FINAL
Sampling and Analysis Plan
Targeted Brownfields Assessment
Phase I/II Investigation
333 & 351 North King Street
Honolulu, Honolulu County, Hawaii

Prepared for:

U.S. Environmental Protection Agency Region 9

Contract Number: W91238-11-D-001
Task Order No.: 20074.063.510.1007

September 2018

Prepared by:

Weston Solutions, Inc.
2300 Clayton Road, Suite 900
Concord, CA 94520

333 & 351 North King Street
Honolulu, Honolulu County, Hawaii
Targeted Brownfields Assessment
Phase I/II Investigation
Sampling and Analysis Plan

Contract Number: W91238-11-D-001
Task Order No.: 20074.063.510.1007

Approved by: ______________________ 9/13/18
Shawn Carrier, Project Manager — Date
Weston Solutions, Inc.

Approved by: ______________________ 9/13/18
Anne Busher, Quality Assurance Coordinator — Date
Weston Solutions, Inc.

Approved by: ______________________ ________
Lisa Hanusiak, U.S. EPA Interagency Agreement Project Officer — Date
U.S. Environmental Protection Agency Region 9

Approved by: ______________________ 11/26/18
Audrey Johnson, Quality Assurance Manager — Date
U.S. Environmental Protection Agency Region 9

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

DISTRIBUTION LIST

Lisa Hanusiak
Interagency Agreement Project Officer
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Noemi Emeric-Ford
Project Manager
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Audrey Johnson
Quality Assurance Manager
USEPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Melody Calisay
Brownfields Project Manager
Hawaii Department of Health Hazard Evaluation and Emergency Response
2385 Waimano Home Road
Pearl City, HI 96782

LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
ºC	degrees Celsius
ACM	asbestos-containing materials
AMEC	AMEC Earth and Environmental, Inc.
AOC	analyte of concern
bgs	below ground surface
CFR	Code of Federal Regulations
DAGS	Department of Accounting and General Services
DBEDT	Department of Business, Economic Development & Tourism
DQI	data quality indicator
DQO	data quality objective
DRO	Diesel Range Organics
DU	decision unit
EALs	Environmental Action Levels
EDD	Electronic Data Deliverable
ESA	Environmental Site Assessment
ft	foot, feet
GPS	Global Positioning System
GRO	Gasoline Range Organics
HCDCH	Housing and Community Development Corporation of Hawaii
HDOH	Hawaii Department of Health
HEER	Hazardous Evaluation and Emergency Response
HFO	Hawaii Film Office
HLA	Harding Lawson Associates
IAPO	Interagency Agreement Project Officer
IDW	investigation-derived waste
LBP	lead-based paint
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mL	milliliter
MI	multi-incremental
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	mean sea level
NSDWR	National Secondary Drinking Water Regulations
OERR	Office of Emergency and Remedial Response
OR&L	Oahu Railway and Land
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
PRG	Preliminary Remediation Goal
QA	quality assurance
QC	quality control
ROE	Right-of-Entry

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

RPD	Relative Percent Difference
RRO	Residue Range Organics
RSL	regional screening level
SAP	Sampling and Analysis Plan
SCS	Soil Characterization Study
SOP	Standard Operating Procedure
SVOC	semivolatile organic compound
TAL	Target Analyte List
TOO	Task Order Official
TPH	Total Petroleum Hydrocarbons
TPH-d	Total Petroleum Hydrocarbons as diesel
TPH-g	Total Petroleum Hydrocarbons as gasoline
TPH-o	Total Petroleum Hydrocarbons as oil
UIC	Underground Injection Control Line
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.

1.0 INTRODUCTION

The United States Environmental Protection Agency (USEPA) Region 9 is conducting a Target Brownfields Assessment (TBA) of the 333/351 North King Street property (the Site) located in Honolulu, Honolulu County, Oahu, Hawaii, for the State of Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response Office (HEER). The TBA is intended to investigate the Site, which contained a former railway line and automotive fueling and services station. The results of the TBA and the preparation of an associated Analysis of Brownfields Cleanup Alternatives, if necessary, will facilitate a more informed decision on the viability of the Site for potential redevelopment or reuse.

The U.S. Army Corps of Engineers (USACE) has tasked Weston Solutions, Inc. (WESTON®) to conduct the TBA under Contract W91238-11-D-001, Task Order No. 20074.063.510.1007. A Phase II ESA, including the collection and analysis of soil samples, soil gas samples and building material samples, is required to assess the presence of environmentally hazardous chemicals. Sampling is tentatively scheduled for October 2018. The purpose of this Sampling and Analysis Plan (SAP) is to describe the rationale, data use objectives, field sampling methods, laboratory methods, and quality assurance (QA) methods for the proposed assessment work. This SAP supersedes the previous SAP that was approved April 2015. The specific field sampling and chemical analytical methods pertaining to the assessment of the Site are addressed in this SAP in accordance with the following documents:

- *Sampling and Analysis Plan Guidance and Template,* Version 3, Brownfields Assessment Projects (EPA, 2012).
- EPA Requirements for Quality Assurance Project Plans (EPA, 2001).
- Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA, 2006).
- Data Quality Objective Process for Superfund, Interim Final Guidance (EPA, 1993).

This SAP provides the planned data-gathering activities to conduct the TBA; however, Site conditions and additional EPA direction may warrant modifications. All significant changes will be documented in the TBA Report. If problems are encountered and/or additional characterization of the Site is warranted, an Addendum to this SAP will be prepared to document the findings and provide for additional Site characterization.

1.1 SITE HISTORY

The Site is a 3.79-acre property owned by the State of Hawaii Department of Accounting and General Services (DAGS). DAGS currently uses the former station depot, the Oahu Railway and Land (OR&L) Building, which is identified as a State of Hawaii historical building. An OR&L Annex building onsite is also utilized for storage and by a local culture and arts organization. Previous environmental assessments (i.e., Phase I and II Environmental Site Assessments [ESAs] and a Site Characterization Study [SCS]) have been conducted at the Site, including removal of four underground storage tanks (USTs) and hydraulic lifts associated with the former gas station.

Results of the previous investigations have indicated the presence of analytes of concern (AOCs) associated with historical railway activities and USTs.

To evaluate potential hazardous substances at the Site, the soil in nine decision units (DUs) will be sampled to investigate the presence of AOCs associated with the former railway line and former areas where USTs were removed. Each DU soil sample will be comprised of 20 incremental soil samples collected from intervals of 0 to 2 feet (ft) below ground surface (bgs), 2 to 4 ft bgs or 4 to 6 ft bgs. Soil will be sampled by advancing soil borings using Geoprobe® drilling technology. Additional activities are focused on investigating soil gas in locations of former USTs. Soil gas borings will be advanced using Geoprobe® drilling technology to approximately 10 ft bgs or 2 ft above groundwater, if encountered shallower than 10 ft Three soil gas samples will be collected from the three former UST locations and analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) using USEPA Method TO-15 and USEPA Method TO-17, respectively. Soil samples will be analyzed for TPHs using USEPA Method 8015B for Diesel Range Organics (DRO) and Residual Range Organics (RRO), Gasoline Range Organics (GRO) and VOCs using USEPA Method 8260B, Target Analyte List (TAL) metals using USEPA Method 6010B, and semivolatile organic compounds (SVOCs) using USEPA Method 8270C, based on the locations of the samples and associated historical activities.

Soil and soil gas sample analysis results will be evaluated against USEPA and HDOH environmental screening levels to assess potential Site contamination. Soil will be screened against USEPA regional screening levels (RSLs) for residential and industrial soil (May 2018) and HDOH Tier 1 Environmental Screening levels (EALs) for soil based on a non-drinking water resource and within 150 meters to a surface water body (Fall 2017). Soil gas samples will be screened against USEPA RSLs for residential and industrial air (May 2018) and HDOH Tier 1 EALs for shallow soil vapor intrusion hazards for residential and industrial air (Fall 2017). Additionally, one building on the Site (OR&L Annex storage building) will be surveyed for potential asbestos-containing materials (ACM) and lead-based paint (LBP) to document the presence and location of these hazardous materials in preparation for demolition. The sampling event is tentatively scheduled for August 2018.

1.2 SITE NAME

The Site is generally known as the North King Street TBA Site.

1.3 SITE LOCATION

The Site is located northwest of the intersection of Iwilei Road and North King Street at 333 and 351 North King Street, Honolulu, Island of Oahu, Hawaii. The Site is bordered by North King Street to the east, Iwilei Road to the south, residential high rise to the west, and commercial businesses to the north. The geographic coordinates for the centroid of the Site are 21° 18' 57.08" North latitude and 157° 51' 53.51" West longitude.

1.4 RESPONSIBLE AGENCY

HDOH HEER is the responsible agency for this Site.

1.5 PROJECT ORGANIZATION

The following is a list of project personnel and their responsibilities (also shown in Table 1-1):

- USEPA Project Manager (PM) – The USEPA PM is Noemi Emeric-Ford. Ms. Emeric-Ford is the primary point of contact for the contractor on site-specific issues. The USEPA PM will coordinate with the USEPA Interagency Agreement Project Officer (IAPO) as appropriate.
- USEPA Interagency Agreement Project Officer (IAPO) – The USEPA IAPO is Lisa Hanusiak. Ms. Hanusiak is the primary decision maker for USEPA for this investigation.
- USEPA, Quality Assurance Manager – The USEPA QA Manager is Audrey Johnson. Ms. Johnson is responsible for USEPA QA review of the SAP and will ensure that USEPA Region 9 QA requirements are achieved.
- HDOH HEER Office – The HDOH HEER Office Brownfields Project Manager is Melody Calisay. Ms. Calisay is the representative from the TBA-applying organization and project stakeholder.
- WESTON QA Manager – The WESTON QA Manager is Anne Busher. Ms. Busher is responsible for the overall quality of the project, including data quality and technical report quality.
- WESTON PM, Field Sampling Quality Control (QC) Coordinator, Field Manager – The WESTON PM, Field Sampling QC Coordinator, and Field Manager is Shawn Carrier. Mr. Carrier is responsible for all tasks assigned to WESTON by USEPA; working with USEPA to ensure project QA goals are met; handling general project management; preparing the SAP amendment; implementing the sampling design; collecting, handling, documenting, and transporting samples; and generating field documentation of sampling activities.
- Analytical Laboratory – A qualified laboratory will be subcontracted by WESTON for analytical services. WESTON personnel will perform data validation activities.

Table 1-1 Key Project Personnel Contact Information

Title/Responsibility	Name/Email Address	Phone Number
USEPA Interagency Agreement Project Officer	Lisa Hanusiak hanusiak.lisa@epa.gov	(415) 972-3152
USEPA Project Manger	Noemi Emeric-Ford emeric-ford.noemi@epa.gov	(213) 244-1821
USEPA QA Manager	Audrey Johnson Johnson.AudreyL@epa.gov	(415) 947-3537
HDOH HEER Brownfields Project Manager	Melody Calisay melody.calisay@doh.hawaii.gov	(808) 586-7577
WESTON QA Manager	Anne Busher ABusher@css-inc.com	(440) 539-0787
WESTON Project Manager	Shawn Carrier Shawn.Carrier@westonsolutions.com	(808) 275-2931

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The Site is a partially developed 3.79-acre property located approximately 0.50 mile northwest of downtown Honolulu, Honolulu County, Hawaii. The Site topography is relatively flat with surface elevations ranging from approximately 4 ft to 10 ft above mean sea level (MSL) and slopes to the southwest. Approximately 85 percent (%) of the Site is covered with concrete or asphalt, and the remaining land is sparsely vegetated. The Site, which is situated in an industrial mixed-use zone for commercial and residential use, is owned by the Hawaii State DAGS.

The Site is bordered by North King Street to the east, Iwilei Road to the south, Housing and Community Development Corporation of Hawaii (HCDCH) Residential Tower to the west, and commercial businesses to the north. Currently, two buildings are located at the Site, the OR&L Building, and the OR&L Annex storage building. The OR&L Building is used for State of Hawaii offices. The OR&L Annex storage building is utilized by the Kalihi-Palama Culture Center and the King Kamehameha Day Celebration Committee, and is also used for storage. The Site property also includes the Right-of-Entry (ROE) to the Department of Business, Economic Development & Tourism (DBEDT) – Hawaii Film Office (HFO) and a utility easement, which corresponds with the portion of the Site formerly used by and adjacent to the former railway line. The Site is fenced and inaccessible to the public, except for business hours at the OR&L Building. The Site location and layout are presented in Figures 2-1 and 2-2.

The HDOH HEER Office has received an USEPA Brownfields Assessment Grant to investigate the Site for planned redevelopment as the Liliha Civic Center for State Offices and programs to service the immediate community and State Capital District. The Honolulu Rail Transit has planned for a new rail to run along the civic center. The OR&L Building (Honolulu Station Depot) is eligible to be included on the National Register of Historic Places.

2.2 OPERATIONAL HISTORY

The Site was utilized as a railway line and for the Honolulu Station Depot (currently the OR&L Building) from 1889 to 1962. The former railway line extended from Kaahi Street to the Iwilei Road and North King Street corner of the Site. Locomotives operating on the railway lines were fueled with coal, oil, diesel, or gasoline. Railway fueling operations were conducted on the property adjacent to the Site. An automotive service station was operated from the mid-1950s to the mid-1970s. During 1952 to 1999, a fruit and vegetable warehouse, with an adjacent storage building, was operated on the Site along the western boundary of the property. In 1999, the warehouse and the storage building were demolished. The OR&L Annex storage building (adjacent to the former automotive service station) has been located on the property from the 1950s to present. The property was conveyed by the OR&L to the State of Hawaii by deed on 11 September 1961. Portions of the Site have been leased to various commercial tenants (Harding Lawson Associates, 1992). Currently, the two OR&L buildings are used for State of Hawaii Offices or storage, and the rest of the property is unoccupied.

2.3 PREVIOUS INVESTIGATIONS

According to the report titled Iwilei Brownfield Site Characterization Study, dated March 2004, the following previous investigations have been conducted at the Site (AMEC, 2004):

- Harding Lawson Associates (HLA) Phase I (HLA, 1992a)
- HLA Phase II ESA (HLA, 1992b)
- HLA Removal of USTs and Hydraulic Lifts (1993)
- Kimura International (Kimura) Limited Phase II ESA (Kimura, 2001)
- Kimura UST Closure and Release Response Report (Kimura, 2002)

Based on a review of these documents, the areas of concern were identified at the Site as the railway line, USTs, and a catch basin. The former OR&L railway line was situated in the current location of Kaahi Street and extended across the property to the OR&L Building. A total of four USTs (two 4,000-gallon USTs [gasoline and diesel]; one 2,000-gallon [unknown] UST; and one 500-gallon [fuel oil] UST) were identified during the HLA Phase I ESA (HLA, 1992a) in the northeastern corner of the property. In 1993, HLA removed the four USTs from the property. A release of petroleum constituents was observed during the removal of the USTs, and the HDOH UST Section was notified. The catch basin, which was situated in the vicinity of the former railway line in the northwest portion of the property, was identified during the Phase I ESA in 1991 (AMEC, 2004).

2.3.1 Site Characterization Study (SCS)

In 2003, an SCS was conducted by AMEC Earth and Environmental, Inc. (AMEC) to assess the potential soil, sediment, and groundwater impacts resulting from historical Site activities, specifically associated with the former railway line, former petroleum and potential chemical storage, and former service station activities onsite. Activities performed during the SCS included geophysical utility clearance, soil sampling and screening, monitoring well installation, groundwater sampling, land survey, water level survey, and investigation-derived waste (IDW) disposal. The SCS investigation activities were focused on the former UST locations (UST Area C and Area B), railroad area, and catch basin area (Figure 2-2). A summary of the results from the SCS is provided below:

- A total of 30 borings were advanced to collect and analyze subsurface soil (ranging from 3.5 ft to 11 ft bgs) and/or groundwater samples.
- Soil and groundwater samples and one sediment sample were analyzed for TPH, VOCs, SVOCs, and/or metals.
- UST Area C characterization results summary:
    - Soil: TPH constituents did not exceed HDOH screening criteria. VOC compounds were detected below the USEPA Preliminary Remediation Goals (PRGs) (PRGs are now known as RSLs). Four metals (chromium, iron, manganese, and/or thallium) were reported exceeding the USEPA PRGs at one or more locations (S20, S21, S22, S22dup, S24, and/or S28).

- Groundwater: TPH concentrations were reported below the laboratory method detection limits. VOCs and SVOCs were detected below the applicable screening criteria. One metal analyte (manganese) was reported at one location (S29) exceeding the screening criteria (National Secondary Drinking Water Regulations [NSDWR]).

- UST Area B characterization results summary:
  - Soil: TPH constituents were not reported at concentrations greater than the laboratory method detection limits. SVOCs were detected in four soil samples (S16, S17, S17dup, and S18) below the screening levels. One SVOC analyte (benzo[a]pyrene) was reported at one location (S19) exceeding the USEPA PRG. Five metals (arsenic, chromium, iron, manganese, and/or thallium) were reported exceeding the USEPA PRGs at one or more locations (S16, S17, S17dup, S18, and/or S19).
  - Groundwater: TPH-g (gasoline) was detected at two sample locations (S17 and S18), whereas TPH-d (diesel) and TPH-o (oil) was reported at one location (S17). HDOH and maximum contaminant level (MCL) screening criteria were not available during the reporting for the SCS. SVOC compounds were detected below screening criteria. Two metal analytes (manganese and/or iron) were reported at five sample locations (S16 through S19) exceeding the screening criteria.

- Railroad Area characterization results summary:
  - Soil: One SVOC analyte (benzo[a]pyrene) was reported at sample location, S9, exceeding the USEPA PRG. Six SVOC analytes (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, and dibenzo[a,h]anthracene) were reported at sample location, S13, exceeding the USEPA PRGs. Three metals (chromium, iron, and thallium) had concentrations exceeding the USEPA PRGs in one or more samples obtained from 13 sample locations (S1 through S8, S10, S11, S13, S13dup, and S14).
  - Groundwater: SVOCs were not reported at concentrations greater than the laboratory detection limit for groundwater. Detected metals concentrations were reported below screening criteria.

- Catch Basin characterization results summary:
  - Sediment: TPH concentrations were reported below screening criteria. SVOCs were not reported at concentrations greater than the laboratory method detection limits. Two metal analytes (iron and thallium) were reported at one location (S30) above screening criteria.

- The groundwater flow direction was measured to be towards the northeast.

As documented in the SCS, the concentrations of five metals (arsenic, chromium, iron, manganese, and thallium) in soils and two metals (manganese and iron) in groundwater exceeded the respective screening criteria (i.e., PRG or MCL) at one or more sample locations. Because the concentrations of these metals are often naturally high in soils derived from volcanic rocks, the reported concentrations may not be related to former operational activities. Generally, USEPA does not require cleanup below naturally occurring background levels. It was recommended that a limited soil excavation and removal action be performed at sample locations S9 and S13 (former Railroad Area) and sample location S19 (former UST B Area) to remediate the SVOC concentrations in soil that exceeded USEPA PRG screening criteria, or alternatively, a site-specific risk assessment be conducted to determine if a removal action is warranted (AMEC, 2004). To date, no remediation or removal action has taken place. Figure 2-3 shows the SCS sample locations and applicable screening criteria exceedances.

2.4 SITE CONDITIONS

2.4.1 Geology

The Site is located at an elevation of approximately 4.5 ft to 9.5 ft above MSL on the seaward side of the Honolulu Plain on the southern flank of the Koolau volcano. The Site is located on a thick wedge of coastal marine sediments inter-layered with alluvial material, volcanic cinder and ash, and near-shore sediments, which are collectively referred to as caprock. A review of the boring logs from the SCS indicate that the Site's shallow subsurface geology is comprised of fill material, consisting of silty sands and gravels, a thin layer of black volcanic cinder, and in situ sediments consisting of coral sands interfingered with lagoonal muds. Underlying the surficial soil is the Koolau basalt.

2.4.2 Surface Water Hydrology

The Site is located approximately 700 ft northeast of Honolulu Harbor, and approximately 500 ft north of Nuuanu Stream (Figure 2-1). Surface water from the Site discharges into several stormwater drains on the property and on North King Street and Iwilei Road. The stormwater drains are assumed to discharge into either Honolulu Harbor (hydraulically down-gradient from the Site) or Nuuanu Stream (cross-gradient from the Site).

The Site receives an average rainfall of about 22 inches per year, with much of the rain falling in the winter months. According to the Atlas of Hawaii, approximately 36% of the rainfall on Oahu infiltrates the soil layers to recharge the groundwater. Approximately 24% of rainfall is lost to surface runoff, and 40% is lost to evapotranspiration (Giambelluca et al., 1986). However, with the exception of the exposed soil in the northern portion of the Site, little infiltration occurs due to the amount of concrete/asphalt cover.

2.5 GROUNDWATER HYDROLOGY

The Site is located above the Kalihi Aquifer, which is separated into upper and lower aquifer types. The upper aquifer, within the caprock sediments, is classified as unconfined, basal, and sedimentary. The status of the upper aquifer is listed as a moderately saline, currently used groundwater source that is replaceable and has a high vulnerability to contamination. The lower aquifer is considered to be confined, basal, and flank. The status of the lower aquifer is listed as an irreplaceable, currently used, fresh drinking water source that has a low vulnerability to contamination (Mink and Lau, 1990).

The groundwater most likely to be impacted by Site activities is the upper aquifer contained within the caprock sediments beneath the Site. Although the brackish caprock water is not potable, it may be used for industrial purposes.

The Site is located adjacent to and up-gradient of the Hawaii State Underground Injection Control Line (UIC), which typically segregates potable from non-potable water. Based on the average specific conductivity measurements reported during the SCS, the groundwater onsite is classified as brackish water. As a result, the groundwater beneath the Site is most likely unsuitable for drinking and would be classified as non-potable (AMEC, 2004).

Public drinking water wells are located hydraulically up-gradient and cross-gradient of the Site. The closest drinking water well is approximately 4,000 ft to the north-northwest of the Site and pumps water from the deeper, basal aquifer (AMEC, 2004).

2.6 IMPACT ON HUMAN HEALTH AND/OR THE ENVIRONMENT

The Site is primarily vacant with a portion of the property being utilized for offices in a historic building. The Site is currently situated in a mixed use portion of Honolulu with residential and industrial properties located adjacent to its boundaries. The property was previously utilized as a railway line from 1889 to 1962 and an automotive fueling and service station from the 1950s to the mid-1970s. The environmental contaminants associated with the Site, based on previous TBAs, include TPHs and VOCs in two former UST areas, and metals and SVOCs in the former railway lines and UST areas.

Currently, the Site is mostly covered with asphalt or concrete acting as a surface barrier to potential contaminants. Additionally, the former railway line and UST areas are fenced limiting access. However, potential contaminants at the Site could pose a risk to human health through ingestion, direct skin contact, or inhalation if allowed to become airborne, especially during redevelopment of the property. Furthermore, the age and physical state of the OR&L Annex storage building at the Site may indicate the presence of LBP and/or ACM as environmental contaminant

Legend

- Stream
- Site Boundary

Feet
0 500 1,000

1 inch = 1,000 feet

Site Location

333 & 351 North King Street
Honolulu, Hawaii

FIGURE 2-1

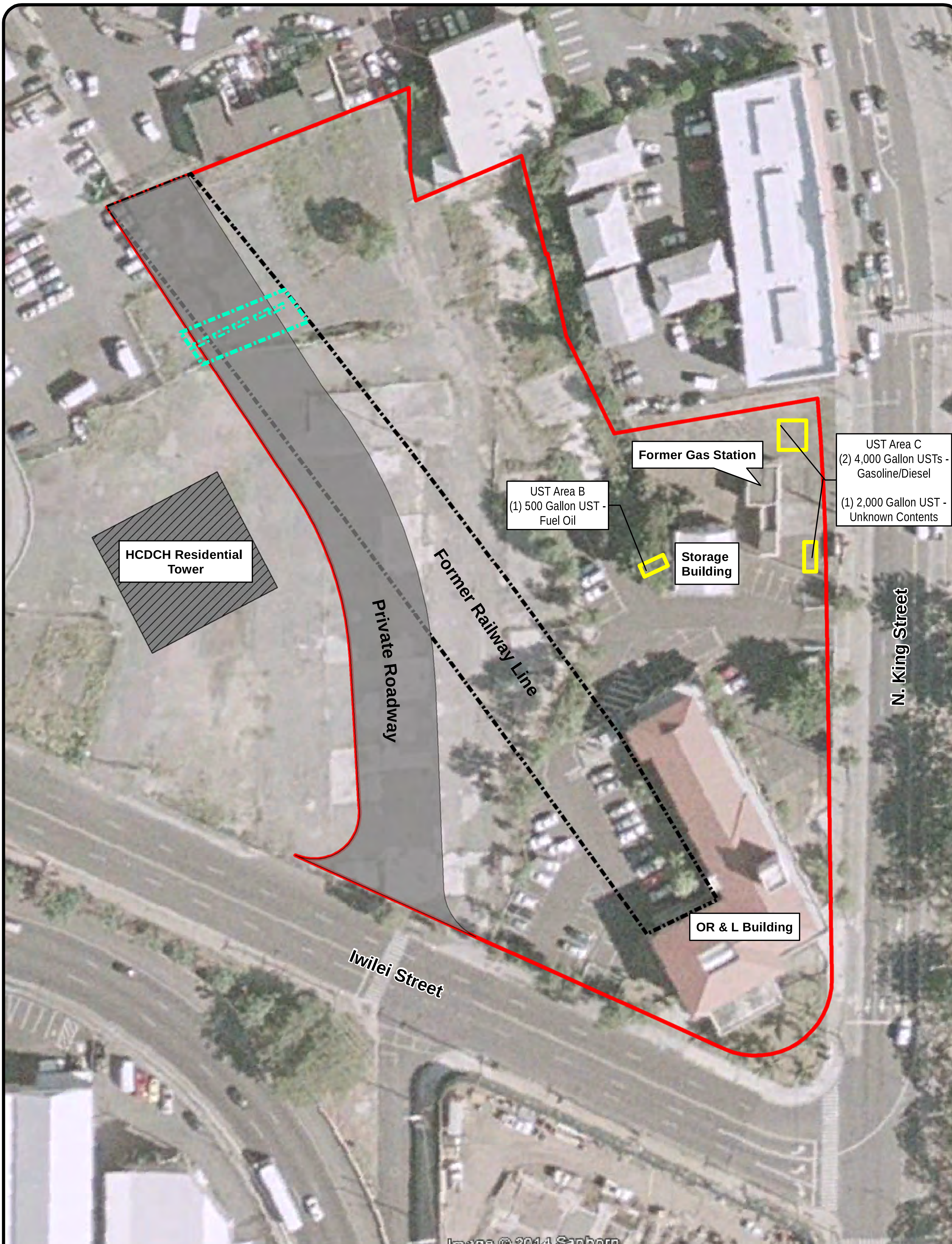
WESTON SOLUTIONS
841 BISHOP STREET SUITE 2301 HONOLULU, HAWAII 96813 808.585.0448

