Work Plan, Long-Term Monitoring,
Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oʻahu, Hawaiʻi

September 2010

Department of the Navy
Naval Facilities Engineering Command, Hawaiʻi
400 Marshall Road
Pearl Harbor, HI 96860-3139

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

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Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
Pearl Harbor, HI 96860-3139

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Prepared under:

Environmental Technical Services
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Approvals Page

Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i

I hereby certify that the enclosed Work Plan, shown and marked in this submittal, is that proposed to be incorporated with Contract Number N62742-08-D-1930, Contract Task Order HC14, "*Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i.*" This Work Plan is in compliance with contract specifications, United States (U.S.) Department of Labor Occupational Safety and Health Administration requirements, U.S. Army Corps of Engineers Safety and Health Manual (EM 385-1-1, 15 Sep 08), and is submitted for Government approval.

Reviewed By:

Milton C. Thompson

Project Manager — **Date** 17 Sep 10

Weixi Zhang

Quality Control Manager — **Date** 17 Sep 10

Approval By:

Navy Technical Representative NAVFAC Hawai'i — **Date**

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List of Acronyms

°C	degrees Celsius
µg/L	micrograms per liter
%D	percent difference
%R	percent recovery
AHA	Activity Hazard Analysis
AMEC	AMEC Earth and Environmental Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
COC	chain of custody
COPC	chemicals of potential concern
DLNR	Department of Land and Natural Resources
DOH	State of Hawai'i Department of Health
DoN	Department of the Navy
DOT	U.S. Department of Transportation
DQO	data quality objectives
EAL	environmental action level
EPA	U.S. Environmental Protection Agency
F-76	marine diesel fuel
FISC	Fleet and Industrial Supply Center
FM	Field Manager
GPS	global positioning system
HAR	Hawai'i Administrative Record
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDMW	Hālawa Deep monitoring well
HPWS	Hawai'i rules relating to potable water systems
HSO	Health and Safety Officer
HSP	Health and Safety Plan
HSWA	Hazardous and Solid Waste Amendments
ID	identification
IDW	investigation-derived waste
JP-5	Jet Propellant-5
JP-8	Jet Propellant-8
LCS	laboratory control samples
LD	laboratory duplicate
LNAPL	light non-aqueous phase liquid
LOD	limit of detection
LOQ	limit of quantitation
LTM	long-term monitoring
MDL	method detection limit
ml	milliliters
ml/min	milliliters per minute

MCL	maximum contaminant level
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NIRIS	Naval Installation Restoration Information System
NPDW	National Primary Drinking Water Act
NTR	Navy Technical Representative
Ogden	Ogden Environmental and Energy Services
OSHA	Occupational Safety and Health Administration
OWDF	Oily Waste Disposal Facility
OWDFMW	Oily Waste Disposal Facility monitoring well
PAHs	polycyclic aromatic hydrocarbons
PAL	Project Action Level
pH	hydrogen activity
PID	photo ionization detector
PM	Project Manager
ppb	parts per billion
ppbv	parts per billion by volume
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RHSF	Red Hill Bulk Fuel Storage Facility
RHMW	Red Hill monitoring well
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SVMP	soil vapor monitoring point
TEC	The Environmental Company Inc.
TPH	total petroleum hydrocarbons
TPH-GRO	total petroleum hydrocarbons gasoline range organics
TPH-DRO	total petroleum hydrocarbons diesel range organics
U.S.	United States
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOA	volatile organic analysis
VOC	volatile organic compound
WMP	Waste Management Plan
WP	Work Plan

Section 1 Introduction

This Work Plan (WP) describes the work procedures and methods that will be implemented and adhered to during the Long-Term Monitoring (LTM) at the Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i, herein after referred to as RHSF (Figure 1-1). The LTM will include quarterly groundwater sampling, monthly soil vapor monitoring, and monthly fuel product monitoring at existing groundwater monitoring wells and soil vapor monitoring points (SVMPs) to evaluate the presence and magnitude of chemicals of potential concern (COPCs).

This WP has been prepared by Environet for Naval Facilities Engineering Command (NAVFAC) Hawai'i under Contract Number N62742-08-D-1930, Contract Task Order HC14. This WP updates the *Red Hill Bulk Fuel Storage Facility Final Work Plan Addendum, Pearl Harbor, Hawai'i*, dated May 2006.

1.1 Project Scope and Objective

The objective of this project is to perform continued LTM to evaluate petroleum–related contamination in soil and groundwater at the RHSF. A total of four quarterly groundwater monitoring events and twelve monthly soil vapor and fuel product monitoring events will be performed starting in September 2010 and ending in August 2011. The LTM data will be used as a basis for decision making at the RHSF.

1.2 Location and Setting

The RHSF is located on the island of O'ahu, Hawai'i, approximately 2.5 miles northeast of Pearl Harbor in Hālawa Heights (Figure 1-1). The RHSF lies along the western edge of the Ko'olau Range and is situated on a low ridge that divides the Hālawa Valley and the Moanalua Valley. Land adjacent to the north of the RHSF is occupied by Hālawa Correctional Facility and private businesses. Land to the south and west of the facility includes the Coast Guard Reservation and other residential neighborhoods. Moanalua Valley is located to the east of the facility. The Salt Lake volcanic crater is located south of the facility. RHSF occupies approximately 144 acres of land. The majority of the surface topography of RHSF lies at an elevation of approximately 200 to 500 feet above mean sea level (msl). However, much of the work conducted onsite will be in underground tunnels, which are located between 100 to 120 feet above msl. The RHSF consists of 18 active and two inactive underground storage tanks (USTs) operated by Department of Navy (DoN) Fleet and Industrial Supply Center (FISC) Pearl Harbor. Each UST has a capacity of approximately 12.5 million gallons (Table 1-1). The UST facility is located approximately 100 feet above the basal aquifer.

Current zoning information obtained from the City and County of Honolulu's Department of Planning and Permitting indicates that the RHSF is located on federal government land, (zoned F1 – Military and Federal) with public land adjacent to the north and northeast. A high cliff (approximately 100 to 200 feet elevation difference) in the public land area separates the RHSF from a mixed industrial area and a residential area containing the Hālawa Correctional Facility.

A quarry is located further to the northwest in an agricultural zone. The H-3 Freeway is located northwest of the quarry.

A total of seven groundwater monitoring wells are included in the current monitoring program (Figure 1-2). Five groundwater monitoring wells are located within RHSF (Red Hill monitoring well (RHMW)01, RHMW02, RHMW03, RHMW05, and RHMW2254-01) and two groundwater monitoring wells are located outside the RHSF Oily Waste Disposal Facility monitoring well(OWDFMW)01) and (Hālawa Deep monitoring well (HDMW)2253-03. The following is a summary of the location of the wells:

- Four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) are located inside the underground tunnels at the RHFS.

- Groundwater monitoring well RHMW2254-01 is located inside the infiltration gallery of United States (U.S.) Navy well 2254-01. The U.S. Navy Well 2254-01 is located approximately 3,000 feet down-gradient (west) of the USTs and provides approximately 24 percent of the potable water to the Pearl Harbor System, which serves approximately 52,200 military consumers. The Navy Public Works Department operates a potable water infiltration tunnel approximately 1,550 feet hydraulically down-gradient from the USTs.

- Groundwater monitoring well OWDFMW01 is located southeast of the Oily Waste Disposal Facility (OWDF) in the western most corner of RHSF property boundary.

- Groundwater monitoring well HDMW2253-03 is located inside the boundaries of the Hālawa Correctional Facility property, north of Hālawa Stream. The groundwater monitoring well is located between the RHSF and the municipal drinking water supply well run by the City and County of Honolulu Board of Water Supply Hālawa Shaft pumping station. Special permission is required from the administration at the Hālawa Correctional Facility for access to groundwater monitoring well HDMW2253-03. The groundwater monitoring well is controlled by the State of Hawai'i Commission on Water Resource Management and special permission is also required from Department of Land and Natural Resources (DLNR) to access this groundwater monitoring well.

Table 1-1: USTs at Red Hill Bulk Fuel Storage Facility

Tank Identification Number	Fuel Type	Status	Capacity
1	None	Not In Use	12.5 million gallons
2	JP-8	In Use	12.5 million gallons
3	JP-8	In Use	12.5 million gallons
4	JP-8	In Use	12.5 million gallons
5	JP-8	In Use	12.5 million gallons
6	JP-8	In Use	12.5 million gallons
7	JP-5	In Use	12.5 million gallons
8	JP-5	In Use	12.5 million gallons
9	JP-5	In Use	12.5 million gallons
10	JP-5	In Use	12.5 million gallons
11	JP-5	In Use	12.5 million gallons
12	JP-5	In Use	12.5 million gallons
13	F-76	In Use	12.5 million gallons
14	F-76	In Use	12.5 million gallons
15	F-76	In Use	12.5 million gallons
16	F-76	In Use	12.5 million gallons
17	JP-5	In Use	12.5 million gallons
18	JP-5	In Use	12.5 million gallons
19	None	Not In Use	12.5 million gallons
20	JP-5	In Use	12.5 million gallons

Notes:
1. JP-5 and JP-8 are Jet Propellant
2. F-76 is marine diesel fuel

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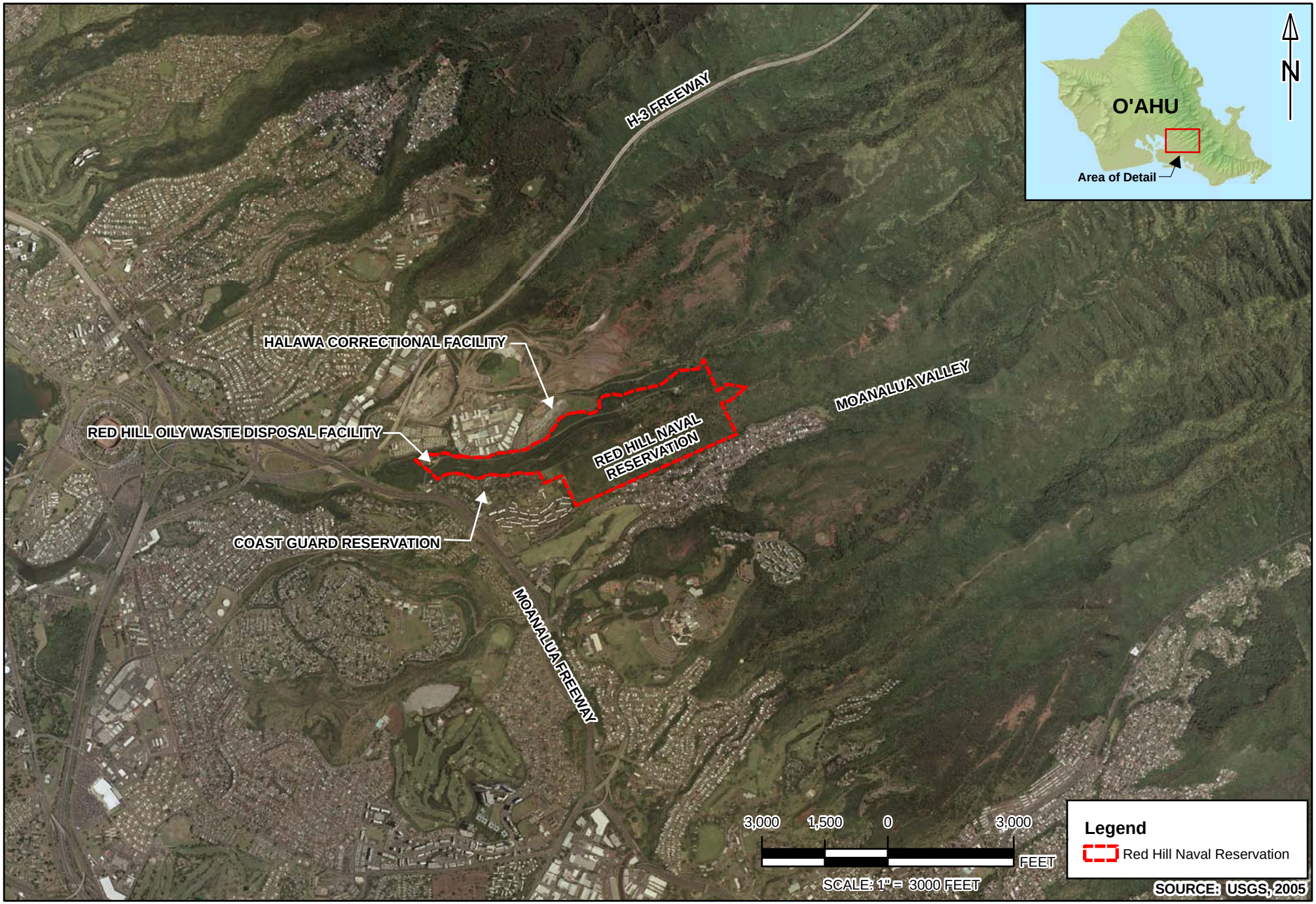

Environet, Inc.

LONG-TERM MONITORING, RED HILL BULK FUEL STORAGE FACILITY

PROJECT LOCATION MAP

FIGURE 1-1

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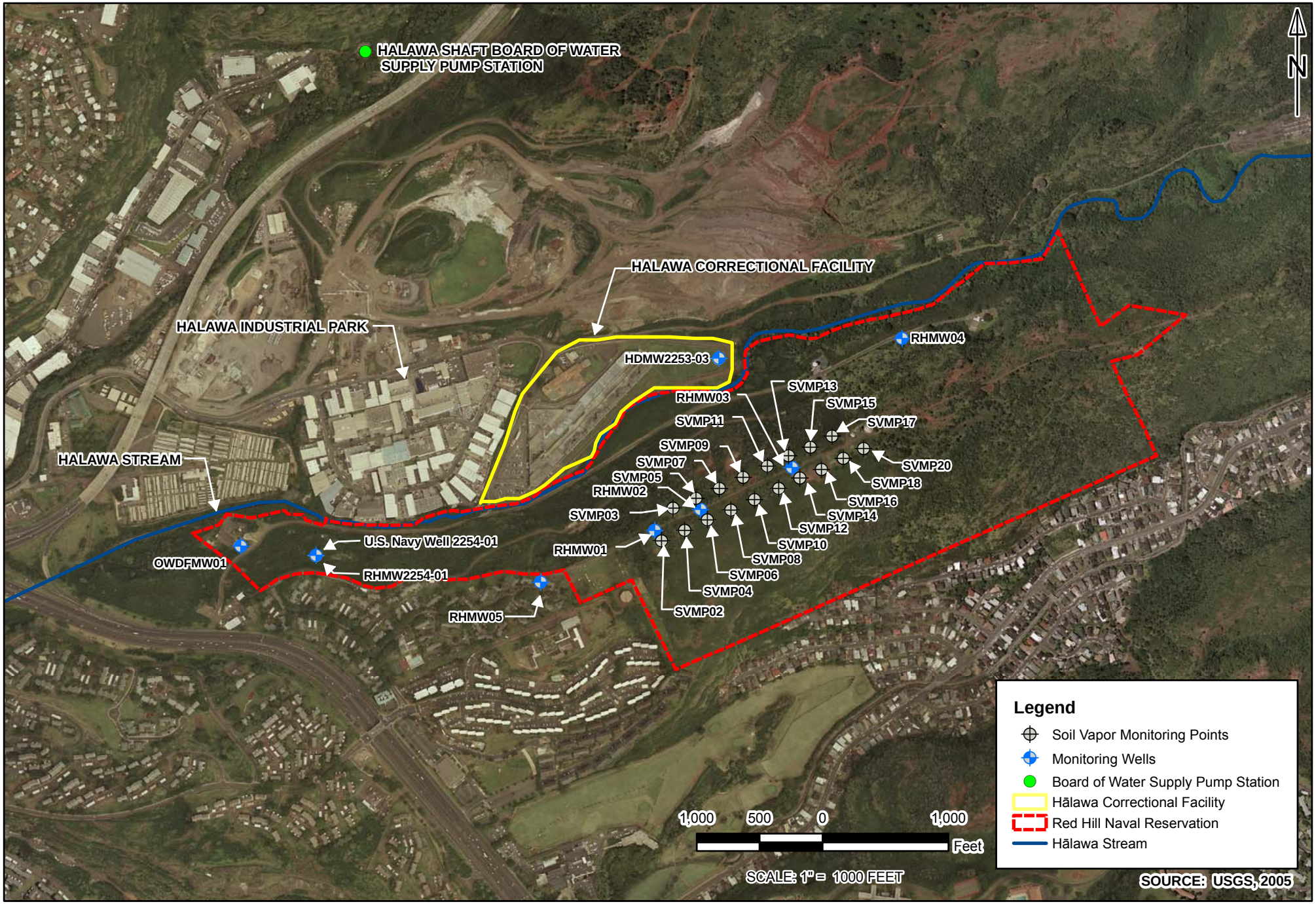

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LONG-TERM MONITORING, RED HILL BULK FUEL STORAGE FACILITY

GROUNDWATER MONITORING WELL AND SOIL VAPOR MONITORING POINT LOCATION MAP

FIGURE 1-2

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1.3 Site Background

The RHSF was constructed by the U.S. government in the early 1940s and includes 20 USTs, each with a capacity of approximately 12.5 million gallons and a series of system tunnels. The tanks are constructed of steel and currently contain jet fuel propellant (JP-5 and JP-8) and marine diesel fuel (F-76). Previously, several of the tanks have also been used to store Navy special fuel oil, Navy distillate, aviation gasoline and motor gasoline. The fueling system is a self-contained underground unit that was installed into native rock comprised primarily of basalt with some inter-bedded tuffs and breccias. Each tank measures approximately 245 feet in height and 100 feet in diameter. The upper domes of the tanks lie at depths varying between approximately 100 feet and 200 feet below the existing ground surface. The tanks are currently being inspected and repaired by Willbros Government Services.

1.3.1 Previous Environmental Activities

This section provides a description of the pertinent environmental activities conducted at RHSF since the facility was declassified (in the late 1990's), up to April 2010.

1998: Groundwater monitoring well OWDFMW01(originally MW08) was installed in 1998 for a Phase II Remedial Investigation/Feasibility Study (RI/FS) for the OWDF (Earth Tech Inc., 1999).

2001: In February 2001, the Navy installed groundwater monitoring well RHMW01 to monitor for contamination of the basal aquifer underlying the RHSF. This groundwater monitoring well was installed and completed at approximately 100 feet below grade within the lower access tunnel. At the time of well completion, depth to water in groundwater monitoring well RHMW01 was measured at 86 feet below grade (The Environmental Company Inc. [TEC], 2009). Groundwater samples collected from RHMW01 in February 2001 contained total petroleum hydrocarbons (TPH) concentrations ranging from 883 micrograms per liter (µg/L) to 1,050 µg/L and total lead ranging from 10.4 µg/L to 15 µg/L. The maximum total lead concentration in the samples was equal to the primary drinking water standard of 15 µg/L for lead and exceeded the Hawai'i Department of Health (DOH) groundwater Tier 1 Environmental Action Level (EAL) of 5.6 µg/L (TEC, 2009).

2005: The Navy began quarterly groundwater monitoring at two existing monitoring wells (RHMW01 and RHMW2254-01) in February 2005. Samples collected in February and June 2005 were not filtered in the field prior to analysis for lead. Analytical results for samples collected from groundwater monitoring well RHMW01 indicated concentrations of total lead were above the DOH EAL of 5.6 µg/L. The results were not considered appropriate for risk evaluation since the samples had not been filtered. In addition, lead was not a component of fuels from the tanks near groundwater monitoring well RHMW01. Lead may have been part of the RHSF construction material.

TEC installed three groundwater monitoring wells at RHSF between June and September 2005. Monitoring wells (RHMW02 and RHMW03) were installed within the RHSF UST system. Monitoring well RHMW04 was installed hydraulically upgradient of the USTs to provide

geochemistry for water moving through the basal aquifer beneath the RHSF. Monitoring wells RHMW02 and RHMW03 were completed to depths of approximately 125 feet below the tunnel floor, and well RHMW04 was completed to a depth of approximately 300 feet below ground surface outside the tunnel. Groundwater samples were collected from the three newly installed wells and two existing wells (RHMW01 and RHMW2254-01) in September 2005. Naphthalene and trichloroethylene were detected in samples collected from RHMW02 at concentrations above the DOH EALs.

2006: Dedicated sampling pumps were installed in five wells (RHMW01, RHMW02, RHMW03, RHMW04, and RHMW2254-01). TEC collected groundwater samples from the five groundwater monitoring wells in July 2006. The groundwater samples were analyzed for petroleum constituents. Naphthalene was detected in samples collected from RHMW02 at concentrations above the DOH EALs.

In September 2006, with concurrence from the DOH, the Navy decided to use the newer DOH EALs for the Red Hill Site Investigation and Risk Assessment project. Since a DOH Policy Letter stated that the two sets of action levels should not be mixed, the Tier 1 screening levels presented in Hawai'i Administrative Record (HAR) Section 11-281-78 would no longer be used to evaluate environmental impact at RHSF (TEC, 2009).

In December 2006, groundwater samples were collected from the five existing monitoring wells. The groundwater samples were analyzed for petroleum constituents. TPH as diesel range organics (TPH-DRO) was detected in groundwater samples at a concentration above the DOH Drinking Water EAL in monitoring well RHMW01. TPH gasoline range organics (TPH-GRO), TPH-DRO, and naphthalene were detected in groundwater samples at concentrations above the DOH Drinking Water EALs in monitoring well RHMW02.

2007: Groundwater samples were collected in March, June, and September 2007. TPH-DRO was detected in groundwater samples at concentrations above the DOH Drinking Water EALs in RHMW01 during all three sampling events. TPH-GRO exceeded DOH Drinking Water EAL in March; TPH-DRO and naphthalene exceeded DOH Drinking Water EALs during all three monitoring events; and 1-methylnaphthalene and 2-methylnaphthalene exceeded the DOH Groundwater Gross Contamination EAL during all three sampling events in RHMW02. TPH-DRO exceeded DOH Drinking Water EALs at RHMW03 in June.

2008: In a response to increasing concentrations of COPCs at groundwater monitoring wells within RHSF (specifically monitoring well RHMW02), quarterly sampling commenced at the outside monitoring wells HDMW2253-03 and OWDFMW01.

Groundwater samples were collected in January, April, July, and October 2008. Analytical results indicated the following:

- petroleum constituents were not detected above DOH Drinking Water EALs at RHMW2254-01;
- trace detections of 1-methylnaphthalene and naphthalene prompted a resample event in December at RHMW2254-01, no chemicals were detected above the method detection limit (MDL);

- TPH-DRO exceeded DOH Drinking Water EALs at RHMW01 during all four sampling events;
- TPH-GRO did not exceed DOH Drinking Water EALs at RHMW02;
- TPH-DRO, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene exceeded DOH Drinking Water EALs at RHMW02; and
- TPH-DRO exceeded DOH Drinking Water EALs at RHMW03 during all four sampling events.

2009 – 2010: In April 2009, a new groundwater monitoring well, RHMW05, was installed by TEC. RHMW05 is located downgradient from the USTs, within the lower access tunnel between RHMW01 and RHMW2254-01. It was installed to identify the extent of contaminant migration downgradient prior to contaminants reaching the infiltration gallery at the U.S. Navy Well 2254-01 (RHMW2254-01). Groundwater samples were collected in February, May, July, and October 2009. Analytical results indicated the following:

- petroleum constituents have not been detected above DOH Drinking Water EALs at RHMW2254-01, OWDFMW01, RHMW04, and HDMW2253-03;
- trace TPH-GRO at RHMW2254-01 was detected above the laboratory MDL and significantly below the laboratory reporting limit and DOH EAL, in February and May 2009;
- TPH-DRO at OWDFMW01 was detected at 1,490 µg/L, exceeding the DOH Groundwater Gross Contamination EAL and Drinking Water EAL (i.e., 100 µg/L and 210 µg/L, respectively). No other COPC was detected above the laboratory MDLs in OWDFMW01 (TEC 2010b).
- TPH-DRO exceeded DOH Drinking Water EALs at RHMW01 and at RHMW02 during all four sampling events;
- TPH-GRO did not exceed DOH Drinking Water EALs at RHMW02;
- Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene exceeded DOH Drinking Water EALs at RHMW02 in February 2009, however only 1-methylnaphthalene exceeded the DOH Drinking Water EALs in May and July 2009. Only naphthalene exceeded the DOH EALs at RHMW02 in October 2009;
- TPH-DRO exceeded DOH Drinking Water EALs at RHMW03 in February, but not in May, July or October 2009.
- TPH-DRO exceeded DOH Drinking Water EALs at RHMW05 during the July 2009 and October 2009 sampling events.

1.4 Regulatory Requirements

This LTM will be completed in accordance with applicable federal regulations, including the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Title 29 of the Code of Federal Regulations (CFR) describing Occupational Safety and Health Standards. Based on the current knowledge of the site, the State and Federal regulatory requirements that apply to RHSF include the following:

- Safe Drinking Water Act (SDWA) and National Primary Drinking Water Act (NPDW); the NPDW regulations within 40 CFR Part 141 implement the provisions of the SDWA.

They establish maximum contaminant levels (MCLs) for various substances in potable water.

- Hawai'i rules relating to the potable water systems (HPWS) – The DOH HPWS (HAR Title 11, Chapter 20) set forth MCLs of certain chemicals in public and private drinking water systems. These MCLs are analogous to the NPDW regulations.

- State of Hawai'i UST Regulations– established in 1979 and amended with the Hazardous and Solid Waste Amendments (HSWA) of 1984 established a comprehensive regulatory program for USTs. The State of Hawai'i adopted its own UST statutes and regulations (Hawai'i Revised Statutes, Title 19, Chapter 342L and HAR, Title 11, Chapter 281, Subchapters 1 through 10) to implement these laws in Hawai'i . Owners and operators of USTs that contain regulated substances such as petroleum are required to take specific actions when investigating releases from their USTs. Regulations and requirements are explained in detail in the Technical Guidance Manual for Underground Storage Tank Closure and Release Response (DOH, 2000).

- DOH, *Evaluation of Environmental Hazards at sites with Contaminated Soil and Groundwater*, which provides guidance for identification and evaluation of environmental hazards associated with contaminated soil and groundwater (DOH, 2009).

Section 2 Project Organization

This section provides a summary of key project personnel, subcontractors, and the project organizational structure. Having a clear understanding of each individual and organization's roles and responsibilities will be instrumental in the successful completion of the project.

2.1 Roles and Responsibilities

Table 2-1 contains the project contact list showing key personnel and organizations for this project.

Table 2-1: Project Organization and Responsibilities

Title	Project Personnel	Contact Information
Navy Technical Representative (NTR)	Darren Uchima	(808) 471-1171 ext. 217 Darren.uchima@navy.mil
Senior Program Manager, Environet	Zachary Payne	(808) 227-0844 zpayne@environetinc.com
Project Manager (PM), Environet	Vilma Dupra	(808) 754-3925 vdupra@environetinc.com
Health and Safety Officer (HSO), Environet	Shelby Koide	(808) 833-2225 ext. 1038 skoide@environetinc.com
Field Manager (FM), Environet	Max Solmssen	(808) 833-2225 ext. 1012 msolmssen@environetinc.com
Quality Control (QC) Manager and Chemist, Environet	Weixi Zheng	(808) 277-0467 wzheng@environetinc.com
APPL Inc. Laboratories	Cynthia Clark	(559) 275-2175 cclark@applinc.com
Pacific Commercial Disposal Services	Jingbo Chang	(808) 545-4599 jingbo.chang@pcshi.com
DLNR Commission on Water Resource Management	Jeremy Kimura	(808) 587-0269 Jeremy.l.kimura@hawaii.gov
Hālawa Correctional Facility Administration	Faye Yap	(808) 483-5221 faye.tyap@hawaii.gov (DLNR will contact)

This organizational structure is designed to ensure that all personnel involved with the project will receive proper instruction and information, and that appropriate quality assurance (QA)/QC procedures will be followed throughout the field effort. The roles and responsibilities of key personnel are presented below.

2.1.1 Project Manager

The PM, Ms. Vilma Dupra, has overall responsibility for completing the project in accordance with the Scope of Work. The PM will be directly responsible for scheduling and developing the technical approach for completing project tasks, providing strategic direction to project personnel, and implementing the Health and Safety Plan (HSP). The PM will also oversee the preparation of the project WP, HSP, and all other project deliverables. The PM will ensure that security passes for all personnel and vehicles are obtained at least three weeks prior to entering the site. The PM will be responsible for monitoring the quality of work products, ensuring that project milestones are being met, and for implementing corrective measures when necessary.

2.1.2 Field Manager

The FM, Mr. Max Solmssen, will be responsible for scheduling and directing all field activities and will implement this WP. The FM will receive strategic instructions from the PM on how to implement the WP. The FM will also be responsible for coordinating with subcontractors and vendors to ensure that all necessary equipment, personnel, and supplies are ready and available to complete the groundwater monitoring activities. The FM will coordinate the site access with the DoN at Pearl Harbor to arrange an escort to the RHSF. The FM will coordinate with the DLNR Commission on Water Resource Management and with the administrator of Hālawa Correctional Facility at least two weeks in advance to obtain clearance and access to the offsite monitoring wells. Mr. Solmssen has completed medical first aid, Cardiopulmonary Resuscitation (CPR), Hazardous Waste Operations and Emergency Response (HAZWOPER) 40 hour, and Occupational Safety and Health Administration (OSHA) construction safety 30 hour courses as required.

2.1.3 Health and Safety Officer

The Environet HSO, Ms. Shelby Koide, will be responsible for implementing and enforcing the HSP during field activities. The HSO will conduct health and safety meetings and daily monitoring and site inspections as required by the HSP, and ensure that personal protective equipment (PPE) and safety monitoring instrumentation are available and ready for use. Any deficiencies will be logged and abated. The HSO will report health and safety issues directly to the Environet PM and has the authority to stop work at any time should conditions be deemed unsafe. If there is a work stoppage due to health and safety reasons, the HSO will consult with the Environet PM to investigate the cause of the concern and implement appropriate corrective action based on the procedures described in the HSP. Ms. Koide has completed the required OSHA 30 hour training requirement as well as CPR, First Aid and OSHA 40 hour HAZWOPER training.

2.1.4 Quality Control Manager

The QC Manager, Ms. Weixi Zheng, has overall responsibility and authority for developing and managing the Project QC Program. The QC Manager is responsible for preparing, updating, and revising the QC Plan for this contract, and for assisting in preparing and implementing QC procedures and plans at the project site. The QC Manager is also responsible for reviewing and approving Project QC Plans prior to delivery to the Contraction Officer for approval.

2.1.5 Project Staff

Each member of the project staff will be responsible for reading and understanding the requirements of this WP and the HSP prior to taking part in any field activities. The project staff will receive their work assignment and instructions from the PM. Members of the project staff are also responsible for understanding and implementing the QA and QC procedures in accordance with the corporate QA Plan.

2.1.6 Analytical Laboratory

APPL, Inc. Laboratories has been contracted to provide analytical services. APPL, Inc. is currently certified by the Naval Facilities Engineering Service Center (NFESC) to perform all of the analytical methods for this project. The laboratory will provide all necessary sample

containers and will coordinate with the PM regarding sample container shipment, sample delivery, and data delivery requirements and schedule. APPL, Inc. is to produce data that meets the requirements set forth in this WP.

2.1.7 Personnel Qualifications

All personnel assigned to the project, including employees and subcontractors, will be qualified to perform the tasks to which they are assigned. Appraisal of personnel qualifications will be made by the PM. The appraisal will include a comparison of the job assignment requirements with the relevant experience and training of the prospective assignee. It will also include a determination of whether further project staff training is required. If further training is required, the PM shall schedule the training so that project staff has the necessary training before the start of field activities.

2.1.8 Subcontractors

All subcontractors will report to the PM or her designee, and furnish all personnel, equipment, and materials required for their delegated tasks. Although Environet expects subcontractors to ensure QC of their own work, the site supervision, inspection, and approval of all subcontracted work will be the responsibility of Environet. The following is a list of subcontractors whose service will be utilized in the LTM of the RHSF:

- Pacific Commercial Systems for investigation derived waste (IDW) removal and treatment and,
- APPL Inc. Laboratories for analytical services.

2.2 Planning

Environet will be responsible for project set-up and planning as follows:

- obtaining security passes and escorts for all personnel and vehicles requiring access to RHSF and surrounding properties when necessary;
- acquiring additional information including utility maps, as-built drawings/record drawings, historical data, and/or any other pertinent background information;
- obtaining all federal, state, and local permits and approvals required to perform the fieldwork;
- preparing a plan for various facility locations including office trailer, staging areas, decontamination areas and material storage;
- attending a pre-performance meeting; and
- preparing and submitting final planning documents prior to initiating fieldwork.

2.3 Permitting

Operations will be performed in compliance with all applicable U.S. federal regulations. In addition, the work will be performed to meet the substantive requirements of State or local laws, rules, and regulations. All members of the field team will have obtained a valid background

check and fingerprinting as required by NAVFAC Hawai'i prior to commencing any field activities.

2.4 Project Schedule

The normal work schedule will be Monday through Friday, eight hours per day. Environet assumes normal work schedule access within the security fence perimeter surrounding RHSF and on neighboring properties.

The sequence and frequency of LTM activities are as follows:

- September 2010 – Initiate the first of 12 monthly soil vapor sampling and monthly fuel product monitoring.
- October 2010 – Initiate the first of four quarterly groundwater sampling events.
- January 2011 – Perform the second of four quarterly groundwater sampling events.
- April 2011 – Perform the third of four quarterly groundwater sampling events.
- August 2011 – The last quarterly groundwater sampling event shall take place.

2.5 Health and Safety Requirements

The entire project team will be required to read and sign the HSP as verification that they understand the plan. As described in the site HSP, Environet will take all necessary preventive measures to provide a safe work environment during field activities. The HSP includes appropriate Activity Hazard Analyses (AHAs), outlines personnel risk minimization through compliance with the Occupational Safety and Health Administration and U.S. Army Corps of Engineers (USACE) safety regulations (Appendix A).

Section 3 Sampling and Analysis Plan

This section provides a detailed description of the sampling activities and analysis plan for the LTM at the RHSF.

3.1 Groundwater Sampling and Analysis

Quarterly groundwater sampling and analysis will be conducted at five existing groundwater monitoring wells inside the RHSF (RHMW01, RHMW02, RHMW03, RHMW05, and RHMW2254-01) and two monitoring wells located outside of the RHSF (HDMW 2253-03 and OWDFMW01) (Figure 1-2). The following sections describe the groundwater sampling procedures that will be utilized. Groundwater sample collection will be conducted in accordance with Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007).

