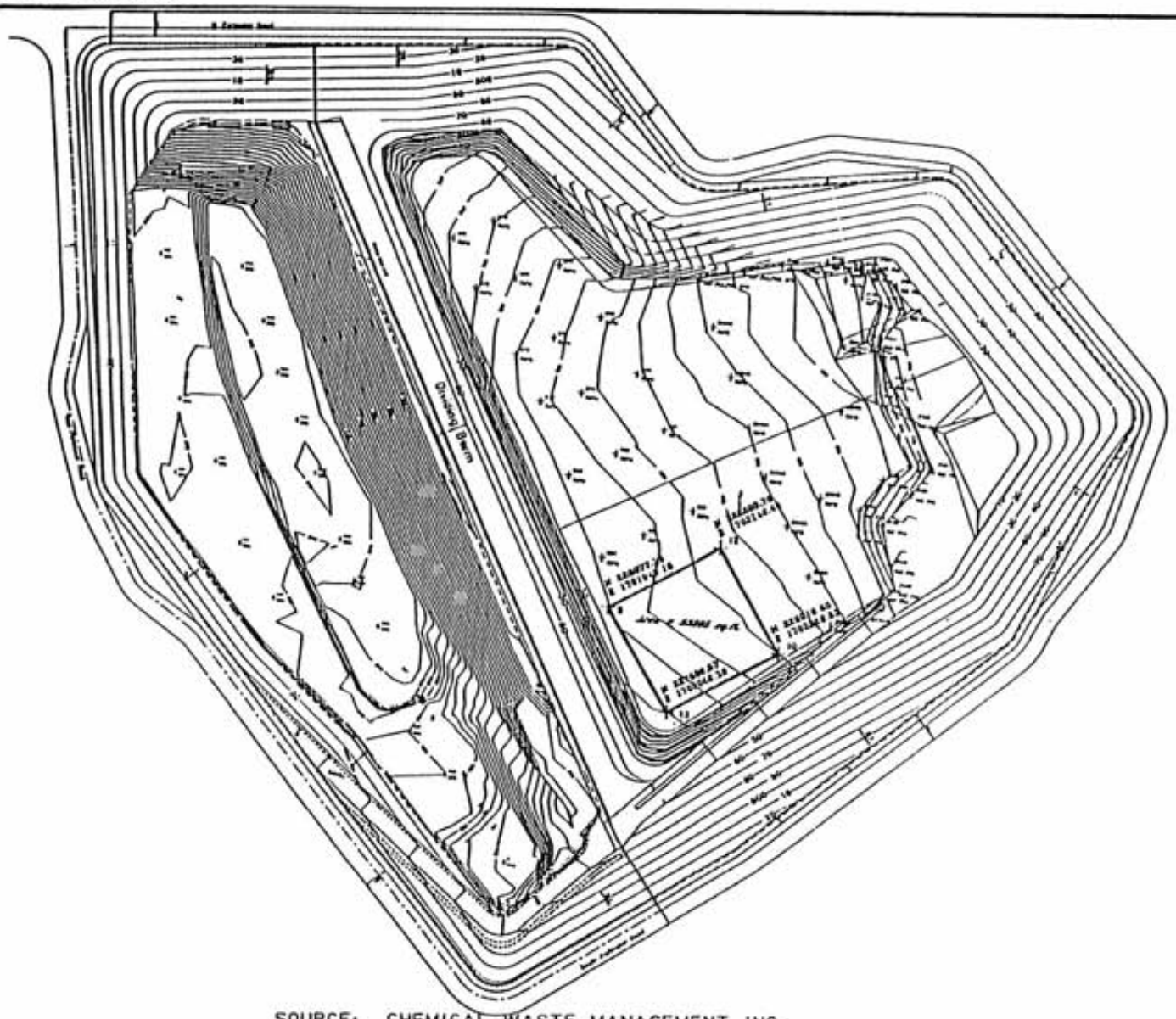

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

N

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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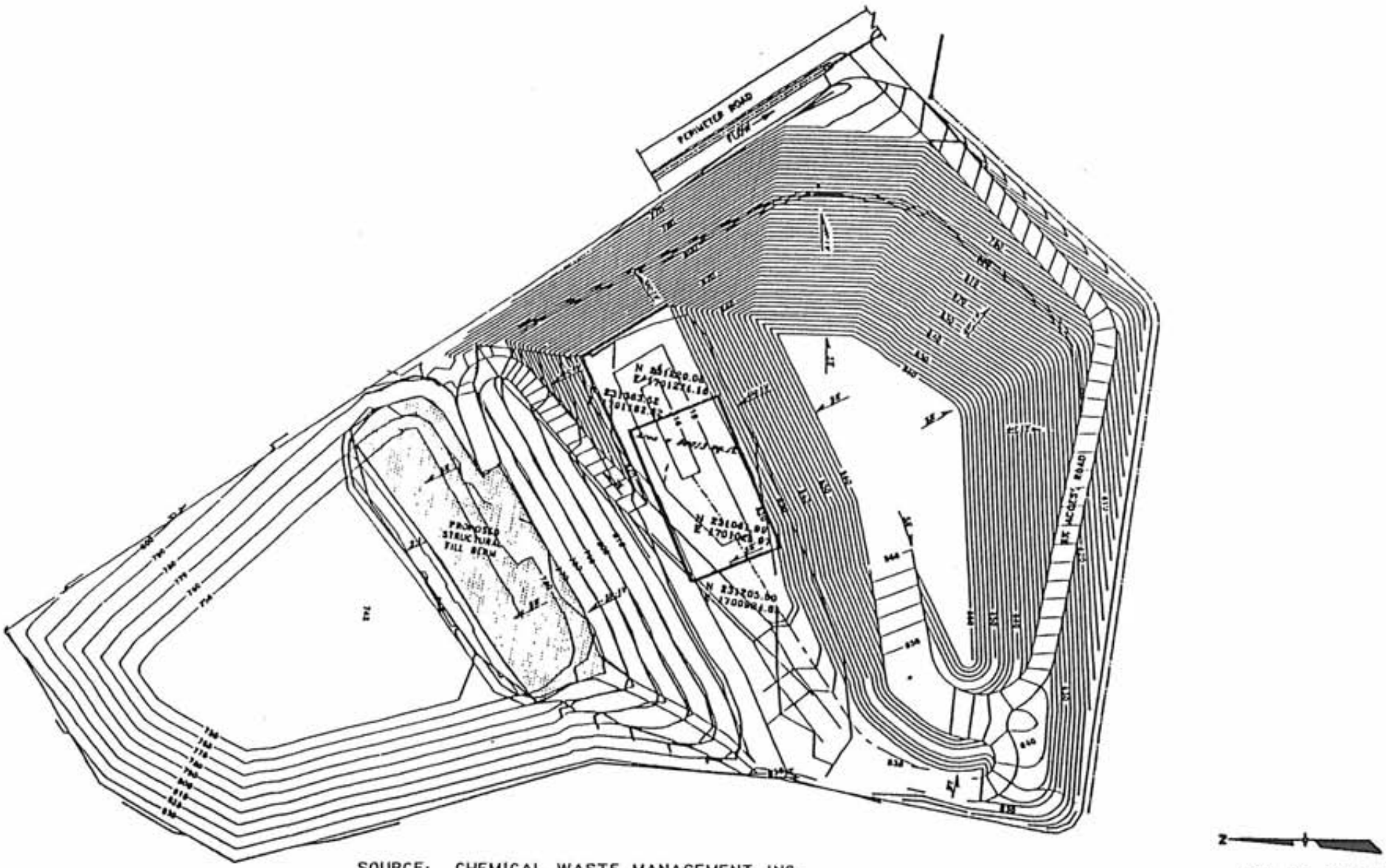

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-19 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

SOURCE: GOLDER ASSOCIATES INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-14 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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Appendix E
Tables of Sampling Dates at Each Source

APPENDIX E

TABLE E-1
LANDFILL COMPOSITE SOIL SAMPLES
SAMPLING DATES AND TARGET ANALYTES

SamplingDate	Field Sample I.D.	Analytes on Target Compound List
3/15/94-3/16/94	B-16	Metals and SVOCs
3/16/94	B-18 PHASE I	Metals and SVOCs
3/16/94	B-18 PHASE II	Metals and SVOCs
3/16/94	B-18 PHASE II COMPOSITE A	Metals and SVOCs
3/16/94	B-18 PHASE II COMPOSITE B	Metals and SVOCs
3/15/94-3/16/94	B-19-PHASE IB	Metals and SVOCs

SVOCs = Semivolatile Organic Compounds

APPENDIX E

TABLE E-2
LANDFILL INTEGRATED SURFACE SAMPLES
SAMPLING DATES AND TARGET ANALYTES

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
4/14/94	B-13	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-15	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-16	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-19	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE I	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE I Equipment Blank	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE II	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE II Duplicate	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/02/94	B-13	Phosgene
5/02/94	B-15	Phosgene
5/04/94	B-16	Phosgene
5/04/94	B-19	Phosgene

VOCs = Volatile Organic Compounds
TVH = Total Volatile Hydrocarbons

APPENDIX E

TABLE E-3
SURFACE IMPOUNDMENT LIQUID SAMPLES
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
3/31/94	P-9	VOC's, SVOC's and TVH
3/31/94	P-14, P-14-Equipment Blank	VOC's, SVOC's and TVH
3/31/94	P-16, P-16-Duplicate	VOC's, SVOC's and TVH
4/06/94	P-9, P-9-Duplicate	VOC's, SVOC's and TVH
4/06/94	P-14	VOC's, SVOC's and TVH
4/06/94	P-16, P-16-Equipment Blank	VOC's, SVOC's and TVH
4/12/94	P-9, P-9-Equipment Blank	VOC's, SVOC's and TVH
4/12/94	P-14, P-14-Duplicate	VOC's, SVOC's and TVH
4/12/94	P-16	VOC's, SVOC's and TVH
4/18/94	P-9	VOC's, SVOC's and TVH
4/18/94	P-14, P-14-Equipment Blank	VOC's, SVOC's and TVH
4/18/94	P-16, P-16-Duplicate	VOC's, SVOC's and TVH
4/30/94	P-9, P-9-Duplicate	VOC's, SVOC's and TVH
4/30/94	P-14	VOC's, SVOC's and TVH
4/30/94	P-16, P-16-Equipment Blank	VOC's, SVOC's and TVH
5/03/94	P-9, P-9, Equipment Blank	VOC's, SVOC's and TVH
5/03/94	P-14, P-14-Duplicate	VOC's, SVOC's and TVH
5/03/94	P-16	VOC's, SVOC's and TVH

Notes:
VOC's=Volatile Organic Compounds
TVH=Total Volatile Hydrocarbons
SVOC's=Semivolatile Organic Compounds

APPENDIX E

TABLE E-4
AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
3/30/94	Equipment Blank	TO-14 VOCs and TVH
3/31/94	P-9	All VOCs and TVH
3/31/94	P-14	TO-14 VOCs and TVH
3/31/94	P-14-Equipment Blank	TO-11 VOCs and Phosgene
3/31/94	P-16	TO-14 VOCs and TVH
3/31/94	P-16-Duplicate	TO-14 VOCs and TVH
4/06/94	P-9	TO-14 VOCs and TVH
4/06/94	P-9-Duplicate	TO-14 VOCs and TVH
4/06/94	P-14	TO-14 VOCs and TVH
4/06/94	P-16	TO-14 VOCs and TVH
4/06/94	P-16-Equipment Blank	TO-14 VOCs and TVH
/12/94	P-9	TO-14 VOCs and TVH
4/12/94	P-9-Equipment Blank	TO-14 VOCs and TVH
4/12/94	P-14	TO-14 VOCs and TVH
4/12/94	P-14-Duplicate	TO-14 VOCs and TVH
4/12/94	P-16	TO-14 VOCs and TVH
4/13/94	FSU	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-Duplicate	TO-14 VOCs, Phosgene, TVH, Metals, SVOCs
4/13/94	FSU-A	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-A-Equipment Blank	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-B	All VOCs, TVH, SVOCs and Metals
4/14/94	DSU	All VOCs, TVH, SVOCs and Metals
4/14/94	CPA	All VOCs, TVH, SVOCs and Metals
4/18/94	P-9	All VOCs and TVH
4/18/94	P-14	All VOCs and TVH
4/18/94	P-14-Equipment Blank	All VOCs and TVH

APPENDIX E

TABLE E-4 (continued)
AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
4/18/94	P-16	All VOCs and TVH
4/18/94	P-16-Duplicate	All VOCs and TVH
4/19/94	FSU	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU Equipment Blank	All VOCs and TVH
4/19/94	FSU-A	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU-A Duplicate	SVOCs
4/19/94	FSU-B	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU-B-Duplicate	All VOCs, TVH, and Metals
4/20/94	DSU	All VOCs, TVH, and Metals
4/20/94	DSU-Duplicate	All VOCs, TVH, and Metals
4/20/94	CPA	All VOCs, TVH, SVOCs and Metals
4/20/94	CPA-Duplicate	SVOCs
4/30/94	P-9	All VOCs and TVH
4/30/94	P-9-Duplicate	All VOCs and TVH
4/30/94	P-14	All VOCs and TVH
4/30/94	P-16	All VOCs and TVH
4/30/94	P-16-Equipment Blank	All VOCs and TVH
5/01/94	DSU	All VOCs, TVH, SVOCs and Metals
5/01/94	CPA	All VOCs, TVH, SVOCs and Metals
5/01/94	CPA-Equipment Blank	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU-A	TO-11 VOCs, Phosgene, SVOCs, Metals
5/02/94	FSU-A-Duplicate	Phosgene, Metals
5/02/94	FSU-B	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU-Duplicate	TO-11 VOCs, SVOCs
5/02/94	FSU-Equipment Blank	SVOCs, Metals

APPENDIX E

TABLE E-4 (continued)
AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
5/03/94	P-9	TO-11 VOCs, Phosgene
5/03/94	P-9-Equipment Blank	All VOCs and TVH
5/03/94	P-14	All VOCs and TVH
5/03/94	P-14-Duplicate	All VOCs and TVH
5/03/94	P-16	All VOCs and TVH
5/04/94	P-9	TO-14 VOCs and TVH
5/04/94	P-9-Equipment Blank	TO-14 VOCs and TVH
5/04/94	FSU-A	TO-14 VOCs and TVH
5/04/94	Air Blank	TO-14 VOCs and TVH

Notes:
VOCs = Volatile Organic Compounds
TVH = Total volatile Hydrocarbons
SVOCs = Semivolatile Organic Compounds

Appendix D

Ambient Air Sampling Schedule

January 2009

January 2009

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February 2009

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				January 1, 2009	2	3
4	5 Initial Monthly Setup	6 Sampling Day	7 Sampling Day	8 Sampling Day	9 Sampling Day	10 Sampling Day
11 Filter Takedown Setup/Calibration Check	12 Sampling Day	13 Sampling Day	14 Sampling Day	15 Sampling Day	16 Sampling Day	17 Filter Takedown Setup/Calibration Check
18 Sampling Day	19 Sampling Day	20 Sampling Day	21 Sampling Day	22 Sampling Day	23 Filter Takedown Setup/Calibration Check	24 Sampling Day
25 Sampling Day	26 Sampling Day	27 Sampling Day	28 Sampling Day	29 Final Takedown/Ship to Lab Motor Replacement	30	31 Initial Setup and Calibration

February 2009

February 2009

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March 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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Sampling Day	Sampling Day	Sampling Day	Sampling Day	Sampling Day	Setup/Calibration Check	Sampling Day
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Sampling Day	Sampling Day	Sampling Day	Sampling Day	Setup/Calibration Check	Sampling Day	Sampling Day
15	16	17	18	19	20	21
Sampling Day	Sampling Day	Sampling Day	Setup/Calibration Check	Sampling Day	Sampling Day	Sampling Day
22	23	24	25	26	27	28
Sampling Day	Sampling Day	Final Takedown/Ship to Lab Motor Replacement				

March 2009

March 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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					Intial Setup and Calibration	Sampling Day
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Sampling Day	Sampling Day	Sampling Day	Sampling Day	Filter Takedown	Sampling Day	Sampling Day
				Setup/Calibration Check		
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Sampling Day	Sampling Day	Sampling Day	Filter Takedown	Sampling Day	Sampling Day	Sampling Day
			Setup/Calibration Check			
22	23	24	25	26	27	28
Sampling Day	Sampling Day	Filter Takedown	Sampling Day	Sampling Day	Sampling Day	Sampling Day
		Setup/Calibration Check				
29	30	31				
Sampling Day	Final Takedown/Ship to Lab					
	Motor Replacement					

April 2009

April 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			April 1	2	3 Intial Setup and Calibration	4 Sampling Day
5 Sampling Day	6 Sampling Day	7 Sampling Day	8 Sampling Day	9 Filter Takedown Setup/Calibration Check	10 Sampling Day	11 Sampling Day
12 Sampling Day	13 Sampling Day	14 Sampling Day	15 Filter Takedown Setup/Calibration Check	16 Sampling Day	17 Sampling Day	18 Sampling Day
19 Sampling Day	20 Sampling Day	21 Filter Takedown Setup/Calibration Check	22 Sampling Day	23 Sampling Day	24 Sampling Day	25 Sampling Day
26 Sampling Day	27 Final Takedown/Ship to Lab Motor Replacement	28	29	30		

May 2009

May 2009

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					May 1 Intial Setup and Calibration	2 Sampling Day
3 Sampling Day	4 Sampling Day	5 Sampling Day	6 Sampling Day	7 Filter Takedown Setup/Calibration Check	8 Sampling Day	9 Sampling Day
10 Sampling Day	11 Sampling Day	12 Sampling Day	13 Filter Takedown Setup/Calibration Check	14 Sampling Day	15 Sampling Day	16 Sampling Day
17 Sampling Day	18 Sampling Day	19 Filter Takedown Setup/Calibration Check	20 Sampling Day	21 Sampling Day	22 Sampling Day	23 Sampling Day
24 Sampling Day	25 Final Takedown/Ship to Lab Motor Replacement	26	27	28	29	30
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June 2009

June 2009

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	June 1	2	3	4	5 Intial Setup and Calibration	6 Sampling Day
7 Sampling Day	8 Sampling Day	9 Sampling Day	10 Sampling Day	11 Filter Takedown Setup/Calibration Check	12 Sampling Day	13 Sampling Day
14 Sampling Day	15 Sampling Day	16 Sampling Day	17 Filter Takedown Setup/Calibration Check	18 Sampling Day	19 Sampling Day	20 Sampling Day
21 Sampling Day	22 Sampling Day	23 Filter Takedown Setup/Calibration Check	24 Sampling Day	25 Sampling Day	26 Sampling Day	27 Sampling Day
28 Sampling Day	29 Final Takedown/Ship to Lab Motor Replacement	30				

July 2009

July 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			July 1	2	3 Intial Setup and Calibration	4 Sampling Day
5 Sampling Day	6 Sampling Day	7 Sampling Day	8 Sampling Day	9 Filter Takedown Setup/Calibration Check	10 Sampling Day	11 Sampling Day
12 Sampling Day	13 Sampling Day	14 Sampling Day	15 Filter Takedown Setup/Calibration Check	16 Sampling Day	17 Sampling Day	18 Sampling Day
19 Sampling Day	20 Sampling Day	21 Filter Takedown Setup/Calibration Check	22 Sampling Day	23 Sampling Day	24 Sampling Day	25 Sampling Day
26 Sampling Day	27 Final Takedown/Ship to Lab Motor Replacement	28	29	30	31	

August 2009

August 2009

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27	28	29	30			

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						August 1
2	3	4	5	6	7 Intial Setup and Calibration	8 Sampling Day
9 Sampling Day	10 Sampling Day	11 Sampling Day	12 Sampling Day	13 Filter Takedown Setup/Calibration Check	14 Sampling Day	15 Sampling Day
16 Sampling Day	17 Sampling Day	18 Sampling Day	19 Filter Takedown Setup/Calibration Check	20 Sampling Day	21 Sampling Day	22 Sampling Day
23 Sampling Day	24 Sampling Day	25 Filter Takedown Setup/Calibration Check	26 Sampling Day	27 Sampling Day	28 Sampling Day	29 Sampling Day
30 Sampling Day	31 Final Takedown/Ship to Lab Motor Replacement					

September 2009

September 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		September 1	2	3	4 Intial Setup and Calibration	5 Sampling Day
6 Sampling Day	7 Sampling Day	8 Sampling Day	9 Sampling Day	10 Filter Takedown Setup/Calibration Check	11 Sampling Day	12 Sampling Day
13 Sampling Day	14 Sampling Day	15 Sampling Day	16 Filter Takedown Setup/Calibration Check	17 Sampling Day	18 Sampling Day	19 Sampling Day
20 Sampling Day	21 Sampling Day	22 Filter Takedown Setup/Calibration Check	23 Sampling Day	24 Sampling Day	25 Sampling Day	26 Sampling Day
27 Sampling Day	28 Final Takedown/Ship to Lab Motor Replacement	29	30			

October 2009

October 2009

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November 2009

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				October 1	2 Intial Setup and Calibration	3 Sampling Day
4 Sampling Day	5 Sampling Day	6 Sampling Day	7 Sampling Day	8 Filter Takedown Setup/Calibration Check	9 Sampling Day	10 Sampling Day
11 Sampling Day	12 Sampling Day	13 Sampling Day	14 Filter Takedown Setup/Calibration Check	15 Sampling Day	16 Sampling Day	17 Sampling Day
18 Sampling Day	19 Sampling Day	20 Filter Takedown Setup/Calibration Check	21 Sampling Day	22 Sampling Day	23 Sampling Day	24 Sampling Day
25 Sampling Day	26 Final Takedown/Ship to Lab Motor Replacement	27	28	29	30	31

November 2009

November 2009

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December 2009

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27	28	29	30	31		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November 1	2	3	4	5	6 Intial Setup and Calibration	7 Sampling Day
8 Sampling Day	9 Sampling Day	10 Sampling Day	11 Sampling Day	12 Filter Takedown Setup/Calibration Check	13 Sampling Day	14 Sampling Day
15 Sampling Day	16 Sampling Day	17 Sampling Day	18 Filter Takedown Setup/Calibration Check	19 Sampling Day	20 Sampling Day	21 Sampling Day
22 Sampling Day	23 Sampling Day	24 Filter Takedown Setup/Calibration Check	25 Sampling Day	26 Sampling Day	27 Sampling Day	28 Sampling Day
29 Sampling Day	30 Final Takedown/Ship to Lab Motor Replacement					

December 2009

December 2009

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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

January 2010

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17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		December 1	2	3	4 Intial Setup and Calibration	5 Sampling Day
6 Sampling Day	7 Sampling Day	8 Sampling Day	9 Sampling Day	10 Filter Takedown Setup/Calibration Check	11 Sampling Day	12 Sampling Day
13 Sampling Day	14 Sampling Day	15 Sampling Day	16 Filter Takedown Setup/Calibration Check	17 Sampling Day	18 Sampling Day	19 Sampling Day
20 Sampling Day	21 Sampling Day	22 Filter Takedown Setup/Calibration Check	23 Sampling Day	24 Sampling Day	25 Sampling Day	26 Sampling Day
27 Sampling Day	28 Final Takedown/Ship to Lab Motor Replacement	29	30	31		

Appendix E

Quality Assurance Project Plan – Congener Study

DRAFT QUALITY ASSURANCE PROJECT PLAN – CONGENER STUDY

Chemical Waste Management, Inc. Kettleman Hills Facility (KHF)

Wenck File #0742-816

Prepared for:

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KETTLEMAN HILLS FACILITY (KHF)
KINGS COUNTY, CALIFORNIA

Prepared by:

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March 2009

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APPENDICES
A QAPP Worksheet Summary
B Data Reduction/Validation

1.0 Overview

Quality Assurance (QA) refers to the system of activities to ensure that the data quality is sufficient to achieve the project goal of the KHF Congener Study. The project goal is to determine if handling and disposal of PCB contaminated waste at KHF results in unacceptable risks to human health and ecological receptors. The QA activities include quality planning, standardization of procedures, documentation, data validation, and data quality evaluations (audits). Quality Control (QC) refers to operational techniques such as instrument checks, flow rate checks, calibration checks, and use of duplicates and blanks.