DRAWN	DATE	CONTRACT NO.
A.DALE	2014-SEP	X
CHKD BY:	CHCK DATE:	WORK ORDER NUMBER:
AROD	2014-SEP	20074.063.510.1007

O:\Alex\AROD\2-1SiteLocation.mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

Projection: UTM Zone 4N. Datum: NAD83



N

Feet
0 30 60
1 inch = 60 feet

Legend
- Site Boundary
- Former Railway Line
- Former UST Location
- Former Catch Basin
- Private Roadway
- HCDCH Building Footprint

Notes:
OR & L - Oahu Railway and Land
UST - Underground Storage Tank
HCDCH - Housing & Community Development Corporation of Hawaii

Site Layout

333 & 351 North King Street
Honolulu, Hawaii

FIGURE **2-2**

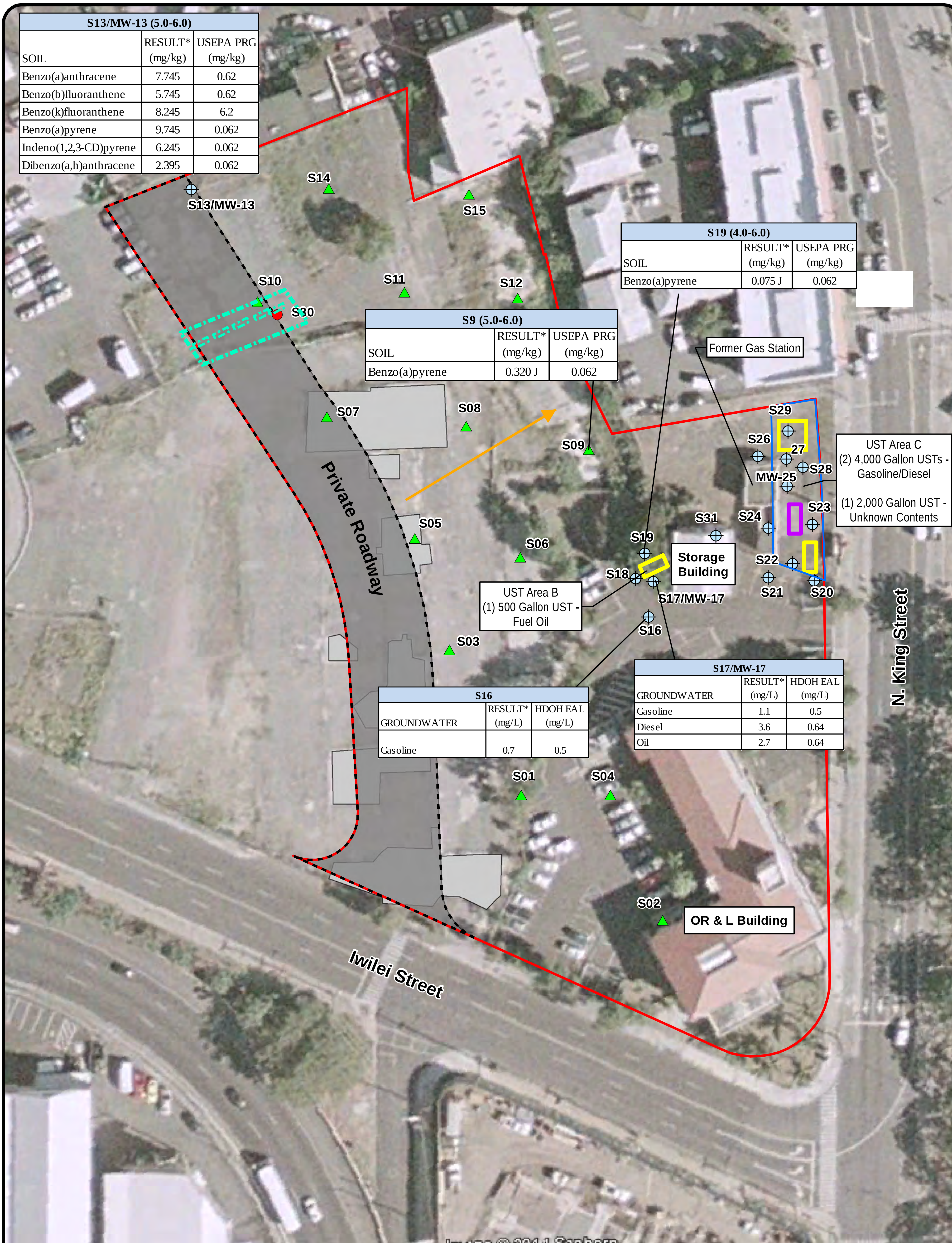
WESTON SOLUTIONS
841 BISHOP STREET SUITE 2301 HONOLULU, HAWAII 96813 808.585.0448

DRAWN	DATE	CONTRACT NO.
A.DALE	2014-SEP	X
CHKD BY:	CHCK DATE:	WORK ORDER NUMBER:
AROD	2014-SEP	20074.063.510.1007

O:\Alex\AROD\2-2SiteLayout.mxd

Service Layer Credits: Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community Google Earth

Projection: UTM Zone 4N. Datum: NAD83



S13/MW-13 (5.0-6.0)

SOIL	RESULT* (mg/kg)	USEPA PRG (mg/kg)
Benzo(a)anthracene	7.745	0.62
Benzo(b)fluoranthene	5.745	0.62
Benzo(k)fluoranthene	8.245	6.2
Benzo(a)pyrene	9.745	0.062
Indeno(1,2,3-CD)pyrene	6.245	0.062
Dibenzo(a,h)anthracene	2.395	0.062

S19 (4.0-6.0)

SOIL	RESULT* (mg/kg)	USEPA PRG (mg/kg)
Benzo(a)pyrene	0.075 J	0.062

S9 (5.0-6.0)

SOIL	RESULT* (mg/kg)	USEPA PRG (mg/kg)
Benzo(a)pyrene	0.320 J	0.062

S17/MW-17

GROUNDWATER	RESULT* (mg/L)	HDOH EAL (mg/L)
Gasoline	1.1	0.5
Diesel	3.6	0.64
Oil	2.7	0.64

S16

GROUNDWATER	RESULT* (mg/L)	HDOH EAL (mg/L)
Gasoline	0.7	0.5

N

Feet
0 30 60
1 inch = 60 feet

Legend
- Former Sediment Sample Location
- Former Subsurface Soil Sample Location
- Former Subsurface Soil and Groundwater Sample Location
- Site Boundary
- Private Roadway
- Former/Existing Concrete Slab
- Former UST Location
- Former Dispenser Island
- UST Area C
- Former Catch Basin
- Groundwater Flow Direction

Notes:
OR & L - Oahu Railway and Land
UST - Underground Storage Tank
* Value is the average of the primary and duplicate sample.
J - Estimated concentration
HDOH EAL based on unrestricted land use, non-drinking water resource, and distance to nearest surface water body of <150 meters.

2003 Site Characterization Study Summary

333 & 351 North King Street
Honolulu, Hawaii

FIGURE 2-3

WESTON SOLUTIONS
841 BISHOP STREET SUITE 2301 HONOLULU, HAWAII 96813 808.585.0448

DRAWN	DATE	CONTRACT NO.
A.DALE	2014-SEP	X
CHKD BY:	CHCK DATE:	WORK ORDER NUMBER:
AROD	2014-SEP	20074.063.510.1007

O:\Alex\AROD\2-3_2003SiteCharacterization141021.mxd

Service Layer Credits: Google Earth

Projection: UTM Zone 4N. Datum: NAD83

3.0 PROJECT AND DATA QUALITY OBJECTIVES

3.1 PROJECT TASK AND PROBLEM DEFINITION

Under the Brownfields program, USACE tasked WESTON to evaluate Site environmental concerns in an effort to facilitate redevelopment. Based on a review of the Site history, the AOCs for the Site include the following: TPHs, VOCs, metals, and/or SVOCs. To evaluate environmental concerns from former Site activities, WESTON will:

- Collect surface and subsurface soil samples between 0 ft and 6 ft bgs from 9 onsite DUs using multi-incremental (MI) soil sampling techniques.
- Collect soil gas samples from 10 ft bgs or 2 ft above groundwater, if encountered shallower than 10 ft using summa canisters and sorbent tubes.
- Hazardous building surveys will be completed for the OR&L Annex storage building onsite (which also includes a smaller storage building) to evaluate ACM and LBP that may require abatement.

Sample results will be evaluated against USEPA RSLs and HDOH EALs to determine the risk to human health and the environment. Soil results will be screened against USEPA RSLs for residential and industrial soil (May 2018) and HDOH Tier 1 EALs for soil based on a non-drinking water resource and within 150 meters to a surface water body (HDOH 2017). Soil gas samples will be screened against USEPA RSLs for residential and industrial air (USEPA, 2018) and HDOH Tier 1 EALs for shallow soil vapor intrusion hazards for residential and industrial air (HDOH, 2017). The data collected during this Site investigation will be used to evaluate environmental concerns at the Site and identify the potential impact on future redevelopment. The data will be specifically used to determine the extent to which the Site has been impacted by historic uses and to support redevelopment decisions.

3.2 DATA QUALITY OBJECTIVES (DQOs)

The DQO process, as set forth in the USEPA document, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4 (USEPA, 2006), was followed to establish the DQOs for this project. An outline of the process and the outputs for this project are included in Appendix A. This investigation will involve the generation of definitive data for soil, soil gas, and building materials. The data generated under this project will comply with the requirements for that data category as defined in *Data Quality Objective Process for Superfund, EPA 540/G-93/71, September 1993* (USEPA, 1993). All definitive analytical methods employed for this project will be methods approved by USEPA.

The State of Hawaii plans to redevelop the Site for a civic center. The protection of future occupants' health and the environment are pertinent to this Site use. Screening criteria were determined in order to correspond with the use of the Site for industrial land use; however, screening levels for residential use will also be considered since these screening levels are the most conservative and allow for unrestricted use. Soil and soil gas sample results for TPH, VOCs, SVOCs, and metals will be compared to USEPA Region 9 RSLs (USEPA, 2018) and HDOH Tier 1 EALs (HDOH, 2017) for residential and industrial uses. HDOH EALs for soil will be based on a nondrinking water source and a surface water body less than 150 meters away. Based on volcanic soils having the potential to produce naturally high concentrations of metals in soils, soil samples will also be compared to background soil concentrations provided in the HDOH Tier 1 EAL data tables and background concentrations reported in the *Hawaiian Islands Soil Metal Background Evaluation Report*, prepared for HDOH (AECOM Technical Services, Inc. [AECOM], 2012). Building materials containing >1% asbestos as determined by PLM methodology are considered to be an ACM as found in 40 Code of Federal Regulations (CFR) Part 763. Building materials containing lead in paint or other surface coating material containing lead greater than or equal to (>) 5,000 parts per million (ppm) or 0.5% by weight are considered to be an LBP according to U.S. Department of Housing and Urban Development (HUD, 2010). Screening criteria will serve as a screening tool to help determine whether further characterization at the Site is necessary.

The AOCs for the project are listed in Table 3-1 and Table 3-2 along with associated screening levels. The AOCs listed in Table 3-1 and Table 3-2 were selected by the scoping team based on professional judgment for the analytes expected to be present at the Site. If analytes not listed in Table 3-1 and Table 3-2 are detected, the sample results will be presented and discussed in the final report.

Results will be evaluated against the following decision rules:

1. If analysis of soil, soil gas, and building material samples documents concentrations of AOCs to be greater than screening levels, then USEPA may request further characterization, removal, or remediation of the impacted media or a different development plan.
2. If analysis of soil, soil gas, and building material samples document concentrations of AOCs to be less than screening levels, then USEPA may request further characterization and/or may allow the redevelopment plan to proceed.

Table 3-1 Screening levels for Analytes of Concern – Soil

Analyte	USEPA RSLs		HDOH Tier 1 EALs	Laboratory	Analyte	USEPA RSLs		HDOH Tier 1 EALs	Laboratory
	Resident	Industrial	Nondrinking Water, Water Body < 150 m	Reporting Limit	Resident	Resident	Industrial	Nondrinking Water, Water Body < 150 m	Reporting Limits
Total Petroleum Hydrocarbons (Diesel and Residual Range Organics) – USEPA Method 8015B									
Diesel Range Organics (C10-C28)	110,000	600,000	260,000	1,000	Residual Range Organics (C28-C40)	2,500,000	33,000,000	500,000	5,000
Total Petroleum Hydrocarbons Gasoline Range Organics/Volatile Organic Compounds (VOCs) – USEPA Method 8260B									
Gasoline Range Organics (C6-C12)	82,000	420,000	100,000	5,000	Carbon tetrachloride	650	2,900	100	50
1,1,1,2-Tetrachloroethane	2,000	8,800	320	50	Chlorobenzene	280,000	1,300,000	1,500	50
1,1,1-Trichloroethane	8,100,000	36,000,000	1,200	50	1,2,4-Trichlorobenzene	24,000	110,000	160	50
1,1,2,2-Tetrachloroethane	600	2,700	10	50	cis-1,2-Dichloroethene	160,000	2,300,000	360	50
1,1,2-Trichloroethane	1,100	5,000	8.9*	50	Chloroethane	-----	------	12,000	50
1,1-Dichloroethane	3,600	16,000	380	50	Chloroform	320	1,400	26	50
1,1-Dichloroethene	230,000	1,000,000	4,200	50	Chloromethane	110,000	460,000	4,000	50
1,2,3-Trichlorobenzene	63,000	930,000	-----	50	cis-1,3-Dichloropropene	1,800	8,200	-----	50
1,2,3-Trichloropropane	5.1*	110	1.6*	50	Dibromomethane	24,000	99,000	-----	50
1,2,4-Trimethylbenzene	300,000	1,800,000	-----	50	Dichlorodifluoromethane	87,000	370,000	-----	50
1,2-Dibromo-3-Chloropropane	5.3*	64*	0.81*	100	Ethylbenzene	5,800	25,000	900	50
1,2-Dichlorobenzene	1,800,000	9,300,000	1,100	50	n-Butylbenzene	3,900,000	58,000,000	-----	50
1,2-Dichloroethane	460	2,000	23*	50	Hexachlorobutadiene	1,200	5,300	61	50
1,2-Dichloropropane	2,500	11,000	60	50	N-Propylbenzene	3,800,000	24,000,000	-----	50
1,3,5-Trimethylbenzene	270,000	1,500,000	-----	50	Methyl tert-butyl ether	47,000	210,000	2,300	100
1,3-Dichlorobenzene	-----	-----	2,500	50	Methylene Chloride	57,000	1,000,000	22,000	50
1,3-Dichloropropane	1,600,000	23,000,000	----	50	m-Xylene	560,000	2,400,000	1,400	50
1,4-Dichlorobenzene	2,600	11,000	55	50	Naphthalene	3,800	17,000	3,100	50
2-Chlorotoluene	1,600,000	23,000,000	-----	50	o-Xylene	650,000	2,800,000	1,400	50
tert-Butylbenzene	7,800,000	120,000,000	-----	50	sec-Butylbenzene	7,800,000	120,000,000	-----	50
4-Chlorotoluene	1,600,000	23,000,000	-----	50	Styrene	6,000,000	35,000,000	2,900	50
Toluene	4,900,000	47,000,000	780	50	Tetrachloroethene	24,000	100,000	98	50
Benzene	1,200	5,100	770	50	trans-1,2-Dichloroethene	1,600,000	23,000,000	3,600	50
Bromobenzene	290,000	1,800,000	-----	50	trans-1,3-Dichloropropene	1,800	8,200	-----	50
Bromoform	19,000	86,000	2,000	50	Trichloroethene	940	6,000	89	50
Bromomethane	6,800	30,000	220	100	Trichlorofluoromethane	23,000,000	350,000,000	-----	50
Vinyl chloride	59	1,700	36*	50	1,2,4-Trichlorobenzene	24,000	110,000	160	50
p-Xylene	555,000	240,000	1,400	50					

Values in µg/kg.

* Denotes Laboratory Reporting Limit Exceeds Screening Level

USEPA Regional Screening Levels for residential and industrial soil, dated May 2018. HDOH Tier 1 EALs based on non-drinking water resource and within 150 meters to a surface water body, dated fall 2017.

Table 3-1 Screening levels for Analytes of Concern – Soil (Continued)

Analyte	USEPA RSLs		HDOH Tier 1 EALs	Laboratory Reporting Limit	Analyte	USEPA RSLs		HDOH Tier 1 EALs	Laboratory Reporting Limit
	Residential	Industrial	Nondrinking Water, Water Body < 150 m			Resident	Industrial	Nondrinking Water, Water Body < 150 m	
Semivolatile Organic Compounds (SVOCs) – USEPA Method 8270C									
1,2-Dichlorobenzene	1,800,000	9,300,000	1,100	330	Benzo[k]fluoranthene	11,000	210,000	39,000	330
1,3-Dichlorobenzene	-----	-----	2,500	330	Benzoic acid	250,000,000	3,300,000,000	-----	1,600
1,4-Dichlorobenzene	2,600	11,000	55*	330	N-Nitrosodi-n-propylamine	78*	330	-----	330
1-Methylnaphthalene	18,000	73,000	890	330	Di-n-butyl phthalate	6,300,000	82,000,000	-----	330
2,4,5-Trichlorophenol	6,300,000	82,000,000	500	330	Bis(2-chloroethoxy)methane	190,000	2,500,000	-----	330
2,4,6-Trichlorophenol	49,000	210,000	310*	330	Bis(2-chloroethyl)ether	230*	1,000	7.9*	330
2,4-Dichlorophenol	190,000	2,500,000	73	330	Bis(2-ethylhexyl) phthalate	39,000	160,000	39,000	330
2,4-Dimethylphenol	1,300,000	16,000,000	9,800	330	Butyl benzyl phthalate	290,000	1,200,000	-----	330
2,4-Dinitrophenol	130,000	1,600,000	1,100*	1,600	Hexachlorocyclopentadiene	1,800	7,500	-----	1,600
2,4-Dinitrotoluene	1,700	7,400	870	330	Chrysene	110,000	2,100,000	30,000	330
2,6-Dinitrotoluene	360	1,500	360	330	Dibenz(a,h)anthracene	110*	2,100	1,600	330
2-Chloronaphthalene	4,800,000	60,000,000	-----	330	Dibenzofuran	73,000	1,000,000	-----	330
2-Chlorophenol	390,000	5,800,000	120*	330	Diethyl phthalate	51,000,000	660,000,000	3,700	330
2-Methylnaphthalene	240,000	3,000,000	1,900	330	Dimethyl phthalate	-----	-----	26,000	330
2-Nitroaniline	630,000	8,000,000	-----	1,600	Di-n-octyl phthalate	630,000	8,200,000	-----	330
Fluorene	2,400,000	30,000,000	93,000	330	Fluoranthene	2,400,000	30,000,000	87,000	330
3,3'-Dichlorobenzidine	1,200*	5,100	1,200*	1,600	Hexachlorobenzene	210*	960	220*	330
4-Chloroaniline	2,700	11,000	-----	330	Hexachlorobutadiene	1,200	5,300	61*	330
Benzo[b]fluoranthene	1,100	21,000	16,000	330	Hexachloroethane	1,800	8,000	680	330
Benzo[a]pyrene	110	2,100	1,600	330	Indeno[1,2,3-cd]pyrene	1,100	21,000	16,000	330
Pyrene	1,800,000	23,000,000	44,000	330	Isophorone	570,000	2,400,000	10,000	330
Phenol	19,000,000	250,000,000	1,800	330	Naphthalene	3,800	17,000	3,100	330
4-Nitroaniline	27,000	110,000	-----	1,600	Nitrobenzene	5,100	22,000	5,600	330
Acenaphthene	3,600,000	45,000,000	120,000	330	N-Nitrosodiphenylamine	110,000	470,000	-----	330
Acenaphthylene	-----	-----	5500	330	Pentachlorophenol	1,000*	4,000	780*	1,600
Anthracene	18,000,000	230,000,000	4,200	330	Phenanthrene	-----	-----	69,000	330
Benzo[a]anthracene	1,100	21,000	10,000	330	Benzo[g,h,i]perylene	-----	-----	35,000	330

Values in µg/kg.

* Denotes Laboratory Reporting Limit Exceeds Screening Level

USEPA Regional Screening Levels for residential and industrial soil, dated May 2018. HDOH Tier 1 EALs based on non-drinking water resource and within 150 meters to a surface water body, dated fall 2017.

Table 3-1 Screening levels for Analytes of Concern – Soil (Continued)

Analyte	USEPA RSLs		HDOH Tier 1 EALs	Background Values	Laboratory MDL	Analyte	USEPA RSLs		HDOH Tier 1 EALs	Background Levels	Laboratory MDL
	Resident	Industrial	Nondrinking Water, Water Body < 150 m				Resident	Industrial	Nondrinking Water, Water Body < 150 m		
TAL Metals – USEPA Method 6010B											
Aluminum	77,000	1,100,000	-----	122,454	20.0	Lead	400	800	200	54.2	1.0
Antimony	31	470	6.3	1.43	2.0	Copper	3,100	47,000	630	204	1.50
Arsenic	0.66*	3	24	23.6	2.0	Manganese	1,800	26,000	-----	2,434	0.5
Barium	15,000	220,000	1,000	607	1.0	Nickel	1,500	22,000	410	340	1.00
Beryllium	160	2,300	31	2.83	0.2	Vanadium	390	5,800	770	720	0.5
Cadmium	71	980	14	4.6	0.2	Selenium	390	5,800	78	5.27	2.0
Chromium	-----	-----	1,100	1,010	0.5	Silver	390	5,800	78	1.17	0.5
Cobalt	23	350	80	71.2	0.5	Thallium	0.78*	12	0.78	N/A	2.0
Iron	55,000	820,000	-----	225,097	10.0	Zinc	23,000	350,000	1,000	232	2.0

Values in milligrams per kilogram (mg/kg).

USEPA Regional Screening Levels for residential and industrial soil, dated May 2018. HDOH Tier 1 EALs based on non-drinking water resource and within 150 meters to a surface water body, dated fall 2017. Background values provided by the *Hawaiian Islands Soil Metal Background Evaluation Report*, dated May 2012.

Table 3-2 Screening levels for Analytes of Concern – Soil Gas

Analyte	USEPA RSLs		HDOH Tier 1 EALs		Reporting Limit	Analyte	USEPA RSLs		HDOH Tier 1 EALs		Reporting Limit
	Resident	Industrial	Residential	Commercial/Industrial			Resident	Industrial	Residential	Commercial/Industrial	
Total Petroleum Hydrocarbons (TPHs) – USEPA Method TO 17											
Gasoline Range Organics (C6-C12)	31	130	590,000	4,900,000	470	Diesel Range (C10-C21)	3.1	13	260,000	2,200,000	500 ng/sample
Volatile Organic Compounds (VOCs) – USEPA Method TO 15											
Acetone	32,000	140,000	13,000,000	1.1E+08	4.8	Benzene	0.36*	1.6	720	6,300	1.6
c-1,2-Dichloroethene	-----	-----	3,300	28,000	2.0	Carbon disulfide	730	3,100	-----	-----	6.2
Carbon tetrachloride	0.47*	2*	940	8,200	3.1	Chlorobenzene	52	220	21,000	180,000	2.3
Dibromochloromethane	-----	-----	270	2,300	4.3	Chloroethane	-----	-----	4,200,000	35,000,000	1.3
Chloroform	0.12	0.53	240	2,100	2.4	Chloromethane	94	390	38,000	320,000	1.0
Ethylbenzene	1.1*	4.9	22,000	200,000	2.2	Dichlorodifluoromethane	100	440	-----	-----	2.5
c-1,3-Dichloropropene	0.7*	3.1	-----	-----	2.3	Benzyl Chloride	0.057*	0.25*	-----	-----	7.8
1,1-Difluoroethane	42,000	180,000	-----	-----	5.4	1,1-Dichloroethane	1.8*	7.7	3,500	31,000	2.0
1,2-Dichlorobenzene	210	880	83,000	700,000	3.0	1,1-Dichloroethene	210	880	83,000	700,000	2.0
1,2-Dichloroethane	0.11*	0.47*	220	1,900	2.0	1,2-Dichloropropane	0.76*	3.3	560	4,900	2.3
1,3,5-Trimethylbenzene	63	260	-----	-----	2.5	1,3-Dichlorobenzene	-----	-----	50,000	420,000	3.0
1,4-Dichlorobenzene	0.26*	1.1*	510	4,500	3.0	Trichloroethene	0.48*	3.0	830	7.000	2.7
2-Hexanone	31	130	-----	-----	6.1	t-1,2-Dichloroethene	-----	-----	33,000	280,000	2.0
1,1,2,2-Tetrachloroethane	0.048*	0.21*	97	850	6.9	Bromodichloromethane	0.076*	0.33*	150	1,300	3.4
Bromoform	2.6*	11	5,100	45,000	5.2	Bromomethane	5.2	22	2,100	18,000	1.9
1,1,1-Trichloroethane	5,200	22,000	2,100,000	18,000,000	2.7	1,1,2-Trichloroethane	0.18*	0.77*	83	700	2.7
1,2-Dibromoethane	0.0047*	0.02*	9.4	82	3.8	Methyl-t-Butyl-Ether (MTBE)	11	47	22,000	190,000	7.2
1,2,4-Trimethylbenzene	63	260	-----	-----	7.4	Hexachloro-1,3-Butadiene	0.13*	0.56*	-----	-----	16
Isopropanol	210	880	-----	-----	12	Methylene Chloride	100	1,200	200,000	2,100,000	17
Styrene	1,000	4,400	420,000	3,500,000	6..4	p/m-Xylene	100	440	-----	-----	8.7
Xylenes	100	440	42,000	350,000	2.2	o-Xylene	100	440	-----	-----	2.2
Tetrachloroethene	11	47	920	8,000	3.4	Toluene	5,200	22,000	2,100,000	18,000,000	1.9
Vinyl Acetate	210	880	-----	-----	7.0	Vinyl Chloride	0.17*	2.8	340	11,000	1.3

Values in µg/m^3.

ng = nanograms

USEPA Regional Screening Levels for Residential and Industrial Air (May 2018) and HDOH Tier 1 EALs Shallow Soil Vapor Intrusion Hazards (fall 2017).