3.1.1 Purging

Prior to purging, depth to groundwater will be measured using a Solinst 122 oil/water interface probe before any water is removed. To prevent possible cross contamination of wells, water level measurement devices will be decontaminated prior to use at each well. The depth to standing water and the total depth of the well will be measured to the nearest 0.01 foot.

Prior to sample collection, the monitoring wells will be purged to remove standing water in the well casing, which may not be representative of the aquifer water quality. Purging will be accomplished by removing water from the well using a dedicated bladder pump. Purging will require a source of compressed air for all monitoring wells except HDMW2253-03 which has no dedicated pump. Disposable bailers will be used at HDMW2253-03. Inside of the RHSF tunnel, a compressed air supply line is usually available and will be used. A QED MP50 MicroPurge Basics Controller© box for the dedicated pumps will be connected to the compressed air system with an in-line filter and water trap. Outside of the RHSF, and if compressed air is unavailable inside the RHSF, a 200 standard cubic feet compressed gas cylinder containing clean dry nitrogen or carbon dioxide or a gas powered air compressor will be used. The compressed gas pressure will be reduced to 125 pounds per square inch, by use of a regulator with high and low pressure gauges attached to the cylinder. Purging will be conducted at a low flow rate of less than one liter per minute. Purge water collected from within the tunnels will be placed directly into the sump pit system near the Tank 17 and 18 bulkhead, that leads to the FISC oil/water separator and associated disposal tanks or placed in a 55-gallon drum for temporary storage. Outside of the tunnels, purge water will be placed in a 55-gallon drum for temporary storage.

Water quality parameters will be measured on a regular basis during well purging, including: hydrogen activity (pH), temperature, conductivity, dissolved oxygen, turbidity, and oxidation reduction potential. At least four to six readings will be taken during the purging process. The water quality parameters will be evaluated to demonstrate that the natural characteristics of the aquifer formation waters are present within the monitoring well prior to sample collection. Purging will be considered complete when at least three consecutive water quality measurements

stabilize within approximately ten percent. All information obtained during purging and sampling will be entered into a groundwater sampling log (Appendix B).

3.1.2 Sample Collection

After purging is complete, groundwater samples will be collected using the same dedicated bladder pump system with the exception of the HDMW2253-03 which will be sampled using disposable bailers. A period of no more than two hours will elapse between purging and sampling to prevent groundwater interaction with the casing and atmosphere. The water level within the monitoring wells will be measured and recorded prior to sampling to ensure that draw-down has not occurred. Groundwater sampling will be conducted at a low flow rate of less than one liter per minute. Dissolved lead samples will be filtered in the field using a 0.45 micron sized filter.

3.1.3 Sample Analysis

Groundwater samples will be analyzed for COPCs listed in Table 3-1.

Table 3-1: Quarterly Groundwater Sampling and Analysis Program

Analytical Method	Analytical Parameter	Number of Samples to be Collected				
		Field Samples	Field Duplicates	Trip Blanks	MS/MSD	Total Number of Samples
RHFS Monitoring Wells (RHMW01, RHMW02, RHMW03, RHMW05, and RHMW2254-01)						
EPA 8015 B	TPH-DRO	5	1	0	1	7
EPA 8260 B	TPH-GRO	5	1	0	1	7
EPA 8260 B	VOCs	5	1	2	1	9
EPA 8270C SIM	PAHs	5	1	0	1	7
EPA 6020	Dissolved lead	5	1	0	1	7
Outside of RHSF Monitoring Wells (HDMW 2253-03 and OWDFMW01)						
EPA 8015 B	TPH-DRO	2	1	0	1	4
EPA 8260 B	TPH-GRO	2	1	0	1	4
EPA 8260 B	VOCs	2	1	1	1	5
EPA 8270C SIM	PAHs	2	1	0	1	4
EPA 6020	Dissolved lead	2	1	0	1	4

MS – matrix spike
MSD – matrix spike duplicate
EPA – U.S. Environmental Protection Agency
PAH – polycyclic aromatic hydrocarbons
VOC – volatile organic compound

3.1.4 Sampling Equipment

All non-disposable sampling equipment will be carefully cleaned and inspected prior to the start of sampling, or if stored, clean equipment will be inspected for any signs of contamination. Equipment will be decontaminated following established procedures between sample locations, and after all of the samples have been collected. Sampling equipment necessary for groundwater monitoring include:

- Horiba© U-22XD Multi-Parameter Water Quality Monitoring System (Meter and Probe) with calibration liquid;
- Dedicated bladder pumps;
- disposable bailers;
- QED MP50 MicroPurge Basics Controller,©
- ppbRae Plus© photo ionization detector (PID),
- Solinst 122© oil/water interface probe, and
- PPE, field forms, flashlight, and decontamination equipment.

3.1.5 Sample Containers

Sample containers will be provided by the subcontract laboratory. All sample bottles shall be new and clean for each analysis and shall be pre-preserved, if necessary. The laboratory also shall provide coolers (or hazardous cargo shipping containers) and appropriate packing materials suitable for shipping environmental samples under USACE and the U.S. Department of Transportation (DOT) regulations. Coolers shall be durable, in good working order, and possess intact handles, latches, and hinges. Coolers shall be able to accommodate laboratory-supplied sample bottles in an upright position.

Prior to sampling, the FM will inspect all supplies and consumables to ensure that they are acceptable for use. Required sample container type, volume, preservative, and recommended holding times for each analysis are summarized in Table 3-2. Groundwater samples will be collected according to analytical procedures in the following order: TPH-GRO and VOCs followed by all other analytes. Once the sample containers are filled, they will be sealed, labeled, placed into individual Ziploc® bags, and placed into an insulated cooler filled with ice for preservation. Samples will be packaged and properly transported within 24 to 48 hours of collection to the subcontract laboratory.

Table 3-2: Analytical Methods, Recommended Sample Containers, Preservatives, and Holding Times for Groundwater Samples

Parameter/Method	Number/Type of Containers per Sample	Preservative	Holding Time	
			Extraction	Analysis
TPH-DRO (EPA 8015B)	One liter amber glass bottle	Cool, 4 degrees Celsius (°C), none	7 days	14 days
TPH-GRO (EPA 8260B)	Three 40-milliliter glass vials with Teflon-lined septum	Cool, 4°C, hydrochloric acid to pH less than 2	7 days	14 days
VOC (EPA 8260B)	Three 40-milliliter glass vials with Teflon-lined septum	Cool, 4°C, hydrochloric acid to pH less than 2	7 hours	14 days
PAHs (EPA 8270C SIM)	One liter amber glass bottle	Cool, 4°C, none	7 days	14 days
Dissolved Lead (EPA 6020)	One 500 milliliter polyethylene bottle (field filtered)	Cool, 4°C, Nitric Acid to pH less than 2	180 days	14 days

3.1.6 Sample Preservation

Samples will be cooled on ice from the time of collection through delivery to the subcontractor laboratory. At a minimum, all samples will be maintained at 4 ºC (± 2 ºC). Sample preservation requirements will follow method requirements. Laboratory sample handling procedures are discussed in the subcontractor laboratory QA plan.

3.1.7 Sample Labeling

Each sample will be assigned both a chain of custody (COC) identification (ID) number and a descriptive ID number in accordance with Procedure I-A-9, *Sample Naming* (DON, 2007). All sample ID numbers will be recorded in the field logbook maintained by the FM.

COC ID Number

The COC ID number, the only ID number submitted to the analytical laboratory, is used to facilitate data tracking and storage. The COC ID number allows all samples to be submitted to the laboratory without providing information on the sample type or source. A COC ID number will be assigned to each sample as follows:

ESzzz

where;

E Designating the sampling team's company (e.g., Environet)

S Designating Storage Facility

zzz Chronological number, starting with 001

QC samples will be included in the chronological sequence.

Descriptive ID Number

A second sample ID number, which is linked to the COC ID number, will be for internal use only and will provide sample-specific information including: the sampling location, type, sequence, matrix, and depth. The descriptive ID number is not revealed to the analytical laboratory.

A descriptive ID number will be assigned to each sample as follows:

RH-MWxx-GWxx

where;

RH designates the associated site location Red Hill

MWxx designates sample MW number (e.g., MW01)

GWxx designates the groundwater sampling event number (e.g., GW01)

3.1.8 Sample Handling and Shipping

Samples will be handled in a manner that ensures their integrity and traceability to the sampling location. This will be achieved through the use of trained field and laboratory personnel; controlled field, transport, and laboratory conditions; and implementation of rigorous sample preparation, containerization, preservation, storage, packaging, transportation, and custody procedures.

Standard COC protocol will be observed during sample collection, management, and shipment to the analytical laboratories. The COC is maintained when sample containers or the coolers that are used to preserve the samples are under direct observation by project personnel at all times or under lock and key, with the person having custody holding the key at all times. Sample shipments to the analytical laboratories will be accompanied by a COC form. An example of the COC form is shown in Appendix B. The purpose of the COC procedure is to document the possession of the samples from collection through transport, storage, and analysis. COC forms will become part of the permanent project record upon completion of the project. The PM will direct project personnel to maintain custody of samples at all times and be responsible for monitoring compliance with COC procedures. Project personnel will be responsible for the care and custody of the samples until they are transferred to another party, shipped to the laboratory, or properly disposed.

3.2 Soil Vapor Monitoring

Monthly soil vapor monitoring will be performed at 18 SVMPs located at the RHSF. Each SVMP will be monitored at three different depths, one near the top, one near the middle, and one that is near the bottom of the SVMP. SVMPs will be purged and monitored for VOCs using a PID. This procedure is described in the SOP included in Appendix C. Purging will be accomplished using an electric air pump or comparable equipment and will occur for five minutes prior to sampling. The flow rate during purging and sampling will be less than 200 milliliters per minute (ml/min).

Monitoring results will consist of field readings collected from a PID probe by field staff. Readings will be recorded in real time and recorded on the soil vapor monitoring log located in Appendix B.

If the parts per billion by volume (ppbv) levels (i.e., 280,000 ppbv for tanks containing jet fuels or 14,000 ppbv for tanks containing diesel) are observed during monthly soil vapor monitoring, it is recommended that aggressive and proactive actions be taken to assess the integrity of the associated tank system and mitigate as needed for potential fuel release(s). If, after an inspection of the tank system it is uncertain whether or not a leak exists, it is recommended that soil vapor samples be taken for laboratory analysis.

3.2.1 Monitoring Procedures

Zero calibrate the PID prior to entering the tunnel inside of RHSF using a single use glass VOC zeroing tube and the tube adapter. After calibration the plastic filter can be attached. Check the

readings on the PID and if readings after attaching the plastic filter raise ambient readings significantly, change the filter.

Upon arrival at RHSF, place all equipment next to the well being tested and connect the extension cord to the 120 volt outlet located on the second steel post down from each tank (except Tanks 15 and 20). Attach the cord to the pump and open the well cover with the socket and ratchet drive. Ziploc® bags will be in the well compartment, take them out and place them to the side. Identify the shallow, medium, and deep probes using the reflective tags attached, or the color coded tape (orange is shallow, blue is middle, and white is deep).

Purging

Connect the purge tube to the intake nozzle on the pump and open the valve by making it parallel to the rest of the apparatus. Turn on the pump, purge for five minutes at a rate of less than 200 ml/min while recording purge time and rate in the field logbook. While purging, identify the appropriate Ziploc® with the dedicated tedlar bag and tygon tubing inside, and take them out of the SVMP. The colors coordinate with the tape.

Place the tedlar bag inside the vacuum chamber then attach the tygon tube to the vacuum chamber (taking the metal ferrals off the tube before inserting the nut, then place them back on again, and attach). Connect the tygon tube to the tedlar bag inside the vacuum chamber then open the bag's valve **no more than one rotation.** Take the appropriate tube from inside the vacuum chamber and snap it on the white plastic tip to the outside of the chamber.

Monitoring

Once purging is complete, turn off the pump and detach the purge tube from the pump then replace it with the open end of the vacuum chamber. Insert the open end of the tygon tube into the purge tube making sure the bag valve and purge valves are open, and close the vacuum chamber. Start the pump and cover the compression hole to fill the tedlar bag. Observe the bag to prevent overfilling. Once the bag is full open the vacuum chamber, close the bag's valve, then turn off the pump (if air is escaping from the bag when the lid is open then try again, however, only partially cover the compression hole to relieve the pressure in the chamber while vapors are slowly collecting in the tedlar bag). Detach the tedlar bag and reattach it to the PID making sure the PID is in survey mode, open the bag valve and begin testing.

Once numbers begin to appear on the PID screen, take readings every 10 seconds for 30 seconds and record in the field notebook. The average will be taken from the three noted values and the peak from the PID. Place the PID back on survey mode. Close the purge valve and begin purging the next probe.

While purging, deflate and close the tedlar bag valve then return it to the Ziploc® bag. Detach the tygon tube and return it to the Ziploc® bag. Begin preparations for the next monitoring reading with the appropriate dedicated tygon tubing and tedlar bags. Continue this process until all points at the location have been tested.

Make sure all valves are closed and bags are deflated before returning them back into the well compartment. Close all purge valves then secure the well cover. Unplug the pump and prepare

to move to the next SVMP. Test the PID in the main tunnel between each SVMP, record the background levels (if it reads more than typical background for the day, change the plastic filter).

3.2.2 Monitoring Equipment

All non-disposable sampling equipment will be carefully cleaned and inspected prior to the start of sampling, or if stored, clean equipment will be inspected for any signs of contamination. Equipment will be decontaminated following established procedures between sample locations, and after all of the samples have been collected. Sampling equipment necessary for soil vapor monitoring include:

- electric pump and extension cord,
- 15/16-inch socket and ratchet drive,
- ppbRae Plus© PID,
- 10,000 parts per billion (ppb) isobutylene,
- vacuum chamber,
- dedicated field notebook,
- field forms, and
- PPE and flashlight.

3.3 Fuel Product Monitoring

Monthly fuel product monitoring will be performed at four wells (RHMW01, RHMW02, RHMW03, and RHMW05) located within the RHSF. A Solinst 122© oil/water interface probe will be used to detect presence and measure the thickness of light non-aqueous phase liquid (LNAPL) to the nearest 0.01 feet at the water surface. Fuel product monitoring will be performed prior to any purging or sampling event. Fuel product measurements will be recorded onto the fuel product monitoring log (Appendix B).

3.4 Field Documentation

Field documentation creates a permanent record of field activities and pertinent sample collection information. Only personnel trained in sampling techniques will collect samples. Standard sample collection procedures will be followed. Documentation of field activities will be in accordance with established procedures and will include field logbooks, sample labels, and COC forms. Field documentation will follow established procedures. Spatial data will be collected, as needed, using a global positioning system (GPS).

3.5 Management and Disposal of IDW

IDW will include water generated as a result of decontamination of field equipment, PPE, and purge water from the wells outside RHSF. All IDW will be managed and disposed in accordance with the Waste Management Plan (WMP) (Appendix D).

Section 4 Quality Assurance Project Plan

This Quality Assurance Project Plan (QAPP) is intended to be used in conjunction with the Sampling and Analysis Plan (SAP) (Section 3) with procedures and methods incorporated. The QAPP includes discussions of the following:

- summary of the data quality objectives (DQO) process;
- QA/QC sampling and sample handling procedures;
- laboratory QC;
- field QC;
- analytical data quality review;
- data reporting and documentation;
- oversight and assessment; and
- corrective action.

The PM will be responsible for ensuring that the appropriate project personnel have the most current version of this QAPP.

4.1 Summary of the Data Quality Objectives Process

The overall sampling and analysis strategy was developed using the EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, Quality Assurance Management Systems (EPA, 2001).

4.1.1 Statement of the Problem

Previous releases from the existing USTs at the RHSF have the potential to impact the underlying freshwater aquifer located approximately 100 feet beneath the USTs. LTM of groundwater, soil vapor, and fuel product is required to evaluate the presence and magnitude of UST-related contamination and to generate data for decision making at the site.

4.1.2 Identify the Goals of the Study

The following generally stated decisions will be made based on the data gathered during LTM:

- What is the extent and magnitude of UST-related contamination?
- Do the COPC concentrations exceed the screening criteria?

4.1.3 Identify the Information

The decisions will be made by comparing the groundwater analytical results with the DOH EALs for sites where groundwater is a current or potential drinking water source and a surface water body is located greater than 150 meters from the site (DOH, 2009). The Project Action Levels (PALs) are the most conservative of either the drinking water toxicity level or the gross contamination level and were previously agreed to by the DOH and DoN (Appendix E). In addition, soil vapor concentrations will be compared to the site specific threshold values of

280,000 in SVMPs beneath USTs containing JP-5 or JP-8 (type of jet propellant) and 14,000 ppbv in SVMPs beneath USTs containing F-76. The following is a list of information that will be used to determine the hazard to human health.

- Analytical data representing groundwater from RHMW01, RHMW02, RHMW03, RHMW05, RHMW2254-01, HDMW2253-03, and OWDFMW01,
- Soil vapor monitoring data from 18 SVMPs,
- Fuel product monitoring data from RHMW01, RHMW02, RHMW03, and RHMW05

4.1.4 Define the Boundaries of the Study

The monitoring is limited to the groundwater monitoring wells located within the RHSF, two groundwater wells outside the RHSF, and 18 SVMPs located inside the RHSF. These monitoring points were selected due to their close proximity to the contaminant source and their position at the contaminant periphery (downgradient and upgradient). Quarterly groundwater sampling events shall be conducted for one year (total of four events commencing October 2010). Monthly soil vapor monitoring shall be conducted for one year (a total of 12 events starting in September 2010). Monthly fuel product monitoring shall occur at four of the aforementioned wells inside RHSF (a total of 12 events commencing September 2010).

4.1.5 Develop the Analytical Approach

- If COPC concentrations at a groundwater monitoring location exceed the screening criteria, then the potential risk to groundwater exposure needs to be evaluated. Conversely, if COPC concentrations in groundwater do not exceed the screening criteria, then no further evaluation will be required.
- If soil vapor concentrations at a monitoring location exceed the site specific threshold values, then evaluate the potential for UST-related contamination to migrate and impact groundwater. Conversely, if soil vapor concentrations do not exceed the site specific threshold values, then no further evaluation will be required.
- If fuel product is identified at a monitoring location, then evaluate the potential risk to groundwater exposure and the need for remedial action. Conversely, if no fuel product is identified, then no further evaluation or action will be required.

4.1.6 Specify Performance Acceptance Criteria

The probability of procedural errors will be controlled through the consistent application of standard sampling and analysis procedures and sound data quality management.

4.1.7 Develop the Plan for Obtaining Data

The sampling locations were chosen based upon previous investigations and monitoring. The analytical methods and criteria are presented in subsequent sections of this document. Also discussed are field and laboratory QA, data management, and data evaluation.

4.2 QA/QC Sampling and Sample Handling Procedures

4.2.1 Sample Collection Method

Collection and handling procedures have been designed to ensure that project personnel will be able to collect, label, preserve, and transport samples in a consistent manner to maintain sample integrity for the intended purposes of this LTM. Field activities will be performed in accordance with the procedures described in Section 3 of this WP.

4.2.2 Field QC Samples

The field QC samples for this project will consist of duplicates, MS/MSDs, and trip blanks.

Duplicates

Field duplicate samples are used to document the overall precision of the sample collection program. Field duplicate samples will be collected at a minimum rate of 10 percent. Field duplicate samples will be assigned unique identification numbers that do not indicate that the sample is a duplicate. All duplicates will be analyzed for the same parameters as regular project samples.

MS/MSD

Laboratory MS and MSD analysis are used to assess analytical accuracy and precision in response to potential matrix interference. If all of the MS and MSD recoveries are within laboratory specified ranges, then all data is considered to be accurate

Trip Blanks

Trip blanks are used to document contamination attributable to shipping and field handling procedures. The trip blanks will be prepared by the analytical laboratories using reagent grade water in 40 ml volatile organic analysis (VOA) vials. Trip blanks will accompany every cooler from the analytical laboratory to the field and will be handled like project samples, and returned to the laboratory along with project sample shipment. The trip blanks will be analyzed for the same parameters as regular project samples.

4.2.3 Sample Containers

The groundwater samples for chemical analyses will be placed in the sample containers listed in Table 3-2, preserved as indicated, and analyzed within the holding times. These containers, preservatives, and holding times are specified in the respective analytical methods. APPL Inc. will supply the required sample containers.

4.2.4 Sample Labeling

Each sample will be assigned both an EPA ID number and a descriptive ID number in accordance with the procedures described in Procedure I-A-9, *Sample Naming* (DON, 2007). All sample ID numbers will be recorded in a sample logbook maintained by the field QA coordinator. This is covered in section 3.1.7.

4.2.5 Field Instrument Calibration/Documentation

The following activities and documentation will be performed and maintained for all field equipment requiring periodic calibration.

- Electronic equipment requiring calibration will be calibrated prior to use by those persons directly responsible for the equipment, such as the field staff.
- Field equipment will be checked to verify that all of the equipment is calibrated according to the manufacturer's instructions and is operating properly prior to use every day.
- Field equipment that has been dropped, damaged, or is believed to be inaccurate will be tagged as inoperable, removed from service and recalibrated. Field equipment that cannot be repaired or recalibrated will be replaced.
- Documentation pertinent to the calibration and maintenance of field equipment will be maintained in a bound field logbook. Entries made into the log book regarding the status of field equipment will contain, but are not necessarily limited to, the following information:
    - date, time, and calibration readings;
    - name of person conducting calibration; and
    - type of field equipment being serviced and identification number (e.g., serial number) and reference standard used for calibration (e.g., pH of buffer solution).

The field logbook or photocopies of applicable pages will be made a part of the permanent project record upon completion of the project.

4.3 Laboratory Requirements

All laboratory activities will be performed in accordance with the *DOD Quality Systems Manual for Environmental Laboratories, Version 4* (DOD, 2009). All laboratory submittals will be Naval Installation Restoration Information Solution compatible.

4.3.1 Project Analytes

Analytical data will be generated using EPA methodologies published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846" (EPA, 1996). The following analytical methods will be used during this investigation:

- TPH-DRO – EPA Method 8015B;
- TPH-GRO – EPA Method 8260B;
- VOCs – EPA Method 8260B;
- PAHs – EPA 8270C SIM; and
- Dissolved lead – EPA 6020.

Standard sample preparation and extraction procedures for each analytical method will be used by the analytical laboratory.

4.3.2 Reporting Limits

Reporting limits are established by the laboratory based on the limits of quantitation (LOQs), historical data, and EPA limits established for the analytical methods employed. The reporting limits for samples may require adjustment due to matrix interference or if high analyte concentrations necessitate sample dilution before analysis. Matrix interference and sample dilutions have the effect of increasing the reporting limits. Failure to meet the specified reporting limits will be described in the sample delivery group case narrative and summarized in the data review reports.

Appendix E lists the analyte DOH EALs along with the respective limits of detection (LODs) and LOQs from APPL, Inc. Laboratories.

4.4 Analytical Data Quality Review

Data quality will be assessed by evaluating the accuracy, precision, representativeness, completeness, and comparability parameters.

4.4.1 Accuracy

Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. When applied to a set of observed values or measurements, accuracy will be a combination of random and systematic (bias) error. Analytical accuracy will be defined as the percent recovery (%R) of an analyte in a reference standard or spiked sample. Accuracy limits for laboratory control samples are established by individual laboratories. The acceptance criteria for accuracy are dependent on the analytical method, and are based on historical laboratory data. Failure to meet the accuracy limits will be described in the sample delivery group case narrative and summarized in the data review reports.

The percent differences (%Ds) of the continuing calibration is also an indication of accuracy. Sample results are qualified "UJ" for non-detects and "J" for detects, if the %D for a continuing calibration is out of the acceptable range, this will be reported by the laboratory in the analytical analysis.

4.4.2 Precision

Precision is defined as the agreement between a set of replicate measurements without assumption or regard about the true value. Precision limits for laboratory measurements will be evaluated from the sample/sample duplicate analyses results. Field sampling precision will be evaluated from field duplicate sample analyses results.

The relative percent difference (RPD) measured between two duplicate samples will serve as the quantitative measure of precision. Precision for sampling is evaluated separately from precision for analytical data. Field co-located samples help clarify the distinction between uncertainty due to analytical variability and heterogeneity of the sample matrix. These field duplicates are co-located samples that are collected either at a location immediately adjacent to the original samples, immediately above or below the original samples, or from the same locations and at the same time as the original samples.

Laboratory control samples (LCS)/duplicate LCS analyses results will be used to assess analytical precision.

4.4.3 Completeness

Completeness is defined as the overall percentage of valid analytical results (including estimated values) compared to the total number of analytical results reported by the laboratory. The completeness goal for this project will be 90 percent. Successful completion of data acquisition can only be accomplished if both the field and laboratory portions of the project are performed according to the procedures described in the QAPP.

4.4.4 Representativeness

Representativeness is the degree that data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be achieved by conducting sampling in compliance with the sample collection procedures described in the SAP (Section 3). Homogenized field duplicate samples will be collected and used as a means to assess field representativeness. The SAP sections details preliminary sample points; however, once on site, the number and types (matrix) of samples collected at each investigation site will be reassessed to ensure that the site is adequately sampled. Sample locations will be biased towards areas where releases would likely migrate to and/or accumulate.

4.4.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be related to accuracy and precision because these quantities are measures of data reliability. Data are considered comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Comparability for sampling will be determined to be acceptable based on the following criteria: a consistent approach to sampling was applied throughout the program; samples were consistently preserved; and sampling was performed during the same time of year and under similar physical conditions.

4.5 Data Reporting and Documentation

All data deliverables will be Naval Installation Restoration Information System (NIRIS) compatible. The subcontracted laboratory will prepare and retain full analytical and QC documentation. The following items present the key components of the hard copy deliverables that will be generated:

- data packages along with supporting QC data;
- original copy COC forms (or certified copies);
- cover sheet listing the samples included in the report and narrative comments describing problems encountered during analysis;
- tabulated presentation of analytical results for all samples including reporting limits for all analytes and any laboratory assigned data qualifiers (data qualifiers will be defined and documented in the case narrative);
- tabulated presentation of results for all method and preparation blanks, as applicable; and

- analytical results for all laboratory QC sample analyses (LCS results and recoveries, surrogate recoveries, recoveries, and RPDs; laboratory duplicate (LD) results; and serial dilution results).

4.6 Oversight and Assessment

The QA/QC protocols and procedures will be implemented for all project activities. The plans and procedures implemented in the field and laboratory will be evaluated by direct oversight of activities, surveillance, and review of documentation and data. The oversight and assessment of project activities will be performed by the PM or designee. If problems or incidences of nonconformance are identified, the following sections identify personnel that will deal with them and corrective measures that will be implemented.

4.7 Corrective Action

The ultimate responsibility for maintaining quality throughout the investigation rests with the PM. The day-to-day responsibility for ensuring the quality of field and laboratory activities rests with the FM.

All incidences of nonconformance with the established QC procedures will be expeditiously identified and controlled. No additional work that is dependent on a nonconforming activity that potentially affects data quality will be performed until the identified nonconformance is corrected. Documentation describing the nonconformity will be submitted to the Environet PM. The documentation will include corrective measures to prevent the nonconformity from recurring.

When errors, deficiencies, or out-of-control situations exist, the QA program provides systematic procedures, called "corrective actions," to resolve problems and restore proper functioning to the analytical system. Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the acceptable limits for precision and accuracy;
- blanks or LCS contain contaminants above acceptable levels;
- there are unusual changes in detection limits;
- deficiencies are detected during internal or external audits or from the results of performance evaluation samples; and
- inquiries concerning data quality are received from clients.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory technical personnel or group leader, manager and/or QA department for further investigation. Once the problem is resolved, full documentation of the corrective action procedure will be filed with the QA department through an anomaly or non-conformance form. This form is kept in a project folder and filed in the QA department. Corrective action documentation is routinely reviewed by the QA Manager.

Corrective action is dictated by the type and extent of the non-conformance. Corrective action may be initiated and carried out by non-supervisory staff, but final approval and data review by management is necessary before reporting any information. All potentially affected data must be thoroughly reviewed for acceptance or rejection. Samples are monitored closely so that they can be analyzed within the recommended holding time. However, should a sample be analyzed outside of the specified holding time, a Holding Time Violation Notification is filled out and the Laboratory PM is informed immediately. It is his/her responsibility to inform the PM and QA Manager so that a decision can be made regarding re-sampling.

The laboratory PMs/QA officer share the responsibility of reviewing all laboratory analytical activities to ensure compliance with the QC requirements outlined in this QAPP. This review serves as a control function in that it should be conducted frequently so deviations from method requirements will be immediately identified and corrected.

4.7.1 Field Corrective Action

The FM will review the procedures being implemented in the field for consistency with the established protocols. Sample collection procedures (e.g., preservation, labeling, etc.) will be checked for completeness. When procedures are not strictly in compliance with the established protocol, the deviation will be documented and reported to the PM. Non-conformances will be expeditiously identified and controlled. No additional work that is dependent on a nonconforming activity that potentially affects data quality will be performed until the identified nonconformance is corrected.

Corrective actions will be defined by the PM and documented as appropriate. After implementation of the corrective action, the FM will provide the PM with a written memorandum documenting field implementation. The memorandum will become part of the project files.

4.7.2 Laboratory Corrective Action

The Laboratory QA/QC Officer or designee will be responsible for initiating corrective action as necessary. Non-conformances or problems occurring at the laboratory will be reported to the PM within one working day of identification. Appropriate corrective action will be required if analyses of QC samples or laboratory conditions do not meet criteria specified in the respective methods, the Laboratory QAPP, or this WP.

The Environet Chemist or designee will review the field and laboratory data generated for this project to determine if project QA objectives are met. If any non-conformances are found in the laboratory analytical results or documentation procedures during data assessment and validation, the impact of those non-conformances on the overall project QA objectives will be assessed. Appropriate actions, including resampling, reanalysis, etc., may be recommended to the PM so that the project objectives can be achieved.

4.7.3 Corrective Action Following Data Assessment

The Environet Chemist or designee will review the field and laboratory data generated for this project to determine if project QA objectives are met. If non-conformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical

and documentation procedures, or data review procedures, the impact of those non-conformances on the overall project objectives will be evaluated. Appropriate actions, including re-sampling, reanalysis, etc., will be recommended to the PM so that the project objectives can be accomplished.

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Appendix A Health and Safety Plan

Health and Safety Plan
Long-Term Monitoring,
Red Hill Bulk Fuel Storage Facility
Pearl Harbor, O‘ahu, Hawai‘i

September 2010

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
Pearl Harbor, HI 96860-3139

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

Health and Safety Plan
Long-Term Monitoring,
Red Hill Bulk Fuel Storage Facility
Pearl Harbor, O‘ahu, Hawai‘i

September 2010

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
Pearl Harbor, HI 96860-3139

Prepared by:

Environet, Inc.
650 Iwilei Road, Suite 204
Honolulu, HI 96817-5318

Prepared under:

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

Approvals Page

Health and Safety Plan
Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility
Pearl Harbor, O'ahu Hawai'i
Contract No. N62742-08-D-1930
Contract Task Order HC14

By signing below, I acknowledge that I have reviewed and hereby approve the Health and Safety Plan for the above referenced site. This Health and Safety Plan has been written for the exclusive use of Environet, Inc., its employees, and subcontractors. The plan is written for the specified site conditions, dates, and personnel, and must be amended if these conditions change.

Plan Written By:

Stacey A. Fineran
Stacey Fineran
Environet, Inc., Honolulu

Date: 17 Sep 10

Plan Approved By:

Colette Sakoda
Colette Sakoda
Health and Safety Manager
Environet, Inc., Honolulu

Date: 17 Sept. 10

Plan Concurrence By:

Vilma C. Dupra
Vilma Dupra
Project Manager
Environet, Inc., Honolulu

Date: 17 Sep 10

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Signature Page

By signing below, the undersigned acknowledges that he/she has read and reviewed the Health and Safety Plan for the Long-Term Monitoring at Red Hill Bulk Fuel Storage Facility, Oʻahu, Hawaiʻi. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

Print Name	Signature	Organization	Date

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Attachments

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List of Acronyms

%	percent
°C	degree Celsius
°F	degree Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
BBP	blood borne pathogen
bpm	beats per minute
BTEX	benzene, toluene, ethylbenzene, and xylene
CFR	Code of Federal Regulations
CNS	central nervous system
CPC	chemical protective clothing
CPR	cardiopulmonary resuscitation
CRZ	contaminant reduction zone
CSIR	Contractor's Significant Incident Report
CTO	Contract Task Order
dBA	decibel (A-weighted scale)
EPA	U.S. Environmental Protection Agency
EZ	exclusion zone
FM	Field Manager
H&SM	Health and Safety Manager
H&SP	Health and Safety Professional
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Health and Safety Officer
HSP	health and safety plan
IDW	investigation derived waste
LTM	Long-Term Monitoring
MTBE	methyl tertiary butyl ether
MSDS	material safety data sheet
NAVFAC	Naval Facilities Engineering Command
NIOSH	National Institute of Occupational Safety and Health
NTR	Navy Technical Representative
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PEL	permissible exposure limit
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
RHFS	Red Hill Bulk Fuel Storage Facility
RM	Response Manager
ROCCC	Regional Operations Command and Control Center

RPM	Remedial Project Manager
SLM	sound level meter
SVMP	soil vapor monitoring point
TLV	threshold limit value
U.S.	United States
UST	underground storage tank
VOCs	volatile organic compounds
WP	work plan

Section 1 Introduction

The provisions of this Health and Safety Plan (HSP) are mandatory for all project personnel and subcontractors involved in the performance of the Long-Term Monitoring at Red Hill Bulk Fuel Storage Facility (herein referred to as RHFS), O‘ahu, Hawai‘i. This HSP also provides the notification of the chemical and physical hazards known to be associated with the activities addressed in this document. A hard bound copy of this HSP will be maintained onsite at all times during the performance of field activities.

No operational changes to this HSP that could affect the health or safety of personnel, the community, or the environment may be made without prior approval of the Environet Project Manager (PM) and the Health and Safety Professional (H&SP), and the concurrence of the Navy’s Contracting Officer. If the HSP should conflict with federal, state, or local regulations, the most stringent rule will apply.

These work activities were authorized by the Naval Facilities Engineering Command (NAVFAC) Hawai‘i as part of Contract Task Order (CTO) HC14 of Environmental Technical Services Contract Number N62742-08-D-1930.

