Final
Master Work Plan
Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the
LANTDIV CLEAN II Program
Contract No. N62470-95-D-6007
CTO-031

Prepared by

CH2MHILL

Tampa, Florida

September 6, 2001

Master Work Plan

Master Work Plan Contents

Project Management Plan

Master Sampling and Analysis Plan

Master Field Sampling Plan

Master Quality Assurance Project Plan

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Introduction and Work Plan Contents

The U. S. Environmental Protection Agency (EPA) and the U.S. Navy (Navy) entered into a Consent Order on January 20, 2000, to address potential environmental contamination at the Atlantic Fleet Weapons Training Facility (AFWTF) on Vieques Island, Puerto Rico. As part of the Consent Order, the Navy is required to perform a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) to fully determine the nature and extent of any releases of hazardous wastes, solid wastes, and/or hazardous constituents from or at AFWTF.

In response to the requirements of Contract Task Order (CTO)-031, CH2M HILL has prepared a work plan for the RFI at AFWTF. The RFI addresses potential soil and groundwater contamination for nine of 12 identified Solid Waste Management Units (SWMUs) and three identified Areas of Concern (AOCs) at AFWTF. The remaining three identified SWMUs at AFWFT not addressed in this work plan are excluded from the corrective action requirements at AFWFT per section IV.7(d) of the Consent Order.

The work plan provides for submission of a draft, draft final, and final work plan; and consists of the following six plans:

- *Project Management Plan*, which contains a discussion of the project background, technical approach (including monitoring rationale), schedules, budget, personnel, and the overall management approach to the RFI
- *Master Quality Assurance Project Plan*, which documents the procedures to ensure that all information, data, and resulting decisions are technically sound, statistically valid, and properly documented
- *Data Management Plan*, which documents and tracks investigation data and results
- *Health and Safety Plan*, which discusses the health and safety requirements for performing fieldwork at the sites
- *Master Investigation-Derived Waste Management Plan*, which provides guidance on handling and disposing of investigation-derived waste (IDW)
- *Community Relations Plan*, which outlines the public outreach activities planned for the project

Master Sampling and Analysis Plan

Master Field Sampling Plan

Draft Final

Master Field Sampling Plan

Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

Contract Task Order 031

Prepared for

Department of the Navy
Atlantic Division
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Under the

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List of Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
ASTM	American Society for Testing and Materials
ATV	All-terrain vehicle
BGS	Below ground surface
°C	Degrees Centigrade
CLP	Contract laboratory program
COC	Chain-of-custody
D.O.	Dissolved oxygen
EPA	Environmental Protection Agency
EM	Electromagnetic induction
FID	Flame ionization detector
FSP	Field Sampling Plan
GPS	Geographic Positioning System
GPR	Ground penetrating radar
HCl	Hydrochloric acid
HNO_3	Nitric acid
HSP	Health and Safety Plan
IDW	Investigation-derived waste
IDWMP	Investigation-derived waste management plan
LANTDIV	Atlantic Division
MHZ	Megahertz
MP	Master Plan
MS/MSD	Matrix spike, matrix spike duplicate
MSL	Mean sea level
NaOH	Sodium hydroxide
NAS	Naval Air Station
NAVFACENGCOM	Naval Facilities Engineering Command
NTR	Navy Technical Representative
NTU	Nephelometric turbidity unit
OVM	Organic vapor monitor
PAH	Polycyclic Aromatic Hydrocarbon
PC	Personal computer
PCB	Polychlorinated biphenyl
PID	Photoionization detector

PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SOP	Standard operating procedures
SSP	Site screening process
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
USCS	Unified soil classification system
USGS	United States Geological Society
VOC	Volatile organic compound
XRF	X-Ray Fluorescence

SECTION 1

Introduction

This Master Field Sampling Plan (FSP) is a compilation of the anticipated field activities that may be performed to support Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) activities at the Atlantic Fleet Weapons Training Facility (AFWTF) on Vieques Island, Puerto Rico. The purpose of the Master FSP is to describe the types of field procedures which may be performed during the course of field activities, and how these procedures will be completed. This Master FSP does not include site-specific information regarding past activities, nor does it include potential sample locations or the number of samples to be collected. Site-specific field activities will be described in separate Site-Specific Work Plans. These work plans will reference this Master FSP, rather than repeat the information contained in this plan. Information to be provided in each site-specific FSP is outlined on the FSP site-specific checklist, located in Attachment 1 of the Master WP.

This Master FSP describes field investigation procedures and practices to be followed at AFWTF and is organized in three sections. Section 1 is a general introduction. Section 2 addresses analytical services and describes the different field activities which may be performed. Section 3 provides protocol for sample documentation and custody. All analyses will be performed in accordance with standard EPA Contract Laboratory Program (CLP) protocol or EPA Test Methods for Evaluating Solid Waste (SW-846) Third Edition. Tests conducted in the field, such as water quality measurements and tests for soil characteristics, will be performed according to the Standard Operating Procedures (SOPs), located in Attachment 2 of the Master WP. The potential field activities that may be conducted at the base include:

- Geophysical surveys
- Soil gas surveys
- Surface water and sediment sampling
- Surface soil sampling
- Soil boring installation
- Subsurface soil sampling
- Monitoring well installation and development
- Monitoring well abandonment
- Groundwater sampling
- Direct-Push groundwater sampling
- Aquifer testing
- Hydrologic measurements
- Sewer Sampling
- Biota sampling
- Trenching
- Land surveying
- Investigation derived waste sampling
- Decontamination
- Health and Safety Monitoring

The background and setting for AFWTF is described in the Master WP and is not repeated here. Site-specific information regarding individual sites will be included in Site-Specific Work Plans.

SECTION 2

Field Activities

This section describes analytical field sampling analytical/quality control protocol and field activities which may be performed at AFWTF. Not all of these activities will be conducted at all sites. The field activities discussion is general; details of the procedures are provided in the SOPs included as Appendix A of the Master WP.

The sampling activities at AFWTF conform to U.S. Navy specifications and guidelines.

2.1 Analytical Services

Analytical services include the measurement of field parameters, routine analyses of environmental samples, and data validation.

2.1.1 Field Measurements

The field parameters temperature, pH, dissolved oxygen (DO), turbidity, and specific conductance are measured as screening tools. These parameters will be used to evaluate groundwater and surface water conditions prior to sample collection. These parameters will also be used to estimate the effectiveness of well development activities.

Field screening also includes the use of an organic vapor monitoring instrument to measure organic vapors in air and an explosimeter to measure the vapors associated with combustible gasses. These data will be used for the following:

- Evaluation of ambient air conditions during field activities to meet the requirements of the HSP
- Assist in the gross screening of soil samples

Field screening procedures are discussed in more detail in Section 4 of the Master Quality Assurance Project Plan (QAPP) and in the SOPs included in Volume 2 of the Master WP.

2.1.2 Routine Sample Analysis

The routine analysis of environmental samples will be requested for Appendix IX constituents and explosives.

These data will be used for the following:

- Risk assessment
- Characterization of the native soil and fill
- Characterization of groundwater, sediment, and surface water

The methods and procedures to be followed during routine sample analyses are discussed in more detail in Section 8 of the Master QAPPs.

2.1.3 Data Validation

Data validation requirements are discussed in more detail in Section 9 of the Master QAPP.

2.2 Field Quality Control (QC) Procedures

QC duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. Table 10-1 in the QAPP is a summary of the collection frequencies of the field QC samples.

2.2.1 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample. American Society for Testing and Materials (ASTM) Type II water will be used for blanks. Four types of blanks will be generated during sampling activities: trip blanks, field blanks, equipment blanks, and temperature blanks.

One trip blank will be included each day for each cooler containing samples for volatile organic compound (VOC) analysis. The trip blanks will be prepared before each sampling event, shipped or transported to the field with the sampling bottles, and sent to the laboratory unopened for analysis. Trip blanks will not be prepared or handled in the field. Trip blanks will indicate whether contamination is introduced during shipment to the field, storage in the field, or shipment from the field to the analytical laboratory.

One field blank will be collected each week of sampling. The field blanks will indicate whether contamination has been introduced by ambient air conditions in the field or by handling the sample bottle in the field or in the laboratory. The pre-preserved sample container will be filled with ASTM Type II water in the field at the time of sampling.

One equipment blank will be collected each day during sampling. The equipment blanks will indicate the completeness of equipment decontamination procedures.

A temperature blank will be included in each cooler containing samples requiring preservation so that the laboratory can record the temperature without disturbing the samples. The temperature blank will not be given a sample number nor listed as a sample on the chain-of-custody (COC).

2.2.2 Duplicates

Field duplicate samples will be collected in accordance with procedures described in Sections 3.2.3 and 3.2.4 of the Site-Specific Work Plan at a frequency of 1 per 10 field samples per matrix. The locations from which the duplicates are taken will be selected with a bias for locations where contamination is expected. The duplicate sample will be submitted for analysis as two independent samples with different sample numbers. Data validators will use these results to evaluate the precision of the analytical data.

2.2.3 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of 1 per 20 field samples. For the MS/MSD measurement, three aliquots of a single sample are analyzed. The matrix spike is an aliquot of sample spiked with a known concentration of target analyte(s). The matrix spike duplicate is an intra-laboratory split sample spiked with identical concentrations of a target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document accuracy in a given sample matrix. The MSD is used to document the precision in a given sample matrix. Thus, the matrix accuracy is evaluated from spike recoveries, while the precision is evaluated from comparison of the spike concentrations (SW846) of the MS and MSD. Data validators will use the results to evaluate the accuracy of the analytical data and precision through comparison of the duplicate spike results.

2.3 Geophysical Surveys

Geophysical survey methods that may be used include electromagnetic induction (EM), ground penetrating radar (GPR), magnetometry, and downhole geophysical surveys. Appropriate survey methods will be selected to delineate potential areas of buried wastes and utilities at the areas under investigation. Utility clearance will be performed by AFWTF and/or its subcontractors prior to any soil disturbance. The results from these surveys will be used to determine the locations of subsequent soil borings and monitoring wells and to characterize the condition of the subsurface.

In general, grids will be established in the field at areas to be evaluated at an appropriate spacing (e.g., 15 to 20 feet), depending on the geophysical method being used and the size of the site. Smaller grid spacings may be used in areas where greater subsurface definition is required (e.g., locating an underground storage tank). The grid spacings will be tied to existing permanent structures (e.g., buildings, monitoring wells) so they can be referenced to later land surveys. In some areas, brush and tree clearing may be required for the geophysical surveying operations. The criteria used to determine grid spacing will be further defined in the Site-Specific Work Plans.

2.3.1 Electromagnetic Induction

EM terrain conductivity profiling is a non-invasive method used to identify lateral changes in subsurface conductivity through inductive electric measurements made at the ground surface. The EM survey is a rapid, cost effective reconnaissance tool. Areas of higher-than-background conductivity may be associated with surficial and buried wastes, contaminants, or metal objects (i.e., buried drums and storage tanks, product lines, utility lines). EM may also be used for contaminant plume mapping, locating abandoned trenches and lagoons, and locating lateral anomalies such as pockets or pits of different materials.

EM data will be digitally recorded and downloaded to a personal computer (PC) for processing and analysis. Data will be profiled and contoured over the area of investigation to determine inordinately high and low conductivity values. Areas interpreted to represent buried waste, contaminants, or metals will be delineated.

2.3.2 Ground Penetrating Radar (GPR)

GPR is an active geophysical system which transmits high frequency EM waves into the ground and detects the energy reflected back to the surface. The GPR transmits electromagnetic waves of radio and microwave frequencies (e.g., 80 megahertz [MHz] to 1,000 MHz). Reflections typically occur at lithologic changes, subsurface discontinuities, and internal soil structures. GPR is useful for determining the presence of underground utilities and buried metallic objects, and for further characterizing buried wastes by producing a graphic cross section of the subsurface. Other applications include locating concrete foundations, buried archaeological artifacts, excavations, filled pits, and lagoons.

2.3.3 Magnetometry

Magnetometry measures local perturbations in the earth's magnetic field. Both naturally-occurring and man-made magnetic materials can modify the ambient field. Buried ferrous objects, such as drums, tanks, and product lines, usually produce a detectable magnetic anomaly.

Magnetic data will be digitally recorded and downloaded to a PC for processing and analysis. Data will be profiled and contoured over the area of investigation to facilitate identification of anomalous magnetic intensities. Areas interpreted to represent buried waste, contaminants, or metals will be delineated.

2.3.4 Downhole Geophysics

Downhole geophysical methods are used to characterize or log the stratigraphy, geology, morphology, and hydrology of a well or open bore hole. Methods that are commonly utilized and what is recorded are summarized below:

- Caliper log – measures changes in the diameter of the borehole
- Fluid resistivity log – records natural variations in electrical resistivity (resistance) of borehole and interstitial fluids
- Electrical resistivity log – records natural variations in electrical resistivity (resistance) between contrasting lithologic types and interstitial fluids
- Spontaneous potential log – records natural variations in electrical potential (voltages) between contrasting lithologic types
- Gamma log – records natural variations in gamma radiation between contrasting lithologic types
- Acoustic (sonic) log – records natural variations in density (porosity) between contrasting lithologic types
- Neutron logs – records natural variations in neutron emission between contrasting lithologic types
- Temperature log – records variations in water temperature within a borehole
- Fluid movement (flow) log – records variations in borehole groundwater flow-through

2.4 Soil Gas Survey

Soil gas surveys are expected to be used in areas where materials containing petroleum-based compounds, VOCs, or other hydrocarbon compounds were used, spilled, or stored. Soil gas survey results will be used to help delineate the extent and concentration of organic vapors in the vadose zone which may be indications of soil and/or groundwater contamination. The results may also be used to determine the need for and locations of confirmatory soil borings and monitoring wells.

Soil gas samples will be collected in-situ and analyzed onsite. Samples may be analyzed for hydrocarbon compounds and/or selected chlorinated compounds (i.e., trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane) using gas chromatographic techniques. Samples can also be analyzed for combustible gases using a portable combustible gas indicator.

2.5 Surface Water and Sediment Sampling

Surface water and/or sediment samples will be collected from the Caribbean Sea sewers, sumps, and other structures across the site. For the sewers, sampling will proceed from downstream to upstream locations to reduce the amount of turbidity and potential cross-contamination of downstream samples. Sampling will be conducted at low tides, where appropriate, and low flow to minimize dilution of possible contaminants. Sampling activities will not occur after periods of heavy rainfall.

2.5.1 Surface Water Sampling

Field parameters (e.g., DO, temperature, specific conductance, pH) will be measured prior to sample collection. Surface water samples will then be collected by submersing the sampling container directly into the surface water body or by using a “thief” type sampler and then transferring the sample to the sample container. The body of the immersed sampling container will face downstream so that any sediment disturbed during the immersion of the container does not enter the sampling vessel. If the volume of surface water encountered is insufficient to allow the direct submersion of the sampling containers, a glass interim vessel will be used to transfer the surface water sample to the sample containers. The glass interim vessel will be laboratory cleaned to the same specifications as the sample containers.

Table 2-1 presents the required containers, preservatives, and holding times for water samples. All appropriate preservatives will be added to the sample containers by the contracted laboratory before shipment to the environmental contractor’s field team. All samples will be kept cool in the field at 4 degrees Celsius (ºC), using bagged ice.

For VOC samples, the bottles will be filled so as to minimize aeration of the samples. During the collection of surface water samples, care will be taken to ensure that any pre-added preservative is not rinsed from the sampling container during sample collection. Sample vials will be filled completely and capped to prevent the entrapment of any air bubbles in the vial.

TABLE 2-1
Required Containers, Preservatives, and Holding Times for Water Samples

Analysis	Analytical Preparation/ Method Number	No. of Containers	Sample Container	Preservative	Holding Time	Volume of Sample Collected
VOCs	SW-846 Method 5030B/8260B	3	Three 40-ml glass vials w/Teflon-lined cap	HCl to pH <2; Cool to 4ºC	14 days	Fill completely; no air bubbles
SVOCs	SW-846 Method 3510C/8270C	2	Two 1-liter bottles	Cool to 4ºC	7 days extraction/40 days to analysis	Fill to shoulder
Pesticides/ PCBs	SW-846 Methods 3510C/8081A and 3510C/8082	2	Two 1-liter bottles	Cool to 4ºC	7 days/ extraction/40 days to analysis	Fill to shoulder
Metals	SW-846 Methods 3010A/6010B and 3010A/7000 series	1	1-liter polyethylene bottle	HNO_3 to pH <2; Cool to 4oC	6 months (28 days for mercury)	Fill to shoulder
Cyanide	SW-846 Methods 9010B and 9012A series	1	1-liter polyethylene bottle	NaOH to pH >12; Cool to 4oC	14 days	Fill to shoulder
Lead and Arsenic	SW-846 Methods 3010A/7421 and 3010A/7061	1	1-liter polyethylene bottle	HNO_3 to pH <2; Cool to 4oC	6 months	Fill to shoulder
Explosives	SW-846 Methods 8330 and 8332	1	1-Liter Amber	Cool to 4ºC	7 days/ extraction/40 days to analysis	Fill to shoulder
Total Organic Carbon	EPA Method 9060	1	500-ml amber glass	H_2SO_4 or HNO_3 to pH<2; Cool to 4oC	28 Days	Fill completely, no air bubbles
TCLP VOCs	SW-1311/5030B/ 8260B	3	40-ml glass vials w/Teflon-lined cap	Cool to 4ºC HCL to pH <2	14 days to filter/14 days to analysis	Fill completely; no air bubbles
TCLP SVOCs, Pesticides, Metals	SW-1311 SW-3510C/ 8270C/8081A SW-3010A/6010B SW-7470A for mercury	2	1-liter bottles	Cool to 4ºC	14 days to filter/40 days to SVOC and Pest analysis; 28 days to mercury analysis; 180 days to metals analysis	Fill to shoulder
Total Suspended Solids (TSS)	EPA Method 160.2	1	500 ml bottle	Cool to 4ºC	7 days	Fill to shoulder
Total Dissolved Solids (TDS)	EPA Method 160.1	1	250 ml bottle	Cool to 4ºC	7 days	Fill to shoulder
Alkalinity	EPA Method 310.1	1	250 ml bottle	Cool to 4ºC	14 days	Fill to shoulder
Hardness	EPA Method130.2	1	250 ml bottle	HNO_3 to pH <2; Cool to 4ºC	6 months	Fill to shoulder

2.5.2 Sediment Sampling

Sediment samples will typically be collected with surface water samples. At locations where both sediment and surface water samples are being collected, the surface water sample will be collected first. This will ensure that any sediment disturbed during the sediment sampling does not enter the surface water sampling container.

Several different techniques may be used to collect sediment samples, including stainless steel trowel sampling, stainless steel hand auger sampling, and grab sampling with a Ponar Dredge. The method selected will typically depend on the flow and depth of water at the sampling location. Sewers will be sampled only at manholes. Brief descriptions of these sampling techniques and their applicability are provided in Section 2.5.2.3 of the Master Field Sampling Plan. Table 2-2 lists required containers, preservatives, and holding times for sediment samples.

During sediment sample collection, the VOC sample containers will be filled first. The sample will be placed directly into the VOC sample container to minimize the volatilization of organic compounds. The remaining sample volume will be placed into a stainless steel bowl and mixed thoroughly. After mixing, all other sample containers will be filled.

2.5.2.1 Stainless-Steel Trowel

A stainless steel trowel will be used to collect sediment samples in areas where there is minimal water flow across the sampling location and depth specific characterization is not required. The trowel will be used to transfer the sediment from the sampling location into the sample containers.

2.5.2.2 Stainless-Steel Hand Auger

For depth-discrete sediment sampling, a clean stainless steel, hand-held coring instrument with a disposable plastic liner tube, fitted with an eggshell catcher to prevent sample loss, will be used. The coring device will be pushed through the thickness of the sediments. The core will either be extruded into a stainless steel bowl or directly into the appropriate sample bottles. The sample recovery will be noted, and the discrete interval (e.g., 0 to 4 inches, 4 to 8 inches, 8 to 12 inches, or deeper if needed) will be placed in a stainless steel mixing bowl.

2.5.2.3 Ponar Dredge Sampling

A Ponar Dredge will be used to collect sediment samples from beneath any surface water greater than 1 foot in depth. The ponar dredge is a “clamshell” type sampling device consisting of the bucket/jaws and the sampler arms. During sampling activities, a length of rope is attached to a ring on the top of the sampler arms. The sampler arms are then pushed toward the bucket to open the sampler jaws. The jaws are locked in the open position by inserting a spring-loaded steel pin through a small hole in the arms. The sampler is lifted by the rope, with the sampler’s weight creating the tension that holds the locking pin in place. The sampler is lowered until the sediments are encountered, pulled up approximately 6 inches, and allowed to free fall. With the tension relieved, the spring on the locking pin forces the pin out of the hole in the arms. As the sampler is retrieved the jaws close, trapping the sediment sample inside. Any surface water entrapped in the sampler is slowly decanted through a screened port on the top of the ponar.

TABLE 2-2
Required Containers, Preservatives, and Holding Times for Soil and Sediment

Analysis	Analytical Preparation/ Method Number	No. of Containers	Sample Container	Preservative	Holding Time	Volume of Sample
VOCs	SW-846 Method 5035/8260B	3 to 4	3-4 each 5-g En Core™ sampler	4°C	48 hours to extraction and 14 days from extraction to analysis	Fill completely with no air bubbles
SVOCs	SW-846 Method 3550B/8270C	1	8-oz. Glass jar [1]	4°C	14 days to extraction and 40 days from extraction to analysis	Fill completely
Pest/PCBs	SW-846 Methods 3550B/8081A/ and 3550B/8082	1	8-oz. Glass jar [1]	4°C	14 days to extraction and 40 days from extraction to analysis	Fill completely
Pesticides	SW-846 Method 3550B/8081A	1	8-oz. Glass jar [1]	4°C	14 days to extraction and 40 days from extraction to analysis	Fill completely
Metals	SW-846 Methods 3050B/6010B 7000 series	1	4-oz. Glass jar [1]	4°C	6 months, 28 days for mercury	Fill to shoulder
Cyanide	SW-846 Methods 9010B and 9012A series	1	8-oz plastic or glass bottle	Cool to 4ºC	14 days	Fill completely
Lead/Arsenic/ Explosives	SW-846 Methods 3050B/7421 and 3050B/7061	1	8-oz plastic or glass bottle	Cool to 4ºC	6 months	Fill to shoulder
Explosives	SW-846 Methods 8330 and 8332	1	4-oz. Glass jar [1]	4°C	7 days to extraction and 40 days from extraction to analysis	Fill completely
Total Organic Carbon	EPA Method 9060	1	8-oz plastic or glass bottle	Cool to 4ºC	28 days	Fill completely
Grain Size	ASTM 0421-58/0422-63	1	Quart size plastic bag	Cool to 4ºC	--	Approximately 1/3rd full
TCLP VOCs	SW846 Method 1311 SW-5030B/8260B	2	2 each 25 gram En Core™ sampler	Cool to 4ºC	14 days to extraction/14 days to analysis	Fill completely
TCLP SVOCs, Pesticides, Metals	SW846 Method 1311 SW-3510C/8270C/ 8081A SW-3010A/6010B SW-7471A for mercury	1	8-oz glass bottle with Teflon-lined cap	Cool to 4ºC	14 days to extraction/40 to SVOC and Pest analysis; 28 days to mercury analysis; 180 days to metals analysis	Fill completely
Reactivity	SW-846 Sections 7.3, 3.2/7.3, 4.2	1	8-oz plastic or glass bottle	Cool to 4ºC	28 days	Fill completely
Corrosivity	SW-846 Section 7.2	1	8-oz plastic or glass bottle	Cool to 4ºC	28 days	Fill completely
Ignitability	SW 846 Method 1010/1020A	1	8-oz plastic or glass bottle	Cool to 4ºC	ASAP	Fill completely

1- Teflon lined cap

2.6 Surface Soil Sampling

Sampling techniques that may be employed for surface soil sampling include stainless steel trowel sampling and stainless steel hand auger sampling, depending on the nature of the material to be sampled. A stainless steel trowel will typically be used to collect samples of loosely packed materials and a stainless steel hand auger for densely packed materials. Surface soil samples will be obtained from a depth of 0 to 6 inches below ground surface (bgs) and typically be used to investigate leaks and spills on the ground surface. Samples collected from beneath paved or gravel surfaces are not considered surface samples. Table 2-2 lists the required containers, preservatives, and holding times for soil samples.