3.3 MEASUREMENT QUALITY OBJECTIVES

Measurement Quality Objectives are criteria established to assess the viability and usability of data. These are based on both field and laboratory protocols that examine whether the data quality indicators (DQIs) meet criteria established for the project. DQI goals for this project were developed following guidelines in *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 Final (USEPA, 2002).

All sampling will be guided by procedures detailed in Section 6.3 and 6.4 and standard operating procedures (SOP) to ensure representativeness of sample results. Table 3-3 and Appendix A document the DQIs for this project. As presented in Table 3-3 and Appendix A, the laboratory has reviewed the DQIs for the project, and the laboratory's QA/QC criteria have been reviewed and will meet the project requirements for both USEPA and HDOH MI sampling and analysis. The laboratory selected for this project has extensive experience with HDOH MI sampling procedures and analysis, including subsample and grain size requirements (HDOH, 2011). The laboratory's reporting limits were determined to be appropriate for this project.

Table 3-3 Data Quality Indicators

Method Number (Method Name)	Matrix	Screening level	Reporting Limit	Accuracy (% Recovery MS/MSD)	Precision (RPD for MS/MSD and dups)	Percent Complete
USEPA 8015B TPH	Soil	See Table 3-1	See Table 3-1	62 – 166%	≤ 30%	90 – 100%
USEPA 8260B VOCs	Soil	See Table 3-1	See Table 3-1	20 – 160%	≤ 30%	90 – 100%
USEPA 8270C SVOCs	Soil	See Table 3-1	See Table 3-1	20 – 165%	≤ 60%	90 – 100%
USEPA 6010B Metals	Soil	See Table 3-1	See Table 3-1	75 – 125%	≤ 20%	90 – 100%
USEPA TO-15 VOCs	Air	See Table 3-2	See Table 3-2	50 – 150%	≤ 30%	90 – 100%
USEPA TO-17 TPH	Air	See Table 3-2	See Table 3-2	50 – 150%	≤ 25%	90 – 100%
USEPA Method SW-846 3050B/700B Lead	Paint	1%	1%	80 – 120%	≤ 20% for MS/MSD and 50% for Field Duplicates	90 –100%
EPA 600/R93/116 Asbestos	Bulk	5,000 ppm	100 ppm	N/A	N/A	N/A

MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference
USEPA = U.S. Environmental Protection Agency
N/A = not applicable
SVOCs = Semivolatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
ppm = parts per million

3.4 DATA REVIEW AND VALIDATION

Due to the investigative nature of this project, the data will not undergo data validation by a third party. Data will undergo a Tier 1 review by a WESTON chemist. The data validation package shall include all original documentation generated in support of this project. In addition, the laboratory will provide original documentation to support that all requirements of the methods have been met. This includes, but is not limited to, sample tags, custody records, shipping information, sample preparation/extraction records, and instrument printouts such as mass spectra. Copies of information and documentation required in this document are acceptable.

The Tier 1 data verification will include a review of the following:

- To meet requirements for categorization as definitive data, the following criteria will be evaluated:
  - Are all analyses requested on the chain-of-custody forms and any change orders present in the data package?
  - Does the data package include a copy of the chain-of-custody forms?
  - Has the laboratory placed any data qualifier flags on the analytical results? If so, is data quality affected?
  - Does the laboratory's case narrative identify problems, including an explanation of flagged data?
  - Does the data package include reports documenting recoveries for:
    - Method blanks?
    - Matrix spikes?
    - Matrix spike duplicates and/or sample duplicates?
    - A blank spike/laboratory control sample second source check sample?
    - Surrogates?
  - Based on any missing information and/or gross QC exceedances, should the laboratory perform additional analytical work on the samples before holding times have expired or the leftover sample is discarded?

Problems or questions about analytical data quality that may require corrective action will be brought to the attention to the laboratory in writing from the WESTON PM. The request may be initiated if QC results exceed method or project criteria, if reporting or flagging errors are identified, or to request information that has not been reported. The laboratory's response shall include a written explanation of the problem, a plan and a schedule for corrective action, and/or a re-issuance of laboratory reports or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, samples may be required to be reanalyzed, or recollected and reanalyzed at the discretion of WESTON and USEPA.

3.5 DATA MANAGEMENT

Samples will be collected and logged on a chain-of-custody form as discussed in Section 9.3. Samples will be kept secure in the custody of the sampler at all times, who will assure that all preservation requirements are followed. Samples will be transferred to the laboratory using a certified carrier in a properly custody-sealed container with chain-of-custody documentation. The laboratory should note any evidence of tampering upon receipt.

Procurement of analytical data from the laboratory shall include a request for an electronic data deliverable (EDD) and complete laboratory data report. Upon receipt, laboratory deliverables will be reviewed by WESTON personnel to ensure acceptable data have been provided by the laboratory. The completed laboratory data report will be submitted for validation. The data validation reports and laboratory data summary sheets will be included in the final report to be submitted to the USEPA TM. Before submittal, the final report will undergo a technical review to ensure that all data have been reported and discussed correctly.

3.6 ASSESSMENT OVERSIGHT

The following assessment activities will be performed by WESTON:

- All project deliverables (SAP, Data Summaries, Data Validation Reports, TBA Report) will be peer-reviewed prior to release to USEPA. In time-critical situations, the peer review may be concurrent with the release of a draft document. Errors discovered in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.
- The WESTON QA Officer will review project documentation (logbooks, chain-of-custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The QA Officer will document deficiencies, and the Field PM will be responsible for corrective actions. The QA Officer is also responsible for review and assessment of the data for data quality issues for the project.
- The WESTON PM is responsible for the review of data and for ensuring that the sampling design approach and total error determination meet the DQOs for this project.

USEPA assessment activities, which can include surveillance, management system reviews, readiness reviews, technical system audits, performance evaluation, and audits and assessments of data quality, have not been formally identified to WESTON by USEPA at the time of completion of the SAP.

It is standard procedure for the WESTON PM to report to the USEPA PM any issues, as they occur, that arise during the course of the project that could affect data quality, data-use objectives, the project objectives, or project schedules.

Assessment of data quality is an ongoing activity throughout all phases of a project. The following outlines the methods to be used by WESTON for evaluating the results obtained from the project:

- Review of the DQO outputs and the sampling design will be conducted by the WESTON QA Officer and USEPA prior to sampling activities. The reviewer will submit comments to the WESTON PM for action, comment, or clarification. This process will be iterative.
- A preliminary data review will be conducted by WESTON. The purpose of this review is to look for problems or anomalies in the implementation of the sample collection and analysis procedures and to examine QC data for information to verify assumptions underlying the DQOs and the SAP. Anomalies may include changes in the method detection limits as a

result of dilution, sampling, and/or matrix factors across the sample suite. Such anomalies will be reported in writing to the USEPA PM when they are confirmed.

- When appropriate to the sample design and if specifically tasked to do so by the USEPA PM, WESTON will examine the underlying assumptions of the statistical hypothesis test in light of the environmental data. This will be accomplished by determining the approach for verifying assumptions, performing tests for assumptions, and determining corrective actions.

4.0 SAMPLING DESIGN AND RATIONALE

The objective of this investigation is to evaluate the Site environmental concerns to facilitate redevelopment. WESTON has reviewed available Site information to determine historical uses and to identify contaminants of concern that may be present at the Site. WESTON used this information to determine the most effective sampling design to meet the project objectives within the schedule and budgetary constraints.

The following potential sources of contamination were identified at the Site:

- Former Railway Line – Historical usage of the property included a railway line along the western half of the property that led to the existing OR&L Building. Based on the contaminants typically associated with railway lines and the results of previous sampling events, there is a potential for metals and SVOC analytes in surface and subsurface soils.
- Former USTs – Historical usage of the property included four USTs (two 4,000-gallon USTs for gasoline and diesel; one 2,000-gallon UST of unknown contents; and one 500-gallon UST for fuel oil) located in the north-northeast portion of the property. Based on the contaminants typically associated with USTs and the results of previous sampling events, there is a potential for TPH, VOC, metals, and SVOC analytes in surface and subsurface soils.
- ACM and LBP – Redevelopment of the property may include the demolition of the OR&L Annex storage building on the Site. The building will be evaluated for ACM and LBP so that demolition materials are properly characterized for disposal purposes in accordance with state and federal disposal regulations.

Considering the historical use and planned development of the Site, a biased sampling approach based on past usage and previous investigations is the most appropriate sampling approach to assess potential contamination of Site. Sampling will be conducted in accordance with the *Technical Guidance Manual for the Implementation of the Hawaii State Contingency* Plan, dated November 12, 2009 (HDOH, 2009). Sample locations are shown in Figure 4-1. Some sample locations may be adjusted in the field based on additional visual observation.

4.1 SOIL SAMPLING

Soil sampling will be performed at the Site using MI sampling methodology. A total of three MI surface DUs and six MI subsurface soil DUs will be sampled. Table 4-1 summarizes proposed sample locations, analytical parameters, sample type, sample location (surface versus subsurface), and design rationale. Proposed sampling locations are presented in Figure 4-1.

The incremental soil sample locations will be identified using a Global Positioning System (GPS). Actual sample locations will be recorded using a GPS and entered into the field logbook as sampling is completed.

Table 4-1 Sample Design and Rationale – Soil

Sample ID	Depth (feet)	Analytical Parameters	Sample Type	Sample Location	Rationale
NKing-DU-01a	0 – 2	Metals, SVOCs	MI	Surface	Former Railway Line
NKing-DU-01b	2 – 4	Metals, SVOCs	MI	Subsurface	Former Railway Line
NKing-DU-01c	4 – 6	Metals, SVOCs	MI	Subsurface	Former Railway Line
NKing-DU-02a	0 – 2	TPH, VOCs, Metals, SVOCs	MI	Surface	Former Railway Line & UST Area
NKing-DU-02b	2 – 4	TPH, VOCs, Metals, SVOCs	MI	Subsurface	Former Railway Line & UST Area
NKing-DU-02c	2 – 6	TPH, VOCs, Metals, SVOCs	MI	Subsurface	Former Railway Line & UST Area
NKing-DU-03a	0 – 2	Metals, SVOCs	MI	Surface	Former Railway Line
NKing-DU-03b	2 – 4	Metals, SVOCs	MI	Subsurface	Former Railway Line
NKing-DU-03c	4 – 6	Metals, SVOCs	MI	Subsurface	Former Railway Line
NKing-DU-04a	0 – 2	TPH, VOCs, Metals, SVOCs	MI	Surface	Duplicate at Former Railway Line & UST Area
NKing-DU-05a	0 – 2	TPH, VOCs, Metals, SVOCs	MI	Surface	Triplicate at Former Railway Line & UST Area

DU = Decision Unit
MI = Multi Incremental
NKING = North King Street Site
UST = Underground Storage Tank
SVOCs = Semivolatile Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds

4.1.1 Multi-Incremental Soil Sampling

MI soil sampling will be conducted using DUs based on the potential sources of contamination identified in Section 4.0 and the scoping meeting held on September 22, 2014, with project stakeholders.

MI sampling includes the collection and analysis of three surface soil (0 to 2 ft bgs) and six subsurface soil (2 to 4 ft and 4 to 6 ft bgs) sample areas or DUs. A DU is a three-dimensional volume of soil (area plus specified depth), from which multi-increment samples are combined to form one single, representative sample. The Site was divided into nine DUs (three surface DUs and six subsurface DUs), ranging from 0.61 acre to 0.96 acre. This sample design was established to characterize potential contamination across and adjacent to the approximate 600-linear-ft former railway line and to characterize potential contamination from activities at the former gas station.

Each DU will be comprised of 20 increments of equal soil volume and combined into a complete incremental sample for submission to the laboratory. Due to budgetary restrictions, a discussion with the two regulatory bodies (USEPA and HDOH) resulted in the reduction of soil increments from 30 to 20 and the inclusion of a hazardous material building survey deemed a priority by the property owner. A TerraCore™ soil sampler, or equivalent, will be utilized to ensure that an equal amount of soil is collected from each increment sample location. The increment locations will be evenly spaced in all directions within the DU (HDOH, 2011) and are determined using a systematic random approach. Increment locations that cannot be collected based on Site conditions will be moved to the nearest safe location. Soil will be sampled from each increment location using Geoprobe® direct-push drilling technology. Drilling activities will be conducted by a WESTON-procured subcontractor. Given the number of borings needed to sample each DU and the onsite geology described from the SCS activities, soil will not be logged on boring logs unless notable conditions (i.e., staining or strong odors) are observed.

The former railway line will be investigated by collecting MI samples from nine DUs for metals and SVOCs analyses. Each DU soil sample will consist of at least 1 kilogram of soil. In order to obtain a representative MI soil sample, a 5-gram Terra Core sample of soil will be collected at 10 equally spaced locations per MI location per sample interval. This approach will meet the target soil volume of 1 kilogram and provide sufficient volume for metals and SVOCs analyses.

The former UST area will be investigated by collecting MI samples from three DUs for TPH, VOC, metals, and SVOC analyses. Collection of soil samples for metals and SVOCs will be equivalent to the sampling strategy for the former railway line. Each DU sample for GRO and VOC analyses will require the collection of 150 grams of soil preserved with 150 milliliters (mL) of methanol. To obtain a representative MI soil sample, 1.5 grams of soil from a Terra Core sampler will be collected at five equally spaced locations per MI location per sample interval. This approach will meet the target soil volume of 150 grams. Duplicate and triplicate soil samples will be collected from the surface soil of DU-2 to estimate sampling precision. A unique randomly selected starting location for duplicate and triplicate samples was generated with subsequent samples being equally spaced across the DU.

A figure depicting the DU locations is presented on Figure 4-1.

4.2 SOIL GAS SAMPLING

Soil gas samples will be collected from soil borings with temporary soil gas implants into SUMMA canisters and sorbent tubes and will be used to obtain definitive data with a low detection level requirement. A total of four soil gas samples (including one duplicate) will be collected from three soil boring locations and analyzed for VOCs/TPH-g using USEPA Method TO-15. The borings will be advanced using direct push methods. Soil gas samples will be collected from approximately 5 ft bgs to minimize the effects of changes in barometric pressure and temperature and breakthrough of ambient air from the surface. The sampling locations will be recorded using a GPS and entered into the field logbook as sampling is completed.

Additionally, a total of four soil gas samples (including one duplicate) will be collected from the three soil boring locations at a depth of 10 ft bgs or 2 ft above groundwater, if encountered shallower than 10 feet. The samples will be collected using sorbent tubes and analyzed for TPH-d using USEPA Method TO-17. Two sorbent tubes will be collected at each soil gas boring, capped, individually wrapped in uncoated aluminum foil if warranted, stored in an air-tight container, and maintained at 4 ^{o}C after sample collection until received at the laboratory.

Table 4-2 summarizes the proposed sampling locations, analytical parameters, and rationale for these soil gas sample locations. Proposed soil gas sampling locations are presented on Figure 4-1.

Table 4-2 Sample Design and Rationale – Soil Gas

Sample ID	Analytical Parameter	Rationale
NKing-SG-01	TPH-g, VOCs	Delineate UST - 1
NKing-SG-02	TPH-d	Delineate UST - 1
NKing-SG-03	TPH-g, VOCs	Delineate UST - 2
NKing-SG-04	TPH-d	Delineate UST - 2
NKing-SG-05	TPH-g, VOCs	Delineate UST - 3
NKing-SG-06	TPH-d	Delineate UST - 3
NKing-SG-07	TPH-g, VOCs	Duplicate Delineate UST - 3
NKing-SG-08	TPH-d	Duplicate Delineate UST - 3
NKing-SG-09	TPH-g, VOCs	Atmospheric Blank - TO-15
NKing-SG-10	TPH-d	Atmospheric Blank – TO-17
NKING = North King Street Site VOCs = Volatile Organic Compounds UST = Underground Storage Tank		TPH-g = Total Petroleum Hydrocarbons as gasoline TPH-d = Total Petroleum Hydrocarbons as diesel

4.3 HAZARDOUS MATERIAL BUILDING SURVEY

Based on the age of the OR&L Annex storage building a hazardous building material survey for ACM and LBP will be completed at the Site by WESTON. The survey will be conducted by a HDOH certified Asbestos Building Inspector and Lead Risk Assessor. A survey of this structure is necessary to document the presence and location of these hazardous materials. Samples collected will be analyzed for ACM using USEPA Method 600/R-93/116 for ACM and USEPA Method SW-846 3050B/700B for LBP. A work plan describing the methods and procedures for building assessment and sampling is attached in Appendix B.

N

Feet
0 30 60
1 inch = 60 feet

Legend

Soil Samples at:
0-2 ft. bgs, 2-4 ft. bgs, 4-6 ft. bgs

- ● normal
- ■ duplicate
- ▲ triplicate
- LBP/ACM survey
- soil gas sample

- Property Boundary
- Former UST Location
- Former Dispenser Island
- Proposed Decision Unit # 1 (0.63 acres)
- Proposed Decision Unit # 2 (0.96 acres)
- Proposed Decision Unit # 3 (0.80 acres)
- Existing Concrete Slab

Notes:
OR & L Oahu Railway & Line

Proposed Sampling Scheme

333 & 351 N. King Street

FIGURE **4-1**

WESTON SOLUTIONS
841 BISHOP STREET SUITE 2301 HONOLULU, HAWAII 96813 808.585.0448

DRAWN	DATE	CONTRACT NO.
LPAYNE	9/14/2018	X
CHKD BY: SCARRIER	CHCK DATE: 9/14/2018	WORK ORDER NUMBER: 20074.063.510.1007

O:\Alex\AROD\ProposedSamplingScheme20180530.mxd

Service Layer Credits: Google Earth

Projection: UTM Zone 4N. Datum: NAD83

5.0 REQUEST FOR ANALYSIS

5.1 ANALYSES NARRATIVE

Soil and soil gas samples will be analyzed for AOCs based on either the analytical narrative for the former railway line or the former UST areas. In total, nine MI samples (three surface and six subsurface) and three soil gas samples will be collected and analyzed. Soil samples will be collected and analyzed based on incremental sampling methodology. Each sample will be placed on ice immediately after collection and submitted to the laboratory for TPH analysis using USEPA Method 8015B for DRO and RRO, GRO and VOCs using USEPA Method 8260B, metals using USEPA Method 6010B, and/or SVOCs using USEPA Method 8270C. A summary of the analyses narrative is as follows:

- Former Railway Line:
  - Three surface soil samples and six subsurface soil samples will be collected using MI sampling methodology and analyzed for SVOCs and metals; and
  - Two quality control surface soil samples (one duplicate and one triplicate) will be collected using MI sample methodology and analyzed for SVOCs and metals.
- Former UST Area:
  - One surface soil sample and two subsurface soil samples will be collected using incremental sampling methodology and analyzed for TPH, VOCs, SVOCs, and metals;
  - Two quality control surface soil samples (one duplicates and one triplicate) will be collected using MI sample methodology and analyzed for TPH, VOCs, SVOCs, and metals; and
  - Five soil gas samples (three normal, one duplicate, one atmospheric blank) will be collected and analyzed for TPH and VOCs.

A summary of laboratory analyses sample containers, preservatives, and holding times from soil and soil gas samples is provided in Table 5-1 for soil and in Table 5-2 for soil gas. Duplicate soil samples (10% of field samples) and laboratory QC samples (one in 20 field samples) are also presented in Table 5-1 and Table 5-2.

To provide QC for the analytical program, the following measures will be utilized:

- Additional sample volume will be collected for at least one sample per matrix per analytical method to be utilized for matrix spike/matrix spike duplicate (MS/MSD) analysis.
- A Contract Laboratory Program type data package will be required from the laboratory for all resultant data.

5.2 ANALYTICAL LABORATORY

MI soil samples will be processed and analyzed by TestAmerica in Honolulu, Hawaii. This laboratory is experienced in performing the MI sample processing and analysis protocols required by HDOH. Samples will be delivered daily to the local laboratory rather than being shipped, which will avoid shipping regulation complications due to the increased amount of methanol needed to preserve the MI samples for soil VOC analysis. Soil gas sample analysis using USEPA Method TO-15 for VOC and TPH-g detection, and USEPA Method TO-17 for TPH-d detection will be conducted by Eurofins CalScience, Inc., located in Garden Grove, California. It is required that all samples be analyzed in accordance with the methods listed in Table 5-1 and Table 5-2.

Table 5-1 Soil Sample Request for Analysis

Method Number and Analysis			8015B DRO/RRO	8260B GRO/VOCs	6010B Metals	8270C SVOCs
Preservatives			Chill to 4°C	Chill to 4°C	Chill to 4°C	Chill to 4°C
Analytical Holding Times			14 days Extraction 40 days Analyze	14 days Extraction 40 days Analyze	180 days	14 days Extraction 40 days Analyze
Sample Volume / Container			1-gallon size plastic ziplock bag	1-Liter Amber with 150 mL Methanol	1-gallon size plastic ziplock bag	1-gallon size plastic ziplock bag
Sample Type			Incremental			
Sample ID	Depth (feet bgs)	Special Designation	DRO/RRO	GRO/VOCs	Metals	SVOCs
NKing-DU-01a	0 – 2	Surface	--	--	X	X
NKing-DU-01b	2 – 4	Subsurface	--	--	X	X
NKing-DU-01c	4 – 6	Subsurface	--	--	X	X
NKing-DU-02a	0 – 2	Surface	X[1]	X[1]	X[1]	X[1]
NKing-DU-02b	2 – 4	Subsurface	X	X	X	X
NKing-DU-02c	4 – 6	Subsurface	X	X	X	X
NKing-DU-03a	0 – 2	Surface	--	--	X	X
NKing-DU-03b	2 – 4	Subsurface	--	--	X	X
NKing-DU-03c	4 – 6	Subsurface	--	--	X	X
NKing-DU-04a	0 – 2	Surface	X	X	X	X
NKing-DU-05a	0 – 2	Surface	X	X	X	X
Number of Field Samples			3	3	9	9
Number of Field Duplicates			1	1	1	1
Number of Field Triplicates			1	1	1	1
Number of MS / MSD			1	1	1	1
Equipment Blank (aqueous)			1	1	1	1
Total Number of Samples			8	8	14	14

°C = Degrees Celsius
DRO = Diesel Range Organics
DU = Decision Unit
GRO = Gasoline Range Organics
NKING = North King Street Site
mL = milliliters
1 = Laboratory QC Sample

Table 5-2 Soil Gas Sample Request for Analysis

Method Number and Analysis	TO-15 TPH-g/VOCs	TO-17 TPH-d
Preservatives	**None**	**Chill to 4°C**
Analytical Holding Times	**30 days**	**30 days**
Sample Volume / Container	**1 x 400 mL SUMMA Canister**	**2 Sorbent Tubes**
Sample Collection Depth	**5 ft bgs**	**10 ft bgs**
Sample ID	**TPH-g/VOCs**	**TPH-d**
NKing-SG-01	X	--
NKing-SG-02	--	X
NKing-SG-03	X	--
NKing-SG-04	--	X
NKing-SG-05	X	--
NKing-SG-06	--	X
NKing-SG-07	X	--
NKing-SG-08	--	X
NKing-SG-09	X	--
NKing-SG-10	--	X
Number of Field Samples	3	3
Number of Field Duplicates	1	1
Method Blank	1	1
Total Number of Samples	5	5

°C = Degrees Celsius
mL = milliliter
ft bgs = feet below ground surface
TPH-g =Total Petroleum Hydrocarbons as gasoline
TPH-d = Total Petroleum Hydrocarbons as diesel
VOCs = Volatile Organic Compounds
NKING = North King Street Site

6.0 METHODS AND PROCEDURES

6.1 FIELD EQUIPMENT

6.1.1 List of Equipment Needed

The following table details the equipment to be used to obtain environmental samples.

Equipment	Fabrication	Dedicated
Geoprobe Soil Sampler	Steel, Acetate Liner	No, Yes
5-gram Terra Core Sampler	Plastic	Yes
Soil Scoops	Plastic	Yes
Gloves	Nitrile	Yes
Expendable Soil Vapor Implants	Stainless Steel	Yes
Tubing	Silicone, Plastic	Yes
SUMMA Canisters (TO-15)	Stainless Steel	Yes
Sorbent Tubes (TO-17)	Stainless Steel	Yes
Soil Sample Containers	Glass/Plastic	Yes
Equipment Blank Containers	250-milliliter polyethylene	Yes
GPS Unit	Plastic Cover	No
Photoionization Detector	Plastic Cover	No
5-Gas Meter	Plastic Cover	No
Calibration Gas	Stainless Steel	No
Helium Meter	Plastic Cover	No
Helium Gas	Stainless Steel	No
Helium Shroud	Plastic	No
Sampling Syringes (Soil Gas)	Plastic	Yes
Soil Gas Purge Syringe	Plastic	Yes
Tedlar Bag	Tedlar	Yes

The planned equipment will be operated in accordance with USEPA Environmental Response Team SOP #2050 GeoProbe^{TM} Operation, SOP #2012 Soil Sampling, SOP #2042 Soil Gas Sampling, and SOP #2006 Sampling Equipment and Decontamination. Copies of these SOPs are presented in Appendix C.

6.1.2 Calibration of Field Equipment

Soil sample field screening will include screening for VOCs with a photoionization detector (PID) only when VOCs are AOCs. Calibration requires the use of isobutylene calibration gas. All calibration records will be documented in the Site logbook.

6.1.3 Inspections/Acceptance Requirements for Supplies and Consumables

There are no project-specific inspection/acceptance criteria for supplies and consumables. It is stated in the SOP that personnel will not use broken or defective materials, items will not be used past their expiration date, supplies and consumables will be checked against order and packing slips to verify the correct items were received, and the supplier will be notified of any missing or damaged items.

6.2 FIELD SCREENING

Field screening of soil samples will be conducted with a calibrated PID only where VOCs are an analytes of concern (AOCs).

6.3 SOIL SAMPLING

6.3.1 Surface Soil Sampling

Surface soil samples will be collected based on available historical documentation and are shown in Figure 4-1. Soil sample locations will be recorded in the field logbook as sampling is completed. Sampling locations will be documented using a Trimble GeoXH 6000 Series GPS unit with sub-meter accuracy. Surface soil samples will be collected using MI sample techniques at each DU.

DU surface soil samples will be collected from 0 to 2 ft bgs. Soil samples will be collected using a direct-push technology drill rig and 2-inch diameter by 5-ft-long steel soil sampler equipped with an acetate liner. The soil core will be examined for visual signs of potential impact (e.g., staining or strong odors) and then screened with a PID (only where VOCs are AOCs). The soil sampler will be advanced to ensure adequate sample recovery and to collect intended subsurface samples. The soil samples will be collected at equal intervals using a TerraCore™ soil sampler, or equivalent, to obtain sufficient soil at each incremental sample location. Soil will be transferred from the soil sampling device to the appropriate sample containers for the requested analyses. DU surface soil samples will not be homogenized in the field; rather laboratory processing will prepare the soil for analyses. See Sections 7.1 and 7.3 for preservation and shipping procedures, respectively.