1.1 Health and Safety Policy Statement

It is the policy of Environet to provide a safe and healthful work environment for all its employees. Environet considers no phase of operations or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency or shortcuts. At Environet, we believe every accident and every injury is avoidable. We will take every reasonable step to reduce the possibility of injury, illness, or accident.

This HSP presents the procedures to be employed during all on site work activities. The practices and procedures in this HSP are mandatory for all project personnel and subcontractors, while engaged in work operations at the site. All visitors to the project sites must also abide by these procedures.

1.2 Classification of Activities

The planned project activities are not considered to be Hazardous Waste Operations as defined in Title 29 of the Code of Federal Regulations (CFR) Part 1910, Section 120, subsection (a) [29 CFR 1910.120(a)].

1.3 Regulatory Requirements

This HSP meets the requirements and follows the guidelines established in the following documents:

- *Safety and Health Requirements Manual*, EM-385-1-1 (United States (U.S.) Army Corps of Engineers, 2008).
- 29 CFR 1910, *Occupational Safety and Health Standards* (with specific attention to Section 120, Hazardous Waste Operations and Emergency Response (HAZWOPER)).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health*. National Institute of Occupational Safety and Health (NIOSH) 85-115, 1985.

The requirements also conform to Environet's Safety Program requirements as specified in the Environet Safety Manual.

1.4 Operational Risk Management

This HSP is prepared in accordance with the Navy's principles of Operational Risk Management (ORM). ORM is a decision making tool used to increase operational effectiveness by anticipating hazards and reducing the potential for loss, thereby increasing the probability of successful job performance.

The purpose of ORM is to minimize risks to acceptable levels, using the following four principles:

- accept risk only when the benefit outweighs the risk;
- accept no unnecessary risk;
- anticipate and manage risk by planning; and
- make risk decisions at the right level.

ORM is conducted using the following 5-step sequence. These steps are incorporated into this HSP, as indicated:

- identify hazards –Section 5;
- assess hazards –Section 5;
- make risk decisions –Section 5;
- implement Controls –Section 4, Section 6, and Section 7; and
- supervise – Section 3.

Section 2 Management of Health and Safety Responsibilities

Project/field level management of health and safety requires that a management organization be established for each project. The organizational structure for health and safety is standardized for all Environet projects, with positions and responsibilities for individual projects defined and assigned according to task requirements. This section describes the organizational structure for this project.

2.1 Program Manager (Mr. Zachary Payne)

The Program Manager is responsible for ensuring that PMs are provided with adequate programmatic guidance, resources, and support to enable safe planning and performance of field operations. Programmatic management and technical support aspects of this responsibility are delegated to the Health and Safety Manager (H&SM); however, the Program Manager retains ultimate responsibility for ensuring that work activities are performed safely.

2.2 Health and Safety Manager (Ms. Colette Sakoda)

The H&SM oversees the technical and programmatic aspects of Environet's Safety Program. In addition, the H&SM exercises CTO-specific duties, which include the following:

- review and approval of this HSP; and
- coordinate/delegate CTO safety duties to the H&SP.

2.3 Health and Safety Professional (Mr. Mike Van Woerkom)

The H&SP is assigned to oversee health and safety requirements for the RHSF Long-Term Monitoring (LTM) and provide any needed technical support. The H&SP will be the first point-of-contact for all of the RHSF LTM health and safety matters. Duties include the following:

- preparing this HSP and any required changes;
- approval of the designated Site Health and Safety Officer (HSO);
- reviewing all personal exposure monitoring results; and
- investigating any reported unsafe acts or conditions.

2.4 Project Manager (Ms. Vilma Dupra)

The PM is responsible for coordinating with local Navy representatives, discipline managers, and subcontractors to complete the project in accordance with requirements set forth in this HSP and/or other project safety documentation. The PM has final responsibility for managing all

aspects of the work operations, and is responsible to Environet management for the safe performance and completion of the work activities. Specific safety-related duties include the following:

- ensuring that an approved HSP is prepared that addresses all aspects of the work to be performed;
- ensuring that all personnel assigned to perform the onsite activities meet the required qualifications;
- providing adequate resources and supplies to fulfill all work safety requirements;
- assigning the Field Manager (FM) and HSO, to provide onsite management of work activities; and
- contacting the HSM for guidance regarding any health and safety-related matters.

2.5 Field Manager (Mr. Max Solmssen)

The FM, Mr. Solmssen will be assigned to manage all project personnel and subcontractor activities at the site, and be responsible for field implementation by all personnel, observing that field supervisors and subcontractors enforce all provisions of the HSP/other safety documentation, working with the HSO, Ms. Koide to implement all safety performance elements, and consulting with the H&SP regarding any necessary changes to safety requirements. Mr. Solmssen has completed the required Occupatoinal Safety and Health Administration (OSHA) 30 hour training requirement as well as cardiopulminary rescesitation (CPR), First Aid and OSHA 40 hour HAZWOPER training. Other responsibilities include the following:

- reading and becoming familiar with the HSP;
- establishing communications with all potential emergency response organizations;
- enforcing the HSP and other safety regulations;
- ensuring that no work is performed that is not properly addressed in this HSP (or approved supplemental guidance);
- maintaining the presence of at least two qualified first-aid providers on site at all times; and
- contacting the H&SP for guidance regarding any health and safety-related matters.

2.6 Health and Site Safety Officer (Ms. Shelby Koide)

The HSO, and will be responsible for the execution of the routine onsite duties for health and safety, with assistance and direction from the designated H&SP. Ms. Koide has completed the required OSHA 30 hour training requirement as well as CPR, First Aid, and OSHA 40 hour HAZWOPER training. The responsibilities of the HSO include the following:

- conducting periodic safety reviews of the project site and project documentation;

- performing daily site inspections to identify hazards and observe employees at work, any deficiencies will be logged and abated;
- stopping work, as required, to maintain personnel and environmental health and safety;
- determining emergency evacuation routes, establish and post local emergency telephone numbers, and arrange emergency transportation;
- ensuring that all site personnel and visitors have received the proper training and medical clearance prior to entering the site;
- establishing any necessary controlled work areas (as designated in this HSP or other safety documentation);
- presenting tailgate safety meetings and maintaining attendance logs and records;
- discussing potential health issues with the FM, H&SP, and the PM;
- implementing air monitoring according to directives in this HSP or other health and safety documentation, and forwarding all employee exposure monitoring information to the H&SP to enable the exposure notification;
- implementing the field elements of the Respiratory Protection Program;
- maintaining decontamination procedures that meet established criteria;
- review and approve subcontractor accident prevention plans, and activitivy hazard analyses; and
- ensure field activities are conducted in accordance with this HSP.

2.7 Subcontractors

Each subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment, to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personal protective equipment (PPE).

Each subcontractor is considered to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Subcontractors will provide properly completed Activity Hazard Analyses (AHA) for tasks they will perform for review prior to the start of onsite activities, if required. In the event that subcontractor procedure/requirements conflict with requirements in this HSP, the more stringent guidance will be adopted.

Hazards not listed in this HSP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the PM or the FM prior to beginning work operations. The FM or authorized representative has the authority to halt any

subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

2.8 Onsite Personnel and Visitors

All onsite personnel and visitors are responsible for his/her own health and safety, for completing assigned tasks in a safe manner, and for reporting any unsafe acts or conditions to his/her supervisor and/or the FM/HSO. All personnel are responsible for continuous adherence to the specified health and safety procedures during the performance of their work. No person may work in a manner that conflicts with the letter or intent of safety and environmental precautions expressed in these procedures. After due warnings, the FM will dismiss from the work site any person who violates safety procedures. All project personnel will be subject to progressive discipline and may be terminated for blatant or continued violations or creating conditions that are immediately life-threatening. All onsite personnel and visitors will attend a daily "tail-gate" safety meeting conducted by the SHO.

All personnel working for Environet and its subcontractors are required to read and acknowledge their understanding of the HSP and any other applicable health and safety documentation. All visitors to controlled work areas of any project site must likewise read and acknowledge their understanding of the applicable health and safety requirements. All personnel are expected to abide by all written health and safety requirements and any supplementary instructions communicated by the HSO, and cooperate with supervisory personnel to ensure a safe and healthful work site. Site personnel are also required to report immediately any of the following to the FM:

- accidents and injuries, no matter how minor;
- unexpected or uncontrolled releases of any hazardous substances;
- any symptoms of exposure to a hazardous substance;
- any unsafe or malfunctioning equipment;
- "Stop Work" order due to an unsafe act; and
- any changes in site conditions, which may affect the health or safety of project personnel.

Section 3 Summary of Site Conditions and Planned Work Activities

The following is a summary of information concerning conditions at the sites and a description of work activities to be performed during the project. A more detailed accounting of this information is presented in the project Work Plan (WP).

3.1 Site History and Current Conditions

Section 1.3 of the WP describes the site history and current conditions for the RHFS addressed in this HSP.

3.2 Scope of Work

Environet will perform groundwater, soil vapor, and fuel product monitoring at the RHFS, and groundwater monitoring at two wells outside RHFS. The monitoring effort includes the following tasks:

- **Groundwater Sampling.** Groundwater samples will be collected from 7 existing groundwater monitoring wells using a low flow dedicated bladder pump (five wells inside RHFS and two wells outside RHFS).
- **Soil Vapor Monitoring.** Soil vapor monitoring will be collected from 18 soil vapor monitoring points (SVMP) under the Underground Storage Tanks (USTs) at RHFS by use of a photo-ionization detector (PID).
- **Fuel Product Monitoring.** Fuel product monitoring on top of the groundwater at four wells located on RHFS will occur using a Solinst 122© oil/water interface probe.

The following additional tasks will also be performed as necessary in support of the site characterization activities:

- **Equipment Decontamination.** The field team will perform decontamination of equipment used to perform work.
- **IDW.** IDW will be collected and categorized as non-hazardous or hazardous. Potentially hazardous IDW (decontamination water) will be tested and disposed of within 90 calendar days of completing the field activities.

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Section 4 General Health and Safety Procedures

The requirements based on 29 CFR 1910.120 or HAZWOPER, including medical monitoring and training, for the project, are identified in the following safety procedures.

Personnel must successfully complete training meeting the provisions established in 29 CFR 1910.120 (e) (2) and (e) (3) (40-hour initial training). All personnel will also receive annual refresher training in accordance with 29 CFR 1910.120 (e) (8), and must have completed the most recent training course within the previous 365 days. In addition, personnel must have completed a physical exam in accordance with the requirements of 29 CFR 1910.120 (f) where the medical evaluation includes a judgment of the employee's ability to use respiratory protective equipment and to participate in hazardous waste site activities.

4.1 Visitor Clearances

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HSP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

- A written confirmation must be received by Environet documenting that each of the visitors has received the proper training and medical monitoring required by this HSP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
- Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
- All visitors must be escorted by project personnel.

If the site visitor requires entry into any Exclusion Zone (EZ), but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

4.2 Onsite Training Procedures

The following training procedures will be accomplished for all operational activities. Additional training may be required according to the specific job task performed by the worker.

4.2.1 Site-Specific Initial Training

All onsite personnel will be trained about potential hazards at the work site, and exposure prevention or control measures. Field personnel will be:

- instructed of the contents of applicable portions of this plan;

- present at a daily "tail-gate" safety meeting prior to the commencement of each field activity;
- made aware of task-specific physical hazards and other hazards that might be encountered during site work (see the AHA in Attachment A);
- informed about potential routes of exposure, protective clothing, precautionary measures, and symptoms or signs of chemical exposure and heat stress; and
- made aware of fire prevention measures, fire extinguishment methods, and evacuation procedures.

The FM shall ensure that this training is provided to each person prior to his/her entry into any controlled area. All site-specific training will be documented on the tailgate safety briefing form.

4.2.2 Site-Specific Tail-Gate Safety Meetings

All onsite personnel will take part in a daily health and safety meeting prior to the start of work. The following topics will be discussed at the daily tail-gate meeting:

- mandatory training and certifications for personnel onsite,
- emergency response procedures including the alarm noise and muster point,
- heat stress, hydration, and breaks,
- biological hazards,
- working in an enclosed space as opposed to outdoors, and
- slips, trips, and falls.

4.2.3 Hazard Communication Training

A copy of the Material Safety Data Sheet (MSDS) for each hazardous material or product brought onto the work site will be provided to the SSO for approval and filing. MSDSs for all hazardous materials brought onto the work site, as well as MSDSs for JP-5, JP-8, and diesel marine fuel are included in Attachment B, a copy of which will be maintained on site as part of the HSP. For locally obtained products, MSDSs may not be available, in which case some alternate form of product hazard documentation can be used, provided it is approved by the H&SP. In accordance with the requirements of Safety Health & Environment 115, Hazard Communication, all personnel shall be briefed on the hazards of any chemical products they use (e.g., propanol used for decontamination), and shall be aware of and have access to all MSDSs.

All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall also contain additional information indicating potential hazards (flammability, reactivity, etc.).

4.3 General Site Safety Rules

In addition to HAZWOPER, the general site safety rules for the project effort are identified in the following sections.

4.3.1 Smoking, Eating, and Drinking

Smoking, eating, and drinking will not be permitted in controlled work areas. Field workers will first wash hands and face immediately after leaving the controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any site.

4.3.2 Personal Hygiene

An adequate supply of potable water will be available for field personnel consumption and use in cleaning activities. Potable water used for drinking can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Adequate disposal containers will be provided.

If access to toilet facilities is not available, then a portable toilet facility will be provided to the work site. Portable toilets must include hand-washing capabilities (hand wipes are adequate to meet this need).

Personnel will be provided access to washing facilities (e.g., buckets with water and Alconox) at the work site. Personnel will be required to clean hands and face using water and hand soap (or similar substance) prior to breaks and at the end of daily work activities.

4.3.3 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Buddies will double check the checklist of items for sampling, decontamination and PPE to be worn prior to entering the tunnel because access to the trucks will be limited. Personnel belonging to another organization on site can serve as "buddies" for project personnel. Under no circumstances will project personnel be present alone in a controlled work area.

4.3.4 Lighting

At a minimum, all portions of each work location will be sufficiently lit so that all surfaces are illuminated at 10 foot-candles or greater. The use of supplemental light is required for this project since most of the sampling will occur in underground tunnels. Each member of the field team that will be working inside a tunnel will be required to carry a flashlight with working batteries.

4.3.5 Work Area Control Records

The HSO will record daily the identities of all personnel at time of entry who are working in or entering the Controlled Area/EZ and note the time of departure of personnel.

4.4 Drum Handling

Where containers greater than 10 gallons are used for containerizing chemical products or waste materials, handling of the containers will be accomplished in accordance with the following:

- When not in use, drums/containers will be covered with tight fitting lids.
- At the conclusion of each work shift all drums/containers will be placed in a designated waste storage area. This area will be properly marked and secured.
- Mechanical or powered drum handling equipment will be used to move drums/containers that weigh in excess of 49 pounds. Manual handling of drums leads to muscular-skeletal injuries and will be avoided to the maximum extent possible.

4.5 Heat Stress Prevention

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in the hot, humid environment of O'ahu. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress.

Administrative controls, physiological monitoring, and the adjusted temperature method will be implemented to manage and minimize the effects of heat stress throughout work activity at the site. These methods are described below.

Heat stress control measures will be implemented as necessary at the inception of work activity. Administrative controls include training in causes of heat stress, physiological reaction/response, preventive measures, and first aid. Other administrative controls encompass intermittent rest periods with water breaks, and shaded break areas.

4.5.1 Responding to Heat-Related Illness

Project site personnel will be observed and evaluated for heat stress from the beginning of work activity (when they wear permeable clothing) through physiological monitoring, as weather and employee conditions require it. This regimen will be followed because Wet Bulb Globe Thermometer Monitoring will not be used. This option is permissible through EM 385-1 Section 06.J 04 a, American Conference of Governmental Industrial Hygienists' Threshold Limit Values and Biological Indices, and Occupational Safety and Health Administration (OSHA) Technical Manual Section III\Chapter 4 Heat Stress.

When ambient temperatures reach 70 degrees Fahrenheit (°F) and site workers are wearing permeable, semi-impermeable or impermeable protective clothing, physiological monitoring will continue. The guidance in Table 4-1 will be used in identifying and treating heat-related illness.

Table 4-1: Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability,	Provide the victim with a work break during which he/she may relax, remove any excess protective

Table 4-1: Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
	lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	clothing, and drink cool fluids. If an air-conditioned spot is available, this is an ideal break location. Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling). Remove all protective outerwear. Call a physician. Treat the victim for shock. (Make the victim lie down, raise his or her feet 6–12 inches, and keep him or her cool by loosening all clothing). If the victim is conscious, it may be helpful to give him or her sips of water. Transport victim to a medical facility as soon as possible.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 °F or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, and nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	Immediately evacuate the victim to a cool and shady area. Lay the victim on his or her back with the head and shoulders slightly elevated. Remove all protective outerwear and as much personal clothing as decency permits. Apply cold wet towels or ice bags to the head, armpits, and thighs. Sponge off the bare skin with cool water or rubbing alcohol, if available. The main objective is to cool without chilling the victim. Give no stimulants or hot drinks. Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility. Victim must be seen by the company or personal physician prior to returning to work.

4.5.2 Adjusted Temperature Method

This method can be utilized where Wet Bulb Globe temperature data is not available, and requires only that the ambient temperature (in °F) be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate humidity, and a fully acclimated work force). The adjustments should be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 4-2. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the *Adjusted Temperature*, which can be compared with the values in Table 4-3 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching, very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 4-2: Temperature Adjustment Factors

Time of Day	Temperature Adjustment Factors
Before daily temperature peak[a]	+2°F
10 am – 2 pm (peak sunshine)	+2°F
Sunshine	
No clouds	+1°F
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F
Cloudy (>7/8 cloud cover)	-7°F
Indoor or nighttime work	-7°F
Wind (ignore if indoors or wearing chemical protective clothing (CPC))	
Gusts greater than 5 miles per hour at least once per minute	-1°F
Gusts greater than 10 miles per hour at least once per minute	-2°F
Sustained greater than 5 miles per hour	-3°F
Sustained greater than 10 miles per hour	-5°F
Humidity (ignore if wearing CPC)	
Relative Humidity greater than 90 percent (%)	+5°F
Relative humidity greater than 80%	+2°F
Relative Humidity less than 50%	-4°F

[a] This adjustment accounts for temperature increase during the day. If the temperature has already reached its daytime peak, it can be ignored.

Table 4-3: Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Schedule	Adjusted Temperature (°F)			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No specified break	< 80	< 75	< 70	< 65
15 minute break every 90 minutes of work	80 – 90	75 – 85	70 - 80	65 – 75
15 minute break every 60 minutes of work	>90 – 100	> 85 – 95	>80 - 85	>75 – 80
15 minute break every 45 minutes of work	>100 – 110	>95 – 100	>85 - 90	>80 – 85
15 minute break every 30 minutes of work	>110 - 115	>100 – 105	>90 - 95	>85 – 90
15 minute break every 15 minutes of work	>115 - 120	>105 – 110	>95 -100	>90 - 95
Stop Work	**>120**	**>110**	**>100**	**>95**

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

4.5.3 Evaluating the Work-Rest Schedule's Effectiveness

The intent of the Work-Rest Schedule is to provide effective administrative controls to preclude exposure to heat stress, as much as possible. Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each worker's pulse and temperature can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

At the start of the workday each worker's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four. Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- each worker's maximum heart rate at the start of any break should be less than [180 minus workers age] bpm. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- at the end of each work period, all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be re- measured and the end-of-break criteria again applied.

Temperature can be checked with an aural, temporal, or disposable oral thermometer after work activity or before the employee drinks water. If the body temperature exceeds 37.6 degrees Celsius (°C) or 99.68 °F, shorten the work cycle by one third[1]. If body temperatures of 38.3 °C or 101 °F is the upper limit for not sending employees back to work.

Recommended Guidelines

The guidelines discussed in this section are intended to be used only as a means for initial establishment of a work/rest regimen.

- The onsite health and safety representative will evaluate the conditions at a specific operation and make final determinations of the work/rest regimen.
- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two eight ounce glasses of water should be taken prior to beginning work, then up to 32 ounces per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration, and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
    - scheduling work at night or during the cooler parts of the day (6 am - 10 am, 3 pm - 7 pm).

[1] Temperature evaluation step obtained from OSHA Technical Manual Section III, Chapter 4 - Heat Stress.

  - erecting a cover or partition to shade the work area.
  - use of cooling garments (this option is expensive and logistically difficult to implement).

- The health and safety representative will determine the potential for heat stress based on planned activities and weather forecasts.
- If the potential for heat stress exists:
  - All site workers will be informed of the potential for heat stress during the daily safety meeting.
  - The health and safety representative will determine if any workers are at particular risk for heat stress due to illness, etc.
  - The health and safety representative will ensure that sufficient quantities of potable water and electrolyte drinks are available in the decontamination area and that a shaded rest area is available at or immediately outside the decontamination area.
  - All workers will drink 16 ounces of water prior to beginning work and at least 16 ounces during each rest period.
- The initial work period and monitoring frequency is set according to the level of risk for heat stress.
- Within the first minute of each rest period, each worker's heart rate (pulse) will be measured, and compared to the following:
  - initial heart rate: 110 bpm (28 beats/15 sec).
- Each worker's heart rate will be measured again three minutes later, and compared to the following:
  - recovery heart rate: 80 bpm (20 beats/15 sec).
- If both heart rate criteria are met, the subsequent work period may be increased by one third, provided the temperature remains constant.
- If the initial heart rate is > 110 bpm, or the recovery rate is not less than 80 bpm, the subsequent work shift is decreased by one third.
- Additional means of prevention include:
  - cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.
  - Employees will open or remove chemical protective garments during rest periods.
  - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
  - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.

4.6 Fire Hazard Prevention

Fire Hazard is a serious potentially life threatening situation at the Red Hill Bulk Fuel Storage Facility. There are 18 USTs that are currently being utilized onsite and each holds 20.5 million gallons of product. Products range from Jet Propellant to diesel, in the past they have also contained automotive gasoline and oil. Sampling will occur on the RHFS in tunnels therefore extreme caution to not ignite any potentially flammable vapors is imperative.

The guidelines discussed in this section are intended to be used as a means for safe sampling activities in the work areas.

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Section 5 Hazard Assessment

For this project, project personnel and subcontractor(s) will perform tasks associated with project activities. Performance of these tasks can expose personnel to a variety of hazards due to the operational activities, physical conditions of the work locations, and potential presence of environmental contaminants (see Section 3).

5.1 Specifications of Work Tasks

The following work task is to be performed during the project activities:

- groundwater monitoring;
- soil vapor monitoring;
- fuel product monitoring;
- equipment decontamination; and
- IDW handling and disposal tasks.

AHAs have been prepared for the work tasks that specify the major performance steps, identify the related hazards and applicable safety procedures, and specify any additional requirements.

5.1.1 Unanticipated Work Activities

When work activities are identified which are not addressed in this HSP, appropriate safety documentation and procedures will be implemented. AHAs are included in Attachment A of this HSP.

5.2 Suspected Environmental Contaminants

The information presented below is intended to inform site personnel about the expected hazards associated with known or suspected environmental contaminants.

Suspected environmental contaminants include the following:

- TPH-Diesel
- TPH-Gasoline
- VOCs
- PAHs
- dissolved lead

Total Petroleum Hydrocarbons in the Gasoline Range

Gasoline is a complex mixture of hydrocarbons and additives, used primarily as a motor fuel. Gasoline possessed moderate to high vapor pressure, meaning it is highly volatile. The lower explosive limit for gasoline is 1.1 percent concentration in air; fire/explosion can be significant in enclosed spaces where airborne concentrations may accumulate.

Chronic exposures or exposures to high concentration of gasoline vapor may cause unconsciousness, coma, and possible death from respiratory failure. Exposure to low concentrations of gasoline vapors may produce flushing of the face, slurred speech, and mental confusion. Gasoline is also irritating to the skin, and may cause drying and dermatitis as a result of prolonged contact.

Various components and additives of gasoline can themselves present significant additional hazards. The aromatic compounds benzene, toluene, ethylbenzene, and xylene (BTEX) are of greatest concern in relation to site characterization activities, and are addressed separately below. However, some additives used for octane control (e.g. methyl tertiary butyl ether MTBE), oxygenated (e.g., alcohols and MTBE), and water scavenging (e.g., methylene glycol methyl ether) can also present significant hazards as a result of prolonged inhalation or skin exposure. In the past, tetra-ethyl and tetra methyl lead, both of which have been identified as carcinogens and present moderate skin contact hazards, were added to gasoline for anti-knock control.

Both the OSHA permissible exposure limit (PEL) and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for gasoline are 300 parts per million (ppm). Control of inhalation exposure to gasoline (and its various constituents and additives) can be accomplished by using air-purifying respirators equipped with organic vapor cartridges. The use of skin protection (e.g. chemically protective gloves) is required when handling gasoline-contaminated materials.

Total Petroleum Hydrocarbons in the Diesel Range

Like gasoline diesel is a complex mixture of hydrocarbons. It is manufactured through refining of middle-distillate crude oil components, and thus is somewhat less volatile than gasoline (which comes from light stocks).

Exposure to diesel fuels can produce intoxication and other central nervous system (CNS) depression effects in cases of acute exposure, and can lead to defatting of skin and contact dermatitis in case of contact exposure. Like gasoline, diesel fuel contains some small quantities of volatile hydrocarbon additives, including BTEX members.

There are no established exposure standards from either OSHA or ACGIH for diesel fuel; however, action levels should be developed that reflect the potential presence of BTEX (particularly benzene) when diesel fuels are present. Control of inhalation exposure to diesel fuel (and its various constituents) can be accomplished by using air-purifying respirators equipped with organic vapor cartridges. The use of skin protection (e.g. chemically protective gloves) is required when handling diesel-contaminated materials.

Volatile Organic Compounds (VOCs)

VOCs are organic chemical compounds that have high enough vapor pressure under normal conditions to significantly vaporize and enter the atmosphere. A wide range of carbon based molecules, such as aldehydes, ketones and other light hydrocarbons are VOCs. The most common VOC is methane. Common artificial VOCs include paint thinners, dry cleaning solvents, and some constituents of petroleum fuels.

The most common hazard for VOCs is inhalation. The proper use of air-purifying respirators equipped with P100 cartridges and chemically-protective gloves will adequately protect personnel.

Polynuclear Aromatic Hydrocarbons (PAHs)

PAHs are produced during combustion events due to inadequate oxidation of fuel. PAHs in the pure state are yellowish crystalline solids. They are found in coal tar and products of incomplete combustion. These chemicals have varying degrees of potency for causing cancer, with benzo(a)pyrene being among the most potent. PAHs are evaluated collectively as coal tar pitch volatiles. Coal tar pitch volatiles may cause photosensitization and a rash where sunlight strikes the skin. Exposure may also cause cancer of the lungs, skin, bladder, or kidneys. Benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and ideno(1,2,3,c,d)pyrene have been identified as carcinogenic.

The information for PAH compounds is presented for site contaminant awareness. While the potential for site personnel sustaining significant inhalation exposures to volatilized PAH compounds during this project's site activities in minimal, there is the potential for inhalation of PAH-contaminated dust, and handling of contaminated soil presents skin exposure hazards. Use of dust suppression techniques (as appropriate) and the proper use of air-purifying respirators equipped with P100 cartridges and chemically-protective gloves will adequately protect personnel.

Heavy Metals (including lead)

As a group, the heavy metals (including lead, arsenic, chromium, nickel, cadmium, and selenium) are toxic to a number of organs and organ systems in the body, including the liver, kidneys, blood-forming organs (primarily located in the bones), and the CNS (especially lead). Acute exposure to metals can produce such symptoms as stomach distress and vomiting, mental confusion and sluggishness, heart palpitations, breathing difficulties, and renal (kidney) failure. Chronic exposures can be characterized by deterioration in function of the liver and kidneys, CNS degradation, and abnormal changes in blood cell counts (especially white blood cells).

The primary route of exposure to heavy metals of concern during this project is contact with contaminated soil and water, which can lead to entry through open wounds or contamination and ingestion of food. Preventing this route of exposure necessitates the use of dust control measures, administrative controls (e.g., no consumption of food/beverages in the work area or smoking/chewing tobacco), chemically-protective gloves, and decontamination procedures.

Methane

Methane is a natural compound which is the primary component of natural gas. Methane is not toxic, however it is an asphyxiate and may displace oxygen in an enclosed space. Asphyxia may result if the oxygen concentration is reduced to below 19.5% by displacement.

5.2.1 Assessment of Hazards

There is the potential for occupational exposure to occur through two direct routes (inhalation and skin contact) and one indirect route (ingestion). Descriptions of exposure hazards and protective measures for each contaminant type were presented above.

Inhalation. A potential inhalation hazard from organic vapors exists during sampling activities. Real-time air monitoring for organic compounds, using a PID, will be conducted at well-head opening during these activities.

Skin Contact. Contact with contaminated materials is likely during sampling activities. Protection against skin contact/adsorption can be accomplished by using protective gloves/clothing.

Ingestion. Contact with contaminated materials is likely during sampling activities. Protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas.

Section 6 Activity-Specific Health and Safety Procedures

6.1 Slips, Trips, Falls, and Protruding Objects

Hazards from protruding objects, careless movements, or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to ensure the prevention of such injuries.

6.2 Hazardous Noise Environments

Although not anticipated, working around heavy equipment often creates excessive noise. The effects of noise can include physical damage to the ear, pain, and temporary and/or permanent hearing loss. Workers can also be startled, annoyed, or distracted by noise during critical activities.

Work within 25 feet of heavy equipment, when in operation, can result in exposure to hazardous levels of noise (levels of greater than 90 decibels). Accordingly, all personnel are required to use hearing protection (earplugs or earmuffs) within 25 feet of any operating piece of heavy equipment.

6.3 Manual Materials Handling

All personnel will minimize the use of their back when performing manual handling in excess of 10 pounds. No person shall lift more than 49 pounds without the use of mechanical aid or assistance from other personnel.

6.4 Chemical Exposure Monitoring Procedures

Monitoring procedures will be employed during project activities to assess employee exposure to chemical and physical hazards. Monitoring of the worker(s) breathing zone will be performed when the wells are first opened to assess employee exposure risk using a RAE® Systems Mini-RAE PID and MIE® Model PDM-3 Aerosol Monitor or comparable equipment. If initial readings are within expectable limits work will proceed as planned. If any chemical or physical hazard is detected at the time of well-head opening, all personnel will be notified and evacuated to a safe distance until the hazard is dispersed. Monitoring will consist primarily of onsite determination of various parameters (e.g., airborne contaminant concentrations and heat stress effects), but may be supplemented by more sophisticated monitoring techniques, if necessary.

Monitoring results will be logged in the field book, reviewed, and discussed during tailgate safety briefing.

6.4.1 Monitoring Instrumentation

To assess the exposure potential to environmental contaminants during project activities, onsite monitoring may be performed using the type of real-time instrumentation indicated in Table 6-1.

Table 6-1: Air Monitoring Instrumentation

Instrument	Manufacturer/Model*	Substances Detected
PID	RAE® Systems mini-RAE Photovac Microtip HNu Model HNu 10.2 eV Bulb	Petroleum hydrocarbons (benzene, toluene, ethylbenzene, and xylenes)
Aerosol Monitor	MIE® Model PDM-3	Aerosols
Sound Level Meter (SLM)	Metrosonics Chameleon Quest Model 215 SLM Quest Model 2700 SLM	Sound pressure level (in decibel (A-weighted scale) (dBA)).

*Or similar unit, as approved by H&SP

dBA: disables

All instruments will be calibrated before and after each period of use in accordance with the manufacturer's instructions and standard industrial hygiene practice. Calibration information for each instrument will be recorded in the site log.

6.4.2 Hazardous Noise Monitoring Procedures

When heavy equipment is in operation, it will be necessary to ensure that each EZ fully encompasses all areas where hazardous noise levels are present (85 dBA or greater). Once each work day, the HSO will use a sound level meter to survey the perimeter of each EZ, while all onsite heavy equipment within the zone is being operated simultaneously. If the sound pressure level exceeds 85 dBA at any location along the site perimeter, the HSO will exit the EZ and use the meter to determine the 85 dBA limit. The EZ boundary will then be adjusted to fully encompass this region. Hearing protection will be required during heavy equipment operations. Although planned field activities at the Site are not anticipated to generate significant sources of noise, Environet staff will have ear protection on-site at all times.

Section 7 PPE and Decontamination Requirements

PPE is used to limit employee exposure to hazards anticipated on site. The United States Environmental Protection Agency (EPA) has defined levels of PPE based on skin and respiratory protection. The components of these levels of PPE are shown in Table 7-1. The initial PPE level for this project is Level D.

The H&SM may modify these initial PPE levels in response to additional site information, with the approval of the H&SM. The level of PPE necessary for any decontamination activity will be determined by the H&SM and will be based on specific monitoring results obtained during field investigation activities.

Table 7-1: PPE Levels

EPA PPE Level	Required PPE
Level D	- Disposable coveralls, cotton coveralls, or work clothes - Safety glasses with side shields - Steel-toe shoes - Hard hat - Ear protection (in high noise areas)
Modified Level D	- Tyvek®, or equivalent (e.g., Comfort-Guard), coveralls/disposal work clothing - Safety glasses with side shields - Chemical protective gloves - Steel-toed shoes with disposable shoe covers or chemical protective steel-toed boots - Hard hat - Ear protection (in high noise areas)
Level C	- Tyvek®, or equivalent (e.g., Comfort-Guard), coveralls/disposal work clothing - Inner Nitrile gloves - Outer Nitrile gloves - Steel-toed shoes - Disposable shoe covers - Hard hat - Full-face respirator with combination dust and organic vapor cartridges. - Ear protection (in high noise areas)

Table 7-1: PPE Levels

EPA PPE Level	Required PPE
Level B	- Tyvek®, or equivalent (e.g., Comfort-Guard), coveralls/disposal work clothing - Inner Nitrile gloves - Outer Nitrile gloves - Steel-toed shoes - Disposable shoe covers - Hard hat - Airline or self contained breathing apparatus - Ear protection (in high noise areas)

7.1 Decontamination Procedures

For decontamination purposes, including personnel and equipment, the proper decontamination procedures during the characterization effort will comply with the following procedures.

7.1.1 Personnel Decontamination

If site conditions require, personnel exiting the EZ will be decontaminated before leaving the contaminant reduction zone (CRZ). Primary decontamination will be conducted at the border of the EZ and CRZ.