2.7 Soil Borings

Before soil borings (or well borings) are initiated, utility clearances will be obtained from the Navy. Borings will be advanced by a tripod, van-mounted probe, truck-mounted drill rig, or all-terrain vehicle (ATV) drill rig, using a split-spoon sampler. The sampler is driven into unconsolidated materials using a falling weight connected to the drill rig. Alternatively, soil samples will be collected using thin-walled tubes for geophysical analysis.

If physical access to areas is restricted, soil borings may also be advanced using a hand auger or a tripod-mounted sampling device. The locations and total depth of hand-augered boreholes will be determined in the field based upon subsurface soil conditions and site-specific sampling objectives.

The soil borings performed under these investigations will typically be sampled continuously (every 2 feet) or periodically (every 5 feet) to depth, as necessary, for lithologic and/or chemical characterization. Soil samples obtained by probe using direct-push methods will be collected either intermittently or continuously at intervals predicated by the equipment used. A geologist will observe the drilling and sampling operations. The soil will be classified according to the Unified Soil Classification System (USCS). Field observations of lithology, moisture content, discoloration, odors, and other visible features will be described and recorded in the field logbook and on to a soil boring log provided in the Field Sampling Plan. During advancement of the boring, a photoionization detector (PID) will be used to measure volatile organic contamination in the soil cuttings and split spoon samples. Subsurface soil samples may be analyzed from all or selected boreholes.

Upon completion, each boring will be backfilled with a bentonite-cement grout mixture. A labeled stake will be placed at the ground surface near the borehole for future reference for soil borings on unpaved areas. Asphalt or other surface material will be patched and the boring location will be identified with spray paint. Auger cuttings will be containerized in a roll-off, or drums. If significant contamination is present, either visually or by measurement from a PID, the soil will be drummed separately from the roll-off box, labeled with the appropriate boring number, and placed on a wooden pallet at the site. Soil cuttings from background locations will be spread on the ground (if the area is unpaved) near the borehole and not containerized; if the area is paved, the soil cuttings will be drummed.

2.8 Subsurface Soil Sampling

Subsurface soil densities vary from site to site across Vieques and will dictate subsurface soil sampling methodologies. Split spoon sampling techniques will typically be used at locations where samples are being collected from depths greater than 3 to 5 feet, discreet sampling intervals, from beneath asphalt, or where compaction of the soil has made sample collection using manual augers or trowels impossible. Alternatively, soil will be sampled using direct-push methods and sampling tubes where soil densities are low enough.

A drill rig will be used to advance 3-¼-inch to 6-¼-inch hollow stem augers to the top of the desired sampling interval. A stainless steel split-spoon sampler will be attached to the proper length of drilling rod and inserted through the hollow stem augers. A 150-pound hammer will be used to advance the split-spoon sampler up to 2 feet below the auger or until refusal, as required for sample collection. The split-spoon sampler will then be retrieved and the sample handled in accordance with site-specific SAPs. Direct-push methods will obtain the sample from the desired depth by pushing the sampling tube directly to that depth.

2.9 Monitoring Well Installation

Monitoring wells will be installed in selected boreholes. Boreholes drilled for monitoring well installation will be lithologically logged by the Field Geologist as described in Section 2.7. Well locations will be determined based upon previous analytical results, or other pertinent field data, as described in the site-specific work plans.

Monitoring well borings will usually be installed using hollow stem augers, unless field conditions require the use of a rotary or sonic method. The rotary method will utilize the addition of drilling water, not drilling mud. Well screens will be placed within the zone of interest. Specific well screen placement will be discussed in the Site-Specific Work Plans.

At locations where permanent wells are not required or well installation cannot be completed using a truck-mounted or ATV drilling rig, drive points may be installed. Drive points are 2-inch-diameter, stainless steel monitoring wells with short screens, and are installed by driving the well point into the ground. These will be installed in wet areas where the weight of a drilling rig cannot be supported, or because of steep slopes or dense forest. Drive points may also be installed in an open borehole.

2.9.1 Monitoring Well Construction

Monitoring wells will be constructed of 2-inch inside diameter (I.D.), Schedule 40 polyvinyl chloride (PVC) risers and screen, with flush joint threads. Wells will be completed with 10-foot-long No. 10 slot size screens. A typical well construction diagram is provided with this FSP. Well construction may differ at locations that warrant larger size diameter wells such as potential free phase product accumulation areas. At these locations, screen lengths may be increased to 15 feet and slot sizes increased to No. 20. Samples of aquifer material for grain size analysis may be collected from selected well borings if unusual size materials are observed; from this information, screen slot size and sand pack particle size will be determined for these wells. Wells also may be constructed of stainless steel rather than PVC in areas where high concentrations of solvents are present in the groundwater that could

degrade a PVC well. Permanent water level measurement notches will be made on the northern side of the riser casing to keep water level gauging events consistent.

A sand pack will be placed around the screened interval to 1 to 2 feet above the top of the screen. A minimum of 2 feet of bentonite will be placed above the sand pack. If above the water table, bentonite will be hydrated with potable water prior to grouting. Grout will be placed via a side-discharging tremie pipe above the bentonite pellets to within 1 foot of the ground surface.

Drive points may be constructed in one of two ways. If the drive point is hammered into place, no other well construction will be necessary, and the well assembly is fabricated from 2-inch-diameter stainless steel and includes a screen (anticipated to be 2 to 3 feet in length), casing, and a hardened point. If a hand-augered borehole is used, the procedure will consist of:

- Advancing a 4-inch-diameter hand auger to the desired depth below the water table
- Installing a temporary casing if the borehole collapses using PVC pipe hammered into the collapsing borehole and reaugered to clean out the soils until final depth is achieved
- Placing a 2-inch-diameter drive point in the open borehole
- Placing sand pack around the drive point to a depth that is approximately 1 foot above the screened interval
- Placing a bentonite seal above the sand pack to the top of the borehole
- Grouting will not be used in drive points

In high traffic areas, wells will be completed with a flush mounted protective casing with locking cap. A 2-foot x 2-foot x 4-inch concrete pad will be installed in the asphalt or concrete to reinforce the shallow wells. This will be sloped away from the well to prevent surface water infiltration. Monitoring well numbers and other pertinent information will be marked either on the concrete pads or on stainless steel well tags attached to the concrete pads.

Wells completed where there is no vehicular traffic will have 2 to 3 feet of “stickup” above ground surface. A steel protective casing will be placed over the riser and cemented into a 4-foot x 4-foot x 4-inch concrete pad. Steel guard posts will be placed around the protective casing to prevent accidental damage. The pad will be sloped away from the well to prevent surface water infiltration.

Piezometers may be installed to be used to measure water levels. These piezometers are not expected to be sampled but will be constructed in the same manner as wells are.

Some wells may require that a surface casing be installed to prevent potential contamination from migrating between water-bearing units separated by low-permeability materials. Surface casings will consist of either PVC or steel. The casings will be set into low-permeability material separating the water-bearing units and will be grouted in place.

2.9.2 Monitoring Well Development

Monitoring wells will be developed prior to groundwater sampling by removing water from each well using a peristaltic pump or submersible pump. The development water will be

discharged into 55-gallon drums or other storage containers (e.g., tankers). A surge block also will be used to aid in development. If dedicated sampling equipment is not used, equipment will be decontaminated between wells.

Well development will be performed after the grout used to construct the well has been allowed to adequately set at least 24 hours. The groundwater levels will be measured to the nearest 0.01 foot from the top of the PVC casing. Development will consist of removing at least three borehole volumes of water, plus the amount of water added during the drilling or installation process. Development will continue until groundwater turbidity levels reach 50 nephelometric turbidity units (NTUs), or until 6 hours of development has passed, whichever comes first. The goal of 50 NTUs was developed due to the nature of geology on Vieques and the persistence of wells going dry during purging activities. Water clarity will be measured with a Hach™ NTU meter or equivalent. Development information, including water clarity, pH, specific conductivity, and temperature, will be recorded in the field logbook.

Wells installed as part of previous investigations will be evaluated in the field to determine if redevelopment is required. Redevelopment will be considered necessary if 10 percent or more of the screen length has been “silted in” (i.e., filled in by soil particles; this soil matter leads to turbid samples and possibly incorrect conclusions about groundwater analytical results). Redevelopment will also be conducted at wells where high turbidity levels are exhibited and water yields are sufficient to warrant redevelopment efforts. If redevelopment is necessary, it will follow similar procedures as for newly installed wells; however, additional time and volume of water removed may be needed to remove the fine sediment from the well.

After installation of drive points, the inside of each drive point screen will be scrubbed with a 2-inch-diameter round steel brush to clean out any mud or sediment that might clog the screen slots. The water in the drive point will then be bailed out. If necessary, certified laboratory grade distilled water may be added and the screens scrubbed again to facilitate water flow through the screen. This procedure may be repeated two or three times to clean the screen.

2.10 Monitoring Well Abandonment

Well abandonment will be performed on monitoring wells which are no longer in use or which are improperly constructed. The well abandonment procedures will be in accordance with Navy requirements. The objective of this procedure is to prevent contamination from reaching groundwater through the well. Abandonment will consist of over-drilling the well using hollow stem augers and, if possible, removing the screen and riser pipe. The riser and screen will be decontaminated, cut into small sections approximately 3 feet long, and disposed of as regular trash. The well borehole will then be filled with cement grout by a tremie pipe, which will extend to the bottom of the well borehole. As the grout fills the well borehole, the pipe will be raised until a return of grout is noted at the surface.

2.11 Groundwater Sampling from Monitoring Wells

Monitoring wells will not be sampled for at least 2 weeks after the well has been developed. This will allow an adequate amount of time for the well to recover. Prior to sampling, groundwater will purged from each well. Purging will be performed until at least three

borehole volumes have been removed and the temperature, specific conductance, and pH have stabilized to within 10 percent for three consecutive readings. The borehole volume will be calculated using values for the depth of the well, the depth to water, and the well diameter. Purging will be accomplished using low flow pumps or bailers. Well purging data will be recorded in the field logbook. The Investigation-Derived Waste Management Plan (IDWMP) discusses treatment and disposal of purge water.

Samples will be collected after the field parameter measurements have stabilized. Wells that are pumped dry during purging will be allowed to recover before sampling; the sample will be obtained as soon as a sufficient volume of groundwater to fill all sample containers has entered the well.

Purging activities will be conducted in a manner which minimizes agitation of groundwater in the wells, and at a pumping rate not to exceed one liter per minute. Purging will be conducted using low flow peristaltic pumps when the depth to water will allow the use of these pumps. Peristaltic pumps, however, can only pull water from a depth of approximately 25 feet. Therefore, in instances where groundwater is greater than approximately 25 feet below grade, variable speed submersible environmental pumps (Grundfos or equivalent) will be utilized for purging. Bladder pumps were ruled out for use at ATWTF for purging because of the difficulty in obtaining compressed gasses on the island. All down-hole and effluent tubing will be Teflon® lined or Teflon®.

Groundwater samples will be collected from the discharge hose of the purge pump into properly-labeled, laboratory-prepared sampling containers filled and/or preserved as appropriate; cooled to approximately 4°C; and shipped to the analytical laboratory under appropriate COC documentation procedures. The pump rate shall be reduced to below one liter per minute, for all samples to reduce the potential for collecting turbid groundwater samples. Care will be taken to minimize degassing during sampling. Clean, double check valve bailers may be used for sampling as a last resort in wells in which the depth to water or other extenuating circumstances preclude the collection of non-turbid samples through the pump. In this case, care will be taken when lowering the bailer not to agitate the water surface. Table 2-1 shows the required containers, preservatives, and holding times for water samples.

2.12 Direct-Push Groundwater Sampling

Groundwater samples may be collected using a direct-push (e.g., Geoprobe® or HydroPunch®) hydraulic sampler mounted on a 4-wheel-drive truck where permanent wells are not installed and the extent of groundwater contamination needs to be defined. Prior to sampling activities, utility clearances will be performed. The direct-push probe will be advanced to the desired depth and the sample will be collected. Alternatively, the borehole will be advanced using a drill rig and hollow stem auger techniques to reach the depth of interest in the aquifer. At that depth, the drill rods will be removed and the direct-push samplers hydraulically pushed to the zone of interest. The cover will then be retracted, allowing water to flow into the device. Groundwater samples will either be retrieved using a double check valve sampling tool or a “mini” bailer. Samples will be collected directly into sample containers that have been precleaned and preserved by the analytical laboratory to EPA specifications.

Table 2-1 shows the required containers, preservatives, and holding times for groundwater samples.

2.13 Aquifer Testing

Aquifer testing that might be completed include slug tests, step-drawdown pumping tests, and constant-rate pumping tests.

2.13.1 Slug Tests

Rising and falling head slug tests may be performed in monitoring wells to evaluate aquifer hydraulic conductivity in the vicinity of the well. Slug tests will be performed after groundwater sampling using solid PVC slugs with clean bailer rope. A pressure transducer attached to an electronic recording device, such as an In-Situ Hermit™, will be used to record changes in pressure associated with water level recovery. Tests will be repeated three times to verify reproducibility. Alternatively, tests will be performed by sealing the top of the well riser, forcing the water level in the well down with nitrogen, releasing the nitrogen pressure, and recording the water level recovery.

The *Bower & Rice* method for unconsolidated aquifers will be used to evaluate the hydraulic conductivity's of the aquifer.

2.13.2 Step-Drawdown Pumping Tests

Step-drawdown pumping tests might be performed to ascertain the efficiency (specific capacity) of a well and to determine an appropriate pumping rate for conducting a constant-rate pumping test. Methodology will be described in site-specific WPs and FSPs.

2.13.3 Constant-rate Pumping Tests

A constant-rate pumping test might be performed on a well to ascertain the transmissivity and storage coefficient or storativity of the aquifer for use in modeling and capture zone analyses. Methodology will be described in site-specific WPs and FSPs.

2.14 Hydrologic Measurements

Groundwater or surface water hydrologic measurements may be collected at AFWTF. Measurement procedures are described below.

2.14.1 Groundwater Level Measurements

Groundwater level measurements will be measured in monitoring wells, piezometers, and drive points. Fluid level measurements will be used to evaluate the movement of groundwater, the horizontal hydraulic gradient, the vertical hydraulic gradient, and the thickness of any free product, if present. This information, when combined with other site-specific information such as hydraulic conductivity, extent of contamination, and product density, may be used to estimate contaminant movement or source areas. Fluid levels will be measured with a water level indicator or oil/water interface probe, as appropriate. The depth from the top of casing to fluid level will be recorded to the nearest 0.01 foot.

2.14.2 Surface Water Level Measurements

Surface water level measurements may be read from surveyed staff gauges placed in surface water bodies. Surface water level measurements will be used with groundwater measurements to help determine communication between surface water and groundwater. Depth of surface water bodies may be measured using a graduated weighted tape or similar device.

2.15 Sewer Sampling

Samples of surface water and/or sediment may be collected from storm sewers on the site to determine if contaminants are being transported in the sewers. All samples will be collected from manholes that provide access to the sewers. Manholes are confined-space entry areas and samples will be collected from the surface, if possible, to avoid the need of staff to enter manholes. Weighted bottles and samplers attached to poles will be used to avoid confined-space entries.

2.16 Biota Sampling

Aquatic biota sampling for surface water and sediment may include collecting aquatic macroinvertebrate and fish. The biota samples will be located to represent upstream, adjacent, and downstream conditions when possible. Sample locations selection will be based on migration pathways. In tidal areas, the presence of a salt wedge and the magnitude of tidal influence upstream will be evaluated by collection of physical field measurements including salinity and conductivity. The degree of tidal influence will provide important information about the flushing of contaminants. Upstream samples collected in fresh water will provide background data from true upstream conditions not impacted by tidal fluctuations in streamflow. Site-specific conditions, such as headwater systems, may preclude the establishment of an upstream station.

Qualitative terrestrial vegetation sampling, qualitative mammalian species surveying, qualitative herpetofauna community surveying, and avian community surveying may be performed.

2.16.1 Aquatic Macroinvertebrate Sampling

Benthic macroinvertebrates may be collected using a Ponar bottom grab sampler or hand-held coring device. A minimum of three replicate grab samples will be collected at each sampling location because of the precision of macroinvertabrate sampling. Sampling precision is affected by the substrate area encompassed by the sampling device and the distribution of the organisms. Three replicate random sampling units at each sampling location generally are considered a minimum based on guidance in *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters* (EPA, 1990). The invertebrate taxa will be identified to genus and species level with the exception of fragmented and juvenile specimens and for those species with known taxonomic difficulties.

2.16.2 Fish Sampling

Fish may be collected from surface water bodies using electrofishing, gill nets, seining, trot lines, or other fish collection techniques. The fish collection method used will depend on whether freshwater or estuarine systems are being evaluated. Electrofishing will be used in freshwater systems. Gill nets, trap nets, and trot lines will be used in estuarine and large stream and riverine systems. Seines will be deployed in small stream systems and from the shore of large estuarine and riverine systems.

Sampling will be conducted in areas within the designated reach that will ensure adequate representation of the fish community. Fish will be held in fish boxes with an adequate air supply until taxonomic identification and field processing. Species will be identified, measured, and weighed. Fish with disease, tumors, fin damage, and skeletal anomalies will be noted. One representative fish from each species will be preserved for taxonomic verification. All remaining fish will be returned to the surface water body.

In addition to fish community sampling, fish tissue sampling may be conducted to determine bioconcentration of selected contaminants in fish.

2.17 Test Pits/Trenching

Test pits or trenches may be completed in areas where characterization of fill or other waste materials is required or the extent of contamination needs to be determined. Test pits and trenches may be excavated up to 15 feet in length and to a maximum depth of 10 feet. Samples of materials excavated from the trench will be collected from the bucket of the backhoe or the pile of excavated material using a stainless steel trowel or spoon. Test pits and trenches will not be entered by any member of the sampling team.

The position of the test pit or trench will be determined in the field by the Project Geologist/Scientist. Utility clearance will be obtained from the Navy prior to excavation. Excavation equipment will be decontaminated prior to and after each test pit or trench excavation. Excavation will proceed by removing lifts of no more than about 6 to 12 inches, until an assessment of the material can be made. The material removed from the trench will be placed on plastic sheeting. A geologist will log the test pit materials. The cross section will be sketched or described and notable features will be identified in the field log book. Depths will be measured from the ground surface. The length and width of the test pit will also be measured. The test pits and trenches will be backfilled with the material removed from the excavation immediately after being completed to reduce site hazards and minimize the potential for rainwater accumulation and subsequent contaminant migration.

2.18 Surveying

Surveying activities will be necessary to establish northing and easting data for subsequent transfer to site maps and for development of groundwater flow maps. Surveying efforts will be completed by a qualified surveying subcontractor utilizing the Puerto Rico coordinate system, NAD 1983 Vertical Datum Grid System as the reference datum. The following land surveying activities may be conducted at the Base:

- Obtaining elevations of groundwater monitoring wells, piezometers, soil borings, and drive points, to an accuracy of 0.01 feet, referenced to mean sea level (MSL). Elevations will be determined from a United States Geological Survey (USGS) benchmark located at the facility. Benchmarks may not be readily accessible to the survey sites.
- Establishing the elevation reference point for wells at the top of the inner PVC well casing, and a permanent mark designating the elevation point. The ground surface elevation for each well and boring will be established to an accuracy of 0.01 feet. Horizontal control shall be established to the 0.1 foot.
- The location of each well, boring, and test pit will be tied into permanent land monuments (e.g., building corners). Horizontal control shall be established to the 0.1 foot.
- Grid intersections (for soil gas or geotechnical surveys) will be marked with wooden stakes or spray paint and will be numbered by the surveyor with a unique location number.
- Surveying of surface water/sediment sampling stations will be performed using geographic positioning system (GPS) equipment.

Portable GPS systems may also be used to determine horizontal coordinates for points, such as sampling locations and grid points. Horizontal control varies with different GPS systems.

2.19 Investigation-Derived Waste Sampling

IDW includes disposable materials used in the normal course of field operations, such as health and safety equipment and sampling equipment. IDW also includes materials generated from drilling and sampling activities, such as drill cuttings, development and purge water, and decontamination water. Base-wide IDW management is addressed in the Master IDWMP.

2.20 Decontamination

Temporary decontamination pads will be placed at strategic locations throughout AFWTF prior to field activities generating large quantities of water. The decontamination pads will be constructed of high density polyethylene and wood with elevated sides and a sump to collect fluids. These fluids will be pumped into a tank designated for that site. The location of the decontamination pads will be finalized during mobilization, as directed by AFWTF, and will be based upon areas or sites that are under investigation. Specific elements of decontamination are described below.

2.20.1 Sampling Equipment Decontamination

Sampling equipment (e.g., split-spoons, sampling trowels, bucket augers, bailers, etc.) will be decontaminated prior to sampling and between samples. Waters generated during decontamination of sampling equipment at each site will be contained in 55-gallon drums, pending receipt of analytical results and final disposition recommended to the facility. Decontamination water will be segregated from all other water because of solvents and acids introduced into the water.