6.3.2 Subsurface Soil Sampling

Subsurface soil samples will be collected based on the available historical documentation and are shown in Figure 4-1. Soil sample locations will be recorded in the field logbook as sampling is completed. Sampling locations will be documented using a Trimble GeoXH 6000 Series GPS unit with sub-meter accuracy. Subsurface soil DU samples will be collected using MI sample techniques in accordance with DU sampling methodology.

Subsurface DU soil samples will be collected from 2 to 4 ft bgs and 4 to 6 ft bgs using a direct-push technology drill rig and 2-inch diameter by 5-ft-long steel soil sampler equipped with an acetate liner. The soil core will be examined for visual signs of potential impact (e.g., staining or strong odors) and then screened with a PID (only where VOCs are AOCs). The soil sample will be collected at equal intervals using a TerraCore™ soil sampler, or equivalent, to obtain sufficient soil at each incremental sample location. Soil will be transferred from the soil sampling device to the appropriate sample containers for the requested analyses. DU soil samples will not be homogenized in the field; rather laboratory processing will prepare the soil for analyses. See Sections 7.1 and 7.3 for preservation and shipping procedures, respectively.

6.4 SOIL GAS SAMPLING

Soil gas samples will be collected based on the locations of former USTs and are shown in Figure 4-1. Sampling locations will be documented using a Trimble GeoXH 6000 Series GPS unit with sub-meter accuracy and will be recorded in the field book as sampling is completed. See Sections 7.2 and 7.3 for preservation and shipping procedures, respectively.

6.4.1 VOC/TPH-g Analysis Using USEPA Method TO-15

Soil gas samples will be collected from temporary soil gas implants installed using direct-push technology. A 2-inch diameter boring will be drilled to 5 ft bgs, and a new 6-inch-long stainless-steel mesh screen implant connected to polyethylene tubing will be inserted to the bottom of the boring. A sand pack will be placed around the implant by backfilling the open boring with clean sand to 1 ft bgs. Bentonite will be used to backfill the boring to ground surface, and the boring will be hydrated with distilled water. The soil gas implant will be left undisturbed for a minimum of 24 hours prior to sampling.

To determine whether atmospheric air is introduced into the soil gas sample, a shut-in test and helium leak check will be performed prior to sample collection. The shut-in test will be used to determine whether the sample train holds a vacuum and is leak free. If leaks are found, the sampling train will be disconnected and reassembled ensuring all fittings and ferrules are tight. The sample train will then be retested. If the sampling train fails the shut-in test a second time, the soil gas implant will be evaluated for leaks, further sealed, and then left undisturbed for an additional 24 hours. The shut-in test will then be repeated the following day. If the shut-in test fails the following day, it may be necessary to remove the soil gas implant and re-install it in a nearby location.

Upon passing the shut-in test, a helium leak check will be performed. A helium detector will be exposed to atmospheric air at the Site and "zeroed out." A helium leak check enclosure attached to a helium source will be placed over the soil gas implant. The soil gas implant will be encapsulated allowing helium to build up within the enclosure in excess of 20%. A minimum of three tubing volumes of air will be purged from the system with a vacuum pump and collected. The collected purged air will be evaluated in the field with the calibrated helium detector to determine whether the soil gas sample has the potential to be contaminated by atmospheric air. Prior to soil gas sample collection, helium in excess of 20% will be added to the leak check enclosure.

A 400-mL stainless steel vacuum SUMMA canister, provided by the laboratory, will be connected to the implant tubing with a vacuum gauge and allowed to fill. The SUMMA canisters will be certified as clean by the laboratory prior to use. The vacuum gauge measurements will be recorded prior to sampling and after filling, leaving a small amount of vacuum in the SUMMA. The implant will be removed from the boring upon completion of the project. The laboratory will be instructed to test for helium using method ASTM-1945D to further evaluate the possibility of atmospheric intrusion. An atmospheric field blank will also be collected for QC purposes.

6.4.2 TPH-d Analysis Using USEPA Method TO-17

Soil gas samples will be collected from temporary sorbent tubes from sample locations collocated with the soil gas sampling conducted using USEPA Method TO-15. A 2-inch diameter boring will be drilled to 10 ft bgs, and a new 6-inch-long stainless-steel mesh screen implant connected to polyethylene tubing will be inserted to the bottom of the boring. A sand pack will be placed around the implant by backfilling the open boring with clean sand to 1 ft bgs. Bentonite will be used to backfill the boring to ground surface and the boring will be hydrated with distilled water. The soil gas implant will be left undisturbed for a minimum of 24 hours prior to sampling. Prior to sampling, one end of the sorbent tube will be connected to the implant tubing using a Swagelok® nut and ferrule with the other end connected to a syringe equipped with a plunger and 3-way valve. A leak check procedure will be performed prior to collection of the soil gas sample. The leak check will be performed by turning the valve to the off position and pulling the plunger on the syringe. If the plunger does not move or immediately returns to the starting position, then the system is leak-tight and is ready for sampling.

Once a successful leak test has been performed, soil gas will be collected by opening the valve and drawing air from the implant into the sorbent tube by pulling the plunger of the syringe. The volume of air drawn through the sorbent tube will be recorded in the field logbook. Two sorbent tubes containing samples will be collected per implant, capped with polytetrafluoroethylene caps, individually wrapped in uncoated aluminum foil and stored in an air-tight container until received by the laboratory.

6.5 SOIL BORING ABANDONMENT

Soil borings will be pressure grouted using neat cement, concrete, sand-cement slurry, or cement-bentonite mixture as recommended by HDOH for environmental investigations conducted in Hawaii requiring drilling for subsurface soil and soil gas sample collection (HDOH, 2009).

6.6 DECONTAMINATION PROCEDURES

All soil samples will be collected using a direct push steel soil sampler equipped with an acetate liner attached to the sampler's cutting shoe. The cutting shoe is the only non-dedicated sampling equipment that will come into contact with the soil sample. A decontaminated cutting shoe will be used at each boring location. Decontamination of sampling equipment must be conducted consistently to assure the quality of samples collected. Dedicated equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of non-dedicated equipment. All non-dedicated sampling devices (steel cutting shoe) used will be decontaminated according to USEPA Region 9 recommended procedures.

The following, to be carried out in sequence, is an USEPA Region 9 recommended procedure for the decontamination of sampling equipment:

1. Non phosphate detergent and tap water wash, using a brush if necessary;
2. Tap water rinse;
3. 10% nitric acid rinse;
4. Deionized/distilled water rinse;
5. Solvent (reagent grade hexane) rinse in a decontamination bucket; and
6. Distilled water rinse (twice).

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

6.7 BUILDING MATERIAL SAMPLING

A hazardous building material survey of the OR&L Annex storage building will be conducted to assess the presence of LBM and ACM. The survey will be conducted by a HDOH certified Asbestos Building Inspector and Lead Risk Assessor. A work plan describing the methods and procedures for building assessment and sampling is attached in Appendix B.

6.8 CULTURAL RESOURCE DISCOVERIES

This TBA is not anticipated to impact any known cultural resources, but the disturbance of Site soils carries the potential of unanticipated discovery. Cultural Resources can be defined as physical evidence of historical human activity. Unanticipated discoveries of cultural resources during an environmental assessment can include, but are not limited to, the following:

- Undocumented structural and engineering features or undocumented archaeological resources, such as foundation remains, burials, artifacts, or other evidence of human occupation or activity;
- Undocumented human remains; and
- Undocumented Native American grave sites, including human remains, funerary objects, sacred objects, or objects of cultural patrimony.

If any unanticipated cultural resource concerns are encountered during the assessment, WESTON will follow the steps presented in Appendix D before continuing any sampling activities.

7.0 SAMPLE CONTAINERS, PRESERVATION, PACKING, AND SHIPMENT

The number and type of sample containers, volumes, and preservatives are listed in Table 5-1. The containers are pre-cleaned and will not be rinsed prior to sample collection. Laboratory containers will come with sufficient preservative volume, if required, prior to collection in the field. Soil and soil gas samples will remain in WESTON possession until they are shipped to the laboratory.

7.1 SOIL SAMPLES

DU soil samples for all analyses (TPH, VOCs, metals, and SVOCs) will not be homogenized in the field during collection. The samples will be placed into a cooler with ice and chilled to 4 degrees Celsius (ºC) immediately following collection. Sample containers will be laboratory-provided except for the 1-gallon plastic ziplock bags used for the collection of DU samples for metals and SVOCs.

7.2 SOIL GAS SAMPLES

Soil gas samples will be collected in the laboratory-provided sample containers and placed into a cooler with ice chilled to 4ºC immediately following collection if necessary.

7.3 PACKAGING AND SHIPPING

Samples will be stored on ice in a secure location pending shipment to the contract laboratory. Sample coolers will be retained in the custody of Site personnel at all times or secured so as to deny access to anyone else. The procedures for shipping samples are as follows:

- Ice will be packed in double ziplock plastic bags;
- The drain plug of the cooler will be taped shut to prevent leakage;
- The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment;
- Screw caps will be checked for tightness;
- Containers will have custody seals affixed to prevent opening of the container without breaking the seal;
- All glass sample containers will be wrapped in bubble wrap or placed back into their shipping boxes; and
- All containers will be sealed in ziplock plastic bags.

All samples will be placed in coolers with the appropriate chain-of-custody forms. All forms will be enclosed in plastic bags and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Each ice chest will be securely taped shut with strapping tape, and custody seals will be affixed to the front, right, and back of each cooler.

8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples at this Site, several different types of potentially contaminated investigation-derived wastes (IDW) will be generated, including the following:

- Soil cuttings from Geoprobe® drilling activities;
- Used personal protective equipment (PPE);
- Disposable sampling equipment; and
- Decontamination fluids.

The USEPA's National Contingency Plan requires that management of IDW generated during site investigations comply with all relevant or appropriate requirements to the extent practicable. This sampling plan will follow the Office of Emergency and Remedial Response (OERR) Directive 9345.3-02 (USEPA, 2009), which provides guidance for management of IDW during site investigations. Listed below are the procedures that will be followed for handling IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered. The procedures are flexible enough to allow the site investigation team to use its professional judgment on the proper method for the disposal of each type of IDW generated at each sampling location.

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any used PPE and disposable equipment that could still be reused will be rendered inoperable before disposal in the refuse dumpster.
- Decontamination fluids that will be generated in the sampling event will consist of deionized or distilled water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the Site or sampling area. The water (and water with detergent) will be left to evaporate onsite.

9.0 SAMPLE IDENTIFICATION, DOCUMENTATION, AND SHIPMENT

9.1 FIELD NOTES

9.1.1 Field Logbook

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. The logbook is bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample.

- Sampler's name(s);
- Site or sampling area sketch showing sample location;
- Sample location and description;
- Date and time of sample collection;
- Type of sample (e.g., surface soil, subsurface soil, and soil gas);
- Type of sampling equipment used;
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.);
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers;
- Shipping arrangements (overnight air bill number); and
- Name(s) of recipient laboratory (ies).

In addition to sampling information, the following specifics may also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities;
- Time of arrival onsite and time of departure;
- Other personnel onsite;
- Summary of any meetings or discussions with any potentially responsible parties, or representatives of any federal, state, or other regulatory agency;
- Deviations from sampling plans or site safety plan procedures;
- Changes in personnel and responsibilities, as well as reasons for the change; and
- Levels of safety protection.

9.1.2 Photographs

Photographs will be taken at representative sampling locations and at other areas of interest on Site. Photographs will verify information entered in the field logbook. When a photograph is taken, the following information will be written in the logbook or will be recorded in a separate field photography log:

- Date and location;
- Description of the subject photographed; and
- Name of person taking the photograph.

9.2 SAMPLE LABELING

A unique, identifiable name will be assigned to each sample. The prefix “NKing” (North King Street) will be applied to each sample location. The identifier “DU” will be used to indicate a decision unit soil sample. A unique number will be assigned to each sample location based upon sequential numbering. For example, a sample label will be “NKing-DU-01a (0-2)", indicating that the soil sample was collected at DU location No. 1 from 0 feet to 2 ft bgs. Since multiple soil samples will be collected at different intervals at each DU, MI DU identifiers will be labelled with an a, b, and c after the DU number to designate the sampling interval corresponding to the 0 to 2 ft, 2 to 4 ft, and 4 to 6 ft bgs sample depths, respectively. Duplicate and triplicate samples will be assigned alternative names similar to normal samples collected during DU MI collection. See Section 4 and Table 4-1 for specific nomenclature and location assignments.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Sample labels will be affixed to the sample containers and secured with clear tape. The sample labels will contain the following information where appropriate:

- Sample number;
- Consultant name (WESTON);
- Date and time of collection; and
- Analytical parameter and method of preservation.

9.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

All sample shipments for analyses will be accompanied by a chain-of-custody record. Chain of custody record form(s) will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone’s physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of WESTON. The sampling team leader or designee will sign the chain-of-custody form in the "relinquished by" box and note the date, time, and air bill number.

Every transfer of custody must be noted and signed; a copy of this record is kept by each individual who has signed. Corrections on sample paperwork will be made by drawing a single line through the mistake and initialing and dating the change. The correct information will be entered above, below, or after the mistake. When samples are not under the direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. The chain-of-custody must include the following:

- Sample identification numbers;
- Sample date;
- Number and volume of sample containers;
- Required analyses;
- Signature and name of samplers;
- Signature(s) of any individual(s) with control over samples;
- Air bill number if shipped; and
- Note(s) indicating special holding times and/or detection limits.

A self-adhesive custody seal will be placed across the lid of each sample. The shipping containers in which samples are stored (usually a sturdy ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

10.0 QUALITY ASSURANCE AND CONTROL

10.1 FIELD QUALITY CONTROL SAMPLES

The QA/QC samples described in the following subsections, which are also listed in Table 5-1, will be collected during this investigation.

10.1.1 Assessment of Field Contaminants (Blanks)

10.1.1.1 Equipment Blanks

An equipment rinsate blank will be collected from non-dedicated sampling equipment (soil sampler cutting shoe) by pouring UltraPure Blank Water DI+™ water over the piece of non-dedicated equipment into a sample bottle. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. The equipment blank will be analyzed according to Table 5-1.

The equipment blanks will be preserved, packaged, and sealed in the manner described for the samples in Section 6.3 and Table 5-1. A separate sample number will be assigned to each sample and it will be submitted blind to the laboratory.

If any compound is detected in equipment blank, then sample data will be considered acceptable without qualification only if the results are above five times the amount detected in the blank(s) for each respective analyte. If the analyte detected in the blank is a common laboratory contaminant, then the sample results for those analytes would be qualified unless the results are above 10 times the amount detected in the blank(s). For sample results that are below five times (10 times for common laboratory contaminants) the amount detected in the blanks, additional evaluation will be required during data validation.

10.1.1.2 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory, a 40-mL vial of deionized water will be included that is marked “temperature blank.” This blank will be used by the sample custodian at the laboratory to check the temperature of samples upon receipt.

10.1.2 Assessment of Sample Variability (Field Replicates)

Replicate soil and soil gas samples (i.e., duplicates and/or triplicates) will be collected at the sample locations determined in the field. For QA/QC purposes, MI sample collection requires that duplicate and triplicate soil samples be collected. For soil gas samples, only duplicates will be collected. Locations for replicate samples will be chosen based on the potential of the sample to contain AOCs. One in 10 samples for each matrix will be designated as a duplicate sample. DU samples will not be homogenized in the field, so replicates will be collected separately using a TerraCore™ sampling device in the same manner as the parent sample. All sample containers will be filled sequentially based on the following order (e.g., VOC, TPHs, SVOCs, and metals).

Duplicate samples will be preserved, packaged, and sealed in the same manner as the field samples. A separate sample number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

10.2 BACKGROUND SAMPLES

Background soil samples will not be collected during this TBA. The HDOH provides background soil data for Hawaii within the Tier 1 EAL Surfer data tables. Additionally, the *Hawaiian Islands Soil Metal Background Evaluation Report* (AECOM, 2012), prepared for HDOH, provides estimates of background concentrations for target metal elements in Hawaiian Island soils. As mentioned in Section 3.2, analyte concentrations will be compared to USEPA RSLs, HDOH Tier 1 EALs, and soil background data to evaluate the extent of contamination at the Site. An atmospheric blank will be collected and analyzed during the soil gas sampling event.

10.3 LABORATORY QUALITY CONTROL SAMPLES

A laboratory QC sample is not an extra sample; rather, it is a sample that requires additional QC analyses. A routinely collected soil sample (a full 8-oz sample jar or 1-kilogram incremental sample in a 1-gallon plastic ziplock bag) contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

At a minimum, one laboratory QC sample is required every 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

One soil sample, as indicated in Table 5-1, will be designated as a laboratory QC sample for each analytical method. Locations for the QC samples were chosen because they are suspected to contain detectable levels of AOCs, are representative of both the former railway line and UST areas, and include all analyses to be conducted. The sample labels and chain-of-custody records for these samples will identify them as a laboratory QC samples.

11.0 FIELD VARIANCES

Because conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

12.0 FIELD HEALTH AND SAFETY PROCEDURES

There are no special training or certification requirements specific to this project. Training requirements relevant to WESTON's health and safety program comply with 29 Code of Federal Regulations (CFR) 1910.120. The Site-Specific Health and Safety Plan is presented in Appendix E.

13.0 REFERENCES

AECOM Technical Services, Inc. (AECOM). 2012. *Hawaiian Islands Soil Metal Background Evaluation Report*. Prepared for the Hawaii Department of Health, Hazard Evaluation and Emergency Response. May 2012.

AMEC Earth and Environmental, Inc. (AMEC). 2004. *Iwilei Brownfields Site Characterization Study*, Honolulu, Hawaii. March 2004.

Giambelluca, T.W., M.A. Nullet, and T.A. Schroeder. 1986. *Rainfall Atlas of Hawaii Report R76: State of Hawaii Department of Land and Natural Resources, Division of Water and Land Development*. Honolulu, Hawaii.

Harding Lawson Associates (HLA). 1992a. *Phase I Environmental Site Assessment, Liliha Civic Center, Honolulu, Oahu, Hawaii*. February 26, 1991.

Hawaii Department of Health (HDOH). 2017. *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Volume 1: Users Guide, Hawaii Edition.* Tier 1 EAL Table B and Table C, Hawaii Department of Health, Office of Hazard Evaluation and Emergency Response, updated fall 2017.

HDOH. 2011. *Technical Guidance Manual Notes: Decision Units and Multi-increment Sample Investigations*. March 2011.

HDOH. 2009. *Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan*, Interim Final, 12 November 2009. http://www.hawaiidoh.org/tgm.aspx

HLA. 1992b. *Phase II Environmental Site Assessment, Activity VII: Subsurface Soils and Groundwater Investigation, Liliha Civic Center, Honolulu, Oahu, Hawaii.* July 10, 1992.

HLA. 1993. *Removal of Underground Storage Tanks (USTs) and Hydraulic Lift, 337 and 357 N. King St.* December 27, 1993.

Kimura International, Inc. (Kimura). 2001. *Limited Phase II Environmental Site Assessment Report, The HCDCH Component of the Iwilei Project Site*. May 9, 2001.

Kimura. 2002. *Underground Storage Tank Closure and Release Report, Iwilei Project Site 920 Iwilei Road, Honolulu, Oahu, Hawaii.*

Mink, J.F, L.S. Lau. 1990. *Aquifer Identification and Classification for O'ahu Groundwater Protection Strategy for Hawai'i. Second Edition, rev. 1990*. Water Resources Research Center, University of Hawaii-Manoa 22:1-11.

U.S. Department of Housing and Urban Development (HUD). 2010. *"Lead Speak" – A Brief Glossary*. https://www.hud.gov/sites/documents/20264_LEADSPEAK.PDF. Accessed on June 13, 2018.

United States Environmental Protection Agency (USEPA). 1993. *Data Quality Objective Process for Superfund (EPA 540/G-93/71).* August 1993.

USEPA. 2001. *Requirements for Quality Assurance Project Plans for Environmental Data Operations (QA/R-5)*, March 2001.

USEPA. 2002. *Guidance for Quality Assurance Project Pla*ns, *EPA QA/G-5.* December 2002.

USEPA. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA, QA/G-4)*. February 2006.

USEPA. 2009. *Principles for Greener Cleanups*. Office of Solid Waste and Emergency Response.. August 27, 2009.

USEPA. 2012. *Sampling and Analysis Plan Guidance and Template*, Version 3, Brownfields Assessment Project. EPAR9QA/008.1. April.

USEPA. 2018. Regional Screening Level Summary Table (TR=1E-06; HQ=1). May 2018.

APPENDIX A
DATA QUALITY OBJECTIVE WORKSHEET

Data Quality Objective Process Worksheet

1. **State the Problem:** Summarize the contamination problem that will require new environmental data, and identify the resources available to resolve the problem.

Project Team:

Lisa Hanusiak, United States Environmental Protection Agency (USEPA) IAPO
Eugenia E. McNaughton, Ph.D., USEPA QA Manager
Noemi Emeric-Ford, USEPA PM
Melody Calisay, HDOH HEER Brownfields PM
Shawn Carrier, Weston Solutions, Inc. PM
Anne Busher, Weston Solutions, Inc. QA Manager

Lisa Hanusiak of the USEPA is the primary decision maker of the scoping team.

SAP Modifications:

- Discrete soil sampling has been removed from the SAP as it will not provide any additional information beyond information collected during previous investigations.
- Groundwater sampling has been removed from the SAP as the Site is located adjacent to and up-gradient of the Hawaii State Underground Injection Control Line, which typically segregates potable from non-potable water. Based on the average specific conductivity measurements reported during the Site Characterization Study, the groundwater onsite is classified as brackish water. As a result, the groundwater beneath the Site is most likely unsuitable for drinking and would be classified as non-potable. Public drinking water wells are located hydraulically up-gradient and cross-gradient of the Site. The closest drinking water well is approximately 4,000 feet to the north-northwest of the Site and pumps water from the deeper, basal aquifer which is listed as having a low vulnerability to contamination.
- For soil sampling, horizontal decision units have been reduced from 4 to 3. Decision units 2 and 4 have been combined. Vertical decision units have been reduced from 4 to 3. Previously, samples were to be collected from 0-0.5 ft bgs, 0.5-2 ft bgs, 2-6 ft bgs, and 6-8 ft bgs. Presently samples will be collected from 0-2 ft bgs, 2-4 ft bgs and 4-6 ft bgs. In total, the number of decision units has been reduced from 16 to 9. The number of incremental samples per decision unit has been reduced from 30 to 20. The reason for the changes is two-fold. 1. The Site is largely paved, thus collection of samples at 0-0.5 ft bgs would prove challenging as this material likely consists predominately of road base. Previously the Site was under consideration for use as a homeless encampment. This is no longer the case and as a result this decision unit is no longer needed. 2. Due to budgetary constraints.
- Soil vapor implants will be installed and sampled at former locations of underground storage tanks per the request of HDOH HEER.
- Building material surveys have been reduced from 3 locations to a single location as two of the other structures to be surveyed have been previously demolished.

Problem:

The Site, a former railway line and automotive fueling and service station, comprises a 3.79 acre lot at the northwest corner of North King Street and Iwilei Road in Honolulu, Oahu, Hawaii. From 1889 to 1962, the western half of the Site was utilized as a railway line which leads to the former station depot, the Oahu Railway and Land (OR&L) Building. The OR&L Building is identified as a Hawaii historic building and will remain onsite. From the mid-1950s to the mid-1970s, the north eastern portion of the Site was utilized as an automotive fueling and service station, which included 4 underground storage tanks (USTs) ranging from 500 to 4,000-gallon capacity storage and contained gasoline, diesel, fuel oil, and unknown contents. The southeast portion of the Site continues to be used as offices and storage within the OR&L and Annex Storage Buildings. The Site is owned by the State of Hawaii Department of Accounting and General Services (DAGS). The State of Hawaii intends to redevelop the property for beneficial reuse. The purpose of the TBA is to evaluate whether the site is suitable for redevelopment and if contamination from historical use presents any limitations on redevelopment land use.

Previous investigations summarizing the environmental condition and history of the Site have identified areas of potential contamination including the former railway line with a catch basin and former automotive fueling service station with USTs and hydraulic lift. The most recent investigation, a Soil Characterization Study (SCS) conducted in 2003, during which subsurface soil and groundwater sampling was conducted revealed potential metal, SVOC, and TPH contamination. However, no data was collected for surface soil, which is most likely to be disturbed during redevelopment activities.

Activities associated with this TBA contribute to previous sampling results, examining environmental contaminants typically associated with railway lines and USTs. These contaminants include total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), metals, and semi-volatile organic compounds (SVOCs) from UST leakage or spillage; SVOCs and metals from railroad construction materials and usage; and asbestos containing materials (ACM) and lead-based paint (LBP) from roofing, sealants / coatings, and insulation products for structures constructed prior to the mid-1970's. One building, the OR&L Annex and storage building built in the 1950s, is proposed for demolition during redevelopment of the Site.

Available Resources:

WESTON personnel, a subcontracted driller, cultural resources monitor and a subcontracted laboratory will be utilized throughout the project. Preliminary data will be available two weeks after fieldwork.

2. Identify the Decision - Identify the decision that requires new environmental data to address the contamination problem.

Data will be used to assess whether contaminants are present in site soils, soil gas, and building materials at concentrations that would pose a danger to human health based on the planned site reuse.

Principal Study Questions:

a) Is soil contamination present at the site at levels that exceed appropriate action levels based on the intended reuse?

b) Is soil gas contamination exceeding appropriate action levels delineated and will contamination limit redevelopment?

c) Do buildings proposed for demolition contain ACM and/or LBP, will abatement measures be needed during demolition, and will special waste management and disposal be required?

Define the alternative actions that could result from the resolution of the principal study question:

a) Soil is not impacted based on intended land use. Redevelopment may begin, or additional characterization may be required.

b) Soil contaminant concentrations are above action levels protective of human health. Remedial actions may be required to make the site suitable for planned redevelopment activity, or the planned site redevelopment may be reconsidered.

c) Building materials do not contain ACM and/or LBP. No special considerations are needed during demolition.

d) Building materials contain ACM and/or LBP. Special abatement procedures will need to be implemented during demolition and waste management.

Decision Statement: If contamination is found in excess of action levels protective of human health, then options for further site characterization, remediation, or alternative uses of the site will be considered.