Decontamination for Level D PPE will include washing boots. Disposable coveralls, gloves, or outer boot coverings, if worn, will be discarded in the appropriate container. If cotton coveralls or work clothes are worn, they will be removed before leaving the site, and street clothes will be donned. Personnel are advised to shower as soon as possible after leaving the site. In the unanticipated event that Modified Level D, Level C, and/or Level B is required at the site, decontamination will be as follows:

- wash boot covers and outer gloves (Wash water will be potable water containing detergent. Rinse water will be potable water.);
- rinse boot covers and outer gloves (e.g., using a long-handled brush in a wash tub containing potable water or a sprayer if available);
- remove tape used to seal gloves and boots and place it in the PPE container;
- remove Tyvek®, coated Tyvek®, or equivalent coveralls (for Level B remove outer coveralls) and place in the PPE container;
- remove boot covers and place in the PPE container;
- remove outer gloves and place in the PPE container;
- inspect boots and check for further decontamination, as needed;
- remove respirators or facemasks and place on equipment table for decontamination;
- remove inner coveralls (Level B) and place in the PPE container;

- remove inner gloves and place in PPE container. If cold weather liners were used, place them in a dedicated receptacle for machine washing and subsequent reuse; and
- if required, transport personnel to the shower and locker room or change out facility for personal washing as necessary.

NOTE: The water repellency of non-coated Tyvek® and similar garments is due to the surface tension of water and the resistance of the Tyvek® fiber to wetting. The presence of surfactants (e.g., detergents) in the water completely defeats the water repellent properties of Tyvek®. Therefore, non-coated Tyvek® and similar fabrics should never be exposed to water and detergent solutions during the decontamination process.

7.1.2 Equipment Decontamination

Equipment decontamination will be performed on all equipment that comes in contact with discreet sampling locations (e.g., sampling equipment). Decontamination will be performed to limit the spread of contamination and limit worker exposure to contamination. Equipment will be decontaminated before personnel decontamination (i.e., personnel will remain in the appropriate level of PPE until equipment decontamination is complete).

7.1.3 Disposal of Decontamination Wastes

A project-specific Waste Management Plan has been prepared and is included in Appendix B of the site RWP. Field personnel will refer to this plan for detailed procedures on disposal of decontamination wastes.

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Section 8 Emergency Action Plan

8.1 General

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the project team. The emergency action plan will be reviewed by all personnel prior to the start of field activities and acknowledged on the Signature Page.

8.2 Responsibilities

8.2.1 Field Manager/Site Safety Officer

The FM/HSO will be the primary contact and coordinator of all emergency activities and will be responsible for the following:

- evaluating the severity of the emergency;
- implementing the emergency evacuation procedures and appropriate response action;
- summoning appropriate emergency services (e.g., fire department, police, or ambulance); and
- notifying all site personnel, the H&SP, and concerned Navy authorities of the emergency situation.

8.3 Emergency Evacuation Procedures

The information contained herein, as it relates to emergency evacuation procedures, is intended for a small work site with limited equipment. The small, mobile work site associated with sample collection operations makes it impractical to pre-determine an evacuation route for inclusion in this HSP; however, the following general evacuation procedure requirements are established here for use by the HSO to determine specific evacuation procedures at each site:

- An alarm system consisting of voice or other audible alarm (e.g., horn) will be identified by the HSO as the emergency evacuation notice, prior to the start of field activities.
- In the event of an emergency evacuation, all personnel in the EZ will exit through the CRZ and congregate at a place of refuge located a safe distance from the site, to be designated by the HSO during the daily tailgate safety briefing.
- The FM will initiate an emergency stop and exit the area in the manner noted in the second bullet.

- Once at the place of refuge, the HSO will account for all site personnel based on the sign-in log for the site; personnel will make all possible attempts to locate unaccounted site personnel and/or contact emergency services.
- Within the first three days of the start of field activities, the HSO will conduct an emergency evacuation training event where all site personnel will practice an emergency evacuation. Immediately following the emergency evacuation training event, a post-training meeting will be held to critique the performance of the training event. The meeting will highlight the strong and weak points of the training event and evaluate corrective actions if necessary.

8.3.1 Other Onsite Personnel

Field personnel are required to inform the HSO of all emergency situations and to abide by their issued response actions. Special medical problems of field personnel, such as allergies to insects, plants, or prescription medication, will be reported to the HSO.

8.4 Emergency Equipment

In accordance with 29 CFR 1910 (General Industry) and 1926 (Construction), the following emergency equipment will be available at the work site and in proper working condition.

8.4.1 First Aid Kit

A first aid kit will be available that meets the following requirements:

- First aid kits will be in weatherproof containers, meet all regulatory requirements, and be present at all locations where project personnel are working.
- Use of any item from the first aid kit shall be replaced within one working day.
- Personnel permitted to use first aid kits will possess a current first aid card. A minimum of two trained first aid/ CPR providers will be present on site at all times. The first-aid/CPR providers will have received blood borne pathogen (BBP) training as required by CFR 1910.1030 and Environet's corporate health and safety policy.

8.4.2 Fire Extinguisher

A fire extinguisher with a minimum rating of 1A:10B:C will be available on site at all times. Site personnel will be trained in the use of the available fire extinguisher type(s), and will be kept aware of any onsite locations of where extinguishers are placed (for access in case of fire).

In addition, a fire extinguisher will be mounted on each piece of heavy equipment for use in an emergency. The minimum rating for each vehicle-mounted extinguisher will be 2A:10B.

8.4.3 Eyewash Units

An eyewash unit will be available at the work site at all times. The eyewash must meet the latest requirements of American National Standards Institute (ANSI) Standard Z358.1 and will be capable of supplying hands-free irrigation for both eyes for at least 15 minutes at a flow rate of at least 0.4-gallon per minute.

8.4.4 Flash Light

Each member of the field team shall carry a flash light incase of a power outage at any time while in the tunnels at RHFS. If a power outage were to occur the tunnels would be completely dark and there would be tripping hazards because there are no known emergency lighting units.

8.5 Response Actions – Safety Equipment Problems

A malfunction or other problem with any health and safety equipment can potentially lead to a medical emergency. Examples include the following:

- leaks or tears in protective clothing;
- failure of respiratory protective devices (i.e., self-contained breathing apparatus or air-purifying respirators); and
- encountering contaminants for which prescribed protective equipment may not be suitable.

These equipment problems must be corrected before proceeding with field activities. Personnel affected by the equipment problem(s) must exit the work area until the problem has been corrected.

8.6 Response Actions – Medical Emergencies

A medical emergency is a situation that presents a significant threat to the health of personnel on site. Chemical exposure, heat stress, cold stress, and poisonous insect bites can cause medical emergencies. Proper care must be initiated immediately. Proper care may be in the form of first aid treatment or emergency hospitalization. Two way radios or some other form of hazard communication devise will need to be onsite in the event of an emergency hospitalization.

Response personnel will accompany victims to the medical facility, whenever possible, to advise on decontamination. Table 8-1 provides instructions to respond to general categories of medical emergencies.

8.6.1 Medical Assistance

The FM or HSO will keep on site the list of emergency telephone numbers and locations of the local fire department, hospitals, ambulance service, and other emergency services (Table 8-2).

All emergency telephone numbers will be verified by the FM or HSO prior to commencing field activities.

In the event of injury, transport personnel to Saint Francis Medical Center-West (Figure 8-1).

At least two qualified first aid providers will be present on site at all times to provide immediate care in the event of accident or injury. Qualified first aid providers will be certified in CPR and BBP training as required by CFR 1910.1030 and Environet's corporate health and safety policy. The HSO will inform hospital personnel of any medical treatment administered to personnel for onsite injury, illness, or exposure to chemical contaminants.

Table 8-1: How to Respond to Medical Emergencies

Emergency	Response
Inhalation	• Call for medical assistance. • Workers wearing proper respiratory protective equipment should remove the victim from the contaminated atmosphere. • If the victim is not breathing, administer mouth-to-mouth resuscitation or CPR immediately.
Eye Contact	• Do not rub eyes. • Flood eyes with emergency eyewash solution. Hold the eye open and flood so that all surfaces are thoroughly washed. • Continue washing for 15 minutes while calling for medical assistance.
Skin Exposure	• Wash skin with soap and water for a minimum of 15 minutes. All contaminated areas on the body, including hair, should be thoroughly decontaminated. • If clothing is contaminated, it should be removed in a way to minimize further contact with the substance. • Seek medical assistance.
Heat Stress	• Remove excess clothing. • Pour water on the victim. • If the victim is conscious, offer water or electrolyte replacement beverage. • Seek medical assistance.

8.6.2 Accident/Incident Reporting

All accidents and incidents that occur onsite during any field activity will be promptly reported to the HSO and the FM.

Table 8-2: Emergency Telephone Numbers and Locations

Fire Department:
Civilian Fire Department 911 Military Fire Department (Navy Regional Operations Command and Control Center [ROCCC]), Pearl Harbor) (808) 474-1271
Medical Care:
Kaiser Permanente Medical Center, Moanalua (808) 834-5333 3288 Moanalua Road

Table 8-2: Emergency Telephone Numbers and Locations

Ambulance:
Military Ambulance (Navy ROCCC, Pearl Harbor) (808) 474-1271
Police:
Military Police (Navy ROCCC, Pearl Harbor) (808) 474-1271 Civilian Police 911
Information and Response Organizations:
National Response Center (if spill over regulated quantity) (800) 424-8802
National Poison Control Center (800) 222-1222
NAVFAC Hawai'i Service Desk (808) 471-8481 or (808) 471-8044
Navy Personnel:
Navy Technical Representative (NTR): Mr. Darren Uchima, NAVFAC Hawai'i (808) 471-1171, ext. 217
Environet Personnel:
Health and Safety Manager, Colette Sakoda (808) 833-2225 Mobile (808) 223-1408
Project Manager Vilma Dupra (808) 833-2225 Mobile (808) 754-3925
Directions to Kaiser Permanente Medical Center, Moanalua - Distance: .1mile, Approximate Travel Time: 5 minutes. 1: Exit and turn right onto Ala Kapuna Street Use the east onramp to the Moanalua Freeway 2: Merge onto the Moanalua Freeway towards Honolulu 3: Take the Puuloa Road Exit 4: Turn LEFT at the stop light 5: Use the onramp to your left to get back onto the Moanalua Freeway 6: Merge onto the Moanalua Freeway heading west. 7: Exit at the first possible exit, Moanalua Road 8: Following the hospital signs, the hospital will be on your right at 3288 Moanalua Road.

If any project personnel are injured and require medical treatment, the FM will contact the PM immediately. The FM will initiate a written report and forward to the PM. The report will then be provided to the H&SP before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the HSO within 24 hours after the accident has occurred.

8.7 Response Actions – Chemical Release or Other Significant Incident

Onsite personnel will implement the following procedures in response to any "incident" which results in an injury, causes damage to Navy or other property that could exceed $500, causes a stoppage or work for more than two hours, or that requires response service from NAVFAC Pacific or other offsite agency. NAVFAC Pacific shall be notified of any chemical spill or petroleum release. The Regional Operations Command and Control Center shall be notified if the spill cannot be contained/controlled, or if it goes into a storm drain, or seeps into the soil, etc. NAVFAC Pacific shall be notified if any damage to utility lines occurs.

8.7.1 Incident Report Actions

1. The senior onsite leader, typically the FM or HSO, will assume full control of all work activities as the designated Response Manager (RM).
2. The RM will assess the incident consequences, and will order an immediate evacuation of the site if an uncontrolled hazard exists to site personnel.
3. Once the risk of worker injury is controlled, priority will be given to identifying and treating injuries, under the direction of the RM. First aid procedures will be implemented immediately for all victims; emergency medical assistance will be contacted (in accordance with HSP procedures) if injuries warrant response by emergency medical technicians. As appropriate, less-severely-injured personnel should be transported to the designated hospital (as time/resources permit), sent home, or released to resume work.
4. Once injury response activities are under control, the RM will perform an assessment of the site conditions and determine if offsite support is required to implement control or corrective procedures. If no outside support is necessary, the RM will direct worker recovery actions to allow resumption of normal activities. Once activities are restored, the RM will contract the PM and HSP-designated H&SP and provide a complete report of the incidence occurrence, any resulting injuries or damage, and the completed response actions. Additional directions issued by the PM or H&SP will be implemented by the RM. The PM will be responsible for notifying the Remedial Project Manager (RPM) and the Program Manager of the incident in as timely a manner as possible. Additional follow-up will be performed as needed, in accordance with the follow-up activities discussed below.
5. If outside support is required in response to post-incident conditions, the RM will contact the NAVFAC Pacific or other designated/appropriate response agency in accordance with the HSP. The response agency will be provided with information concerning site location, the nature of the incident, the assessment of conditions, and what type of support is required. In addition, during the initial contact, the response agency must be informed that the work site is undergoing environmental investigation and that response actions may entail exposure to environmental contaminants.
6. After notifying the response agency of the incident, the RM will immediately contact the PM and HSP-designated HSP and provide a complete report of the incidence occurrence, any resulting injuries and damage, and the status of the on-going response actions. Additional directions issued by the PM or H&SP will be implemented by the RM. The PM will be responsible for notifying the RPM and the Program Manager before the close of business that day, if possible, or else at the start of the next business day. Additional follow-up will be performed as needed, in accordance with the follow-up activities discussed below
7. If response team support will be immediate, the RM will remain on site to meet the response team. If response will be delayed, the RM will coordinate the response schedule to be present when the response agency arrives. If response will not be immediate, the RM will ensure that the site is controlled and poses no health or safety hazard to persons or property before leaving it uncontrolled. If this cannot be

ensured, the RM or other designated personnel will stay on site to maintain control until the response team arrives.

8. The RM will provide the response team leader with a copy of the HSP, along with a concise briefing on site conditions, known physical/chemical hazards, and recommended safety procedures. The RM will endeavor to answer any questions the response team leader may have regarding the environmental conditions of the site or the circumstances of the incident.
9. Once the status briefing is complete, the RM will relinquish operational control of the site to the response team. The RM will remain on site throughout the response team's work unless dismissed by the response team leader or relieved by an appropriate representative (e.g., the PM); however, the RM will NOT direct any response team actions. When the response team has completed its work, control of the site will return to the RM.
10. Once response activities have been completed, the RM will notify the PM and the H&SP.

8.7.2 Injury/Incident Follow-Up Actions

Following any onsite incident, injury, or near-miss, the PM will provide initial and follow-up notification to the contracting officer in accordance to the following schedule:

Serious Contractor Mishap

For any mishap involving a fatality or the hospitalization of three or more workers, or resulting in property damage exceeding $200,000 in value, the following actions will be implemented:

- The H&SP will provide immediate positive voice contact to the RPM. If the RPM is unavailable, the NTR will be contacted.
- The H&SP will provide e-mail or written notification to the contracting officer within four hours of the incident.
- A preliminary *Contractor's Significant Incident Report* (CSIR) must be submitted to the contracting officer within 24 hours of the mishap.
- A final CSIR must be submitted to the contracting officer within five days of the mishap.

Non-Serious Contractor Mishap

For any mishap that causes one or more OSHA-recordable injuries or which results in more than $2,000 in property damage, but does not qualify as "serious", the following actions will be implemented:

- The H&SP will provide telephone or e-mail notification to the contracting officer within four hours of the mishap.

- A final CSIR must be submitted to the contracting officer within five days of the mishap.

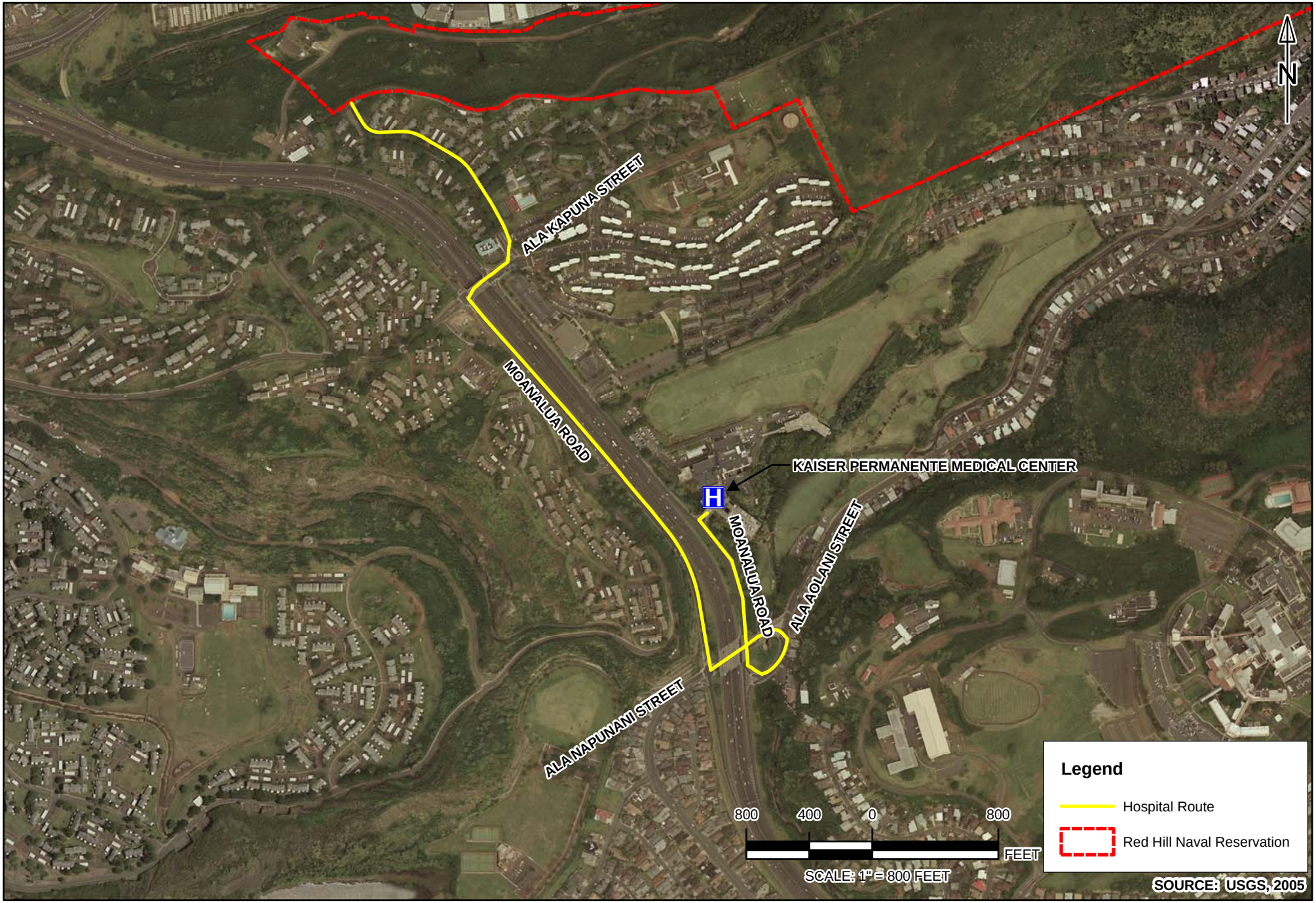
Other Mishaps

For all non-OSHA-recordable injuries or near-miss incidents (defined in EarthTech Safety Procedure EHS 101) and incidents involving less than $2,000 in damage, the following actions will be implemented:

- The H&SP will provide telephone or e-mail notification to the contracting officer within three working days of the mishap.
- No CSIR is required; however the project team will provide the contracting officer with a copy of its own investigation report once completed.

Follow-Up Investigations

The project team will perform an Incident Investigation for every incident that occurs at the Site. Results of this investigation will be implemented by the PM (as applicable), and will be communicated by the H&SM to all PMs for appropriate implementation.



Environet, Inc.	LONG-TERM MONITORING, RED HILL BULK FUEL STORAGE FACILITY HOSPITAL ROUTE MAP	FIGURE 8-1

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Attachment A Activity Hazard Analyses

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Mobilization**			
Analysis Performed by: **Stacey Fineran**	**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
TASK DESCRIPTION			
Activity/Hazard	**POTENTIAL SAFETY / HEALTH HAZARDS**	**RECOMMENDED CONTROLS**	
These safety/health hazards are applicable to the mobilizing of equipment and materials to the project site.	**Slip, Trip, Fall / Personal Injury**	• Evaluate site area for potential hazards or obstructions. • Review (or participate in a review of) potential hazards before entering site. • Use 911 for emergencies. If on military base, note where emergency facilities are located and acquire emergency phone number at gate. • If necessary contact a security agency prior to mobilization to provide site security. • Workers will be aware of uneven ground surfaces and site terrain.	
	Overhead Hazards	• Wear ANSI approved hard hat. • Ensure toe-boards are installed on overhead work platforms. • Maintain minimum distance of 10-feet from overhead utilities. This distance will increase as the voltage of the power lines increase. • All ground personnel will stay clear of all suspended loads.	
	Heat Stress	• Wear appropriate clothing. • Have cool drinks/electrolytes available and take small drinks frequently. • Take regular breaks in shaded, cool areas and monitor temperature as specified in Heat Stress Monitoring Program. • Use Buddy System and report signs of heat stress to Supervisor immediately.	
	Severe Weather	• Shut down operations during severe electrical storms, heavy rain, high wind and evacuate site/take cover. • Train personnel on Emergencies Response. • Monitor weather systems.	

Activity/Phase of Work: **Mobilization**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
These safety/health hazards are applicable to the mobilizing of equipment and materials to the project site.	**Biological Hazards** (poisonous plants, ticks, wild pigs, insect stings / bites)	• Practice personal awareness; do not place hands / feet in areas that cannot be observed / inspected. • Avoid areas of tall grass/brush. • Wash hands/face with soap and water prior to breaks and lunch and at the end of a shift. • Properly dispose of unwanted food items. • Avoid contact with wildlife. <u>Insects</u> • Identify infested areas and report them to the Site Supervisor. • Use insect repellant. • Identify workers who are allergic or capable of allergic reactions to bee, wasp, or ant stings or bites. • Evaluate need for sensitive workers to have prescribed antibiotic or medicine to combat onset of symptoms.		
	Fire Hazards	• Have fire extinguishers readily available at all sites. • No smoking in work zone/fueling areas. • No smoking/ open flame in refueling areas. • Train personnel on use of fire extinguishers. • Refuel equipment, which has cooled to ambient temperature with motor off. • Store fuel/ in labeled safety cans away from heat sources. • Store all flammables in approved cabinet. • Complete a hot work permit and post the permit for all site personnel to see. • Properly store and label compressed gas cylinders. • Fuel tanks and equipment will be grounded and bonded during fueling operations.		
	Noise	• Wear hearing protective devices (Ear muffs/plugs) inside the work zone, when using or near high noise producing equipment, or when directed by ECC SSHO in response to noise monitoring. • Ensure adequate maintenance on equipment.		
	Manual Lifting/Backs	• Train/Utilize correct lift techniques. • Stretch before start of work. Personnel will not lift more than 50 lb. • Use Buddy System. • Use mechanical lifting procedures whenever possible.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Mobilization**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
These safety/health hazards are applicable to the mobilizing of equipment and materials to the project site.	**Spills**	• Review of all Material Safety Data Sheets related to the materials being used. • Personnel will be trained in emergency spill response procedures. • Locate spill kit in the secondary storage area and train on proper use. • Personnel will be instructed as to proper fueling techniques. • Fuel nozzle and hose will be secured in holder after use. • Fuel caps will be secured after fueling operations. • Fuel tanks and equipment will be grounded and bonded during fueling operations. • Ensure proper fuel/oil storage.		
	Struck By/Against Vehicles Heavy Equipment	• Set up temporary parking locations outside the immediate work zone. • Maintain radio/verbal communication. • Make eye contact with operators and indicate your movements with hand signals before approaching trucks. • Equipment will not be approached on blind sides. • Personnel will understand and review hand signals. • All machines will be equipped with backup alarms and lighting. • Obey all posted speed limits. • Properly maintain/inspect equipment.		
	Flying Objects/Debris	• All personnel are required to wear safety glasses meeting ANSI Standard Z87. • A portable eye wash station will be located by the work zone. • Monitor weather patterns.		
	Tool Safety	• Cut resistant work gloves will be worn. • Use caution when working with hand, power and pneumatic tools. • Maintain proper distance between body, equipment and other personnel. • Inspect before use and remove defective tools. • Ensure all guards and safety devices are in place. • Only qualified, trained personnel shall use.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Mobilization**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**		

• PPE – OSHA Level D ensemble
  • Non-slip shoes or boots (ANSI approved steel-toed if appropriate for site conditions)
  • Long pants
  • High-visibility reflective safety vest (if encounter traffic area)
  • ANSI approved hardhat
  • ANSI approved safety glasses
  • Gloves
  • Sleeved work shirt
• Insect repellant
• Sun block
• First aid kit
• Fire extinguisher
• Flashlight
	• Conduct daily site safety inspection to identify and eliminate hazards.
	• Inspect all tools before use.
	• Inspect fall protection daily.
	• Inspect all Equipment daily.
	• Rigging/Lifting straps daily.
		• All field personnel will have Site Safety and Health Plan /Activity Hazard Analysis training; Hazard Communication training and Daily Tailgate Safety Meetings. Applicable Operator Certifications, HAZWOPER Certifications, Fall Protection/ training, Safe Tool Use, Ladder training, Fire Safety training, Emergency Response Training, First Aid/Cardiopulmonary Resuscitation.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Groundwater Monitoring, Soil Vapor monitoring, and Fuel Product Monitoring**			
Analysis Performed by: **Stacey Fineran**	**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**

TASK DESCRIPTION

- Groundwater samples will be collected for laboratory analyses from a total of 7 monitoring wells, 5 inside RHSF and 2 outside RHSF. Groundwater samples will be collected at a low flow rate using dedicated bladder pumps, which will be operated by compressed air. The five wells inside RHSF are located inside tunnels.

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
Walking on-site	**Slip, Trip, Fall / Personal Injury**	• Evaluate site area for potential hazards or obstructions. • Review (or participate in a review of) potential hazards before entering site. • Use 911 for emergencies. If on military base, note where emergency facilities are located and acquire emergency phone number at gate. • If necessary contact a security agency prior to mobilization to provide site security. • Workers will be aware of uneven ground surfaces and site terrain. • Keep open communication with security or other employees when working in the tunnel because of excess time and effort to remove injured person(s) from tunnels. •
	Heat Stress	• Wear appropriate clothing. • Have drinks / electrolytes available; intake liquids frequently. • Take regular breaks in shaded areas and monitor temperature as specified in Heat Stress Monitoring Program. • Use Buddy System and report signs of heat stress to Supervisor immediately.
	Severe Weather	• Terminate site walk during severe electrical storms, heavy rain, and high wind. • Evacuate site and seek shelter. • Train personnel on emergency response evacuation procedures / routes. • Monitor weather systems.
	Overhead Hazards	• Wear ANSI approved hard hat. • Ensure toe-boards are installed on overhead work platforms. • Maintain minimum distance of 10-feet from overhead utilities. This distance will increase as the voltage of the power lines increase. • All ground personnel will stay clear of all suspended loads.

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Groundwater Monitoring, Soil Vapor monitoring, and Fuel Product Monitoring**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
	Manual Lifting	• Train/Utilize correct lift techniques. • Personnel will not lift more than 50 lb. • Use Buddy System. • Use mechanical lifting procedures whenever possible. • Position equipment as to eliminate over stretching/ergonomic concerns.		
	Biological Hazards (Poisonous plants, insect stings / bites)	• Practice personal awareness; do not place hands / feet in areas that cannot be observed / inspected. • Avoid areas of tall grass/brush. • Wash hands/face with soap and water prior to breaks and lunch and at the end of a shift. • Properly dispose of unwanted food items. • Avoid contact with wildlife. Insects • Identify infested areas and report them to the Site Supervisor. • Use insect repellant. • Identify workers who are allergic or capable of allergic reactions to bee, wasp, or ant stings or bites. • Evaluate need for sensitive workers to have prescribed antibiotic or medicine to combat onset of symptoms.		
Opening Monitoring Wells	**Manual Hand Tool Safety**	• Use, handle, and store all manually operated hand tools and equipment in accordance with the tools design. Follow instructions on tool and/or package. • Inspect tools before use; discard if any are damaged or abused. • Keep hands away from sharp edges and position body securely while working with tool.		
	Inhalation Hazard	• Avoid direct inhalation of COPCs including; VOCs, TPH-DRO, PAHs, and methane • Open well covers slowly. • Work upwind of the monitoring wells. • Work in a well vented area. • Monitoring the worker(s) breathing zone if necessary.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAI'I

Activity/Phase of Work: **Groundwater Monitoring, Soil Vapor monitoring, and Fuel Product Monitoring**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
	Fire hazard	• Have fire extinguishers readily available at all sites. • No smoking in work/fueling areas. • No smoking/ open flame in refueling areas. • Train employees on use of fire extinguishers. • Refuel cooled equipment with motor off. • Store fuel/ in labeled safety cans away from heat sources. • Store all flammables in approved cabinet. • Complete a hot work permit and post the permit for all site personnel to see. • Properly store and label compressed gas cylinders. • Atmospheric testing for presence of flammable vapors. • Fuel tanks and equipment will be grounded and bonded during fueling operations.		
Collecting Groundwater Samples	**Chemical Hazards (skin)**	• Avoid direct contact with water. Chemicals of Potential Concern (COPCs) include: VOCs, PAHs, and methane. • Use the appropriate PPE (e.g., disposable nitrile gloves, long pants) when handling groundwater sampling equipment. • Remove all disposable PPE after leaving sampling areas and place used PPE in appropriate bags for disposal. • Handle groundwater as hazardous until evidence becomes available to indicate otherwise. • Face protection shall be comfortable and of proper size to fit the employee if required. • All face protection shall comply with provisions of ANSI standard Z87.1, 1989.		
	Eye Hazards	• Avoid direct exposure to potential eye hazards. • Wear ANSI approved safety glasses at all times. • Utilize face shield/goggles if potential for flying debris/splash hazards. • Carry a flashlight when working inside tunnels to avoid blackout conditions.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Groundwater Monitoring, Soil Vapor monitoring, and Fuel Product Monitoring**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**		

• PPE – OSHA Level D ensemble
  • Non-slip shoes or boots (ANSI approved steel-toed if appropriate for site conditions)
  • Long pants
  • High-visibility reflective safety vest (if encounter traffic area)
  • ANSI approved hardhat
  • ANSI approved safety glasses
  • Gloves
  • Sleeved work shirt
• Insect repellant
• Sun block
• First aid kit
• Fire extinguisher
• Flashlight
	• Ensure soles of shoes or boots are appropriate for the terrain
	• Inspect hardhat for cracks or stress fractures
	• Inspect drill rig for proper working condition
		• All field personnel will have training / certification regarding:
		  • Site Safety and Health Plan / Activity Hazard Analysis.
		  • Hazard Communication Training and Daily Tailgate Safety Meetings.
		  • HAZWOPER Certifications (medical, respiratory-as needed).
		  • Safe Tool Use, Fire Safety, Emergency Response.
		  • Signs, symptoms, and treatment of heat stress / First Aid / Cardiopulmonary Resuscitation training.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Decontaminating Equipment**			
Analysis Performed by: **Stacey Fineran**	**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**

TASK DESCRIPTION		
Activity/Hazard	**POTENTIAL SAFETY / HEALTH HAZARDS – RISK**	**RECOMMENDED CONTROLS**
These safety/health hazards are generally applicable to the decontamination of equipment.	**Slip, Trip, Fall / Personal Injury**	• Be aware of physical hazards - watch for uneven ground, rocks, dirt clods, etc; • Practice good housekeeping. • Use care when walking on surface tarp, especially when wet. • Clean all spills immediately. • Proper PPE to include shoes which allow for good footing. • Keep open communication with security or other employees when working in the tunnel because of excess time and effort to remove injured person(s) from tunnels
	Overhead Hazards	• Wear ANSI approved hard hat. • Ensure toe-boards are installed on overhead work platforms. • Maintain minimum distance of 10-feet from overhead utilities. This distance will increase as the voltage of the power lines increase. • All ground personnel will stay clear of all suspended loads.
	Manual Lifting/Backs/Ergonomic	• Train/Utilize correct lift techniques. • Personnel will not lift more than 50 lb. • Use Buddy System. • Use mechanical lifting procedures whenever possible. • Position equipment as to eliminate over stretching/ergonomic concerns.
	Eye Hazards	• Avoid direct exposure to potential eye hazards. • Wear ANSI approved safety glasses at all times. • Utilize face shield/goggles if potential for flying debris/splash hazards. • Carry a flashlight when working inside tunnels to avoid blackout conditions.

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

Activity/Phase of Work: **Decontaminating Equipment**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
These safety/health hazards are generally applicable to the decontamination of equipment.	**Heat Stress**	• Wear appropriate clothing. • Have cool drinks/electrolytes available and take small drinks frequently. • Take regular breaks in shaded, cool areas and monitor temperature as specified in Heat Stress Monitoring Program. • Use Buddy System and report signs of heat stress to Supervisor immediately.		
	Severe Weather	• Shut down operations during severe electrical storms, heavy rain, high wind, and evacuate site/take cover. • Train employees on Emergencies Response. • Monitor weather systems.		
	Biological Hazards (poisonous plants, ticks, insect stings / bites)	• Practice personal awareness; Do not place hands/feet in areas that cannot be observed/ inspected; • Avoid areas of tall grass/brush; • Use insect repellant • Wash hands/face prior to breaks and lunch and at the end of a shift. Insects: • Identify infested areas to the Site Supervisor. • Workers who are allergic or capable of allergic reactions to bee, wasp, or ant stings or bites shall notify their Supervisor(s). • Evaluate need for sensitive workers to have prescribed antibiotic or medicine to combat onset of symptoms.		
	Fire Hazards	• Have fire extinguishers readily available at all sites. • No smoking in work/fueling areas. • No smoking/ open flame in refueling areas. • Train employees on use of fire extinguishers. • Refuel cooled equipment with motor off. • Store fuel/ in labeled safety cans away from heat sources. • Store all flammables in approved cabinet. • Complete a hot work permit and post the permit for all site personnel to see. • Properly store and label compressed gas cylinders. • Atmospheric testing for presence of flammable vapors • Fuel tanks and equipment will be grounded and bonded during fueling operations.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAI'I

Activity/Phase of Work: **Decontaminating Equipment**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
These safety/health hazards are generally applicable to the decontamination of equipment.	**Noise**	• Wear hearing protective devices (ear muffs/plugs) when using or near high noise producing equipment, or when directed by the SSO in response to noise monitoring. • Ensure adequate maintenance on thermal/heavy equipment.		
	Spills	• Review of all Material Safety Data Sheets related to the materials being used. • Personnel will be trained in emergency spill response procedures. • Locate spill kit in the secondary storage area and train on proper use. • Personnel will be instructed as to proper fueling techniques. • Fuel nozzle and hose will be secured in holder after use. • Fuel caps will be secured after fueling operations. • Fuel tanks and equipment will be grounded and bonded during fueling operations. • Ensure proper fuel/oil storage.		
	Struck By/Against Vehicles Heavy Equipment	• Set up temporary parking locations outside the immediate work zone. • Maintain radio/verbal communication. • Make eye contact with operators and indicate your movements with hand signals before approaching trucks. • Equipment will not be approached on blind sides. • Personnel will understand and review hand signals. • All machines will be equipped with backup alarms and lighting. • Obey all posted speed limits. • Properly maintain/inspect equipment.		
	Chemical Exposure	• Conduct air monitoring, upgrade respiratory protection as directed. • Protective clothing/PPE (goggles, face-shields, chemical gloves, tyvek, respirator) may be worn depending on direct reading (PID)/lab results and materials encountered; • Decontaminate equipment away from intrusive activities and upwind; • Practice good personal hygiene including hand, face and arm washing, no eating, drinking, smoking or hand-to mouth activities. • All MSDSs/Hazard Communication will be reviewed with employees. • • Proper decontamination procedures shall be followed. • Train employees on potential routes of exposure including ingestion, inhalation and absorption through skin (dermal contact, mucous membranes); • Avoid skin contact by utilizing described PPE and procedures.		