All heavy equipment, including the drilling rig, rods and augers, and other downhole equipment used during site investigation activities will be decontaminated prior to use and between locations using a high-pressure steam wash at a decontamination pad located on or near the site. The steam-cleaning water will be from a potable source. The decontamination water will be pumped into drums with a sump pump and the drums will be emptied immediately into a tank that is centrally located at each site. Monitoring well casings and screens will also be steam-cleaned using the same procedure, unless they are certified by the manufacturer as clean, and plastic seals are intact.

2.20.2 Personnel Decontamination

Personnel decontamination is discussed in the Master HSP.

2.21 Health and Safety Monitoring

The ambient air will be monitored during most field activities to determine the presence of organic and/or explosive vapors that may pose a health risk. The monitoring activities are discussed in detail in the Master HSP.

2.22 Field Tests

Various field tests may be performed during sampling activities. Field tests are commonly used at AFWTF to measure water quality parameters of groundwater and surface water and to assess the chemical properties of soil.

Water quality parameters that may be measured during field activities include pH, specific conductance, DO, temperature, alkalinity, and turbidity. Measurement of these parameters will be performed in accordance with site-specific WPs and FSPs, and with the SOPs located in Attachment 2 of the MP.

Field tests used to assess the chemical properties of site soils include, but are not limited to, X-ray fluorescence (XRF) field screening (to identify soil containing concentrated amounts of heavy metals); immunoassay screening (to determine the presence of polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons [PAHs], benzene, or trinitrotoluene [TNT] above certain concentrations); flame ionization detector (FID) and PID headspace screening (to detect the presence of organic and inorganic vapors being emitted from soil). All soil field tests will be performed in accordance with site-specific WPs, FSPs, and SOPs.

SECTION 3

Documentation

3.1 Sample Designation

Each sample will be designated by an alphanumeric code that identifies the site and matrix sampled and contains a sequential sample number. Site-specific procedures are elaborated below.

Location types will be identified by a two-letter code. Each sampling location will be identified with a two-digit number corresponding to the well or sampling location.

The following is a general guide for sample identification:

First Segment of Sample Number	Second Segment of Sample Number	Third Segment of Sample Number	
Naval Installation Abbreviation	**Site Number**	**Sample Type**	**Sample Location**
AA	AAA	AA	AAAAA

Symbol Definition:

A = Alphanumeric

Site Abbreviation:

AA = Two letter abbreviation identifying the Naval Installation where the sample was collected. Vieques Island = VI.

Site Number:

AAA = One letter and two numbers or three numbers identifying the site on the facility where the sample was collected (i.e., S01 = Site 1 and 201 = AOC 201)

Sample Type:

SS = Soil Sample
SB = Soil Boring (subsurface soil) Sample
SD = Sediment Sample
SW = Surface Water Sample
GP = Direct-Push Groundwater Sample
GW = Groundwater Sample
DR = Drum Sample
PZ = Piezometer Sample
SG = Soil Gas Sample
TR = Trench Sample

IS	=	IDW Soil Sample
IW	=	IDW Water Sample

Sample Location

AAAAA	=	Unique sample number and qualifiers

Qualifiers

P	=	Duplicate Sample
L	=	Diluted for laboratory analysis
R	=	Rerun of laboratory analysis

Numbering Format for QA/QC Samples

QA/QC samples will follow the following pattern:

AA-DDMMYY

where the two digits before the hyphen will be alphabetic, by QA/QC type, and the six digits after the hyphen will designate the date on which the samples were collected. Eligible QA/QC sample types are:

FB	Field blank
TB	Trip blank
EQ	Equipment blank

The date designation will always have six digits in a DDMMYY format. Examples of this numbering approach for QA/QC samples are:

FB-100196	Field blank collected on October 1, 1996
TB-072997	Trip blank collected on July 29, 1997
EQ-080198	Equipment blank collected on August 1, 1998

3.2 Sample Shipping Procedures

All field sampling activities will be documented through the use of field logs and COC procedures. Sample containers will be provided by the laboratory as certified clean. An identification label, indicating the sample number, station number, analysis to be performed, preservative used, date and time of sample collection, and the name of the responsible sampling team member, will be attached to each sample container.

After being collected, samples will be packed in coolers with vermiculite and ice for delivery to the laboratory. COC forms will be taped to the inside of the lid of each cooler. COC forms contain general information about the location of the activity and the members of the sampling team, as well as specific information about type of sample, sample location, number of sample containers from each station, and analyses to be performed. Each time the sample is relinquished or received, the party involved signs the form and notes the time and date.

The coolers used to deliver the samples will be sealed with strapping tape. Evidence tape will be placed across the front and back of each lid to control tampering. The samples will be

delivered to the laboratory at the end of each day of sampling to ensure that holding times are not exceeded.

SECTION 4

References

U.S. Environmental Protection Agency. *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters*. 1990.

ATTACHMENT A

Typical Soil Boring Log

ATTACHMENT B

Typical Well Construction Diagram

ATTACHMENT A

Typical Soil Boring Log

CH2MHILL

PROJECT NUMBER	BORING NUMBER SHEET 1 OF 1

SOIL BORING LOG

PROJECT : LOCATION :

ELEVATION : DRILLING CONTRACTOR :

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
5						
10						
15						
20						
25						

ATTACHMENT B

Typical Well Construction Diagram

CH2MHILL

PROJECT NUMBER	WELL NUMBER SHEET 1 OF 1

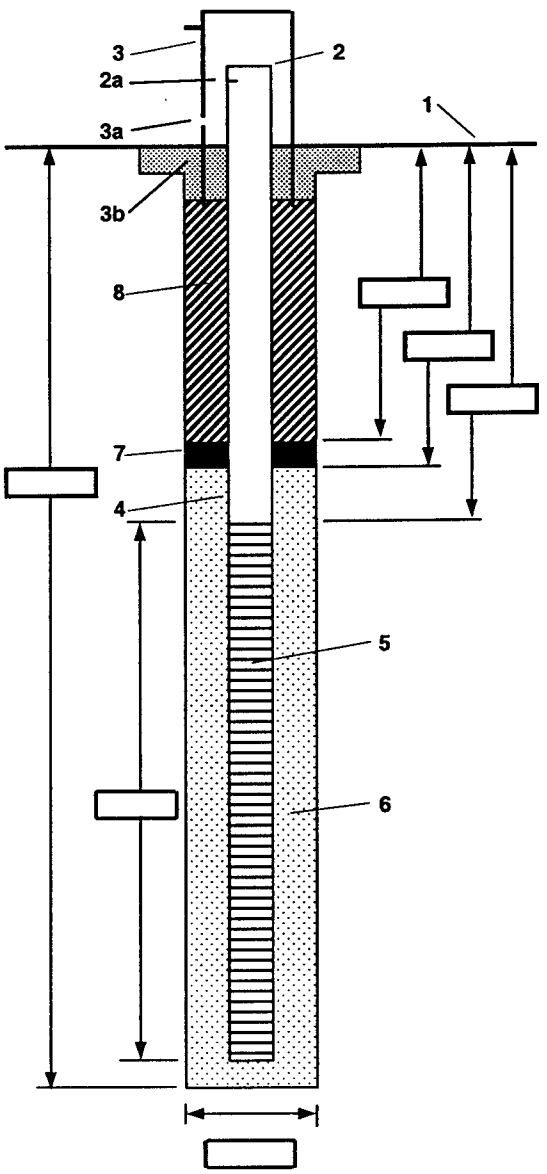
WELL COMPLETION DIAGRAM

PROJECT : LOCATION :

DRILLING CONTRACTOR :

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :



1- Ground elevation at well _____

2- Top of casing elevation _____
   a) vent hole? _____

3- Wellhead protection cover type _____
   a) weep hole? _____
   b) concrete pad dimensions _____

4- Dia./type of well casing _____

5- Type/slot size of screen _____

6- Type screen filter _____
   a) Quantity used _____

7- Type of seal _____
   a) Quantity used _____

8- Grout
   a) Grout mix used _____
   b) Method of placement _____
   c) Vol. of well casing grout _____

Development method _____

Development time _____

Estimated purge volume _____

Comments _____

Master Quality Assurance Project Plan

Draft Final
Master Quality Assurance Project Plan

Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

Contract Task Order 031

Prepared for

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Atlantic Division
Naval Facilities Engineering Command

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SECTION 7

Equipment Calibration

Various instruments will be used in the field and in the laboratory to collect data and monitor site conditions. Proper calibration, maintenance, and use of the instruments is important for collecting high-quality data. A record of calibration and maintenance activities is as important as the data record itself for verifying the delivery of high-quality data.

7.1 Field Equipment Calibration

The following field equipment to be used during this investigation will require calibration:

- pH meter
- conductivity meter
- organic vapor meter (OVM)
- organic vapor analyzer (OVA)
- explosimeter
- turbidity meter
- dissolved oxygen (DO) meter
- portable gas chromatograph
- x-ray fluorescence

The meters used for field measurement will be calibrated before and during each day's use according to procedures and schedules outlined in the HASP or SOPs. The standards that will be used to calibrate these instruments are shown in Table 7-1. Standards will be purchased as necessary from appropriate vendors.

If an individual suspects an equipment malfunction, the meter will be removed from service and tagged so that it is not used inadvertently, and the equipment manager will be notified so that a substitute piece of equipment can be used. Some backup equipment will be available in the field for use in case of a malfunction.

Equipment that fails calibration or becomes inoperable during use will be removed from service and tagged so that it is not used inadvertently. Such equipment will be repaired and satisfactorily re-calibrated. Equipment that cannot be repaired will be replaced.

The results of activities performed using equipment that has failed re-calibration will be evaluated. If the results are adversely affected, the outcome of the evaluation will be documented and the task manager will be notified.

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List of Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BOA	Basic ordering agreement
BTAG	Biological Technical Assistance Group
CLP	Contract Laboratory Program
COC	Chain-of-custody
CTO	Contract task order
DO	Dissolved Oxygen
DQOs	Data quality objectives
EFA	Engineering Field Activity
EPA	Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
GC/MS	Gas chromatograph/mass spectrometer
HASP	Health and Safety Plan
IDWMP	Investigation derived waste management plan
ILM03	EPA CLP SOW for multimedia, multi-concentration inorganic analysis
LANTDIV	Atlantic Division
LQAP	Laboratory Quality Assurance Plan
MCL	Maximum contaminant level
MS	Matrix spike
MSD	Matrix spike duplicate
µg/L	Micrograms per liter
µg/mg	Micrograms per milligram
NAVFACENGCOM	Naval Facilities Engineering Command
NFEC	Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
OLC02	EPA analytical method for organic low-concentration water
OLM03	EPA CLP SOW for multimedia, multi-concentration organic analysis

OVA	Organic vapor analyzer
OVM	Organic vapor meter
PA	Preliminary Assessment
PARCC	Precision, accuracy, representativeness, completeness, and comparability
%R	Percent recovery
PCB	Polychlorinated biphenyl
PQL	Practical quantitation limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RF	Response factor
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RPD	Relative percent difference
RPM	Remedial project manager
RSD	Relative standard deviation
SAP	Sampling and analysis plan
SMC	System monitoring compound
SOP	Standard operating procedure
SOW	Statement of work
SSAs	Site screening areas
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity characteristic leaching procedure
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
VOA	Volatile organic analysis
VOC	Volatile organic compound
WP	Work Plan

SECTION 1

Introduction

This master quality assurance project plan (QAPP) has been developed for the field investigation activities at the Atlantic Fleet Weapons Training Facility (AFWTF) on Vieques Island, Puerto Rico. This Master QAPP describes the general quality assurance and quality control (QA/QC) procedures used for conducting groundwater, surface water, sediment, soil, waste liquids and solids, and biota sampling at sites under investigation at AFWTF. Investigation sites covered under this QAPP include those that will be part of future preliminary assessment (PA), remedial investigation (RI), or feasibility study (FS) actions as well as initial investigations at site screening areas (SSAs). This QAPP is intended to encompass most analytical methodologies that may be used in investigations at AFWTF. Not all analytical methods will be utilized at all sites; however, this Master QAPP is intended to be comprehensive such that any analyses that might be performed for future investigations are included herein. This document will be reviewed and updated at least once every 3 years as required by the U.S. Environmental Protection Agency (EPA), Region II. Future additions of analytical parameters or changes in methodologies will be provided as addenda to the Master QAPP.

Field investigations and corresponding QA/QC procedures at specific sites, solid waste management units (SWMUs), or SSAs will be described in the site-specific sampling and analysis plans (SAPs) submitted under separate cover. Detailed information regarding sample handling and analytical methods are provided in Sections 4 and 6, respectively. Sample collection procedures are provided in the Master Field Sampling Plan (FSP) or in the standard operating procedures (SOPs) in Appendix A of the Master Work Plan (WP) as summarized in Section 5.

Field sampling and laboratory analyses will be conducted in accordance with the *Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document* (Naval Facilities engineering Services Center [NFESC], February 1996).

SECTION 2

Project Description

The AFWTF provides facilities and schedules naval gunfire support (NGFS) and air-to-ground (ATG) ordnance delivery training for Atlantic Fleet ships and other allied nations. It is located on the eastern end of Vieques Island, Puerto Rico. A general description of the facility and its environmental history are provided in the Master WP. Site-specific historical information or plans for investigation will be provided in the site-specific work plans, which will be developed as each site or group of sites is investigated.

The Navy CLEAN II contract awarded to CH2M HILL by the Naval Facilities Engineering Command (NAVFACENGCOM), LANTDIV, specifies investigation and study at several sites. Studies at the AFWTF are intended to characterize the potential human and ecological effects associated with past activities at the facility. Goals of the studies include:

- Obtaining data to determine the nature and extent of contamination at each of the sites, SWMUs, and SSAs
- Identifying potential sources, migration pathways, and receiving media
- Obtaining data to assess the potential human health risks and ecological effects associated with contamination
- Obtaining data to support the selection and development of remedial alternatives

The scope and specific objectives of the studies to be conducted at AFWTF are presented in the Master WP and will be updated in each site-specific work plan.

CH2M HILL will use subcontractors to perform laboratory analysis, data validation, drilling, monitoring well construction, investigative-derived waste disposal, and surveying. Specific subcontractors have not yet been identified.

The objectives of the sampling work to be performed are not the same for all the sampling events. Most sampling results are expected to be used for:

- Determining the nature and extent of contamination
- Assessing ecological and human health risks
- Screening
- Assessing engineering and water quality parameters
- Characterizing wastes generated by site activities

The quality of the data must be very high to meet the first two objectives. The EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for organic and inorganic analytical methods outlines rigorous quality control with full documentation. The CLP methods combined with the highest level of EPA-guided data validation provides the

highest level of data quality. The CLP methods are to be used when available for risk assessment and evaluation of remedial alternatives.

Data quality does not need to be as stringent for the remaining objectives. Screening provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to Applicable or Relevant and Appropriate Requirements (ARARs), initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). Such data include those generated onsite through the use of an Organic Vapor Meter (OVM), pH, conductivity, and other real-time monitoring equipment at the site. Results from parameters such as total organic carbon (TOC), total dissolved solids (TDS), and total suspended solids (TSS) will be used to evaluate process options and determine general water quality. Waste products will be analyzed by the toxicity characteristic leaching procedure (TCLP) and for Resource Conservation and Recovery Act (RCRA) characteristics (reactivity, ignitability, and corrosivity) to determine disposal options described in the Master Investigative-Derived Waste Management Plan (IDWMP).

Whenever appropriate, samples will be analyzed for the full Appendix IX list of compounds according to the SW-846 protocols for organic and inorganic compounds. The Appendix IX list for organics includes volatile organic compounds (volatiles or VOCs), semivolatile organic compounds (semivolatiles or SVOCs), pesticides, and polychlorinated biphenyls (PCBs). The individual compounds in each group are listed in Section 8, Table 8-2. The Appendix IX list for inorganic analytes includes 17 metals (see Table 8-2).

Additional analyses will be necessary for some sites. The parameters will be analyzed by EPA SW846 methods.

2.1 Project Schedule

Sample collection events will be planned to maximize efficiency while maintaining field quality control. A detailed schedule will be included in the site-specific work plans.

SECTION 3

Project Organization

The CH2M HILL activity manager will serve as the primary contact and will assume primary responsibility for ensuring that the work is performed in a manner that is acceptable to LANTDIV, Atlantic Division. With the activity manager's oversight, the various project managers will be responsible for activities such as budget and schedule review and tracking, preparation and review of invoices, personnel-resource planning and allocation, and coordination with LANTDIV, AFWTF, and CH2M HILL subcontractors. Senior reviewers and the Quality Control Officer for CH2M HILL will review documents and procedures. Technical performance of the investigations to be conducted at AFWTF and the key personnel responsible for quality assurance throughout its duration are presented in Section 4. of the Master WP. Management personnel will be identified for each site in the site-specific addenda to the Master WP. Figure 3-1 shows the project organization and lines of authority.

The field investigation tasks will be performed by CH2M HILL personnel. CH2M HILL will notify AFWTF and LANTDIV before initiating field activities that require CH2M HILL personnel to mobilize to the site. A field task manager will be assigned to lead field activities. The field task manager will be responsible for maintaining the field log book, ensuring that the SAP is being followed, and monitoring the site for releases. The responsibilities of the field staff will include collecting the samples in accordance with the SAP, supervising subcontractors, completing sample paperwork, and shipping samples.

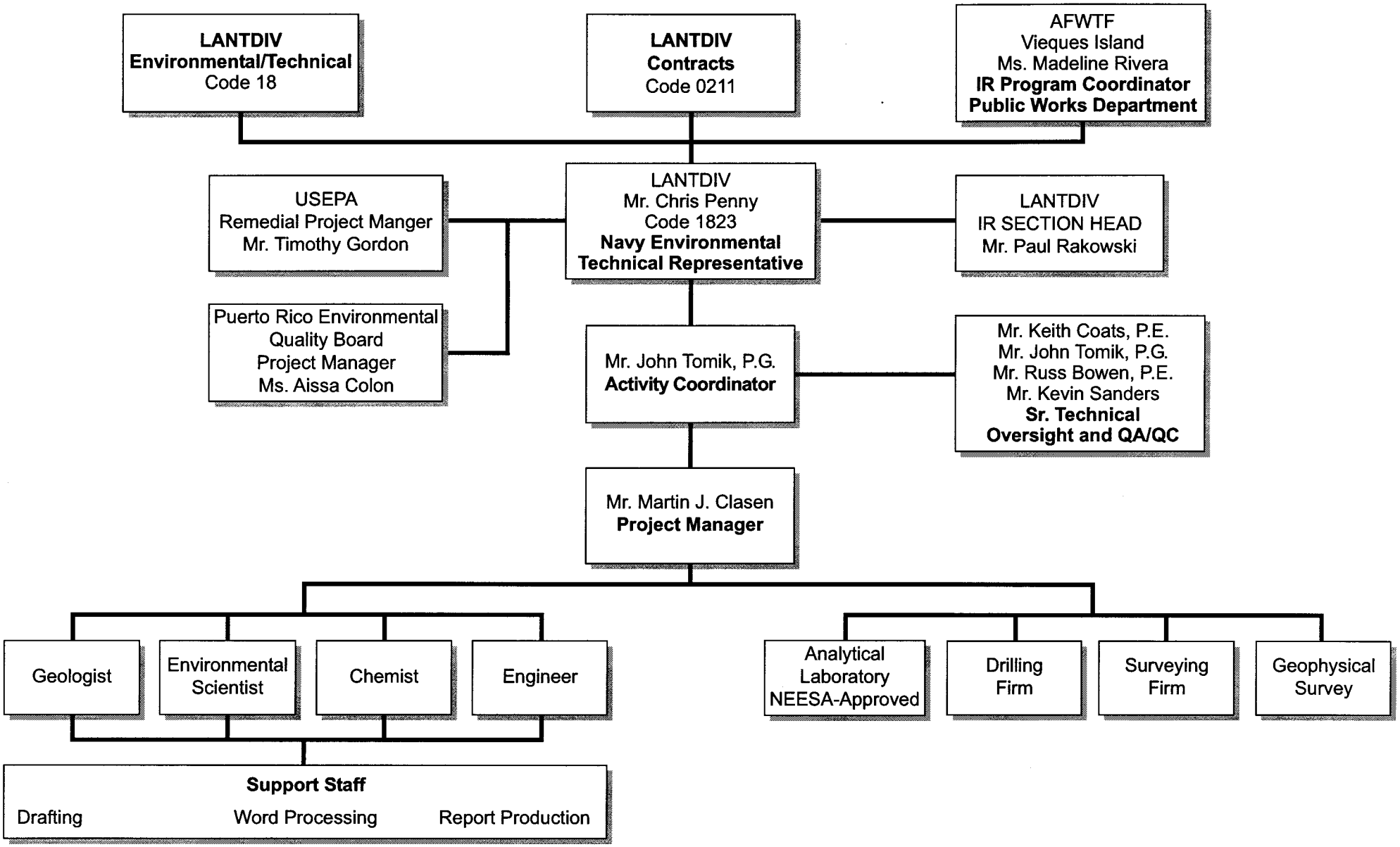

FIGURE 3-1
Project Organization
AFWTF Vieques Island, Puerto Rico

CH2MHILL

SECTION 4

Quality Assurance Objectives

The required quality of the analytical data to be collected is dependent upon the use of the data. Data development during the Installation Restoration (IR) Program activities will be used site-specific and delivery order specific purposes. This QAPP may be used to accomplish program-wide IR activities.

4.1 Data Quality Objectives

Data Quality Objectives (DQOs) will be established for each major sample collection effort as specified in the *Guidance for the Data Quality Objectives Process* (*EPA QA/G4*). DQOs are the quantitative and qualitative descriptions of the data required to support an environmental decision or action. As target values for data quality, they are not necessarily criteria for acceptance or rejection of individual analytical results. DQOs for a site vary according to the end use of the data. Everyone, from the data gatherer to the analytical laboratory, is involved in the DQO development process from the beginning.

The following fundamental mechanisms will be used to achieve quality goals:

- Prevention of errors through planning, documented instructions and procedures, and careful selection and training of personnel
- Assessment of data through field and laboratory audits and data validation of the analytical results
- Correction of errors through a corrective-action program

The DQOs for this project are based on the use of the data, including potential comparisons to concentrations of concern. Analytical data quality levels and concentrations of concern are described in this section.

4.1.1 Analytical Data Quality Levels

Once the DQO process has been completed, the specific QA/QC requirements will be evaluated to determine the type of analytical data that will be collected. Analytical data quality is specified in terms of levels defined in the DQO Guidance Document (*EPA QA/G4*). Two analytical levels are defined below:

High Level DQOs - The higher level DQOs for this project as described in Section 2 are to reliably determine the nature and extent of contamination and to assess the ecological and human health risks. Risk assessments involve comparing detected concentrations of contaminants with standards and toxicological or biological criteria.
Low Level DQOs - Analyses of engineering and water quality parameters or waste disposal characteristics do not require the level of quality control and documentation

needed for risk assessment. In the field, all instruments will be calibrated according to the SOPs and site-specific FSPs and documented in the log books. When appropriate, equipment blanks will be collected and analyzed, and matrix influences will be determined. The laboratories will follow the procedures of the EPA methods selected, and submit documentation to substantiate the analyses.