3. **Identify Inputs to the Decision:** Identify the information needed to support the decision, and specify which inputs require new environmental data.

Information Required to Resolve the Decision Statement: Definitive data from chemical analysis of samples are required. Based on a review of the available site history, the goal of the sampling will be to collect and analyze surface and shallow subsurface soil for possible site contaminants commonly associated with a railway line, automotive fueling and service station, and building materials used prior to the 1970s. These contaminants include TPHs (GRO, DRO, and RRO), VOCs, metals, and/or SVOCs, LBP, and ACM.

Source(s) for Information: The primary source of information will be the results of WESTON's sampling event. In addition, city, state, and county agencies may have information pertaining to the site.

Information Needed to Establish Action Levels: The State of Hawaii intends on redeveloping the property as a civic center; however, future plans will be dictated based on results of the TBA. The protection of future occupant's health and the environment are pertinent to this Site use. Action levels were determined in order to correspond with the likely use of the Site for industrial purposes; however, residential action levels will also be used for screening as they provide the most conservative value. Soil and soil gas sample results for TPH, VOCs, metals, and/or SVOCs will be compared to USEPA Region 9 Regional Screening Levels (RSLs) for residential and industrial use from November 2017. Where applicable, soil and soil gas TPH results will be compared to HDOH Tier 1 Environmental Action Levels (EALs) for a nondrinking water source and distance to the nearest surface water body is less than 150 meters. These action levels will serve as a screening tool to help determine whether further characterization at the Site is necessary.

Confirm that measurement methods exist to provide data:

Soils:	USEPA Method 8015B for TPHs USEPA Method 8260B for VOCs USEPA Method 6010 for Metals USEPA Method 8270C for SVOCs
Soil Gas :	USEPA Method TO-15 USEPA Method TO-17
Building Materials:	USEPA Method 600/R-93/116 for ACM USEPA Method SW-846 3050B/700B

4. **Define the Study Boundaries:** Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision.

Specific characteristics that define population being studied: Former railway line, UST areas, and building proposed for demolition.
Spatial boundary of decision statement: The boundaries of the areas of concern, totaling approximately 2.39 acres of the 3.79 acre Site, from the surface soils to 6 feet below ground surface, soil gas, and former OR&L Annex and storage buildings.

Temporal boundary of decision statement: The data will represent the conditions of contaminants at the time of sampling and into the foreseeable future.

When to collect samples: It is anticipated that field activities will begin in August 2018. The date of the field sampling event is contingent on the project scoping team's ability to review the SAP amendment and subcontractor availability.

Practical constraints on data collection: There are no known constraints on data collection.

5. **Develop a Decision Rule:** Develop logical "if...then" statements that define the conditions that would cause the decision maker to choose among alternative actions.

Statistical parameter that characterizes a population: Each analytical result, not statistical parameter, will be evaluated against the action levels.

Specify the action level(s) for the study: Action levels were determined in order to correspond with the likely use of the Site for industrial purposes; however, residential action levels will also be used for screening as they provide the most conservative value. Soil and soil gas sample results for TPH, VOCs, metals, and/or SVOCs will be compared to USEPA Region 9 RSLs for residential and industrial use from November 2017. Where applicable, soil and soil gas TPH results will be compared to HDOH Tier 1 Environmental Action Levels (EALs) for a nondrinking water source and distance to the nearest surface water body is less than 150 meters. These action levels will serve as a screening tool to help determine whether further characterization at the Site is necessary.

Decision Rules:

a) If concentrations of contaminants in soil and soil gas samples are above specified action levels, then additional characterization, remedial actions, or reconfiguration of future site uses may be required.

b) If concentrations of contaminants in building materials proposed for demolition, then abatement procedures will be implemented during demolition and waste management activities.

6. **Specify the Limits on Decision Errors:** Specify the decision maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.

Use of biased sampling points precludes statistical determination of limits on decision errors. Measurement error, rather than sampling error, is deemed to be the primary factor affecting any decision error. Validated, definitive data will be required to limit measurement error. Sampling error will be limited to the extent practicable by following approved USEPA methods and applicable SOPs. Sampling error and tolerable limits cannot be quantified.

7. **Optimize the Design for Obtaining Data:** Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy the DQOs.

The goals of the sampling event are to establish whether soil, soil gas, and building materials at the site are contaminated with hazardous materials. Samples will be collected at various locations throughout the site that have been identified as potential sources of contamination. All samples will be analyzed for TPH, VOCs, metals, and/or SVOCs.

APPENDIX B
HAZARDOUS BUILDING SAMPLING PLAN

HAZARDOUS MATERIALS – BUILDING SAMPLING PLAN
USEPA NORTH KING STREET TBA
HONOLULU, HAWAII

TWO STORY BUIDLING

ACM SAMPLING
9' x 9' Floor Tile and Mastic Plaster
Hollow Tile Brick Skim Coat Cove Base and Adhesive
Door and Window Caulking Drywall
Joint Compound
Mirror Mastic
Roofing System

LEAD ANALYSIS
Concrete – Beige, Brown, and White
Wood – Beige and Brown
Metal – Black, Gray, and Brown

APPENDIX C
STANDARD OPERATING PROCEDURES

U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOIL SAMPLING

CONTENTS

SUPERCEDES: SOP #2012; Revision 0.0; 11/16/94; U.S. EPA Contract 68-C4-0022.

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

5.0 EQUIPMENT

Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
  - Tubes
  - Points
  - Drive head
  - Drop hammer
  - Puller jack and grip
- Backhoe

6.0 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

7.2 Sample Collection

7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.

3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.

5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler, and unscrew the drill rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.

10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

    When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.

12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler in a perpendicular position on the sample material.

3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.

5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.

4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration

activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OHSA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.

APPENDIX A
Figures
SOP #2012
February 2000

FIGURE 1. Sampling Augers

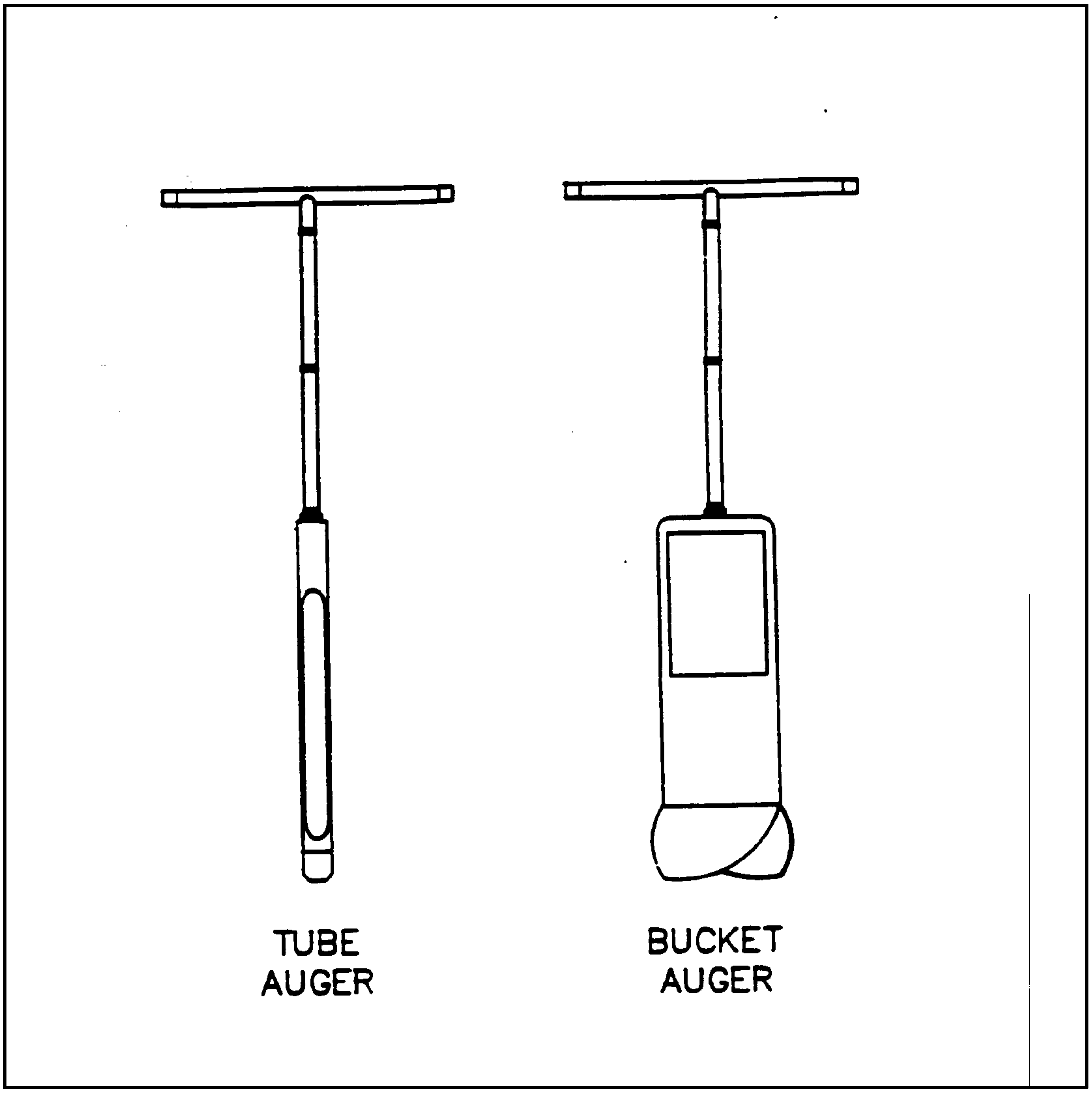
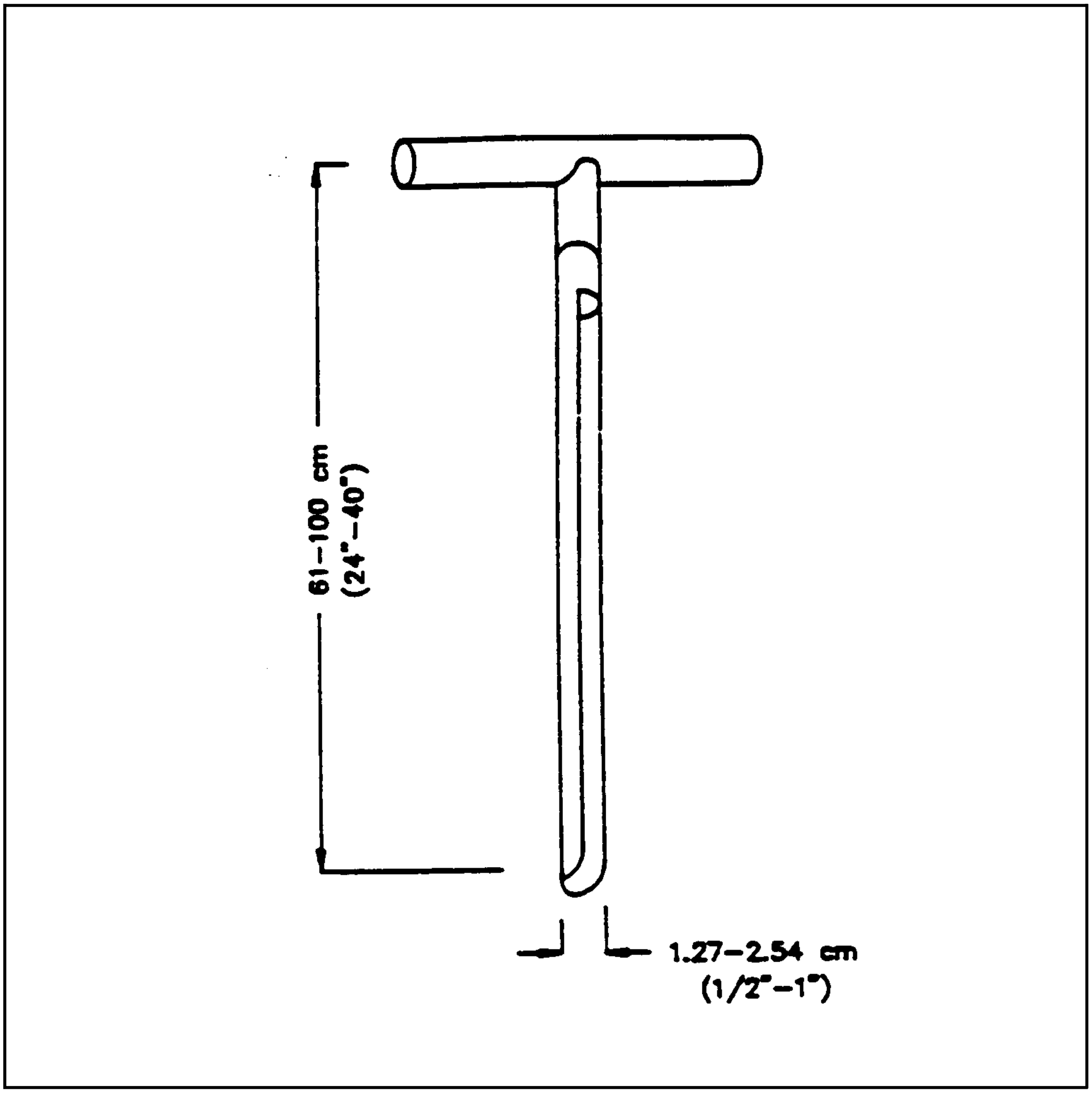


FIGURE 2. Sampling Trier



SOIL GAS SAMPLING

1.0 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of waste site evaluation. Using this method, underground contamination can be identified, and the source, extent, and movement of the pollutants can be traced.

This standard operating procedure (SOP) outlines the methods used by U.S. EPA/ERT in installing soil gas wells; measuring organic vapor levels in the soil gas using a Photoionization Detector (PID), Flame Ionization Detector (FID) and/or other air monitoring devices; and sampling the soil gas using Tedlar bags, Tenax sorbent tubes, and/or Summa canisters.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

A 3/8" diameter hole is driven into the ground to a depth of four to five feet using a commercially available slam bar. Soil gas can also be sampled at other depths by the use of a longer bar or bar attachments. A 1/4" O.D. stainless steel probe is inserted into the hole. The hole is then sealed around the top of the probe using modeling clay. The gas contained in the interstitial spaces of the soil is sampled by pulling the sample through the probe using an air sampling pump. The sample may be stored in Tedlar bags, drawn through sorbent cartridges, or analyzed directly using a direct reading instrument. The air sampling pump is not used for Summa canister sampling of soil gas. Sampling is achieved by soil gas equilibration with the evacuated Summa canister.

Other field air monitoring devices, such as the combustible gas indicator (MSA CGI/02 Meter, Model 260) and the Organic Vapor Analyzer (Foxboro OVA, Model 128), can also be used dependent on specific site conditions. Measurement of soil temperature using a temperature probe may also be desirable. Bagged samples are usually analyzed in a field laboratory using a portable Photovac GC.

Power driven sampling probes may be utilized when soil conditions make sampling by hand unfeasible (i.e., frozen ground, very dense clays, pavement, etc.). Commercially available soil gas sampling probes (hollow, 1/2 = O.D. steel probes) can be driven to the desired depth using a power hammer (e.g., Bosch Demolition Hammer or Geoprobe™). Samples can be drawn through the probe itself, or through Teflon tubing inserted through the probe and attached to the probe point. Samples are collected and analyzed as described above.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

3.1 Tedlar Bags

Soil gas samples are generally contained in 1.0-L Tedlar bags. Bagged samples are best stored in dark plastic bags placed in coolers to protect the bags from any damage that may occur in the field or in transit. In addition, coolers insure the integrity of the samples by keeping them at a cool temperature and out of direct sunlight. Samples should be analyzed as soon as possible, preferably within 24 - 48 hours.

3.2 Tenax Tubes

Bagged samples can also be drawn onto Tenax or other sorbent tubes to undergo lab GC/MS analysis. If Tenax tubes are to be utilized, special care must be taken to avoid contamination. Handling of the tubes should be kept to a minimum and only while wearing nylon or other lint-free gloves. After sampling, each tube should be stored in a clean, sealed culture tube; the ends packed with clean glass wool to protect the sorbent tube from breakage. The culture tubes should be kept cool and wrapped in aluminum foil to prevent any photodegradation of samples (see Section 7.4.).

3.3 Summa Canisters

The Summa canisters used for soil gas sampling have a 6 liter sample capacity and are certified clean by GC/MS analysis before being utilized in the field. After sampling is completed, they are stored and shipped in travel cases.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 PID Measurements

A number of factors can affect the response of a PID (such as the HNu PI 101). High humidity can cause lamp fogging and decreased sensitivity. This can be significant when soil moisture levels are high, or when a soil gas well is actually in groundwater. High concentrations of methane can cause a downscale deflection of the meter. High and low temperature, electrical fields, FM radio transmission, and naturally occurring compounds, such as terpenes in wooded areas, will also affect instrument response.

Other field screening instruments can be affected by interferences. Consult the manufacturers manuals.

4.2 FID Measurements

A number of factors can affect the response of an FID (such as the OVA model 128). High humidity can cause the FID to flame out or not ignite at all. This can be significant when soil moisture levels are high, or when a soil gas well is actually in groundwater. The FID can only read organic based compounds (they must contain carbon in the molecular structure). The FID also responds poorly to hydrocarbons and halogenated hydrocarbons (such as gasoline, propane fuel). High and low temperature, electrical fields and FM radio transmission will also affect instrument response.

4.3 Factors Affecting Organic Concentrations in Soil Gas

Concentrations in soil gas are affected by dissolution, adsorption, and partitioning. Partitioning refers to the ratio of component found in a saturated vapor above an aqueous solution to the amount in the solution; this can, in theory, be calculated using the Henry's Law constants. Contaminants can also be adsorbed onto inorganic soil components or "dissolved" in organic components. These factors can result in a lowering of the partitioning coefficient.

Soil "tightness" or amount of void space in the soil matrix, will affect the rate of recharging of gas into the soil gas well.

Existence of a high, or perched, water table, or of an impermeable underlying layer (such as a clay lens or layer of buried slag) may interfere with sampling of the soil gas. Knowledge of site geology is useful in such situations, and can prevent inaccurate sampling.

4.4 Soil Probe Clogging

A common problem with this sampling method is soil probe clogging. A clogged probe can be identified by using an in-line vacuum gauge or by listening for the sound of the pump laboring. This problem can usually be eliminated by using a wire cable to clear probe (see Section 7.1.3.).

4.5 Underground Utilities

Prior to selecting sample locations, an underground utility search is recommended. The local utility companies can be contacted and requested to mark the locations of their underground lines. Sampling plans can then be drawn up accordingly. Each sample location should also be screened with a metal detector or magnetometer to verify that no underground pipes or drums exist.

5.0 EQUIPMENT/APPARATUS

5.1 Slam Bar Method

- Slam Bar (1 per sampling team).
- Soil gas probes, stainless steel tubing, 1/4" O.D., 5 ft length.
- Flexible wire or cable used for clearing the

tubing during insertion into the well.

- "Quick Connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box.
- Modeling clay.
- Vacuum box for drawing a vacuum around Tedlar bag for sample collection (1 per sampling team).
- Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
- 1/4" Teflon tubing, 2 ft to 3 ft lengths, for replacement of contaminated sample line.
- 1/4" Tygon tubing, to connect Teflon tubing to probes and quick connect fittings.
- Tedlar bags, 1.0 L, at least 1 bag per sample point.
- Soil Gas Sampling labels, field data sheets, logbook, etc.
- PID/FID, or other field air monitoring devices, (1 per sampling team).
- Ice chest, for carrying equipment and for protection of samples (2 per sampling team).
- Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- Photovac GC, for field-lab analysis of bagged samples.
- Summa canisters (plus their shipping cases) for sample, storage and transportation.
- Large dark plastic garbage bags

5.2 Power Hammer Method

- Bosch demolition hammer.
- 1/2" O.D. steel probes, extensions, and points.
- Dedicated aluminum sampling points.
- Teflon tubing, 1/4".
- "Quick Connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box.
- Modeling clay.
- Vacuum box for drawing a vacuum around Tedlar bag for sample collection (1 per sampling team).
- Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
- 1/4" Teflon tubing, 2 ft to 3 ft lengths, for replacement of contaminated sample line.
- 1/4" Tygon tubing, to connect Teflon tubing to probes and quick connect fittings.
- Tedlar bags, 1.0 L, at least 1 bag per sample point.
- Soil Gas Sampling labels, field data sheets, logbook, etc.
- HNu Model P1101, or other field air monitoring devices, (1 per sampling team).
- Ice chest, for carrying equipment and for protection of samples (2 per sampling team).
- Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- Photovac GC, for field-lab analysis of bagged samples.
- Summa canisters (plus their shipping cases) for sample, storage and transportation.
- Generator w/extension cords.
- High lift jack assembly for removing probes.

5.3 Geoprobe™ Method

The Geoprobe is a hydraulically-operated sampling device mounted in a customized four-wheel drive vehicle. The sampling device can be deployed from the truck and positioned over a sample location. The base of the sampling device is positioned on the ground. The weight of the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. A built-in hammer mechanism allows the probe to be driven past some dense stratigraphic horizons. When the probe reaches the sample depth, up to 50 feet under favorable geologic situations, samples can be collected.

Soil gas can be collected from specific depths in two general ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe rod section. Correctly used, this method provides more reliable results. Manufacturer's instructions and the SOP for the Model 5400 Geoprobe™ Operation should be followed when using this method.

6.0 REAGENTS

- PID/FID or calibration gases for field air monitoring devices (such as methane and isobutylene).

- C Deionized organic-free water, for decontamination.
- C Methanol, HPLC grade, for decontamination.
- C Ultra-zero grade compressed air, for field blanks.
- C Standard gas preparations for Photovac GC calibration and Tedlar bag spikes.
- C Propane Torch (for decontamination of steel probes)

7.0 PROCEDURES

7.1 Soil Gas Well Installation

1. Initially a hole slightly deeper than the desired depth is made. For sampling up to 5 feet, a 5-ft single piston slam bar is used. For deeper depths, a piston slam bar with threaded 4-foot-long extensions can be used. Other techniques can be used, so long as holes are of narrow diameter and no contamination is introduced.

2. After the hole is made, the slam bar is carefully withdrawn to prevent collapse of the walls of the hole. The soil gas probe is then inserted.

3. It is necessary to prevent plugging of the probe, especially for deeper holes. A metal wire or cable, slightly longer than the probe, is placed in the probe prior to inserting into the hole. The probe is inserted to full depth, then pulled up three to six inches, then cleared by moving the cable up and down. The cable is removed before sampling.

4. The top of the sample hole is sealed at the surface against ambient air infiltration by using modeling clay molded around the probe at the surface of the hole.

5. If conditions preclude hand installation of the soil gas wells, the power driven system may be employed. The generator powered demolition hammer is used to drive the probe to the desired depth (up to 12 Ft may be attained with extensions). The probe is pulled up 1-3 inches if the retractable point is used. No clay is needed to seal the hole. After sampling, the probe is retrieved using the high lift jack assembly.

6. If semi-permanent soil gas wells are required, the dedicated aluminum probe points are used. These points are inserted into the bottom of the power driven probe and attached to the Teflon tubing. The probe is inserted as in step 5. When the probe is removed, the point and Teflon tube remain in the hole, which may be sealed by backfilling with clean sand, soil, or bentonite.

7.2 Screening with Field Instruments

1. The well volume <u>must</u> be evacuated prior to sampling. Connect the Gilian pump, adjusted to 3.0 L/min, to the sample probe using a section of Teflon tubing as a connector. The pump is turned on, and a vacuum is pulled through the probe for approximately 15 seconds. Longer time is required for sample wells of greater depths.

2. After evacuation, the monitoring instrument(s) (i.e. HNu or OVA) is connected to the probe using a Teflon connector. When the reading is stable, or peaks, the reading is recorded on soil gas data sheets.

3. Of course, readings may be above or below the range set on the field instruments. The range may be reset, or the response recorded as a greater than or less than figure. Recharge rate of the well with soil gas must be considered when resampling at a different range setting.

7.3 Tedlar Bag Sampling

1. Follow step 7.2.1 to evacuate well volume. If air monitoring instrument screening was performed prior to sample taking, evacuation is not necessary.

2. Use the vacuum box and sampling train (Figure 1) to take the sample. The sampling train is designed to minimize the introduction of contaminants and losses due to adsorption. All wetted parts are either Teflon or stainless steel. The vacuum is drawn indirectly to avoid contamination from sample pumps.

3. The Tedlar bag is placed inside the vacuum box, and attached to the sampling port. The sample probe is attached to the sampling port via Teflon tubing and a "Quick Connect" fitting.

4. A vacuum is drawn around the outside of the bag, using a Gilian pump connected to the vacuum box evacuation port, via Tygon tubing and a "Quick Connect" fitting. The vacuum causes the bag to inflate, drawing the sample.

5. Break the vacuum by removing the Tygon line from the pump. Remove the bagged sample from the box and close valve. Record data on data sheets or in logbooks. Record the date, time, sample location ID, and the PID/FID instrument reading(s) on sample bag label.

CAUTION: Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material, contaminating the sample. Place labels on the edge of the bags, or tie the labels to the metal eyelets provided on the bags. Markers with inks containing volatile organics (i.e., permanent ink markers) should not be used.

Chain of Custody Sheets must accompany all samples submitted to the field laboratory for analysis.

7.4 Tenax Tube Sampling

Samples collected in Tedlar bags may be adsorbed onto Tenax tubes for further analysis by GC/MS.

7.4.1 Additional Apparatus

A. Syringe with a luer-lock tip capable of drawing a soil gas or air sample from a Tedlar bag onto a Tenax/CMS sorbent tube. The syringe capacity is dependent upon the volume of sample begin drawn onto the sorbent tube.

B. Adapters for fitting the sorbent tube between the Tedlar bag and the sampling syringe. The adapter attaching the Tedlar bag to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok cat. # SS-400-6-ILV or equivalent) with a length of 1/4" O.D. Teflon tubing replacing the nut on the 1/6" (Tedlar bag) side. A 1/4" I.D. silicone O-ring replaces the ferrules in the nut on the 1/4" (sorbent tube) side of the union.

The adapter attaching the sampling syringe to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok Cat. # SS-400-6-ILV or equivalent) with a 1/4" I.D. silicone O-ring replacing the ferrules in the nut on the 1/4" (sorbent tube) side and the needle of a luer-lock syringe needle inserted into the 1/16" side. (Held in place with a 1/16" ferrule.) The luer-lock end of the needle can be attached to the sampling syringe. It is useful to have a luer-lock on/off valve situated between the syringe and the needle.