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ACTIVITY HAZARD ANALYSIS: LONG-TERM MONITORING AT RED HILL BULK FUEL STORAGE FACILITY, RED HILL HALAWA HEIGHTS, OAHU, HAWAIʻI

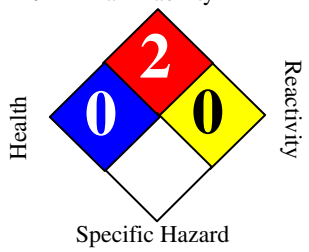
Activity/Phase of Work: **Decontaminating Equipment**				
Analysis Performed by: **Stacey Fineran**		**Date: September, 2010**	**Analysis Approved by:** **Colette Sakoda**	**Date: September, 2010**
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**		

• PPE – OSHA Level D ensemble
  • Non-slip shoes or boots (ANSI approved steel-toed if appropriate for site conditions)
  • Long pants
  • High-visibility reflective safety vest (if encounter traffic area)
  • ANSI approved hardhat
  • ANSI approved safety glasses
  • Gloves
  • Sleeved work shirt
• Insect repellant
• Sun block
• First aid kit
• Fire extinguisher
• Flashlight
• Radio/Cell Phone/Two way
	• Conduct daily site safety inspection to identify and eliminate hazards.
	• Inspect all tools before use.
	• Inspect fall protection daily.
	• Inspect Heavy Equipment daily.
	• Rigging/Lifting straps daily.
		• All field personnel will have current 40-Hour OSHA training and 3-day supervised hazardous waste field experience; SSHP training; Hazard Communication training; Respirator Fit testing, Daily Tailgate Safety Meetings. In addition, supervisors will have OSHA 8-Hour Supervisor training. Forklift training. Equipment Operator Certification, Excavation Safety training, Emergency Response Training, Project AHAs/SOPs, and First Aid/CPR.		

Attachment B MSDS

Material Safety Data Sheet
Diesel Fuel - NRLM

NFPA:



HMIS III:

HEALTH	1
FLAMMABILITY	2
PHYSICAL	0

0 = Insignificant, 1 = Slight, 2 = Moderate, 3 = High, 4 = Extreme

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Diesel Fuel - NRLM		
Synonyms	:	Dakota 50; Diesel Fuel - Non-Road Locomotive and Marine;, 888100005480		
MSDS Number	:	888100005480	**Version**	: 2.13
Product Use Description	:	Fuel		
Company	:	For: Tesoro Refining & Marketing Co. 300 Concord Plaza Drive, San Antonio, TX 78216-6999		
Tesoro Call Center	:	(877) 783-7676	**Chemtrec (Emergency Contact)**	: (800) 424-9300

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Regulatory status : This material is considered hazardous by the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200).

Signal Word : WARNING

Hazard Summary : Combustible Liquid

Toxic

Potential Health Effects

Inhalation : Vapors or mists from this material can irritate the nose, throat, and lungs, and can cause signs and symptoms of central nervous system depression, depending on the concentration and duration of exposure.

Eyes : Eye irritation may result from contact with liquid, mists, and/or vapors.

Skin : Skin irritation leading to dermatitis may occur upon prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed. Long-term, repeated skin contact may cause skin cancer.

Ingestion : Harmful or fatal if swallowed. Do NOT induce vomiting. This material can irritate the mouth, throat, stomach, and cause nausea, vomiting, diarrhea and restlessness. Aspiration hazard if liquid is inhaled into lungs, particularly from vomiting after ingestion. Aspiration may result in chemical pneumonia, severe lung damage, respiratory failure and even death.

Target Organs : Kidney, Liver, Central nervous system, Eyes, Skin

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Weight %
Fuels, diesel, No 2; Gasoil - unspecified	68476-34-6	100%
Naphthalene	91-20-3	1 - 5%
Xylene	1330-20-7	1 - 5%
Nonane	111-84-2	0.75 - 1%
1,2,4-Trimethylbenzene	95-63-6	0.75 - 1%
Sulfur	7704-34-9	500 ppm Maximum

SECTION 4. FIRST AID MEASURES

Inhalation : Move to fresh air. Give oxygen. If breathing is irregular or stopped, administer artificial respiration. Seek medical attention immediately.

Skin contact : Take off all contaminated clothing immediately. Wash off immediately with soap and plenty of water. Wash contaminated clothing before re-use. If skin irritation persists, seek medical attention.

Eye contact : Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If eye irritation persists, seek medical attention.

Ingestion : Do NOT induce vomiting. Ingestion may result in nausea, vomiting, diarrhea and restlessness. Aspiration may cause pulmonary edema and pneumonitis. Seek medical attention immediately.

Notes to physician : Symptoms: Dizziness, Discomfort, Headache, Nausea, Disorder, Vomiting, Lung edema, Aspiration may cause pulmonary edema and pneumonitis. Liver disorders, Kidney disorders.

SECTION 5. FIRE-FIGHTING MEASURES

Form : Liquid

Flash point : 38 ℃ (100 ℉)Minimum for #1 NRLM ; 52° Minimum for #2 NRLM

Lower explosive limit : 0.7 %(V)

Upper explosive limit : 5 %(V)

Suitable extinguishing media : Carbon dioxide (CO2), Water spray, Dry chemical, Foam, Keep containers and surroundings cool with water spray.

Specific hazards during fire fighting : Fire Hazard Do not use a solid water stream as it may scatter and spread fire. Cool closed containers exposed to fire with water spray.

Special protective equipment for fire-fighters : Wear self-contained breathing apparatus and protective suit. Use personal protective equipment.

Further information : Exposure to decomposition products may be a hazard to health. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions : Consider wind direction; stay upwind and uphill, if possible. Evacuate nonessential personnel and remove or secure all ignition sources. Evaluate the direction of product travel, diking, sewers, etc. to contain spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact. Ensure adequate ventilation. Use personal protective equipment.

Environmental precautions : Carefully contain and stop the source of the spill, if safe to do so. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection. Discharge into the environment must be avoided. If the product contaminates rivers and lakes or drains inform respective authorities.

Methods for cleaning up : Take up with sand or oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

CERCLA Hazardous substances and corresponding RQs :

Naphthalene	91-20-3	100 lbs
Xylene	1330-20-7	100 lbs
Nonane	111-84-2	100 lbs

SECTION 7. HANDLING AND STORAGE

Handling : Keep away from fire, sparks and heated surfaces. No smoking near areas where material is stored or handled. The product should only be stored and handled in areas with intrinsically safe electrical classification.

Advice on protection against fire and explosion : Hydrocarbon liquids including this product can act as a non-conductive flammable liquid (or static accumulators), and may form ignitable vapor-air mixtures in storage tanks or other containers. Precautions to prevent static-initated fire or explosion during transfer, storage or handling, include but are not limited to these examples:

(1) Ground and bond containers during product transfers. Grounding and bonding may not be adequate protection to prevent ignition or explosion of hydrocarbon liquids and vapors that are static accumulators.
(2) Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil or diesel) is loaded into tanks previously containing low flash point products (such gasoline or naphtha).
(3) Storage tank level floats must be effectively bonded.

For more information on precautions to prevent static-initated fire or explosion, see NFPA 77, Recommended Practice on Static Electricity (2007), and API Recommended Practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents (2008).

Dust explosion class : Not applicable

Requirements for storage areas and containers : Keep away from flame, sparks, excessive temperatures and open flame. Use approved containers. Keep containers closed and clearly labeled. Empty or partially full product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose containers to sources of ignition. Store in a well-ventilated area. The storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

Advice on common storage : Keep away from food, drink and animal feed. Incompatible with oxidizing agents. Incompatible with acids.

Other data : No decomposition if stored and applied as directed.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

List	Components	CAS-No.	Type:	Value
OSHA Z1	Naphthalene	91-20-3	PEL	10 ppm 50 mg/m3
	Xylene	1330-20-7	PEL	100 ppm 435 mg/m3
ACGIH	Diesel Fuel	68476-30-2	TWA	100 mg/m3
ACGIH	Naphthalene	91-20-3	TWA	10 ppm
		91-20-3	STEL	15 ppm
	Xylene	1330-20-7	TWA	100 ppm
		1330-20-7	STEL	150 ppm
	Nonane	111-84-2	TWA	200 ppm

Engineering measures : Use only intrinsically safe electrical equipment approved for use in classified areas.

Eye protection : Safety glasses with side-shields reference to 29 CFR 1910.133

Hand protection : Gloves constructed of nitrile, neoprene, or PVC are recommended. Consult manufacturer specifications for further information.

Skin and body protection : If needed to prevent skin contact, chemical protective clothing such as of DuPont TyChem®, Saranex or equivalent recommended based on degree of exposure. The resistance of specific material may vary from product to product as well as with degree of exposure.

Respiratory protection	:	A NIOSH/ MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection. NIOSH/MSHA approved positive-pressure self-contained breathing apparatus (SCBA) or Type C positive-pressure supplied air with escape bottle must be used for gas concentrations above occupational exposure limits, for potential of uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere.
Work / Hygiene practices	:	Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	Liquid
Appearance	:	Clear, straw colored to red if dye added.
Odor	:	Characteristic petroleum (kerosene) odor
Flash point	:	38 °C (100 °F)Minimum for #1 NRLM ; 52° Minimum for #2 NRLM
Thermal decomposition	:	No decomposition if stored and applied as directed.
Lower explosive limit	:	0.7 %(V)
Upper explosive limit	:	5 %(V)
Freezing point	:	Not applicable
Boiling point	:	160 °C(320 °F)
Vapor Pressure	:	< 2 mm Hg at 20 °C
Relative Vapor Density	:	5.7 (Air = 1.0)
Water solubility	:	Negligible
Percent Volatiles	:	100 %
Conductivity (conductivity can be reduced by environmental factors such as a decrease in temperature		Diesel Fuel Oils at terminal load rack: At least 25 pS/m Ultra Low Sulfur Diesel (ULSD) without conductivity additive: 0 pS/m to 5 pS/m ULSD at terminal load rack with conductivity additive: At least 50 pS/m but conductivity may decrease from environmental factors such as temperature drop. JP-8 at terminal load rack: 150 pS/m to 600 pS/m

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid	:	Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers. Viton ® ; Fluorel ®
Materials to avoid	:	Strong oxidizing agents Peroxides
Hazardous decomposition products	:	Carbon monoxide, carbon dioxide and noncombusted hydrocarbons (smoke). Diesel exhaust particulates may be a lung hazard - see Section 11.
Thermal decomposition	:	No decomposition if stored and applied as directed. No decomposition if used as directed.
Hazardous reactions	:	Keep away from oxidizing agents, and acidic or alkaline products.

SECTION 11. TOXICOLOGICAL INFORMATION

Carcinogenicity

NTP	:	Naphthalene (CAS-No.: 91-20-3)
IARC	:	Naphthalene (CAS-No.: 91-20-3)
OSHA	:	No component of this product which is present at levels greater than or equal to 0.1 % is identified as a carcinogen or potential carcinogen by OSHA.
CA Prop 65	:	WARNING! This product contains a chemical known to the State of California to cause cancer. Naphthalene (CAS-No.: 91-20-3)
Skin irritation	:	Irritating to skin.
Eye irritation	:	Irritating to eyes.
Further information	:	Studies have shown that similar products produce skin cancer or skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation. Positive mutagenicity results have been reported. Repeated over-exposure may cause liver and kidney injury IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A). NIOSH regards whole diesel fuel exhaust particulates as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

Component:

Fuels, diesel, No 2; Gasoil - unspecified	68476-34-6	Acute oral toxicity: LD50 rat Dose: 5,001 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 2,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 7.64 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Severe skin irritation Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Naphthalene	91-20-3	Acute oral toxicity: LD50 rat

		Dose: 2,001 mg/kg Acute dermal toxicity: LD50 rat Dose: 2,501 mg/kg Acute inhalation toxicity: LC50 rat Dose: 101 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation Carcinogenicity: N11.00422130
Xylene	1330-20-7	Acute oral toxicity: LD50 rat Dose: 2,840 mg/kg Acute dermal toxicity: LD50 rabbit Dose: ca. 4,500 mg/kg Acute inhalation toxicity: LC50 rat Dose: 6,350 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Nonane	111-84-2	Acute oral toxicity: LD50 mouse Dose: 218 mg/kg Acute inhalation toxicity: LC50 rat Exposure time: 4 h
1,2,4-Trimethylbenzene	95-63-6	Acute inhalation toxicity: LC50 rat Dose: 18 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Skin irritation Eye irritation: Classification: Irritating to eyes. Result: Eye irritation
Sulfur	7704-34-9	Acute oral toxicity: LD50 rat Dose: 5,001 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 2,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 9.24 mg/l Exposure time: 4 h Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation

SECTION 12. ECOLOGICAL INFORMATION

Biochemical Oxygen Demand (BOD) : No data available

Chemical Oxygen Demand (COD)	:	No data available
Adsorbed organic bound halogens (AOX)	:	Not included
Additional ecological information	:	Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

Component:

Naphthalene	91-20-3	Toxicity to algae: EC50 Species: Dose: 33 mg/l Exposure time: 24 h
1,2,4-Trimethylbenzene	95-63-6	Toxicity to fish: LC50 Species: Pimephales promelas (fathead minnow) Dose: 7.72 mg/l Exposure time: 96 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia Dose: 3.6 mg/l Exposure time: 48 h
Sulfur	7704-34-9	Acute and prolonged toxicity for aquatic invertebrates: EC0 Species: Daphnia magna (Water flea) Dose: > 10,000 mg/l Exposure time: 24 h

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal : Consult federal, state and local waste regulations to determine appropriate waste characterization of material and allowable disposal methods.

SECTION 14. TRANSPORT INFORMATION

CFR

Proper shipping name	: DIESEL FUEL
UN-No.	: 1202 (NA 1993)
Class	: 3
Packing group	: III

TDG

Proper shipping name	: DIESEL FUEL
UN-No.	: UN1202 (NA 1993)
Class	: 3
Packing group	: III

IATA Cargo Transport

UN UN-No.	: UN1202 (NA 1993)
Description of the goods	: DIESEL FUEL
Class	: 3
Packaging group	: III

ICAO-Labels	: 3
Packing instruction (cargo aircraft)	: 310
Packing instruction (cargo aircraft)	: Y309

IATA Passenger Transport

UN UN-No.	: UN1202 (NA 1993)
Description of the goods	: DIESEL FUEL
Class	: 3
Packaging group	: III
ICAO-Labels	: 3
Packing instruction (passenger aircraft)	: 309
Packing instruction (passenger aircraft)	: Y309

IMDG-Code

UN-No.	: UN 1202 (NA 1993)
Description of the goods	: DIESEL FUEL
Class	: 3
Packaging group	: III
IMDG-Labels	: 3
EmS Number	: F-E S-E
Marine pollutant	: No

SECTION 15. REGULATORY INFORMATION

OSHA Hazards : Combustible Liquid
Toxic by ingestion
Severe skin irritant
Moderate eye irritant
Possible Cancer Hazard

TSCA Status : On TSCA Inventory

DSL Status : All components of this product are on the Canadian DSL list.

SARA 311/312 Hazards : Fire Hazard
Acute Health Hazard
Chronic Health Hazard

SARA III US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 313 Toxic Chemicals (40 CFR 372.65) - Supplier Notification Required

Components	CAS-No.
Naphthalene	91-20-3
Xylene	1330-20-7
1,2,4-trimethylbenzene	95-63-6

PENN RTK US. Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Components	CAS-No.
Sulfur	7704-34-9

1,2,4-trimethylbenzene	95-63-6
Nonane	111-84-2
Xylene	1330-20-7
Naphthalene	91-20-3
Fuels, diesel, No 2; Gasoil - unspecified	68476-34-6

MASS RTK US. Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Components	CAS-No.
Sulfur	7704-34-9
1,2,4-Trimethylbenzene	95-63-6
Nonane	111-84-2
Xylene	1330-20-7
Naphthalene	91-20-3

NJ RTK US. New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Components	CAS-No.
Sulfur	7704-34-9
1,2,4-Trimethylbenzene	95-63-6
Nonane	111-84-2
Xylene	1330-20-7
Naphthalene	91-20-3
Fuels, diesel, No 2; Gasoil - unspecified	68476-34-6

California Prop. 65 : WARNING! This product contains a chemical known to the State of California to cause cancer.

Naphthalene 91-20-3

SECTION 16. OTHER INFORMATION

Further information

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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Revision Date : 05/04/2009

75, 105, 1076

HOVENSA

MATERIAL SAFETY DATA SHEET

Jet Fuel JP-5 **MSDS No. 1809**

EMERGENCY OVERVIEW
CAUTION!
COMBUSTIBLE LIQUID - SLIGHT TO MODERATE IRRITANT
EFFECTS CENTRAL NERVOUS SYSTEM
HARMFUL OR FATAL IF SWALLOWED

NFPA 704 (Section 16)

Moderate fire hazard. Avoid breathing vapors or mists. May cause dizziness and drowsiness. May cause eye irritation and skin irritation (rash). Long-term, repeated exposure may cause skin cancer.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

1. CHEMICAL PRODUCT and COMPANY INFORMATION

HOVENSA LLC
1 Estate Hope
Christiansted, VI 00820-5652

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours): **(340) 692-3000**

SYNONYMS: JP – 5; Military Aviation Jet Fuel JP –5
See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Kerosene (8008-20-6)	100
Naphthalene (91-20-3)	Typically 0.04

A complex combination of hydrocarbons including naphthenes, paraffins, and aromatics.

3. HAZARDS IDENTIFICATION

EYES
Contact with eyes may cause mild to moderate irritation.

SKIN
May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

INGESTION

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Similar products produced skin cancer and systemic toxicity in laboratory animals following repeated applications. The significance of these results to human exposures has not been determined - see Section 11 Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash).

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	> 140 ^{o}F (60 ^{o}C) TCC
AUTOIGNITION POINT:	475 ^{o}F (246 ^{o}C)
OSHA/NFPA FLAMMABILITY CLASS:	IIIA (COMBUSTIBLE)
LOWER EXPLOSIVE LIMIT (%):	0.7
UPPER EXPLOSIVE LIMIT (%):	5.0

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS
Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may

be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY'S SPILL CONTINGENCY OR EMERGENCY RESPONSE PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING PRECAUTIONS

Handle as a combustible liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use gasoline or solvents (naphtha, kerosene, etc.) for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Kerosene (8008-20-6)	OSHA	5 mg/m^3 as mineral oil mist	
	ACGIH	100 mg/m^3 TWA	A3
Naphthalene (91-20-3)	OSHA	10 ppm	
	ACGIH	10 ppm TWA/ 15 ppm STEL	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying

SKIN PROTECTION

Gloves constructed of nitrile, neoprene, or PVC are recommended. Chemical protective clothing such as of E.I. DuPont Tyvek QC®, Saranex®, TyChem® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information

RESPIRATORY PROTECTION

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use gasoline or solvents (naphtha, kerosene, etc.) for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

Pale yellow to water-white liquid

ODOR

Characteristic petroleum distillate odor

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	0.029 psia @ 100 °F (38 °C)
VAPOR DENSITY (air = 1):	AP 4.5
SPECIFIC GRAVITY (H_2O = 1):	AP 0.80
PERCENT VOLATILES:	100 %
EVAPORATION RATE:	Slow; varies with conditions
SOLUBILITY (H_2O):	Negligible

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers such as nitric and sulfuric acids.

HAZARDOUS DECOMPOSITION PRODUCTS:

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

11. TOXICOLOGICAL PROPERTIES

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: NO NTP: NO ACGIH: 1997 NOIC: A3
Dermal carcinogenicity: positive (mice)

ACUTE TOXICITY

Acute dermal LD50 (rabbits): > 5 g/kg
Acute oral LD50 (rats): > 25 g/kg
Primary dermal irritation: mildly irritating (rabbits)
Primary eye irritation: mildly irritating (rabbits)
Guinea pig sensitization: negative

Studies have shown that similar products produce skin cancer or skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Fuel, Aviation, Turbine Engine
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1863
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

May be reclassified for transportation as a COMBUSTIBLE LIQUID under conditions of DOT 49 CFR 173.120(b)(2).

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a “petroleum exclusion” clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the *de minimis* levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 3 (Combustible Liquid) Class D, Division 2, Subdivision B (Toxic by other means)

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	**Date Listed**
Naphthalene	04/19/2002

16. OTHER INFORMATION

NFPA® HAZARD RATING

HEALTH:	0
FIRE:	2
REACTIVITY:	0

Refer to NJPA 704 “Identification of the Fire Hazards of Materials” for further information

HMIS® HAZARD RATING	HEALTH:	1*	Slight
	FIRE:	2	Moderate
	PHYSICAL:	0	Negligible
			*Chronic

SUPERSEDES MSDS DATED: 1/14/99

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than
N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
AIHA	American Industrial Hygiene Association	OPA	Oil Pollution Act of 1990
ANSI	American National Standards Institute (212)642-4900	OSHA	U.S. Occupational Safety & Health Administration
API	American Petroleum Institute (202)682-8000	PEL	Permissible Exposure Limit (OSHA)
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act	RCRA	Resource Conservation and Recovery Act
DOT	U.S. Department of Transportation [General info: (800)467-4922]	REL	Recommended Exposure Limit (NIOSH)
EPA	U.S. Environmental Protection Agency	SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
HMIS	Hazardous Materials Information System	SCBA	Self-Contained Breathing Apparatus
IARC	International Agency For Research On Cancer	SPCC	Spill Prevention, Control, and Countermeasures
MSHA	Mine Safety and Health Administration	STEL	Short-Term Exposure Limit (generally 15 minutes)
NFPA	National Fire Protection Association (617)770-3000	TLV	Threshold Limit Value (ACGIH)
NIOSH	National Institute of Occupational Safety and Health	TSCA	Toxic Substances Control Act
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)	TWA	Time Weighted Average (8 hr.)
		WEEL	Workplace Environmental Exposure Level (AIHA)
		WHMIS	Canadian Workplace Hazardous Materials Information System

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Material Safety Data Sheet

24-Hour Emergency Telephone Numbers
HEALTH: Chevron Emergency Information Center (800) 231-0623 or (510) 231-0623
TRANSPORTATION: CHEMTREC (800) 424-9300 or (703) 527-3887
Emergency Information Centers are located in the U.S.A. International collect calls accepted.

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

JP-8

Product Use: Fuel
Product Number(s): CPS243791
Synonyms: AVTUR

Company Identification
Chevron Global Aviation
a division of Chevron U.S.A., Inc.
1500 Louisiana Street
Houston, TX 77002

Product Information
MSDS Requests: 800-689-3998 (USA)
Product Information: 510-242-5357 (USA)

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Kerosene	8008-20-6	> 99 %weight
Diethylene glycol monomethyl ether	111-77-3	< 1 %weight

SECTION 3 HAZARDS IDENTIFICATION

****

EMERGENCY OVERVIEW

Clear to light yellow liquid with petroleum odor.

- COMBUSTIBLE LIQUID AND VAPOR
- HARMFUL OR FATAL IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE
- MAY CAUSE RESPIRATORY TRACT IRRITATION IF INHALED
- CAUSES SKIN IRRITATION
- TOXIC TO AQUATIC ORGANISMS

****

IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin causes irritation. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if

subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include nausea, vomiting, and diarrhea.
Inhalation: Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death. Mists of this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing.

SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required because this material is not expected to cause eye irritation. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get immediate medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.
Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

See Section 7 for proper handling and storage.

FIRE CLASSIFICATION:
OSHA Classification (29 CFR 1910.1200): Combustible liquid.

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

FLAMMABLE PROPERTIES:
Flashpoint: (Tagliabue Closed Cup) 100 ºF (38 C) (Min)
Auto ignition: 410ºF (210ºC)
Flammability (Explosive) Limits (% by volume in air): Lower: 0.7 Upper: 5

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible,

observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Liquid evaporates and forms vapor (fumes) which can catch fire and burn with explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 85F. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or fumes. Do not breathe mist. Do not taste or swallow. Wash thoroughly after handling.

Do not use as a portable heater or appliance fuel. Toxic fumes may accumulate and cause death.

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.
General Storage Information: DO NOT USE OR STORE near heat, sparks or open flames. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Polyvinyl Alcohol (PVA) (Note: Avoid contact with water. PVA deteriorates in water.), Viton
Respiratory Protection: Determine if airborne concentrations are below the recommended exposure limits. If not, wear a NIOSH approved respirator that provides adequate protection from measured concentrations of this material, such as: Air-Purifying Respirator for Organic Vapors
Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling	Notation
Kerosene	CHEVRON	350 mg/m3	1000 mg/m3		

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Clear to light yellow liquid with petroleum odor.
pH: NA
Vapor Pressure: 1 kPa (0.14 psi) @ 100 ºF
Vapor Density (Air = 1): 5.7
Boiling Point: 160 - 300 ºC (320 - 572 F)
Solubility: Low PPM range in water.
Freezing Point: -47 ºC (-53 F) (Max)
Density: 0.755 - 0.84 g/ml @ 15 ºC
Viscosity: 8 cSt @ -20 ºC (Max)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: May react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS
Eye Irritation: The eye irritation hazard is based on evaluation of data for similar materials or product components.
Skin Irritation: The skin irritation hazard is based on evaluation of data for similar materials or product components.
Skin Sensitization: The skin sensitization hazard is based on evaluation of data for similar materials or product components.
Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for similar materials or product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for similar materials or product components.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is expected to be toxic to aquatic organisms.

ENVIRONMENTAL FATE
Ready Biodegradability:
This material is not expected to be readily biodegradable.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Name: FUEL, AVIATION, TURBINE ENGINE
DOT Hazard Class: 3 (Flammable Liquid)
DOT Identification Number: UN1863
DOT Packing Group: III

SECTION 15 REGULATORY INFORMATION

SARA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	YES
2.	Delayed (Chronic) Health Effects:	NO
3.	Fire Hazard:	YES
4.	Sudden Release of Pressure Hazard:	NO
5.	Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

4A=IARC Group 1	12=TSCA Section 8(a) PAIR	21=TSCA Section 5(a)
4B=IARC Group 2A	13=TSCA Section 8(d)	25=CAA Section 112 HAPs
4C=IARC Group 2B	15=SARA Section 313	26=CWA Section 311
05=NTP Carcinogen	16=CA Proposition 65	28=CWA Section 307
06=OSHA Carcinogen	17=MA RTK	30=RCRA Waste P-List
09=TSCA 12(b)	18=NJ RTK	31=RCRA Waste U-List
10=TSCA Section 4	19=DOT Marine Pollutant	32=RCRA Appendix VIII
11=TSCA Section 8(a) CAIR	20=PA RTK	

The following components of this material are found on the regulatory lists indicated.

Kerosene	17, 18, 20
Diethylene glycol monomethyl ether	17, 20, 25

CHEMICAL INVENTORIES:
UNITED STATES: All of the components of this material are on the Toxic Substances Control Act (TSCA) Chemical Inventory.
CANADA: All the components of this material are on the Canadian Domestic Substances List (DSL).
WHMIS CLASSIFICATION:
Class B, Division 3: Combustible Liquids
Class D, Division 2, Subdivision B: Toxic Material -
Skin or Eye Irritation

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: REVISION STATEMENT: This document has been prepared using a new MSDS format and all 16 sections have been revised. Please read the entire document. Also, this is the first MSDS from Chevron Global Aviation, a division of Chevron USA, Inc.

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV	-	Threshold Limit Value	TWA	-	Time Weighted Average
STEL	-	Short-term Exposure Limit	PEL	-	Permissible Exposure Limit
			CAS	-	Chemical Abstract Service Number
NDA	-	No Data Available	NA	-	Not Applicable
<=	-	Less Than or Equal To	>=	-	Greater Than or Equal To

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1).

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Appendix B Field Forms

Soil Vapor Monitoring Point Data Sheet
Red Hill Long-Term Monitoring at Bulk Fuel Storage Facility
Pearl Harbor, O‘ahu, Hawai‘i

Date: _____ Instrument Type/No.: RAE or equivalent_____

Sampler:_____ Ambient Air Reading:
Calibration Date: CH_4= CO_2= ; O_2=;
Hg =

SVMP No.	Avg. Shallow Range	Avg. Mid Range	Avg. Deep Range	Pressure		% LEL	Sample Time	Remarks
				Open	Closed	n/a		
SVMP-02								
SVMP-03								
SVMP-04								
SVMP-05								
SVMP-06								
SVMP-07								
SVMP-08								
SVMP-09								
SVMP-10								
SVMP-11								
SVMP-12								
SVMP-13								
SVMP-14								
SVMP-15								
SVMP-16								
SVMP-17								
SVMP-18								
SVMP-20								
Office Structure:								

Notes:
LEL = lower explosive limit which is 5% by volume for methane (CH_4)
White = Deep, Blue = Mid, Orange = Shallow

Comments: _____

_____

_____

DRUM ID NUMBER: _____

DATE: _____

CONTENTS: _____

SITE LOCATION:
PROJECT TITLE:

CONTRACT NUMBER: **POINT OF CONTACT:** Environet, Inc.
Vilma Dupra
(808) 754-3925
vdupra@environethawaii.com

COMMENTS:

Fuel Product Monitoring Log

Project Name: _____ **Location:** _____
Project Number: _____ **Date:** _____
Project Manager: _____ **Equipment:** Solinst Interface Meter
Field Personnel: _____ **SOPs Used:** _____

Well ID	Gauge Time	Well Depth (feet bMP)	Depth to Product (feet bMP)	Depth to Groundwater (feet bMP)	Comments - Other Observations

NOTES:
MP = Measuring point; bMP = below measuring point; aMSL = above mean sea level

CHAIN OF CUSTODY RECORD

APPL, Inc.
4203 W. Swift
Fresno, CA 93722

Phone: (559) 275 2175

Fax: (559) 275-4422

C.O.C. № 21365

Report to: *PLEASE PRINT*	Invoice to: *PLEASE PRINT*
Company Name _____ Phone: _____	Company Name _____ Phone: _____
Address _____ Fax: _____	Address _____ Fax: _____
Attn: _____	Attn: _____

Project Name/Number	Sampler (Print)	Analysis Requested/Method Number	Date Shipped:
Purchase Order Number	Sampler (Signature)		Carrier:
			Waybill No.:
			Comments:

Sample Identification	Location	Date Collected	Time Collected	Matrix	Number of Containers										

Shuttle Temperature:	Turnaround Requested: MUST CHECK ONE ☐ Standard (2-3 week) ☐ One week ☐ 24-48 hour	Sample Disposal: ☐ Return to client ☐ Disposal by Lab (30-day retention)

Relinquished by sampler:	Date	Time	Received by:	Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:	Relinquished by:	Date	Time	Received at lab by:

White: Return to client with report Yellow: Laboratory Copy Pink: Sampler

SAFETY MEETING DOCUMENTATION

Project name: _____ Date: _____
and location _____ Time: _____
_____

Type of Safety Meeting: ☐ Initial Safety Briefing ☐ Daily Safety Meeting

Name of Person Conducting Meeting: _____

TOPIC DISCUSSED: _____

a. _____

b. _____

c. _____

d. _____

e. _____

NAME OF EMPLOYEES ATTENDING:

1._____ 11. _____

2. _____ 12. _____

3. _____ 13. _____

4. _____ 14. _____

5. _____ 15. _____

6. _____ 16. _____

7. _____ 17. _____

8. _____ 18. _____

9. _____ 19. _____

10. _____ 20. _____

INCEDENT REPORT FORM

Section 1: Data for Employee Involved in Incident – To be completed by supervisor.

Injury Illness Injury From a Vehicle Incident Near Miss
Employee Name

Work Phone Home Phone Birth Date SSN

Home Address (City, State, Zip)

Hire Date Hourly Wage Marital Status Dependents Job Title

Section 2: Supervisor (Must complete each item) - Print Clearly
Date of Incident Time Date/Time Reported To Whom

Client Name/Job Number Job Assignment at Time of Incident Time Shift Began

Exact Location & Address of Incident

Describe Incident

Root cause of Incident

Nature of Injury

Medical Attention? Yes No If yes, describe treatment

Dr./Hospital Name Address/Phone of Hosp.\

Witness Name *(Any witnesses should attach a short statement)*

Did injured leave work? When? Has injured returned to work? Yes No

Corrective Action(s) to Prevent Future Occurrence:

Supervisor/Foreman (Print Name) Telephone

Signature and Date

Section 3: Manager
Comprehensive comments on root cause of incident and corrective action
Manager (Print Name) Telephone

Signature and Date

Section 4: Environmental Safety and Health Professional

Concur with action taken? Yes No Remarks:

No Medical Care First Aid Only Medical Care by Medical Professional Fatality

OSHA Classification Pending OSHA Yes No Days away from work Restricted Days_____

ESH Professional (Print Name)

Signature and Date

Appendix C Environet SOPs (on CD-ROM)

■■■■■■ ***STANDARD OPERATING PROCEDURE***

DECONTAMINATION

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
650 Iwilei Road, Suite 204
Honolulu, Hawai'i 96817

Table of Contents

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for decontamination of personnel and equipment engaged in sampling activities. This SOP serves as a supplement to the project work plan, and the project Health and Safety Plan (HSP). It is intended that these procedures described below be used together with the project work plan, the project HSP, and other SOPs.