4.1.2 Concentrations of Concern

In order to define data needs, potential concentrations of concern (screening criteria) must be established. Comparison of analytical results to established screening criteria (i.e., risk-based criteria, etc.) will be conducted to determine if further action is warranted at a particular site. Screening criteria applicable to the Navy sites at AFWTF for each media were derived from the following sources:

- Groundwater - Lowest of the Federal Maximum Contaminant Level (MCL) or EPA Region IX Preliminary Remedial Goals (PRGs)
- Surface Water – USEPA National Recommended Water Quality Criteria (the lower of the human health or ecological criteria)
- Soil – The lower of the EPA Region IX PRG (leachability or direct contact) or EPA Region IV ecological screening criteria
- Sediment – NOAA guidelines for ecological receptors.

These values have been established as the Program Required Quantitation Limits (PRQLs).

Once a laboratory is selected for the project, the laboratory quantitation limits (limits corresponding to the lowest calibration standard) must be developed by considering the screening criteria, the laboratory MDL, and the laboratory standard levels. Laboratory quantitation limits should be selected to meet as many screening criteria as possible while still maintaining acceptable calibration quality control results. In general, the laboratory quantitation limit for a given parameter should be at least two times greater than the laboratory's MDL.

Due to very low concentrations of concern, there may be laboratory quantitation limits that are not low enough to meet some concentrations of PRQLs due to limitations of the analytical methods. The laboratory and Prime Contractor will work together to try to meet the PRQLs for as many compounds as concern as possible. An exception report will be generated which lists all the laboratory quantitation limits which exceed PRQLs, and appropriate actions will be taken to minimize the number of laboratory quantitation limits which exceed the PRQLs. This may involve selection of a different analytical method, performance of calibration studies to lower the laboratory quantitation limit, or other appropriate actions. For all analytes in which the PRQL is not achievable, evidence that the level is technically unachievable will be provided to EPA prior to sampling for EPA approval.

4.2 Project QA Objectives

Once the DQO process has been completed, the specific QA/QC requirements will be evaluated to determine the type of analytical data that will be collected. The overall QA objectives for the Program-Wide IR Program is to develop and implement procedures that will provide data that are of known, documented, and defensible quality. QA/QC is ensured through appropriate sample collection, preservation and transportation methods combined with an evaluation of analytical performance through analysis of quality control samples.

The three documents in the Master SAP (QAPP, FSP, and IDWMP) contain the plans and procedures for safe, competent sampling and for effective management of the data. Each laboratory providing analytical data for the sampling efforts will developed its own laboratory quality assurance plan (LQAP). The SAP and the LQAP must address the elements of the Navy QA Program. Audits in the field and in the laboratories will determine how the QA/QC procedures are being implemented. Discrepancies, if any, will be addressed through the corrective action programs described in the SAP and the LQAP.

Data evaluation will be conducted by the data management staff of CH2M HILL. The Chain of Custody (COC) forms, laboratory case narratives, and log books will be checked against sample results, blank results, and percent recoveries (where applicable).

The quality of the data generated by sampling, monitoring, and analyses will be evaluated in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC) DQOs are measured by the degree of precision, accuracy, representativeness, completeness, and comparability (PARCC) of the data required for the project. The project's precision and accuracy objectives for laboratory analysis are in Table 4-1. Laboratory specific limits will be generated after a laboratory has been contracted. The quality objectives for field parameters (OVM, conductivity, etc.) are included in SOPs in Appendix A of the Master WP.

TABLE 4-1
Precision, Accuracy, and Completeness of Objectives

Parameter	Precision[1] (Relative Percent Difference)	Accuracy[1] (Percent Spike Recovery)	Analytical Method	Intended Data Use
Groundwater and Surface Water				
Organic Compounds	≤ 20	50 – 150	SW-846 Methods 8260B, 8270C, and 8081A/8082	Determine extent of contamination. Human and ecological risk assessment.
Organophosphorus Pesticides	≤ 20	50 – 150	SW-846 Method 8141A	Determine extent of contamination Human and ecological risk assessment.
Chlorinated Pesticides	≤ 20	50 – 150	SW-846 Method 8151A	Determine extent of contamination Human and ecological risk assessment.
TAL Metals and Cyanide	≤ 20	75-125	SW-846 Methods 6010B and 7000 series	Determine extent of contamination Human and ecological risk assessment.
Low-concentration Metals and Cyanide	≤ 20	75-125	SW-846 Methods 6010B and 7000 series	Determine extent of contamination Human and ecological risk assessment.
Explosives	≤ 20	75-125	SW-846 Methods 8330 and 8332 series	Determine extent of contamination Human and ecological risk assessment.
TOC	≤ 20	75-125	EPA Method 9060	Evaluate process options
TSS, TDS	≤ 20	75-125	EPA Methods 160.1 and 160.2	Evaluate process options
Alkalinity	≤ 20	75-125	EPA Method 310.1	Evaluate process options and determine water quality
Hardness	≤ 20	75-125	EPA Method 130.2	Evaluate process options and determine water quality
Soil and Sediment				
Organics	≤ 35	50 – 150	SW-846 Methods 8260B, 8270C, and 8081A/8082	Determine extent of contamination Human and ecological risk assessment.
Organophosphorus Pesticides	≤ 35	50 – 150	SW-846 Method 8141A	Determine extent of contamination Human and ecological risk assessment.
Chlorinated Pesticides	≤ 35	50 – 150	SW-846 Method 8151A	Determine extent of contamination Human and ecological risk assessment.
TAL Metals and Cyanide	≤ 35	75-125	SW-846 Methods 6010B and 7000 series	Determine extent of contamination Human and ecological risk assessment.
Explosives	≤ 20	75-125	SW-846 Methods 8330 and 8332 series	Determine extent of contamination Human and ecological risk assessment.
Grain Size	--	--	ASTM 0421-58/0422-63	Characterize soil or sediment
TCLP Organics and Inorganics	≤ 35	75-125	SW-846 Method 1311	Determine disposal options
RCRA Parameters (Reactivity, Ignitability, Corrosivity)	≤ 35	--	SW-846 Sections 7.3, 3.2/7.3, 4.2, SW-846 Method 1010/1020A, SW-846 Section 7.2	Determine disposal options

[1]Target QC limits until laboratory specific limits are generated.

4.3 PARCC

4.3.1 Accuracy and Precision

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter. Analytical accuracy can be determined by using known reference materials or matrix spikes (MS). Spiking of reference materials into the actual sample matrix is the preferred technique because it quantifies the effects of the matrix on the analytical accuracy. Accuracy can be expressed as percent recovery (%R) determined by the following equation:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where: SSR = spiked sample result
SR = sample result (native)
SA = spike added

Precision is the measure of the agreement or repeatability of a set of duplicate results obtained from repeat determinations made under the same conditions. The precision of a duplicate determination can be expressed as the relative percent difference (RPD), which is determined by the following equation:

$$RPD = \frac{|X1 - X2|}{X1 + X2} \times 200$$

where: X1 = first duplicate value
X2 = second duplicate value

For a given laboratory analysis, the duplicate RPD values are tabulated, and the mean and standard deviations of the RPD are calculated. Control limits for precision usually are plus or minus two standard deviations from the mean.

Accuracy and precision will be monitored by using field duplicate, MS, and matrix spike duplicate (MSD) samples. These data alone cannot be used to evaluate the accuracy and precision of individual samples, but will be used to assess the long-term accuracy and precision of the analytical method.

4.3.2 Completeness

Completeness will be calculated on an overall basis with data quality evaluations being performed on any data rejections as described in Appendix K of the *NASD Phase I Expanded Preliminary Assessment/Site Investigation Report, CH2M HILL, October, 2000.* Completeness is defined as the percentage of analytical measurements that are judged to be valid, validity being defined by the DQOs. Percent completeness is calculated as the

number of analyses meeting all quality criteria divided by the total number of analyses performed, multiplied by 100. The completeness goal for the project is 85 percent.

4.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent parameter variations at a sampling point. Representativeness is a measure of how closely the measured results reflect the actual distribution and concentration of certain chemical compounds in the medium sampled. The Master FSP and the SOPs describe the procedures to be used for collecting samples. This process will generate samples that are as representative as possible. Documentation of laboratory and field procedures, as described in the FSP, will be used to verify that protocols have been followed and that sample identification and integrity have been maintained.

4.3.4 Comparability

"Comparability" is the term that describes the confidence with which one data set can be compared to another. Comparability refers to such issues as using standard field and analytical techniques, following the same QA/QC procedures, and reporting data in the same units. This criterion becomes important if more than one field team is collecting samples or more than one laboratory is analyzing samples. Consistency in sampling and laboratory procedures will be maintained throughout the project. (See the Master FSP and the SOPs in Appendix A of the Master WP for a discussion of sampling procedures.) In addition, accepted methodologies will be used for sample analysis, and these methods will not be changed during the project.

SECTION 5

Sample Collection Procedures

Descriptions of sampling procedures are contained in the attached Master FSP and in the SOPs in Appendix A of the Master WP. Procedures are included that describe the following, at a minimum:

- Sampling methods
- Sample packing, handling, and shipment, including time considerations
- Preparation and use of trip blanks, field blanks, equipment blanks, and duplicate samples
- Documentation of sampling activities

Site-specific sampling procedures, sampling point selection, special conditions for sample container preparation, or special time requirements will be addressed in the site-specific SAPs.

SECTION 6

Sample Custody

Essential to a sampling and analysis program is maintaining the integrity of the sample, from collection to data reporting. This requires tracking the possession and handling of samples from the time of collection, through analysis, to final disposal. This documentation is referred to as chain-of-custody (COC). Figure 6-1 shows an example of a COC form. The essential components of the COC are described in the section 3.2.6 of the Site-Specific Work Plan and section 3.2 of the FSP as summarized below.

6.1 Field Custody

The field team leader is responsible for the care and custody of samples until they are shipped or otherwise delivered to the laboratory custodian in accordance with methods for sample shipment procedures defined in section 3.2 of the FSP.

6.2 Transfer of Custody

The COC form must be completed before samples are shipped. The persons involved in relinquishing and receiving the samples will sign, date, and note the time of sample receipt on the COC form. The first such transfer may occur between the field sampler and the sample carrier. Another transfer may occur between the sample carrier and the laboratory's sample custodian. Each sample shipment will be accompanied by a COC record that identifies the contents of the shipment.

6.3 Laboratory Custody

Laboratory custody procedures are detailed in each laboratory's LQAP. The laboratory custodian will verify that the custody seals on the sample shipment or the containers are intact and that the information on the COC matches the actual contents. The laboratory custodian also will note anomalies, such as broken bottles, elevated temperatures, and missing labels. The project-specific procedures for sample custody are described fully in the FSP. Once a laboratory has been selected, a QAPP Addendum will be developed to provide laboratory specific custody controls.

6.4 Sample Disposal

Unless otherwise instructed, the analytical laboratory will dispose of unused sample portions after 180 days, in accordance with RCRA regulations and the LQAP. Unused samples will be offered to the EPA prior to disposal.

FIGURE 6-1
Sample COC Form

Progress Environmental Laboratories

№ 21359

4420 Pendola Point Road
Tampa, Florida 33619
(813) 247-2805
FAX: (813) 248-1537

Client:	Due Date(TAT):
Project Mgr:	Fax Reports to:( ) -
Project :	Bill to:
Project #:	
PO #:	Sampler's Initials:

Station ID	Date	Time	PEL Lab #	# of Bttls	Pres									Remarks

Relinquished By:	Received By:	Date	Time	Project Notes
Relinquished By:	Received By:	Date	Time	
Relinquished By:	Received By:	Date	Time	
Relinquished By:	Received By:	Date	Time	

7.2 Laboratory Equipment Calibration

The laboratory itself is responsible for equipment and instrument calibration and maintenance. Manufacturer's guidance shall be followed for general upkeep. Laboratory calibration procedures are outlined in the LQAP which will be included as an Addendum to the Master QAPP following laboratory selection.

TABLE 7-1
Calibration Standards

Instrument	Calibration Standard	Span	Reading	Method
OVM (11.7 eV)	100 ppm isobutylene	RF = 0.68	68 ppm	1.5 L/min reg: T-tubing
OVA	100 ppm methane	RF = 1.00	100 ppm	1.5 L/min reg: T-tubing
pH Meter	pH 4 and 7 Buffers	N/A	N/A	N/A
Conductivity Meter	EC 225 and 1,000 µS/cm	N/A	N/A	N/A
Explosimeter	75% LEL Pentane	N/A	50% ±5% LEL Oxygen	1.5 L/min: Direct tubing
Turbidity Meter	Per instrument instructions	N/A	N/A	Per instrument instructions
DO meter	N/A	N/A	> 0.1 ppm	Adjust for temperature, altitude, and salinity

SECTION 8

Analytical Procedures

All laboratory analyses will be performed by a laboratory approved by NFESC. The laboratories will be procured using basic ordering agreements (BOAs). Until the BOAs with CH2M HILL are in place, the BOA laboratories from Baker will be used. Table 8-1 lists analytical procedures that may be used for samples collected at AFWTF. Other analyses may be required and will be discussed in the site-specific SAP. Table 8-2 lists the chemicals analyzed by each method and the reporting limits.

TABLE 8-1
Analytical Procedures

Analysis	Methodology
TCL VOCs, SVOCs, and Pesticides/PCBs	SW-846 Methods 8260B, 8270C, and 8081A/8082
Low-concentration VOCs, SVOCs, and Pesticides/ PCBs (for groundwater samples)	U.S. EPA CLP SOW for Low-concentration Water OLC02.1 (2/96)[a], OLC03.1 (7/00)
Organophosphorus pesticides	SW-846 Method 8141A
Chlorinated pesticides	SW-846 Method 8151A
TAL Metals and Cyanide	SW-846 Methods 6010B and 7000 series
TOC	EPA Method 9060
TDS	EPA Method 160.1
TSS	EPA Method 160.2
Hardness	EPA Method 130.2
Alkalinity	EPA Method 310.1
Grain Size	ASTM 0421-58/0422-63
TCLP Extraction	SW-846 Method 1311
Corrosivity	SW-846 Section 7.2
Ignitability	SW-846 Method 1010/1020A
Reactivity	SW-846 Sections 7.3, 3.2/7.3, 4.2
Explosives	SW-846 Method 8330

[a] The laboratory may analyze organic samples under another U.S. EPA CLP organics SOW if the reporting limits
on Table 8-2 can be met and verified by MDL studies. The requested reporting limit for pentachlorophenol is 5 micrograms per liter (µg/L).

TABLE 8-2A
RLs for Appendix IX VOCs, SW-846 method 8260B

Compound	Water RL (µg/L)	Soil RL (µg/kg)	Compound	Water RL (µg/L)	Soil RL (µg/kg)
1,1,1,2-Tetrachloroethane	1	5	cis-1,2-Dichloroethylene	0.5	2.5
1,1,1-Trichloroethane	1	5	cis-1,3-Dichloropropene	1	5
1,1,2,2-Tetrachloroethane	1	5	Dibromochloromethane	1	5
1,1,2-Trichloroethane	1	5	Dichlorodifluoromethane	2	10
1,1-Dichloroethane	1	5	Ethyl methacrylate	1	5
1,1-Dichloroethylene	1	5	Ethylbenzene	1	5
1,2,3-Trichloropropane	1	5	Isobutyl alcohol	40	200
1,2-Dibromo-3-chloropropane	2	10	Methacrylonitrile	2	10
1,2-Dibromoethane	1	5	Methyl bromide	2	10
1,2-Dichloroethane	1	5	Methyl chloride	2	10
1,2-Dichloropropane	1	5	Methyl ethyl ketone	10	20
1,4-Dioxane	200	500	Methyl iodide	1	5
2-Hexanone	10	20	Methyl methacrylate	1	5
4-Methyl-2-pentanone	5	20	Methylene bromide	1	5
Acetone	10	20	Methylene chloride	1	5
Acetonitrile	20	100	N-butyl alcohol	50	1000
Acrolein	20	100	Propionitrile	4	20
Acrylonitrile	20	100	Styrene	1	5
Allyl chloride	2	10	Tetrachloroethylene	1	5
Benzene	1	5	Toluene	1	5
Bromodichloromethane	1	5	trans-1,2-Dichloroethylene	0.5	2.5
Bromoform	1	5	trans-1,3-Dichloropropene	1	5
Carbon disulfide	1	5	trans-1,4-Dichloro-2-butene	1	5
Carbon tetrachloride	1	5	Trichloroethylene	1	5
Chlorobenzene	1	5	Trichlorofluoromethane	2	10
Chloroethane	2	10	Vinyl acetate	2	10
Chloroform	1	5	Vinyl chloride	2	10
Chloroprene	1	5	Xylenes, Total	1	5

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory

TABLE 8-2B
RLs for Appendix IX SVOCs SW-846 method 8270C

Compound	Water RL (µg/L)	Soil RL (µg/kg)
1,2,4,5-Tetrachlorobenzene	10	330
1,2,4-Trichlorobenzene	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
1,4-Naphthoquinone	50	1600
1-Naphthylamine	10	330
2,3,4,6-Tetrachlorphenol	50	1600
2,4,5-Trichlorophenol	10	330
2,4,6-Trichlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
2,4-Dinitrophenol	50	1600
2,4-Dinitrotoluene	10	330
2,6-Dichlorophenol	10	330
2,6-Dinitrotoluene	10	330
2-Acetylaminofluorene	100	3300
2-Chloronaphthalene	10	330
2-Chlorophenol	10	330
2-Naphthylamine	10	330
2-Picoline	20	660
3,3'-Dimethylbenzidine	50	1600
3,3'-Dichlorobenzidine	50	1600
4,6-Dinitro-o-cresol	50	1600
4-Aminobiphenyl	50	1600
4-Bromophenyl phenyl ether	10	330
4-Chlorophenyl phenyl ether	10	330
4-Nitroquinoline 1-oxide	100	3300
5-Nitro-o-toluidine	20	660
Acenaphthene	10	330

TABLE 8-2B
RLs for Appendix IX SVOCs SW-846 method 8270C

Compound	Water RL (µg/L)	Soil RL (µg/kg)
Acetophenone	10	330
alpha,alpha-Dimethylphenethylamine	50	1600
Aniline	10	330
Anthracene	10	330
Aramite	20	660
Benzyl alcohol	10	330
Bis(2-chloro-1-methylethyl)ether	10	330
Bis(2-chloroethoxy)methane	10	330
Bis(2-chloroethyl)ether	10	330
Bis(2-ethylhexyl)phthalate	10	330
Butyl benzyl phthalate	10	330
Chlorobenzilate	10	330
Diallate	20	660
Dibenzofuran	10	330
Diethyl phthalate	10	330
Dimethoate	20	660
Dimethyl phthalate	10	330
Di-n-butyl phthalate	10	330
Di-n-octyl phthalate	10	330
Dinoseb	20	660
Diphenylamine	10	330
Ethyl methanesulfonate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	50	1600
Hexachloroethane	10	330
Hexachloropropene	100	3300
Isophorone	10	330
Isosafrole	20	660
m-Cresol	10	330

TABLE 8-2B
RLs for Appendix IX SVOCs SW-846 method 8270C

Compound	Water RL (µg/L)	Soil RL (µg/kg)
m-Dinitrobenzene	10	330
Methapyrilene	50	1600
Methyl methanesulfate	10	330
m-Nitroaniline	50	1600
Nitrobenzene	10	330
N-Nitrosodiethylamine	10	330
N-Nitrosodimethylamine	10	330
N-Nitrosodi-n-butylamine	10	330
N-Nitrosodiphenylamine	10	330
N-Nitrosodipropylamine	10	330
N-Nitrosomethylethylamine	10	330
N-Nitrosomorpholine	10	330
N-Nitrosopiperidine	10	330
N-Nitrosopyrrolidine	10	330
o-Cresol	10	330
o-Nitroaniline	50	1600
o-Nitrophenol	10	330
o-Toluidine	20	660
p-(Dimethylamino)azobenzene	20	660
p-Chloroaniline	10	330
p-Chloro-m-cresol	10	330
p-Cresol	10	330
Pentachlorobenzene	10	330
Pentachloroethane	50	1600
Pentachloronitrobenzene	50	1600
Pentachlorophenol	10	330
Phenacetin	20	660
Phenol	10	330
p-Nitroaniline	50	1600
p-Nitrophenol	50	1600
p-Phenylenediamine	100	3300
Pronamide	20	660

TABLE 8-2B
RLs for Appendix IX SVOCs SW-846 method 8270C

Compound	Water RL (µg/L)	Soil RL (µg/kg)
Pyrene	10	330
Pyridine	20	660
Safrole	20	660
sym-Trinitrobenzene	50	1600

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory

TABLE 8-2C
RLs for Appendix IX PAHs, SW-846 method 8310

Analyte	Water RL (µg/L)	Soil RL (µg/kg)	Analyte	Water RL (µg/L)	Soil RL (µg/kg)
2-Methylnaphthalene	0.02	5	Benzo(g,h,i)perylene	0.02	5
3-Methylcholanthrene	0.50	5	Benzo(k)fluoranthene	0.02	5
7,12-Dimethylbenz(a)anthracene	0.50	5	Chrysene	0.02	5
Acenaphthylene	0.02	5	Dibenz(a,h)anthracene	0.02	5
Benzo(a)anthracene	0.02	5	Indeno(1,2,3-cd)pyrene	0.02	5
Benzo(a)pyrene	0.02	5	Naphthalene	0.02	5
Benzo(b)fluoranthene	0.02	5	Phenanthrene	0.02	5

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory

TABLE 8-2D
RLs for Appendix IX Organochlorine Pesticides, SW-846 method 8081A

Analyte	Water RL (µg/L)	Soil RL (µg/kg)	Analyte	Water RL (µg/L)	Soil RL (µg/kg)
4,4'-DDD	0.05	1.7	Endosulfan sulfate	0.05	1.7
4,4'-DDE	0.05	1.7	Endrin	0.05	1.7
4,4'-DDT	0.05	1.7	Endrin aldehyde	0.05	1.7
Aldrin	0.05	1.7	Gamma BHC	0.05	1.7
Alpha BHC	0.05	1.7	Heptachlor	0.05	1.7
Beta BHC	0.05	1.7	Heptachlor epoxide	0.05	1.7
Chlordane	0.5	17	Isodrin	0.1	3.3
Delta BHC	0.05	1.7	Kepone	1.0	33
Dieldrin	0.05	1.7	Methoxychlor	0.1	3.3
Endosulfan I	0.05	1.7	Toxaphene	2.0	67
Endosulfan II	0.05	1.7			

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory

TABLE 8-2E
RLs for Appendix IX Organophosphorous Pesticides, SW-846 method 8141A

Analyte	Water RL (µg/L)	Soil RL(µg/kg)
Disulfoton	1	33
Famphur	1	33
Methyl parathion	1	33
Parathion	1	33
Phorate	1	33
Tetraethyl dithiopyrophosphate	1	33
O,O-Diethyl O-2-pyrazinyl phosphorothioate	1	33
O,O,O-Triethyl phosphorothioate	1	33

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory.