C. Two-stage glass sampling cartridge (1/4" O.D. x 1/8" I.D. x 5 1/8") contained in a flame-sealed tube (Manufacturer: Supelco Custom Tenax/Spherocarb Tubes) containing two sorbent sections retained by glass wool:

Front section: 150 mg of Tenax-GC
Back section: 150 mg of CMS (Carbonized Molecular Sieve)

These tubes are prepared and cleaned in accordance with EPA Method EMSL/RTP-SOP-EMD-013 by the vendor. The vendor sends ten tubes per lot made to the REAC GC/MS Laboratory and they are tested for cleanliness, precision, and reproductability.

D. Teflon-capped culture tubes or stainless steel tube containers for sorbent tube storage and shipping. These containers should be conditioned by baking at 120 degrees C for at least two hours. The culture tubes should contain a glass wool plug to prevent sorbent tube breakage during transport. Reconditioning of the containers should occur between uses or after extended periods of disuse (i.e., two weeks or more).

E. Nylon gloves or lint-free cloth. (Hewlett Packard Part # 8650-0030 or equivalent.)

7.4.2 Sample Collection

Handle sorbent tubes with care, using nylon gloves (or other lint-free material) to avoid contamination.

Immediately before sampling, break one end of the sealed tube and remove the Tenax cartridge.

Connect the valve on the Tedlar bag to the sorbent tube adapter. Connect the sorbent tube to the sorbent tube adapter with the Tenax (white granular) side of the tube facing the Tedlar bag. Connect the sampling syringe assembly to the CMS (black) side of the sorbent tube. Fittings on the adapters should be finer-tight. Open the valve on the Tedlar bag. Open the on/off valve of the sampling syringe. Depending on work plan stipulations, at least 10% of the soil gas samples analyzed by this GC method must be submitted for confirmational GC/MS analysis (according to modified methods TO-1 [Tenax absorbent] and TO-2 [Carbon Molecular Sieve (CMS) absorbent]). Each soil gas sample must be absorbed on replicate Tenax/CMS tubes. The volume absorbed on a Tenax/CMS tube is dependent on the total concentration of the compounds measured by the photovac/GC or other applicable GC:

Total Concentration (ppm)	Sample Volume (mL)
>10	Use Serial Dilution
10	10 - 50
5	20-100
1	100-250

After sampling, remove the tube from the sampling train with gloves or a clean cloth. DO NOT LABEL OR WRITE ON THE TENAX/CMS TUBE.

Place the sorbent tube in a conditioned stainless steel tube holder or culture tube. Culture tube caps should be sealed with Teflon tape.

7.4.3 Sample Labeling

Each sample tube container (not tube) must be labeled with the site name, sample station number, date sampled, and volume sampled.

Chain of custody sheets must accompany all samples to the laboratory.

7.4.4 Quality Assurance (QA)

Before field use, a QA check should be performed on each batch of sorbent tubes by analyzing a tube by thermal desorption/cryogenic trapping GC/MS.

At least one blank sample must be submitted with each set of samples collected at a site. This trip blank must be treated the same as the sample tubes except no sample will be drawn through the tube.

Sample tubes should be stored out of UV light (i.e., sunlight) and kept on ice until analysis. Samples should be taken in duplicate, when possible.

7.5 Summa Canister Sampling

1. Follow step 7.2.1 to evacuate well volume. If PID/FID readings were taken prior to taking a sample, evacuation is not necessary.

2. Attach a certified clean, evacuated 6-liter Summa canister via the 1/4" Teflon tubing.

3. Open valve on Summa canister. The soil gas sample is drawn into the canister by pressure equilibration. The approximate sampling time for a 6 liter canister is 20 minutes.

4. Site name, sample location, number, and date must be recorded on a chain of custody form and on a blank tag attached to the canister.

8.0 CALCULATIONS

8.1 Field Screening Instruments

Instrument readings are usually read directly from the meter. In some cases, the background level at the soil gas station may be subtracted:

Final Reading = Sample Reading - Background

8.2 Photovac GC Analysis

Calculations used to determine concentrations of individual components by Photovac GC analysis are beyond the scope of this SOP and are covered in ERT SOP #2109, *Photovac GC Analysis for Soil Water and Air/Soil Gas*.

9.0 CALIBRATION

9.1 Field Instruments

It is recommended that the manufacturers' manuals be consulted for correct use and calibration of all instrumentation.

9.2 Gilian Model HFS113A Air Sampling Pumps

Flow should be set at approximately 3.0 L/min; accurate flow adjustment is not necessary. Pumps should be calibrated prior to bringing into the field.

10.0 QUALITY ASSURANCE/ QUALITY CONTROL

10.1 Sample Probe Contamination

Sample probe contamination is checked between each sample by drawing ambient air through the probe via a Gilian pump and checking the response of the FID/PID. If readings are higher than background, replacement or decontamination is necessary.

Sample probes may be decontaminated simply by drawing ambient air through the probe until the HNu reading is at background. More persistent contamination can be washed out using methanol and water, then air drying. For persistent volatile contamination, use of a portable propane torch may be needed. Using a pair of pliers to hold the probe, run the torch up and down the length of the sample probe for approximately 1-2 minutes. Let the probe cool before handling. When using this method, make sure to wear gloves to prevent burns. Having more than one probe per sample team will reduce lag times between sample stations while probes are decontaminated.

10.2 Sample Train Contamination

The Teflon line forming the sample train from the probe to the Tedlar bag should be changed on a daily basis. If visible contamination (soil or water) is drawn into the sampling train, it should be changed immediately. When sampling in highly contaminated areas, the sampling train should be purged with ambient air, via a Gilian pump, for approximately 30 seconds between each sample. After purging, the sampling train can be checked using an FID or PID, or other field monitoring device, to establish the cleanliness of the Teflon line.

10.3 FID/PID Calibration

The FID and PIDs should be calibrated at least once a day using the appropriate calibration gases.

10.4 Field Blanks

Each cooler containing samples should also contain one Tedlar bag of ultra-zero grade air, acting as a field blank. The field blank should accompany the samples in the field (while being collected) and when they are delivered for analysis. A fresh blank must be provided to be placed in the empty cooler pending additional sample collection. One new field blank per cooler of samples is required. A chain of custody sheet must accompany each cooler of samples and should include the blank that is dedicated to that group of samples.

10.5 Trip Standards

Each cooler containing samples should contain a Tedlar bag of standard gas to calibrate the analytical instruments (Photovac GC, etc.). This trip standard will be used to determine any changes in concentrations of the target compounds during the course of the sampling day (e.g., migration through the sample bag, degradation, or adsorption). A fresh trip standard must be provided and placed in each cooler pending additional sample collection. A chain of custody sheet should accompany each cooler of samples and should include the trip standard that is dedicated to that group of samples.

10.6 Tedlar Bag Check

Prior to use, one bag should be removed from each lot (case of 100) of Tedlar bags to be used for sampling and checked for possible contamination as follows: the test bag should be filled with ultra-zero grade air; a sample should be drawn from the bag and analyzed via Photovac GC or whatever method is to be used for sample analysis. This procedure will ensure sample container cleanliness prior to the start of the sampling effort.

10.7 Summa Canister Check

From each lot of four cleaned Summa canisters, one is to be removed for a GC/MS certification check. If the canister passes certification, then it is re-evacuated and all four canisters from that lot are available for sampling.

If the chosen canister is contaminated, then the entire lot of four Summas must be recleaned, and a single canister is re-analyzed by GC/MS for certification.

10.8 Options

10.8.1 Duplicate Samples

A minimum of 5% of all samples should be collected in duplicate (i.e., if a total of 100 samples are to be collected, five samples should be duplicated.) In choosing which samples to duplicate, the following criteria applies: if, after filling the first Tedlar bag, and, evacuating the well for 15 seconds, the second HN (or other field monitoring device being used) reading matches or is close to (within 50%) the first reading, a duplicate sample may be taken.

10.8.2 Spikes

A Tedlar bag spike and Tenax tube spike may be desirable in situations where high concentrations of contaminants other than the target compounds are found to exist (landfills, etc.). The additional level of QA/QC attained by this practice can be useful in determining the effects of interferences caused by these non-target compounds. Summa canisters containing samples are not spiked.

11.0 DATA VALIDATION

11.1 Blanks (Field and Tedlar Bag Check)

For each target compound, the level of concentration found in the sample must be greater than three times the level (for that compound) found in the field blank which accompanied that sample to be considered valid. The same criteria apply to target compounds detected in the Tedlar bag pre-sampling contamination check.

12.0 HEALTH AND SAFETY CONSIDERATIONS

Due to the remote nature of sampling soil gas, special considerations can be taken with regard to health and safety. Because the sample is being drawn from underground, and no contamination is introduced into the breathing zone, soil gas sampling usually occurs in Level D. Ambient air is constantly monitored using the HNu PI101 to obtain background readings during the sampling procedure. As long as the levels in ambient air do not rise above background, no upgrade of the level of protection is needed.

When conducting soil gas sampling, leather gloves should be worn, and proper slam bar techniques should be implemented (bend knees). Also, an underground utility search should be performed prior to sampling. (See Section 4.5).

13.0 REFERENCES

Gilian Instrument Corp., Instruction Manual for Hi Flow Sampler: HFS113, HFS 113 T, HFS 113U, HFS 113 UT, 1983.

HNu Systems, Inc., Instruction Manual for Model PI 101 Photoionization Analyzer, 1975.

N.J.D.E.P., Field Sampling Procedures Manual, Hazardous Waste Programs, February, 1988.

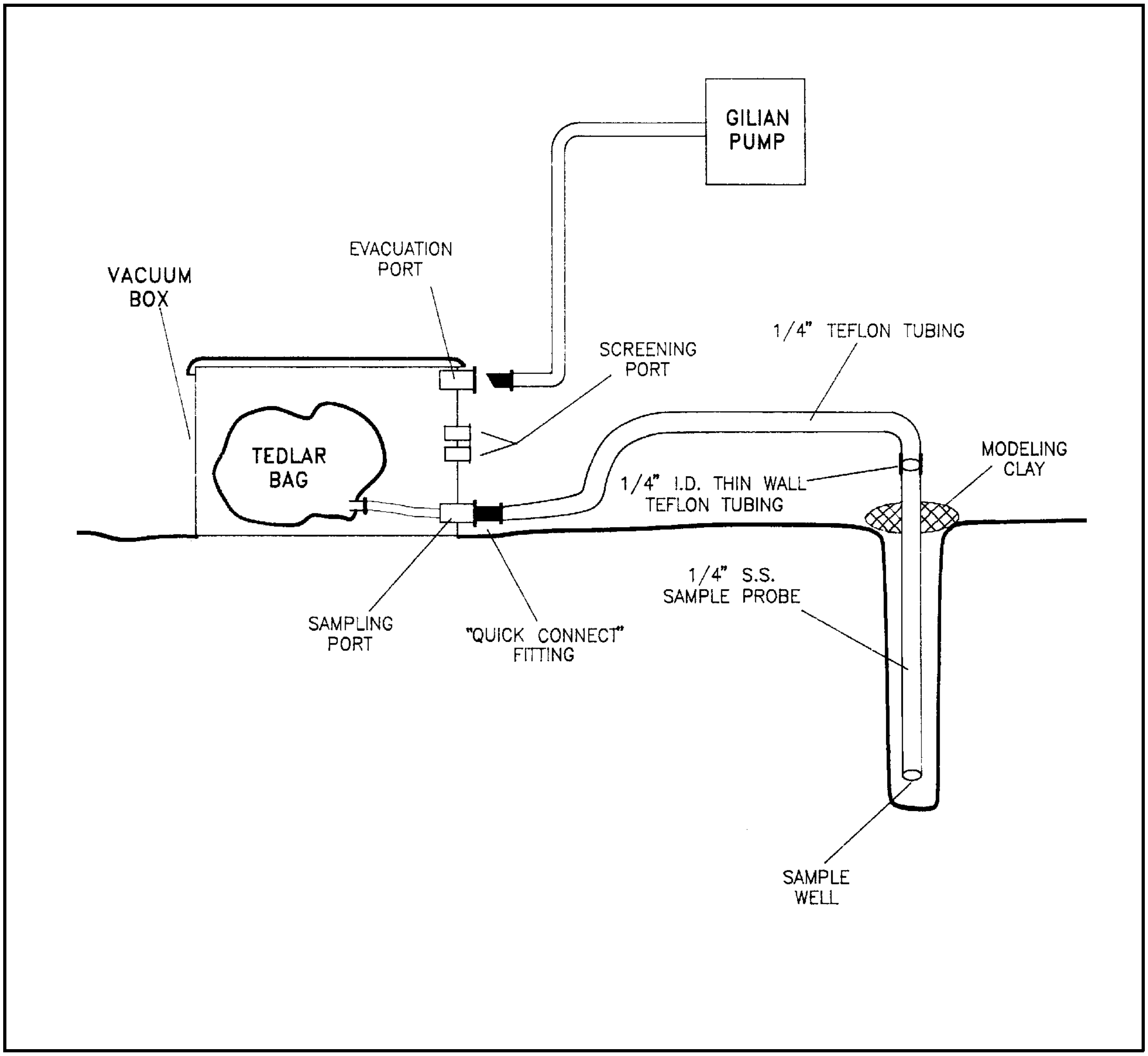
Roy F. Weston, Inc., Weston Instrumentation Manual, Volume I, 1987.

U.S.E.P.A., Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods, 2nd Edition, EPA-600/4-84-076, December, 1984.

APPENDIX A

Figure

FIGURE 1. Sampling Train Schematic



APPENDIX B

HNu Field Protocol

Field Procedure

The following sections detail the procedures that are to be followed when using the HNu in the field.

Startup Procedure

a. Before attaching the probe, check the function switch on the control panel to ensure that it is in the off position. Attach the probe by plugging it into the interface on the top of the readout module. Use care in aligning the prongs in the probe cord with the plug in; don't force.

b. Turn the function switch to the battery check position. The needle on the meter should read within or above the green battery are on the scale. If not, recharge the battery. If the red indicator light comes on, the battery needs recharging.

c. Turn the function switch to any range setting. Look into the end of the probe for no more than two to three seconds to see if the lamp is on. If it is on, it will give a purple glow. Do not stare into the probe any longer than three seconds. Long term exposure to UV light can damage eyes. Also, listen for the hum of the fan motor.

d. To ZERO the instrument, turn the function switch to the standby position and rotate the zero adjustment until the meter reads zero. A calibration gas is not needed since this is an electronic zero adjustment. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. Wait 15 to 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

Operational Check

a. Follow the startup procedure.

b. With the instrument set on the 0-20 range, hold a solvent-based major market near the probe tip. If the meter deflects upscale, the instrument is working.

Field Calibration Procedure

a. Follow the startup procedure and the operational check.

b. Set the function switch to the range setting for the concentration of the calibration gas.

c. Attach a regulator (HNu 101-351) to a disposable cylinder of isobutylene gas (HNu 101-351). Connect the regulator to the probe of the HNu with a piece of clean Tygon tubing. Turn on the value on the regulator.

d. After fifteen seconds, adjust the span dial until the meter reading equals the concentration of the calibration gas used. Be careful to unlock the span dial before adjusting it. If the span has to be set below 3.0, calibration internally or return to equipment maintenance for repair.

e. Record in the field logbook: the instrument ID no. (EPA decal or serial number if the instrument is a rental); the initial and final span settings; the date and time; concentration and type of calibration has used; and the name of the person who calibrated the instrument.

Operation

a. Follow the startup procedure, operational check, and calibration check.

b. Set the function switch to the appropriate range. If the concentration of gases or vapors is unknown, set the function switch to the 0-20 ppm range. Adjust it if necessary.

c. While taking care not to permit the HNu to be exposed to excessive moisture, dirt, or contamination, monitor the work activity as specified in the Site Health and Safety Plan.

d. When the activity is completed or at the end of the day, carefully clean the outside of the HNu with a damp disposable towel to remove any visible dirt. Return the HNu to a secure area and place on charge.

e. With the exception of the probe's inlet and exhaust, the HNu can be wrapped in clear plastic to prevent it form becoming contaminated and to prevent water from getting inside in the event of precipitation.

SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.
More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

- The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

- If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

- Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

- Non-phosphate detergent
- Selected solvents (acetone, hexane, nitric acid, etc.)
- Tap water
- Distilled or deionized water

5.2 Decontamination Tools/Supplies

- Long and short handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers (H_2O)
- Solvent sprayers
- Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

- Trash bags
- Trash containers
- 55-gallon drums
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In general, the following solvents are typically utilized for decontamination purposes:

- 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- Acetone (pesticide grade)[1]
- Hexane (pesticide grade)[1]
- Methanol[1]

[1] - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- The number, location, and layout of decontamination stations.

- Decontamination equipment needed.

- Appropriate decontamination methods.

- Methods for disposal of contaminated clothing, equipment, and solutions.

- Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.
Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station . Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10 : Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.

2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.

6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.

7. Empty low-pressure sprayer water onto the ground.

8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITYASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT[1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent[2]	Hexane	PCBs

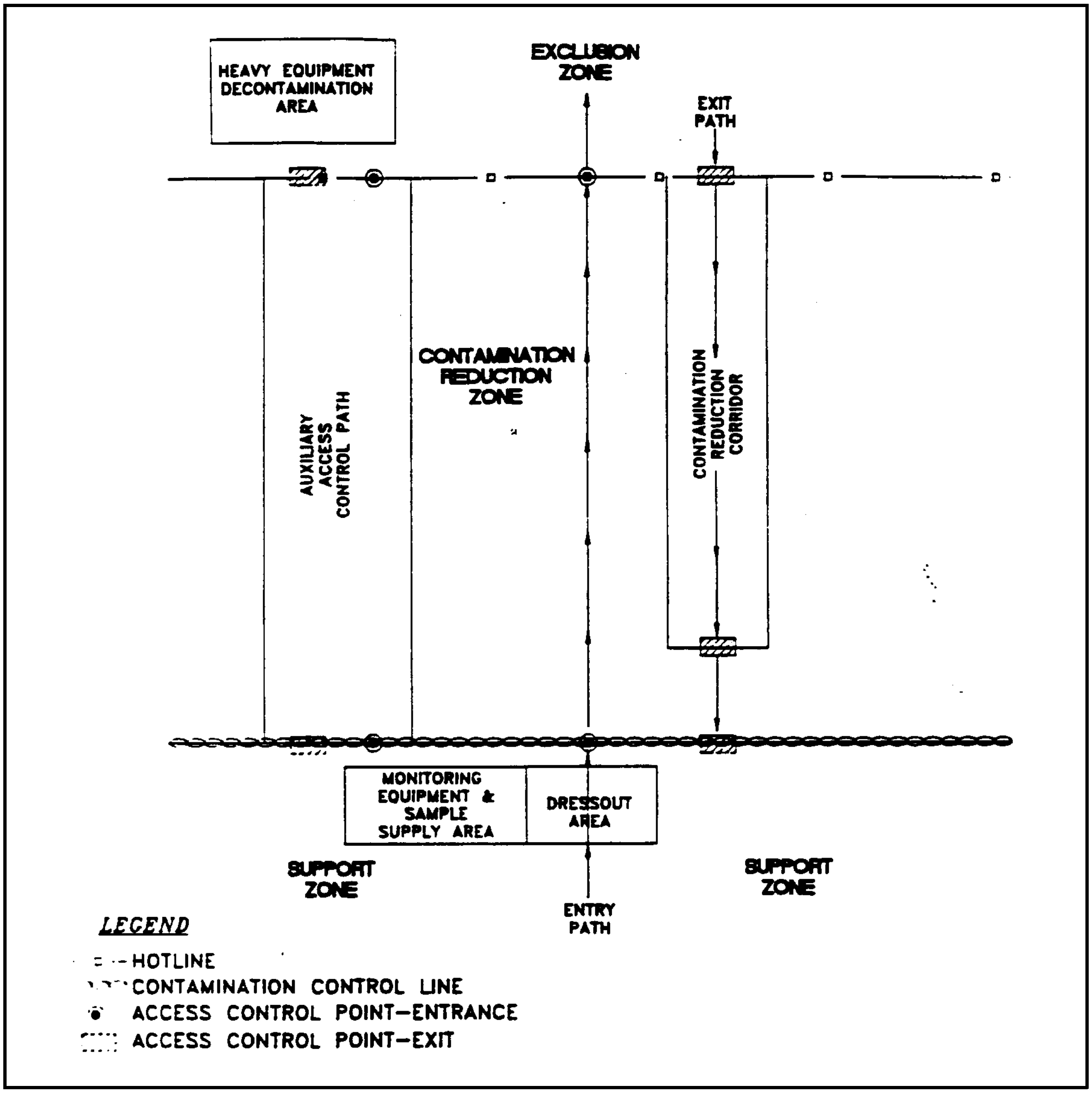
[1] - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

[2] - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

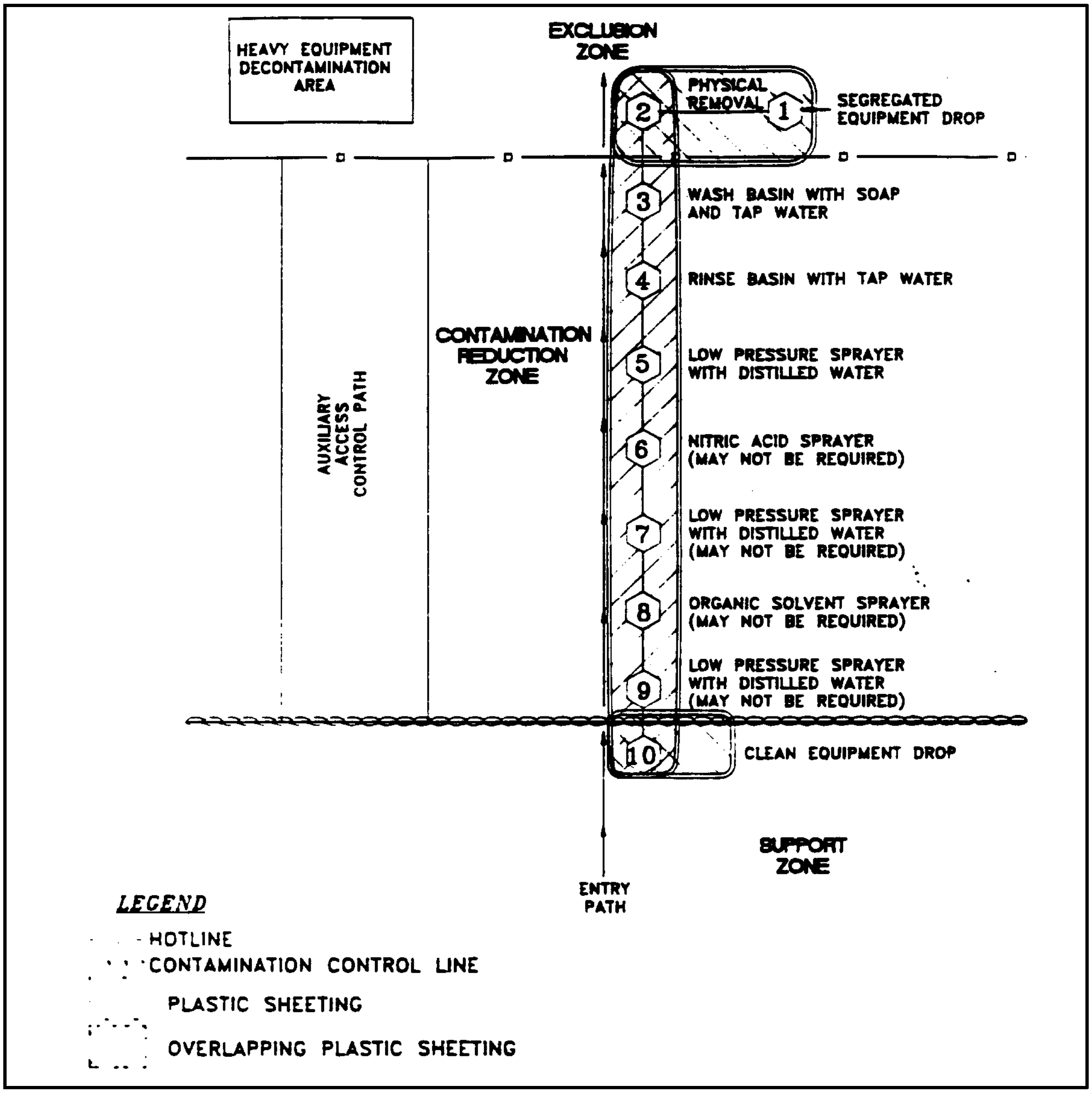
Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout



MODEL 5400 GEOPROBE™ OPERATION

SOP#: 2050
DATE: 03/27/96
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the collection of representative soil, soil-gas, and groundwater samples using a Model 5400 Geoprobe™ sampling device. Any deviations from these procedures should be documented in the site/field logbook and stated in project deliverables.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

The Geoprobe™ sampling device is used to collect soil, soil-gas and groundwater samples at specific depths below ground surface (BGS). The Geoprobe™ is hydraulically powered and is mounted in a customized four-wheel drive vehicle. The base of the sampling device is positioned on the ground over the sampling location and the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. A built-in hammer mechanism allows the probe to be driven through dense materials. Maximum depth penetration under favorable circumstances is about 50 feet. Components of the Model 5400 Geoprobe™ are shown in Figures 1 through 6 (Appendix A).

Soil samples are collected with a specially-designed sample tube. The sample tube is pushed and/or vibrated to a specified depth (approximately one foot above the intended sample interval). The interior plug of the sample tube is removed by inserting small-diameter threaded rods. The sample tube is then driven an additional foot to collect the samples. The probe sections and sample tube are then withdrawn and the sample is extruded from the tube into sample jars.

Soil gas can be collected in two ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe section. Correctly used, the latter method provides more reliable results.

Slotted lengths of probe can be used to collect groundwater samples if the probe rods can be driven to the water table. Groundwater samples are collected using either a peristaltic pump or a small bailer.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

Refer to specific ERT SOPs for procedures appropriate to the matrix, parameters and sampling objector.

Applicable ERT SOPs include:

ERT #2012, Soil Sampling

ERT #2007, Groundwater Well Sampling

ERT #2042, Soil Gas Sampling

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

A preliminary site survey should identify areas to be avoided with the truck. All underground utilities should be located and avoided during sampling. Begin sampling activities with an adequate fuel supply.

Decontamination of sampling tubes, probe rods, adaptors, non-expendable points and other equipment that contacts the soil is necessary to prevent cross-contamination of samples. During sampling, the bottom portion and outside of the sampling tubes can be contaminated with soil from other depth intervals.