The overall objective of the sampling program is to obtain samples that accurately characterize the chemical contamination present at the sampling site. Extraneous contaminant materials can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g., by improperly cleaning the split spoon sampler between individual soil samples). Trace quantities of these contaminant materials can consequently be captured in a sample and lead to false positive analytical results, and, ultimately, to an incorrect assessment of the contaminant conditions associated with the Site. Decontamination of sampling equipment (e.g., bailers, pumps, tubing, soil and sediment sampling equipment) and field support equipment (e.g., drill rigs, vehicles) is therefore required prior to use to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off-site.

Section 2
Procedure

Equipment and personnel must be thoroughly decontaminated prior to entering the environmental investigation area (exclusion zone). Upon leaving the exclusion zone, all personnel and equipment must be thoroughly decontaminated. In addition, decontamination may be necessary from sample site to sample site within the exclusion zone. Proper decontamination of equipment and personnel will decrease the potential for cross contamination and reduce adverse health effects.

This procedure describes the decontamination of personnel, soil drilling and sampling equipment, monitoring well installation and sampling equipment, and tools used during field investigation activities. These procedures will remain in place unless modified by the site specific work plan or HSP.

2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

Plastic sheeting
Scrub brushes
Wash tubs
Buckets
Scrapers, flat blade
Hot water - high-pressure sprayer
Disposal drums (55-gallon with secure lids)
Sponges or paper towels
Alconox/Liquinox detergent (or equivalent)
Potable tap water
Laboratory-grade deionized water
Garden-type water sprayers
Isopropyl alcohol
Hand soap
Hand wipes

2.2 Personnel Decontamination

A temporary personnel decontamination line will be set up around each exclusion zone. If contamination is not encountered, a dry decontamination station may be established which consists of discarding of disposable personal protective equipment (PPE).

If real-time monitoring instruments indicates that contamination has been encountered, (i.e., action levels are exceeded requiring an upgrade from initial PPE levels), or if the initial PPE is Level B or C, a complete personnel decontamination station will be established.

The temporary decontamination line should provide space to wash and rinse boots, gloves, and all sampling or measuring equipment and a container to dispose of used disposable items such as gloves, tape, or tyvek.

The decontamination procedure for field personnel in Level B or C PPE shall include (also see the HSP):

Glove and boot wash in an Alconox solution
Glove and boot rinse
Duct tape removal
Outer glove removal
Coverall (Tyvek) removal
Respirator or self-contained breathing apparatus (SCBA) removal
Inner glove removal

2.3 Sampling Equipment Decontamination

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the HSP.
- Sampling equipment will be decontaminated prior to sampling activities, between sample locations, and at the end of sampling activities.
- Gross contamination on equipment will be scraped off at the sampling site.
- Equipment that will not be damaged by water will be placed in a wash tub containing Alconox or equivalent detergent along with tap water and scrubbed with a scrub brush or similar tool.
- Equipment will be rinsed with tap water, then with isopropyl alcohol and then a final rinse with deionized/distilled water.
- Groundwater sampling pumps will be “turned on” to allow detergent, tap water, and deionized/distilled water to cycle through the pump.
- The equipment will be allowed to air dry.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with deionized water. Care will be taken to prevent any equipment damage.
- Rinse and detergent water will be replaced with new solutions between borings or sample locations or as determined necessary by the field manager.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent cross contamination. If the equipment is to be transported, it will be

covered or wrapped in aluminum foil (preferred method), plastic sheeting, or heavy-duty trash bags to minimize potential airborne contamination.

The following guidelines will be followed in the field at all times to ensure sample integrity and to prevent any cross contamination of samples.

- A clean pair of disposable latex gloves will be worn each time a different location is sampled and shall be changed each time the gloves come into contact with a material that has not been properly decontaminated.
- Sample collection activities will proceed from the least contaminated area to the most contaminated area when this information is available.

2.4 Drilling and Heavy Equipment Decontamination

Drilling rigs will be decontaminated at the decontamination station. The following steps may be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the HSP.
- Drilling and heavy equipment will be decontaminated prior to drilling, between locations, and at the end of drilling.
- Remove as much soil and debris as possible from augers and tools at the borehole or sampling location.
- Equipment that will not be damaged by water, such as drill rigs, augers, drill bits, and shovels, will be sprayed and then rinsed with potable water. Care will be taken to adequately clean the insides of the hollow-stem augers.
- If augers and tools are visibly contaminated, clean tools in large tub so that decontamination water is contained.
- During soil sampling, the split spoon sampler and sample sleeves shall be decontaminated by the field crew and not the drilling contractor.
- After cleaning, place augers and tools on plastic sheeting on the cleaned bed of the support truck or the cleaned auger rack on the drill rig.
- Any decontamination water that was generated during drilling and heavy equipment decontamination shall be placed in 55-gallon drums or other suitable storage tank and the source of the water (i.e., borehole where tools were last used) shall be marked on the drum or tank.

An alternative to the above would be to steam clean auger flights.

2.5 Waste Handling

Any waste generated during decontamination activities will be collected and handled according to the procedures outlined in the project work plan and the SOP for waste handling.

2.6 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field notebook with consecutively numbered pages. The information entered in the field book concerning decontamination should include the following:

Decontamination personnel
Date and start/end times
Decontamination observations
Weather conditions

Section 3
Quality Assurance Requirements

Equipment rinsate samples will be taken of the decontaminated sampling equipment to verify the effectiveness of the decontamination procedures. The sampling procedure will include rinsing deionized water through or over a decontaminated sampling tool (such as a split spoon sampler or groundwater pump) and collecting the rinsate water into the appropriate sample bottles, which will be sent to the laboratory for analysis. The rinsate procedure, including the sample number, will be recorded in the field notebook. The frequency of rinsate sample collection and the laboratory analysis required are described in the project work plan. The handling and documentation procedures of the rinsate sample are described in the Containerizing, Preserving, Handling, and Shipping Samples SOP.

■■■■■ *STANDARD OPERATING PROCEDURE*

DRUM HANDLING

March 2001

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Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for the handling of drums (primarily 55-gallon drums) during the Johnston Island site characterization report. This SOP serves as a supplement to the Sampling and Analysis Plan (SAP) that is included in the Work Plan (WP). This document is intended to be used together with the SAP and other SOPs.

Section 2
Hazard Awareness and Regulatory Considerations

2.1 Hazard Awareness

A variety of work site activities may require unearthing, moving, lifting, overpacking, or sampling drums. Such activities are inherently hazardous and will always require special health and safety precautions. Drum handling presents numerous serious physical hazards including back injury, crushing, bruising, laceration, and severe trauma from mishandling. Drum contents may represent a fire or explosion hazard or may consist of shock-sensitive or pyrophoric materials. Drum contents may be pressurized or be acutely toxic. Contents may be corrosive or irritating or have other toxic effects. Drum handling may, therefore, represent both physical and chemical hazards.

2.2 Personal Protective Equipment (PPE)

The appropriate PPE ensemble for drum handling (and sampling) can vary significantly depending on the particular job conditions. Supplied air equipment (SCBAs or airlines) may be appropriate respiratory protection for a wide range of potential exposures. Full face air-purifying respirators may be adequate for other situations. Some drums may be safely handled without respiratory protection. The types of gloves, coveralls (coated or uncoated), boots, and other PPE can also vary based on hazard evaluation. The selection of the appropriate PPE should ultimately be performed by a Environet's Health and Safety Officer, as part of the site-specific Health and Safety Plan (HSP).

2.3 Regulatory Considerations

The primary regulation dealing with drum handling in hazardous waste operations is section (J) of 29 CFR 1910.120. These OSHA regulations are unique to hazardous waste operations and do not cover all contingencies.

Section 3
Drum Handling Procedures

3.1 Movement of Drums

The movement of full 55-gallon drums solely by hand is not recommended. Full drums should be moved with a dolly, hoist, sling, drum carrier, front end-loader, or other specialized device. A hydraulic drum grappler works well in certain applications. When drums are being moved, suspended, or overpacked, personnel should stand well clear of the drum.

3.2 Inspection of Drums

Prior to any handling, drums with unknown contents should be visually inspected for any words, symbols or labels on the drum surface which would indicate the nature of its contents. A careful inspection should also be made for signs of leakage, rusting, corrosion, or bulging. If the drum is of unusual construction or material, such as nickel or stainless steel, it may contain a particularly hazardous or sensitive material. The type of drumhead and type of bungs (if any) should be inspected. If the whole drum lid is removable, it may be designed to contain solid materials. If it has a bung (or bungs) it may be designed to contain a liquid. If the drum has a polyethylene or PVC liner, it may have been designed to contain a corrosive material. The top of the drum and the area around the bungs should be inspected for any signs of crystal formation, staining or unusual materials on the surface. An experienced drum handler may, on occasion, lightly tap the exterior of the drum or rock it very lightly to attempt to determine the level or amount of material in the drum. The drum may need to be photographed and numbered during the inspection process.

3.3 Spill Control During Drum Handling

Spills or leaks may occur during drum movement and handling. Absorbent materials (clay, oil-dry, etc.) should be readily available in sufficient quantity to absorb spilled or leaked material. Where large spills could occur, a containment berm should be constructed around the area. A special pad for drum handling (concrete, HDPE, etc.) with containment berms may be required for certain types of work. Spill control should be performed by appropriately trained personnel wearing adequate PPE. A Spill Plan should be part of the HSP.

3.4 Opening Drums

A non-sparking bung wrench should be used for removing bungs to gain access to the drum interior. An appropriately rated fire extinguisher should be on hand ready for use to control incipient fires. OSHA specifies that a "suitable shield" be placed between the employee and the drum being opened to protect the employee in case of accidental explosion. If there appears to be real danger of accidental explosion, the drum should be opened remotely. One of the best ways to do this is to use a bronze spike mounted on the end of a backhoe arm. The backhoe operator looks out through a clear explosion shield. The spike is used to punch a hole through the surface of the drum. A variety of pneumatic and hydraulic remote drum-operating devices may be available. The efficiency of their use must be evaluated on a case-by-case basis.

3.5 Drum Overpacking

Leaking fifty-five gallon drums are usually overpacked into an 85-gallon overpack drum. There are a variety of ways to perform this safely. It can be done by vertical suspension and insertion or it may be done by sliding the two drums together horizontally (laying down). If the drum to be overpacked is suspended, it must be firmly held by a scissor clamp or other positive gripping device.

Do not contact the drum with hands while it is suspended. Use a board or other device to steady or position the drum which is being overpacked. If a forklift is used, the operator must have specialized training prior to performing drum overpacking. Horizontal overpacking may be a safer technique in some cases. However, great care must be exercised to avoid back injury when pushing the overpacked drum into an upright position.

■■■■■ *STANDARD OPERATING PROCEDURE*

EMERGENCY PROCEDURES

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

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Section 1 Purpose

The purpose of this Standard Operating Procedure is to provide guidance in preparing for contingency or emergency situations during field activities. Accidents can and do happen. However, with adequate planning and preparedness resulting consequence can be minimized or prevented.

Emergency preparedness starts with advanced planning. It requires anticipation of potential problems or hazards. Proper emergency preparedness involves use of the project health and safety plan that may address emergency situations. It involves training, site orientation of personnel, medical information of personnel, and availability of emergency equipment and services.

Section 2 Types of Emergencies

There are three major categories of emergencies that can occur during hazardous waste site investigations. They are medical emergencies, accidents, and safety equipment problems.

2.1 Medical Emergencies

Medical emergencies can be described as situations that present a significant threat to the health of personnel involved in site investigations. These can result from chemical exposures, heat stress, cold stress, and poisonous insect or snake bites. Medical emergencies must be dealt with immediately and proper care should be administered. This may be in the form of first aid and emergency hospitalization.

2.2 Accidents

Accidents can result from physical hazards on a site. These hazards can include tripping, catching, cutting, and may be associated with debris on a site or heavy equipment used in the investigation. Accidents may include:

- Broken bones;
- Burns;
- Sprains;

- Puncture wounds;
- Electrical shock; and
- Cuts by contaminated materials.

Appropriate medical attention must be provided to individuals involved in site investigations who have suffered an accident.

2.3 Safety Equipment Problems

A source of emergency may develop due to malfunction or other problem associated with safety equipment being utilized by investigative personnel. These types of problems may or may not result in emergency situations. However, safety equipment problems must be corrected before proceeding with field investigative activities. Safety problems may include:

- Leaks or tears in protective clothing;
- Failure of respiratory protective devices (SCBA, air-purifying respirators); and
- Encountering contaminants for which prescribed protective equipment may not be suitable.

Section 3 Advance Planning

Advance planning should be practiced and include assessments of potential hazards or problems that may be encountered. Emergency preparedness should be addressed in the site safety plan. It should consider:

- Hazard evaluation;
- Emergency precautions;
- Hospital/poison control centers (telephone numbers);
- Emergency transportation systems (fire, police, ambulance);
    - Emergency routes (maps, dry runs); and
    - Escape routes:
        - On-site escape (rapid evacuation to safe area)
        - Off-site escape (best means of evacuation from site).

Section 4 Training

Investigative teams should include personnel with training in first aid and CPR. Personnel should become familiar with site area, available equipment, and emergency services available.

Section 5 Medical Surveillance Information

Personnel should be aware of any special medical problems of individual team members. This may include allergies, insect stings, poison plants, penicillin, etc.

Section 6 Emergency Equipment

Provisions should be made to have appropriate emergency equipment available and in proper working condition. This equipment may include:

- First aid kits;
- Eye wash kits - fill and pressurize;
- Fire extinguisher;
- Emergency oxygen;
- Splints;
- Stretcher;
- Blankets; and
- Life vests.

Equipment should be checked before commencing site investigation activities, and defective equipment repaired or replaced before performing site investigation. Provisions should be made for redundant or back-up safety equipment.

Section 7 Safety Practices

The following safety practices should be utilized to prevent or deal with emergency situations:

1. A continuous line-of-sight should be maintained between work party downrange and personnel at the command post. Personnel stationed beyond the command post, in

order to maintain the line-of-sight with the work party, must be outfitted with appropriate protective equipment.

2. Person should be dressed to same degree as the work party in order to provide an extra man for any needed rescue effort.
3. Communications should be maintained and work party must have system for rapid and clear distress call back to command post.
4. Check to insure that all preplanning information is correct.
5. Maintain thorough knowledge of expected weather conditions. Avoid working in wet weather, electrical storms, extremely hot conditions, or extremely cold conditions.
6. Thoroughly understand tasks to be performed.
7. Thoroughly brief all team members on all aspects of the tasks.

Section 8 Documentation

Records should be maintained with regard to emergency situations. Incident/Accident Reports should be filed in the event of an incident or accident (see OP SOP-103).

■■■■■■ ***STANDARD OPERATING PROCEDURE***

FIELD EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

April 2010

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List of Acronyms

%	percent
ºC	degrees Celsius
°F	degrees Fahrenheit
cc	cubic centimeter
CH_4	methane
cm	centimeter
CO_2	carbon dioxide
COND	conductivity
DEP	depth
DO	dissolved oxygen
H_2O	water
LCD	liquid crystal display
LED	light emitting diode
m	meter
mg/L	milligrams per liter
ml	milliliter
N_2	nitrogen
NTU	Nephelometric Turbidity Unit
O_2	oxygen
pH	hydrogen activity
PID	photo-ionization detector
psig	pound-force per square inch gauge
S/m	siemens per meter
SOP	standard operating procedure
TURB	turbidity
VOC	volatile organic compound
WP	Work Plan

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Section 1 Purpose and Scope

This document defines the standard operating procedure (SOP) for calibrating, operating, and maintaining equipment commonly used during field investigation activities. This SOP serves as a supplement to the Work Plan (WP). This procedure is intended to be used together with the WP and other SOPs.

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Section 2 Calibration Procedures

2.1 Horiba Multiparameter Probe

To obtain correct measurements, the Horiba Multiparameter Probe must be calibrated each day before performing measurements. In general, calibration is done by adjusting the probe with standard solution(s). Calibration, operation, and maintenance of the multiparameter probe should follow the manufacturer's specific instructions.

The specific calibration procedures for the Horiba Multiparameter Probe will consist of the following procedures:

Auto Calibration Method

1. Fill the calibration beaker to the marked line with hydrogen activity (pH) 4 standard solution (use the 100-4 pH standard solution manufactured by Horiba).

2. Wash the Horiba probe sensor in distilled water three times and then immerse in the pH 4 solution.

3. Press the POWER key.

4. While "AUTO" is displayed, press the CAL key in one of the measurements modes pH, conductivity (COND), turbidity (TURB), dissolved oxygen (DO), and depth (DEP). "AUTO" and "CAL" appear and the instrument enters the auto calibration mode.

5. Press the ENT key to start auto calibration. Upon completion of all the pH, COND, TURB, DO, and DEP modes, "End" will be displayed. The instrument is now calibrated.

6. Complete the calibration form, and record the time and the standard solution temperature in the field notebook. The 100-4 pH standard solution contents at 25 degrees Celsius (ºC) are as follows: pH (4.01); COND (0.449 siemens per meter (S/m)); TURB (0 Nephelometric Turbidity Unit (NTU)); DO (8.52 milligrams per liter (mg/L)); and DEP (0 meter (m)).

7. Press the MEAS key to return to the measurement mode.

Manual Calibration Method

Manual pH Calibration

1. Wash the sensor three times using distilled water, then pour pH 7 standard solution into the calibration beaker to the marked line, and immerse the sensor in it.

2. Press the POWER key.

3. While "MAN" is displayed, press the CAL key twice in the pH measurement mode.

4. Use the UP/DOWN keys to input the value for the pH 7 standard solution at the measurement temperature.

5. Press the ENT key.

6. Wash the sensor three times using distilled water, then pour pH 4 or pH 9 standard solution into the calibration beaker to the marked line, and immerse the sensor in it.

7. After the zero calibration of the pH sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

8. Use the UP/DOWN keys to set the value for the pH 4 or pH 9 standard solution at the measurement temperature.

9. Press the ENT key. The manual span calibration starts.

10. Press the MEAS key to return to the measurement mode.

Manual Conductivity Calibration

1. Wash the conductivity sensor three times using distilled water. Completely remove the water on the sensor and calibrate the instrument in the atmosphere.

2. Press the CAL key twice in the conductivity measurement mode.

3. Use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key.

5. Wash the sensor three times using distilled water, then pour standard solution into the calibration beaker, and immerse the sensor in it.

6. After the zero calibration of the conductivity sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. Use the UP/DOWN keys to set the standard solution value.

8. Press the ENT key. The manual span calibration starts.

9. Press the CAL key and use each standard solution and perform steps 1 and 4 (above) for calibration.

10. Press the MEAS key to return to the measurement mode.

Manual Turbidity Calibration

1. Wash the sensor three times using distilled water, then place some distilled water into the calibration beaker, and immerse the sensor in it.

2. Press the CAL key twice in the turbidity measurement mode.

3. Use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key.

5. Wash the sensor three times using distilled water, then pour standard solution into a calibration beaker, and immerse the sensor in it.

6. After the zero calibration of the turbidity sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. Use UP/DOWN keys to set the standard solution value.

8. Press the ENT key. The manual span calibration starts.

9. Press the MEAS key to return to the measurement mode.

Manual Dissolved Oxygen Calibration

1. Wash the sensor three times with distilled water and immerse the DO sensor completely in zero calibrated liquid.

2. Press the CAL key twice in the DO measurement mode.

3. After the display has stabilized, use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key. The manual calibration starts.

5. Wash the sensors three times with distilled water and immerse the DO sensor completely in span calibrated liquid.

6. After the zero calibration of the DO sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. After the display has stabilized, use the UP/DOWN keys to set the amount of saturated DO in water at the temperature.

8. Press the ENT key.

9. Press the MEAS key to return to the measurement mode.

2.2 MiniRAE 2000 Portable VOC Monitor

WARNING: *The MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is classified as to intrinsic safety for use in class I division 1, groups A, B, C, D, or non-hazardous locations only. Do NOT proceed before reading the instrument manual.*

MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is a compact monitor designed as a broadband volatile organic compound (VOC) gas monitor and data logger for work in hazardous environments. It monitors VOCs using a photo-ionization detector (PID). It gives real time measurements and activates alarm signals whenever the exposure exceeds preset limits.

Primary Calibration

Primary calibration of the MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is accomplished annually at the factory using isobutylene-in-air standard calibration gas. The MiniRAE 2000 is also programmed at the factory with default alarm limits.

Fresh Air and Span Calibration

1. Press the MODE key for one second and release to turn on the instrument. The audio buzzer will beep once and the air pump will turn on. The display will show series of information as it runs through the start up menu.
2. Then the "Ready…" message or the instantaneous reading display "0.0 ppm" is displayed.
3. Press and hold down both N/- and MODE keys for three seconds to enter programming mode.
4. The first menu item "Calibrate/Select Gas?" will be displayed.
5. Release both N/- and MODE keys simultaneously.
6. Press Y/+ key to select "Calibrate/Select Gas?"
7. Press Y/+ to select "Calibrate/Select Gas?" sub-menu "Fresh Air Cal?"
8. Make sure that the MiniRAE is connected to a fresh air source (ambient air without detectable contaminant).
9. Press Y/+ key, the display shows "Zero in Progress", followed by "Wait" and a countdown timer.
10. After a 15 second pause, the display will show the message "update data… zeroed… reading = X.X ppm…"
11. Press any key or wait about 20 seconds, the monitor will return back to the "Fresh Air Calibration?" submenu.
12. Make sure the monitor is connected to a span gas source.
13. Press the Y/+ key at the "Span Cal?" to start the calibration. The display shows the gas name and the span value of the corresponding gas.

14. The display shows, “Apply Gas Now!” Turn on the valve of the span gas supply.
15. The display shows, “Wait… 30”, with a count-down timer showing the number of remaining seconds while the monitor performs the calibration.
16. When the countdown timer reaches zero, the display shows the calibrated value. The reading should be very close to the span gas value.
17. After a span calibration is completed, the display will show the message, “Update Data Span Cal Done! Turn Off Gas”.
18. Turn off the flow of gas. Disconnect the calibration adapter from the MiniRAE 2000.
19. Press any key and it returns back to “Span Gas Cal?”
20. Press and hold the MODE key for five seconds to turn off the instrument.

2.3 GEM 2000 Gas Meter

WARNING: *The GEM 2000 is not certified as intrinsically safe. The following procedure MUST NOT be done in a confined space or where there is any chance of sparking or ignition. No smoking, exposed lighting, or other sources of ignition should be in the area. On the GEM 2000, ensure that the exhaust gas is safe, not blocked and properly vented away from you. Ensure that no leaks are present. Unless all above conditions are maintained, an explosion could occur resulting in serious injury or death.*

Primary Calibration

Primary calibration of the GEM 2000 is accomplished at the factory using a gas mixture of 50 percent (%) methane (CH_4), 35% carbon dioxide (CO_2) for CH_4 and CO_2 calibration and gas mixture of 2% oxygen (O_2), balance nitrogen (N_2) for O_2 calibration. The primary calibration is performed annually.

Daily Calibration

1. Connect the calibration gas cylinder to the pressure regulator using the same gas mixtures as the one used for primary calibration.

2. Connect the pressure regulator to a one liter Tedlar bag using 24 inches of a 1/8 inch Tygon tubing.

3. Fully open the Tedlar bag fill/sample valve, then slowly open the pressure regulator valve and allow the gas measure to flow into the Tedlar bag. Once the Tedlar bag is full, shut the valve on the pressure regulator and on the Tedlar bag.

4. Connect one end of 1/8 inch Tygon tubing to the Tedlar bag and one end to the sample inlet of GEM 2000, use 1/8 inch quick disconnect to connect tubing to GEM 2000.

5. Once the instrument is on the appropriate screen, start opening the Tedlar bag fill/sample valve slowly and follow the steps below.

Methane and Carbon Dioxide Calibration Procedure:

1. Turn the instrument on and press key 1-Menu.

2. From the main menu, scroll down to select Field Calibration.

3. Zero the CH_4 as follows:

    a. Connect a zero CH_4 gas mixture to the instrument following the setup procedure above and allow calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve, you may use 2.0% O_2/balance N_2. Allow gas to flow for at least 30 seconds or until reading stabilizes.

    b. Press Calibration Menu, then Zero Channels.

    c. Press Zero CH_4.

4. Connect 50% CH_4, 35% CO_2 gas mixture to GEM 2000 following the set up procedure above and allow the calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve.

5. Allow gas to flow for 30 seconds, then Span gases as follows:

    a. Press 3-Edit Target Concentrations, and then enter gas concentrations by key in percentages as three digits for each gas in the corresponding column under row S. After keying in each value press Enter.

    b. Press enter Calibration Menu, then scroll down and press Enter to select Span Channels.

    c. Press Enter to select Span CH_4 at 50%; the screen will prompt a message, "Calibration Complete".

    d. Scroll down to select Span CO_2 at 35%; the screen will prompt a message, "Calibration Complete".

    e. Scroll down to select Span O_2 at 2.0%; the screen will prompt a message, "Calibration Complete".

6. Continue allowing gas to flow into the instrument and check current readings (row R). If current reading is within ±0.5 %, repeat span calibration again.

Oxygen Calibration Procedure

1. Turn the instrument on and press key 1-Menu.

2. From the main menu, scroll down to select Field Calibration.

3. Zero the O_2 as follows:

a. Connect a zero O_2 gas mixture to the instrument following the set up procedure above and allow the calibration gas mixture to flow slowly into GEM inlet port by opening the Tedlar Bag fill/sample valve, you may use 50% CH_4, 35% CO_2, balance N_2 mixture. Allow gas to flow for at least 30 seconds or until reading stabilizes.

b. Press Calibration Menu, then Zero Channels.

c. Scroll down and press enter Zero O_2.

4. Connect 2.0% O_2/balance N_2 mixture to the GEM 2000 following the set up procedure above and allow the calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve.

5. Allow gas to flow for 30 seconds, then span gases as follows:

   a. Press enter Calibration Menu, then scroll down and select Span Channels.

   b. Scroll down to select Span O_2 at 2.0%, the screen will prompt a message "Calibration Complete".

6. Continue allowing gas to flow into the instrument and check current readings (row R). If the current reading is within ±0.5% of calibration gas concentration, calibration is satisfactory.

7. If current reading is greater that ±0.5% range, repeat span calibrations again.

2.4 LANDTEC GA-90 Landfill Gas Analyzer

WARNING: *The LANDTEC GA-90 is not certified as intrinsically safe. The following procedures MUST NOT be done in a confined space such as vaults, excavations, indoors, or where there is any chance of sparking or ignition. Ensure that exhaust gas is safe, not blocked and properly vented away from you. Ensure no leaks are present. Unless all above conditions are maintained, an explosion could result causing serious injury or death.*

Primary Calibration

The GA-90 is a portable scientific field instrument that does require factory calibration using various gas mixtures in an environmental chamber at recommended six month intervals under normal landfill usage. Factory calibration has been designed to give the best possible results over a wide range of conditions; however, the instrument's accuracy can be improved in specific operating ranges by performing "field calibration." At any time, the GA-90 can be reset by returning to the "factory settings." This clears the GA-90 of any user calibration setting and restores the GA-90 to its original factory calibration.

Field Calibration

Field calibration should be performed prior to taking a series of gas or pressure readings. It is important to field calibrate the GA-90 on-site after the instrument has stabilized at working temperature. Field calibration is menu-guided and can be completed in about 10 minutes.

To perform field calibration, the following items are required:

1. gas mixture of 50% CH_4 and 35% CO_2;

2. gas mixture of 2% O_2 and 98% N_2;

3. pressure regulators for the above cylinders capable of regulating in the range of 0 to 5 pound-force per square inch gauge (psig) fitted with connectors suitable for ¼ inch Tygon tubing;

4. regulator/flow meter capable of measuring in the range of 100 to 600 cubic centimeter (cc) per minute maximum with fitting suitable for ¼ inch Tygon tubing or LANDTEC regulator which is set to deliver the required flow; and

5. interconnecting lengths of ¼ inch Tygon tubing.

Gas Calibration

1. Connect the calibration gas cylinder to the pressure regulator.

2. Connect the sample input line.

3. Connect a second 24 inches of ¼ inch Tygon tubing to the exhaust nozzle of the GA-90. Direct exhaust away from you and out of the immediate area.

4. Turn the calibration gas cylinder valve two turns.

5. If using LANDTEC regulator, no flow meter is required. Turn off cylinder valve.

6. If not using the LANDTEC regulator, adjust the regulator discharge pressure to 2 psig and the flow meter to 300 cc per minute. Pinch the gas supply hose that will attach to the GA-90. The regulator discharge pressure should not climb greater than 5 psig. Turn off the cylinder valve.

7. Turn unit on by pressing the red on/off key. The warning screen will appear for five seconds. This is a reminder that the GA-90 is not to be used in confined areas such as vaults, excavations, or indoors.

8. Press Key 0 to go to the Main Menu Screen. All GA-90 functions are accessed from the Main Menu Screen.

9. Press Key 1 “General Utilities” on the Main Menu Screen.

10. Press Key 9 “More” followed by Key 5 “Gas Calibration”.

11. There are four possible choices. The first allows a field calibration to be performed on the GA-90 for CH_4, the second for CO_2, the third for O_2, and the fourth returns the GA-90 to the original factory settings.

Methane Calibration- Zero Methane

1. Press Key 1 “CH_4 Calibration”.

2. Press Key 1 “Zero CH_4”. A CH_4 percentage will not display until the IR Bench warms up. A plus or negative sign may appear on the far left of the display. This symbol can be ignored. **Note: Do not perform this procedure in the presence of CH_4.**

3. Pressing Key 5 “Pump” turns on the GA-90 sample pump. There should be no calibration hose attached to the GA-90 during this procedure. The GA-90 will be drawing in a sample of normal air **which must be free of CH_4**. Run the pump for five minutes.

4. Press Key 1 “Zero Level”. If the “CH_4 Not Zeroed” Screen displays, return to the Gas Calibration Screen by pressing Key 0 “Exit”. Recheck that no CH_4 was present and re-zero the CH_4. If the problem persists, proceed to the Factory Settings Calibration section of this manual.

5. When the “CH_4 Zeroed OK” Screen appears, press Key 0 “Exit” to return to the CH_4 Calibration Screen. Press Key 2 “Calibrate CH_4 Span” and proceed to the next section.

Methane Calibration- Methane Span

1. Connect the ¼ inch Tygon tubing from the calibration gas regulator/flow meter to the GA-90 gas sample port. Attach, if not already attached, the Tygon tubing to the exhaust port of the GA-90. Direct the exhaust away from you and out of the immediate area.

2. Turn on the calibration gas mixture of CH_4 and CO_2. The pump does not have to be on.

3. If not using LANDTEC supplied regulator, check the calibration gas flow at 300 cc and pressure no greater than 2 psig.

4. Allow calibration gas to flow into the GA-90 for two minutes or until the instrument gas reading stabilizes. After two minutes, read the CH_4 gas concentration on the screen. It should be stable and not changing more than a few tenths of one percent at the 15% gas level, 1% at the higher gas level.

5. Press Key 1 “Enter Gas Con” and input the CH_4 concentration of the calibration gas using the keyboard. Enter the percentage as three digits (e.g., 50% CH_4 would be input as 500).

6. Press Key 0 “Exit”. A “Caution Re-Calibrate” Screen will appear. Press Key 1 “Yes” and one of two messages will appear:

a. If the "Calibration OK" Screen flashed, proceed to step seven.

b. If the "Calibration Gas Not Accepted" Screen appears, press Key 1 "Yes" and re-enter CH_4 percentage. If the calibration gas percentage is still not accepted, press Key 0 "No" and start the procedure again from zero CH_4. If the problem persists, proceed to Factory Settings Calibration section of this manual.

7. If CO_2 is to be calibrated, press Key 0 twice to return to the Gas Calibration Screen.

8. If no further calibration is required, turn off the calibration gas cylinder. Remove gas hose attached to gas sample port. Leave the exhaust port hose connected. Turn on the pump and purge the instrument with air for 60 seconds (CH_4 concentration should read 0.00%). Press Key 0 to return to Main Menu Screen.

Carbon Dioxide Calibration

1. Press Key 2 "CO_2 Calibration" on the Gas Calibration Screen.

2. Press Key 1 "Enter Gas Con". Input the CO_2 concentration of the calibration gas using the keyboard. Enter the percentage as three digits (e.g., 35% CO_2 would be input as 350). Press Key 0 "Exit".

3. Press Key 1 "Yes" on the Caution Re-Calibrate Screen. One of two messages will appear.

   a. If the "Calibration OK" screen flashed, proceed to step four.

   b. If the "Calibration Gas Not Accepted" Screen appears, press Key 1 "Yes" and re-enter the CO_2 percentage. If the screen still appears, press Key 0 "No" and start the procedure again. If the problem persists, proceed to the Factory Setting Calibration section of this manual.

4. If O_2 is to be calibrated, press Key 0 to return to the Gas Calibration Screen.

5. If no further calibration is required, turn off the calibration gas cylinder. Remove the gas hose attached to gas sample port. Leave the exhaust port hose connected. Turn on the pump and purge instrument with air for 60 seconds (CO_2 concentration should read 0.00%). Press Key 0 twice to return to Main Menu Screen.

Oxygen Calibration- Zero Oxygen

1. There are two calibration gas mixtures used for the calibration of O_2. The CH_4/CO_2 calibration gas previously used to calibrate the CH_4 and CO_2 and a second calibration gas with a mixture of O_2 and N_2 will be used to set the O_2 level.

2. Press Key 3 "O_2 Calibration" on the Gas Calibration Screen.

3. Press Key 1 "Zero O_2". Read the O_2 Gas Concentration on the screen. It should read very near to 0.00% and not change more than a few tenths of one percent.