TABLE 8-2F
RLs for Appendix IX PCBs, SW-846 method 8082

Analyte	Water RL (mg/L)	Soil RL (mg/kg)
Aroclor-1016	1	33
Aroclor-1221	1	33
Aroclor-1232	1	33
Aroclor-1242	1	33
Aroclor-1248	1	33
Aroclor-1254	1	33
Aroclor-1260	1	33

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory

TABLE 8-2G
RLs for Appendix IX Herbicides, SW-846 method 8151A

Analyte	Water RL (µg/L)	Soil RL (µg/kg)
2,4-D	4.0	80
2,4,5-T	1.0	20
2,4,5-TP (Silvex)	1.0	20

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory.

TABLE 8-2H
RLs for Appendix IX Dioxins and Furans, SW-846 method 8290

Analyte	Water RL (µg/L)	Soil RL (µg/kg)
2,3,7,8-TCDD	0.0007	0.003
Total HxCDD	NA	NA
Total HxCDF	NA	NA
Total PeCDD	NA	NA
Total PeCDF	NA	NA
Total TCDD	NA	NA
Total TCDF	NA	NA

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory.

NA – Not Available.

TABLE 8-2I
RLs for Appendix IX Inorganics, SW-846 method 6010B, a 9000 series method for cyanide and sulfide, and a 7000 series method for mercury

Analyte	Water RL (µg/L)	Soil RL (µg/kg)	Analyte	Water RL (µg/L)	Soil RL (µg/kg)
Antimony	60	6,000	Mercury	0.2	100
Arsenic	10	1,000	Nickel	40	4,000
Barium	200	20,000	Selenium	5	500
Beryllium	5	500	Silver	10	1,000
Cadmium	5	500	Sulfide	500	50000
Chromium	10	1000	Thallium	10	1,000
Cobalt	50	500	Tin	100	10,000
Copper	25	2,500	Vanadium	50	5,000
Cyanide	10	500	Zinc	20	2,000
Lead	3.0	300			

RLs are estimated reporting limits for the applicable analyte. Laboratory specific reporting limits will be obtained and compared with the screening criteria upon contracting with an analytical laboratory.

TABLE 8-2J
Analytical Parameters and Reporting Limits
Explosives
SW-846 Method 8330 and 8332

Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1,3,5-Trinitrobenzene		
1,3-Dinitrobenzene		
2,4,6-Trinitrotoluene		
4-Amino-2,6-dinitrotoluene		
2-Amino-4,6-dinitrotoluene		
2,4-Dinitrotoluene		
2,6-Dinitrotoluene		
Nitrobenzene		
2-Nitrotoluene		
3-Nitrotoluene		
4-Nitrotoluene		
Hexahydro-1,3,5-trinitro-1,3,5-triazine		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
Nitroglycerin		
Pentaeythritol tetranitrate (PETN)		
Ammonium Perchlorate		
Picric Acid		

SECTION 9

Data Reduction, Validation, and Reporting

Data reduction and reporting are steps in the overall management and use of both field and laboratory data, and data validation is a step in the overall management and use of laboratory data. The selected laboratory will provide a SOW and QAPP that will be included as an Addendum to the Master QAPP providing detail on methods of laboratory data reduction. Figure 9-1 illustrates the flow of information and sample-tracking forms.

9.1 Data Reduction

Data reduction, validation, and reporting will ensure that all documents for the investigations can be accounted for when they are completed. Documents requiring accountability include logbooks, field data records, correspondence, COC records, analytical reports, data packages, and reports.

9.2 Definition

Collected analytical data will be computerized. Electronic data will be requested for all Target Compound List (TCL) and Target Analyte List (TAL) analyses from the laboratory in a format agreed upon by the data manager. Other types of analytical data will be entered and then verified by spot-checking procedures. The sample manager will handle data entries that are unverified.

9.3 Background Data

Background data produced for internal records and not reported as part of the analytical data include the following: laboratory worksheets, laboratory notebooks, sample-tracking system forms, maintenance records, calibration records, and associated QC records. These sources will be available for inspection and for determining the data validation.

9.4 Data Validation

Validation of analytical data will be in accordance with NFESC QA guidance and EPA QA/QC requirements. The validation will be performed according to the updated *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, September 1999) and *USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, February 1994). Data validation will be performed by a subcontractor to CH2M HILL utilizing EPA Region II data validation formats. Example data validation sheets will be provided following the selection of a BOA approved

subcontractor. An example DQE Report is included as Attachment A. The Data Validation Report will meet all CLP requirements.

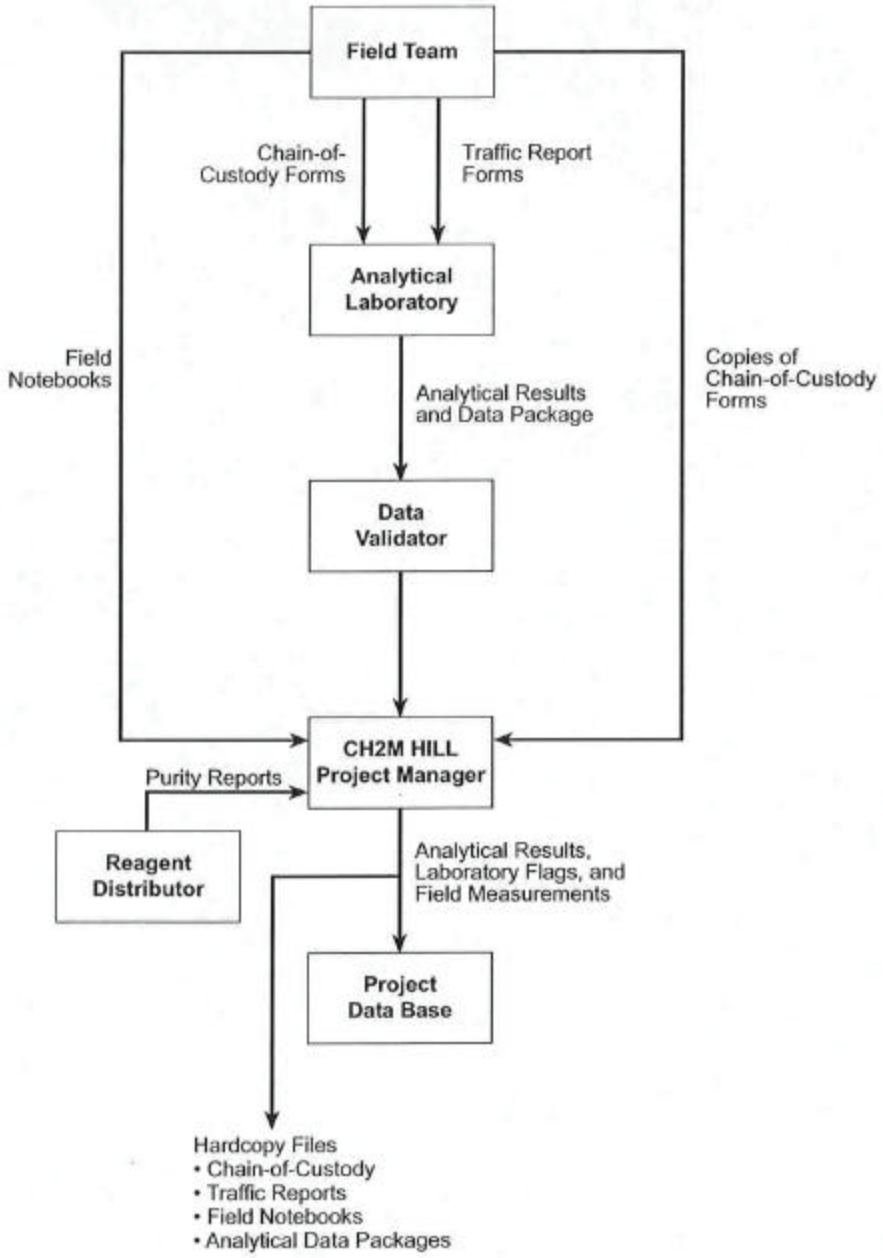

FIGURE 9-1
Flow of Forms and Sample and Analysis Information

CH2MHILL

The project, its objectives, and the intended use of the data will be discussed with the data validation personnel. Analytical results with low level DQOs will be evaluated for completeness and applicable precision, accuracy, and blank contamination.

9.5 Data Records

The following procedures will be used for maintaining the project records:

- The task manager will determine the records to be generated before the start of work. The records will be listed in the site-specific WPs and SAPs.
- Records of field activities that support the integrity of samples will be entered on bound and numbered pages. Such records will be dated and signed or otherwise authenticated on the day of entry. All entries will be made in indelible ink, and corrections will be made by crossing out mistakes with a single line so that the original entry is legible. Changes will be initialed and dated.
- Records retained on file will be indexed. The indexing system will include the locations of records within the indexing system. (The indexing system will be in alphabetical, chronological, or numerical order or as otherwise indicated in written procedures.)
- There will be sufficient information in records to permit identification between the record and the item(s) or activity to which it applies. Identification of records will be by means that permit traceability.
- The record storage system will provide for accurate retrieval of records without undue delay.

SECTION 10

Quality Control Checks

A number of QA/QC samples will be collected to check the adequacy of sample collection and analysis and to monitor laboratory performance. Duplicates, blanks, and spiked samples are used to determine if the sampling technique affects the analytical results, to measure the internal consistency of the samples, and to estimate variances or biases in the analytical process. The field and laboratory QA/QC sampling procedures are described below.

10.1 Field Sampling QC Procedures

QC duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and an estimate of variance and bias. Table 10-1 shows the number of each type of field QC sample that should be collected for the number of investigative samples collected. The number and kinds of QC samples to be collected for each sampling event will be listed in each site-specific SAP.

TABLE 10-1
Summary of QC Collection Frequencies

Type of QC Sample	Frequency Collected
Field Duplicate	One per 10 samples per matrix
Trip Blank	One per cooler containing samples for VOC analysis
Field Blank	One per sampling event, and at least one per week (if very windy or dusty, collect one per day)
Equipment Blank	One each day per matrix
Temperature Blank	One per cooler
MS/MSD	One per matrix for each group of up to 20 samples sent to a single laboratory

One duplicate sample will be obtained for every 10 field samples collected. The sampling station from which the duplicate is taken will be selected with a bias toward locations where measurable concentrations are expected. Each duplicate sample will be split evenly into two sample containers and submitted for analysis as two independent samples.

MS/MSDs will be collected at the rate of one for every 20 field samples collected. MS/MSD samples give an indication of the laboratory's analysis accuracy and precision within the sample matrix.

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample. Three types of blanks can be generated during sampling activities: trip blanks, field blanks, and equipment rinsate blanks.

One trip blank will be included in each cooler used for the daily shipment of VOC samples. If more than one cooler is being sent on a given day, all of the VOC samples should be placed in one cooler, if possible, to minimize the number of trip blanks needed. The trip blanks will be prepared before each sampling event, shipped or transported to the field with the sampling bottles, and returned unopened for analysis. Trip blanks will indicate if there is contamination during shipment to the field, from storage in the field, or from shipment from the field to the analytical laboratory.

One equipment blank per sample medium will be obtained for each day of sampling. Equipment blanks will give an indication of the efficiency of decontamination procedures.

One field blank will be collected per sampling event. If sampling events extend beyond 1 week (5 working days) or for windy and dusty field conditions, the number of field blanks should be increased. Field blanks are used to determine the chemical quality of water used for such procedures as decontamination and blank collection.

EPA has recently requested that a temperature blank be included in each cooler containing samples for CLP analyses so that the laboratory can record the temperature without disturbing the samples. The temperature blank will not be given a sample number nor listed as a sample on the COC.

10.2 Laboratory Analytical QC Procedures

The analytical laboratory will use the QC elements, including method or laboratory blanks, initial and continuing calibrations, MS/MSDs, and surrogate spike standards as specified in the laboratory LQAP and in *Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document* (U.S. Navy, February 1996). The LQAP will identify the QC samples, frequency of analysis, acceptance criteria, and corrective actions for each laboratory method.

Method blanks monitor potential contamination introduced during analysis. Calibration standards are used to calibrate the instrumentation, thereby controlling the accuracy of the results. Once an instrument has been calibrated, calibration is confirmed periodically by monitoring the instrument response to internal standards. For some analyses, such as those performed by gas chromatograph/mass spectrometer (GC/MS), a sample and a blank are spiked with a surrogate compound or a system-monitoring compound (SMC) chosen for properties similar to those of the analyte of interest. The surrogate spikes or SMCs evaluate the efficiency of the analytical procedure in recovering the true amount of a known compound. Laboratory duplicates are performed in certain instances (especially for inorganic analyses) to evaluate the reproducibility of the method.

MS/MSDs are spiked by the laboratory in two separate aliquots of a sample selected by the sampler from each batch of 20 field samples. The MS/MSDs will be used to assess accuracy and precision. The MSD is identical to the MS; both are analyzed to determine the reproducibility of the results. The sampler will collect a triple volume of one sample to give the laboratory enough material for analyzing the sample, the spiked sample, and the spiked sample duplicate.

SECTION 11

Performance and Systems Audits

Both field and laboratory audits will be conducted.

11.1 Laboratory Performance and Systems Audits

The analytical laboratories will conduct internal QC checks as indicated in each laboratory's LQAP. Each approved BOA laboratory has been audited to qualify for the list and is subject to external audits by the Navy and CH2M HILL. Results of the audit will be available following the selection process.

11.2 Field Team Performance and Systems Audits

The project manager or designee will conduct a performance audit as needed during sampling activities to verify that the proper sampling and documentation procedures presented in the QAPP and the FSP are followed and that subsequent sample data are valid. The audit will focus on the details of the QA program. The audit checklist is the guide for performing audits for field procedures, and is shown in Figure 11-1. The audit will evaluate the following:

- Project responsibilities
- Sample collection and sample preservation procedures
- Equipment decontamination procedures
- Field equipment calibration procedures
- Sample custody procedures
- Document control
- Sample identification system
- QC corrective action procedures

An audit report summarizing results and corrections will be prepared and filed in the project files. Significant variances from established procedures will be reported to the project manager.

Figure 11-1

FIELD PERFORMANCE AUDIT CHECKLIST

Project Responsibilities

Project No.: _____ Date: _____

Project Location: _____ Signature: _____

Team Members:

Yes __ No __ 1) Was a SAP Prepared?
Comments _____

_____

Yes __ No __ 2) Was a briefing held for project participants?
Comments _____

_____

Yes __ No __ 3) Were additional instructions given to project participants?
Comments _____

_____

Sample Collection

Yes __ No __ 1) Is there a written list of sampling locations and descriptions?
Comments _____

_____

Yes __ No __ 2) Are samples collected as stated in the FSP?
Comments _____

_____

Yes __ No __ 3) Are samples collected in the type of containers specified in the FSP?
Comments _____

_____

Figure 11-1

FIELD PERFORMANCE AUDIT CHECKLIST

(Continued)

Yes __ No __ 4) Are samples preserved as specified in the FSP?
Comments _____

_____

Yes __ No __ 5) Are the number, frequency, and type of samples collected as specified in the FSP?
Comments _____

_____

Yes __ No __ 6) Are quality assurance checks performed as specified in the FSP?
Comments _____

_____

Yes __ No __ 7) Are photographs taken and documented as specified in the FSP?
Comments _____

_____

Document Control

Yes __ No __ 1) Have any accountable documents been lost?
Comments _____

_____

Yes __ No __ 2) Have any accountable documents been voided?
Comments _____

_____

Yes __ No __ 3) Have any accountable documents been disposed of?
Comments _____

_____

Figure 11-1

FIELD PERFORMANCE AUDIT CHECKLIST

(Continued)

Yes __ No __ 4) Are the samples identified with sample tags?
Comments _____

_____

Yes __ No __ 5) Are blank and duplicate samples properly identified?
Comments _____

_____

Yes __ No __ 6) Are samples listed on a chain-of-custody record?
Comments _____

_____

Yes __ No __ 7) Is chain-of-custody documented and maintained?
Comments _____

_____

SECTION 12

Preventive Maintenance

Routine maintenance procedures and schedules for field sampling equipment are described in the manufacturers' instruction manuals. Maintenance procedures and schedules for all field instruments will follow the recommendations of the equipment manufacturers. All records of inspection and maintenance will be dated and documented in the field notebook for each site.

Routine laboratory equipment maintenance will be performed by laboratory personnel as needed or as indicated in the LQAP of the selected laboratory. Maintenance procedures and schedules for laboratory analytical instruments will follow the recommendations of the equipment manufacturers. All records of inspection and maintenance will be dated and documented in laboratory record books.

Critical spare parts for the pH meter, the OVM, the OVA, the conductivity meter, the DO meter, and the explosimeter include batteries, electrodes, and membranes. They will be included in the sampling kits to minimize downtime. In addition, backup meters will be available, if needed. Spare parts will be purchased from accepted vendors. An inventory of available spare parts for field equipment will be kept in the field logbook and updated as necessary. Daily inspections of field equipment will be conducted to ensure that equipment is functioning properly. If inspection results indicate that a piece of field equipment is deemed faulty or not useable, replacement equipment will be cleaned, calibrated if necessary, and used in place of the faulty equipment. The faulty equipment will then be shipped back to the vendor for repair.

SECTION 13

Data Assessment Procedures

The precision and accuracy of data will be assessed routinely to ensure that they meet the requirements of the DQOs.

All data will be validated before interpretation by a subcontractor. The validation will be performed according to *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, September 1999) and *EPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, February 1994).

Data with high level DQOs will be validated by an independent contractor. NFESC guidance does not allow CH2M HILL to validate data collected by CH2M HILL staff. Data that should be qualified will be flagged with the appropriate symbol.

Data with low level DQOs will be evaluated by CH2M HILL. The results for field and equipment blanks will be reviewed if available, and the data will be qualified if necessary. The data set as a whole will be examined for completeness, consistency, anomalous results, and reasonableness.

SECTION 14

Corrective Actions

Anyone who determines that a problem exists will initiate the corrective action process by consulting the project manager. Corrective action will include problem identification, investigation-responsibility assignment, action for eliminating the problem, increased monitoring of the effectiveness of the corrective action, and verification that the problem has been eliminated.

Documenting the problem is important to the overall QA program. A memorandum to file will be written for a problem associated with sample collection. A copy will be sent to the laboratory, if appropriate, to document corrections to sample identification. The memo will be written by the person discovering the QA problem or the person responsible for the problem. The memo should identify the problem, establish possible causes, and designate the person responsible for action. The responsible person will be either the project manager or the field team leader. The responsible person will verify that initial action has been taken and appears to be effective and, at an appropriate later date, will recheck to see if the problem has been resolved fully. A standard corrective action form is provided as Figure 14-1.

Examples of corrective actions include, but are not limited to, correcting COC forms, analysis reruns (if holding-time criteria permit), recalibration with fresh standards, replacement of sources of blank contamination, examination of calculation procedures, additional training in sample preparation and analysis, reassignment of analytical responsibilities using a different batch of containers, and recommending an audit of laboratory procedures. Additional approaches may include the following:

- Resampling and analyzing
- Evaluating and amending procedures for sampling and analysis
- Accepting the data and acknowledging the level of uncertainty or inaccuracy by flagging the data and providing an explanation for the qualification

FIGURE 14-1

CORRECTIVE ACTION REQUEST FORM

Originator: _____ Date: _____

Person responsible for replying: _____

Description of problem and when identified: _____

_____

Sequence of Corrective Action (CA): (If a responsible person is not identified, submit this form directly to the PM)

State date, person, and action planned:

_____

_____

_____

_____

_____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approval by: _____ Date: _____

Information copies to:

Responsible person: _____

Field Team Leader: _____

Project Manager: _____

SECTION 15

Quality Assurance Reports

A QA report with attached corrective action forms will be distributed to all appropriate parties at the end of the field activity to summarize the QA/QC status of the project and problems, if any. The report will be an assessment of the measured QA parameters (for example, precision and accuracy), the results of performance audits, reported nonconformance, and significant QA problems and the recommended solutions. A change in the QAPP will be summarized in a report or a letter, and will be sent to NAVFACENGCOM, LANTDIV, the EPA, and distributed to the CH2M HILL project team.

ATTACHMENT A

Example Data Quality Evaluation Report

Example Data Quality Evaluation (DQE)

TO: Marty Clasen / TPA
Astrid Clarke / DFB

FROM: Kevin A. Sanders / GNV

DATE: 2 / 19 / 01

The purpose of the data quality evaluation process is to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of matrix interferences is more subtle and involves the analysis of several areas of results including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

Introduction

Samples were collected from April 4, 2000 through June 12, 2000. Field QC samples collected included field duplicates, field blanks, trip blanks (analyzed for VOCs only), and equipment rinsate blanks. The number of each type of sample is listed by analytical method in Table 1. The samples were analyzed for the following analytical fractions:

- Volatile organic compounds (VOCs) by CLP SOW OLMO4.2
- Semivolatile organic compounds (SVOCs) by CLP SOW OLMO4.2
- Metals by ILMO4.0
- Organochlorine Pesticides and PCB's by CLP SOW OLMO4.2
- Explosives by SW846 method 8330
- Low Level Organics by OLCO2.1

Before the analytical results were released by the laboratory, both the sample and QC data were carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data were reduced and the resulting data were reviewed to ascertain whether they were within the laboratory-defined limits for accuracy and precision. Any non-conforming data were discussed in the data package cover letter and case narrative.

The hardcopy data packages were reviewed by the project data validation subcontractor (Heartland Environmental Services, Inc) using the process outlined in the *EPA Region II's Functional Guidelines for Data Review* (Organic and Inorganic) SOPs. Data validation checklists used were those specified by EPA Region II. Areas of review included (when applicable to the SOW) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by LCSs, field duplicate results, surrogate recoveries, internal standard performance, and interference

checks. The Region II data review worksheet was completed for each of these data packages and any non-conformance documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Data that were not within the acceptance limits were appended with a qualifying flag, which consists of a single or double-letter abbreviation that reflects a problem with the data. Although the qualifying flags originate during the database query process, they are included in the final data summary tables deliverable so that the data will not be used indiscriminately. The following flags were used in this text:

- **U -** Undetected. Analyte was analyzed for but not detected above the method detection limit.
- **UJ -** Detection limit estimated. Analyte was analyzed for, and qualified as not detected. The result is estimated.
- **J -** Estimated. The analyte was present, but the reported value may not be accurate or precise.
- **R -** Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)

Numerical sample results that are greater than the method detection limit or inorganic instrument detection limit (MDL or IDL) but less than the contract required reporting limit (CRDL) are qualified with a “J” for estimated as required by the EPA Functional Guidelines for Evaluating Data Quality.