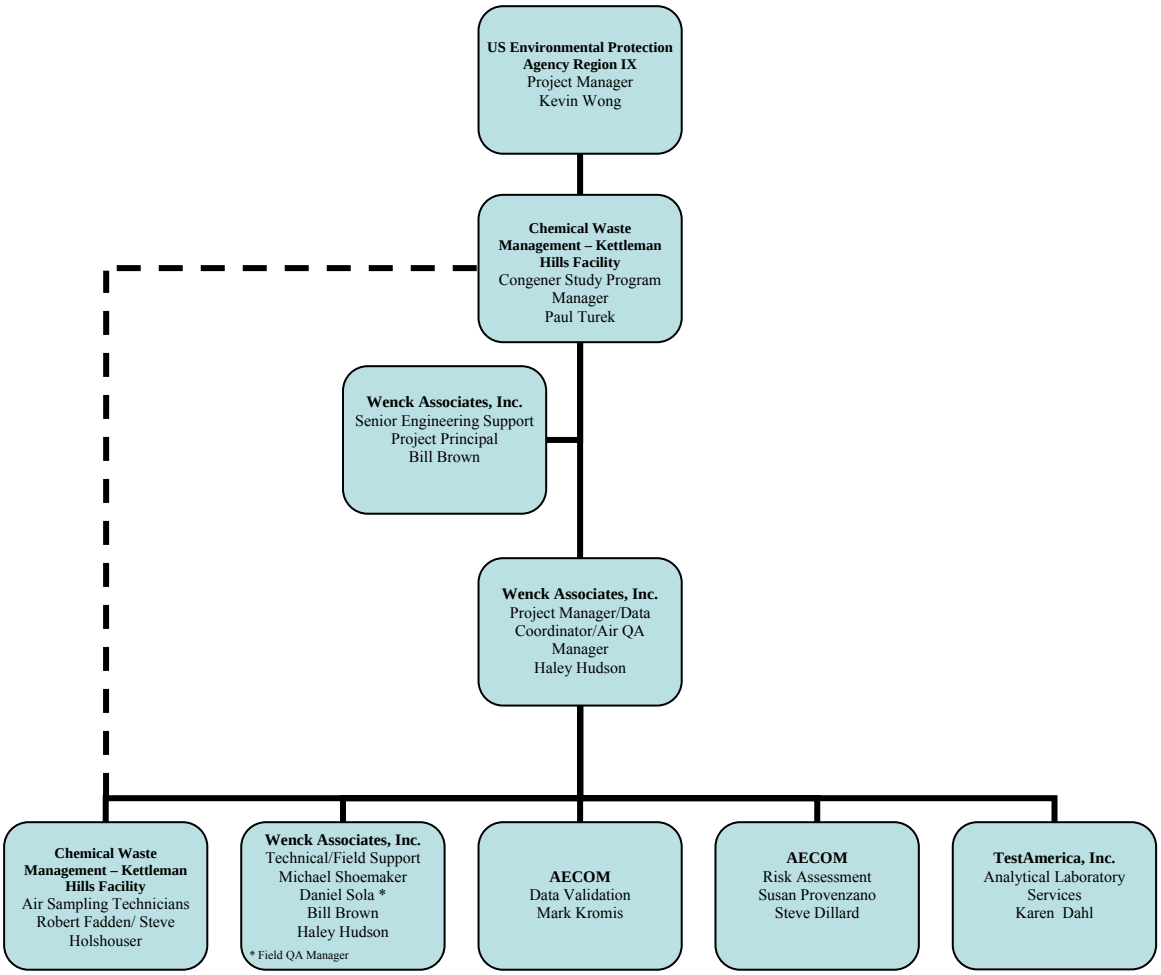
The purpose of the Quality Assurance Project Plan (QAPP) is to specify the procedures to ensure that the data accuracy, precision, completeness, and representativeness are known, documented, and sufficient to achieve the project goal. This QAPP has been designed in accordance with USEPA guidance, sampling methods, and good engineering and scientific practice.

The QAPP objectives are to ensure that the monitoring data is: 1) technically sound and defensible, and 2) is of sufficient quality to achieve the project goal. To facilitate a concise QAPP, the *Workbook for Uniform Federal Policy for Quality Assurance Project Plans,* which is Part 2A of the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP), was utilized in preparing this document. It provides examples of worksheets to assist with the preparation of QAPP in accordance with Part 1 of the UFP-QAPP (the UFP-QAPP Manual) and Section 6 (Part B) of *Quality Systems for Environmental Data and Technology Programs - Requirements with guidance for use*, ANSI/ASQ E4 (February 2004). Selected worksheets were used to address specific QAPP needs of this focused project.

Appendix A presents the Worksheets prepared to document the QAPP procedures. Several worksheets were not used since they were not applicable or unnecessarily duplicated existing documentation. The worksheets not used are listed in Appendix A along with a brief rationale for their exclusion.

2.0 Project Organizational Chart of Responsibility

Worksheets #7 and # 8 present the project personnel, responsibilities and qualifications. The following chart presents the project organization:



NOTE: Specific names subject to change.

3.0 Data Quality Objectives

The Data Quality Objective (DQO) process used for this revision of the Congener Study Workplan does not explicitly follow the sequential step-by-step guidelines presented in EPA's *Data Quality Objectives Process for Hazardous Waste Site Investigation*, EPA QA/G-4HW, Final (EPA/600/R-00/007), January 2000. , This revision of the Congener Study Workplan, which has been prepared and framed around the letter to KHF from USEPA-IX dated December 2, 2008, the USEPA-IX Technical Review of the first Draft Congener Study Workplan dated February 12, 2009, and on-going discussions with USEPA-IX, contains all of the key elements of identified in the DQO process in various locations throughout the Workplan, except for one element. The one element of the formal DQO process that has not clearly been identified is the Decision Rule, or, at what point will KHF receive the Coordinated Approval to renew their TSCA permits, including the expansion of the B-18 landfill.

4.0 Site Selection/Sample Procedures

A summary of the strategy used in determining the number and locations of the sampling areas is included in Section 3.0 of the Workplan and Worksheets #17-18. The sampling locations are presented in Figures 3 and 4 of the Workplan.

4.1 Modified Air Sampling Procedures

With several modifications to collect month-long ambient air samples, the sampling methodology will follow the procedures described in USEPA Compendium Method TO-9A (TO-9A). A site and project specific SOP is located in Appendix F of the Workplan. Worksheets #19-22 also summarize various elements related to the sampling procedures.

4.2 Surficial Soil and Vegetation Sampling Procedures

A site and project specific SOP is located in Appendix G of the Workplan. Worksheets #19-22 also summarize various elements related to the sampling procedures.

5.0 Sample Custody

All field and laboratory personnel will follow the sample custody procedures specified by applicable sampling methods in the Workplan, TO-9A and 1668A. During sample collection in the field, the chain-of-custody form will be completed. The chain-of-custody will accompany the collected samples until received from the respective laboratories. Collected samples will be shipped in accordance with the temperature preservation requirements summarized below in Section 5.1 and in Worksheet #19. Collected samples will be shipped overnight via Federal Express or UPS so as not to jeopardize the holding time requirements summarized in Section 5.2. Worksheets #26-27 also summarize the requirements for sample handling and custody.

5.1 TEMPERATURE PRESERVATION REQUIREMENTS

The temperature requirements of the samples vary between methods and are shown below. Filters will be located in their protective container and in a transport container. Excessive heat must be avoided (e.g., do not leave in direct sunlight). Once at the laboratory, all samples need to be stored at ≤ 4°C until they are extracted for analysis.

Item	Temperature Requirement	Reference
TO-9A filter and PUF cartridge temperature control during sampling and until recovery	Ship on ice, maintain <6˚ C until lab receipt Maintain <-10˚ C at lab	US EPA Compendium Method TO-9A, US EPA Method 1668A
1668A Soil and Vegetation temperature control during storage	Ship on ice, maintain <4 ˚C during shipment and at lab	US EPA Method 1668A

5.2 PERMISSIBLE HOLDING TIMES

The permissible holding times for the sample are detailed in the referenced methods. These holding times are provided in the following table:

Item	Holding Time	From:	To:	Reference
TO-9A filter and PUF cartridge	Extraction within 7 days[1], analysis less than 40 days	Completion of sample period	Time of analysis	US EPA Compendium Method TO-9A, US EPA Method 1668A
1668A Soil and Vegetation Samples	Extraction within 30 days, up to one year if stored at <-10˚ C	Completion of sample period	Time of analysis	US EPA Method 1668A

[1] Extraction within seven days after sampling only applies to the PUF filter, and not the top filters which are used to samples PCB congeners in the particulate phase. The 5-day segment top filters will be stored and refrigerated on-site until the final 5-day segment is collected. The four top filters will then be combined with the PUF filter and sent to the laboratory and extracted as one sample, as described in the sampling section of the Congener Study Workplan.

6.0 Calibrations and Frequency

Field Sampling Equipment

The calibration procedures for the PUF samplers are located in the sampling SOP located in Appendix F of the Workplan. These procedures are based on the parent method US EPA Compendium Method TO-9A. Worksheet #22 also summarizes this information. In general, each sampling unit will be fully calibrated prior to initiating each monthly sampling event. A calibration check will be performed every five days when the top filter is replaced. A full calibration will be performed after motor replacement and maintenance, prior to each month-long sampling event. Calibration criteria and corrective actions are described in the SOP. All calibration activities will be documented and maintained onsite.

The meteorological monitoring equipment is calibrated semi-annually in accordance with the manufacturer's instructions and *US EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods*. Additional detail on meteorological sampling is also located in Section 3.0 of the Workplan and Worksheet #22.

Analytical Instrumentation

Calibration procedures for individual laboratory instruments are on file with the laboratory. The sampling calibration frequency will follow manufacturer's recommendations and the laboratory SOP provided to USEPA-IX as Confidential Business Information. Worksheet #24 summarizes the required calibrations and frequency.

7.0 Analytical Procedures

Test America will be performing the analytical laboratory services for the Study and follow the analytical procedures required by US EPA Method 1668A. Test America's Standard Operating Procedure (SOP) for this method has been provided to USEPA-IX under a separate cover as Confidential Business Information.

Contact information for TestAmerica is below:

TestAmerica West Sacramento
880 Riverside Pkwy
West Sacramento, CA 95605
(916) 373-5600
Account Manager: Karen Dahl
(916) 374-4384
karen.dahl@testamericainc.com

8.0 Data Reduction, Validation, Reporting

Data reduction, validation, and reporting are discussed in Section 4.0 of the Workplan. Worksheets #34, #35 and #36 present the data validation procedures. Appendix B of this QAPP provides a detailed description of the data validation procedures.

9.0 Internal Quality Control (QC)

QC samples include field/travel blanks and duplicate samples. KHF will collect field blanks for air samples and duplicate samples air, soil, and vegetation samples. Duplicate samples will be collected for air, soil, and vegetation samples at a frequency of no less than one in every 10 samples. Field/travel blanks originate in the laboratory, and consequently represent the combined performance of both field and travel exposure. Worksheet #20 summarizes the internal QC samples for each sampled matrix.

Air Sampling

For ambient air sampling using TO-9A, field personnel will conduct sampling QC checks such as flow rate checks, leak checks, timer checks, and visual inspection of sampling lines and inlets for cracks, moisture, and debris. Sampling QC checks will be conducted before and after each sampling period. All sampling QC check activities will be documented and maintained onsite. This is discussed in detail in the SOP located in Appendix F of the Workplan and Worksheets #20 and #22.

Surficial Soil/Vegetation

Worksheets #24, #25 and #26 document the internal (QC) procedures for soil sample analyses, as well as the SOP located in Appendix G of the Workplan.

Laboratory Analysis

The laboratory will conduct and document analytical QC checks specified by Method 1668A and the laboratory's SOP provided to USEPA-IX under a separate cover as Confidential Business Information.

10.0 Performance/System Audits

TO-9A PUF Sampling

Performance and system audits are conducted to determine if QA goals have been achieved. To maintain objectivity, an independent technician will conduct one performance and system audit during the Study. All audit activities will be documented and maintained onsite.

For method TO-9A, a performance audit will quantitatively and independently evaluate the instrument flow rate calibrations. The materials and supplies used during the audit will be different than those used during normal operations.

The system audit will include confirming that personnel have followed the defined sampling and analytical procedures in the Workplan and thoroughly documented and maintained all required records on-site.

The procedure for performing this audit is summarized in the SOP located in Appendix F.

Meteorological Monitoring

Performance audits of the meteorological monitoring equipment are conducted quarterly at KHF. The audits are generally performed in accordance with the *US EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods*. This is discussed further in Section 3.4 of the Workplan.

11.0 Preventative Maintenance

Air Sampling

For TO-9A, the facility will follow the preventative maintenance task schedule based on the manufacturer's recommendations. The mobile set of monitoring equipment used for duplicate samples additionally functions as a temporary inventory of critical spare parts in case of emergency. The onsite inventory will minimize instrument downtime, while replacement parts are ordered. Preventative maintenance activities are discussed in the SOP located in Appendix F of the Workplan and Worksheet #22.

Meteorological Monitoring

Preventative maintenance on the meteorological monitoring equipment is performed semi-annually in accordance with the manufacturer's recommendations.

Laboratory Analysis

Laboratory maintenance activities are documented in Worksheet #25.

12.0 Data Procedures for Precision, Accuracy, and Completeness

Specific procedures will be used to evaluate data quality in terms of precision, accuracy, and completeness. Data precision will be evaluated on the basis of a relative standard deviation of ±20% or better for the collocated samples. Accuracy determinations will be performed by the laboratory following all internal QA/QC requirements. Duplicates will be collected in all matrices; air, soil, and vegetation. Data completeness will be evaluated as the percentage of valid data relative to the amount of data that was expected to be obtained under correct normal conditions.

The data validation process is documented in Worksheets #33, #34, #35, #36 and #37 and Appendix B of this QAPP.

13.0 Corrective Actions

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-range QC performances that may affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. This discussion of corrective actions is limited to field activities for air, soil, and vegetation sampling. Analytical methods have their own set of corrective action criteria and will not be discussed here.

Deviations from sampling procedures that may require corrective action include failed calibration checks, failed system or performance audit, failure to properly maintain equipment, incorrect operation of equipment, sampling procedures not followed correctly, timer error, and power failures.

Corrective actions for many of these deviations will simply be repair and recalibration of the equipment. However, deviations from sampling procedures that may potentially impact samples must be reported to both the Project Manager and the QA Manager, identified in Section 2.0, within 72 hours of discovery. Based on the impact and samples affected, a determination will be made on whether the data can be qualified. If the data is accepted, it will be flagged appropriately.

All corrective action proposed and implemented must be documented and reported to the Project and QA Managers.

14.0 Reporting

Specific recordkeeping requirements are discussed in Section 4.0 of the Workplan. In addition to these requirements, QA reports will be submitted to management regularly. These QA reports are documented in Worksheet #33. Reporting of project documents and records is also summarized in Worksheet #29.

15.0 References

Air/Superfund National Technical Guidance Study Series. Volume IV – Guidance for Ambient Air Monitoring at Superfund Sites (Revised). Office of Air Quality Planning and Standards. U.S. Environmental Protection Agency, May 1993.

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Appendix A

QAPP Worksheet Summary

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Worksheets Not Used (and brief rationale):

QAPP Worksheet #1.	Title and Approval Page (Administrative information not applicable to this study)
QAPP Worksheet #2.	QAPP Identifying Information (Worksheets are an integral component of the QAPP)
QAPP Worksheet #3.	Distribution List (Administrative information not applicable to this study)
QAPP Worksheet #4.	Project Personnel Sign-Off Sheet (Project team and sampling effort are small and concise enough that this is not warranted)
QAPP Worksheet #5.	Project Organizational Chart (Presented in Work Plan)
QAPP Worksheet #6.	Communication Pathways (The project and project team are small enough that laying out a communication plan isn't warranted)
QAPP Worksheet #9.	Project Scoping Session Participants Sheet (Overall scope of project has been laid out in December 2, 2008 letter from USEPA-IX)
QAPP Worksheet #13.	Secondary Data Criteria and Limitations Table (No secondary data to be collected)
QAPP Worksheet #14.	Summary of Project Tasks (Fully presented in Work Plan)
QAPP Worksheet #28.	QC Samples Table (This is a duplicate of information provided in other tables.)
QAPP Worksheet #31.	Planned Project Assessment Table (Fully addressed in Risk Assessment portion of Work Plan)
QAPP Worksheet #32.	Assessment Findings and Response Actions (Fully addressed in Risk Assessment portion of Work Plan)

QAPP Worksheet #7

Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Paul Turek	Environmental Manager	Chemical Waste Management Kettleman Hills Facility	Overall Project Manager for WM and liaison with USEPA.	B.S. Meteorology. Nineteen years in the environmental field, the last sixteen years with WM.
Bill Brown, P.E.	Project Principal/Field Team Leader	Wenck Associates	Overall program coordination, member of field sampling team.	B.S. Chemistry; M.S. Chemical Engineering. Twenty-two years experience with environmental consulting and impact analysis studies.
Haley Hudson	Project Manager	Wenck Associates	Project management, data management, member of field sampling team.	B.S. Chemical Engineering. Four years experience environmental consulting, performed ambient air studies at KHF.
Daniel V Sola	Field QA Manager/Field Team Leader	Wenck Associates	Provides oversight and documentation of field QA/QC procedures. Coordinates sample shipment and delivery with laboratory, member of field sampling team.	B.S. Geology. Twenty-five years experience with Superfund and RCRA protocols.
Mike Shoemaker, P.E.	Project Engineer	Wenck Associates	Member of field sampling team, ambient air auditor.	B.S. Chemical Engineering. Six years experience environmental consulting, sampling, and impact analysis studies.

QAPP Worksheet #7 (cont.)

Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Robert Fadden	Environment Compliance Specialist	Chemical Waste Management Kettleman Hills Facility	Air sampling via TO-9A, member of field sampling team.	B.S. Professional Aeronautics, MS Environmental Policy and Management. Ten years overall experience in groundwater, air and soil sampling.
Steve Holshouser	Field Technician	Chemical Waste Management Kettleman Hills Facility	Air sampling via TO-9A, member of field sampling team.	One year of experience in air sampling and one year of experience in PCB and water sampling.
Susan Provenzano	Risk Assessor	AECOM	Human Health Risk Assessment.	B.S. Earth Science; MS Marine Environmental Science, twenty-five years overall experience with over twenty years performing risk assessments.
Steve Dillard	Risk Assessor	AECOM	Ecological Risk Assessment.	B.S Zoology; MS Environmental Systems Engineering, Over twenty years consulting experience, including risk assessments.
Mark Kromis	Chemist	AECOM	Data Validation.	B.S Chemistry; twenty-two years overall experience. Certified on all three ACS levels for performing data validation, Certified ISO 17025 lead auditor.
Karen Dahl	Laboratory Project Manager	TestAmerica	Acts as the primary point of contact at TestAmerica.	BS Biological Science; fifteen years experience.