4. Press Key 1 “Zero Level”. One of two of the following screens will appear:

    a. If the “O_2 NOT Zeroed” screen displays, return to the O_2 Calibration Screen. Recheck hose for air leaks and that the calibration gas contains no O_2. The gas used must be O_2 free. Re-zero the O_2. If the problem persists, proceed to instructions contained in the Factory Settings Calibration section of this manual.

    b. If the “O_2 Zeroed OK” Screen displays, turn off the calibration gas and remove the hose to the GA-90 from the flow regulator. Press Key 0 “Exit” to return to the O_2 Calibration Screen.

Oxygen Calibration- Oxygen Span

Note: The calibration gas used in this procedure is a mixture of O_2 and balance gas. The O_2 concentration by volume can be 2 to 5% with the remainder N_2. The instructions assume a 4% O_2/96% N_2 mixture will be used.

1. Press Key 2 “Calibrate O_2 Span” on the O_2 Calibration Screen.

2. Change the calibration gas mixture to O_2/N_2. Install the regulator/flow meter on the new calibration gas mixture. Check and adjust the gas flow to 300 cc and pressure to 2 psig if not using the LANDTEC regulator/flow meter. Turn off the gas.

3. Connect the ¼ inch Tygon tubing from the calibration gas regulator/flow meter to the GA-90 gas sample port. Attach, if not already attached, the Tygon tubing to the exhaust port of the GA-90. Direct the exhaust away from you and out of the immediate area.

4. Turn on the calibration gas mixture.

5. Check the calibration gas flow (300 cc) and pressure (2 psig) if not using the LANDTEC regulator.

6. Allow the calibration gas to flow into the GA-90 for two minutes or until the O_2 reading stabilizes. After two minutes, read the O_2 gas concentration from the screen. It should be stable and not changing more than a few tenths of one percent.

7. Press Key 1 “Enter Gas Con” and input the O_2 concentration of the calibration gas using the keyboard. Enter the percentage using three digits (e.g., 2% O_2 would be input as 020). Press Key 0 “Exit”.

8. Press Key 1 “Yes” on the Caution Re-Calibrate Screen. One of two screens will appear.

    a. If the “Calibration Gas NOT Accepted” Screen appears, press Key 1 “Yes” and enter the percentage of O_2 gas. If the screen still appears, press Key 0 “No” and return to the O_2 Calibration Menu. Start the procedure again. If the problem persists, proceed to the Factory Settings Calibration section of this manual.

b. If the "Re-Calibrated OK" Screen appears, press Key 0 "Exit" to return to the O_2 Calibration Screen. Turn off the calibration gas and remove the calibration gas hose attached to the gas sample port. Leave the exhaust port hose connected. Press Key 5 "Pump" to purge instrument with air for 60 seconds.

9. Optional Step Upper O_2 Scale Calibration-The GA-90 was just calibrated on 0 to 5% O_2 scale. The 5 to 21% scale can be calibrated using normal air. While on the O_2 Calibration Screen press Key 5 "Pump" and enter an O_2 concentration of 21.0% even though the screen will seldom reach more than 20.6%. You have just calibrated the upper O_2 scale. To exit, press Key 0 until the Main Menu screen appears.

Factory Settings Calibration

Note: This procedure eliminates the field calibration done in the above procedures. It is sometimes necessary to bring the GA-90 back to factory settings before trying to field calibrate the unit.

1. From the Gas Calibration Screen, press Key 5 "Factory Settings".

2. Press Key 1 "Yes".

3. After loading the factory setting, the CH_4 and O_2 calibration must be re-zeroed prior to use.

Section 3 Operation Procedures

3.1 Horiba Multiparameter Probe

1. After the probe is calibrated, immerse the sensor in the sample.
2. Select the measurement item. Press the MEAS key to switch measurements.
3. Record measurement data in the groundwater sampling log or store measurement data in the instrument memory.
4. After completion of measurement, turn the power to the instrument off.
5. Wash off the sensor using distilled water and then wipe off the water drops.
6. Pour about 20 milliliters (ml) distilled water in the probe cap and install it on the sensor probe.

3.2 MiniRAE 2000 Portable VOC Monitor

1. After the MiniRAE 2000 is calibrated, it is ready for immediate operation.
2. Press the MODE key for one second and release to turn on the instrument. The audio buzzer will beep once and the air pump will turn on. The display will show series of information as it runs through the start up menu.
3. Then the "Ready…" message or the instantaneous reading display "0.0 ppm" is displayed.
4. Press and hold the MODE key for five seconds to turn off the instrument.

3.3 GEM 2000 Gas Meter

1. After the GEM 2000 is calibrated, it is ready for immediate measurement.
2. Turn the instrument on. The instrument will perform a self-test sequence taking approximately 20 seconds.
3. Upon self-test completion, the instrument automatically enters the read gas levels screen.
4. Connect well sample gas outlet to GEM 2000 and allow gas to flow into the GEM inlet port by opening the well sample outlet valve.
5. Allow gas to flow for 30 seconds, then record and/or save readings.
6. To turn the instrument off, press and hold the On/Off button for 15 seconds.

3.4 LANDTEC GA-90 Landfill Gas Analyzer

1. After the LANDTEC GA-90 is calibrated, additional General Utilities functions should be addressed prior to sampling.

    a. Key 1 “Check Time/Date” to make sure the data collected is properly date stamped.

    b. Key 9 “More”, then Key 4 “Check Memory” to see if there is enough space in the GA-90 for the reading. Otherwise the memory will have to be cleared.

    c. Key 3 “Gas Alarms” if you wish to have the GA-90 alert you to unusual gas conditions.

    d. Key 7 “Battery” to check if the battery is charged.

2. The proper hoses must be connected from the GA-90 to a wellhead in order to collect data.

    a. Connect the Tygon hose to the Sampling Port to measure pressure when connected to wellhead static pressure port by tubing.

    b. Connecting to the Pressure Port measures impact pressure when connected to wellhead impact pressure port by the tubing.

    c. The Exhaust Port must be kept clear. If blocked while operating, over pressurization and damage to internal components and the case could occur.

    d. The Receptacle Port is used for battery recharging, data downloading, and temperature readings.

3. Press Key 2 on the Main Menu Screen.

4. Press Key 1 “Yes” on the Read Using ID Screen. The Enter ID Screen will display.

    a. Press Key 1 “Scroll” to scroll through ID information. Press Key 2 to select the desired ID.

    b. Press Key 2 “Manual” on the Enter ID Screen to assign each monitoring point a unique identification. This code must be eight characters long and may be a combination of letters and numbers. Typically, the landfill name or an abbreviation is used for the first four characters and one letter and three numbers for the second four characters. Enter the ID code using number and/or letter mode (Use the BLUE Key to switch between numbers and letters). For letters, press Key 1 “Cursor Up” and/or Key 6 “Cursor-Down” and enter each letter by pressing Key 0 “Enter”.

5. Once ID information has been correctly entered, press the Key 1 “Read Gas Levels”

Pressure Measurements

1. If the ID requires a pressure measurement, a screen will ask whether you wish to zero. Press Key 1 for "Yes" and remove all hoses and press any key. Ensure that the pressure indicated is 000.00 in water (H_2O). If not, zero again.

2. Once pressure is zeroed, press Key 0 "Exit". Reconnect the hose to the pressure port and press any key to continue.

3. The well or probe pressure will be shown. Press Key 1 to store this reading. The Reading Stored Screen will be shown for three seconds before returning to the previous screen. An updated pressure may be stored by repeating this step.

Gas Measurements

1. To continue to gas measurement, press Key 0. After reconnecting the hose to the sample port, press any key.

2. Press Key 5 "Pump" to turn the pump on and draw a gas sample. Allow readings on the left side of the screen to become stable (about 60 seconds) before pressing Key 6 "Store".

3. Press Key 5 "Pump" to turn the pump off.

4. Press Key 1 "LEL" to display the Lower Explosive Limit Screen. Press Key 0 "Exit" when finished.

Gas Sample Temperature and Probe Depth

1. Press Key 2 "More" to display gas sample temperature and probe depth.

2. Leading zeros must be inserted for both temperature and depth (e.g., 78 degrees Fahrenheit (°F) would be entered as 078 and 5 feet 6 inches would be entered as 00506).

3. Press Key 6 "Store" and Key 4 "ID" to advance to next programmed ID.

4. After pressing Key 4 "ID", the pump will automatically shut off if it is still on. Press Key 5 "Purge" and follow screen instructions to perform purge. You should purge after each sample.

5. Press Key 1 "Next ID" to begin with the next sample and repeat above steps. If an alternate ID needs to be located, select Key 2 "Retry" and select an alternate ID.

Read Gas-Logging Function

Six hours of automatic gas data logging is possible as long as the batteries are fully charged. The logging time interval is from five to 60 minutes. The well to be logged must have an ID already stored.

1. Connect hose to gas sample port.

2. Press Key 8 to start the logging function.

3. Input a sampling time interval of five to 60 minutes and press Key 0 to exit.

4. The next screen allows the user to select the running time for the pump. There are five choices ranging from 15 to 90 seconds. Input a time and press Key 0 to exit.

5. To end logging, press Key 0 “Stop Logging”.

Section 4 Maintenance Procedures

4.1 Horiba Multiparameter Probe

Sensor Probe

After use, wash with distilled water and wipe off all contamination. Pour about 20 ml of distilled water into the probe cap, install it on the sensor probe, and store in the carrying case.

In order to use the instrument regularly for a long time, store it after wiping off all contamination from the cable, sensor probe, and sensors.

TEMP/COND/TURB Unit

1. To remove contamination, remove the lid from the cell.

2. Clean the unit in distilled water. If the unit is severely contaminated, use an absorbent cotton to remove contamination.

3. Attach the lid to the cell block before storage.

pH/ORP Sensor

To remove contamination, use a piece of gauze dampened with detergent and wipe off the contamination.

For long-term storage, remove the sensor from the sensor probe and check that the internal solution replenishment port is closed. Then, attach a seal to the liquid junction and attach the rubber caps before storage.

For monthly maintenance, replace the internal solution as described below:

1. remove the sensor from the sensor probe using a sensor spanner;

2. open the internal solution replenishment rubber stopper and remove the internal solution with a syringe;

3. inject new internal solution to the level near the rubber stopper. Be careful to avoid air bubbles from coming in the solution; and

4. attach the sensor to the sensor probe.

DO Sensor

To remove contamination, wipe off contamination with gauze to avoid damage to the diaphragm.

For long-term storage, remove the DO sensor from the sensor probe using a sensor spanner. Set the supplied short socket and store the sensor in a cool (0 to 10 ºC), dark place.

To replace the diaphragm:

1. Cut a diaphragm sheet to about 3 x 3 centimeters (cm) in size. Do not get any fingerprints or dust on the center part of the square.

2. Detach the DO sensor from the sensor probe.

3. Detach the protection tube that holds the diaphragm in place.

4. Detach the diaphragm retaining ring and diaphragm. Replace the diaphragm retaining ring and diaphragm if damaged or no longer functional.

5. Set the sensor in the replacement stand and fill the internal solution with the attached syringe until the sensor tip is soaked with the solution.

6. Fit the diaphragm retaining ring into the diaphragm retaining plate. Then, lay the diaphragm over the sensor and carefully cover with the ring and plate so that the diaphragm does not wrinkle. Finally, remove the retaining plate.

7. Cut the draped edge of the diaphragm to the shape of the sensor.

8. Check that there are no bubbles inside the sensor and tighten the protection tube securely.

9. Check that the diaphragm is tightly attached and that it is not wrinkled.

4.2 MiniRAE 2000 Portable VOC Monitor

Battery Charging and Replacement

Recharge the MiniRAE 2000 before and after fieldwork. A fully charged battery runs a MiniRAE 2000 monitor for 10 hours continuously. The charging time is less than 10 hours for a fully discharged battery. The battery may be replaced in the field (in an area known to be non-hazardous) if required.

Replacing Battery Pack

1. Turn off the power of the MiniRAE 2000.

2. Unscrew the two battery compartment screws located on the bottom of the monitor and remove the cover.

3. Remove the battery pack from the compartment.

4. Replace with a fully charged spare battery pack inside the battery compartment. Make sure the battery pack is oriented properly inside the compartment.

5. Close the battery cover and tighten the two screws.

Replacing Alkaline Battery Adapter

1. Insert four fresh "AA" size alkaline batteries into the alkaline battery holder. Make sure that the polarity of the batteries is correct.

2. Follow the same procedure as described above to replace the battery holder.

Note: The internal charging circuit is designed to prevent charging to alkaline batteries.

PID Sensor and Lamp Cleaning/Replacement

Note: Normally the cleaning procedure is not needed. Clean the PID sensor module, the lamp, and the lamp housing only when one of the following happened:

1. the reading is inaccurate even after calibration;

2. the reading is very sensitive to air moisture; or

3. a chemical liquid has entered into the unit and damaged the unit.

Use of the water trap filter will help prevent contamination.

To access the sensor components and lamp, gently unscrew the lamp-housing cap. Remove the sensor adapter with the gas inlet probe and the metal filter together. Then, hold the PID sensor and pull straight out to avoid bending the electrical pins on the sensor. A slight gentle rocking motion helps to release the sensor.

To Clean the PID Sensor:

1. Place the entire PID sensor module into analytical grade methanol.

2. Dry the sensor thoroughly. ***Never touch the electrodes of the sensor by hand.***

3. Use a methanol-soaked cotton swab to wipe off the lamp housing where it contacts the sensor when the sensor is installed.

4. Turn over the sensor so that the pins point out and up and the sensor cavity is visible. Examine the sensor electrodes for any corrosion, damage, or bending out of alignment. The metal sensor electrode "fingers" should be flat and straight. If necessary, carefully bend the sensor fingers to ensure that they do not touch the Teflon portions and that they are parallel to each other. Make sure that the nuts on the sensor pins are snug but not over tight. If the sensor is corroded or otherwise damaged, it should be replaced.

4.3 GEM 2000 Gas Meter

Battery/Charging

The battery used in the GEM 2000 is a Nickel Metal Hydride manufactured as an encapsulated pack from six individual cells. This type of battery is not susceptible to "memory effects" although it is not recommended that the unit be given short-term charges. When the flashing light emitting diode (LED) indicates "Charging Complete", disconnect the charger.

The battery charger indicates when the unit is charging, charged, or if there is a fault. A full charge should take approximately two hours.

Taking Probe Readings

Prior to going to the test site, ensure:

- the water trap has a clean and dry filter;
- the inlet-port particulate filter is clean and dry;
- a supply of spare filters is available;
- the battery has a good charge;
- the CH_4, CO_2, and O_2 readings have been auto-zeroed, without gas concentration present; and
- check the span calibration with a known concentration calibration gas.

Travel to the site with the instrument in the vehicle's interior – not in the trunk or truck bed, where it may be subjected to extremes of temperature and possible shock damage. This may cause erroneous readings.

When moving around the site, protect the instrument from strong direct sunlight, heavy rain, or wind-chill. Strong direct sunlight can raise the temperature of the instrument beyond its operating range. If this occurs, the liquid crystal display (LCD) will appear almost black and the contrast setting cannot alter the contrast.

4.4 LANDTEC GA-90 Landfill Gas Analyzer

Battery/Charging

The internal battery pack of the GA-90 is designed to be recharged many times but as with all nickel-cadmium cells, certain rules should be observed or the batteries will not provide their full power or charge cycles.

1. Discharge the batteries by setting logging function for a five minute interval and pump running to 90 seconds. The unit will run until batteries are discharged.

2. Charge batteries for at least 14 hours. LANDTEC chargers will not over charge batteries.

3. Never try to operate the GA-90 while batteries are charging.

4. When charging the battery overnight, lay the GA-90 flat or stand upright.

5. If the unit is to be stored for a long period, charge the internal batteries prior to storage. Re-charge the unit every two months during storage and store flat or the O_2 sensor may ultimately dry out. This condition can be corrected with normal use.

Battery Shut-Off

A circuit within the GA-90 continuously monitors the battery voltage. If the battery voltage falls below a predetermined level, the unit will automatically shut itself off in order to prevent memory loss. If the unit shuts itself off, the unit requires a full charge of 14 hours to restore the battery to its maximum level.

Battery Low Symbol

When the battery voltage drops below 60% capacity, a Battery Symbol will appear on the top right corner of the display screen. Approximately two hours of full pump power remain when the symbol is displayed.

Automatic Power-Off

The GA-90 has an automatic power-off time to conserve battery power. If no key is pressed for 15 minutes, the unit will automatically switch itself off (no stored readings will be lost).

Emergency Battery Power

In emergencies, the GA-90 may be operated with six "C" sized alkaline batteries. To use alkaline cells, remove the nickel-cadmium battery pack by using a Phillips screw driver on the back battery compartment and insert the "C" cells. DO NOT use the battery charger in conjunction with standard alkaline batteries. They can explode if re-charged.

Cleaning

The polycarbonate membrane panel may be wiped clean with soapy water and a damp cloth if required.

Dust Caps

Always keep the protective dust caps in place when ports and connectors are not in use.

Filters

The unit is equipped with two filters. One filter is in-line in the sample hose and can be easily accessed by unscrewing the filter holder. The second filter is located just inside the sample port inlet. This filter can be accessed by unscrewing (counter-clockwise) the port using a screwdriver or small coin. Inspection/replacement instructions are as follows:

1. Both filters are sealed with o-rings. Periodically inspect the o-rings to check their condition. Replace the o-rings when they become nicked, cut, swelled, or otherwise damaged. DO NOT OVERTIGHTEN O-RINGS.

2. Replace the filter when the sample pump has difficulty drawing a sample of gas into the unit or a "Flow Fail" message appears on the screen and a continuous audible warning is heard.

Storage and Travel

1. Store the GA-90 in its protective hard case when taking it from site to site.

2. When in use, keep the GA-90 in its protective soft case.

3. The unit should not be left out in direct sunlight for long periods of time as this will raise the temperature inside the case which could cause damage to components. The GA-90 may not operate or may operate erratically if it gets too hot. Let it cool before trying to use.

Section 5 Documentation

The Field Team Leader and Site Health and Safety Officer will review calibration and maintenance records on a regular basis to ensure that required maintenance is being performed. These activities will be recorded in the field logbook to document that established calibration and maintenance procedures have been followed. Entries made on the equipment calibration log regarding the status of any field equipment will contain, but are not necessarily limited to, the following information:

- date and time of calibration;
- name of person conducting the calibration;
- type of equipment being serviced, and identification number (such as serial number);
- reference standard used for calibration (such as pH buffer solutions);
- calibration and/or maintenance procedure used; and
- other pertinent information.

Field instruments will be checked and calibrated prior to their use on site, and batteries will be charged and checked daily where applicable. Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be properly tagged to indicate that it should not be used until the nature of the problem can be determined. Equipment requiring repair or recalibration must be approved for use by the Site Manager or Site Health and Safety Officer prior to placement back into service. Equipment that cannot be repaired or recalibrated will be replaced.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during expected working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a dry room for overnight storage.

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Table 5-1: Field Equipment Calibration and Maintenance

Equipment	Calibration Procedure	Calibration Frequency	Maintenance Procedure
Horiba U22 Multiparameter Probe	Two-point calibrate instrument. Auto calibrate instrument.	Every six months. Before each day's use.	Wash probe after every measurement. Replace ORP/pH sensor internal fluid monthly. Replace DO diaphragm as needed. Check battery charge and replace if necessary.
MiniRAE 2000	Factory calibrate instrument. Calibrate using 100 ppm isobutylene.	Annually. Before each day's use.	Charge battery daily.
GEM 2000	Factory calibrate instrument. Calibrate instrument using standard gas mixtures.	Annually. Before each day's use.	Charge battery daily.
LANDTEC GA-90	Factory calibrate instrument. Calibrate instrument using calibration gases.	Every six months. Before each day’s use.	Charge battery daily. Replace filters and o-rings as necessary.

Appendix A: Equipment Calibration Log

Equipment Calibration Log

Project Name: _____ **Project No**. _____

DATE	TIME	INITIALS	INSTRUMENT	CALIBRATION SOLUTION OR GAS CONCENTRATION	ADJUSTMENTS REQUIRED AND COMMENTS

Appendix B: Groundwater Sampling Log, Soil Boring Log, and Landfill Gas Monitoring Log

GROUNDWATER SAMPLING LOG

WELL ID: _____ LOCATION: _____ PROJECT NO: _____

INITIAL WATER LEVEL: _____ DATE: _____ TIME: _____

TOTAL DEPTH OF WELL: _____ PERSONNEL INVOLVED: _____

LENGTH OF SATURATED ZONE: _____ WEATHER CONDITIONS: _____

VOLUME OF WATER TO BE REMOVED: _____ METHOD OF REMOVAL: _____

WATER LEVEL AFTER PURGING: _____ PUMPING RATE: _____

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^{o}C)	SALINITY (%)	REDOX (ORP) (mV)

SAMPLE RETRIEVAL METHOD: _____

SAMPLE ID: _____

SAMPLE COLLECTION TIME: _____

SAMPLED BY: _____

APPEARANCE OF SAMPLE:

COLOR _____

TURBIDITY _____

SEDIMENT _____

OTHER _____

COMMENTS AND OBSERVATIONS: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: _____

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: _____

DECONTAMINATION PROCEDURES: _____

SAMPLES DELIVERED TO: _____ TRANSPORTERS: _____

SAMPLE DELIVERY DATE: _____ SAMPLE DELIVERY TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

SOIL BORING LOG

Project Name:		**BORING:**	
Project Number:		**SHEET:**	_____of _____
Date:	Drilled By:	Rig Type:	
Logged By:	Sampling Method:	Hammer Weight (lb):	
Total Depth (ft):	Sampling Equipment:	Hammer Drop (in):	
Water Depth (f During Drilling _____	Hours After	_____ Hours After	
Northing (ft):	Easting (ft):	Elevation (ft):	
Borehole Backfill:	Comments:		

Depth (feet)	Samples: Type	Samples: Number	Sampling Resistance	Recovery	PID Reading (ppm)	Graphic Log	Material Description	Notes

Notes: Sample Types: B = Bulk, CAL = California Spoon, GEO = Geoprobe, SS = Split Spoon
T = trace, S = slight, M = moderate, H = highly, ft = feet, ppm = parts per million
NA = not applicable, NE = not encountered, PID = photoionization detector

Landfill Gas Monitoring Log

Project Name: _____

Project No.: _____ Instrument Type/No.: _____

Date: _____ Calibration Date: _____

Sampler: _____ Ambient Air Readings:

CH_4: _____

CO_2: _____

O_2: _____

Hg: _____

Gas Vent/Probe No.	CH_4[1]	CO_2[1]	O_2[1]	Pressure (mmHg)		% LEL[2]	Sample Time	Remarks
Gas Vents:				***Closed***	***Open***			
GV-01								
GV-02								
GV-03								
GV-04								
GV-05								
GV-06								
GV-07								
GV-08								
GV-09								
Gas Probes:								
GP-01								
GP-02								
GP-03								
GP-04								
GP-05								
Office Structure:								

Notes:

[1]Gas concentrations are shown as percent volume

[2]LEL = lower explosive limit which is 5% by volume for methane (CH_4)

Comments: _____

Appendix C: Certificate of Calibration/Equipment User Logs

Certificate of Calibration/Equipment User Log

Instrument Name: LANDTEC GA-90 Landfill Gas Analyzer

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments
29-Jan-10	29-Jul-10	

EQUIPMENT USER LOG

User Name	Date Out	Date Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: MiniRAE 2000 Portable VOC Monitor

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments
27-Feb-10	27-Feb-10	

EQUIPMENT USER LOG

User Name	Date Out	Date Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: GEM 2000 Gas Meter

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments

EQUIPMENT USER LOG

User Name	**Date** Out	**Date** Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: Horiba Multiparameter Probe

CERTIFICATE OF CALIBRATION

Date Calibrated	**Expiration**	**Comments**

EQUIPMENT USER LOG

User Name	**Date** Out	**Date** Returned	**Comments**

Standard Operating Procedures for Soil Vapor Sampling
Red Hill Bulk Fuel Storage Facility
FISC, Pearl Harbor

I. Equipment Needed
   a. Extension cord
   b. Electric pump
   c. 15/16 Socket and ratchet drive
   d. PPBRAE Plus Photo-Ionization Detector (PID)
   e. 10 PPM Isobutylene
   f. Vacuum chamber
   g. Dedicated field notebook
   h. Field forms
   i. Box of nitrile gloves
   j. Ear protection
   k. Flashlight

II. Set up Procedures
   a. Calibrate PPBRAE Plus
      i. Zero cal the PPBRAE Plus outside of the tunnel by attaching the glass VOC zeroing tube and the tube adapter directly onto the PPBRAE probe
         1. Zero tube is single use (THROW AWAY AFTER SINGLE USE)
      ii. Span cal with 10 PPM Isobutylene
      iii. DO NOT attach the plastic filter until after the PID has been calibrated
      iv. Check difference in readings after attaching the plastic filter. If the filter is used it may raise the ambient readings significantly. If so, change the filter to a new one.
   b. Place all equipment right next to the well being tested
   c. Connect the extension cord to the 120V outlet (usually located on the second steel post down from each tank, except 15 and 20)
   d. Run the cord and attach it to the pump
   e. Open the well cover with the 15/16 socket and ratchet drive (place the cover and bolts at a convenient location out of the way)
   f. Take the ziplock bags out of the well compartment, and place them conveniently to the side
   g. Identify the deep, medium, and shallow probes using the reflective tags attached, or the color coded tape (white=deep; blue=mid; orange=shallow)

III. Sampling Procedures
   a. Purging
      i. Connect the purge tube to the intake nozzle on the pump
      ii. Open the valve by making it parallel to the rest of the apparatus
      iii. Turn on the pump, and purge for 5 minutes (record purge time!)
   b. While purging
      i. Identify the appropriate ziplock with the dedicated tedlar bag and tygon tubing inside, and take them out (white=deep; blue=mid; orange=shallow)
      ii. Place the tedlar bag inside the vacuum chamber
      iii. Attach the tygon tube to the vacuum chamber (note: take the metal ferrals off the tube before inserting the nut, then place them back on again, and attach)

iv. Connect the tygon tube to the tedlar bag inside the vacuum chamber then open the bag's valve **no more than one rotation**
v. Take the appropriate tube from inside the vacuum chamber and snap on the white plastic tip to the outside of the chamber

c. Taking Samples
i. Once purging is complete turn off the pump then detach the purge tube from the pump and replace it with the open end of the tube on the vacuum chamber
ii. Insert the open end of the tygon tube into the purge tube
iii. Be sure the bag valve and purge valves are open, and close the vacuum chamber
iv. Start the pump and cover the compression hole to fill the tedlar bag.
v. Observe the bag to prevent overfilling
vi. Once the bag is full open the vacuum chamber, close the bag's valve, then turn off the pump (if air is escaping from bag when lid is opened then try again, however, only partially cover the compression hole to relieve the pressure in the chamber while vapors are slowly collected in the tedlar bag)
vii. Detach the tedlar bag and reattach it to the PID
viii. Be sure the PID is on survey mode, open the bag valve and begin testing
ix. **Once numbers begin to appear** on the PID screen take readings every 10 seconds for 30 seconds.
x. Once the 30 seconds is up press "MODE" then "Y" to stop
xi. The average will be taken from the 3 noted values, and the peak from the PID
xii. Place the PID back on survey mode

d. Close the purge valve and begin purging the next probe
e. While purging
i. Deflate and close the tedlar bag valve then return it to the ziplock bag
ii. Detach the tygon tube and return it to the ziplock bag
iii. Begin preparations for the next sample with the appropriate dedicated tygon tubing and tedlar bags
iv. Continue this process until all points at the location has been tested

IV. Tear down Procedures
a. Make sure all valves are closed and bags are deflated before returning them back into the well compartment
b. Close all purge valves then secure the well cover
c. Unplug the pump and prepare the extension cord for the next location
d. Be sure to test the PID in the main tunnel between each location, record background levels (if it reads more than typical background for the day, change the plastic filter)

■■■■■■ *STANDARD OPERATING PROCEDURE*

GROUNDWATER SAMPLING

June 2007

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

List of Attachments

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for collecting groundwater samples from groundwater monitoring wells. This SOP serves as a supplement to the procedures described in the project work plan. The procedures described in this SOP are intended to be detailed enough so personnel following these procedures will collect representative samples. The sample locations and frequency of collection are specified in the project work plan. Groundwater sample collection will be conducted in accordance with this SOP and applicable requirements of equipment operation and maintenance (O&M) manuals and the project health and safety plan (HSP). These procedures are intended to be used together with the project work plan and other SOPs.

Section 2
Procedures

Groundwater samples will be collected using hand bailers or low-flow pump.

2.1 Equipment List

The following is a list of equipment that may be needed to perform groundwater sampling. Other items may be added as field conditions warrant or as determined by the field manager.

- Health and safety monitoring equipment and personal protective equipment (as specified in the HSP
- Water level indicator
- Water quality kit
- Sample containers, preferably already containing appropriate preservatives
- Sample labels
- Indelible marker
- Groundwater sampling log (see Attachment 1)
- Chain of custody form (see Attachment 2)
- Disposable latex or nitrile gloves
- Purge water storage containers
- Paint marker
- Ice cooler with ice
- Ziploc type re-sealable plastic bags
- Hand tools (wrenches, utility knife, etc.)

In addition, the following equipment may be required depending upon the methodology employed to obtain the sample:

- Teflon or disposable polyvinyl chloride (PVC) bailers, verify diameter of well to be sampled
- Nylon twine or monofilament (e.g., fishing line)
- Pump; electrical, pneumatic, or peristaltic
- Pump discharge tubing
- Power source for pump
- Decontamination equipment

2.2 Monitoring Well Purging

All monitoring wells shall be purged prior to sample collection. The period between purging and sample collection shall not be greater than 24 hours. If a newly installed monitoring well

is to be sampled, than purging will not occur until 24 hours after the well has been installed and developed. The volume of water to be removed from each well during purging will depend on the purging and sample collection method.

2.2.1 Low-flow Purging

Low-flow purging, is an EPA-approved method of collecting groundwater samples that is an alternative to the industry-standard of purging three casing volumes. Low-flow purging has several benefits over the traditional method, including the following:

- Low-flow purging minimizes disturbance of sediment particles in the well, leading to less turbid samples;
- Low-flow purging minimizes aeration of the samples, improving the quality and representativeness of volatile organic compound (VOC) analysis;
- The volume of purge water is generally significantly reduced when utilizing low-flow purging techniques, saving costs associated with transport, treatment, and disposal of purge water.

This purging method requires that groundwater be purged at approximately one liter/minute or less (varies slightly depending upon the aquifer) so that drawdown of the well water level is 0.3 feet or less. Purging is considered complete when successive water quality parameter measurements (minimum of three) have stabilized to within ten percent. Water quality parameters to be measured include: conductance, dissolved oxygen, pH, salinity, temperature, and turbidity. Purging will continue until water quality parameters have stabilized.

2.2.2 Non Low-flow Purging

If methods other than low-flow are used, than a minimum of three (3) times the submerged monitoring well casing volume of water will be removed during purging, and purging will be considered complete when successive water quality parameter measurements (minimum of three) have stabilized to within ten percent.

2.2.3 General Purging Procedures

The following are monitoring well purging procedures, all measurements, calculations and observations shall be recorded on the Groundwater Sampling Log:

- All field personnel shall wear the appropriate level of personal protective equipment (PPE) during purging.
- Decontaminate all non-dedicated equipment that will be inserted into the monitoring well.
- Measure the depth to groundwater (relative to a fixed reference point) before purging.

- Calculate the minimum volume of groundwater to be removed based on the well diameter, total depth of the well, and the depth to groundwater measurement.
- Purge groundwater by bailing or pumping, place purged water into a suitable container or discharge to an approved location.
- Collect water quality parameter measurements at a rate of about one for every 10 percent of the minimum required volume to be removed (e.g., one measurement every 3 gallons if the minimum volume to be removed is 30 gallons).
- Continue purging until the water quality parameters have stabilized and the minimum required volume has been removed.
- Label the purge water storage container with the following information using a paint marker:
  - Location or project identification
  - Source identification (e.g. monitoring well identification number)
  - The words "Purge Water"
  - Date of generation

During well purging, water quality parameter measurements and sample collection, minimize splashing and spillage of groundwater. Secure purge water container(s) after sample collection has been completed in an approved temporary storage location.

2.3 Groundwater Sample Collection

Groundwater sample collection shall be conducted in the following sequence:

- Volatile organic compounds (VOC) analyses samples (e.g., TPH gas, BTEX)
- Total petroleum hydrocarbon (TPH) analysis samples (except gasoline fraction)
- Semivolatile organic compounds (SVOC) analyses samples
- Other organic analyses samples
- Inorganic analyses samples

VOC samples shall be collected into volatile organic analysis (VOA) vials with Teflon lined caps. Place sufficient quantity of sample into to the VOA vials so that the liquid crowns above the top of the vial opening. Slowly screw the Teflon lined cap into place, the cap should bulge slightly. Turn the vial upside down and tap vigorously and observe for air bubbles in the vial. There shall be no air bubbles in the VOA vial. Repeat sample collection procedure if air bubbles are observed.

2.3.1 General Sample Collection Procedures

All field personnel shall wear the appropriate level of PPE during sample collection.

When using a low-flow pump, groundwater shall be collected from the end of the sample tubing directly into the appropriate sample container. Do not place the sample tubing into the sample container. Be cautious not to over fill the sample containers.

When using bailers, lower and raise the bailer slowly, especially within the water column, to minimize disturbance of the groundwater. Groundwater shall be transferred into appropriate sample containers from the bottom end of the bailer, not poured from the top, using a sample filling tube (usually a short tube supplied with the bailer that has diagonally cut openings). Utilize VOC sample dispenser when available (usually an adapter that fits onto the end of a bailer that has a small diameter discharge tube).

2.4 Sample Management

After all of the required sample containers have been filled, the containers shall be labeled individually. At a minimum, the following information will be record on the sample container label:

- Project identification
- Monitoring well identification
- Unique sample identification number
- Sample collection date
- Sample collection time
- Initial(s) of person(s) collecting sample
- Required laboratory analyses
- Sample preservative

The same information shall also be recorded in a field note book.

The sample containers should be placed into individual Ziploc type re-sealable plastic bags, then into an insulated cooler with ice for preservation. In the case of VOA vials, all vials for a particular sample (usually 3 to 5) can be placed into the same bag. The samples shall be maintained at 2° - 4° C until delivery to the laboratory.

The samples shall be managed under chain of custody documentation from collection to receipt by the analytical laboratory. Chain of custody means the sample are under direct observation by project personnel at all times or under lock and key with the person who has custody holding the only key. Chain of custody documentation shall be completed by the field manager.