The entire database was queried for frequency of detection in blanks and samples, detailed listing of blank detects, matrix spike/matrix spike duplicate (MS/MSD) results, field duplicate precision, surrogate recoveries, preparation and analysis dates pertaining to holding times. The queries were then manipulated to calculate necessary statistics for evaluation of the data.

Once the data review and validation process was completed, the entire data set were reviewed for chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set was also evaluated to identify potential data limitations, uncertainties, or both in the analytical results. Attachment A lists the changes in data qualifiers due to the validation processes. Attachment H presents all data which were rejected.

Holding Times

Table 3 reflects the data which were qualified as estimated (J or UJ) for being prepared outside of holding time criteria. None of the data were rejected for failure to meet holding times.

Calibration

Attachment A indicates that several organic compounds were qualified as estimated due to initial or continuing calibration deficiencies. Table 4 presents these data. Of the 1037 results qualified for calibration criteria outside control limits, 420 were rejected. The rejected data applied to acetone and 2-butanone only. These compounds are identified as poor performers in the CLP SOW. All other 617 qualifications were estimated (J or UJ).

Method Accuracy

The laboratory control sample (LCS) reflects method accuracy. The LCS consists of deionized water spiked with target compounds or elements and processed through the entire method of preparation and analysis. All LCS recoveries met control limit criteria for these data.

Potential Field Sampling and Laboratory Contamination

Four types of blank samples were used to monitor potential contamination introduced during field sampling, sample handling, shipping activities, as well as sample preparation and analysis in the laboratory.

- **Trip Blank (TB)**: A sample of ASTM Type II water that is prepared in the laboratory prior to the sampling event. The water is stored in VOC sample containers and is not opened in the field, and travels back to the laboratory with the other samples for VOC analysis. This blank is used to monitor the potential for sample contamination during the sample container trip. One trip blank should be included in each sample cooler that contained samples for VOC analysis. Twenty-three trip blanks were submitted to the laboratory with these samples.
- **Equipment Rinsate Blank (ERB)**: A sample of the target-free water used for the final rinse during the equipment decontamination process. This blank sample is collected by rinsing the sampling equipment after decontamination and is analyzed for the same analytical parameters as the corresponding samples. This blank is used to monitor potential contamination caused by incomplete equipment decontamination. One equipment rinsate blank should be collected per day of sampling, per type of sampling equipment. Depending on the method, up to twenty-six equipment rinsate blanks were submitted to the laboratory for this field effort.
- **Field Blank or Ambient Blank (FB or AB)**: The field blank is an aliquot of the source water used for equipment decontamination. This blank monitors contamination that may be introduced from the water used for decontamination. One field blank should be collected from each source of decontamination water and analyzed for the same parameters as the associated samples. Depending on the method, up to five field blanks were collected during this sampling event.
- **Laboratory Method Blank or Method Blank (MB)**: A laboratory method blank is ASTM Type II water that is treated as a sample in that it undergoes the same analytical process as the corresponding field samples. Method blanks are used to monitor laboratory

performance and contamination introduced during the analytical procedure. One method blank was prepared and analyzed for every twenty samples or per analytical batch, whichever was more frequent.

According to the EPA Functional Guidelines, concentrations of common organic contaminants detected in samples at less than ten times the concentration of the associated blanks can be attributed to field sampling and laboratory contamination rather than environmental contamination from site activities. Common organic contaminants include acetone, methylene chloride, 2-butanone, and the phthalates. For other inorganic and organic contaminants, five times the concentration detected in the associated blanks (rather than ten times) is used to qualify results as potential field and/or laboratory contamination rather than environmental contamination. The ten times rule was applied on an SDG by SDG basis and not globally. EPA Region II direction does not provide for the validation contractor to use any blank value determined below the CRDL. Additionally, use of field blank data is left to the validation contractors discretion and is generally not applied, as was the case with this data set.

Field blank or global blank application would account for anomalous data which should also be attributed to laboratory or field blank contamination and, or instrument noise for many organic compounds and metals.

Attachment A (Change in Qualifiers) lists all changes in qualifier due to data validation and blank contamination. A comprehensive list of all detects in each blank is provided in Attachment B. Table 2 compiles the blank detections into a “frequency of detection” by target parameter. Additionally, Attachment G compiles frequency of detection by target analyte for all field samples after validation.

Eleven volatile compounds were reported in laboratory and/or field blanks. Two common disinfection byproducts (DPBP) were detected in ambient and rinsate blanks. Chloroform, a trihalomethane (THM) was reported in all ambient and rinsate blanks. Bromodichloromethane, also a THM, was detected in ambient and rinsate blanks. Chloromethane was detected in a single ambient and rinsate blank. No field samples reported detections for these THM compounds. As Table 2 indicates, 1,1-dichloroethene, 1,2-dichloroethane, ethylbenzene, sum of m.p-xylene, o-xylene, styrene, toluene, and total xylenes were reported in a minimal number of blanks at concentration levels well below the reporting limit. No field samples were qualified by the subcontractor for these compounds.

Phthalates are used as plasticizers. The most common phthalates are bis(2-ethylhexyl) phthalate (BEHP), Di-n-butylphthalate, and Diethyl phthalate. Phthalates are often introduced into samples during handling. Gloves are often used when handling sampling equipment such as pumps, hoses, split spoons, dredges and bailers. Additionally, laboratory chemists use gloves when handling samples and extracts. Gloves are coated with plasticizers such as BEHP to facilitate release of the gloves from the skin. Table 2 indicates that BEHP was detected in ambient and rinsate blanks; Diethylphthalate in equipment and laboratory blanks, and Di-n-octylphthalate in a laboratory blank. Attachment A indicates that 10 and 31 samples were qualified as non-detect for BEHP and di-ethylphthalate, respectively. If global application of the flags were applied, the majority of all phthalate detections would be qualified as not detected due to contamination. Thus, caution should be utilized when making decisions based upon phthalate data.

Phenol, benzo(g,h,I)perylene, and indeno(1,2,3-c,d)pyrene were detected in a single rinsate blank at concentrations below the reporting limit. No field samples were flagged for these compounds due to blank contamination.

A single soil laboratory method blank and a single water laboratory method blank were reported to contain low levels of p,p'-DDT and PCB-1016, respectively. No field samples were qualified for blank contamination for these compounds.

As listed in Table2, several metals were reported in either the laboratory method, equipment rinsate, and/or ambient field blanks. However, no samples were qualified due to metallic blank contamination.

Matrix Effects

Surrogate Spike Recovery

Surrogate spike compounds were added to every sample analyzed for the organic parameters including field and laboratory blanks as well as field environmental samples. Surrogate spikes consist of organic compounds which are similar to the method targets in chemical composition and behavior in the analytical process, but which are not normally found in environmental samples.

Surrogate spike recoveries were used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks were used to evaluate laboratory performance because the blanks should represent an "ideal" sample matrix. Surrogate spike recoveries for field samples were used to evaluate the potential for matrix interferences. According to *Functional Guidelines*, data are not qualified with respect to surrogate recoveries unless one or more volatile surrogates are out of specifications. Semivolatiles are not qualified unless two or more surrogates, within the same fraction (base/neutral or acid fraction), are out of specification.

All reported surrogate spike recoveries for field and QC samples are presented by each analytical fraction in Attachment C.

As Attachment C indicates, the majority of surrogate recoveries were well within method acceptance ranges. A single sample (NDA104FD1) was rejected for the 12 method 8330 compounds due to poor surrogate recovery. All other samples affected by surrogates outside control limits were estimated. The recoveries indicate that the matrix did not significantly influence the analytical method or the final analytical result.

Matrix Spike/Matrix Spike Duplicate Precision and Accuracy

A matrix spike is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. The matrix spike duplicate is an intralaboratory-split sample spiked with identical concentrations of target analyte(s) as the MS. This spiking also occurs prior to sample preparation and analysis. They (the MS/MSD pair) are used to document the accuracy and precision of a method as influenced by a given sample matrix. For the MS/MSD measurement, three aliquots of a single sample are analyzed; one native sample and two spiked with target analytes or compounds. Matrix accuracy is evaluated from the spike recoveries, while precision is

evaluated from comparison of the percent recoveries of the MS and MSD. All MS/MSD precision and accuracy results are listed in Attachment D. Another measurement of precision is the native duplicate. This is an intralaboratory-split sample which is not spiked, but reflects the actual concentrations in the sample and its duplicate. The results are compared and precision calculated. Results which are non-detect or near the reporting limit cannot be calculated for the precision statistic. Attachment E presents laboratory native duplicate precision statistics.

Organic results are not qualified upon the results of MS/MSD results alone. Evaluation is in conjunction with surrogate and internal standard (if applicable) results. Additionally, many MS/MSD samples require dilution and thus the spike compounds added are diluted out and unable to be evaluated. The majority of the accuracy and precision results were well within established criteria, indicating that the specific sample matrix did not influence the overall analytical process or the final numerical sample result. No organic methods required qualification due to the MS/MSD precision and accuracy measurements indicating that the matrix did not influence the method or the final analytical result.

Inorganic results may be qualified solely upon the results of the matrix spike/matrix spike duplicate precision and accuracy. Instances where the native sample concentration for a given element exceeds the spike added concentration by a factor of four or more are disregarded as the spike added would be masked by the native concentration. According to *Functional Guidelines*, metals results obtained through analysis by traditional methods with recoveries of greater than 30% and outside the 75-125% recovery control limits are required to be flagged as estimated. Precision requirements for soils and waters are at 35 and 20 relative percent difference (RPD), respectively.

As Attachments D and E indicate, the majority of the accuracy and precision results were well within established criteria. Only 10 barium, 9 manganese, 5 dissolved iron, and 5 mercury results were rejected due matrix spike recoveries. These data indicate that the specific sample matrix did not greatly influence the overall analytical process or the final numerical sample result.

Field Duplicate Sample Results

Field duplicate analyses measure both field and laboratory precision and can also be affected by the homogeneity of the samples. Therefore the results may have more variability than lab duplicates, which measure only lab performance. According to the EPA *Functional Guidelines*, there are no qualification criteria for field duplicate precision.

Dependent upon the method, there were up to ten sets of field duplicates collected during this field effort. Both the native and duplicate samples were analyzed for the same parameters.

An aqueous control limit of ± 20% for the RPD was used for original and duplicate sample values greater than or equal to five times the RL. Solid samples utilized a control limit of 35 RPD. A control limit of ± the RL was used if either the sample for the duplicate value was less than five times the RL for waters and 2 times the RL for soils. In the cases where only one result is above the five times the RL level and the other is below, the ± RL criteria were applied. Attachment F includes a summary of the field duplicate measurements and their associated precision statistic.

As the attachment reflects, the vast majority of the calculated precision data were within the defined control limits. Thus, the precision data indicate that matrix heterogeneity and sampling technique did not greatly influence the final numerical result.

Sample Results for Metals Near the Method Detection Limit (MDL)

The MDL is defined as the minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. Sample results at, or near the MDL may be false positives caused by instrument noise or low-level background shifts enhanced by a matrix, rather than a true analyte signal. Additionally, concentrations reported at up to 5 times the MDL should be recognized as lacking accuracy or precision.

PARCCs

Precision—is defined as the agreement between duplicate results, and was estimated by comparing duplicate matrix spike recoveries, native laboratory duplicates, and field duplicate sample results. MS/MSD and laboratory duplicate precision was documented as well within control limit criteria for most samples and targets. Other than the documented exceptions, the precision between native and field duplicate sample results were within acceptable criteria for the majority of the measurements indicating that sample matrix did not significantly interfere with the overall analytical process.

Accuracy—is a measure of the agreement between an experimental determination and the true value of the parameter being measured. For the organic analyses, each of the samples was spiked with a surrogate compound; and for organic and inorganic analyses a MS/MSD, and LCS were spiked with a known reference material before preparation. Each of these approaches provides a measure of the matrix effects on the analytical accuracy. The LCS results demonstrate accuracy of the method. MS/MSD results establish precision and accuracy of the matrix. Spike recoveries were within the method acceptance limits for the majority of the measurements; therefore, other than the documented exceptions, there was no evidence of significant matrix interferences that would affect the usability of the data.

Representativeness—this criteria is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness was demonstrated by providing full descriptions in the project scoping documents of the sampling techniques and the rationale used for selecting sampling locations.

Completeness—is defined as the percentage of measurements that are judged to be valid compared to the to total number of measurements made. Other than the 34 non-detected acrolein results rejected for poor continuing calibration statistics as previously mentioned, no other data were rejected. A goal of 90 percent usable data was established in the project scoping document and 98 percent (60437/61685) of the data was determined to be valid.

Comparability—is another qualitative measure designed to express the confidence with which one data set may be compared to another. Factors that affect comparability are sample collection and handling techniques, sample matrix type, and analytical method.

Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from this investigation are comparable with other data collected at the site because only EPA methods were used to analyze the sample and EPA Level III QC data are available to support the quality of the data.

Summary and Conclusions

Conclusions of the data quality evaluation process include:

- The laboratory analyzed the samples according to the EPA methods stated in the work plan as demonstrated by the deliverable summaries and analytical run sequences
- Sample results for metals above the IDL but less than the CRDL may be attributed to instrument noise and/or low level contamination and not site-related activities and as such may be false positives.
- Sample results for target organic compounds above the MDL but less than the RL should be considered as uncertain but indicative of the presence of that compound at an estimated concentration
- Spike recoveries, surrogates, and duplicate sample results (other than the exceptions documented in the text and attachments) indicate that the specific sample matrix did not significantly interfere with the analytical process or the final numerical result.

The project objectives or PARCCs were met, and the data can be used in the project decision-making process as qualified by the data quality evaluation process.

Master Data Management Plan

Draft Final

Data Management Plan
for RCRA Facility Investigation

Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

Contract Task Order 031

Prepared for

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List of Acronyms

A / E	Architect / Engineer
AFWTF	Atlantic Fleet Weapons Training Facility
CADD	Computer-Aided Drafting and Design
DCQAP	Data Collection Quality Assurance Plan
DMP	Data Management Plan
EDMS	Electronic Data Management System
EPA	U.S. Environmental Protection Agency
ERMA	Environmental Resource Management Application
FTP	File Transfer Protocol
GIS	Geographic Information System
IDW	Investigation-Derived Waste
IIS	Internet Information Server
Kbps	Kilobytes
LANTDIV	Atlantic Division
MB	Megabyte
MCL	Maximum Contaminant Level
MGE	Modular GIS Environment
MHz	Megahertz
NAVFACENGCOM	Naval Facilities Engineering Command
NFEC	Naval Facilities Engineering Command
NTR	Naval Technical Representative
PWC	Navy Public Works Center
QA / QC	Quality Assurance / Quality Control
RBC	Risk Based Criteria
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
WEDMS	WEB Environmental Data Management System
WWW	World Wide Web
X-Ref	External Reference File

SECTION 1

Introduction

This data management plan (DMP) has been developed for the field investigation activities at the Atlantic Fleet Weapons Training Facility (AFWTF) on Vieques Island, Puerto Rico.

The DMP is broadly applicable to the management of data generated during environmental investigations. The DMP is intended to be a living document and will be amended or revised to accommodate changes in the scope of environmental investigation or data management requirements.

During the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI), CH2M HILL will collect a variety of environmental information that will support data analysis, reporting, and presentation activities. These activities will ultimately support a determination of risk to human health and the environment posed from releases at the RCRA facility. Environmental analytical samples and various types of field data will be collected during the investigation. These data must support subsequent data analysis for site characterization and reporting. The data also must support any subsequent decisions for remedial action and the presentation of investigation results to the Navy, regulatory agencies, and the public. To meet quality assurance (QA) provisions of current regulatory requirements, a complete audit trail of the information flow must be established. Each step in the data management process (data collection, handling, control, storage, access, and analysis) must be adequately planned, executed, and documented. To meet this requirement, CH2M HILL will employ an environmental data management system (EDMS) that manages mission-critical information throughout the RFI process.

The EDMS will broadly support the collection and storage of analytical and field environmental data and project documentation in electronic format; the analysis of data and the presentation of investigation findings using geographic information system (GIS) technology; and the access to environmental data and mapping through interactive viewer tools that facilitate management review and decision-making processes. This program is not proprietary and is available for use on Navy projects. It should not be distributed outside of the Navy for use on non-Navy projects.

The EDMS will be a networked information system capable of receiving, organizing, storing, and distributing large volumes of complex environmental data in multiple formats to support the environmental characterization, restoration, and monitoring activities being performed during the RFI.

This DMP addresses data management practices for the following types of RFI data:

- Organic and inorganic analytical results from fixed-based laboratories for:
  - Groundwater
  - Surface soil
  - Surface water
  - Subsurface soil
  - Sediment
  - Investigative-derived waste (IDW)

- Field Characterization Data:
  - Geologic logs and subsurface stratigraphy / hydrography
  - Well construction information
  - Potentiometric measurements
  - Field geochemical parameters
- Spatial Data:
  - Sample station locations (surface and subsurface soil, sediment, and groundwater)
  - Well casing and ground survey elevations
  - Latitude / longitude coordinates
  - Buildings, roads, site features, and utilities

This DMP is composed of seven sections. Section 1 of this document introduces the DMP and documents the RFI data management scope and objectives. Section 2 contains the organization of the CH2M HILL data management team. Section 3 contains data format and organization specifications for various types of data and maps. Section 4 outlines the structure of the EDMS database. Section 5 documents data management deliverables. Section 6 summarizes the formats of data management deliverables; and Section 7 contains the proposed data sharing and information management strategy.

1.1 RFI Data Management Scope and Objectives

The objectives of RFI data management are as follows:

- Standardize and facilitate the collection, formatting, and transfer of field generated data to the EDMS.
- Provide an accurate, structured data set that will support environmental investigation planning and decision-making.
- Minimize the uncertainties associated with the data, data-derived products, and interpretation of results through quality assurance and quality control (QA / QC) defined measures and practices.
- Ensure the accessibility of environmental data for environmental characterization, report generation, risk assessments, and other environmental needs.
- Ensure that data are adequately documented with descriptive information to ensure the technical defensibility and legal admissibility of the data.

The scope of the RFI data management activities addressed by this plan includes, but is not limited to:

- Modification, operation, and maintenance of the EDMS database to organize and store current environmental information generated by this RFI and historical information (28 wells previously installed at AFWTF)
- Conversion of geologic and geographic information into a GIS format for use in hydrogeologic data analysis, report preparation, and graphical presentation of environmental data
- Three-dimensional data analysis and visualization

- Implementation of a World Wide Web (WWW)-viewer program to facilitate remote access of the project data and graphics
- Implementation and modification of a field data entry system for transferring of field data into the EDMS database
- Incorporation of existing data into the EDMS
- Management of project documentation, hard copy, or electronic copy in document libraries
- Standardized electronic data deliverables, as agreed to by LANTDIV
- Protection of data through read-only mechanisms, backup procedures, and selective access
- Periodic provision of a copy of the GIS database to LANTDIV for their use

SECTION 2

Data Management Team Organization

The CH2M HILL data management team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The team is composed of qualified specialists and managers. The functional responsibilities of the data management team are described below; the responsibilities are identified by titles but are not necessarily individual staff positions.

Data management specialists have broadly defined multidisciplinary responsibilities. Their tasks include the following:

- Responsible for the proper execution of the DMP and interface with the team to identify all relevant data, ensure that data are complete and consistent, and resolve problems associated with data
- Oversee contracted analytical and data validation services, which may include pre-award auditing and review, coordination of the project / laboratory / data validation interfaces, and continuing performance review of the laboratory and data validator
- Participate in QA / QC activities including nonconformance investigations and reports and QA reviews; when coordinating data support for the multidisciplinary technical team, prepare work agreements as necessary, review sample receipt acknowledgments, and receive laboratory and data validator data packages
- Conduct verification activities following receipt of electronic data and participate in QA / QC activities to resolve nonconformances as necessary
- Evaluate the effectiveness of QA activities through scheduled audits and surveillance, and help resolve quality problems and ensure that corrective actions are taken and appropriately documented
- Manage the recorded information about project activities that is keyed input into the data management system

Database administrators have overall responsibility for the design, operation, and maintenance of the databases. They also control the interface between data entry programs and databases. Some database administrators also will serve as programmers responsible for designing, developing, and implementing databases and data entry tools.

Data entry clerks have responsibility for the entry of new or existing data generated by field activities or as a result of laboratory analyses, and for verifying data that has been entered.

Field team leaders help prepare the work plan and implement it in the field; assign staff members to sampling teams; assign responsibilities to team members; prepare for and coordinate sampling activities; oversee the collection, recording, and documentation of the field data; and ensure that the chain-of-custody (COC) form is completed correctly. The field team leaders alsocompile and perform QC checks on field data.

Project scientists perform statistical summaries of physical and chemical data by medium, location, and sampling event, and present these summaries in tables, charts, graphs, and maps. The data are examined for consistency with the data collection quality assurance plan (DCQAP). The analysts identify anomalies in the data and determine whether corrections or qualifiers are required, performing statistical analyses as needed, and prepare data for input to numerical models.

GIS applications specialists prepare maps that illustrate geographical features and area characteristics, such as topology, land use, ground cover, roads, buildings, and hydrography; digitize existing maps; edit and format spatial data, combine them with attribute data from the project database, and prepare topological overlays; and display results through graphic outputs that include maps, color displays, and tabular information. Some of our GIS specialists also are hydrogeologists who prepare geologic cross sections, fence diagrams, chemical isoconcentration maps, water table maps, three-dimensional block diagrams, and well construction diagrams as part of hydrogeologic analyses and reporting and presentation.

SECTION 3

Data Specifications

This section documents the specifications for types of data that will be managed in the RFI. The types of data include field station data, analytical data, geographic data, geological data, and project documentation. The section also specifies the electronic data deliverable formats for analytical laboratories, data validators, and surveyors.

3.1 Specifications for Field Location Data

Field station data are information assigned to a physical location in the field at which some type of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides for a key in a database to which any samples collected from that location can be linked in order to form a relational database structure.

The field team leader will maintain a list of the location identification numbers, and is responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the stations location by facility, site type, site number, station type, and sequential station number. Table 3-1 documents the scheme that will be used to identify field station data.

For example, a monitoring well located near Building 33 (Site 2) at the AFWTF would be called WS02-MW02. Similarly, the deep well of a paired set of wells (both shallow and deep) at the same location would be called WS02-MW02D.

3.2 Specifications for Analytical Data

Analytical data will be generated through sampling of various media at the AFWTF. Each analytical sample collected in the field will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is documented below.

The format that will be used for electronic deliverables from the analytical laboratory and the data validator also is documented below.

3.2.1 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during the sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A list of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the following format.