Care must be taken to prevent soil which does not represent the sampled interval form being incorporated into the sample. Excess soil should be carefully wiped from the outside surface of the sampling tube and the bottom 3 inches of the sample should be discarded before extruding the sample into a sample jar.

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent upon the parameter(s) of interest. Guidelines for the containment, preservation, handling and storage of soil-gas samples are described in ERT SOP #2042, Soil-Gas Sampling.

Obtaining sufficient volume of soil for multiple analyses from one sample location may present a problem. The Geoprobe™ soil sampling system recovers a limited volume of soil and it is not possible to reenter the same hole and collect additional soil. When multiple analyses are to be performed on soil samples collected with the Geoprobe™, it is important that the relative importance of the analyses be identified. Identifying the order of importance will ensure that the limited sample volume will be used for the most crucial analyses.

5.0 EQUIPMENT/APPARATUS

Sampling with the Geoprobe™ involves use of the equipment listed below. Some of the equipment is used for all sample types, others are specific to soil (S), soil gas (SG), or groundwater (GW) as noted.

- Geoprobe™ sampling device
- Threaded probe rods (36", 24", and 12" lengths)
- Drive Caps
- Pull Caps
- Rod Extractor
- Expendable Point Holders
- Expendable Drive Points
- Solid Drive Points
- Extension Rods
- Extension Rod Couplers
- Extension Rod Handle
- Hammer Anvil
- Hammer Latch
- Hammer Latch Tool
- Drill Steels
- Carbide-Tipped Drill Bit
- Mill-Slotted Well Point (GW)
- Threaded Drive Point (GW)
- Well Mini-Bailer (GW)
- Tubing Bottom Check Valve (GW)
- 3/8" O.D. Low Density Polyethylene Tubing (GW, SG)
- Gas Sampling Adaptor and Cap (SG)
- Teflon Tape
- Neoprene "O" - Rings (SG)
- Vacuum System (mounted in vehicle) (SG)
- Piston Tip (S)
- Piston Rod (S)
- Piston Stop (S)
- Sample Tube (11.5" in length) (S)
- Vinyl Ends Caps (S)
- Sample Extruder (S)
- Extruder Pistons (Wooden Dowels) (S)
- Wire Brush
- Brush Adapters
- Cleaning Brush (Bottle)

6.0 REAGENTS

Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURES

Portions of the following sections have been condensed from the Model 5400 Geoprobe™ Operations Manual(1). Refer to this manual for more detailed information concerning equipment specifications, general maintenance, tools, throttle control, clutch pump, GSK-58 Hammer, and trouble-shooting. A copy of this manual will be maintained with the Geoprobe™ and on file in the Quality Assurance (QA) office.

7.1 Preparation

1. Determine extent of the sampling effort, sample matrices to be collected, and types and amounts of equipment and supplies required to complete the sampling effort.

2. Obtain and organize necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site

entry in accordance with the site-specific Health and Safety Plan.

5. Use stakes or flagging to identify and mark all sampling locations. All sample locations should be cleared for utilities prior to sampling.

7.2 Setup of Geoprobe™

1. Back carrier vehicle to probing location.

2. Shift the vehicle to park and shut off ignition.

3. Set parking brake and place chocks under rear tires.

4. Attach exhaust hoses so exhaust blows downwind of the sampling location (this is particularly important during soil gas sampling).

5. Start engine using the remote ignition at the Geoprobe™ operator position.

6. Activate hydraulic system by turning on the Electrical Control Switch located on the Geoprobe™ electrical control panel (Figure 1, Appendix A). When positioning the probe, always use the SLOW speed. The SLOW speed switch is located on the hydraulic control panel (Figure 2, Appendix A).

   Important: Check for clearance on vehicle roof before folding Geoprobe™ out of the carrier vehicle.

7. Laterally extend the Geoprobe™ from the vehicle as far as possible by pulling the EXTEND control lever toward the back of the vehicle while the Geoprobe™ is horizontal.

8. Using the FOOT control, lower the Derrick Slide so it is below cylinder (A) before folding the Geoprobe™ out of the carrier vehicle (Figure 3, Appendix A). This will ensure clearance at the roof of the vehicle.

9. Use the FOLD, FOOT, and EXTEND controls to place Geoprobe™ to the exact probing location. Never begin probing in the fully extended position.

10. Using the FOLD control, adjust the long axis of the probe cylinder so that it is perpendicular (visually) to the ground surface.

11. Using the FOOT control, put the weight of the vehicle on the probe unit. Do not raise the rear of the vehicle more than six inches.

    Important: Keep rear vehicle wheels on the ground surface when transferring the weight of the vehicle to the probe unit. Otherwise, vehicle may shift when probing begins.

12. When the probe axis is vertical and the weight of the vehicle is on the probe unit, probing is ready to begin.

7.3 Drilling Through Surface Pavement or Concrete

1. Position carrier vehicle to drilling location.

2. Fold unit out of carrier vehicle.

3. Deactivate hydraulics.

4. Insert carbide-tipped drill bit into hammer.

5. Activate HAMMER ROTATION control by turning knob counter-clockwise (Figure 4, Appendix A). This allows the drill bit to rotate when the HAMMER control is pressed.

6. Press down on HAMMER control to activate counterclockwise rotation.

7. Both the HAMMER control and the PROBE control must be used when drilling through the surface (Figure 4, Appendix A). Fully depress the HAMMER control, and incrementally lower the bit gradually into the pavement by periodically depressing the PROBE control.

8. When the surface has been penetrated, turn the HAMMER Control Valve knob

clockwise to deactivate hammer rotation and remove the drill bit from the HAMMER.

Important: Be sure to deactivate the rotary action before driving probe rods.

7.4 Probing

1. Position the carrier vehicle to the desired sampling location and set the vehicle parking brake.

2. Deploy Geoprobe^{TM} Sampling Device.

3. Make sure the hydraulic system is turned off.

4. Lift up latch and insert hammer anvil into hammer - push latch back in (Figure 5, Appendix A).

5. Thread the drive cap onto the male end of the probe rod.

6. Thread an expendable point holder onto the other end of the first probe rod.

7. Slip an expendable drive point into point holder.

8. Position the leading probe rod with expendable drive point in the center of the derrick foot and directly below the hammer anvil.

   Important: Positioning the first probe rod is critical in order to drive the probe rod vertically. Therefore, both the probe rod and the probe cylinder shaft must be in the vertical position (Figure 6, Appendix A).

9. To begin probing, activate the hydraulics and push the PROBE Control downward. When advancing the first probe rod, always use the SLOW speed. Many times the probe rods can be advanced using only the weight of the carrier vehicle. When this is the case, only the PROBE control is used.

   Important: When advancing rods, always keep the probe rods parallel to the probe cylinder shaft (Figure 6, Appendix A). This is done by making minor adjustments with the FOLD control. Failure to keep probe rods parallel to probe cylinder shaft may result in broken rods and increased difficulty in achieving desired sampling depth.

7.5 Probing - Percussion Hammer

The percussion hammer must be used in situations where the weight of the vehicle is not sufficient to advance the probe rods.

1. Make sure the Hammer Rotation Valve is closed.

2. Using the PROBE control to advance the rod, press down the HAMMER control to allow percussion to drive the rods (Figure 2, Appendix A).

   Important: Always keep static weight on the probe rod or the rod will vibrate and chatter while you are hammering, causing rod threads to fracture and break.

3. Keep the hammer tight to the drive cap so the rod will not vibrate.

4. Periodically stop hammering and check if the probe rods can be advanced by pushing only.

5. Any time the downward progress of the probe rods is refused, the derrick foot may lift off of the ground surface. When this happens, reduce pressure on the PROBE control. Do not allow the foot to rise more than six inches off the ground or the vehicle's wheels may lift off the ground surface, causing the vehicle to shift (Figure 6, Appendix A).

6. As the derrick foot is raised off the ground surface, the probe cylinder may not be in a perpendicular position. If this happens, use the FOLD control to correct the probe cylinder position.

7.6 Probing - Adding Rods

1. Standard probe rods are three feet in length. If the desired depth is more than three feet,

another rod must be threaded onto the rod that has been driven into the ground. In order to ensure a vacuum-tight seal (soil-gas sampling), two wraps of teflon tape around the thread is recommended.

2. Using the PROBE control, raise the probe cylinder as high as possible.

Important: Always deactivate hydraulics when adding rods.

3. Deactivate hydraulics.

4. Unthread the drive cap from the probe rod that is in the ground.

5. Wrap teflon tape around the threads.

6. Thread the drive cap onto the male end of the next probe rod to be used.

7. After threading the drive cap onto the rod to be added, thread the rod onto the probe rod that has been driven into the ground. Make sure threads have been teflon taped. Continue probing.

8. Continue these steps until the desired sampling depth has been reached.

7.7 Probing/Pulling Rods

1. Once the probe rods have been driven to depth, they can also be pulled using the Geoprobe™ Machine.

2. Turn off the hydraulics.

3. Lift up latch and take the hammer anvil out of the hammer.

4. Replace the drive cap from the last probe rod driven with a pull cap.

5. Lift up the hammer latch.

6. Activate the hydraulics.

7. Hold down on the PROBE control, and move the probe cylinder down until the latch can be closed over the pull cap.

Important: If the latch will not close over the pull cap, adjust the derrick assembly by using the extend control. This will allow you to center the pull cap directly below the hammer latch.

8. Retract the probe rods by pulling up on the PROBE control.

Important: Do not raise the probe cylinder all the way when pulling probe rods or it will be impossible to detach a rod that has been pulled out. However, it is necessary to raise the probe cylinder far enough to allow the next probe section to be pulled.

9. After retracting the first probe rod, lower the probe cylinder only slightly to ease the pressure off of the hammer latch.

10. Attach a clamping device to the base of the rods where it meets the ground to prevent rods from falling back into the hole.

11. Raise the hammer latch.

12. Hold the PROBE control up and raise the probe cylinder as high as possible.

13. Unthread the pull cap from the retracted rod.

14. Unthread the retracted rod.

15. Thread the pull cap onto the next rod that is to be pulled.

16. Continue these steps until all the rods are retracted from the hole.

17. Decontaminate all portions of the equipment that have been in contact with the soil, soil gas and groundwater.

7.8 Soil-Gas Sampling Without Interior Tubing

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Remove hammer anvil from hammer.

3. Thread on pull cap to end of probe rod.

4. Retract rod approximately six inches. Retraction of the rod disengages expendable drive point and allows for soil vapor to enter rod.

5. Unthread pull cap and replace it with a gas sampling cap. Cap is furnished with barbed hose connector.

   Important: Shut engine off before taking sample (exhaust fumes can cause faulty sample data).

6. Turn vacuum pump on and allow vacuum to build in tank.

7. Open line control valve. For each rod used, purge 300 liters of volume. Example: Three rods used = 900 liters = .900 on gauge.

8. After achieving sufficient purge volume, close valve and allow sample line pressure gauge to return to zero. This returns sample train to atmospheric pressure.

9. The vapor sample can now be taken.

   1. Pinch hose near gas sampling cap to prevent any outside vapors from entering the rods.

   2. Insert syringe needle into center of barbed hose connector and withdraw vapor sample.

10. To maintain suction at the sampling location, periodically drain the vacuum tank.

11. To remove rods, follow procedures outlined in Section 7.7.

7.9 Soil-Gas Sampling With Post-Run Tubing (PRT)

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Retract rod approximately six inches. Retraction of rod disengages expendable drive point and allows for soil vapor to enter rod.

3. Remove pull cap from the end of the probe rod.

4. Position the Geoprobe™ to allow room to work.

5. Secure PRT Tubing Adapter with "O" - Ring to selected tubing.

6. Insert the adapter end of the tubing down the inside diameter of the probe rods.

7. Feed the tubing down the hole until it hits bottom on the expendable point holder. Cut the tubing approximately two feet from the top probe rod.

8. Grasp excess tubing and apply some downward pressure while turning it in a counter-clockwise motion to engage the adapter threads with the expendable point holder.

9. Pull up lightly on the tubing to test engagement of threads.

10. Connect the outer end of the tubing to silicon tubing and vacuum hose (or other sampling apparatus).

11. Follow the appropriate sampling procedure (ERT SOP #2042, Soil Gas Sampling) to collect a soil-gas sample.

12. After collecting a sample, disconnect the tubing from the vacuum hose or sampling system.

13. Pull up firmly on the tubing until it releases from the adapter at the bottom of the hole.

14. Extract the probe rods from the ground and recover the expendable point holder with the attached adapter.

15. Inspect the "O"-ring at the base of the adapter to verify that proper sealing was achieved during sampling. The "O"-ring should be compressed.

Note: If the "O"-ring is not compressed, vapors from within the probe sections may have been collected rather than vapors from the intended sample interval.

7.10 Soil Sampling

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Assemble soil-sampling tube.

    1. Thread piston rod into piston tip.

    2. Insert piston tip into sample tube, seating piston tip into cutting edge of sample tube.

    3. Thread drive head into threaded end of sample tube.

    4. Thread piston stop pin into drive head. Stop pin should be tightened with wrench so that it exerts pressure against the piston rod.

3. Attach assembled sampler onto leading probe rod.

4. Drive the sampler with the attached probe rods to the top of the interval to be sampled.

5. Move probe unit back from the top of the probe rods to allow work room.

6. Remove drive cap and lower extension rods into inside diameter of probe rods using couplers to join rods together.

7. Attach extension rod handle to top extension rod.

8. Rotate extension rod handle clockwise until the leading extension rod is threaded into the piston stop in downhole.

9. Continue to rotate extension rod handle clockwise until reverse-threaded stop-pin has disengaged from the drive head.

10. Remove extension rods and attached stop-pin from the probe rods.

11. Replace drive cap onto top probe rod.

12. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (dependent on sample tube length).

13. Drive probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube, making it difficult to extrude.

    Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Correct Method - Sample Location S-6, 12.0' - 13.0'. Incorrect Method - Sample Location S-6, 12.0'.

14. Retract probe rods from the hole and recover the sample tube. Inspect the sample tube to confirm that a sample was recovered.

15. Disassemble sampler. Remove all parts.

16. Position extruder rack on the foot of the Geoprobe™ derrick.

17. Insert sample tube into extruder rack with the cutting end up.

18. Insert hammer anvil into hammer.

19. Position the extruder piston (wood dowel) and push sample out of the tube using the PROBE control on the Geoprobe™. Collect the sample as it is extruded in an appropriate sample container.

    Caution: use care when performing this task. Apply downward pressure gradually. Use of excessive force could result in injury to operator or damage to tools. Make sure proper diameter extruder piston is used.

20. To remove rods follow procedures outlined in Section 7.7.

7.11 Groundwater Sampling

1. Follow Sections 7.1 thorough 7.6 with the following exception: the Mill-Slotted Well Rod with attached threaded drive point should be the first section probed into the ground. Multiple sections of mill-slotted well rods can be used to provide a greater vertical section into which groundwater can flow.

2. Probe to a depth at which groundwater is expected.

3. Remove Drive Cap and insert an electric water-level indicator to determine if water has entered the slotted sections of probe rod. Refer to ERT SOP #2043, Water Level Measurement, to determine water level.

4. If water is not detected in the probe rods, replace the drive cap and continue probing. Stop after each additional probe length and determine if groundwater has entered the slotted rods.
5. After the probe rods have been driven into the saturated zone, sufficient time should be allowed for the water level in the probe rods to stabilize.

   Note: It will be difficult if not impossible to collect a groundwater sample in aquifer material small enough to pass through the slots (<0.02 inch diameter).

6. Groundwater samples may be collected with the 20-mL well Mini-Bailer or a pumping device. If samples are being collected for volatile organic analysis (VOA), the 20-mL Well Mini-Bailer should be used. If samples are being collected for a variety of analyses, VOA samples should be collected first using the bailer. Remaining samples can be collected by pumping water to the surface. Withdrawing water with the pump is more efficient than collecting water with the 20-mL well Mini-Bailer.

   Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Sample Location GW-6, 17'-21' bgs, water level in probe rods is 17 feet bgs, and the leading section of probe rod is 21 feet bgs. The water sample is from this zone, not from 17 feet bgs or 21 feet bgs.

7. Remove rods following procedures outlined in Section 7.7.

8.0 CALCULATIONS

Calculating Vapor Purge Volume for Soil-Gas Sampling without Interior Tubing

Volume of Air to be Purged (Liters) = 300 x Number of Rods in the Ground

Volume in Liters/1000 = Reading on Vacuum Pump Instrument Gauge

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and the REAC site specific Health and Safety Plan. The following is a list of health and safety precautions which specifically apply to Geoprobe^{TM} operation.

1. Always put vehicle in "park", set emergency the brake, and place chocks under the tires, before engaging remote ignition.

2. If vehicle is parked on a loose or soft surface, do not fully raise rear of vehicle with probe foot, as vehicle may fall or move.

3. Always extend the probe unit out from the vehicle and deploy the foot to clear vehicle roof line before folding the probe unit out.

4. Operators should wear OSHA approved steel-toed shoes and keep feet clear of probe foot.

5. Operator should wear ANSI approved hard hats.

6. Only one person should operate the probe machine and the assemble or disassemble probe rods and accessories.

7. Never place hands on top of a rod while it is under the machine.

8. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.

9. Operator must stand on the control side of the probe machine, clear of the probe foot and mast, while operating controls.

10. Wear safety glasses at all times during the operation of this machine.

11. Never continue to exert downward pressure on the probe rods when the probe foot has risen six inches off the ground.

12. Never exert enough downward pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.

13. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.

14. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.

15. Geoprobe™ operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.

16. Locations of buried or underground utilities and services must be known before starting to drill or probe.

17. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.

18. Exercise extreme caution when using extruder pistons (wooden dowels) to extrude soil from sample tubes. Soil in the sample tube may be compacted to the point that the extruder piston will break or shatter before it will push the sample out.

19. A dry chemical fire extinguisher (Type ABC) should be kept with the vehicle at <u>all</u> times.

12.0 REFERENCES

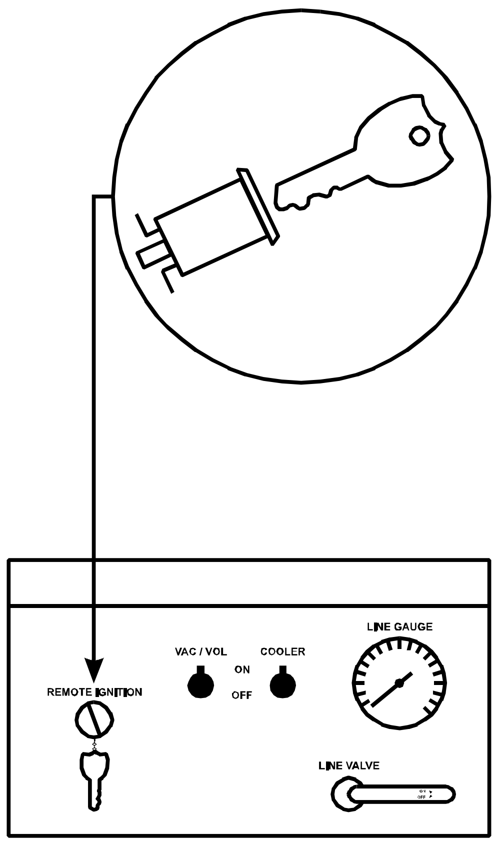
1. Model 5400 Geoprobe™ Operations Manual. Geoprobe™ Systems, Salina, Kansas. July 27, 1990.

2. Geoprobe™ Systems - 1995-96 Tools and Equipment Catalog.

APPENDIX A

Figures

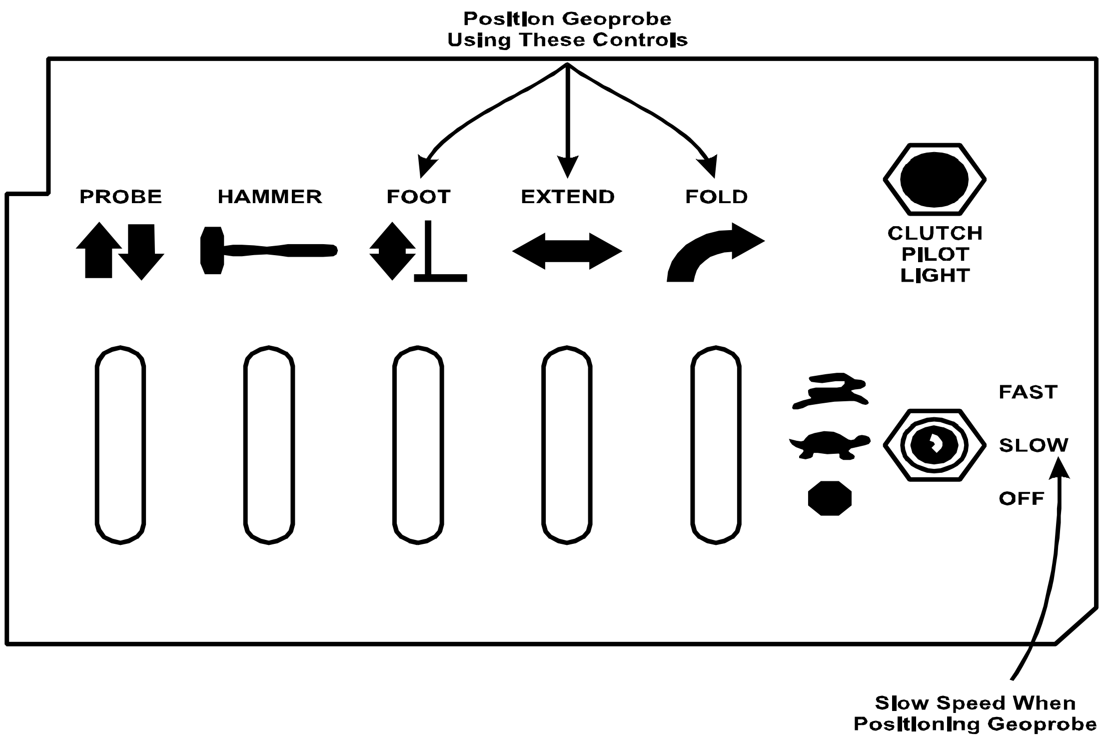
FIGURE 1. Electrical Control Panel



APPENDIX A (Cont'd)

Figures

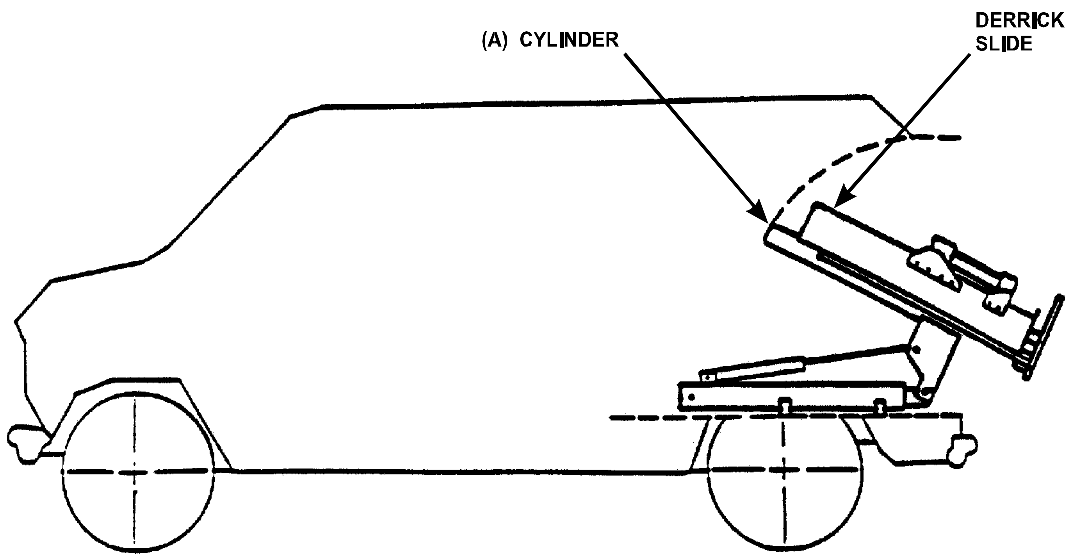
FIGURE 2. Hydraulic Control Panel



APPENDIX A (Cont'd)

Figures

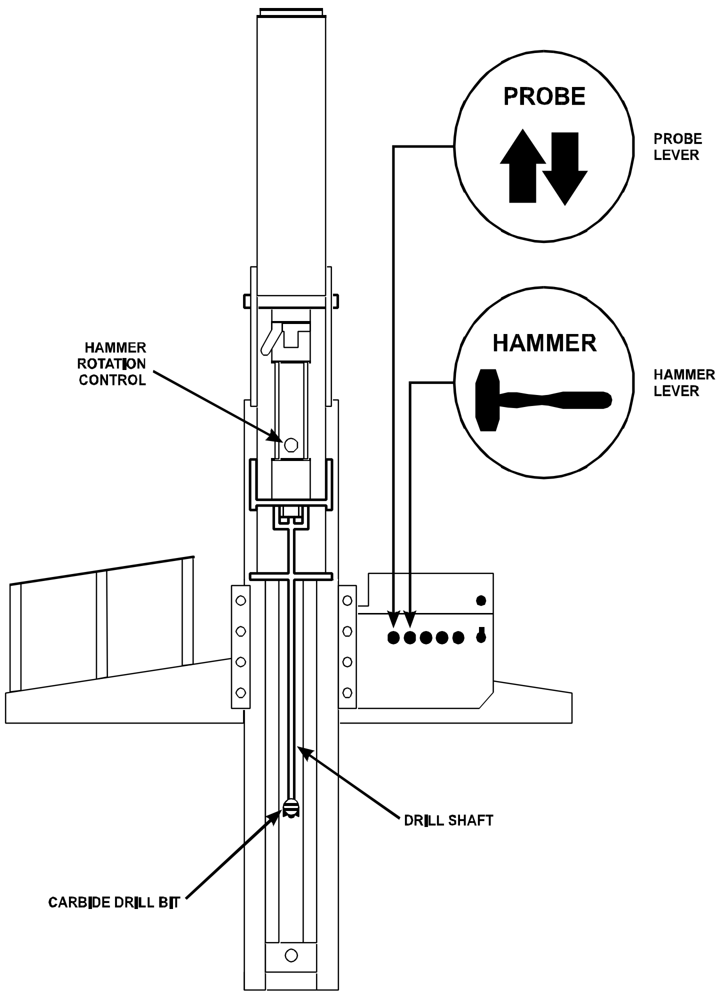
FIGURE 3. Deployment of Geoprobe™ from Sampling Vehicle



APPENDIX A (Cont'd)