QAPP Worksheet #8

Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Sampling	40 CFR 1910.120 "HAZWOPER"	Various	Various (Base 40-hr and annual refresher updates completed)	Wenck Associates: Bill Brown Haley Hudson Mike Shoemaker Dan Sola, WMI field staff	Field Sampling	Wenck Associates, Inc. H &S files
Field Sampling	40 CFR 1910.120 "HAZWOPER"	Various	Various (Base 40-hr and annual refresher updates completed)	Waste Management: Rob Fadden Steve Holshouser	Field Sampling	WMI H&S Files

QAPP Worksheet #10

Problem Definition

The problem to be addressed by the project:

Chemical Waste Management, Inc. (CWMI) – Kettleman Hills Facility (KHF) is answering the environmental question being asked (below) in sufficient detail to finally obtain a Coordinated Approval from United States Environmental Protection Agency – Region IX (USEPA-IX) and California's Department of Toxic Substances Control (DTSC) to renew KHF's Toxic Substances Control Act (TSCA) permits to handle and dispose polychlorinated biphenyl (PCB) containing waste, and expand KHF's B-18 landfill .

The environmental questions being asked:

"Have the retrospective and current facility operations adversely impacted the health and welfare of the proximate residential community and ecosystem directly adjacent to the facility"? This question has been asked by community stakeholders and environmental activists and is summarized in a letter from USEPA-IX to KHF dated December 2, 2008. In this same letter USEPA-IX has focused the scope of this question to 12 designated dioxin-like or co-planar PCB congeners.

Observations from any site reconnaissance reports:

None currently identified or listed.

A synopsis of secondary data or information from site reports:

- Current and historic records of wastes received at KHF
- Meteorological data collected on-site at KHF, as well as data collected in Fresno, CA
- 1994 Topographical, Meteorological and Airborne Contaminant Characterization Study completed at KHF
- Ambient Air Monitoring Program (AAMP) ongoing at KHF

The possible classes of contaminants and the affected matrices:

12 designated dioxin-like or co-planar PCB congeners and their effects on human health and ecological receptors exposed to the air, surficial soil, and vegetation adjacent to KHF.

The rationale for inclusion of chemical and nonchemical analyses:

See December 2, 2008 letter to KHF from USEPA-IX

Information concerning various environmental indicators:

The impact to human health and ecological receptors from current and bio-accumulated exposure will be assessed through field sampling and analysis followed by a human health and ecological risk assessment.

Project decision conditions ("If..., then..." statements):

These will be determined by USEPA-IX depending on either the absence or level of exposure risk determined through the project.

QAPP Worksheet #11

Project Quality Objectives/Systematic Planning Process Statements

Who will use the data? CWMI, Wenck Associates and AECOM will be the primary data users. USEPA-IX staff will be the regulatory agency and reviewer of the data and final report.

What will the data be used for? Preparation of a Human Health and Ecological Risk Assessment as described in the Workplan**.**

What type of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) 12 dioxin-like PCB congeners in surficial soil, vegetation, and ambient air representing the KHF buffer zone as described in the December 2, 2008 Request for sampling letter from the USEPA-IX.

How "good" do the data need to be in order to support the environmental decision?

The data must achieve low enough detection limits to support the quantitative human health and ecological risk assessment. The data validation, quality, and usability requirements have been established and are summarized in Appendix B of the Quality Assurance Project Plan.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)

The number and location of the samples of air, soil, and vegetation were agreed to with the USEPA and this level of effort is summarized in Section 3.0 of the Workplan.

Where, when, and how should the data be collected/generated?

The vegetation data will be collected during the 2009 growth (target March) and dormant (summer) periods at the site. The surficial soil sampling can be collected in conjunction with the first (growth phase) of the vegetation sampling. Air sampling began in January 2009 and month-long samples will be collected for a period of one year.

How will the data be reported? Validated data will be compiled in a database and provided to the AECOM risk assessment team. A final report will be prepared summarizing all of the sampling and analytical results as well as a final report of the risk assessment. The report will be provided to USEPA-IX.

How will the data be archived? Wenck, AECOM, and CWMI will retain project files according to corporate policies.

QAPP Worksheet #12

Measurement Performance Criteria Table

Matrix	Soil
Analytical_Group	PCBs
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance_Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Soil and Vegetation Sampling SOP	2	Precision-Overall	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Field Duplicates	S+A
		Precision-Lab	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Laboratory Duplicates	A
		Accuracy/Bias	%Recovery 50% - 150%	OPR	A
		Accuracy/Bias	%Recovery within limits specified in Table 6 of method 1668A	Labeled Standards	A
		Sensitivity	< QL	EB, FB, MB	S+A
		Sensitivity	40% at QL	Lab Fortified Blank at QL	A

QAPP Worksheet #12

Measurement Performance Criteria Table

Matrix	Vegetation
Analytical Group	PCBs
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
Soil and Vegetation Sampling SOP	2	Precision-Overall	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Field Duplicates	S+A
		Precision-Lab	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Laboratory Duplicates	A
		Accuracy/Bias	%Recovery 50% - 150%	OPR	A
		Accuracy/Bias	%Recovery within limits specified in Table 6 of method 1668A	Labeled Standards	A
		Sensitivity	< QL	EB, FB, MB	S+A
		Sensitivity	40% at QL	Lab Fortified Blank at QL	A

QAPP Worksheet #12

Measurement Performance Criteria Table

Matrix	Air
Analytical Group	PCBs
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Air Sampling SOP	2	Precision-Overall	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Field Duplicates	S+A
		Precision-Lab	RPD ≤ 50% when PCB detects for both field duplicate samples are > 5X the QL	Laboratory Duplicates	A
		Accuracy/Bias	%Recovery 35% - 135%	Surrogate Spike (organics)	A
		Accuracy/Bias	%Recovery 50% - 150%	OPR	A
		Accuracy/Bias	%Recovery within limits specified in Table 6 of method 1668A	Labeled Standards	A
		Sensitivity	< QL	EB, FB, MB	S+A
		Sensitivity	40% at QL	Lab Fortified Blank at QL	A

[1]Reference number from QAPP_Worksheet_#21 (see Section 3.1.2).
[2]Reference number from QAPP_Worksheet_#23 (see Section 3.2).

QAPP Worksheet #15

Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	Congener Number	CAS Number	Project Action Limit [1] (pg/g)	Project Quantitation limit (pg/g)[2]	Analytical Method 1668A MDLs (pg/g)
3,3'4,4'-Tetrachlorobiphenyl	77	32598-13-3	34,000	2	2
3,4,'4,5-Tetrachlorobiphenyl	81	70362-50-4	11,000	2	2
2,3,3',4,4'-Pentachlorobiphenyl	105	32598-14-4	110,000	2	2
2,3,4,4',5-Pentachlorobiphenyl	114	74472-37-0	110,000	2	2
2,3',4,4',5-Pentachlorobiphenyl	118	31508-00-6	110,000	2	2
2',3,4,4',5-Pentachlorobiphenyl	123	65510-44-3	110,000	2	2
3,3',4,4',5-Pentachlorobiphenyl	126	57465-28-8	34	2	2
2,3,3',4,4',5-Hexachlorobiphenyl	156	38380-08-4	110,000	2	2
2,3,3',4,4',5'-Hexachlorobiphenyl	157	69782-90-7	110,000	2	2
2,3',4,4',5,5'-Hexachlorobiphenyl	167	52663-72-6	110,000	2	2
3,3',4,4',5,5'-Hexachlorobiphenyl	169	32774-16-6	110	2	2
2,3,3',4,4',5,5'-Heptachlorobiphenyl	189	39635-31-9	110,000	2	2

(1) Project Action Limits are the December 2008 USEPA-IX Preliminary Remediation Goals.
(2) MDLs listed in the table above are not corrected for sample weight or % moisture. Sample reporting limits will be corrected for weight and % moisture.

QAPP Worksheet #15

Reference Limits and Evaluation Table

Matrix: Vegetation

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	Congener Number	CAS Number	Project Action Limit [1] (pg/g)	Project Quantitation limit (pg/g)[2]	Analytical Method 1668A MDLs (pg/g)
3,3'4,4'-Tetrachlorobiphenyl	77	32598-13-3	34,000	2	2
3,4,'4,5-Tetrachlorobiphenyl	81	70362-50-4	11,000	2	2
2,3,3',4,4'-Pentachlorobiphenyl	105	32598-14-4	110,000	2	2
2,3,4,4',5-Pentachlorobiphenyl	114	74472-37-0	110,000	2	2
2,3',4,4',5-Pentachlorobiphenyl	118	31508-00-6	110,000	2	2
2',3,4,4',5-Pentachlorobiphenyl	123	65510-44-3	110,000	2	2
3,3',4,4',5-Pentachlorobiphenyl	126	57465-28-8	34	2	2
2,3,3',4,4',5-Hexachlorobiphenyl	156	38380-08-4	110,000	2	2
2,3,3',4,4',5'-Hexachlorobiphenyl	157	69782-90-7	110,000	2	2
2,3',4,4',5,5'-Hexachlorobiphenyl	167	52663-72-6	110,000	2	2
3,3',4,4',5,5'-Hexachlorobiphenyl	169	32774-16-6	110	2	2
2,3,3',4,4',5,5'-Heptachlorobiphenyl	189	39635-31-9	110,000	2	2

(1) Project Action Limits are the December 2008 USEPA-IX Preliminary Remediation Goals.
(2) MDLs listed in the table above are not corrected for sample weight or % moisture. Sample reporting limits will be corrected for weight and % moisture.

QAPP Worksheet #15

Reference Limits and Evaluation Table

Matrix: Air

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	PCB Congener Number	CAS Number	Project Action Limit [1] (pg/m^3)	Approximate Quantitation Limits[2] (pg/m^3)	Analytical Method 1668A MDLs (pg/filter)
3,3'4,4'-Tetrachlorobiphenyl	77	32598-13-3	640	0.15	1,000
3,4,4',5-Tetrachlorobiphenyl	81	70362-50-4	210	0.15	1,000
2,3,3',4,4'-Pentachlorobiphenyl	105	32598-14-4	2,100	0.15	1,000
2,3,4,4',5-Pentachlorobiphenyl	114	74472-37-0	2,100	0.15	1,000
2,3',4,4',5-Pentachlorobiphenyl	118	31508-00-6	2,100	0.15	1,000
2',3,4,4',5-Pentachlorobiphenyl	123	65510-44-3	2,100	0.15	1,000
3,3',4,4',5-Pentachlorobiphenyl	126	57465-28-8	0.64	0.15	1,000
2,3,3',4,4',5-Hexachlorobiphenyl	156	38380-08-4	2,100	0.15	1,000
2,3,3',4,4',5'-Hexachlorobiphenyl	157	69782-90-7	2,100	0.15	1,000
2,3',4,4',5,5'-Hexachlorobiphenyl	167	52663-72-6	2,100	0.15	1,000
3,3',4,4',5,5'-Hexachlorobiphenyl	169	32774-16-6	2.1	0.15	1,000
2,3,3',4,4',5,5'-Heptachlorobiphenyl	189	39635-31-9	2,100	0.15	1,000

(1) Project Action Limits are the December 2008 USEPA-IX Preliminary Remediation Goals.
(2) Estimated to compare to Project Action Levels assuming 6,480 m^3 of air is sampled per filter each month.

QAPP Worksheet #16

Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Anticipated Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Air Sampling (Q1)	Wenck/CWMI	January 2009	March 2009	Analytical Results	April 2009
Meteorological Monitoring	Wenck/CWMI	January 2009	March 2009	Analytical Results	April 2009
Surficial Soil Sampling	Wenck	March 2009	March 2009	Analytical Results	April 2009
"Green" Vegetation Sampling	Wenck	March 2009	March 2009	Analytical Results	April 2009
Risk Assessment	Wenck/AECOM	May 2009	June 2009	Risk Assessment and Summary Report	June 2009
USEPA-IX Review of Risk Assessment and Release of "Coordinated Approval" to CWMI	USEPA-IX	June 2009	August 2009	"Coordinated Approval"	August 2009
"dormant" vegetation sampling	Wenck	Summer 2009	Summer 2009	Analytical Results	August 2009
Air Sampling (Q2-Q4)	Wenck/CWMI	April 2009	December 2009	Final Summary Report	February 2010
Meteorological Monitoring (Q2-Q4)	Wenck/CWMI	April 2009	December 2009	Final Summary Report	February 2010

QAPP Worksheet #17

Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

See Workplan and USEPA-IX letter dated December 2, 2008, Appendix A of the Workplan for additional detail.

In general, the air sampling is based on one location being representative of background (UMS-1) and two locations representative of KHF impacts (MSP & DMS-1) given the predominant wind directions typically flowing from the northwest to southeast. The impact locations were selected given their proximity to the B-18 landfill which is the only active waste disposal unit at KHF permitted to accept TSCA designated waste. Meteorological data will also be collected to support the justification of the sampling stations as background and impact.

Surficial soil and vegetation samples are collected in a grid system near the facility property line to represent the bio-accumulated impacts from current and historic deposition to the buffer zone surrounding KHF. Samples will be collected inside of the facility property line firebreak, closer to the source of emissions, to avoid access issues and to conservatively estimate emissions in areas where the target pollutants would be expected to be at a higher concentration. One sample location next to the B-18 landfill was also selected to represent ecological exposures inside the property line as requested by USEPA-IX. This location will integrate five increments for hillside deposits from air transport and also integrate into its composite five discrete sample points that will be collected in runoff swales to represent surficial sediments that may concentrate target pollutants in sedimentation collection areas.

Composite samples will be collected to capture impacts around the entire facility. Given the transport pathway of the target pollutants is wind-blown dust, the samples collected on the northern half of the facility will represent background while those on the southern end will represent those affected by facility operations.

Vegetation samples will be collected two times during the year. The first round of vegetation sampling, and the data set used in the risk assessment, will be during the spring when the vegetation is green. This is assumed to be the conservative data set given that PCB congeners are water soluble and, if taken up by plant species, would be expected to be at a higher concentration in the green plant tissue. As a measure of thoroughness and control, a second round of vegetation samples will be collected in the summer when most of the plant species and dried out and dormant.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

See Workplan, Workplan Figures, Appendix A of the Workplan, and USEPA-IX letter dated December 2, 2008 for additional detail.

See above for additional detail.

The matrices selected for this study were selected as prescribed by USEPA-IX. However, the overall rational is that the off-site exposure routes for PCB congeners are inhalation of wind-blown dust in air, feeding on vegetation, and contact exposure to PCB congeners in the wind blown dust deposited on the plants and surficial soil. Because KHF is located in a very arid region, there is no surface water for exposure along that pathway. Also, since any wind blown PCB congeners would not be expected to reach groundwater, this matrix was eliminated from the study as well.

QAPP Worksheet #18

Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (Identify Field Duplicates)	Sampling SOP Reference	Rationale for Sampling Location
See Section 3.0, 3.2, and Fig 4 of Work Plan	Soil	Surface 0-2 inches	Dioxin-Like PCB Congeners	Low	8 Composites (80 Increments, 10 Increments/Composite)[1] 16 Field Composite Duplicates[2] 1 Laboratory Duplicate[3] 1 Matrix Spike[3] 1 Matrix Spike Duplicate[3]	Workplan Appendix G	See Work Plan Section 3.2
See Appendix G of the Workplan	Water	NA	Dioxin-Like PCB Congeners	Low	4 Rinsate Blanks[4]	Workplan Appendix G	See Workplan Appendix G
See Section 3.0, 3.2, 3.3, and Fig 4 of Work Plan	Vegetation	NA	Dioxin-Like PCB Congeners	Low	8 Composites 1 Laboratory Duplicate[3] 1 Matrix Spike[3] 1 Matrix Spike Duplicate[3]	Workplan Appendix G	See Work Plan Section 3.2 and 3.3
See Section 3.0, 3.1 and Fig 3 of Work Plan	Ambient Air	NA	Dioxin-Like PCB Congeners	Low	12 x 1 Month Samples at Each of Three Locations 1 Collocated Sample[5] 4 Duplicates[6]	Workplan Appendix F	See Work Plan Section 3.1
See Section 3.0, 3.1, 3.4, and Fig 3 of Work Plan	Meteorology	NA	Meteorology Wind Speed and Direction	Wind Speed +/- 0.6 mph Wind Direction +/-5 degrees	Continuous	Mfg. Information KHF	Workplan Section 3.4

1 – Each composite sample will consist of 10 increments, which means that 80 soil/vegetation samples will be collected in the field. All increments will be composited at the laboratory in order to reduce handling of samples in the field.

2 – USEPA-IX will collect a field composite of each of the soil samples for independent analysis. Each field composite will consist of the same 10 increments from the respective areas that the laboratory will composite with the only exception that they will be composited in the field. Wenck will collect a duplicate of the USEPA field composites to put on hold at the laboratory.

3 – Since the sample increments will be composited in the laboratory, these samples will not be collected separately in the field. The lab will run these analyses from the composited samples. More than enough material will be available for these analyses.

4 – One rinsate sample will be collected each day of sampling (anticipate 2 days) from each sample team for a total of 4 (2 soil/2 vegetation). One rinsate blank will be analyzed for each sampling matrix and the second sample will be held for additional confirmation in the event of detected contamination.

5 – A fourth "collocated" sample will be collected during one month of the first five months of sampling to determine if impact sample locations are optimally sited. Once results are received, the impact sampling locations will be reviewed.

6 – Four duplicates will be collected (approximately 1 per quarter) to maintain a duplicate rate of 10% (4 duplicates for 36 month-long samples).

QAPP Worksheet #19

Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Surficial Soil	Dioxin-Like PCB Congeners	Low	Method 1668A	10 g	1 4-oz[2] glass jar, amber[3]	Ice, <6˚ C until lab receipt <-10˚ C at lab	365/45
Vegetation	Dioxin-Like PCB Congeners	Low	Method 1668A	10 g	1 500-mL[2] glass jar, amber[3]	Ice, <6˚ C until lab receipt <-10˚ C at lab	365/45
Ambient Air	Dioxin-Like PCB Congeners	Low	Method 1668A	6,480 m^3 +/- 10%	Quartz filter and PUF/XAD Cartridge	Ice, <4 ˚C	Extraction within 7 days Analysis within 40 days of extraction
Water (for rinsate)	Dioxin-Like PCB Congeners	Low	Method 1668A	1 L	1 1-L glass jar, amber[3]	Ice, <6˚ C	365/45

1 - Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

2 – As provided by the laboratory

3 - Clear glass is acceptable if sample is protected from light

QAPP Worksheet #20

Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Discrete Sampling Locations[2]	No. of samples at Each Location	No. of Total Composite Samples	No. of Travel Blanks	No. of Field Duplicates	No. of Equip. Blanks	Total No. of Samples to Lab[4]
Soil	Dioxin-like PCB Congeners	Low	Method 1668A	80	1	8	NA	16[note 3]	1	89 (80 increments, 8 field composite duplicates, 1 equip blank)
Vegetation "green"	Dioxin-like PCB Congeners	Low	Method 1668A	80	1	8	NA	0	1	81
Vegetation "dormant"	Dioxin-like PCB Congeners	Low	Method 1668A	80	1	8	NA	0	1	81
Air	Dioxin-like PCB Congeners	Low	Method 1668A	3	12	NA	12	4	NA	52
Air "Admin Bldg"[5]	Dioxin-like PCB Congeners	Low	Method 1668A	1	1	NA	NA	NA	NA	1
Water[6]***	Dioxin-like PCB Congeners	Low	Method 1668A	4	1	NA	NA	NA	NA	4

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
[2]If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
[3]Two field composites will be collected from each area. One will be sent from USEPA-IX to an independent lab and one will be held by Wenck.
[4]The lab will composite the samples. Duplicates will be taken from the composite samples at the lab.
[5]This sample is the one-month collocated sample that will be collected near the administration building to correlate to the MSP location.
[6]The water sample will be a rinsate blank. ***NO ground or surface water is being sampled.***

QAPP Worksheet #21

Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
NA	Air Sampling SOP (Appendix F in Workplan)	Wenck Associates	TE-1000 Hi-Volume PUF samplers	Y	
NA	Soil and Vegetation Sampling SOP (Appendix G in Workplan)	Wenck Associates	Misc hand tools	Y	

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
TE-1000 PUF Samplers	Multi-point calibrations	Motor replacement		Motor seals, gaskets, other mechanical parts	Monthly	Slope +/- 0.990	Recalibrate and/or perform maintenance	Rob Fadden/ Steve Holshouser	Workplan Appendix F
TE-1000 PUF Samplers	Single-point calibration checks			Motor seals, gaskets, other mechanical parts	Weekly	Flow +/- 10%	Recalibrate and/or perform maintenance	Rob Fadden/ Steve Holshouser	Workplan Appendix F
TE-1000 PUF Samplers			Performance Audit	Systems Audit	Annually	Audit points +/- 10%	Flag affected data	Mike Shoemaker	Workplan Appendix F
Meteorological Station	Various Calibration Methods as listed in Semiannual Calibration Reports	Various	Performance Audit	Debris, connections, other mechanical parts	Quarterly	Wind Speed +/- 0.6 mph Wind Direction +/-5 degrees Temp +/-0.4 ˚F Barometric Pressure +/-2 mb Precipitation +/- 3% of input	Recalibrate and/or perform maintenance	AMEC Geomatrix	Mfg information KHF