TABLE 3-1
Field Station Scheme

First Segment	Second Segment	
Facility, Station Type, Site Number	**Station Type**	**Station Number, Qualifier**
AANNN	**AA**	**NNNA**
Notes: "A"= alphabetic "N"= numeric		
Facility: CG = Camp Garcia Station Type: S = Site W = SWMU O = Operable Unit U = UST A = AOC Site Number: 01 = SWMU 01 02 = SWMU 02 04 = SWMU 04 05 = SWMU 05 06 = SWMU 06 07 = SWMU 07 08 = SWMU 08 10 = SWMU 10 12 = SWMU 12 A = AOC A F = AOC F G = AOC G	Station Type: DW = Direct Push - Soil DW = Direct Push - Water DG = Direct Push – Soil Gas GB = Geotechnical Boring GG = Geophysical Grid Node MW = Monitoring Well PW = Purge Well PZ = Piezometer RW = Residential Well SB = Soil Boring SD = Sediment Sample Location SS = Surface soil Sample Location SW = Surface Water Sample Location TS = Tissue Sample Station Number: Sequential Station Number Qualifier: S = Shallow D = Deep K = Background	

Note: Read subsection 3.1 of the text.

Each sample will be designated by an alphanumeric code that will identify the facility, site, and matrix sampled and contain a sequential sample number. QA/QC samples will have a unique sample designation. The general guide for sample identification is documented in Table 3-2. If one qualifier is pertinent to the sample ID but another is not, use only the applicable qualifiers. A character space does not have to be maintained.

3.2.2 Electronic Deliverable File Format

An offsite analytical laboratory will analyze the RFI samples and tabulate results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the table of analytical results. In addition to a hard copy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate downloading into the EDMS. The EDMS then will assign a sequential sample ID to each sample to assure uniqueness within the database. Table 3-3 documents the format to be used for electronic deliverables from the analytical laboratory and the data validator.

3.3 Specifications for Geographic Data

Specifications for geographic data pertain primarily to graphical standards for mapping. Mapping specifications and base map standards are documented below.

3.3.1 Mapping Specifications

Geographic data contained in the EDMS will conform as applicable to the Computer-Aided Drafting and Design (CADD) and GIS spatial data standards being developed by the Tri-Service CADD/GIS Technology Center. The Tri-Service Spatial Data Standards were developed as a single comprehensive master and environmental planning data model for the U.S. Air Force, Army, and Navy installations, as well as U.S. Army Corps of Engineers civil works projects. The Spatial Data Standards were designed to complement Federal Geographic Data Committee data standards that address small scale mapping (map scales greater than 1:24,000) with graphic and attribute data standards for entities depicted in large scale mapping (1 inch = 400 feet [1:4,800] to 1 inch = 50 feet [1:600]).

3.3.2 Installation Base Maps

All mapping activities performed on the RFI will utilize base map files of the installation provided by the Navy Public Works Center (PWC). The PWC maps will include a set of electronic images (raster data) and a set of CADD files (vector data) that were derived from aerial photography taken in 1995 by Photo Science, Inc.

3.3.2.1 Coordinate System

All mapping and surveying performed during the RFI will conform to the following:

Coordinate System	=	Maryland State Plane
U.S. Geological Survey Zone Code	=	4126
Horizontal Datum	=	North American Geodetic Datum 1983
Vertical Datum	=	North American Vertical Datum 1988

TABLE 3-2
Sample Designation Scheme

First Segment	Second Segment		Third Segment
Facility, Station Type, Site Number	**Sample Type**	**Sample Location + Sample Qualifier**	**Additional Qualifiers (sample depth, sampling round, etc.)**
AANN	**AA**	**NNNA or NNAA**	**ANN or NNNN**
Notes: "A"= alphabetic "N"= numeric			
Facility: CG = Camp Garcia Station Type: S = Site W = SWMU O = Operable Unit U = UST Site Number: 01 = SWMU 01 02 = SWMU 02 04 = SWMU 04 05 = SWMU 05 06 = SWMU 06 07 = SWMU 07 08 = SWMU 08 10 = SWMU 10 12 = SWMU 12 A = AOC A F = AOC F G = AOC G	Sample Type: DS = Direct Push – Soil Sample DW = Direct Push – Water Sample DG = Direct Push – Soil Gas Sample GB = Geotechnical Boring Sample MW = Monitoring Well Sample PW = Purge Well PZ = Piezometer Sample RW = Residential Well Sample SB = Soil Boring Sample SD = Sediment Sample SS = Surface Soil Sample SW = Surface Water Sample TB = Trip Blank EB = Equipment Blank FB = Field Blank Sample Location: 1. Station Samples (NNA) NNA – refers to sequential station number NNA – letter qualifier for deep or shallow sample (if applicable) 2. QC Samples (NNN) NNN- numbered sequentially for each type of blank (i.e., 1,2,etc.) collected for that day's sampling. NNN – refers to month of sampling event Sample Qualifiers: F = filtered sample P = duplicate sample K = Background sample		Additional Qualifiers: 1. Monitoring Well Groundwater Sample (refers to sampling round for that well): R01 – Round 1 R02 – Round 2 R03 – Round 3 2. Direct Push Subsurface Sample (refers to depth of sample): Enter depth of top of sample interval 3. QC Samples NNNN – refers to day and year of sampling event

Note: Read subsection 3.2.1 of the text.

TABLE 3-3
Analytical Data Electronic Deliverable Format

Field Name	Field Type	Description
Sample_ID	A	The CH2M HILL sample ID (taken from the Chain-of-Custody)
Sample-Analysis	A	The method code
Date_Analyzed	D	The date the sample was analyzed.
Date-Received	D	The date the sample was received in the lab.
Lab_Sample ID	A	The lab sample ID.
Dilution Factor	N	The dilution factor used, if applicable.
SDG Number	A	The Sample Delivery Group number
CAS Number	A6-A2-A1	CAS Number (Note dashes)
Chem_Name	A	The compound being analyzed
Ana-Value	N	The analytical result
Std_Qual	A	The lab qualifiers, if any (e.g., U, UJ, B)
DV_Qual	A	Leave blank; used for data validation
Units	A	The unit of the result (e.g., mg/L)
Detect Limit	N	The detection limit for the compound
Method	A	Analytical method used to analyze the sample fraction

Note:
CAS = chemical abstract service
SDG = sample delivery group

Survey data will be collected in an electronic format either from a global positioning survey conducted by CH2M HILL personnel, or by floppy disk transfer from a licensed surveyor. The file format for survey information will be provided to the surveyor in advance of the survey.

3.3.2.2 Vector Data

The vector data files are in MicroStation CADD format and include levels for buildings, roads, parking lots, piers, transportation, and vegetation. The MicroStation files will be utilized by the Intergraph GIS which uses MicroStation as its graphical engine. Vector data will be stored in the GIS database.

3.3.2.3 Raster Data

The raster data will be in 24-bit color tagged information file format and consist of aerial photography. Because of the size of the image, the facility has been divided into a number of files that may be composited to create a complete facility-wide image.

3.4 Geological Data

Geological data that will be collected in the field during the RFI include direct-push log data, monitoring well construction data, soil boring log data, field parameters for well development and water sampling, and depth-to-groundwater data. Where possible, these data will be entered into a remote database application that will reside on a laptop computer in the field. CH2M HILL will modify the database to facilitate the entry of field data in a logical format that follows the method and order of data collection. Input screens will be developed for each of the field forms. Field data will be input at the end of each day and provided to the data management specialist for inclusion into the EDMS. The field team leader will be responsible for the process of inputting the field data and ensuring that the data are complete before they are transferred to the data management specialist. Where a paper copy of the data is required, the program will print the data in the required format. The site data entry program will interface with Oracle database to facilitate automated transfer of field data into the Oracle database.

Historical environmental data that will be entered into the EDMS database will be entered using a double-key entry process. Upon completion of doubly-key entry, the data sets will be compared electronically. Errors will be reported and rectified so that both data sets match. Then, one data set will be assigned to populate the EDMS database. This quality control procedure will ensure that the data are complete and correct. Data completeness and correctness are of paramount importance when such a large investment is made in creating a geographic database.

3.5 Project Documentation

A large variety of technical data will be generated during the course of the RFI. A data document tracking system will be maintained so that the integrity of the data is preserved. Project tracking data, schedules, progress reports, and field notes will be maintained to monitor, manage, and document the progress of the RFI.

3.5.1 General Data Records and Logs

Selected data from past investigations and from the RFI will be compiled and summarized in tables that will comprise reports. Types of data that will be tabulated include:

- Analytical data laboratory summaries
- Data validation summaries
- Well construction information
- Well development information
- Chain-of-custody records
- Field logbooks
- Location sketches
- Photographs (if necessary)
- Telephone conversation logs

3.5.2 Document Tracking

A document tracking system that uses a spreadsheet will identify the titles, authors, contents, and locations of non-electronic reports and files. All incoming data and reports will be logged and

dated, and given a location designation. Reports may be checked out by leaving a signed and dated card in place of the document.

Electronic files will be housed on the CH2M HILL intranet using the Saros Document Manager system through the Mezzanine® library. AFWTF will have its own “smart folder” for project documents. The system will provide accessibility, security, version control, and document integrity. Public documents can be viewed or printed, but only designated personnel will be able to revise the documents. Confidential documents will be secured from public access. Incremental backup of the electronic files will occur daily, and there will be a full backup every Friday. CH2M HILL documents will generally exist in a Microsoft file format.

SECTION 4

Database Structure

This section documents the structure of the EDMS/GIS database, the relationships between the various data tables, and the valid entries for each field.

4.1 Data Table Relationship Diagram

The EDMS relies on multiple relational database tables designed to facilitate the efficient storage and retrieval of project data. This database serves the EDMS and the Intergraph GIS. Figure 4-1 diagrams the primary data tables and how they are related to one another.

4.2 Relational Database

A relational database is at the heart of the EDMS. The core database resides in Oracle. The Intergraph GIS uses this database. A front-end database resides in MS Access. The front-end database is used for electronic analytical data entry, database statistics, entry of field data that cannot be entered electronically, and entry of historical data for which no electronic information exists. The front-end database periodically updates the Oracle database.

Table 4-1 documents the EDMS database structure. The primary or parent database table is the site table. The database fields have relationships. For example, one site can have many stations, one station can have many wells, and one well can have many casings. This type of design maximizes the efficiency of the database for storage space and data access and maintenance.

4.3 GIS Functionality

The GIS software implemented for CH2M HILL's EDMS is Intergraph's modular GIS environment (MGE) and Environmental Resource Management Applications (ERMA). This GIS software runs on a PC under the Windows NT environment. MGE provides full GIS mapping and spatial data analysis, and is similar to ARC/INFO in functionality. The graphics engine for MGE is Intergraph/Bentley MicroStation. MGE can import a wide variety of spatial data and similarly can export a range of formats (e.g., ARC/INFO). ERMA provides a range of analysis and visualization tools that can help interpret the resulting project data.

TABLE 4-1
EDD Format Example

Field Name	Field Type	Req'd	Description
Sample_ID	A25	R	CH2M HILL sample ID (taken from the chain of custody).
Analysis_Group	A9	R	The analysis performed on the sample.
Date_Collected	D10	R	The date the sample was collected (from the chain of custody).
Time_Collected	T5	R	Time of sample collection (from the chain of custody) - 24h clock.
Date_Received	D10	R	The date the sample was received in the lab.
Date_Extracted	D10	RA	Extraction or preparation date.
Date_Analyzed	D10	R	The date the sample was analyzed.
Lab_Sample_ID	A15	R	The laboratory sample ID.
Dilution_Factor	N5	RA	The dilution factor used.
SDG_Number	A15	R	Laboratory code for the group of samples in a data deliverable package.
Chem_Code	A12	R	The ERPIMS parameter code.
Chem_Name	A45	R	The compound being analyzed.
CAS_Number	A6-A2-A1	R	CAS Number (Note dashes).
Ana_Value	N11	R	The analytical result.
Lab_Qual	A5	RA	The lab qualifiers, if an (e.g., U, UJ, B).
DV_Qual	A5		Left blank for data validation qualifiers.
Units	A15	R	The unit of the result (e.g., m /L).
Detect_Limit	N11	R	The minimum available sample-specific detection limit for the compound.
MDL	N1	NR	Method detection limit.
Prep_Method	A15	R	Analytical method used to analyze the sample fraction. Use ERPIMS codes.
Analysis_Method	A15	R	Analytical method used to analyze the sample fraction. Use ERPIMS codes.
Sample_Type	A15	NR	The matrix of the sample.
Result_Type	A15	R	The laboratory QC type (e.g., SURR, MS, MSD, LCS).
Analysis_Anomaly	A15	R	To note more than one analysis of a sample.
PCT_Moisture	N5	RA	Percent moisture for soil samples; not applicable for aqueous samples.
Basis	A3	R	Concentrations are reported on a wet or dry weight basis. Use ERPIMS codes.
Batch	A5	NR	Laboratory code for the batch of samples included in a given run.
Method Blank	A15	R	Laboratory name for the method blank associated with the analysis.
Lab_Code	A10	R	The ERPIMS code for the laboratory.
Comment	A30	NR	For laboratory to note exceptions.

Notes:
R - required field
NR - not required
RA - Required as appropriate

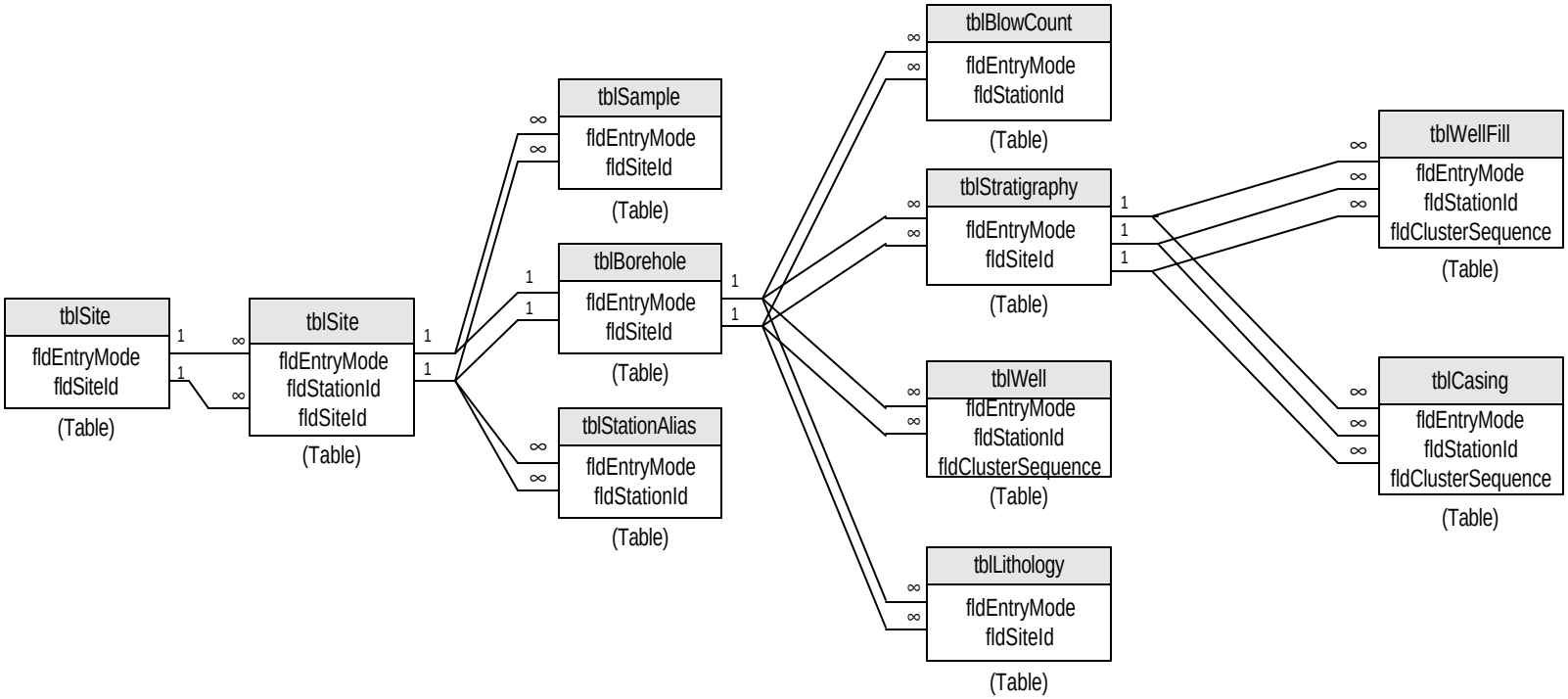

FIGURE 4-1
Relationships Diagram

SECTION 5

Data Management Deliverables

Several maps to support the RFI are proposed for development using the EDMS and GIS workstation. The format and content of these maps could vary depending on the ability to perform areal statistics for contouring, the density of the data, or the effective three-dimensional depiction capability of a data set as a whole. Some of the maps will use a photographic layer. The maps will be available for viewing and queries over the internet connection with the GIS database. Proposed RFI map deliverables for the sites at AFWTF include:

- Map that illustrates the location of the facility within the geographic area
- Maps that illustrate the site locations within the facility
- Maps that illustrate the sample locations within the sites
- Map that illustrates what types of sampling activities have occurred at each station location
- Maps that illustrate the sampling results, posting exceedances of regulatory standards for various media
- Maps that contain contours or other scalers of contaminant concentrations with respect to an aerial distribution for various media
- Geologic cross sections
- Approximately 14 water table elevation maps
- Block diagrams that illustrate the locations of contaminant plumes and their subsurface distribution

Other data management deliverables that will be part of the RFI are:

- A data catalog of all analytical samples and pertinent information related to them
- A library catalog of electronic documentation that is a part of the RFI
- A spreadsheet tabulation of nonelectronic RFI documentation

SECTION 6

Electronic Deliverables Format

LANTDIV has issued standards for electronic deliverables. These standards will be observed for all RFI electronic submittals of documents or maps.

6.1 Policy for 3.5-inch (1.44 Megabyte [MB]) Floppy Disk Submittals

The following system will be used in the preparation process when making final submittals on floppy disks:

- Do not arbitrarily compress multiple files for efficiency of storage. If compression is required, follow the prioritized methodology stipulated below using the PKZIP compression software. File names should be ISO 9660 compliant using permissible characters. A DOS text file shall be included in all floppy disk submittal packages.
- Use native file formats where possible. In general, files shall remain in their native uncompressed format—be it AutoCAD drawing, word processing, cost estimating, or SPECINTACT format. Place as many uncompressed files as possible on a single MS DOS-formatted 1.44 MB floppy disk.
- Compress files in self extracting (.exe) formats. Avoid compression of multiple files during a single session if the final resulting compressed file is larger than 1.44 MB. Do not use multiple floppy disks to produce a single compression file.
- If the compressed version of a single file exceeds 1.44 MB, use the “span” option of the compression software to provide file linking across multiple diskettes. The compression technique for “spanned” files will be the (.zip) zipped format. Do not use self-extracting (.exe) compression formats for single files spanning multiple floppy disks.

6.2 Policy for Recordable Compact Disks (CD-R)

The following system will be used in the preparation process when making final submittals on floppy disks:

- Media that will be used will be 75-year or longer shelf life recordable CDs. All CD media should be manufactured with a protective coating on the label side surface. Most name brand disks have the coating but check the supplier to be sure.
- CDs will be recorded in ISO 9660 format.
- All filenames will be ISO 9660 compliant. Do not use characters that do not comply with ISO 9660 in any filename or AutoCAD X-ref because they will be rewritten when the CD is recorded. ISO 9660 Level 1 filenames allow capital A to Z, 0 to 9, and the underscore (_) character.

- Record all files in one recording session. Multi-session CDs are not acceptable at this time because they are not readable by all CD-ROMs.
- Files on CDs will be in uncompressed, native format, and devoted to a single project.
- A DOS text file named PROJxxxx.TXT, where "xxxx" is the last four digits of the construction contract number, will be included in the root directory of the CD. This file will contain pertinent project information such as the project title, location, specification number, construction contract number, Architect/Engineer (A/E) firm names (both prime and sub) with applicable addresses and phone numbers, listings of the project design team members, and a listing or table cross-indexing file names to their corresponding directory path, sheet titles, sheet numbers, and Naval Facilities Engineering Command (NAVFACENGCOM) and EFD drawing numbers.
- All external reference files (X-REFs) will be included in the CD-ROM. Do not "bind" XREFs to the drawing files.
- The exact content, quantity, submittal dates, and milestones for digital submittals are addressed separately in the *Guide for Architect Engineer Firms Performing Services for the Atlantic Division* (the A&E Guide) and specified in the *Appendix A* project scopes. Although not all directories and associated data are to be included with every submittal, a standard directory structure will be as follows:

/DWD	=	for all drawings
/XREF	=	for all external reference files
/SPECS	=	for all specifications
/PHOTOS	=	for all digital photos
/OTHER	=	for any other pertinent project files

SECTION 7

Data Sharing and Information Management

The WWW provides superb tools for sharing and disseminating data not only to project team members, but also on a controlled basis to the general public. This section documents the proposed methods for GIS data sharing between the Navy, the contractor, regulators, and other authorized personnel. Both WWW-based data sharing and desktop-applications data sharing are discussed. At this time, however, only WWW-based data sharing is proposed. Document sharing, data sharing system requirements, and data security also are discussed.

7.1 Web-Based GIS Data Sharing

CH2M HILL proposes to use the WWW to provide ready access by project team members to up-to-date data at AFWTF. Because of the high visibility of activities at AFWTF, and the number of parties that might need to provide collaborative evaluation of the data, data sharing to authorized users via the WWW will provide the most efficient and cost-effective method of information management and distribution.

The site will contain access to a Web Environmental Data Management System (WEDMS) that handles the web-based GIS data sharing functions. The site will provide team members with current lab results, queries for selected information, and online GIS map viewing and querying capability. The WEDMS will provide access to information through a direct link to the EDMS database. (Depending on the size of the database and site maps, along with network traffic volume, response time could be unacceptably slow. In that case, a replicated database and maps that are updated frequently can be placed on the Web Server to increase speed.)

We will include a Project Management section for the AFWTF site where documents can be stored and downloaded. A common project calendar will be maintained for the project. Furthermore, a section of the AFWTF site can be created for public access. Selected data and materials and links to other sites could be placed in this part of the AFWTF site, if the Navy chooses to do so. This feature could be a particularly powerful public information tool. The other parts of the site would remain secure, requiring a login and a password for access. Security is discussed later in this section.

We plan to work with the Navy in designing this site, and have factored in costs for time to review and revise the design of the site. The design will be particularly important if the Navy decides to provide public access to the site.