Attachments

GROUNDWATER SAMPLING LOG

WELL ID:_____ LOCATION:_____ PROJECT NO:_____

INITIAL WATER LEVEL:_____ DATE:_____ TIME:_____

TOTAL DEPTH OF WELL:_____ PERSONNEL INVOLVED:_____

LENGTH OF SATURATED ZONE:_____ WEATHER CONDITIONS:_____

VOLUME OF WATER TO BE REMOVED:_____ METHOD OF REMOVAL:_____

WATER LEVEL AFTER PURGING:_____

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (°C)	SALINITY (%)

SAMPLE RETRIEVAL METHOD:_____ APPEARANCE OF SAMPLE:_____

COLOR:_____

SAMPLE ID:_____ TURBIDITY:_____

SAMPLE COLLECTION TIME:_____ SEDIMENT:_____

OTHER:_____

COMMENTS AND OBSERVATIONS:_____

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED:_____

DECONTAMINATION PROCEDURES:_____

SAMPLES DELIVERED TO:_____ TRANSPORTERS:_____

SAMPLE DELIVERY DATE:_____ SAMPLE DELIVERY TIME:_____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

■■■■■■ ***STANDARD OPERATING PROCEDURE***

HEARING CONSERVATION

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

Section 1 Purpose

The purpose of this Operating Procedure (OP) is to establish Environet, Inc. (EI) procedures and responsibilities for the administration of a hearing conservation program. A proper hearing conservation program will reduce the risk of occupationally induced hearing loss and provide education and guidance for the prevention of "lifestyle" induced hearing loss.

Section 2 Hazard Information

Excessive noise exposure can cause both temporary and permanent effects on hearing. The temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effect of long-term excessive noise includes varying degrees of noise induced hearing loss.

The damaging effects of noise are dependent on the noise intensity (decibels), the time of exposure, the noise frequency (Hertz), and individual susceptibility. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) set exposure limits based on exposure per day (in hours) and sound intensity (in decibels A scale or dBA). Exposures above these limits require use of hearing protection (plugs or muffs) to reduce the sound level or the use of noise engineering controls to reduce the sound level.

It is known that noise intensity above 85 dBA for prolonged periods will induce hearing loss. Eighty-five dBA represents a noise level where normal conversation is difficult and individuals will be shouting or talking into the ear of the person to be understood.

Section 3 Requirements

OSHA regulations issued in late 1981 require a hearing conservation program for workers exposed to 85 dBA as an 8-hour time-weighted average.

The OSHA regulation addresses several requirements for a good hearing conservation program. These requirements are as follows:

- Noise exposure monitoring
- Audiometric testing
- Hearing protectors
- Training programs
- Access to information
- Recordkeeping and posting

Section 4 Responsibilities

Each employee has the responsibility to comply with all aspects of this Operating Procedure. Managers with input from the Health and Safety Officer (HSO)'s and Site Safety Officer (SSO)'s are responsible for enforcing the provisions of this Operating Procedure as it applies to field work. Scheduling of audiograms (accomplished through Medical Surveillance) and training are the responsibility of the HSO and Corporate Health and Safety Officer (CHSO).

Section 5 Noise Exposure Monitoring

The SSO with assistance from the HSO and/or CHSO will determine when noise monitoring is required for jobs where EI employees are potentially exposed to excessive noise. The SSO/HSO will perform noise monitoring as necessary and make recommendations to assure compliance with Section 212.3 of this Operating Procedure. Engineering controls, ear protection, and posting may be required to comply with Section 212.3. In jobs where EI is working in a client's noisy area, EI personnel will comply with the client's existing hearing conservation program. If a client has a noisy area and has no hearing conservation program, EI will establish a plan for its employees and subcontractors to be in compliance with Section 212.3.

Section 6 Training

All workers required to wear hearing protectors will be trained in their proper use. In addition, all workers who may be exposed to greater than 85 dBA will be provided refresher training.

This training will include at least the following: (1) Effects of noise on hearing; (2) the purpose, selection, fitting, use and care of hearing protectors; and (3) the purpose of audiometric testing and an explanation of the test procedure.

Section 7 Hearing Protectors

When hearing protectors are required the employee must have received training on the proper use. Proper noise reduction ratings will be applied by the HSO/CHSO to the noise in the environment.

Hearing protectors act as barriers to reduce sound entering the ear. Noise Reduction Ratings (NRR) for each product reflects the effectiveness of the protector chosen. Generally, muffs offer a greater NRR (25-30 dBA) than plugs (15-25 dBA). Comfort is an important factor when wearing ear protection over many hours; it is recommended to try different types of plugs or muffs to determine the best combination of comfort and fit.

Section 8 Audiometric Testing

Audiograms are administered upon employment and annually/biennially thereafter. The audiograms are conducted by the medical clinics approved for EI physicals and must meet all the applicable requirements (including Appendices C, D, and E of the OSHA Std. Title 29 Code of Federal Regulations (CFR) 1910.95). The local medical clinic in consultation with Greaney Medical will comply with applicable provisions of Title 29 CFR 1910.95(g) with regard to recordkeeping.

Section 9 Access to Information, Recordkeeping

Each office shall have a copy of Title 29 CFR 1910.95 available for any employee requesting access to the standard. Employee training aids shall also be available to any employee. All noise monitoring data shall be retained for at least two years and Greaney Medical shall maintain the audiometric results for thirty years beyond the last date of employment.

■■■■■ *STANDARD OPERATING PROCEDURE*

INCIDENT REPORTING

June 2007

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

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Section 1 Purpose and Scope

All safety and health incidents shall be reported to Environet (EI) management and Safety and Health Coordinator. Prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect EI employees, and reduce EI liability.

Section 2 Definitions

A safety and health incident is any event listed below:

- Illness resulting from chemical exposure or suspected chemical exposure.
- Physical injury to EI employees or subcontractors regardless of whether the injury requires medical attention.
- Fire or explosion resulting from activities performed by EI and its subcontractors.
- Property damage resulting from activities performed by EI and its subcontractors.
- Vehicular accidents occurring on-site, while traveling to and from client locations, or with any company-owned vehicle.
- Infractions of safety rules and requirements.
- Unexpected chemical exposures.
- Complaints from the public regarding EI field operations.

Section 3 Reporting Procedures

3.1 Reporting Format

Incident reports shall be prepared by completing Form SOP-103. This form may be obtained from any EI Health and Safety Officer (HSO) and is attached to this operating procedure.

3.2 Responsible Party

Reports of incidents occurring in the field shall be prepared by the Site HSO or, in the absence of the Site HSO, the supervising field engineer, witness, or injured/exposed individual.

3.3 Filing

A report must be submitted to the Safety and Health Coordinator within 24 hours of each incident involving medical treatment. The Safety and Health Coordinator will deliver a copy of the report to

the Vice President of Operations within 48 hours of each qualifying incident so that a Worker's Compensation Insurance Report can be filed if necessary.

3.4 Major Incidents

Incidents that include fatalities, hospitalization of employees or subcontractors, or involve injury/illness of the public shall be reported to the Project Manager and Safety and Health Coordinator as soon as possible. Any contact with the media should be referred to the Project Manager and Vice President of Operations. Major incidents that result in death or injury to 3 or more persons admitted to a hospital or damages in excess of $200,000 shall be reported to the Occupational Safety and Health Administration (OSHA).

EI SAFETY AND HEALTH INCIDENT REPORT

Project Name: _____

Project Number: _____

Date of Incident: _____

Time of Incident: _____

Location: _____

_____

TYPE OF INCIDENT (Check all applicable items)

☐ Illness ☐ Fire, explosion, flash

☐ Injury ☐ Unexpected exposure

☐ Property Damage ☐ Vehicular Accident

☐ Health & Safety Infraction

☐ Other (describe) _____

DESCRIPTION OF INCIDENT (Describe what happened and possible cause. Identify individual involved, witnesses, and their affiliations; and describe emergency or corrective action taken. Attach additional sheets, drawings, or photographs as needed.)

_____
_____
_____
_____
_____
_____
_____
_____
_____

Reporting Person:

_____ _____ _____

Print Name Signature Date

Reporting person must deliver this report to the EI Safety and Health Coordinator within 24 hours of the reported incident if medical treatment was required and within five days for all other incidents.

Reviewed by: _____ _____

Safety and Health Coordinator Date

Distribution:

- Vice President of Operations
- Project Manager

■■■■■ ***STANDARD OPERATING PROCEDURE***

SAMPLE HANDLING AND SHIPPING

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

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List of Forms

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for sample handling and shipping including containerizing, preserving, handling, and shipping of samples collected during the site sample handling. This SOP serves as a supplement to the project work plan.

Section 2
Responsible Personnel

The Environet Site Manager is responsible for conducting and/or overseeing sample, handling, and shipping. The project organization and responsibilities are outlined in the project work plan.

Section 3
Material and Equipment

The following list of equipment is not intended to be task specific. The equipment and materials listed may be needed for sample handling, packaging, and shipping.

- 12 x 12 inch re-sealable plastic bags
- Large plastic trash bags
- Blue ice
- Shipping coolers (sample transport)
- Bubble wrap
- Latex gloves
- Self-adhesive sample labels
- Shipping Labels (i.e., "Fragile", "This Side Up", etc.)
- Shipping forms (provided by shipping courier)
- Tape (i.e., clear cellophane tape, packing tape (reinforced strapping or duct), and custody sealing tape)
- Detergent for sample container exterior decontamination (phosphate free)
- Refrigerator
- Wash/rinse tubs with brushes
- Distilled/deionized water (DI water)
- Pre-certified clean sample containers (e.g., glass, polyethylene), as specified in the SAP
- 4 x 4 inch Teflon® film (for capping core tubes, if used)
- Preservatives (e.g., hydrochloric acid, nitric acid), as specified in SAP
- pH paper
- Paper towels
- Disposable pipettes and bulb

Section 4
Procedures

The following procedures for containerizing, preserving, handling, and shipping samples meet criteria as specified by United States Army Corps of Engineers (USACE) guidelines.

4.1 Sample Containers and Preservative

Only sample containers certified as clean by the manufacturer or laboratory and meeting contract requirements will be used for environmental sample collection. The containers and preservatives may be obtained from the contracted analytical laboratory, their designated supplier, or a suitable supply company. Any preservative(s) required may be added to the container by the contracted analytical laboratory, field sampling team, and/or on-site chemist prior to, during or after sample collection (with the exception of volatiles).

Recommended sample containers, preservatives, and holding times for analytical methods, are shown in the Sampling and Analysis Plan (SAP).

4.2 Container Labeling, Decontamination, and Field Packaging

The sample bottles will be labeled by the field sampling team. Collection time and date will be completed in the field by the sampler. The labels will be filled out at the time of collection and indicate:

- Activity name and/or number
- Unique sample number
- Sample time and date
- Chemical preservative used
- Sample type (grab, composite)
- Analyses required
- Filtered/unfiltered
- Comments or special precautions, as needed
- Sampler's initials

The sample label will be marked with a waterproof pen. Clear tape will be placed over labels before sampling to assure that the labels remain legible.

After sampling, the exterior of the sample containers will be decontaminated according to the Decontamination SOP, and placed in coolers dedicated for sample transportation. The collected samples will be immediately placed in a cooler packed with wet ice, or other

appropriate means to bring the sample temperatures to 4° ± 2°C. Samples will not be frozen. The temperature in the coolers will be maintained at approximately 4°C by adding sealed plastic bags containing blue ice (or an equivalent) to the coolers.

4.3 Chain of Custody

Official custody of samples will be maintained and documented from the time of collection until the time that valid analytical results have been obtained or the laboratory has been released to dispose of the samples. The sampling team will be responsible for initiating the original chain of custody (COC) and will sign and date the COC when relinquishing sample custody. The COC and sample labels will be checked to verify that samples are accounted for and in good condition, and that no errors were made.

A sample is considered to be in a person's custody if any of the following conditions are met:

- The sample is in the person's physical possession.
- The sample is in the line of sight of the person after they have taken possession.
- The sample is secured by that person to prohibit any tampering.
- A sample is secured by the person in possession in an area which only authorized personnel can enter.

4.3.1 Tampering of Sample Containers

If, at any time after samples have been secured, custody seals on the cooler are identified as having been tampered with, this procedure will be followed to ensure that sample integrity has not been compromised.

- Check cooler to verify the temperature is between 2°C to 6°C.
- Check with personnel having access to sample coolers to verify possible inadvertent tampering.
- Check every sample container for any signs of tampering, such as loose lids, foreign objects in containers, broken or leaking containers, etc.
- Verify adequate and appropriate packaging.
- Document findings of the incident in the sample manager's logbook.

If it is determined that malicious tampering of samples has occurred and/or it is believed that sample integrity has been compromised, the subcontractor will immediately contact the site manager.

If it can be determined that sample integrity has not been compromised based on the above criteria, document findings in a logbook.

4.3.2 Chain of Custody Form

A three-page carbonless COC form will be used. A COC is shown at the end of this SOP. The original and second (or yellow) copy will be included with the samples to be shipped enclosed in a plastic bag and taped inside the lid of the cooler. The third (or pink) copy will be sent to the Environet Data/Sample Manager, and the photocopy of the original will remain on file with the field personnel. The contract laboratory will sign as having received the samples and return the yellow copy of the COC to Environet for verification by the Environet Data/Sample Manager. The yellow and pink copies will then be matched and filed to complete the chain of custody procedure for the field sampling efforts. The white (original) will be placed in the appropriate data package by the laboratory. The COC will include the following information:

- Unique sample number and sample location
- Project number
- Date and time of sample collection
- Signature or initials of collector or field custodian
- Laboratory designation
- Sample matrix
- Condition of sample cooler on receipt at the laboratory (includes temperature inside the cooler)
- COC number
- Signature and date blocks for personnel relinquishing or receiving sample custody
- Space for additional comments
- Name and phone number of emergency contact person
- Analyses requested
- Preservatives added to the sample
- Any nonconformance with this SOP identified by the laboratory

4.4 Field Data Documentation

Field descriptions, measurements, and observations will be recorded on the appropriate field data forms or logbook in accordance with the SAP and appropriate SOPs. The original data forms will be collected and filed on-site by the designated staff. Data will also be recorded in field logbooks. Field data will be filled out at the time a sample is taken and will include, but not be limited to, the following information:

- Sampling activity name and number
- Sampling point name and number
- Sample number
- Name(s) of collector(s) and others present
- Date and time of sample collection
- Sample container tag/label number (if appropriate)
- Preservative(s) used

- Requested analyses
- Sample matrix
- Filtered/unfiltered
- Designation of QC samples (ONLY for MS and MSD)
- Collection methods
- COC numbers
- Field observations and measurements during sampling (comment section)
- Signature of responsible observer

4.5 Packaging and Shipping

Samples will be packaged properly to prevent breakage of containers, leakage of contents, and to ensure the samples arrive at the analytical laboratory within the required temperature range of 2°C to 6°C. The following procedures will be followed during the packaging and shipping process.

- Check container lids and tighten as necessary.
- Wrap individual sample containers, if glass, with bubble wrap.
- Place sample containers in re-sealable plastic bags as secondary containment.
- Place sufficient amounts of bubble wrap in the bottom and sides of the shipping cooler to prevent movement of contents.
- Add double bagged ice to the cooler in quantities adequate to maintain required temperature of 2°C to 6°C. Line the bottom, sides and top of cooler to ensure proper shipment temperature. (Using six pieces of blue ice per 48 qt. cooler is not uncommon)
- Line the inside of the area created by the ice placement with a plastic trash bag and place the wrapped samples inside in an upright position.
- Tie shut the trash bag holding the samples.
- Fill excess space in the cooler with packing material (i.e. bubble wrap) to prevent movement of sample containers.
- Review the previously completed COC paperwork and sample packaging before proceeding.
- The white and yellow portions of the COC are then placed inside a plastic bag, and taped inside of the cooler lid.
- Close the cooler lid and seal with appropriate packaging tape in a manner to prevent inadvertent opening during shipment.
- Place two custody seals on the cooler in separate areas that would indicate if tampering had occurred.

The following markings will be placed on the top of the cooler:

- This end up

- Fragile
- Next day priority service
- Shipment delivery address
- Sender's return address
- A completed shipping bill should be made for the carrier of choice and taped to the top of the cooler using the envelope provided by the shipper.
- The express carrier should be called to arrange pick-up of the cooler(s), or delivered to the nearest carrier's office.
- The pink copy of the shipping bill should be retained by the sample manager for attachment to the pink copy of the corresponding COC(s).

An express carrier will be used to aid in meeting sample holding time requirements. The Environet Site Manager or designee is responsible for verifying that samples collected by the field team have been properly packed in ice chests and for verifying the accuracy and completeness of sample labels and COC forms.

The following is a summary of steps to be followed to verify that paperwork is complete:

- Prepare sample labels prior to sampling for sampling crew.
- Receive samples from decontamination/sampling crews.
- Check or complete the COC form(s).
- Pack samples in cooler and verify COC accuracy.
- Verify all labels and forms to meet shipping requirements.
- Photocopy the COC(s) and retain the photocopy and pink copy for Environet files.
- Send original COC(s) (white and yellow copy) to the contract laboratory.
- Photocopy field notes if required and send with COC.
- Obtain pink copy of shipping bill and staple to pink portion of corresponding COC(s).

Appendix D Waste Management Plan

Waste Management Plan
Long-Term Monitoring
Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O‘ahu, Hawai‘i

September 2010

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
Pearl Harbor, HI 96860-3139

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

Waste Management Plan
Long-Term Monitoring,
Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oʻahu, Hawaiʻi

September 2010

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Hawaiʻi
400 Marshall Road
Pearl Harbor, HI 96860-3139

Prepared by:

Environet, Inc.
650 Iwilei Road, Suite 204
Honolulu, HI 96817-5318

Prepared under:

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

Approvals Page

Waste Management Plan
Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i, September 2010
Contract No. N62742-08-D-1930
Contract Task Order HC14

I hereby certify that the enclosed Waste Management Plan (WMP), shown and marked in this submittal, is that proposed to be incorporated with Contract Number N62742-08-D-1930, Contract Task Order HC14, "*Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i.*" This WMP is in compliance with the Contract specifications, and is submitted for Government approval.

Reviewed By:

Milton C. Ayers — 17 Sep 10

Project Manager — **Date**

Weizi Zhang — 17 Sep 10

Quality Control Manager — **Date**

Approved By:

Navy Technical Representative NAVFAC Hawai'i — **Date**

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Table of Contents

Tables

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List of Acronyms

COPC	chemicals of potential concern
DON	Department of the Navy
EPA	United States Environmental Protection Agency
FM	Field Manager
HSO	Health and Safety Officer
HSP	Health and Safety Plan
IDW	investigation derived waste
LTM	long term monitoring
NAVFAC	Naval Facilities Engineering Command
PM	Project Manager
PPE	personal protective equipment
RHSF	Red Hill Bulk Fuel Storage Facility
QA	quality assurance
QC	quality control
SVMPs	soil vapor monitoring points
WMP	Waste Management Plan
WP	work plan
UST	underground storage tank

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Section 1 Introduction

Long-term monitoring (LTM) at the Red Hill Bulk Fuel Storage Facility Pearl Harbor, O‘ahu, Hawai‘i, herein after referred to as RHSF, will occur between September 2010 and August 2011. The LTM will include quarterly groundwater monitoring, monthly soil vapor monitoring, and monthly fuel product monitoring at existing groundwater monitoring wells and soil vapor monitoring points (SVMPs) to evaluate the presence and magnitude of chemicals of potential concern (COPCs).

This Waste Management Plan (WMP) has been prepared by Environet for Naval Facilities Engineering Command (NAVFAC) Hawai‘i under Contract Number N62742-08-D-1930, Contract Order HC14. This WMP updates the *Red Hill Bulk Fuel Storage Facility Final Work Plan Addendum, Pearl Harbor, Hawai‘i*, dated May 2006.

1.1 Project Description and Management

Previous investigations at the site indicate that the subsurface is contaminated with petroleum products and lead. Major tasks that will be performed include four rounds of quarterly groundwater monitoring at seven groundwater monitoring wells, five of which are inside RHSF and two which are outside RHSF, to give an accurate profile of the groundwater in the area.

The objective of this project is to perform continued LTM to evaluate underground storage tank (UST) – related contamination in soil and groundwater at the RHSF. A total of four quarterly monitoring events and twelve monthly events will be performed starting in September 2010 and ending in August 2011. The LTM data will be used as a basis for decision making at the site.

Details and references to the site background, previous investigations and results, regulatory requirements, as well as the details of the remedial action are presented in the Work Plan (WP).

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Section 2 Project Organization

This section provides a summary of key project personnel, subcontractors, and the project organizational structure. Having a clear understanding of each individual and organization's roles and responsibilities will be instrumental in the successful completion of the project.

2.1 Project Organization and Responsibilities

The following table contains the project contact list showing key personnel and organizations for this project.

Table 2-1: Project Organization and Responsibilities

Title	Project Personnel	Contact Information
Navy Technical Representative	Darren Uchima	(808) 471-1171 ext. 217
Program Manager, Environet	Zachary Payne	(808) 227-0844 zpayne@environetinc.com
Project Manager (PM), Environet	Vilma Dupra	(808) 754-3925 vdupra@environetinc.com
Health and Safety Officer (HSO), Environet	Shelby Koide	(808) 833-2225 ext. 1038 skoide@environetinc.com
Field Manager (FM)	Branden Ibara	(808) 833-2225 ext. 1016 bibara@environetinc.com
Quality Control (QC) Manager	Weixi Zheng	(808) 277-0467 wzheng@environetinc.com

This organizational structure is designed to ensure that all personnel involved with the project will receive proper instruction and information, and that appropriate quality assurance (QA) and QC procedures will be followed throughout the field investigation. The roles and responsibilities of key project personnel are presented below.

2.1.1 Project Manager

The PM, Ms. Vilma Dupra, has overall responsibility for completing the project in accordance with the scope of work. The PM will be directly responsible for scheduling and developing the technical approach for completing project tasks, providing strategic direction to project personnel and implementing the Health and Safety Plan (HSP). The PM will also oversee the preparation of the project WP, HSP, and all other project deliverables. The PM will be responsible for monitoring the quality of work products, ensuring that project milestones are being met, and for implementing corrective measures when necessary.

2.1.2 Field Manager/Health and Safety Officer

The FM, Mr. Ibara, will be responsible for scheduling and directing all field activities and will implement the WP. The FM will receive strategic instructions from the PM on how to implement the WMP. The FM will also be responsible for coordinating with subcontractors and

vendors to ensure that all necessary equipment, personnel, and supplies are ready and available to complete the groundwater monitoring activities.

The HSO Ms. Shelby Koide will be responsible for implementing and enforcing the HSP during field activities. The HSO will conduct health and safety meetings and monitoring as required by the HSP, and ensure that personal protective equipment (PPE) and safety monitoring instrumentation are available and ready for use. The HSO will report health and safety issues directly to the Environet PM and has the authority to stop work at any time should conditions be deemed unsafe. If there is a work stoppage due to health and safety reasons, the HSO will consult with the PM to investigate the cause of the concern and implement appropriate corrective action based on the procedures described in the HSP.

2.1.3 Project Staff

Each member of the project staff will be responsible for reading and understanding the requirements of this WP and the HSP prior to taking part in any field activities. The project staff will receive their work assignment and instructions from the Environet PM.

2.1.4 Personnel Qualifications

All personnel assigned to the project, including employees and subcontractors, will be qualified to perform the tasks to which they are assigned. Appraisal of personnel qualifications will be made by the PM. The appraisal will include a comparison of the job assignment requirements with the relevant experience and training of the prospective assignee. It will also include a determination of whether further project staff training is required. If further training is required, the PM shall schedule the training so that project staff has the necessary training before the start of field activities.

Section 3 Identification of Waste Streams

The investigation-derived waste (IDW) from the sampling activities will consist of PPE, miscellaneous waste, and decontamination and purge water taken from the two existing groundwater monitoring wells from outside of the RHSF.

3.1 PPE and Miscellaneous Waste

Incidental waste including PPE (e.g., nitrile gloves), will be generated due to site activities and may have been in direct contact with site groundwater. Miscellaneous waste, including paper towels, plastic sheeting, plastic drink bottles, and disposable sampling equipment will also be generated.

3.2 Decontamination and Purge Water

Decontamination water will be generated as a result of decontamination of field equipment and PPE. The collected purge water is generated during sampling activities from monitoring wells that are not located inside the RHSF tunnels. The purge water is not expected to be contaminated and a low amount of purge water is expected to be generated (approximately two drums per monitoring event). The decontamination and purge water will be collected and stored in 55-gallon drums. The IDW decontamination and purge water is assumed to be non-hazardous waste and will be transported offsite to an on-island treatment facility for disposal.

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Section 4 Waste Management and Disposal

IDW will be managed in accordance with United States Environmental Protection Agency (EPA) Guidance for Management of IDW during Site Inspections (1992) and *Procedure I-A-6 IDW Management* of the Project Procedures Manual United States Navy Environmental Restoration Program Naval Facilities Engineering Command Pacific Division (DON, 2007). IDW will be disposed of in accordance with applicable State, Federal, or local regulations.

4.1 IDW Storage

The IDW will be stored in 55-gallon drums at the Site. Drums will be placed upright on pallets before the drums are stored to minimize damage to drums from weathering and exposure to the surrounding environment. Environet will store the IDW drums in dry, shaded areas and covered with impervious plastic sheeting.

All spent PPE and miscellaneous waste will be disposable and managed as non-hazardous solid waste. All PPE and miscellaneous waste will be collected in plastic trash bags and disposed on a daily basis in the proper on-site trash receptacle.

4.2 Waste Characterization

Waste characterization of IDW water will be performed to determine the method and location of disposal. Environet will characterize all wastes prior to transport and disposal.

Groundwater collected as part of the monitoring will be analyzed for volatile organic compounds (EPA-8260B), total petroleum hydrocarbons-diesel range organics (EPA-8015B), total petroleum hydrocarbons-gasoline range organics (EPA-8260B), dissolved lead (EPA-6020), and polynuclear aromatic hydrocarbons (EPA-8270C SIM). The results of the sampling activities will be used to characterize the IDW water.

Environet will evaluate the results for the samples collected to determine the appropriate waste class. Constituent concentrations found in these results will be compared to the regulatory levels as found in 29 Code of Federal Regulations 1910.1200, and to the waste acceptance criteria of the respective waste disposal facility. Closure requirements under Resource Conservation Recovery Act are not applicable to the Site. Based on analytical results of samples collected during previous monitoring events, Environet anticipates that the purge water generated during field activities will be predominantly non-hazardous.

4.3 Transportation and Disposal

Environet will oversee and coordinate all phases of waste removal and disposal including, but not limited to, the following:

- waste classification;
- waste loading;

- preparation of shipping papers;
- waste transportation;
- waste disposal; and
- waste tracking.

All IDW drums will be loaded into end-dump trucks or equivalent State of Hawai‘i Department of Transportation-approved transport. The trucks will be covered with tarps, and provided with the proper shipping papers for transport to the appropriate disposal facility. All loads will be logged and tracked to ensure that each load arrives at its respective destination. All waste generated at the Site will be transported and disposed of in accordance with applicable Federal and State laws and regulations.

4.4 Disposal Facilities

All waste at the Site is expected to be non-hazardous. The IDW will be disposed of according to analytical testing and acceptance by the receiving facility. Environet will prepare a profile for each waste stream to be disposed of and submit the profile to the receiving facility for approval.

In the event that hazardous waste is found, Environet will designate an appropriate disposal facility at that time. The determination of an appropriate hazardous waste landfill depends on the unit costs determined under a competitive bidding system that is affected by the overall quantity to be generated. At this point, no hazardous waste is expected to be found; therefore, no hazardous waste quantity has been estimated.

Appendix E Table of EALs

GROUNDWATER

Analytes	DOH EAL[a]		PAL	PQL Goal	Laboratory-Specific Limits[b]		
	Drinking Water Toxicity	Gross Contamination			LOQs	LODs	MDLs
Analytical Group: VOCs (EPA- 8260B)							
1,1,1-Trichloroethane	200	970	200	20	1.0	0.28	0.14
1,1,2-Trichloroethane	5	50,000	5	0.5	1.0	0.4	0.2
1,1-Dichloroethane	2.4	50,000	2.4	0.24	1.0	0.38	0.19
1,1-Dichloroethylene	7	1,500	7	0.7	1.0	0.6	0.30
1,2,3-Trichloropropane	0.6	50,000	0.6	0.06	2.0 [c]	0.78	0.39
1,2,4-Trichlorobenzene	70	3,000	70	7	1.0	0.42	0.21
1,2-Dibromo-3-chloropropane	0.04	10	0.04	0.004	2.0 [c]	1.52	0.76
1,2-Dibromoethane	0.0065	50,000	0.0065	0.00065	1.0 [c]	0.4	0.20
1,2-Dichlorobenzene	600	10	10	1.0	1.0	0.34	0.17
1,2-Dichloroethane	0.15	7,000	0.15	0.015	1.0 [c]	0.28	0.14
1,2-Dichloropropane	5	10	5	0.5	1.0	0.34	0.17
1,3-Dichlorobenzene	180	50,000	180	18	1.0	0.22	0.11
1,3-Dichloropropene (total of cis/trans)	0.43	50,000	0.43	0.043	1.0 [c]	0.36	0.18
1,4-Dichlorobenzene	75	5	5	0.5	1.0	0.38	0.19
Acetone	22,000	20,000	20,000	2,000	10.0	1.9	0.95
Benzene	5	170	5	0.5	1.0	0.32	0.16
Bromodichloromethane	0.22	50,000	0.22	0.022	1.0 [c]	0.28	0.14
Bromoform	100	510	100	10	1.0	0.28	0.14
Bromomethane	8.7	50,000	8.7	0.87	2.0	0.48	0.24
Carbon Tetrachloride	5	520	5	0.5	1.0	0.2	0.10
Chlorobenzene	100	50	50	5	1.0	0.42	0.21
Chloroethane	8,600	16	16	1.6	1.0	0.42	0.21
Chloroform	70	2,400	70	7	1.0	0.14	0.07
Chloromethane	1.8	50,000	1.8	0.18	1.0	0.62	0.31
cis-1,2-Dichloroethylene	70	50,000	70	7	1.0	0.32	0.16
Dibromochloromethane	0.16	50,000	0.16	0.016	1.0 [c]	0.38	0.19
Ethylbenzene	700	30	30	3	1.0	0.46	0.23
Hexachlorobutadiene	0.86	6	0.86	0.086	1.0 [c]	0.38	0.19
Methyl ethyl ketone	7,100	8,400	7,100	710	10.0	1.2	0.6
Methyl isobutyl ketone	2,000	1,300	1,300	130	10.0	3.8	1.9
Methyl tert-butyl Ether	12	5	5	0.5	1.0	0.38	0.19
Methylene chloride	4.8	9,100	4.8	0.48	5.0 [c]	0.7	0.35
Styrene	100	10	10	1	1.0	0.5	0.25
Tetrachloroethane, 1,1,1,2-	0.52	50,000	0.52	0.052	1.0 [c]	0.26	0.13
Tetrachloroethane, 1,1,2,2-	0.067	500	0.067	0.0067	1.0 [c]	0.2	0.10
Tetrachloroethylene	5	170	5	0.5	1.0	0.3	0.15
Toluene	1,000	40	40	4	1.0	0.34	0.17
trans-1,2-Dichloroethylene	100	260	100	10	1.0	0.38	0.19
Trichloroethylene	5	310	5	0.5	1.0	0.32	0.16
Vinyl chloride	2	3,400	2	0.2	1.0	0.46	0.23

Analytes	DOH EAL[a]		PAL	PQL Goal	Laboratory-Specific Limits[b]		
	Drinking Water Toxicity	Gross Contamination			LOQs	LODs	MDLs
Xylenes	10,000	20	20	2.0	1.0	0.38	0.19
Analytical Group: PAHs (EPA 8270C SIM)							
Acenaphthene	370	20	20	2.0	0.2	0.12	0.0612
Acenaphthylene	240	2000	240	24	0.2	0.13	0.0657
Anthracene	1800	22	22	2.2	0.2	0.22	0.110
Benzo(a)anthracene	0.092	4.7	0.092	0.0092	0.2[c]	0.14	0.0689
Benzo(g,h,i)perylene	1500	0.13	0.13	0.013	0.2[c]	0.16	0.0785
Benzo(a)pyrene	0.2	0.81	0.2	0.02	0.2	0.12	0.0577
Benzo(b)fluoranthene	0.092	0.75	0.092	0.0092	0.2[c]	0.12	0.0621
Benzo(k)fluoranthene	0.92	0.4	0.4	0.04	0.2	0.19	0.0947
Chrysene	9.2	1	1	0.1	0.2	0.17	0.0837
Dibenzo(a,h)anthracene	0.0092	0.52	0.0092	0.00092	0.2[c]	0.13	0.0650
Fluoranthene	1500	130	130	13	0.2	0.16	0.0823
Fluorene	240	950	240	24	0.2	0.14	0.0724
Ideno(1,2,3-cd)pyrene	0.092	0.095	0.092	0.0092	0.2[c]	0.13	0.0644
1,-Methylnaphthalene	4.7	10	4.7	0.47	0.2	0.12	0.06
2,- Methylnaphthalene	24	10	10	1	0.2	0.12	0.06
Naphthalene	17	21	17	1.7	0.2	0.11	0.0536
Phenanthrene	240	410	240	24	0.2	0.16	0.0788
Pyrene	180	68	68	6.8	0.2	0.17	0.0845
Analytical Group: TPH							
TPH-GRO (EPA 8260B)	100	100	100	10	50	17.2	8.6
TPH-DRO (EPA 8015B)	210	100	100	10	150[c]	80.8	40.4
Analytical Group: Dissolved Lead (EPA 6020)							
Lead	15	5000	15	1.5	0.5	0.22	0.11

Note: All units are in micrograms per liter (µg/L).
DOH – State of Hawai'i Department of Health
EAL – environmental action level
LOD – Limit of Detection
LOQ – Limit of Quantification
MDL –method detection limit
PAL – project action level
PQL - project quantification limit

[a] DOH EALs (DOH 2009a): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site)

[b] Laboratory-specific LOQs, LODs, and MDLs are limits that an individual laboratory can achieve when performing a specific analytical method.

[c] In the case where an EAL for a specific chemical is less than the standard method reporting limit for a commercial laboratory, it is generally acceptable to consider the method reporting limit in place of the action level (DOH, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* 2008, updated March 2009).