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #23

Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or DisplayText	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
1	PCB Preparation for Analysis by HRGC/HRMS [Method 1668A] 5/23/08 SOP No. WS-IDP-0013, Rev. 1	Definitive	PCBs	Extract Apparatus	Test America	N
2	PCB Analysis by HRGC/HRMS [Method 1668A] 5/23/08 SOP No. WS-ID-0013, Rev. 3	Definitive	PCBs	HRGC/HRMS	Test America	N
3	SOP SAC-QA-0004 Maintenance and Calibration Check of Fixed and Adjustable Volume Autopipettors, Autodispensers and Volumetric Containers, 10/15/08, Revision 4	Definitive	General	Auto-pipettes	Test America	N
4	SOP SAC QA-0041, Calibration and Calibration Check of Balances, 01/05/09, Revision 6 Maintenance and Calibration Check of Fixed and Adjustable Volume Autopipettors, Autodispensers and Volumetric Containers, 10/15/08, Revision 4	Definitive	General	Balance	Test America	N
5	SOP WS-OP-0013, Determination of Percent Moisture, 11/15/2008, Revision 4	Definitive	General	Drying Oven	Test America	N

QAPP Worksheet #24

Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS	Tune (PFK)	Once per 12 hours, prior to sample analysis.	Resolving power > 10,000 at m/z 304.9824 +/- 5ppm of expected mass	1) Retune instrument. 2) Reanalyze PFK	Analyst	WS-ID-0013
HRGC/HRMS	Multipoint Calibration (5points, ICAL)	Initially and as required	Int. Std < 40% RSD Natives < 20% RSD Ion Rations within Table 9 limits, and S/N ≥ 10	1) Evaluate system 2) Recalibrate	Analyst	WS-ID-0013
HRGC/HRMS	Daily Continuing Calibration Standard (CCV)	Once per 12 hours, prior to sample analysis	Int. Std < 50% RSD Natives < 30% RSD Ion Rations within Table 9 limits, and S/N ≥ 10	1) Evaluate system 2) Reanalyze CCV 3) Recalibration (ICAL) as necessary	Analyst	WS-ID-0013

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #25

Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
HRGC/HRMS	Parameter Setup	Physical Check	Physical Check	Initially, prior to daily use	Correct Parameters	Reset if incorrect	Analyst	WS-ID-0013
HRGC/HRMS	Tune Check	Instrument Performance	Conformance to instrument tuning	Initially, prior to daily use	Compliance to ion abundance criteria	Correct the problem then repeat the tune check	Analyst	WS-ID-0013

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #26

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Wenck and CWMI Field Staff
Sample Packaging (Personnel/Organization): Wenck and CWMI Field Staff
Coordination of Shipment (Personnel/Organization): Wenck and CWMI Field Staff
Type of Shipment/Carrier: FEDEX
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Assigned laboratory personnel (See Worksheet 30 for laboratories providing analytical services)
Sample Custody and Storage (Personnel/Organization): Assigned laboratory personnel (See Worksheet 30 for laboratories providing analytical services)
Sample Preparation (Personnel/Organization): Assigned laboratory personnel (See Worksheet 30 for laboratories providing analytical services)
Sample Determinative Analysis (Personnel/Organization): Assigned laboratory personnel (See Worksheet 30 for laboratories providing analytical services)
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection):7days for air if not extracted/40 days for air if extracted/365 days for soil and vegetation
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extraction and digestion holding times are summarized in Worksheet 19.
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Assigned laboratory personnel (See Worksheet 30 for laboratories providing analytical services)
Number of Days from Analysis: 365

QAPP Worksheet #27

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Samples are collected in the field at KHF, labeled, sealed, packaged in a cooler, and shipped to the laboratory. Chain-of-custody forms are originated at this step and follow the samples to the laboratory.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

The laboratory has a sample custodian who accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies, document sample condition upon receipt at the laboratory and will sign and date all appropriate receiving documents. The laboratory has an SOP (WS-QA-0003) which details the procedures used to document sample receipt and custody within the laboratory.

Sample Identification Procedures:

See Workplan Appendix F for the air sample naming procedure and Appendix G for soil and vegetation.

Chain-of-custody Procedures:

See above.

QAPP Worksheet #29

Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Sampling Notebooks Plant tissue sampling field data sheets Field maps w/mark-ups as needed Electronic GPS files Photographs Field Chain of Custody forms Shipping bills PUF sampling calibration and sampling data sheets. Maintenance and calibration logbooks	QA management reports (see Worksheet #33) PUF sampling calibration and sampling data sheets. Maintenance and calibration logbooks Meteorological data Congener Study Workplan Chain of Custody Forms	Electronic and paper analytical reports Internal laboratory records (chromatograms, method notes etc.) Laboratory instrument maintenance, testing, inspection and calibration, records (see Wk. 23-25) Completed Chain of custody Congener Study Workplan Chain of Custody Forms Audit reports and Manufacturer Specifications for Meteorological and PUF sampling equipment	Data validation reports (see Worksheets #34 and #35) Risk Assessment Report Final Project Summary Report	

QAPP Worksheet #30

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Soil and Vegetation	Dioxin-Like PCB Congeners	Low	Assigned in field	WS-ID-0013	1 month from receipt	TestAmerica 880 Riverside Parkway West Sacramento, CA 95616 Karen Dahl (916) 374-3484	
Air	Dioxin-Like PCB Congeners	Low	Assigned in field	WS-ID-0013	1 month from receipt	TestAmerica 880 Riverside Parkway West Sacramento, CA 95616 Karen Dahl (916) 374-3484	

QAPP Worksheet #33

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Soil and Vegetation QC Report	Once per sampling round	Two weeks following sampling	Daniel V. Sola Field QA Manager Wenck Associates, Inc.	Haley Hudson Project Manager Wenck Associates, Inc.
Field Air Sampling Report	Once per sampling round	Two weeks following sampling	Haley Hudson Project Manager Wenck Associates, Inc.	Haley Hudson Project Manager Wenck Associates, Inc.
Data Validation Report	One per sampling round	30 days following receipt of laboratory data package	Mark Kromis Data Validation Manager AECOM	Haley Hudson Project Manager Wenck Associates, Inc.
Meteorological Audit Report	Quarterly	One month after audit	AMEC Geomatrix, Inc.	Paul Turek Project Manager Chemical Waste Management, Inc.
Air Sampling Performance and Systems Audit	Annually	One month after audit	Michael Shoemaker Project Engineer Wenck Associates, Inc.	Haley Hudson Project Manager Wenck Associates, Inc.

QAPP Worksheet #34

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Work Plan and QAPP	Evidence of required approval of QAPP will be verified by ensuring that the appropriate personnel have signed off on this page	Internal	Dan Sola, Wenck
Field Reports	Field reports will be verified with field log books to ensure correct rporting of information. Review will be conducted with completion of each report.	Internal	Dan Sola, Wenck
Chain-of-Custody	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. When everything is verified, the shipper's signature on the chain-of-custody form will be initialed by the reviewer, a copy of the form will be retained in the site file and the original and remaining copies will be taped inside the cooler for shipment.	Internal	Dan Sola, Wenck
Analytical data package	All analytical data generated by the laboratory will be extensively reviewed prior to report generation, to assure the validity of the reported data. This internal data review process will consist of data generation, reduction and a minimum of three levels of data review*. Each step of this review process involves evaluation of data quality based on both results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that data of known quality are generated consistently. The laboratory shall complete the appropriated form documenting the organization and complete contents of each data package.	Internal	Karen Dahl, Test America
QC summary report	A summary of all QC samples results will be verified for completeness upon receipt of data packages from the laboratory. The results will also be verified for measurement performance criteria.	External	Mark Kromis, AECOM

*** Level 1, Technical Data Review**

Each laboratory analyst will review all of his/her work. The review at a minimum will include the following:

- sample preparation information is correct and complete
- analysis information is correct and complete
- the appropriate SOPs have been followed
- analytical results are correct and complete
- QC samples are within established control limits
- special sample preparation and analytical requirements have been met
- documentation is complete (any abnormalities have been documented and forms complete, holding times documented, etc.)

Level 1 data review will be documented, signed, and dated by the reviewer.

Level 2, Technical Review

The Level 2 review will be performed by a supervisor, data review specialist, or a qualified peer whose function is to provide an independent review of the data package. This review will be conducted according to established procedures as follows:

- all appropriate laboratory SOPs have been followed
- calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- qualitative identification of sample components is correct
- quantitative results are correct
- documentation is complete and accurate (any anomalies have been documented and forms completed, etc.)
- the data are ready for incorporation into the final report

Level 2 review will be structured so all calibration data and QC sample results are reviewed and all of the analytical results of the samples are checked back to the sample preparation and analytical bench sheets. All errors and corrections noted will be documented. Level 2 data review will also be documented, signed, and dated by the reviewer.

Level 3, Administrative Data Review

Level 3 review is performed by the QA Manager or the program administrator at the laboratory. This review will provide a total overview of the data package to ensure its consistency and compliance with project objectives and that the data package is complete and ready for data archive. All errors noted will be corrected and documented. Level 3 data review will also be documented, signed, and dated by the reviewer.

QAPP Worksheet #35

Validation (Steps IIa and IIb) Process Table

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Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Sampling	Records support implementation of the SOP for soil and vegetation sampling.	Dan Sola, Wenck
IIa	Sampling	Records support implementation of the SOP for air sampling.	Haley Hudson, Wenck
IIa	Methods	Records support implementation of the SOPs for analysis.	Mark Kromis, AECOM
IIa	Chain-of-custody	Examine traceability of data from sample collection to generation of sample receipt.	Dan Sola/Haley Hudson Wenck
IIb	Deviations	Determine impacts of any deviations from methods	Project Team
IIb	Project Quantitation Limit	PQL achieved as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.	Mark Kromis, AECOM
IIb	Field and Lab Data and QC	A summary of all QC samples and results will be verified for measurement performance criteria and completeness. Any deviations noted will be discussed in the data validation report.	Mark Kromis, AECOM

QAPP Worksheet #36

Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Soil	PCBs	Low	Method 1668A, SOPs	Mark Kromis, AECOM
IIb	Soil	PCBs	Low	See text below	Mark Kromis, AECOM
IIa	Vegetation	PCBs	Low	Method 1668A, SOPs	Mark Kromis, AECOM
IIb	Vegetation	PCBs	Low	See text below	Mark Kromis, AECOM
IIa	Air	PCBs	Low	Method 1668a, SOPs	Mark Kromis, AECOM
IIb	Air	PCBs	Low	See text below	Mark Kromis, AECOM

The guidelines specified in the following documents may be used as applicable when performing the data validation process:

- EPA Region III Interim Guidelines for the Validation of Data Generated Using Method 1668 PCB Congener Data; April 2004
- Routine Validation of Chlorinated Biphenyl Congener Analytical Data (EPA Method 1668A; Los Alamos National Laboratory, SOP-5170, July 1, 2008

The Ion-Abundance Ratio Acceptance Ranges listed Table 8 of Method 1668A will be utilized with the exception of the following:

- Ion ratios used for the pentachlorobiphenyl's will be 0.61 with a range of 0.52 - 0.70
- Ion ratios used for the decachlorobiphenyl's will be 0.70 with a range of 0.59 - 0.81.

QAPP Worksheet #37

Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Usability will be determined in the Risk Assessment process. Validated data will be reviewed by the risk assessment team who will specifically determine the usability of the data to support the calculations and statistical analysis needed to complete the work. Ultimately, the USEPA-IX staff will review the data and calculations and provide concurrence that the data are useable to support the assessments.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Overall error will be addressed in the Risk Assessment process.

Identify the personnel responsible for performing the usability assessment:

Susan Provenzano, Steve Dillard, and Mark Kromis of AECOM.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

Risk Assessment report and associated documentation.

Appendix B

Data Reduction/Validation

DATA REDUCTION, VERIFICATION, AND REPORTING

This section presents the methods for data validation, documentation, and report format. All analytical data generated by the laboratory will be extensively reviewed prior to report generation, to assure the validity of the reported data. This internal data review process will consist of data generation, reduction, and a minimum of three levels of data review. Each step of this review process involves evaluation of data quality based on both results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that data of known quality are generated consistently. In each stage, the review process will be documented, signed, and dated by the reviewer.

The laboratory analyst performing the tests shall review 100 percent of the data and has the prime responsibility for data correctness and completeness. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by the laboratory supervisor of the respective analytical section using the same criteria or in accordance with the laboratory SOP for data review. All corrective action reports pertaining to the data package shall be reviewed, and if corrective actions were ineffective, appropriate qualifier flags shall be applied to the data by the supervisor or the senior analyst.

After the first and second level of laboratory data reviews have been performed, "Result" data qualifiers shall be added by the laboratory supervisor of the respective analytical section or in accordance with the laboratory SOP.

Case narratives shall be added to the first page of the report certificates to explain any nonconformance or other issues. The "Result" data qualifiers and their definitions are shown in Table 1.

Each section supervisor shall submit the data to the QA manager or the program administrator who is responsible for combining all the laboratory data into a package to be submitted to Wenck Associates. The QA manager or the program administrator performs a verification of the quality of the entire data package after it has been assembled and prepares a case narrative for the package. The verification includes confirmation of the quality of the submitted data from various sections, evaluating the corrective action reports, and assigning the final data flag where necessary.

DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Level 1, Technical Data Review

Each laboratory analyst will review all of his/her work. The review at a minimum will include the following:

- sample preparation information is correct and complete
- analysis information is correct and complete
- the appropriate Standard Operating Procedures (SOPs) have been followed
- analytical results are correct and complete
- QC samples are within established control limits
- special sample preparation and analytical requirements have been met
- documentation is complete (any abnormalities have been documented and forms complete, holding times documented, etc.)

Level 1 data review will be documented, signed, and dated by the reviewer or documented in accordance with the laboratory SOP.

Level 2, Technical Review

The Level 2 review will be performed by a supervisor, data review specialist, or a qualified peer whose function is to provide an independent review of the data package. This review will be conducted according to established procedures as follows:

- all appropriate laboratory SOPs have been followed
- calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- qualitative identification of sample components is correct
- quantitative results are correct
- documentation is complete and accurate (any anomalies have been documented and forms completed, etc.), and
- the data are ready for incorporation into the final report

Level 2 review will be structured so all calibration data and QC sample results are reviewed and all of the analytical results of the samples are checked back to the sample preparation and analytical bench sheets. All errors and corrections noted will be documented. Level 2 data review will also be documented, signed, and dated by the reviewer or documented in accordance with the laboratory SOP.

Level 3, Administrative Data Review

Level 3 review is performed by the QA Officer or the program administrator at the laboratory. This review will provide a total overview of the data package to ensure its consistency and compliance with project objectives and that the data package is complete and ready for data archive. All errors noted will be corrected and documented. Level 3 data review will also be documented, signed, and dated by the reviewer or documented in accordance with the laboratory SOP.

Laboratory Data Reports

Definitive data are generated using rigorous analytical methods, such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identification and concentration. Methods produce tangible raw data in the form of printouts or computer-generated electronic files. Laboratory reports will be required to contain a results summary for each sample. The full data package is due to Wenck no later than 30 days after the validated time of sample receipt. Validated time of sample receipt starts when the laboratory sample receipt is logged on the sample COC.

The full data package will consist of the analytical results being reported in Electronic Data Deliverable (EDD) Excel format or equivalent. In addition to the EDD, the full data package deliverable will include at a minimum the following QA/QC information in CLP or CLP like deliverable forms:

- Sample results summary
- Cross reference sample ID (laboratory/client)
- Sample holding times
- Detection limits and qualifiers
- Internal and external chain of custody documentation
- Initial and continuing calibration data
- Method blanks (instrument, extraction, etc.)
- Surrogate spike data with control limits
- Labeled compounds with control limits
- Laboratory Control Sample with control limits
- Internal standard area count and retention time

- GC/HRMS performance sample with control criteria
- Ion abundance ratios for PCB Congeners
- Second column confirmation data when required by method
- Raw data
- A case narrative to include cleanup and dilution procedures, interference's encountered, and if any regional QC criteria is not met a discussion of when and why regional QC criteria was not met

TABLE 1 RESULT DATA QUALIFIERS

Qualifier	Description
J	analyte present at concentration greater than the MDL (or EDL) but less than the RL
ND	Non detect
B	analyte present in blank at greater than reporting limit (lower calibration point)
Q	analyte meets all criteria except for ion ratio
C	coelutes with other isomer(s)
G	reporting limit raised due to interferences
E	analyte concentration exceeds upper calibration limit
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.

Table 2 below details the general guidelines for applying these data qualifiers.

TABLE 2 FLAGGING CONVENTIONS

QC Requirement	Criteria	Laboratory Flag	Validator Flag	Validator Flag Reason Description
Holding time	>1 and ≤ 2 times the applicable holding time requirement	Comment in narrative	J detected results, UJ non-detects	1A
	> 2 times the applicable holding time requirement		J detected results, R non-detects	1B
OPR	%R < 10%	A=recovery outside limit	J detected results, R non-detects	2A
	%R > 10% and < LCL		J detected results, UJ non-detects	2B
	%R > UCL	A=recovery outside limit	J detected results, Non-detects N/A	2C
	The OPR sample documentation is missing, Data may not be acceptable for use		R detected results, R non-detects	2D
	If recoveries of more than half of the compounds in the OPR analysis exceed the acceptance range, both above and below		J detected results, UJ non-detects	2E
Clean-up standard	%R outside the CL of 30% - 135%	* in report and narrate	J detected results, UJ non-detects	-
Surrogate compounds	%R outside the CL of 30% - 135%	* in report and narrate	J detected results, UJ non-detects	-

TABLE 2 FLAGGING CONVENTIONS (CONTINUED)

QC Requirement	Criteria	Laboratory Flag	Validator Flag	Validator Flag Reason Description
Method blank (MB)	Sample result is ≤ 5 times the concentration of the related analyte in the MB	B	U detected results, Non-detects N/A	3A
	Sample result is ≥ 5 times the concentration of the related analyte in the MB	B	J detected results, Non-detects N/A	3B
	Sample result is ≤ 5 times the concentration of the related analyte in the rinsate blank or equipment blank		Detected results N/A U Non-detects	3C
	Required MB information is missing. Data may not be acceptable		R detected results, R non-detects	3D
Field duplicate and co-located samples	Sample result > 5x RLs and RPD > CL (CL= <50%)	N/A	J detected results	4
Laboratory duplicates	Matrix duplicates > 5x RL and RPD outside CL	P= precision outside limit	J for all positive results	4
Sample preservation / collection	Sample temperature greater than CL (CL < 4° C)	Comment in narrative	J detected results, UJ non-detects	5
Sample storage (as specified by the method)	Sample temperature greater than CL (Cl < -10° C	Comment in narrative	J detected results, UJ non-detects	6

TABLE 2 FLAGGING CONVENTIONS (CONTINUED)

QC Requirement	Criteria	Laboratory Flag	Validator Flag	Validator Flag Reason Description
Initial five point calibration (HRGC/HRMS methods)	Sample results were not analyzed with a valid 5-point calibration curve and/or a standard at the reporting limit	J detected results	J detected results, UJ non-detects	7A
	Sample results were analyzed with an initial calibration curve that exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995		J detected results, UJ or R non-detects	7B
Calibration verification (HRGC/HRMS methods)	The affected analytes did not meet the ion abundance ratios criteria in the initial calibration and /or CCV	Comment in narrative	N detected results, Non-detects N/A	8A
	The ICV and/or CCV were recovered outside method limits		J or R detected results, UJ or R non-detects	8B
	The ICV and/or CCV were not analyzed at the appropriate frequency,		J detected results, UJ non-detects	8C
	Required calibration information is missing or samples were analyzed on an expired calibration		R detected results, R non-detects	8D
Retention time	Retention time criteria were not met	J detected results	R detected results, R non-detects	9A
	Required retention time documentation is missing. Data may not be acceptable for use		R detected results, R non-detects	9B

TABLE 2 FLAGGING CONVENTIONS (CONTINUED)

QC Requirement	Criteria	Laboratory Flag	Validator Flag	Validator Flag Reason Description
Labeled compound	Labeled compound %R > UCL	* in report	J detected results, Non-detects N/A	10A
	Labeled compound %R ≥ 10% but < LCL	* in report	J detected results, UJ non-detects	10B
	Labeled compound %R < 10%	* in report	J detected results, R non-detects	10C
	Required labeled compound information is missing, Data may not be acceptable for use		R detected results, R non-detects	10D
Mass spectrometer performance sample	Instrument performance sample did not pass method acceptance criteria	Comment in narrative	R detected results, R non-detects	11A
	Required instrument performance sample information is missing		R detected results, R non-detects	11B
Compound identification	Criteria for Identification in 1668A Sections 16.1-16.5 were not met	Q C ND J E	J or EMPC detected results, R non-detects	12A
	IS ion abundance ratio outside ±15% ratio	Q	N detected results, R non-detects	12B

Notes:
UCL – Upper Control Limit
LCL – Lower Control Limit
CL – Control Limit
LCS – Laboratory Control Sample
ms – matrix spike
QC – Quality Control
RL – Reporting Limit

Validator Flag Reason Description

1A.
The extraction/analytical holding time was exceeded by less than 2x the published method for holding times. There are no demonstrated maximum holding times associated with the PCBs in EPA Method 1668A, aqueous, solid, semi-solid, tissues, or other sample matrices. If stored in the dark at 0-4ºC and preserved as given above (if required), aqueous samples may be stored for up to one year. Similarly, if stored in the dark at <-10ºC, solid semi-solid, multi-phase, and tissue samples may be stored for up to one year. Store sample extracts in the dark at <-10ºC until analyzed. If stored in the dark at <-10ºC, sample extracts may be stored for up to one year.