7.1.1 Web-Based GIS Data Sharing

Web-based GIS data sharing is centered around GIS data viewing capability over the WWW. WWW-based GIS data sharing allows a viewer to query and view data but not to make changes to the data or maps. Using WWW-based GIS data sharing for viewing data provides several advantages over standard publication and distribution methods:

- Web-based access to GIS data provides a powerful way to publish data for sharing to a targeted audience with minimal expense. Access to the varying levels of information data can be controlled through password access privileges. This provides significant savings over the

usual approach of loading data into a desktop PC data management system and periodically producing paper reports with varying content, for distribution to various readers. Users will have the increased power and flexibility of being able to use the GIS to query the data, as well as obtaining database reports.

- The viewer needs no specialized GIS software. The only necessary component that potentially has a cost is the link to the Internet, and possibly a modem. Anyone designated by the Navy can access the site and the data at no additional cost or effort. Each viewer will be provided with a login name and a password.
- The WWW GIS will have the most current data available because the Web GIS server can easily link to the database that contains the analytical data. Therefore, data currency issues are greatly minimized and all viewers will be accessing the same set of data on the WWW GIS server.
- The interface is familiar to anyone who uses a WWW browser.
- The WWW site can easily integrate other functionality such as a document library, project calendar, or information sharing.

One limitation to WWW-based GIS data sharing as compared to desktop applications data sharing is that the functionality is more limited than having a full desktop GIS, and its functionality must be programmed. This does not have to be a limitation because few of the features in a desktop application are used on a regular basis. The WWW site will contain the key functionality. Also, the GIS WWW software, which resides on the server and translates map (vector) data across the WWW, is more costly than a desktop GIS viewer. Because the Web-based GIS software can serve an unlimited number of users, however, the software and its programming can quickly become much less expensive than the cost of multiple desktop GIS software packages.

Several software packages will translate GIS map data over the WWW. Each has its own advantages. CH2M HILL will be able to support and implement whichever system best meets the needs of the AFWTF. Depending upon the tool selected, and where the site is hosted, CH2M HILL may be able to link the WWW site directly to a current copy of the EDMS database that contains the ERMA-generated site maps so that the maps and other environmental data will not require replication to a separate server. This will ensure that the maps and site data are always current. Other data, such as historical building information, can also be imported to the Web GIS for viewing along with mapping and analytical data.

7.1.2 Web-Based GIS Data Sharing Features

The AFWTF WWW Site will contain access to the WEDMS as well as to other features and information such as a project calendar, discussion group feature, and links to other WWW sites. The site will provide up-to-date analytical data directly to users because they will be able to query the database directly. The data can be downloaded to the user's computer for further analyses and reporting. The functions of the WEDMS and the additional WWW site features are discussed below.

7.1.2.1 WEDMS Analytical Reporting

Analytical results from the AFWTF RFI will be available on a site-by-site basis. Users will be able to browse the analytical results and compare them to the limits defined for this project

(Environmental Protection Agency [EPA] Region III Risk Based Criteria [RBC] for soil and a combination of EPA Drinking Water maximum contaminant levels [MCLs], EPA Region III RBCs, and Washington, D.C., Water Quality Standards, for ground water).

7.1.2.2 Query Selection and Data Downloading

Users will be able to point-and-click to select from a set of pre-designed, pre-built queries. The results of the query will display within the user's browser. Users will have the choice of viewing the results in a table format or packaged to be downloaded to their PCs. Downloading of data can be accomplished using two different methods. For convenience, the data can be mailed to the user electronically, or it can be displayed on their screen so that it can be saved as ASCII text. ASCII text can be loaded directly into spreadsheets or desktop databases.

7.1.2.3 WEDMS Two-Dimensional Mapping

The WEDMS will serve several interactive mapping applications that will enable users to view and query several types of information from facility and site maps, including site locations, sample locations, analytical results, water table elevations, and locations where regulatory limits are exceeded for various sampled media. The interactive mapping applications will utilize installation base maps derived from 1995 aerial photography.

Historical drawings and documentation from the AFWTF administrative record also could be added to the inventory of viewed material. However, that functionality is not currently included in the scope of work.

7.1.2.4 WEDMS Three-Dimensional Viewing

ERMA's Voxel Analyst has the ability to produce three-dimensional views of the site data. Selected views can be stored on the WEDMS for viewing. CH2M HILL will work with users to identify a set of views to be available for each site that contains a data set conducive to meaningful three-dimensional graphical representation. The Voxel images will be based on analyses done in ERMA and processed for viewing.

7.1.3 Document Reference Section

The WEDMS will include a document reference section using the Saros Document Manager system in the Mezzanine® library. The AFWTF will have its own "smart folder" for project documents. The system will provide accessibility, security, version control, and document integrity. Public documents can be viewed or printed, but only designated personnel will be able to revise the documents. Confidential documents will be secured from public access. The online document library will be useful for reviewing scopes of work, project plans, regulatory standards and screening levels, and other relevant information. Users also will be able to upload documents to the Reference Section to make them available to others. These documents will be available to all authorized users of the WEDMS.

7.1.4 Data and File Transfer

Data and file transfers to the WEDMS will be performed either through the Saros Document Manager system in the Mezzanine® library (discussed above) or by file transfer protocol (FTP). End users may use any available FTP software package to perform the file transfers. Information

on the type of file or data transfer process required to view or download a document will be provided to site users directly on their screens.

7.1.5 WWW Site Project Calendar

The WWW Site will include a management section for coordination and communication. It will include a calendar that any authorized user may update with activities. The calendar will enable maintenance of delivery schedules along with notes about individual items. Meetings and other activities also can be included on the site. This has been a useful feature on other project sites, and is used internally within CH2M HILL.

7.1.6 WWW Site Discussion Topics

The discussion group feature of the WWW Site can be particularly useful in selected situations where responses are made to a message posted by another user. The system groups the responses so that users can readily see when a response has been made. It provides a ready record of discussion on a topic that can easily be searched and reviewed, unlike phone calls.

7.1.7 Site Online Help Applications

Help information will be provided at selected areas of the site.

7.2 Desktop-Applications GIS Data Sharing

Desktop-applications GIS data sharing is centered around desktop GIS applications that run on a user's desktop PC and access data and maps from an EDMS database. Desktop systems also have the ability to link to a variety of spatial databases (e.g., historic building information), enabling users to conduct a range of spatial queries. Several powerful and flexible tools are available for viewing and analyzing GIS data. ArcView is a widely used desktop tool. Similarly, the recently released GeoMedia desktop GIS also provides a wide range of viewing capability. In either case, users must have these tools available on their desktop PC to view the data. Thus, there are generally some client software purchase requirements to provide desktop data analysis capabilities to individual users. CH2M HILL will be able to provide support (e.g., interface customization, data conversion, data loading, and database linking) for whichever desktop GIS system meets the needs of the AFWTF. Once a specific system is selected, a detailed scope of GIS desktop support services can be provided.

7.3 Site Maintenance

Periodic maintenance of the site will be necessary to update data, provide minor enhancements, and deal with a changing network environment.

7.4 User Access

Users interested in gaining access to the WEDMS will be able to fill out an online registration form available from the WEDMS home page. The information will be captured and forwarded to the Navy Technical Representative (NTR) for approval. If access is granted, a user name and password will be assigned by the WEDMS administrator and forwarded to the requester along

with any additional information necessary to establish the appropriate connection. If access is denied, the requester will be notified via e-mail if possible.

7.5 System Specifications

WEDMS system specifications, data security measures, and system backup specifications are documented below.

7.5.1 WWW Site Access Requirements

Access to the WEDMS will be available on the Internet to a controlled group of users. Access will require an authorized user name and password. Users are required to use the Microsoft Internet Explorer 3.02 (or higher) WWW browser for guaranteed data access and retrieval. Netscape Navigator (version 3.0 or later) should also work. Internet Explorer is available free to users with a legal license for any Microsoft operating system. The WEDMS WWW home page will contain a hyperlink to download Internet Explorer for users who need it.

CH2M HILL recommends that users have at least a 100 megahertz (MHz) Pentium-class CPU, a minimum of 16 MHz of RAM, a video graphics card capable of displaying 256 colors, and connection to the Internet at 28,800 kilobytes (kbps) or faster.

7.5.2 WEDMS Server System Configuration

The WEDMS design will enable any authorized user with internet access to reach the site. CH2M HILL plans to host the site on its WWW server. The site could be hosted either at the Navy or through an Internet Service Provider. Either of the options would probably increase cost, however, since additional software (already in service at CH2M HILL) will have to be purchased. In addition, hosting the site elsewhere would likely require that the ERMA database be copied and run from that server.

7.5.2.1 Hardware Specifications

If the AFWTF Site is hosted somewhere other than on CH2M HILL's WWW server, it will require a 200 MHz Pentium Pro file server, with 32 MHz of RAM, a video graphics card capable of displaying 256 colors, and minimum of 4 gigabytes fixed-disk storage space. The file server should be connected to the Internet via a 64 kbs ISDN gateway (or faster connection).

7.5.2.2 Software Specifications

The WEDMS server requires the Windows NT Server 4.0 industry standard multi-user operating system. It will include FTP and WWW services along with either Oracle or structured query language server database accessibility.

7.5.3 System Security

In placing the WEDMS on a publicly accessible network, a number of security issues need to be examined at a variety of levels. In examining the security issues, two distinct areas of concern are identified:

1. Access level security
2. Transaction-based security

7.5.3.1 Access Level Security

Windows NT Server 4.0 provides a secure operating environment for WEDMS. Access rights can be set based on users and groups. NT's Internet Information Server (IIS) also enables access to be restricted to specific internet addresses, thereby blocking out all but a selected set of users.

7.5.3.2 Transaction-Based Security

Beyond the detail of access level security, issues may arise as to the need for some degree of transactional security (i.e., the encryption of data packets as they are transferred across the Internet). Should the need for this level of security be determined, an Internet server product utilizing the Secure Socket Layer protocol will be utilized along with compatible client browser software and digital certificates to ensure an encrypted connection between the server and the client browser.

7.5.4 Data Backup and Retrieval

The method and schedule for data backup and retrieval are documented below.

7.5.4.1 Method

The file server disk subsystem will be backed up automatically through scheduled system services of the selected operating system. Backups will be maintained offsite from the server location to facilitate full system recovery in the event of a physical catastrophe at the server location.

7.5.4.2 Schedule

A backup schedule will be implemented that will ensure a minimal loss of mission-critical data and minimize the time required to recover files and operation.

A full backup will occur on a weekly basis. Daily backups will occur at the end of each day to capture any files changed since the previous daily backup. This will ensure that the maximum amount of data loss will not exceed 1 day of activity on the system.

Master Investigation-Derived Waste Management Plan

Draft Final

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Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

Contract Task Order 031

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Abbreviations and Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
EPA	Environmental Protection Agency
FS	Feasibility Study
IDW	Investigation-Derived Waste
IDWMP	Investigation-Derived Waste Management Plan
NFESC	Navy Facilities Engineering Services Command
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SSA	Site Screening Area
TCLP	Toxicity Characteristic Leaching Procedure

SECTION 1

Introduction

The Remedial Investigation (RI) and Site Screening Area (SSA) activities at the Atlantic Fleet Weapons Training Facility (AFWTF) on Vieques Island, Puerto Rico will produce investigation-derived waste (IDW). IDW will subsequently require waste management and disposal in a manner that minimizes potential hazards to the public. This Master Investigation Derived Waste Management Plan (IDWMP) describes methodologies and procedures that CH2M HILL field personnel will implement to handle, manage, and dispose of IDW at AFWTF.

Site-specific IDW will be addressed in the site-specific IDWMP. Some examples of IDW that may be generated during field activities include:

- Soil cuttings generated during drilling
- Groundwater extracted during well development and sampling procedures
- Residual soil and wastewater generated during the decontamination of field equipment
- Non-soil solids including used personal protective equipment (PPE) and disposable sampling equipment

SECTION 2

Waste Handling

This section describes the waste handling procedures to be followed during the RI/Feasibility Study (FS) and SSA activities.

2.1 Solid IDW

Solid wastes, including soils, soil cuttings, and non-soil wastes will be produced during field investigations. These types of solid IDW are discussed below.

2.1.1 Soils and Soil Cuttings

Soil cuttings generated during field activities will be contained in 55-gallon drums if the existence of contamination at the site has either been confirmed or suggested from previous investigations, or if no previous site investigation has taken place. Soil to be contained includes the soil cuttings generated during any intrusive activity, and any soil that accumulates in the decontamination pad from the washing of drilling equipment. Drums will be sealed and appropriately labeled.

If previous investigations have confirmed that contamination does not exist at the site, soil cuttings generated during the field activities will be returned to the borehole from which they were removed. Excess soil cuttings will be spread on the ground near the boring from which they were removed and graded and seeded as necessary. If the boring is located in an area with a maintained lawn, asphalt, or concrete surface, excess soil cuttings will be spread on the ground and graded and seeded at a location designated by the Navy.

At the conclusion of a drilling event, drums filled with potentially contaminated soil cuttings will be stockpiled temporarily at a location designated by Navy personnel. The Navy will then verify whether the site contains listed hazardous wastes, as specified in Title 40 of the Code of Federal Regulations, Part 261 (40 CFR 261).

If the site does contain listed hazardous waste, CH2M HILL's waste management subcontractor will dispose of the drummed soil as hazardous waste at a regulated hazardous waste landfill. If the site does not contain listed hazardous wastes, CH2M HILL's waste management subcontractor will collect composite soil samples from the drums and submit the samples to an approved laboratory for the waste characterization analyses required by the proposed disposal facility. The drums will remain at the temporary location until the waste management subcontractor and CH2M HILL receive the characterization sampling analytical results. The wastes must be handled and disposed of within 90 days of being stockpiled at the temporary location. For planning purposes, IDW will be stored at AFWTF for a maximum of 60 days in order to ensure compliance with the 90-day accumulation limit.

Upon the receipt of these results, CH2M HILL will formulate a preliminary assessment of any potential hazards posed by the IDW and submit waste management recommendations to the Navy and, if requested by the Navy, to the EPA. Recommendations will be based on the analytical results of soil and groundwater sampling conducted during field activities and on the results of characterization sampling. If the site's soil and groundwater sampling analytical results are

"clean," and if the characterization sampling results do not contain listed hazardous wastes and are below Toxicity Characteristic Leaching Procedure (TCLP) and Resource Conservation and Recovery Act (RCRA) characteristic regulatory limits, CH2M HILL will recommend that the waste management subcontractor dispose of the soil at a non-hazardous waste disposal facility.

If the composite soil samples from the drums contain contaminant concentrations above the regulatory limits, the drummed soil will be considered hazardous. The waste management subcontractor will ship the hazardous waste to a regulated hazardous waste landfill where it will either be treated or stockpiled, as appropriate, and as directed by the Navy.

The proposed steps for accumulating, handling, and disposing of IDW soils and soil cuttings are as follows:

1. If the existence of contamination at the site has either been confirmed or suggested from previous investigations, or if no previous site investigation has taken place, shovel soils and soil cuttings from the boring into 55-gallon drums.
2. If previous investigations have confirmed that contamination does not exist at the site, return soils and soil cuttings directly into the boring from which they were removed. Excess cuttings will be spread on the ground surface near the boring from which they were removed or shoveled into 55-gallon drums if the boring is located in an area with a maintained lawn, asphalt, or concrete surface.
3. Stockpile drums in the area(s) designated by the Navy.
4. Verify with the Navy whether the site contains listed hazardous wastes as specified in 40 CFR 261. If the site does contain listed hazardous wastes, as specified in 40 CFR 261, refer to step 9.
5. Upon completion of field activities, if the site does not contain listed hazardous wastes as specified in 40 CFR 261, notify the waste management subcontractor that drums are ready to be sampled for waste characterization.
6. The subcontractor will collect composite samples from the drums and submit them to an approved offsite laboratory for the analyses required by the proposed disposal facility.
7. Upon receipt of characterization results, write a memorandum to the Navy recommending whether to handle the soil as hazardous or non-hazardous waste.
8. If the waste is considered non-hazardous, upon receipt of concurrence by the Navy, the waste management subcontractor will dispose of the soil in a non-hazardous landfill.
9. If the waste is considered hazardous, upon receipt of concurrence by the Navy, the waste management subcontractor will dispose of the waste at a regulated hazardous waste landfill where it will either be treated or stockpiled, as designated by the Navy. The Navy will be responsible for signing all manifests.

2.1.2 Non-soil Solids

The disposable PPE used by CH2M HILL field personnel and CH2M HILL's subcontractors will be placed in 55-gallon steel drums. Examples of PPE to be contained include nitrile gloves, tyveks, rubber boots, and respirator cartridges. Any expendable items used during sampling will also be

contained in drums, such as in-line water filters, C-flex tubing, and paper towels. Drums will be sealed and labeled appropriately.

The PPE will be bagged and drummed pending receipt of sampling analytical results. If the sampling analytical results indicate that the site's soil and groundwater are non-hazardous, the PPE and sampling expendable items will be placed in marked bags and discarded in dumpsters. If sampling analytical results indicate that the site's soil and groundwater are hazardous, the handling and disposal procedures of PPE and sampling expendable items will be identical to those that apply for hazardous soils and soil cuttings.

2.2 Liquid IDW

Groundwater as IDW will be produced during monitoring well development and groundwater purging and sampling. Groundwater will be contained in 55-gallon drums if previous investigations have either confirmed or suggested the existence of contamination at the site, or if investigations have not yet been conducted at the site. In addition, water generated during decontamination processes and excessive liquids that separated from soil cuttings will be added to drums containing groundwater IDW. Drums will be sealed and appropriately labeled until final disposition is determined.

If groundwater is extracted from a background location where previous investigations have confirmed that contamination does not exist at the site, groundwater will be discharged at grade in an area that will not affect the well being sampled or adjacent sampling locations.

At the conclusion of field activities, drums containing liquid IDW will be stockpiled temporarily at a location designated by Navy personnel. The contained wastes must be disposed of within 90 days of being stockpiled at the temporary location. For planning purposes, IDW will be stored at AFWTF for a maximum of 60 days in order to ensure compliance with the 90-day accumulation limit.

The Navy will then verify whether the site contains listed hazardous wastes, as specified in 40 CFR 261. If the site does contain listed hazardous waste, CH2M HILL's waste management subcontractor will dispose of the liquid IDW as hazardous waste at a regulated hazardous wastewater treatment facility where it will be treated until it meets standards for disposal as appropriate, and as directed by the Navy.

If the site does not contain listed hazardous wastes, CH2M HILL will formulate a preliminary assessment of any potential hazards posed by the IDW and submit waste management recommendations to the Navy and, if requested by the Navy, to the EPA. Recommendations will be based on the analytical results of groundwater sampling conducted during field activities. If the site's groundwater sampling analytical results are "clean," CH2M HILL will recommend that the liquid IDW be discharged to the industrial wastewater treatment facility.

If the groundwater sampling results contain contaminant concentrations above regulatory limits, the drummed water will be considered hazardous. The waste management subcontractor will ship the liquid IDW to a regulated hazardous wastewater treatment facility where it will be treated until it meets standards for disposal as appropriate, and as directed by the Navy.

The proposed steps for accumulating, handling, and disposing of IDW liquids are as follows:

1. If previous investigations have either confirmed or suggested the existence of contamination at the site, or if investigations have not yet been conducted at the site, groundwater will be contained in 55-gallon drums. In addition, water generated during decontamination processes and excessive liquids that separated from soil cuttings will be added to drums containing groundwater IDW. The drums will be sealed and appropriately labeled.
2. If groundwater is extracted from a background location where contamination is not expected, or if previous investigations have confirmed that contamination does not exist at the site, groundwater will not be contained during field activities.
3. Stockpile drums in the area(s) designated by the Navy.
4. Verify with the Navy whether the site contains listed hazardous wastes, as specified in 40 CFR 261. If the site does contain listed hazardous wastes, refer to step 7.
5. If the site does not contain listed hazardous wastes, CH2M HILL will write a memorandum to the Navy recommending whether to handle the drummed water as hazardous or non-hazardous waste. The recommendations will be based on results of groundwater sampling conducted during field activities.
6. If the waste is considered non-hazardous, upon receipt of concurrence by the Navy, the waste management subcontractor will haul the liquid IDW to the industrial wastewater treatment facility.
7. If the waste is considered hazardous, upon receipt of concurrence by the Navy, the waste management subcontractor will haul the liquid IDW to a regulated hazardous wastewater treatment facility where it will be treated until it meets standards for disposal as appropriate, and as directed by the Navy. The Navy will be responsible for signing all manifests.

SECTION 3

General Considerations

General considerations pertinent to the generation and handling of IDW are documented below. These include the minimization of waste volume, drum labeling and storage, and disposal and manifesting protocol.

3.1 Minimization of IDW Volume

To minimize the volume of IDW soil generated during drilling, cuttings will be used to backfill the boreholes from which they were removed when previous investigations have confirmed that contamination does not exist at the site. Only excess cuttings will then be contained as IDW.

IDW soil generated during trenching will be minimized by backfilling the trench pits with soil that was extracted from them during the excavation process. Excess soil will be graded with a backhoe in the vicinity of the filled trench.

To minimize the volume of IDW groundwater, only the minimum volume of discharge purge water necessary to stabilize the pH, conductivity, temperature, and other parameters will be purged from wells. In addition, groundwater will not be contained if extracted from background locations where contamination is not expected, or if previous investigations have confirmed that contamination does not exist at the site.

3.2 Labeling Drums

Each 55-gallon drum containing IDW will be labeled with the following information: the type of IDW (groundwater, soil, PPE, etc.), the date the drum was filled and sealed, and a brief warning not to handle the drum or its contents without permission from AFWTF. The following is an example of the information to be included on each drum:

Investigation Derived Wastes
Purge Water from Site 2 - MW1
4-8-96
Do Not Handle - Analysis Pending
Ms. Madeline Rivera, NSRR

3.3 Storing IDW

Drums containing IDW will be stockpiled at an onsite location designated by Navy personnel, pending the receipt of characterization and sampling analytical results. The contained wastes must be disposed of within 90 days of being stockpiled at the temporary location. For planning purposes, IDW will be stored at AFWTF for a maximum of 60 days in order to ensure compliance with the 90-day accumulation limit.

3.4 Waste Disposal and Manifesting

Upon the receipt of characterization and sampling analytical results, CH2M HILL will assess the potential hazards posed by the IDW and submit waste management recommendations to the Navy. If the test results indicate that the IDW is not a listed or characteristic hazardous waste, CH2M HILL will recommend that soil be disposed of at a non-hazardous landfill, that water be disposed of at an industrial wastewater treatment plant, and that PPE and sampling expendable items be disposed of in a trash dumpster for disposal with other non-hazardous trash generated at AFWTF.

If the test results or the Navy indicate that the IDW is generated from a site that contains a listed or characteristic hazardous waste, CH2M HILL will recommend that the soil, water, and PPE be manifested, handled, treated, and disposed of as a hazardous waste by a CH2M HILL waste management subcontractor. The waste management subcontractor will prepare manifests for a completeness review by CH2M HILL. The Navy will be responsible for signing all manifests.