2A.
The Ongoing Precision Recovery (OPR) percent recovery was less than 10%.OPR is a method blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this EPA Method for precision and recovery. OPR must be established for every batch of samples extracted and analyzed and must meet the recovery and %RSD limits listed in Attachment 5. If the OPR criteria are not met and reanalysis was not performed, the laboratory performance and method accuracy are in question:

1. If the OPR recovery is <10% qualify all detects as J and all associated non-detects as 'R".

2. If recoveries of more than half of the compounds in the OPR analysis are below 10%, qualify all associated defects as J and all associated non-detects as "R".

(NOTE: If recoveries for more than half of the compounds in the OPR analysis are below the acceptance range, the laboratory has not shown that it can actually meet program required detection limits.)

2B.
The OPR sample percent recovery was < the Lower Acceptance Limit (LAL) but >10%. If the OPR recovery is < the LAL, qualify all associated detects as "J" and all associated non-detects as "UJ" if the recovery is ≥10%.

2C.
The OPR sample percent recovery was < the Lower Acceptance Limit (LAL) but >10%. If the OPR recovery is < the LAL, qualify all associated detects as "J" and all associated non-detects as "UJ" if the recovery is ≥10%.

2D.
The OPR sample documentation is missing. Data may not be acceptable for use. Contact the laboratory regarding missing information.

2E.
Recoveries of more than half of the compounds in the OPR analysis exceed the acceptance range, both above and below.

3A.
The sample result is ≤5 times the concentration of the related analyte in the method blank, which indicates the reported detection is considered indistinguishable from contamination in the blank.

3B.
The affected analytes are considered estimated and biased high because this analyte was identified in the method blank but was >5x.

3C.
The sample result is ≤5x the concentration of the related analyte in the rinsate blank and equipment blank, which indicates the reported detection is considered indistinguishable from contamination in the blank.

3D.
The required blank documentation is missing. Data may not be acceptable for use. Contact the laboratory regarding missing information.

4. Duplicate

5. Sample preservation/collection

6. Sample Storage (as specified by method)

7A.
The affected results were not analyzed with a valid 5-point calibration curve and/or a standard at the reporting limit.

7B.
Isotope dilution shall be used for calibration of the toxics and beginning and ending level of chlorination (LOC) chlorinated biphenyls (CBs). A 5- or 6-point calibration is prepared for each native congener. The RRF %RSD for all native toxins/LOC CBs must be <20% for those analytes analyzed by isotope dilution or 35% for those analytes analyzed by the internal standard method. If a linear curve is used for initial calibration, the r2 of the curve must be >0.99.

1. If the %RSD for any target compound is >20% but ≤40%, qualify all associated detects as "J" and, if any other calibration criteria have been exceeded for that compound, qualify all associated non-detects as 'UJ".

2. If the %RSD for any target compound is >40% but ≤60%, qualify all associated detects as "J" and all associated non-detects as 'UJ".

3. If the %RSD for any target compound is >60%, qualify all associated detects as "J" and all associated non-detects as "R".

4. If the r2 for any target compound is <0.99 but ≥0.90, qualify all associated detects as “J” and , if any other calibration criteria have been exceeded for that compound, qualify all associated non-detects as “UJ”.

5. If the r2 for any target compound is <0.90 but ≥0.80, qualify all associated detects as “J” and all associated non-detects as “UJ”.

6. If the r2 for any target compound is <0.80, qualify all associated detects as “J” and all associated non-detects as “R”.

8A.
The affected analytes did not meet the ion abundance ratios criteria in the initial calibration and/or CCV. Calibration using internal standards is used for determination of native CBs for which a labeled compound is not available. For these CBs, calibration is performed at a single point. Compounds should be quantitated using the appropriate reference internal standard listed in Table 1 of method 1668A. Ion abundance ratios must meet the criteria as stated in Table 8 of method 1668A, Theoretical Ion Abundance Ratios and QC Limits, of this procedure, or must be within 15% of the theoretical ratio of the ion monitored. If the ion abundance criteria are not met, qualify all detected results for that analyte as “R”.

8B.
The ICV and/or CCV were recovered outside the method limits (see Table 6 in method 1668A). At the beginning of each 12-hour period during which analysis is performed, calibration is verified for all native CBs and labeled compounds. The ion abundance ratios for all CBs must be within the limits as stated in the method, and all compounds must meet the calibration verification recovery limits listed as stated in the method, QA Acceptance Criteria for CBs in Calibration Verification, Initial Precision and Recovery, OPR, and Samples for EPA Method 1668A.

RRTs of native CBs and labeled compounds in the calibration verification must be within ±0.5% of the mean RRT determined from the initial calibration or most recent calibration verification standard. The diluted combined 209 congener solution must be analyzed as a final step in the calibration verification and must meet the minimum analysis and resolution specifications of the method.

If the ion abundance ratio for any calibration verification compound is outside of the method limits, qualify all associated detects as J and all associated non-detects as “UJ”.
If the verification limits are not met for any calibration verification compound and the recovery is above the verification limits, qualify all associated detects as “J”. If the verification limits are not met for any calibration verification compound and the recovery is below the verification limits, qualify all associated detects as “J” and all associated non-detects as “UJ” if the recovery is ≥10% and as “R” if the recovery is <10%. If the RRT of any compound is outside of the RRT window, qualify all associated
results as “R”.

8C.
The ICV and/or CCV were not analyzed at the appropriate method frequency. At the beginning of each 12-hour period during which analysis is performed, calibration is verified for all native CBs and labeled compounds. Use professional judgment based on when ICVs and CCVs were analyzed.

8D.
The required calibration information is missing or samples were analyzed on an expired calibration. Data may not be acceptable for use. Contact the laboratory regarding missing information.

9A.
The absolute RT of CB 209 must be ≥55 minutes if the SPB-octyl column is used. If a GC column or column system alternate to the SPB-octyl column is used, the absolute Retention Time (RT) of CB 209 must be ≥ the laboratory-established minimum RT for CB 209. If the laboratory has not established a minimum RT value for CB 209, the RT for CB 209 must be ≥55 minutes. If an SPB-octyl column was used and the absolute RT of CB 209 is <55 minutes, qualify all associated results as "R". If a GC column on column systems alternate to the SPB-octyl column was used and the absolute RT is less than the laboratory established minimum RT for CB 209, or <55 minutes if the laboratory has not established a minimum RT, qualify all associated results as "R".

The absolute retention times of the Labeled Toxics/LOC/window defining standard congeners in the verification test must be within ±15 seconds of the respective retention times in the calibration or, if an alternate column or column system is employed, within ±15 seconds of the respective retention times in the calibration for the alternate column or column system. The relative retention times (RRTs) of native CBs and labeled compounds in the verification test must be within their respective RRT limits or, if an alternate column or column system is employed, with their respective RRT limits for the alternate column or column system.

If the absolute or relative retention time of any compound is not within the limits specified, the GC is not performing properly. In this event, adjust the GC and repeat the verification test or recalibrate, or replace the GC column and either verify calibration or recalibrate. The RRT of each Chlorinated Biphenyl must be within ±0.5% of the mean RRT determined from the initial calibration or ±0.5% of the RRT from the most recent calibration verification standard.

9B.
Required RT documentation is missing. Data may not be acceptable for use. Contact the laboratory regarding missing information.

10A.
The labeled compound is > the Upper Acceptance Limit. The recovery of each labeled compound must be within the limits listed in Table 6 of method 1668A. If the recovery of any labeled toxics/LOC/window defining standard compound is above acceptance limits, qualify all detects for that sample fraction as "J" and all non-detects for that sample fraction as "UJ".

10B.
The labeled compound is < the Lower Acceptance Limit but ≥ 10% "R". The recovery of each labeled compound must be within the limits in Table 6 of method 1668A. If the recovery of any labeled toxics/LOC/window defining standard compound is below acceptance limits, qualify all detects for that sample fraction as "J" and all non-detects for that sample fraction as "UJ" if the recovery is ≥10%.

10C.
To assess method performance on the sample matrix, the laboratory must spike all samples with the labeled toxics/LOC/window defining standard spiking solution and all sample extracts with the labeled cleanup standard spiking solution. The recovery of each labeled compound must be

within the limits listed in Table 6 of method 1668A. If the recovery of any labeled toxics/LOC/window defining standard compound is <10%, qualify all not detected results as "R" and all detected results as "J".

10D.
Required labeled compound information is missing. Data may not be acceptable for use. Contact laboratory regarding the missing information.

11A.
Gas chromatograph/mass spectrometer (GC/MS) instrument performance checks are performed to ensure mass resolution, identification, and to some degree, sensitivity. These criteria are not sample specific. Conformance is determined using standard materials; therefore, these criteria should be met in all circumstances. Failure to meet either the resolution or the retention window criteria invalidates all calibration or sample data collected during the 12-hour time window. If mass spectrometer performance was not evaluated at the required frequency or if method criteria were not met, qualify all associated detects and non-detects as "R".

11B.
The required instrument performance sample information is missing. Contact laboratory regarding the missing information.

12A.
If all of the criteria for identification in Method 1668A Sections 16.1-16.5 are not met, the congener has not been identified and the result for that congener is not to be reported by the laboratory or on the data summary form (validation report). Professional judgment is to be used for determining if congener overlaps (interferences) have occurred. When this occurs all of the identification criteria (Sections 16.1-16.4) may not be met. There may be loss of one or more chlorines from a highly chlorinated congener causing inflated or false concentration for a less-chlorinated congener that elutes at the same retention time. If ion abundance criterion for a detected analyte is outside ±15% theoretical ion abundance ratio but within ±25% report positive result as the congener and qualify with a "J". If ion abundance ratio is outside the ±25%, confirm the value is reported as EMPC by the laboratory.

If internal standard ion abundance ratio is outside ±15% ratio, then the standards are not positively identified by a laboratory and the stability of mass spectra is in question. Qualify reported results as presumptive ("N") and reject ('R") the non-detects.

DATA VERIFICATION METHODS

Data verification is defined as, "the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications".

The data verification chemist shall review the entire definitive data report package including but not limited to raw data, extraction log books, internal chains-of-custody, and corrective action measures and, based on this review, apply appropriate final data qualifiers for the definitive data. Initially, the data verification chemist must review the flags applied by the laboratory for accuracy.

The data verification chemist may use various checklists during the verification process to document all the verification activities. All changes to the data or flags must be explained in the Data Validation Report. If any of the QC Requirements listed in Table 2 are outside of the acceptance criteria the data validator will append the result(s) with the applicable Validator Flag listed in Table 2.

The data verification chemist shall review all data, field QC samples, and will also appropriately qualify any of the associated site samples identified with the field QC sample. Data review is performed both on field data sheets (Chain-of-custody) and laboratory data packages.

Field data documentation is checked for completeness by reviewing the laboratory sample receipt form to verify correct preservation of samples. Chain-of-custody forms are checked to verify the there is a signature and date for each transfer of custody.

Analytical laboratory data are checked for completeness of analysis as requested, inclusion of required frequency of QC samples, conformance to acceptance criteria for QC samples, adherence to holding times requirements, and second column confirmation where required. Nonconformances will be reviewed for acceptable corrective action for any out-of-control events.

Results from field duplicates are compared and Relative Percent Difference (RPD) calculated, where possible. If one or both results are non-detects, the RPD cannot be calculated. For values less than five times the detection limit, RPDs will not be calculated. Results are evaluated based on whether corresponding values are close. RPDs below 30 percent for air samples represent good agreement. If every duplicate pair shows larger differences, sampling or analytical procedures will be re-evaluated.

All laboratory and field blanks will be reviewed for blank contamination, and the sample results qualified in the event that the contamination level exceeds the sample result (10x for common laboratory contaminants such as phthalates and 5x for all other analytes).

In instances where more than one blank is associated with a given sample, qualifications should be based upon a comparison with the associated blank having the highest concentration of a contaminant.

The results must not be corrected by subtracting any blank value. The guidelines specified in the following documents may be used as applicable when performing the data validation process:

- EPA Region III Interim Guidelines for the Validation of Data Generated Using Method 1668 PCB Congener Data; April 2004

- Routine Validation of Chlorinated Biphenyl Congener Analytical Data (EPA Method 1668A; Los Alamos National Laboratory, SOP-5170, July 1, 2008

The Ion-Abundance Ratio Acceptance Ranges listed Table 8 of Method 1668A will be utilized with the exception of the following:

Ion ratios used for the pentachlorobiphenyl's will be 0.61 with a range of 0.52 - 0.70

Ion ratios used for the decachlorobiphenyl's will be 0.70 with a range of 0.59 - 0.81.

Data will be reviewed and verified by experienced personnel. Data review and verification may be documented on special forms. For projects where electronic data deliverables have been provided by the laboratory, the electronic data will be evaluated against the hard copy provided by the laboratory.

RECONCILIATION WITH USER REQUIREMENTS

Data quality and validity will be assessed routinely during the project and upon completion of the project to ensure that the Data Quality Objectives (DQOs) prescribed in each work plan are achieved. The characteristics of major importance are accuracy, precision, representativeness, comparability, and completeness.

Precision and accuracy measure the reproducibility of analytical results and the bias of a measurement method, respectively. QC limits for the precision and accuracy parameters have been established under EPA method-specific QC requirements. These QC limits must be met by the laboratory for the data to be considered of acceptable quality.

Precision

Quality control procedures, such as control sample analyses and replicate analyses, represent the primary mechanism for evaluating measurement data variability or precision. Replicate analyses will be used to define analytical replicability, while results for replicate samples may be used to define the total variability (replicability) of the sampling/analytical system as a whole.

Control limits for control sample analyses, acceptability limits for replicate analyses, and response factor criteria are based upon precision in terms of RSD or RPD. The standard deviation is a measure of the average distance of an individual observation from the mean. It is usually denoted "s" and defined as:

$$SD = s = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \left[\sum_{i=1}^{n} x_i\right]^2 / n}{n - 1}}$$

In this equation, n is the number of observations and x_i is the ith observation. The percent RSD is a measure of variability that is adjusted for the magnitude of the values in the sample:

$$\% \text{ RSD} = \frac{\text{Standard Deviation}}{\text{Sample Mean}} \times 100$$

The percent RSD is used when the size of the standard deviation changes with the size of the mean. RPD is another measure of variability that is adjusted for the magnitude of the measured values.

It is used only when the sample contains two observations, and is calculated as follows:

$$RPD = \frac{|X_1 - X_2|}{(X_1 + X_2)/2} \times 100$$

where X_1 and X_2 are duplicate sample measurement results. RPD is directly related to RSD for duplicate results by:

$$RPD = \sqrt{2\ RSD}$$

RSD is used for calculating precision of response factors in calibration procedures and acceptability of the calibration. RPD is calculated on sample duplicates or spike duplicates. RPDs cannot be calculated in the instance one or both values are non-detects. In these cases an evaluation will be made during data validation on the replication.

Accuracy

For surrogate compounds, laboratory control samples, and continuing calibration check standards, the calculation formula for percent recovery is:

$$\%\ Recovery = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

A similar calculation used to determine the recovery of a spike concentration added to a sample. The percent spike recovery:

$$\%\ Spike\ recovery = \frac{\text{Value of sample plus spike} - \text{Value of unspiked sample}}{\text{Value of spike added}} \times 100$$

The percent recovery is compared with the established control limits. For matrix spikes the assignable cause for recoveries outside acceptable limits may be, and often is, due to matrix interference. If a matrix effect is confirmed by acceptable performance on the Laboratory Control Sample (LCS), the data will be flagged.

LCSs will be analyzed routinely to demonstrate that the analytical system is performing within acceptable limits. These LCS results will provide another measure of accuracy of the measurement data.

Blanks will make up one other group of QC checks that will address measurement bias. Instead of assessing and controlling overall accuracy, field and laboratory blanks will be used to control bias due to sample contamination and to assess the extent to which this source of bias impacts the measurement results. Since sample contamination generally occurs at relatively low concentrations, contamination effects are most pronounced, in terms of relative error, for low-concentration samples.

The control limits for precision and accuracy established under SW-846 and EPA methodology guidelines will be used to identify outliers (data results outside the specific control limits). If outliers occur, the samples in question will be re-analyzed, if possible, or carefully evaluated on a case-by-case basis.

Representativeness
Representativeness expresses the degree to which sample data accurately and precisely reflect site conditions. Representativeness of the data is determined by:

- Comparing actual sampling procedures to those delineated in the field sampling plan
- Comparing analytical results of field duplicates to determine the spread in the analytical results
- Examining the results of QC blanks for evidence of contamination - contamination may be cause for qualification of the affected samples

The data validation process will determine whether any results will be classified as questionable or qualified by any of these criteria.

Comparability
Comparability expresses the confidence with which one set of analytical data may be compared with another. Comparability is maintained by being aware of previous analytical work and through the use of standard analytical methods and units such as:

- Demonstrating traceability of standards to NIST or EPA sources
- Use of Standard and Approved methodologies
- Standardized units of measure
- Participation in inter-laboratory studies to demonstrate laboratory performance

The laboratory will use all of these measures to ensure the data produced are of the highest quality and comparable to that of other quality laboratories in the industry.

Completeness
Completeness is a measure of the valid data obtained from an analysis expressed as the percentage of the total data that should have been obtained.

$$\% \text{ Completeness} = \frac{\text{Amount of valid data obtained}}{\text{Total amount of valid data expected}} \times 100$$

During data assessment, an evaluation will be made of whether restrictions on data usability will permit the use of the data for specific purposes identified during the DQO process.

If DQOs state that the data will only be used for screening purposes, estimated values can be used without restrictions, and even unusable data may provide useful information. If DQOs indicate that a portion of the data will be used for confirmation of clean-up goals, any restrictions on the data would seriously impact their usability.

Appendix F

Congener Air Sampling Standard Operating Procedures

FORM 1

PUF SAMPLER
STANDARD OPERATING PROCEDURES
CALIBRATION LOG

PUF SAMPLER CALIBRATION LOG
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Date of Calibration	Elapsed Time Meter Reading	Technician's Initials

NOTE: 1) **Calibrator must be re-certified and sent to Tisch Environmental each year. Replace the certification worksheet (Form 3).**

2) **Each unit must be calibrated on a quarterly schedule and after any maintenance, movement, or failed calibration check.**

FORM 2

PUF SAMPLER
STANDARD OPERATING PROCEDURES
CALIBRATION SHEET

PUF SAMPLER CALIBRATION SHEET
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Project Name: **CWMI – KHF**
Date: _____
Barometric Pressure, P_a (mmHg): _____
Calibration Orifice Serial Number: _____
Sampler Calibrated By: _____
Leak Check (Pass/Fail): _____

Sampler Serial Number: _____
Temperature, T_a (°K): _____
Orifice Calibration Date: _____
Orifice Intercept (b): _____
Orifice Slope (m): _____

ORIFICE			MOTOR	
T_a(°K) below = T_a above (°C) + 273 °C = $\frac{(°F - 32)\,5}{9}$ mmHg = $\frac{\text{in } H_2O * 25.4}{13.6}$			Magnehelic Gauge (magn) (inches of H_2O)	Magn (corrected) $\left(\sqrt{magn\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)}\right)$
Run Point	ΔH_2O Pressure Drop Orifice (inches of H_2O)	Q_{std} (m^3/min)		
1				
2				
3				
4				
5				

$$Q_{std} = \frac{\sqrt{\Delta H_2O\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{Orifice intercept } (b)}{\text{Orifice slope (m)}}$$

Perform a linear regression calculation on Q_{std} versus Magn(corrected) and obtain the sampler slope, intercept and correlation coefficient. Record data below.

PUF Sampler Correlation Coefficient (r) = _____ (*Must be greater than 0.990*)
PUF Sampler Slope (m) = _____ PUF Sampler Intercept (b) = _____

Comments and Notes_____

_____

_____

_____

_____

FORM 3

PUF SAMPLER
STANDARD OPERATING PROCEDURES
ORIFICE TRANSFER STANDARD
CERTIFICATION WORKSHEET

TISCH ENVIROMENTAL, INC.
145 SOUTH MIAMI AVE.
VILLAGE OF CLEVES, OH 45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX
WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5040A

Date - Apr 21, 2008 Rootsmeter S/N 9833620 Ta (K) - 295
Operator Jim Tisch Orifice I.D. - 1064 PVF Pa (mm) - 753.11

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	6.6950	3.6	2.00
2	NA	NA	1.00	4.0270	10.0	5.50
3	NA	NA	1.00	3.2410	15.3	8.50
4	NA	NA	1.00	2.7660	20.7	11.50
5	NA	NA	1.00	2.4480	26.1	14.50
6	NA	NA	1.00	2.2860	29.7	16.50

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9961	0.1487	1.4149		0.9951	0.1486	0.8851
0.9877	0.2452	2.3464		0.9867	0.2450	1.4678
0.9806	0.3025	2.9170		0.9796	0.3022	1.8247
0.9734	0.3519	3.3929		0.9724	0.3515	2.1224
0.9662	0.3947	3.8098		0.9652	0.3943	2.3832
0.9615	0.4206	4.0641 -		-0.9605	0.4201	2.5423
Qstd slope (m) =		9.75202		Qa slope (m) =		6.10655
intercept (b) =		-0.03866		intercept (b) =		-0.02418
coefficient (r) =		0.99998		coefficient (r) =		0.99998

y axis = SQRT[H2O(Pa/760)(298/Ta)] y axis = SQRT[H2O(Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}

FORM 4

PUF SAMPLER
STANDARD OPERATING PROCEDURES
SAMPLING DATA SHEET

PUF SAMPLING DATA SHEET
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Monitoring Station:		Project Name:	**Waste Management - KHF**
Sample Identification:		Operator:	
Sampler Serial Number:		PUF Sampler Slope(2):	
Filter Media ID(1):		PUF Sampler Intercept(2):	
PUF ID(1)		Orifice (Q_{std}) Slope(3):	
Sampling Date:		Orifice (Q_{std}) Intercept(3):	
Sampling Time:	**00:00 Hrs - 23:59 Hrs**		

One Point Calibration Data(4)

Target Magnehelic Pressure	ΔH_2O Pressure Drop Across Orifice (inches of H_2O)	Q_{std} (calc) (m^3/min)	Initial Magnehelic Reading (magn) (inches of H_20)	Q_{std} (meas) (m^3/min)	%D (must not be greater than ± 10 %)
~50			50		

Filter Setup

Date:	
Time:	
Pressure, P_a (mmHg):	
Temperature, T_a (°K):	
Initial Magnehelic (magn):	
Q_{std}(meas) (m^3/min): (Flow Rate Set Point)	0.225
Initial Elapsed Timer (hrs):	

Filter Takedown

Date:	
Time:	
Pressure, P_a (mmHg):	
Temperature, T_a (°K):	
Final Magnehelic (magn):	
Q_{std}(meas) (m^3/min): (Final Sampling Flow Rate)	
Final Elapsed Timer (hrs):	
Elapsed Time (hrs):	
Total Volume (m^3):	

Notes:

The setup flow rate should be 0.225 m^3/min ±10%.

(1) Lab provided.
(2) From the most recent Calibration Sheet.
(3) From the most recent Orifice Transfer Standard Certification Worksheet.
(4) One point calibration must be done before every sampling event. It must also be done after the sampling event if the unit has been moved.

Additional Comments and Notes:

Standard Flow Calculated

$$Q_{std}\ (\text{calc}) = \frac{\sqrt{\Delta H_2O\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{Orifice intercept } (b)}{\text{Orifice slope (m)}}$$

Standard Flow Measured

$$Q_{std}\ (\text{meas}) = \frac{\sqrt{magn\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{PUF Sampler intercept } (b)}{\text{PUF Sampler slope (m)}}$$

Flow Corrected

$$\text{Magn (corrected)} = \sqrt{magn\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)}$$

% Difference

$$\%D = \frac{\left|Q_{std}(\text{calc}) - Q_{std}(\text{meas})\right|}{Q_{std}(\text{calc})} \times 100$$

FORM 5

PUF SAMPLER
STANDARD OPERATING PROCEDURES
PREVENTATIVE MAINTENANCE AND
CORRECTIVE ACTION LOGS

PUF SAMPLER PREVENTATIVE MAINTENANCE LOG

PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Date of Maintenance	Elapsed Time Meter Reading	Description of Maintenance Performed	Technician's Initials

PUF SAMPLER CORRECTIVE ACTION LOG
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Date of Issue/Action	Elapsed Time Meter Reading	Description of Action Performed	Technician's Initials

FORM 6

PUF SAMPLER
STANDARD OPERATING PROCEDURES
QC CHECKLIST

PUF SAMPLER QC CHECKLIST
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Station Number _____
Sampler Number _____
Date _____
Auditor_____

Operation	Completed? YES	NO
SAMPLING SETUP		
• Has the sampling unit been calibrated within the past six months?	____	____
• Has the motor or motor brushes been replaced in the past six months?	____	____
• Correct date, time, temperature and pressure recorded on the field data sheet?	____	____
• Inspected faceplate gasket (Is it cracked?)	____	____
• Has the sampling media been installed properly?	____	____

Operation	Completed? YES	NO
SAMPLING TAKEDOWN		
• Record the correct date, time, temperature and pressure on the field data sheet?	____	____
• Measure and record the final magnehelic reading & actual air flow rate (Q_{std})?	____	____
• Check and record the elapsed time meter reading?	____	____
• Properly remove the PUF cartridge and filter from the sampling unit?	____	____

Additional Observations or Comments:_____

FORM 7

PUF SAMPLER
STANDARD OPERATING PROCEDURES
QA AUDIT WORKSHEET

PUF SAMPLER QA AUDIT WORKSHEET
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Site Location: _____
Project Name: **CWMI – KHF**
Auditor: _____
Technician Name: _____
Sampler Serial Number: _____

Audit Orifice Serial Number: _____
Audit Orifice Calibration Date: _____
Audit Orifice Slope (1): _____
Audit Orifice Intercept (1): _____
PUF Sampler Slope (2): _____
PUF Sampler Intercept (2): _____

Date: _____
Time: _____
Barometric Pressure (mmHg): _____
Temperature (°K): _____

AUDIT DATA

AUDIT ORIFICE			SAMPLER		VERIFICATION
T_a(°K) below = T_a above (°C) + 273 °C = (°F - 32) 5 / 9			Magnehelic Gauge (magn) (inches of H_2O)	Q_{std} Sampler flow rate indicated by magnehelic gauge (m^3/min)	% Difference $\frac{\lvert Q_{std} - Q_c \rvert}{Q_c}$ x 100 {must not be Greater than ± 10 %}
Observation Point	ΔH_20 Transfer Standard Reading (inches of H_2O)	Q_c True flow rate indicated by audit orifice (m^3/min)			
1					
2					
3					

$$Q_c = \frac{\sqrt{\Delta H_2O\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{Audit Orifice intercept } (b)}{\text{Audit Orifice slope (m)}}$$

$$Q_{std} = \frac{\sqrt{magn\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{PUF Sampler intercept } (b)}{\text{PUF Sampler slope (m)}}$$

Notes:

(1) From the most recent Audit Orifice Certification.
(2) From the most recent Calibration Sheet.

Additional Comments and Notes_____

FORM 8

PUF SAMPLER
STANDARD OPERATING PROCEDURES
SYSTEMS AUDIT CHECKLIST

SYSTEMS AUDIT CHECKLIST
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Site Location _____
Date _____
Auditor_____

Operation	**YES**	**NO**
A. NETWORK/SITE FACILITIES		
1. Upon arrival, was the security fence intact and locked?	____	____
2. Is the fenced-in area free of trash, tall grass, and vandalism?	____	____
3. Is the electrical system at the station in working order?	____	____
B. SITE OPERATIONS		
1. Are the latest calibration data for all samplers available?	____	____
2. Are the monitor logbooks maintained properly?	____	____
3. Are proper and timely operator checklist entries noted?	____	____
4. Are the calibrators currently certified?	____	____
5. Are operation manuals available for all equipment?	____	____
6. Are the field SOPs and QA/QC documents available?	____	____
7. Does the operator keep the filter-handling area neat and clean?	____	____
8. Do the sampler(s) appear to be well maintained and free of dirt and debris, bird/animal/insect nests, excessive rust and corrosion, etc.?	____	____
9. Are the walkways to the station and equipment kept free of tall grass, weeds, and debris?	____	____

Additional Questions or Comments:

_____
_____
_____
_____
_____
_____
_____
_____

SYSTEMS AUDIT CHECKLIST (continued)
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Operation	**YES**	**NO**
C. <u>SAMPLE MEDIA HANDLING</u>		
1. Are all filters, cartridges, and/or canisters handled with the necessary care to avoid contamination?	____	____
2. Are field blanks routinely used by the monitoring organization? Check log books at the site to verify field blanks are run periodically, as specified by the weighing laboratory. *One field blank per sampling event.*	____	____
3. Observe the following handling steps for routine sample media, verifying that the operator follows the media handling SOPs correctly:		
• receipt of media at the sampling site and unpacking	____	____
• completion of logbook entries and other required documentation	____	____
• inspection of the media prior to sampling	____	____
• installation of media in the sampler	____	____
• retrieval from the sampler after sampling	____	____
• packing and sending to the laboratory	____	____
• completion of chain of custody and field data forms	____	____

Additional Questions or Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

APPENDIX F

CONGENER AIR SAMPLING
STANDARD OPERATING PROCEDURES

For sampling PCB Congeners in Ambient Air Using the Sample Collection Procedures Outlined in EPA Compendium Method TO-9A

March 2009

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1.0 SCOPE AND APPLICABILITY

The Chemical Waste Management, Inc. (CWMI) - Kettleman Hills Facility (KHF) is a commercial Class I hazardous waste treatment, storage, and disposal facility (TSDF), and Class II/III designated waste/municipal solid waste (MSW) disposal facility owned and operated by Waste Management, Inc. (US EPA Facility Identification Number CAT 000646117). In April and July 1997, KHF submitted requests to United States Environmental Protection Agency Region IX (USEPA-IX) to renew the existing KHF Approvals to Operate for landfill B-18 and the Polychlorinated Biphenyl (PCB) Flushing/Storage Unit for continued handling and disposal of PCBs regulated by the Toxic Substances Control Act (TSCA). During the lengthy renewal process, at the request of USEPA-IX, in October 2003 KHF requested a Coordinated Approval, using the (then) recently renewed June 2003 Hazardous Waste Facility "Part B" Permit as the basis for the Coordinated Approval. After another lengthy renewal process, the Draft Coordinated Approval was issued by USEPA-IX February 2007. In a letter titled "Request for Additional Sampling of Air, Soil, and Biota/Vegetation and Analysis for PCB Congeners", dated December 2, 2008, EPA-IX requested a Congener Study "to address specific public comments on the Draft PCB Coordinated Approval". This USEPA-IX approved Congener Study Workplan details how KHF plans to implement this Workplan.

The purpose of this SOP is to describe the step-by step operating procedures for the TE-1000 Poly-Urethane Foam High Volume Air Sampler. The following publications from US EPA may be used for supplemental guidance: Compendium Method TO-9A and Quality Assurance Handbook Section 2.11.

US EPA COMPENDIUM METHOD TO-9A

This document describes the method for sampling and analysis for the quantitative determination of polyhalogenated dibenzo-p-dioxins and dibenzofurans (PHDDs/PHDFs) in ambient air, which include the polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDDs/PCDFs), polybrominated dibenzo-p dioxins and dibenzofurans (PBDDs/PBDFs), and bromo/chloro dibenzo-p-dioxins and dibenzofurans (BCDDs/BCDFs). The method uses a high volume air sampler equipped with a quartz-fiber filter and polyurethane foam (PUF) adsorbent for sampling

325 to 400 m^3 ambient air in a 24-hour sampling period. However, for the purpose of this study, the method and this SOP have been modified to allow for a month-long (20-day) sample to be collected, specifically for the analysis of PCB congeners in ambient air. The quartz-fiber filters will be replaced after each of the four, five-day consecutive segments. A total of four quartz-fiber filters and one PUF adsorbent will be collected for each month-long sample.

2.0 HEALTH AND SAFETY WARNINGS

Read and understand all instructions. Failure to follow all instructions listed in this manual may result in electric shock, fire and/or personal injury.

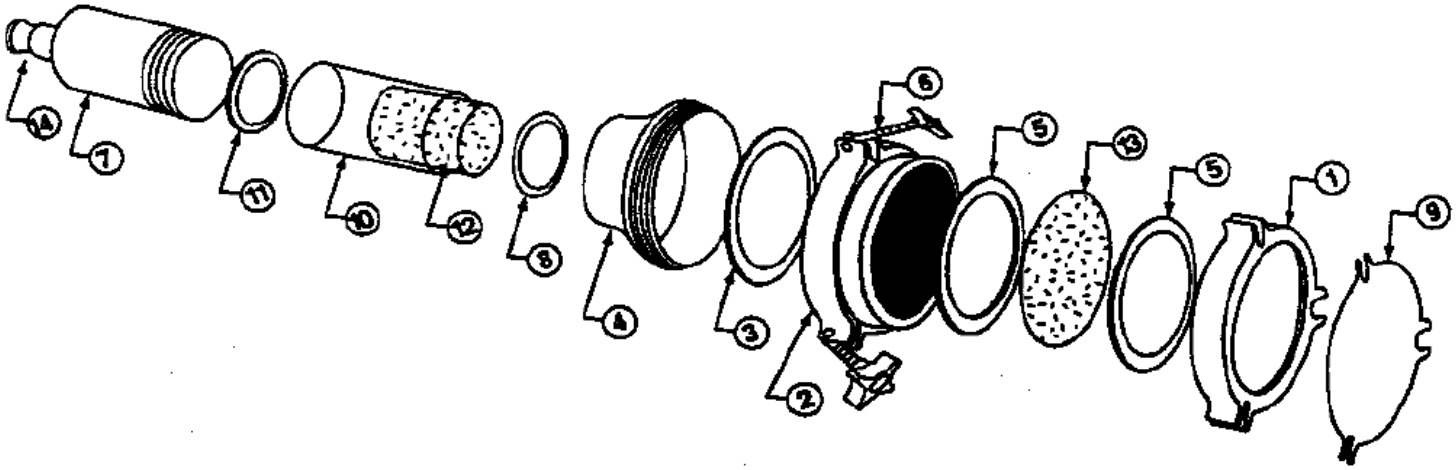
2.1 IMPORTANT SAFETY INSTRUCTIONS

Never operate this unit when flammable materials or vapors are present because electrical devices produce arcs or sparks that can cause a fire or explosion. When using an electrical device, basic precautions should always be followed including the following section of this manual. Be sure to disconnect power supply before attempting to service or remove any components. Never immerse electrical parts in water or any other liquid. Avoid body contact with grounded surfaces when plugging and unplugging this device in wet conditions. Installation must be carried out by specialized personnel only, and must adhere to all local safety rules.

3.0 EQUIPMENT AND SUPPLIES

Figure 1 – PUF Filter Assembly

Item No.	Part No.	Description
1	TE-1008-1	4” Hold Down Frame
2	TE-1008-2	4” Filter Holder Body w/ stainless steel screens
3	TE-1008-8	Filter Holder Gasket (Silicone 4 ½”OD)
4	TE-1002-2	Module Reducer
5	TE-1008-5	Teflon Gasket each (2 required)
6	TE-1002-14	Plastic Thumb Nut, Brass Bolt, washer and S/S Bolt Each (3 required)
7	TE-1002-3	Module Body
8	TE-1002-6	Upper Module Gasket (Silicone 2 7/8”)
9	TE-1008-9	Aluminum Cover for 4” Filter Holder
10	TE-1009	Glass Cartridge w/ stainless steel screens
11	TE-1002-8	Lower Module Gasket (Silicone 2 9/16”)
12	TE-1010	3” Long Polyurethane Vapor Collection Substrate (unwashed) package of 10
	TE-1011	2” Long Polyurethane Vapor Collection Substrate (unwashed) package of 10
	TE-1012	1” Long Polyurethane Vapor Collection Substrate (unwashed) package of 10
13	TE-QMA4	Micro-Quartz Filter Media 4” Round (10 per box)
14	TE-1002-4	Module Plug Coupler



Note: PUF Filter Assembly may also be referred to as the Dual Sampling Module, Sampling Module, or PUF Cartridge Assembly.

Figure 2 – PUF Blower Motor Assembly

Item No.	Part No.	Description
1	TE-1004-1	Blower Motor Flange
2	TE-1004-2	Flange Gasket
3	TE-1004-3	Blower Motor Housing with Integral Side Exhaust
4	TE-5005-4	Motor Cushion
5	TE-5010-4	Power Cord
6	TE-5005-8	Pressure Tap
7	TE-1004-7	Back Plate
8	TE-1004-8	Motor Spacer Ring
9	TE-116336	Replacement Motor for 110V PUF Blower
	TE-116125	Replacement Motor for 220V PUF Blower
10	TE-33384	Replacement Motor Brushes for 110V Motor TE-116336
	TE-33378	Replacement Motor Brushes for 220V Motor TE-116125

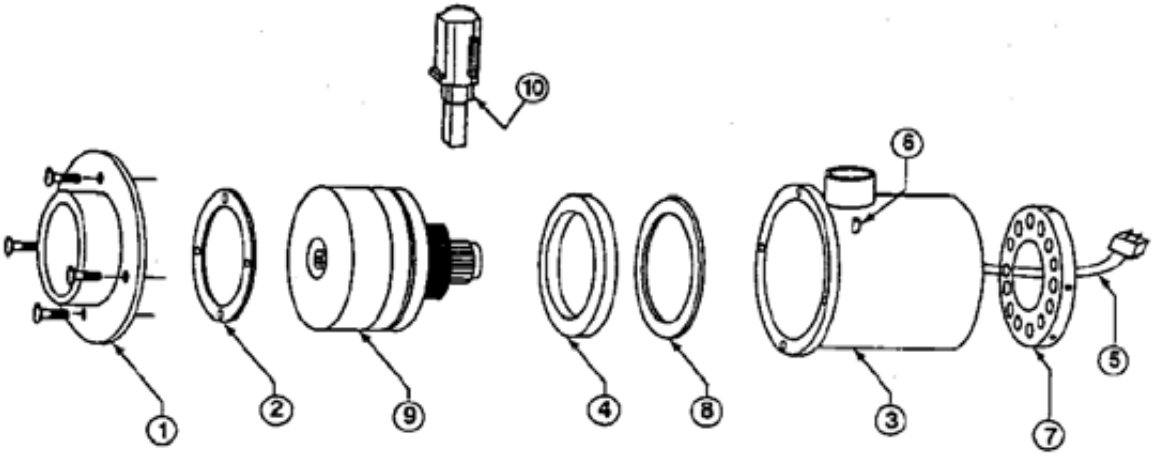
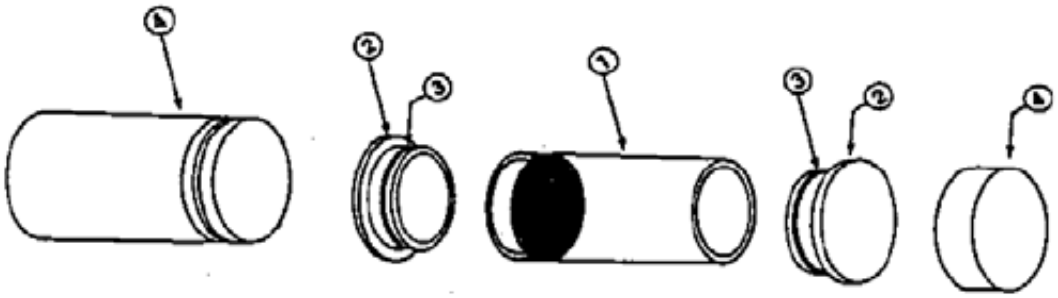


Figure 3 – Glass Cartridge and Teflon End Caps

Item No.	Part No.	Description
1	TE-1009	Glass Cartridge
2	TE-1026	Teflon End Cap with Silicone "O" Ring each (2 required)
3	TE-1026-1	Silicone End Cap "O" Ring each (2 required)
4	TE-1027	Aluminum Screw top shipping container



DESCRIPTION OF INSTRUMENT

TE-PUF Poly-Urethane Foam sampler is a complete system designed to simultaneously collect suspended airborne particulates as well as trap airborne pesticide vapors at flow rates up to 280 liters per minute. The TE-PUF features the latest in technological advances for accurately measuring airborne particulates and vapors.

1. Samples semivolatile organic compounds.
2. Especially designed for sampling airborne particulates and vapor contamination from pesticide compounds.
3. Successfully demonstrated to efficiently collect a number of organochlorine and organophosphate pesticides.

4. By-pass blower motor design permits continuous sampling for extended periods at rates to 280 liters per minute.
5. Proven sampler components housed in an anodized aluminum shelter for outdoor service.
6. Samples in accordance with U.S. EPA Method TO-9A, "Determination of Polychlorinated, Polybrominated and Brominated / Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air".

A dual chambered aluminum sampling module contains both filtering systems. The upper chamber supports the airborne particulate filter media in a circular filter holder. The lower chamber encapsulates a glass cartridge which contains the Poly Urethane Foam for vapor entrapment.

A wide variety of sorbents can be used in a manner that permits their continual use. Poly urethane foam or wet/dry granular solid media can be used individually or in combination. The dual chambered sampling module is designed for easy access to both upper and lower media. The threaded lower canister is removed with the cartridge intact for immediate exchange. Filter support screens and module components are equipped with gaskets providing a leak proof seal during the sampling process. Air flow rates are infinitely variable up to 280 liters per minute. The voltage variator adjusting screw alters the blower motor speed to achieve the flow rate desired. Air flow rate is measured through the flow venturi utilizing a 0-100" Magnehelic Gage. Periodic calibration is necessary to maintain on-site sampling accuracy. A Seven Day Mechanical Timer (TE-5007) was included as standard equipment and permitted weekly scheduling with individual settings for each day and 14 trippers to turn the sampler On and Off as desired. The Tisch TE-1000 samplers used at KHF have been modified with an electronic timer which replaced the Seven Day Mechanical Timer (TE-5007) that came stock with the equipment.

4.0 PROCEDURE

4.1 SETUP AND INSTALLATION INSTRUCTIONS

For setup and installation instructions, reference manufacturer's operating manual.

4.2 CALIBRATION REQUIREMENTS

The TE-1000 PUF Sampler should be calibrated and the calibration data recorded in the Calibration Log (PUF Sampler Form 1 or electronic spreadsheet equivalent):

1. Upon installation
2. After any maintenance or movement of sampler
3. After each 5 day sampling event (calibration check only).
4. After each month-long sampling event (due to the motor replacement)
5. After any failed calibration check

4.3 CALIBRATION PROCEDURES

4.3.1 Leak Check

Conduct a leak test by covering the hole on top of the calibration orifice and pressure tap on the orifice with palm of hand. Listen for a high-pitch sound created by escaping air. If this sound is audible, a leak is present and the top loading adaptor nuts need to be adjusted and re-tightened. **WARNING: Avoid running the sampler for longer than 30 seconds at a time with the orifice blocked. This will reduce the chance of the motor overheating. Never try this leak test procedure with a manometer connected to the side tap on the calibration orifice or the blower motor. Liquid from the manometer could be drawn into the system and cause motor damage.**

4.3.2 Calibration Procedure

1. Calibration of the PUF Sampler is performed without a foam plug (TE-1010) or filter media in the sampling module. However the empty glass cartridge must remain in the module to insure a good seal through the module.

2. Install the TE-5040A Calibrator (Transfer Standard) on top of the 4" Filter Holder. Tighten and make sure there are no leaks.
3. Open both ports on top of manometer and connect tubing from manometer port to the pressure tap on the TE-5040A Calibrator. Leave the opposite side of manometer port open to the atmosphere.
4. Open ball valve fully (handle should be straight up), this is located inside of shelter directly above the blower motor.
5. Turn the system on by tripping the manual switch on the timer. Allow several minutes for the motor to warm up.
6. Adjust and tighten the voltage control screw (variac) on the TE-5010 to obtain a reading of 70 inches on the dial of the magnehelic Gage (or 80 whatever is desired). Do not change until completion of calibration.
7. With 70 inches on the gage as the first calibration point, record this value and the orifice manometer reading on the Calibration Sheet (PUF Sampler Form 2). To read a manometer one side goes up and one goes down, add both sides together as ΔH_2O.
8. Close the ball valve slightly to readjust the dial gage down to 60 inches. Record this figure and the orifice manometer reading on the Calibration Sheet (PUF Sampler Form 2.
9. Repeat this procedure for magnehelic readings at 50, 40, and 30 inches and record this and associated ΔH_2O for manometer on the Calibration Sheet (PUF Sampler Form 2).
10. Manually turn sampler off.

The orifice slope and intercept for the orifice are taken from the transfer standard orifice calibration relationship which is obtained from the most recent Orifice Transfer Standard Certification Worksheet (PUF Sampler Form 3) that accompanies the calibrator orifice. The Orifice Transfer Standard must be recertified every 12 months. Therefore, the Certification Worksheet (PUF Sampler Form 3) will be replaced every 12 months.

The orifice manometer readings need to be converted to the standard air flows they represent using the following equation:

$$Q_{std} = \frac{1}{m}\left(\sqrt{\Delta H_2O\left(\frac{P_a}{P_{std}}\right)\left(\frac{T_{std}}{T_a}\right)} - b\right)$$

Where:

Q_{std} = actual flow rate as indicated by the calibrator orifice, m^3/min

ΔH_2O = orifice manometer reading during calibration, (inches) H_2O

T_a = ambient temperature during calibration, °K (°K = 273 + °C)

T_{std} = standard temperature, 298°K

P_a = ambient barometric pressure during calibration, mm Hg

P_{std} = standard barometric pressure, 760 mmHg

m = *slope of orifice* calibration relationship

b = *intercept of orifice* calibration relationship.

Once these standard flow rates have been determined for each of the five run points, they are recorded in the column titled Q_{std} on the Calibration Sheet (PUF Sampler Form 2) with units of cubic meters per minute.

The Magnehelic Gage readings taken during the calibration need to be corrected to the current meteorological conditions using the following equation:

$$magn(corrected) = \sqrt{magn\left(\frac{P_a}{P_{std}}\right)\left(\frac{T_{std}}{T_a}\right)}$$

Where:

magn (corrected) = Magnehelic Gage readings corrected to current temperature and pressure

magn = Magnehelic Gage readings during calibration

T_a = ambient temperature during calibration, °K (°K = 273 + °C)

T_{std} = standard temperature, 298°K

P_a = ambient barometric pressure during calibration, mmHg

P_{std} = standard barometric pressure, 760 mmHg

After each of the Magnehelic Gage readings have been corrected, they are recorded in the column titled Magn(corrected) (PUF Sampler Form 2).

Using Q_{std} and Magn(corrected) as the x and y axis respectively, a slope, intercept, and correlation coefficient must be calculated using a linear regression calculation. The correlation coefficient across the five calibration points must be greater than 0.990. If less, then repeat

calibration procedure. If continued failure, then troubleshooting for leaks or maintenance may be required. Continue with calibration until correlation coefficient is greater than 0.990 the record sampler slope and intercept on the calibration worksheet.

4.4 SAMPLING PROCEDURE

4.4.1 Single Point Calibration Check and Sampling Event Setup

The single point calibration is performed exactly the same as TO-9A. An initial calibration will need to be performed at the beginning of each month due to the motor replacement at the end of each previous month.

Procedurally the setup is the same as TO-9A with one exception. Instead of programming the samplers to run for 24 hours, they are programmed to run for 5 continuous days – 24 hours each day. Sampling is initiated at midnight the day of setup and end at midnight after five continuous days of sampling, in accordance with the sampling schedule.

1. Begin the single point calibration check by installing a NIST traceable transfer standard (TE-5040A Calibrator).
2. Connect a slack tube manometer to the transfer standard.
3. Turn the sampling unit on and allow it to warm up for several minutes.
4. Record the current date/time, barometric pressure, and temperature on the Sampling Data Sheet (PUF Sampler Form 4 or electronic spreadsheet equivalent).
5. Using the variac screw, adjust the magnehelic reading to be about 50 inches.
6. Record ΔH_2O for 50 inches of water across the transfer standard orifice using the slack tube manometer.
7. Turn sampling unit off.
8. If the percent difference (%D) is less than 10% then the single point calibration is complete. If it is greater than 10%, re-perform the calibration check again. If the calibration continues to fail, then perform a complete multiple point calibration. If the full calibration passes, then use the new calibration data from this point forward. If the full calibration fails, motor maintenance needs to be replaced. Once the motor has been replaced, re-perform the full calibration procedures.

9. Install the "dummy" PUF filter assembly into the sampler.
10. Turn on the sampler and let it warm up for several minutes.

    NOTE: If the single point calibration was performed immediately prior to this step, the sampler does not need to be warmed up again. However, if the sampler has been off for 15 minutes or more, allow it to warm up for several minutes.
11. Make sure the ball valve lever is fully open and using the variac screw, adjust the flow until the magnehelic gauge is set to the desired reading.
12. Turn the sampler off and remove "dummy" PUF filter assembly.
13. Record the elapsed time meter reading.
14. With the sampling module removed from the sampler, rinse all contact areas using reagent grade hexane in a Teflon squeeze bottle. Allow the hexane to evaporate from the module before loading the samples. After the hexane rinse has evaporated, install a clean, pre-weighed filter and PUF cartridge into the sampling module. Handle the filter using Teflon-tipped forceps to avoid cross-contamination. Also, make sure to wear nitrile or powder-free latex gloves when handling the sampling media.

    NOTE: This step is performed prior to entering the field while module is being pre-loaded. Also, be sure to keep the aluminum foil in which the samples are received. The sample collector will wrap the used sample media in this aluminum foil after the sampling event is completed. If the original foil is compromised, a new piece of aluminum foil should be rinsed with hexane and, after allowing the hexane to evaporate, used in place of the original foil.

15. Once in the field, install the pre-loaded sampling module into the unit.
16. Label the filter module with the appropriate sample ID.
17. Set the timer to run for 120 hours beginning at 00:00 hrs on the targeted sampling event start date.
18. Close the sampler lid.

4.4.2 Down Day Filter Takedown, Calibration Check, and Setup

After the five-day segment is completed there is a "down day" to perform a calibration check, recalibrate if necessary, readjust the flow rates if necessary, and to change out the top filters. With the exception of removing the PUF cartridge module to change out the top filter and perform the down day calibration check, the PUF cartridge remains in each sampler throughout the entire month's sampling period (20 sampling days plus 3 down days).

The top filter at each site gets removed, labeled (i.e., the aluminum foil or Ziploc bag used to house filter), and stored at 4°C until all four sampling segments are completed. After each 5-day segment, the exposed top filter is removed and combined with the respective sample filters from the previous segments and stored in a sub zero freezer awaiting shipment.

1. Manually turn the sampler on and let it warm up for several minutes.
2. Record the magnehelic reading. Do NOT adjust the magnehelic gauge.
3. Turn the sampler off.
4. Record the elapsed timer reading, current temperature, and barometric pressure on the Sampling Data Sheet.
5. Remove the sampling module from the PUF sampler.
6. Wearing nitrile or powder-free latex gloves, carefully remove the exposed filter with a pair of Teflon-tipped forceps. Fold filter in half twice with the exposed sample side on the inside of the fold. Place the filter inside a hexane-rinsed replacement foil, as discussed in 4.4.1, Step 14. Label the Ziploc bag containing aluminum foil/filter and place in a cooler ≤ 4°C.
7. Install the next clean top filter in the module with the PUF cartridge exposed from the previous 5-day segment.
8. Re-install the sample module and run a calibration check. (recalibrate if necessary)
9. Set/adjust the flow rate and record all data on a new Sampling Data Sheet for the next sequential segment.
19. Set the timer to run for another 120 hours beginning at 00:00 hrs on the targeted sampling event start date.
10. Close the sampler lid.
11. The steps are repeated on each of the three down days during the 20 day sampling period.

4.4.3 Final Takedown and Monthly Maintenance

1. Manually turn the sampler on and let it warm up for several minutes.
2. Record the magnehelic reading. Do NOT adjust the magnehelic gauge.
3. Turn the sampler off.
4. Record the elapsed timer reading, current temperature, and barometric pressure on the Sampling Data Sheet.
5. Place the face plate back over filter and remove the sampling module, wrap in tin foil, and place in a cooler ≤ 4°C.
6. Once in a controlled environment and wearing nitrile or powder-free latex gloves, carefully remove the exposed filter with a pair of Teflon-tipped forceps. Fold filter in half twice with the exposed sample side on the inside of the fold. Place the filter inside of a hexane rinsed aluminum foil, as discussed.In 4.4.1, Step 14. Each individual piece of hexane rinsed aluminum foil and labeled with the sampling location, will contain the three filters from the previous takedown events
7. Remove the exposed PUF cartridge glass housing and place in a labeled shipping container with the labeled filter from the same sampling module so these media do not get separated.
8. After the final (4th) sampling segment, for each sampling location there should be four top filters and one PUF cartridge. Place all four labeled filters and PUF cartridges shipping containers into a shipping cooler at ≤ 4°C.
9. Fill out a chain-of-custody and place in shipping cooler.
10. Fill out a shipping manifest.
11. Ship to lab overnight via Federal Express to TestAmerica for analysis.

    TestAmerica West Sacramento
    880 Riverside Pkwy
    West Sacramento, CA 95605
    (916) 373-5600
    Account Manager: Karen Dahl
    (916) 374-4384
    karen.dahl@testamericainc.com

12. There will be several days before the next month's sampling event is initiated. During this time the motors will need to be replaced due to the number of hours they ran during the month. Use this time to perform motor replacement and any other maintenance that may be required.

Sampling Naming Scheme

Samples will be named similar to the naming scheme for the AAMP (date (month and year), location, method).
Example name for the sample collected at UMS1 in January 2009:

Sample ID: Jan09-UMS1-TO9A

Identify the met station pad location as MSP.

Field/Travel Blank

An extra PUF cartridge and top filter will need to be identified as a Field/Travel Blank (FB) and accompany the sample filters to and from the sites during each segment and then back to the lab at the end of the month. Only one FB will be necessary each month. During the 5-day sampling periods, keep this with the exposed top filters where ever they are kept at 4°C until the end of the month.

5.0 MAINTENANCE

A regular maintenance schedule will allow a monitoring network to operate for longer periods of time without system failure. All maintenance and corrective action activities should recorded in the Maintenance and Corrective Action Logs (PUF Sampler Form 5). The following cleaning and maintenance activities are recommended until a stable operating history of the sampler has been established.

TE-PUF Sampler

The TE-PUF sampler should be routinely inspected and maintained as follows:

1. Power cords should be checked for crimps, cracks or exposed junctions each sample day. Do not allow power cords or outlets to be immersed in water; if necessary raise the cords above the ground by taping them to the shelter legs.
2. Inspect the TE-1002 Dual Sampling Module.
   a. Make sure all gaskets are sealing properly; replace if necessary.
   b. Clean any dirt that is built up around the module and filter holder.
   c. Make sure quick disconnect is working correctly by making a good seal.

TE-1004 Blower Motor Assembly

The motor assembly is durable and has a long life if maintained properly. The routine maintenance required is:

1. Inspecting and replacing the motor flange gasket and motor cushion routinely.
2. Replacing the motor **TE-33384** carbon brushes every 400 to 500 hours of operation. It is imperative that the brushes be replaced before the brush shunt touches the motor commutator.

5.1 MOTOR BRUSH REPLACEMENT

Model TE-PUF Sampler–Brush part #TE-33384 (220 volt Brush part #TE-33378)

CAUTION: Ensure that all electrical power to the PUF Sampler is disconnected prior to opening the motor housing. Unplug the motor power cord.

1. Remove the Motor Mounting Cover by removing the four bolts. This will expose the flange gasket and the motor. Turn motor over.
2. Remove ground wires from backplate and carefully lift the metal housing from the motor.
3. With a screwdriver carefully remove the plastic fan cover by prying in between brush and cover until both sides pop loose.
4. With a screwdriver carefully pry the brass quick disconnect tabs away from the expended brushes.
5. With a screwdriver remove brush holder and release **TE-33384** brushes.
6. With new **TE-33384** brushes, carefully slide quick disconnect tabs firmly into tab slot until seated.
7. Push brush carbon against commutator until plastic brush housing falls into place on commutator end bracket.
8. Replace brush holder clamps onto brushes.
9. Assemble motor after brush replacement: snap plastic fan cover back into place, feed ground wires back through backplate, put housing back on to motor, pull cord set back to normal position, (**** Make sure wires do not get smashed between metal ring and housing! **)** fasten ground wires to backplate, turn motor over, tighten flange on top of housing and gasket.

****WARNING** Change Brushes Before Brush Shunt Touches Commutator!!**

5.2 MOTOR BRUSH SEATING PROCEDURE

To achieve best performance from new **TE-33384** brushes they must be seated on the commutator before full voltage is applied. After brush change apply 50% voltage for fifteen to twenty minutes to accomplish this seating. Use of **TE-5010** Flow Selector on system provides the reduced voltage for brush seating.

CAUTION: Direct application of full voltage after changing brushes will cause arcing, commutator pitting, and reduce overall life.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 QUALITY CONTROL CRITERIA FOR FILTER SAMPLES

Quality control evaluation criteria for filter samples collected on the TE-1000 PUF High Volume Samplers are listed below. All samples collected in the field will be checked against these criteria and the QC Checklist (PUF Sampler Form 6) completed before and after each sampling event. Associated samples will be flagged accordingly if any of the evaluation criteria are pertinent.

1. Filter contamination - Filter samples which are dropped or become contaminated by any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.).
2. Damaged or torn filters.
3. Sample takedown flow rate - If the flow rate through the sampler at takedown is outside the design operating range 8 cfm (0.225 m^3/min ± 10%).
4. Start/Stop times - The sampler start and stop time must be midnight to midnight for four 5-day segments.
5. Sample run duration - Sample run duration shall be 120 hours ± 5 hours.
6. Power failure.

6.2 FIELD/TRAVEL BLANKS AND DUPLICATE SAMPLES

During each sampling event, one filter and one PUF cartridge will be shipped to the field and returned, without drawing air through the sampler to serve as a field/travel blank.

Duplicate samples will be collected four times during the sampling year using the spare (mobile) PUF sampler. The station for the duplicate sample will rotate starting at DMS-1, then MSP, then UMS-1, then back to DMS-1. This sequence is subject to change based on observed sampling data and the desire to verify results at a specific location. The duplicate sampler will be located no more than four meters away from the fixed sampler and must be positioned at the same intake elevation. These duplicate samples will provide information on the precision of sampling methodology.

As discussed in the Workplan and QAPP, using the mobile PUF sampler, a one-month sample will also be collected at a location near the administration building. The sample results from this location will be used as a comparison of results to the MSP location.

6.3 QUALITY ASSESSMENT AND PERFORMANCE AUDITS

6.3.1 General Auditing Procedures

The primary goal of an auditing program is to identify system errors that may result in suspect or invalid data. The absolute efficiency of the monitoring system (labor input versus valid data output) is contingent upon effective quality assurance procedures. Performance audits will be conducted annually, or once during the Congener Study.

The true assessment of the accuracy and efficiency of the sampler's measurement system can only be achieved by conducting an audit under the following guidelines:

a. Without special preparation or adjustment of the system to be audited.
b. By an individual with a thorough knowledge of the instrument or the process that is being evaluated, but not by the routine operator.
c. With accurate calibrated National Institute of Standards Technology (NIST) traceable transfer standard that is completely independent of the one used in routine calibration.
d. With complete documentation of all sampling data which must be made available during a system audit.

An observer should be present, preferably the routine operator of the sampling equipment. This practice not only contributes to the integrity of the audit, but also allows the operator to offer any explanations and information that will help the auditor to determine the cause of discrepancies between measured audit data and the sampling equipment response.

6.3.2 Flow Rate Auditing Procedures

Audit procedures provided here are specific to the TE-1000 PUF sampler. In this subsection, the following conditions are assumed:

a. The volumetric flow rate, at the sampler inlet, is designed to operate in the range of 0.203 to 0.248 m^3/min at actual conditions.
b. The calibrated transfer standard is a BGI variable orifice equipped with a differential pressure gauge. The equipment must be NIST traceable with the most recent calibration data.
c. The audit orifice calibration data is expressed in terms of the true volumetric flow rate (Qc) as indicated by the audit orifice.

6.3.3 Audit Equipment

Performance audits of Tisch PUF Sampler require the following equipment:

a. A calibrated (NIST traceable) orifice device that has been certified within 12 months.
b. A differential pressure gauge with a range of 0-10 inches.
c. A thermometer capable of accurately measuring temperature to the nearest 1°C.
d. A barometer capable of accurately measuring ambient pressures to the nearest millimeter of mercury (mm Hg).
e. QA Audit Worksheet (PUF Sampler Form 7).
f. Systems Audit Checklist (PUF Sampler Form 8).
g. Loaded PUF cartridge assembly.

   NOTE: The site operator is responsible for providing the sampler's most recent calibration slope and intercept data for the subsequent determination of the PUF sampler's indicated flow rate (Q_{std}).

6.3.4 Flow Rate Performance Audit Procedures for PUF Samplers

When conducting an audit of the high volume particulate sampler, perform the following procedures:

A. Record the following parameters:
   1. Sampler serial number
   2. Site Location
   3. Date

B. Install a loaded "dummy" filter/cartridge assembly in the PUF sampler.

C. Install the faceplate and audit orifice on the loaded filter/cartridge assembly. Do not restrict the flow rate through the orifice (by closing the ball valve). Simultaneously tighten the faceplate nuts on alternate corners to prohibit leaks and to assure even tightening. The fittings should be hand-tightened; too much compression can damage the sealing gasket. Make sure the orifice gasket is present and the orifice is not cross-threaded on the faceplate.

NOTE: The sampler inlet may be partially lowered, within 2 inches, over the audit orifice to act as a draft shield.

D. Inspect the magnehelic gauge and verify if it is zero.

E. Turn on the sampler and allow several minutes for it to warm up to operating temperature.

F. Observe and record the following parameters on the QA Audit Worksheet (PUF Sampler Form 7):

1. Technician name.
2. Auditor name.
3. Audit orifice serial number.
4. Most recent audit orifice transfer standard calibration certification date, calibration slope and intercept.
5. Barometric pressure (P_a) in mm Hg. and Ambient temperature (T_a) in degrees Kelvin (°K).

G. When the sampler has warmed up to operating temperature, read the pressure differential across the orifice by reading the slack tube manometer and record as ΔH_2O on the QA Audit Worksheet (PUF Sampler Form 7).

H. Record the magnehelic gauge reading (magn) on the worksheet (PUF Sampler Form 7).

I. Turn off the sampler and repeat Steps G and H two more times until a total of three observations are obtained.

J. The three audit readings will be checked for accuracy and be reported.

K. Record all audit data, including the audit orifice calibration information and the PUF sampler's calibration data from most recent calibration.

L. Determine the true flow rate through the audit transfer standard orifice using the equation below:

$$Q_c = \frac{\sqrt{\Delta H_2O\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{Audit Orifice intercept } (b)}{\text{Audit Orifice slope (m)}}$$

Where:

Q_c = true volumetric flow rate as indicated by the audit orifice, m^3/min

ΔH_2O = pressure change across the orifice, in inches of water

T_a = ambient temperature, °K (°K = 273 + °C)

P_a = ambient barometric pressure, mm Hg

m = slope of the audit orifice.

b = intercept of the audit orifice.

M. Determine the standard flow rate (Q_{std}) as indicated by the magnehelic gauge readings using the equation below:

$$Q_{std} = \frac{\sqrt{magn\left(\frac{P_a}{760}\right)\left(\frac{298}{T_a}\right)} - \text{PUF Sampler intercept } (b)}{\text{PUF Sampler slope (m)}}$$

Where:

Q_{std} = standard flow rate as indicated by the magnehelic gauge readings, m^3/min

magn = Magnehelic Gage readings during audit, in inches of water

T_a = ambient temperature, °K (°K = 273 + °C)

P_a = ambient barometric pressure, mm Hg

m = slope of the PUF sampler from most recent calibration.

b = intercept of the PUF sampler from most recent calibration.

N. Calculate the percent difference between the sampler indicated flow rate (Q_{std}) and the corresponding audit true flow rate (Q_c) using the equation:

$$\%\,Difference = \frac{Q_{std} - Q_c}{Q_c} x100$$

O. Verify that the true flow rate determined by the audit orifice is within the specified volumetric flow rate range of 0.203 to 0.248 m^3/min. Note whether the true flow rate is

outside the specified range. Upon investigation, the invalidation or correction of all data from the last calibration forward or known date of change may result.

P. Record the responses in the field book or data sheet and use these responses to produce an audit report.

6.3.5 Systems Audit

The systems audit is an evaluation of the completeness of recordkeeping and the adherence to the overall sampling plan. The systems audit checklist (PUF Sampler Form 8) is a series of questions and observations that the auditor will assess to evaluate the compliance with the sampling plan. The auditor will record assessment data on the PUF Sampler Form 8 and evaluate/implement any necessary changes.

6.4 AUDIT DATA REPORTING

The Program and QA Managers should be given a copy of the audit results (PUF Sampler Forms 7 and 8) when the audit is completed. If a sampler exhibits unsatisfactory agreement with the audit results, the Program and QA Managers need to be informed within 72 hours, and a calibration should be performed prior to the next sampling event.

A post-audit verification of audit equipment and data is essential before inferences can be drawn regarding the sampler's performance. An auditor should be able to support audit data with equipment verification documentation.

7.0 REFERENCES

Operations Manual TE-1000 PUF Poly-Urethane Foam High Volume Air Sampler. Tisch Environmental, Inc., 1998.

Quality Assurance Handbook for Air Pollution Measurement Systems. Volume II: Part 1. Ambient Air Quality Monitoring Program Quality System Development. United States Environmental Protection Agency, August 1998.

Quality Assurance Volume II. Standard Operating Procedures for Air Quality Monitoring Appendix E: High Volume Sampler. State of California Air Resources Board, Monitoring and Laboratory Division, March 1992.

Winberry, W. T. Jr., et al. January 1999, "Compendium Method TO-9A: Determination Of Polychlorinated, Polybrominated And Brominated/Chlorinated Dibenzo-p-Dioxins And Dibenzofurans In Ambient Air" Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition. *United States Environmental Protection Agency.*

Appendix G

Field Sampling for Vegetation and Soil Standard Operating Procedures

FIELD SAMPLING FOR VEGETATION AND SOIL
STANDARD OPERATING PROCEDURES (SOP)

Dioxin-Like Polychlorinated Biphenyl (PCB) Congener Study Work Plan
Chemical Waste Management, Inc. - Kettleman Hills Facility

SCOPE AND APPLICATION

This SOP addresses vegetation and soil sampling for the KHF Dioxin-Like PCB Congener Study. The sampling strategy has been designed to capture PCB congeners that may have deposited around the facility, accumulated in the surface soil, and deposited on or taken up by the vegetation. This is more reflective of the historic potential impacts to the buffer zone from handling PCB contaminated waste at KHF as compared to the air sampling which is more reflective of current activities at the site. Vegetation and soil sampling has been combined in one SOP since the sample locations are collocated and will follow many of the same procedures. This SOP is based on and incorporates EPA Guidance and Methods:

- US EPA Region 4 *Operating Procedure for Soil Sampling*. Science and Ecosystem Support Division (SESDPROC-300-R1, 2007),
- US EPA Region 4 *Operating Procedure for Field Sampling Quality Control*, Science and Ecosystem Support Division (SEDPROC-011-R2, 2007),
- US EPA Region 9 Laboratory Field Sampling Guidance Document #1205 Soil Sampling (US EPA Region 9 Soil Sampling, 1999),
- US EPA Method 1668A Chlorinated Biphenyl Congeners in Water Soil, Sediment, and Tissue by HRGC / HRMS, Revision A (US EPA Method 1668a, 1999), and
- US EPA Emergency Response Team (ERT) Vegetation Assessment Field Protocol (ERT Vegetation SOP, 1996).

Vegetation and soil sample analysis may determine whether concentrations of Dioxin-like PCB congeners exceed concentrations that present a risk to public health, welfare, or the environment as described in the Congener Study Workplan.

GENERAL

The field QA Manager will be responsible for assuring the following sampling procedures are followed.

Due to the low concentrations and detection limits for US EPA Method 1668a, the following special precautions, as stated in pages 12-14 and 11-14 of US EPA Region 4 Operating Procedures for Soil Sampling and Field Sampling Quality Control, respectively, will be followed during sampling:

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves will be donned immediately prior to sampling. Every attempt will be made to minimize glove contact with the media

being sampled. [Note: Latex gloves are mentioned but nitrile gloves may be used and are a suitable substitute.]

- Sample containers for source samples or samples suspected of containing high concentrations of contaminants will be placed in separate plastic bags immediately after collecting, tagging, etc. These samples will consist of samples taken from the area adjacent to the B-18 landfill.
- Background samples and impact samples will be collected by different field teams. Impact samples shall never be placed in the same ice chest as background samples. Ice chests or shipping containers for samples suspected to contain high concentrations of contaminants shall be lined with new, clean, plastic bags.
- When possible, one member of each field sampling team will take all the notes, fill out tags, etc., while the other member collects the samples.
- Sample collection activities will proceed progressively from the least suspected contaminated area to the most suspected contaminated area.
- Team members will use equipment constructed of Teflon®, stainless steel, or glass that has been properly pre-cleaned (according to the listed decontamination procedures) for collection of samples for organic compounds analyses. Equipment constructed of plastic or PVC shall not be used to collect samples for trace organic compounds analyses.
- In no case will painted or plastic equipment make direct contact with the sample where trace levels of organic contaminants are of concern.

Sample Preservation, Containers, Handling, and Storage

The following is based on US EPA Region 9 Laboratory Field Sampling Guidance Document #1205, Soil Sampling (Section 3.0) and US EPA Method 1668a. However, procedures apply to both the vegetation and soil samples:

- Samples will be stored on ice (blue ice). Chemical preservation of solids is not recommended or required. Cooling is usually the best approach, supplemented by the appropriate holding time as listed in the QAPP.
- Wide-mouth amber glass containers with Teflon-lined caps are utilized for vegetation and soil samples. The sample volume is a function of the analytical requirements (30-g for vegetation and 10-g for soils).
- Soil will be transferred from the sample collection device to an appropriate sample container using a stainless steel spoon or equivalent. Vegetation and soil sample increments will be composited in the laboratory for each target area (see Figure 4 of Workplan).
- Compositing will be completed in the field only for the US EPA Region-IX field split sample. When composite samples are collected, the soil sample will be placed in a stainless steel bowl, and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling increment. Then the soil sample will be placed into labeled containers. The quartering method will be used to composite individual soil increment samples in the field and for US EPA Region-IX field splits.
- To avoid knocking off any dust particles adhering to the vegetation surface, vegetation will be deposited directly into the sample container. Each increment

will be composited by clipping various selected vegetation in equal amounts until the total quantity is met. This is described in collection procedures.

- All sampling devices will be decontaminated, and then wrapped in aluminum foil. The sampling device will remain in this wrapping until it is needed. Each sample device will be used for only one increment sample per area. Completely dedicated sampling devices for all vegetation and soil samples will be impractical due to the large number of increment samples. In this case, sampling equipment will be cleaned using the decontamination procedure described in this SOP between each new composite area.

Equipment

Field Equipment will consist of the following:

- Maps/aerial photos
- GPS units
- Tape measures
- Wire flags
- Digital cameras
- Stainless steel spoons
- Stainless steel bowls
- 4-oz, one-quart, 500 mL, and 1-L, wide-mouth amber glass sampling jars w/Teflon-lined lids (laboratory provided with traceable lot numbers)
- Bound logbook
- Sample jar labels
- Chain of custody forms
- Custody seals
- Field data sheets
- Coolers
- Ice
- Decontamination supplies/equipment
- Spade or shovel
- Stainless steel scissors
- Appropriate personal protective equipment
- Aluminum foil
- Plastic sheeting
- Ziplock, or equivalent, polyethylene bags

PROCEDURES

Preparation

1. General sample location coordinates will be loaded into GPS units prior to arrival in the field based on Figure 4.

2. All sampling equipment will be decontaminated and wrapped in aluminum foil prior to entering the field. The decontamination procedures are included on the following page.

Equipment Decontamination

Sampling equipment will be decontaminated in a well-ventilated area free of dust, approved by the QA Manager. Cleaning will not be conducted in the field. A cleaning station will be established and all personnel will wear gloves during cleaning. Equipment will be free of visual dust or other contamination prior to the decontamination procedure.

Based on a discussion with the laboratory, a cleaning sequence similar to and consistent with that employed at the laboratory was developed. Non-dedicated equipment (spoons, bowls and scissors) will be cleaned a follows:

1. A detergent wash using commercially available TSP and soft bristle brush.
2. A triple rinse with commercial distilled water.
3. Air dry on aluminum foil.
4. Rinse with reagent grade toluene (lab provided)
5. Final air dry on aluminum foil.
6. Wrapped in unused aluminum foil.

The spent toluene will be collected for proper disposal.

Sample Locations

The initial location for each sample will be pre-selected using GPS coordinates (Latitude/Longitude) based on the grid spacing as established in Section 3.2.1 and identified on Figure 4. The locations will be located in the field with a GPS unit. If the pre-selected location is not suitable (e.g. insufficient soil or vegetation) the location will be systematically relocated in 1 meter increments inward from the facility fence until a suitable location is found. The direction and offset will be recorded in a bound field book and the new coordinates measured and then recorded in the GPS unit. Available landmarks will also be recorded. Once the sample location is established, a 1 m^2 area will be marked with flags labeled according to the naming scheme presented later in the sample labeling section. Photos will also be taken at each sample location depicting actual conditions at each sample point.

If the sampling grid is modified due to rocky conditions or uneven soils cover the modifications will be recorded in the field book. The soil collected will be described using the Unified Soil Classification System (USCS).

During the second round of vegetation sampling, the sampling team will identify how the location of vegetation samples collected in the first and second rounds of sampling will

relate to each other (e.g., offset by ___ feet to the ___) in a bound logbook. The use of flags will allow for accurate location of dry vegetation sampling.

Sample Collection

Vegetation and soil sampling collection will follow a similar collection technique. Each collection procedure is listed separately to ensure proper collection order and technique is followed.

VEGETATION SAMPLE COLLECTION

Vegetation samples will be collected first from each sampling location to ensure that soil deposited on foliar surfaces is captured for inclusion in the analysis.

1. Each sample collection site will be approached from a down wind direction to the extent possible.
2. The sampling site will consist of a 1 meter by 1 meter square area. The corners of the area will be staked with wired flags and photographed, both close up and from an appropriate distance to characterize the location.
3. Sampling personnel will wear new latex or nitrile gloves at each location. Frequent glove changes will be made in the event the sampler touches material outside the sample location or un-cleaned sampling equipment.
4. The sampling technician will kneel outside the sample site from the downwind side to collect the samples.
5. Vegetation samples will be collected using stainless steel scissors. The cuttings will be carefully allowed to drop (or placed) directly into the amber glass sample jar to preserve any soil deposited on foliar surfaces:
    a. Vegetation Selection Criteria: Green, or actively growing, portions of each plant type within the sample site will be selected. The vegetation to be sampled will consist of leafy plant tissue types that potentially would be consumed by herbivores such as those to be evaluated as representative receptors in the RA (see Workplan Section 5.4.2.2).
        i. The mammalian receptor (a rodent) may consume a variety of vegetation, such as seeds, fruit, grasses, forbs, and the leaves of shrubs;
        ii. The avian receptor likely would consume mainly seeds and fruit.
        iii. Based on discussions with personnel at the site, larger mammals (i.e., cattle) have been observed consuming a variety of fresh vegetation such as grasses, saltbrush, and other leafy plants of various sizes.
        iv. A variety of green vegetation (not woody material), seeds, and fruit found to be present at each sample location will be collected and combined in a sample jar to provide a representation of the plant material on which herbivorous receptors in the area may feed. As such, the vegetation sampling is biased towards grasses, leaves, fruits, flowers, and seeds.

b. Visually equal portions of each plant type in the sample area will be collected. It is expected that vegetation will be sparse and the field staff will need to exercise judgment to collect representative samples.
c. Data regarding the vegetation collected will be recorded in a bound logbook. Data will include those items as listed on the Plant Tissue Sampling Field Data Sheet included for reference.

6. The sampler will secure the cap tightly.
7. The sampler will label and tag the sample containers.
8. The sampler will place the glass sample containers into sealable plastic bags and then into an iced shipping container. Samples should be cooled to 4°C as soon as possible.
9. The sampler will complete the chain of custody forms and ship as soon as possible in order to minimize sample holding time. Scheduled arrival time at the analytical laboratory should give the lab as much time as possible for scheduling of sample analysis.

SOIL SAMPLE COLLECTION

Soil samples will be collected from each composite area. Individual increments will be composited by the laboratory to reduce handling in the field.

10. The sampling site will consist of the same 1 meter by 1 meter square area from which the vegetation sample was collected. The corners of the area will be staked with wired flags and photographed, with time stamps, both close up and from an appropriate distance to characterize the location.
11. Sampling personnel will wear new latex or nitrile gloves for the soil samples. Frequent glove changes will be made in the event the sampler touches material outside the sample location or un-cleaned sampling equipment.
12. The sampler will kneel outside the sample site from the downwind side to collect the samples.
13. A stainless steel spoon will be used to collect soil from an evenly spaced 9-cell grid within the 1 meter square sampling site.
14. The upper two-inches of soil will be collected. Visually equal portions will be collected from each cell and placed in the stainless steel bowl.
15. The soil will be mixed with the stainless steel spoon until homogenized using the quartering method or stirring the material in a circular fashion and then reversing direction, and occasionally turning the material over (p. 13, SESDPROC-300-R1).
16. The soil sample will be placed in a 4 oz amber glass jar, (fully filled).
    a. An additional 4 oz sample of the homogenized soil will be placed in a field composite stainless steel bowl.
    b. The field composite stainless steel bowl will be covered with aluminum foil and taken to the next sampling increment location within the composite sample area.
    c. Each composite sample area will produce two field composites. One field composite from each composite location will be taken by USEPA-IX for independent analysis. One field composite will be shipped with KHF samples and placed on hold with the laboratory.

17. The cap will be secured tightly.
18. The sampler will label and tag sample containers, and record appropriate data on soil sample log book (depth, location, color, other observations)
19. The sampler will place the glass sample containers into a sealable plastic bags and then into an iced shipping container. Samples should be cooled to 4°C as soon as possible.
20. The sampler will complete the chain of custody forms and ship to the analytical lab as soon as possible to minimize sample holding time. Scheduled arrival time at the analytical laboratory should give as much of a holding time as possible for scheduling of sample analysis (p. 6, US EPA Region 9 Soil Sampling).

21. Each sample increment within a composite sample area (e.g., the NE property line sample area) will be collected using a different stainless steel spoon and bowl.
22. All reusable sample equipment will be decontaminated after each composite sample area has been completed and prior to reuse at the next sampling area.

Rinsate Blank Procedures

One rinsate sample will be collected each day of sampling from each sampling team. A total of 4 rinsate blanks (2 soil/2 vegetation) are expected (2 teams, two days of sampling). One rinsate blank will be analyzed for each sampling matrix and the second sample(s) will be held at the laboratory for additional confirmation analysis if rinsate contamination is detected.

Each rinsate blank will be collected using a set of pre-cleaned sampling tools. For the rinsate blank laboratory grade, distilled-deionized (DI) water will be provided in sealed and numbered vials from the laboratory. Each rinsate sample will be collected by pouring the laboratory provided DI water into the stainless steel bowl and over the sampling tool(s). The water will then be poured into lab provided sampling vials.

Duplicate Sampling Procedures

Duplicate and Matrix Spike/Matrix Spike Duplicate samples will be identified by the project manager and communicated to the laboratory. Since the sample will be composited at the laboratory, blind-field duplicates are not possible. There is sufficient soil volume in the 4-oz jars.

Sample Labeling

Each sample will be labeled with the date, the composite area identifier as included on Figure 4 and the table in Section 3.2.1, a 2 digit location identifier, and “S” or “V-G or V-D” for soil or vegetation-green or vegetation-dry, and the samplers initials. The time will be recorded separately on the sample label. For example:

090216-NE-01-S-MRS 14:30 (February 16, 2009, Northern Half of Eastern Property Line, location 1, Soil, by Michael R. Shoemaker, at 2:30 PM))

The sample numbers, time and notes will be recorded in the field book.

The laboratory will be provided with a key indicating the samples to be composited. Samples being composited will be placed in one cooler, as feasible. All samples being composited will have the same composite area identifier in their name.

Chain of Custody and Shipping

Field personnel are responsible for sample custody from the time of sample collection until the time of shipment. Samples will be kept in the secure possession of the sampler, meaning they are either within sight of the sampler, in the sampler's secure vehicle, or within a secure office area.

The following procedures for chain-of-custody forms will be followed:

- Chain-of-custody forms will be provided by the laboratory (see attached example).
- Chain-of-custody forms will include the project name, Wenck project number, signature of sampler, receiving laboratory, sample ID numbers, date and time of collection, sample location, number of containers, analyses requested, sample matrix, and custody transfer signatures, including the name of the shipping company. Signatures of personnel from the shipping company are not required. The shipping bill number will be recorded on the chain-of-custody form.
- One chain-of-custody form will be supplied per cooler.
- Chain-of-custody forms will be completed in ink.
- Mistakes will be lined out with a single line and initialed and dated.
- Entries will be sequentially numbered.
- Repetitive entries made in the same column may be simplified with a continuous vertical arrow between the first entry and the next different entry. A "ditto" or quotation marks indicating repetitive information will not be used.
- Multiple chain-of-custody forms for a single shipment will be consecutively numbered using the "Page ___ of ___" designation.
- One copy of the chain-of-custody form will be filed with the Wenck for tracking and laboratory communication purposes.

The laboratory will retain a copy of the shipping bill as proof of custody during transit.

Sample coolers will be prepared for shipment as follows:

- Each cooler will be wiped clean of all debris and water.
- Each cooler will contain a corresponding chain-of-custody form sealed in a polyethylene bag.
- Each cooler will contain a temperature blank that will be checked by the laboratory when the cooler arrives at the laboratory.

- Each cooler will be packed with bubble pack or similar packing media and contain a sufficient volume of ice to maintain a temperature of 4ºC ± 2ºC.
- Cooler ice will be double bagged.
- Coolers will be secured with at least two cooler custody seals (see attached example) and covered with clear plastic packing tape.
- Each cooler will be taped and sealed shut with clear plastic packing tape around each end of the cooler.
- Each cooler will be shipped to the laboratory by overnight courier or hand delivered.

PLANT TISSUE SAMPLING DATA SHEET
PCB Congener Study
Kettleman Hills Facility (KHF)
Kings County, California

Project Name: **CWMI – KHF**
Sample Identification: _____ Date: _____
Composite Name: _____ Time: _____
Composite Increment: _____ Chain of Custody Number: _____
Weather Conditions: _____

LOCATION DESCRIPTION

- primarily grassy
- scarce grass
- brush/scrubs

SAMPLE TYPE

Species:
- leaves
- saltbrush
- grasses
- seeds
- flowers
- forbs
- fruits
- whole plant

SAMPLE PREPARATION

Container:

Preservation:

- Shipping _____
- Packaging _____

Comments and Notes_____
_____
_____

Sample Chain of Custody Form

Anchorage
2000 W. International Airport Road
Suite A10
Anchorage, AK 99502
phone 907.563.9200 fax 907.563.9210

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:	_____ of _____ COCs
Address	Analysis Turnaround Time			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
(xxx) xxx-xxxx Phone	TAT if different from Below _____			
(xxx) xxx-xxxx FAX	☐ 2 weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O#	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																		Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Sample pictures of vegetation types at Kettleman Hills Facility

Saltbrush (close-up)

California Poppy

Typical Small Flowering Plants and Grasses (Saltbrush in background)

Typical Small Flowering Plants and Grasses (close-up)