Figures

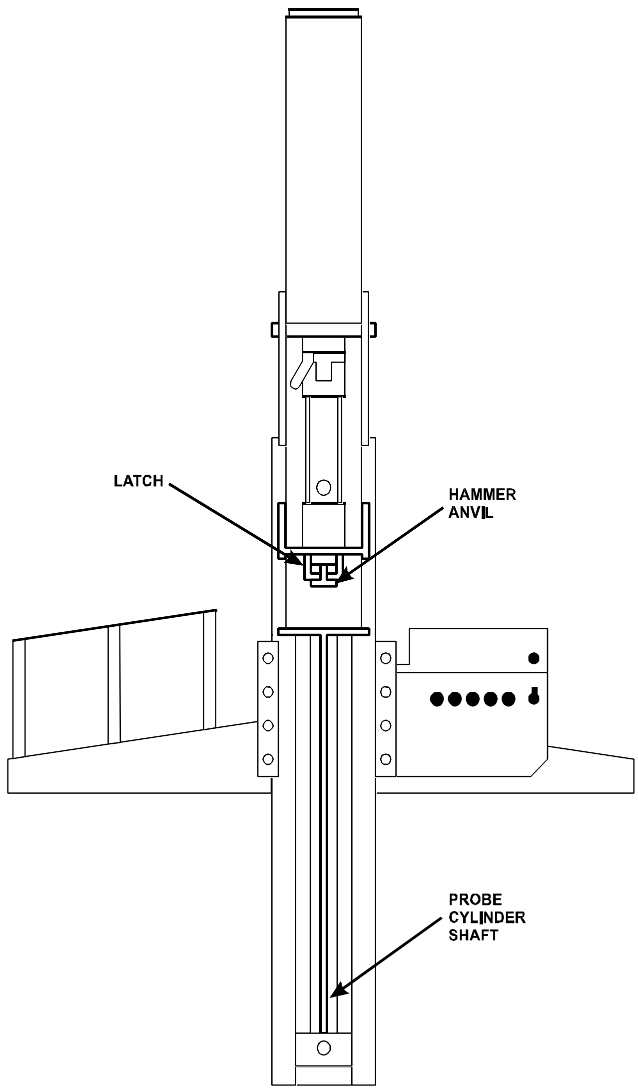
FIGURE 4. Geoprobe^{TM} Setup for Drilling Through Concrete and Pavement



APPENDIX A (Cont'd)

Figures

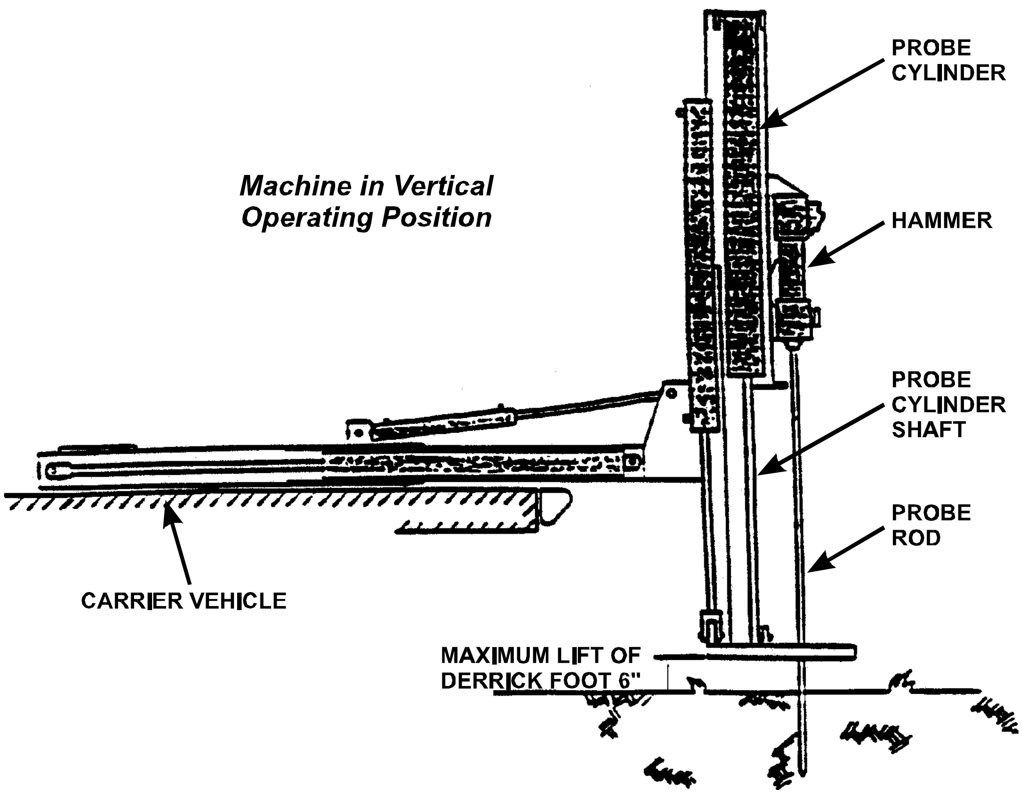
FIGURE 5. Inserting Hammer Anvil



APPENDIX A (Cont'd)

Figures

FIGURE 6. Probe Cylinder Shaft and Probe Rod - Parallel and Vertical



APPENDIX D
UNANTICIPATED CULTURAL RESOURCE DISCOVERY

APPENDIX D
Addressing Unanticipated Cultural Resource Discoveries

1.0 Recognizing Cultural Resources

This Targeted Brownfields Assessment is not anticipated to impact any known cultural resources, but the disturbance of Site soils carries the potential of unanticipated discovery.

Cultural Resources can be defined as physical evidence of historic human activity. Unanticipated discoveries of cultural resources during an environmental assessment can include but are not limited to:

- Undocumented structural and engineering features or undocumented archaeological resources, such as foundation remains, burials, artifacts, or other evidence of human occupation or activity
- Undocumented human remains
- Undocumented Native American grave sites, including human remains, funerary objects, sacred objects, or objects of cultural patrimony

2.0 Initial Discovery Procedures

If any unanticipated cultural resource concerns are encountered during the assessment, WESTON will follow the steps below:

1. *STOP WORK*. If any WESTON, EPA, Stakeholder, Contractor, or other Site personnel or visitor believes that he or she has uncovered any cultural resource at any point in the project, all work within 50-feet of the site of discovery must be immediately halted. The discovery location should not be left unsecured at any time.
2. *NOTIFY MONITOR*. If there is an archaeological monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow its provisions.
3. *NOTIFY THE EPA PROJECT MANAGER*. The WESTON Project Lead will notify the EPA Project Manager (PM) in order to evaluate the cultural resources and potential impacts. The EPA PM will notify the American Samoa Historic Preservation Office (ASHPO).

3.0 Resource Specific Procedures

3.1 *Unanticipated Discovery of Structural or Archaeological Resources*

If any undocumented structural and engineering features or undocumented archaeological resources, such as foundation remains, burials, artifacts, or other evidence of human occupation or activity features are encountered during the assessment, WESTON will suspend work at the site of discovery and consult with the EPA PM in order to evaluate the cultural resources and potential impacts.

In the event that unintentional partial damage occurs to an NRHP eligible site, WESTON will immediately notify the EPA PM and document any damage. The EPA PM will contact the ASHPO.

3.2 *Unanticipated Discovery of Human Remains*

In the event that human remains are encountered, WESTON will suspend activities within a 50-foot radius of the area of discovery and make an effort to protect the resources while notifying the EPA PM. WESTON will also contact the local coroner. The EPA PM with the help of a coroner or physical or forensic anthropologist will determine if the remains are human, and whether or not they are associated with an archaeological deposit. If the remains are not human and are not associated with an archaeological deposit, the work may continue. If the remains are human, the appropriate law enforcement officials should be notified. These officials will visit the site with the EPA PM and determine, with the aid of a coroner or physical/forensic anthropologist, if the remains are recent or ancient.

If the remains are recent, then the matter becomes the responsibility of law enforcement officials who will determine when project activities will resume. If the remains are not modern and not Native American, the EPA PM will identify adequate protection and treatment options and what potential actions may be taken to resolve any impacts at the Site. The EPA PM will submit a thorough investigation report upon completion of the fieldwork to document compliance.

If the remains are determined to be of Native American origin, specific regulations must be followed as described below in Section 3.3.

3.3 *Unanticipated Discovery of Native American Grave Sites*

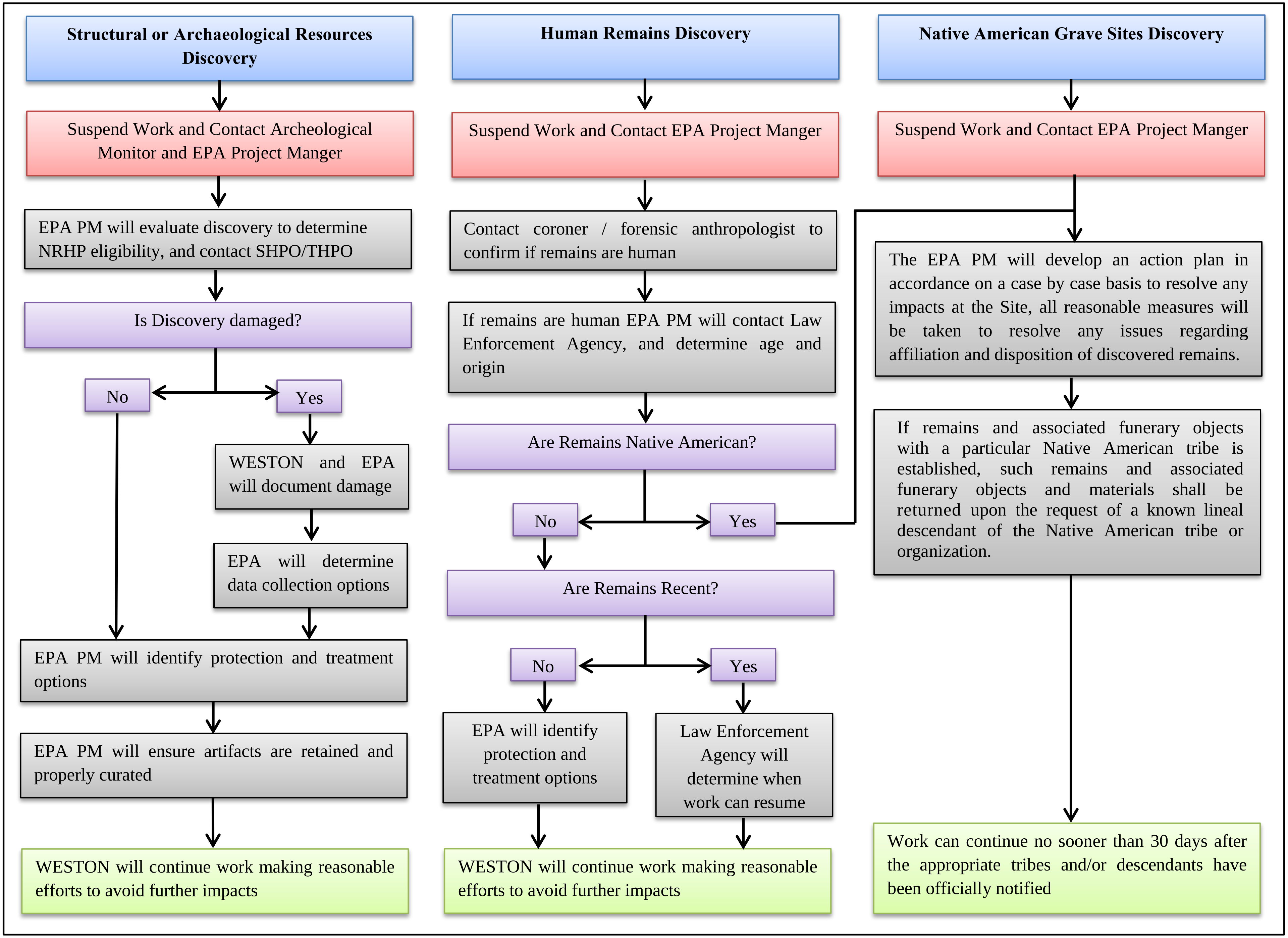
In the event that Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony are encountered, WESTON will suspend activities within a 50-foot radius of the area of discovery and make an effort to protect the resources while notifying the EPA PM. As required by the Native American Graves Protection and Repatriation Act (NAGPRA), all assessment activities in the area of discovery will cease for 30 days after the appropriate Federally recognized tribes and/or lineal descendants have been officially notified. The EPA PM will develop an action plan in accordance with 43 CFR 10 on a case by case basis to resolve any impacts at the Site. All reasonable measures will be taken to resolve any issues regarding affiliation and disposition of discovered remains. In accordance with NAGPRA, if the cultural affiliation of Native American human remains and associated funerary objects with a particular Native American tribe is established, such remains and associated funerary objects and materials shall expeditiously be returned upon the request of a known lineal descendant of the Native American tribe or organization.

4.0 Contact Information

In the event that cultural resources are encountered during this assessment, the following contacts have been identified:

Role	Agency	Name	Phone
WESTON Project Lead	WESTON	Shawn Carrier	(808) 275-2931
EPA Project Manager	EPA	Noemi Emeric-Ford	(213) 244-1821
Stakeholder Contact	State of Hawaii Department of Accounting and General Services	To be determined	To be provided
State/Tribal Historic Preservation Office	ASHPO	Susan Lebo, PhD Archeological Branch Chief	(808) 692-8019
Local Coroner	Honolulu Medical Examiner Office	Christopher Happy	(808) 768-3090

Figure D-1 – Unexpected Cultural Resource Discovery Work Flow



APPENDIX E
HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN (HASP)-FORM 1

Prepared by: Shawn D. Carrier | **W.O. Number:** 20074.063.510.1007 | **Date:** May 24, 2018

Project Identification
Office: Walnut Creek, CA
Site Name: North King Street TBA
Client: USEPA
Work Location Address: 333/351 North King St. Honolulu, HI 96813

Site History:
The Site, a former railway line and automotive fueling and services facility, occupies 3.79 acres located around 333/351 North King Street in Honolulu, Oahu, Hawaii. From 1889 to 1962, the Site was utilized as a railway line and station depot. From the mid-1950s to the mid-1970s, an automotive fueling and service station was operated. The Site is abandoned except for the former station depot, the Oahu Railway and Line (OR&L) Building which is a State of Hawaii historic building and is currently being used as an office building. The site is owned by the State of Hawaii Department of Accounting and General Services (DAGS). The State of Hawaii would like to redevelop the property and would like to determine whether the Site has limitations based on historical usage and residual contamination.

Scope of Work:
Sampling at the Site will include surface and subsurface soil sampling to be collected from nine decision units, soil gas sampling from 3 temporary soil gas implants, and asbestos-containing materials (ACM) and lead-based paint (LBP) sampling during a hazardous building survey of one onsite building (OR&L Annex and storage building). Soil sampling will be conducted using direct-push drilling technology and soil samples will be collected for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), metals, and/or semivolatile organic compounds (SVOCs). Drilling activities will be performed by a WESTON-procured subcontractor. Weston will notify utility location service prior to sampling and drilling activities, and will secure a private utility locator, if necessary.

☐ Site visit only; site HASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA / SARA RCRA Other

Federal Agency

☒ USEPA	☐ USDA	☐ DOE
☐ State	☐ State	☐ USACE
☐ NPL Site	**NRC**	☐ Air Force
☐ OSHA	☐ 10 CFR 20	☐ ________

Hazard Communication (Req'd - See Attachment D)
☐ 1910 ☐ 1926 ☐ State

Safety Officer Manual (Required to be On-Site)
Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

☐ Stack Test	☐ ______________
☐ Air Emissions	☐ ______________
☒ Asbestos	☐ ______________
☐ Industrial Hygiene	☐ ______________
☐ ______________	☐ ______________

Review and Approval Documentation:

Reviewed by:
SO/DSM/CHS ______________________ Date: ________
Name (Print) Signature

Approved by:
Project Manager Shawn Carrier Date: ________
Name (Print) Signature

Hazard Assessment and Equipment Selection:
In accordance with WESTON's Personal Protective Equipment Program and 29 CFR 1910.132, at the site prior to personnel beginning work, the SHSC and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this HASP is appropriate for the hazards known or expected to exist. (Refer to Safety Officer Manual Section 2, Personal Protection Program, for guidance.)

☐ SHSC ☒ Site Manager Shawn Carrier Date: ________
Name (Print) Signature

Project start date: August 1, 2018 End date: *To be determined*	This site HASP **must** be r**eissued/reapproved** for any activities conducted after: Date: 01/01/2019	Amendment date(s) By: 1. 2. .

WESTON REPRESENTATIVES-FORM 2			
Organization/Branch	**Name/Title**	**Address**	**Telephone**
WESTON/Walnut Creek	Joe DeFao Program Manager	1340 Treat Boulevard, Ste 210 Walnut Creek, CA 94597	(510) 788-3820
WESTON/Walnut Creek	Shawn Carrier Project Manager, Field Manager	841 Bishop Street, Ste. 2301 Honolulu, HI 96813	(808) 275-2931

Roles and Responsibilities: The Project Manager is responsible for management of the site investigation work assignment. The Field Sampling QC Coordinator is responsible for making sure that field QC requirements are met during the sampling event. The Field Manager is responsible for completion of technical and field activities associated with this site investigation.

WESTON SUBCONTRACTORS			
Organization/Branch	**Name/Title**	**Address**	**Telephone**
Drilling	Kevin Rogers / GeoTek Hawaii	94-59 Leokane St. Waipahu, HI 96797	(808) 223-9810
Laboratory	Jill Kellmann Test America	765 Amana Street, Suite 308 Honolulu, HI 96814	(916) 374-4402
Laboratory	Carla Hollowell Eurofins CalScience	7440 Lincoln Way Garden Grove, CA 92841	(714) 895-5494

Roles and Responsibilities: Geoprobe drilling services, laboratory analysis of soil and soil gas samples, and hazardous building survey to collect ACM and LBP samples.

SITE-SPECIFIC HEALTH AND SAFETY PERSONNEL

The Site Health and Safety Coordinator (SHSC) for activities to be conducted at this site is: Shawn Carrier

The SHSC has total responsibility for ensuring that the provisions of this Site HASP are adequate and implemented in the field.

Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.

Qualifications: 40-Hour HAZWOPER, current 8-Hour HAZWOPER Refresher, 8-Hour HAZWOPER Supervisor, First Aid, CPR, BBP

Designated alternates include: Travis Defries /Christine Kline

The Dangerous Goods Shipper for activities to be conducted at this site is: ______________________________

☒ Dangerous Goods Shipping not required for this site because only environmental samples will be shipped.

Qualifications:

Designated alternates include:

The Environmental Compliance Officer (ECO) for activities to be conducted at this site is:

The ECO has total responsibility for ensuring that the provisions of the Site EC Plan are adequate and implemented in the field.

Qualifications: Hazardous Waste Management & Shipping for Environmental Professionals

Designated alternates include:

HEALTH AND SAFETY EVALUATION-FORM 3

Hazard Assessment

Background Review: ☐ Complete ☒ Partial

If partial why? Soil sampling has been limited to subsurface soil at this site. The HASP will be amended to include hazards noted during the field activities.

Activities Covered Under This Plan:

No.	Task/Subtask	Description	Schedule
1	Soil Sampling	9 MIS samples will be collected from the former railway line and UST area	August 2018
2	Soil Gas Sampling	3 samples will be collected from the former UST area.	August 2018

Types of Hazards:

The number 1 refers to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical 1
- ☐ Flammable
- ☐ Explosive
- ☐ Corrosive
- ☐ Reactive
- ☐ O_2 Rich
- ☐ O_2 Deficient

Chemically Toxic 1
- ☐ Inhalation
- ☐ Carcinogen
- ☒ Ingestion
- ☐ Mutagen
- ☒ Contact
- ☐ Teratogen
- ☒ Absorption
- ☐ OSHA 1910.1000 Substance (Air Contaminants)
- ☒ OSHA Specific Hazard Substance Standard (Refer to following page for listing)

Radiation 3

Ionizing:
- ☐ Internal exposure
- ☐ External exposure

Non-ionizing:
- ☒ UV
- ☐ IR
- ☐ RF
- ☐ MicroW
- ☐ Laser

Biological 2
- ☐ Etiological Agent
- ☒ Other (plant, insect, animal)

☒ **Physical Hazards 4**
- ☐ Construction Activities

Source/Location of Contaminants and Hazardous Substances:

Directly Related to Tasks
- ☐ Air
- ☐ Other Surface
- ☐ Groundwater
- ☒ Soil
- ☐ Surface Water
- ☐ Sanitary Wastewater
- ☐ Process Wastewater
- ☒ Other: Building Materials (ACM and LBP)

Indirectly Related to Tasks — Nearby Process(es) That Could Affect Team Members:
- ☐ Client Facility/WESTON Work Location
- ☐ Nearby Non-Client Facility

Describe:

- ☒ Have activities (task[s]) been coordinated with facility?

HEALTH AND SAFETY EVALUATION—CHEMICAL HAZARDS OF CONCERN-FORM 4 (REVISED 02/1998)			
☐ **N/A** Chemical Contaminants of Concern Provide the data requested for chemical contaminants on HASP Form 25 or attach data sheets from an acceptable source such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, etc. List chemicals and concentrations below and locate data sheets in Attachment B of this HASP.		☐ **N/A** Identify hazardous materials used or on-site and attach Material Safety Data Sheets (MSDSs) for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all subcontractors and other parties working nearby are informed of the presence of these chemicals and the location of the MSDSs. Obtain from subcontractors and other parties, lists of the hazardous materials they use or have on-site and identify location of the MSDSs here. List chemicals and quantities below and locate MSDSs in Attachment B of this HASP.	
Chemical Name	**Concentration (if known)**	**Chemical Name**	**Quantity**
Metals (Chromium, iron, manganese, thallium)	~background levels	HNO3	10%
SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenzo[a,h]anthracene)	2.395 to 9.745 mg/kg		
TPH (GRO, DRO, RRO)	Unknown site wide/surface soil		
VOCs	Unknown site wide/surface soil		
Lead-Based Paint	Unknown		
Asbestos	Unknown		

OSHA-SPECIFIC HAZARDOUS SUBSTANCES

The following substances may require specific medical, training, or monitoring based on concentration or evaluation of risk. See the appropriate citation listed under 29 CFR 1910 or 1926 for additional information.

☒ 1910.1001 Asbestos	☐ 1910.1002 Coal tar pitch volatiles	☐ 1910.1003 4-Nitrobiphenyl, etc.	☐ 1910.1004 alpha-Naphthylamine
☐ 1910.1005 [Reserved]	☐ 1910.1006 Methyl chloromethyl ether	☐ 1910.1007 3,3'-Dichlorobenzidine (and its salts)	☐ 1910.1008 bis-Chloromethyl ether
☐ 1910.1009 beta-Naphthylamine	☐ 1910.1010 Benzidine	☐ 1910.1011 4-Aminodiphenyl	☐ 1910.1012 Ethyleneimine
☐ 1910.1013 beta-Propiolactone	☐ 1910.1014 2-Acetylaminofluorene	☐ 1910.1015 4-Dimethylaminoazobenzene	☐ 1910.1016 N-Nitrosodimethylamine
☐ 1910.1017 Vinyl chloride	☐ 1910.1018 Inorganic arsenic	☒ 1910.1025 Lead (Att. FLD# 46)	☐ 1910.1027 Cadmium
☐ 1910.1028 Benzene	☐ 1910.1029 Coke oven emissions	☐ 1910.1043 Cotton dust	☐ 1910.1044 1,2-Dibromo-3-chloropropane
☐ 1910.1045 Acrylonitrile	☐ 1910.1047 Ethylene oxide	☐ 1910.1048 Formaldehyde	☐ 1910.1050 Methylenedianiline
☐ 1910.1051 1,3 Butadiene	☐ 1910.1052 Methylene chloride		

HEALTH AND SAFETY EVALUATION — 2 BIOLOGICAL HAZARDS OF CONCERN-FORM 5	
☐ **Poisonous Plants** (FLD 43) Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No	☒ **Insects** (FLD 43) Location/Task No(s).: Source: ☐ Known ☒ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☒ Contact ☒ Direct Penetration Team Member(s) Allergic: ☐ Yes ☒ No Immunization required: ☐ Yes ☒ No
☐ **Snakes, Reptiles** (FLD 43) Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No	☐ **Animals** (FLD 43) Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No
FLD 43 — WESTON Biohazard Field Operating Procedures: Att. OP ☐	
☐ **Sewage** Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No Tetanus Vaccination within Past 10 yrs: ☐ Yes ☐ No	☐ **Etiologic Agents (List)** Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No
FLD 44 — WESTON Bloodborne Pathogens Exposure Control Plan – First Aid Procedures: Att. OP ☒	
FLD 45 — WESTON Bloodborne Pathogens Exposure Control Plan – Working with Infectious Waste: Att. OP ☐	

HEALTH AND SAFETY EVALUATION — 3 RADIATION HAZARDS OF CONCERN-FORM 6 (REVISED 02/1998)

NONIONIZING RADIATION

Task No.	Type of Nonionizing Radiation	Source On-Site	TLV/PEL	Wavelength Range	Control Measures	Monitoring Instrument
1, 2	Ultraviolet	Sun			Sunscreen, stay hydrated	
N/A	Infrared					
N/A	Radio Frequency					
N/A	Microwave					
N/A	Laser					

IONIZING RADIATION

Task No.	Radionuclide	Major Radiations	Radioactive Half-Life (Years)	DAC (μCii/mL)			Surface Contamination Limit	Monitoring Instrument
				D	W	Y		

HEALTH AND SAFETY EVALUATION — 4 PHYSICAL HAZARDS OF CONCERN-FORM 7			
Phy. Haz. Cond.	**Physical Hazard**	**Attach OP**	**WESTON OP Titles**
Loud noise	Hearing loss/disruption of communication	☒	FLD01 - Noise Protection
Inclement weather	Rain/humidity/cold/ice/snow/lightning	☒	FLD02 - Inclement Weather
Steam heat stress	Burns/displaced oxygen/wet working surfaces	☐	FLD03 - Hot Process - Steam
Heat stress	Burns/hot surfaces/low pressure steam	☐	FLD04 - Hot Process - LT3
Ambient heat stress	Heat rash/cramps/exhaustion/heat stroke	☒	FLD05 - Heat Stress Prevention/Monitoring
Cold stress	Hypothermia/frostbite	☐	FLD06 - Cold Stress
Cold/wet	Trench/paddy/immersion foot/edema	☐	FLD07 - Wet Feet
Confined spaces	Falls/burns/drowning/engulfment/electrocution	☐	FLD08 - Confined Space Entry
Explosive vapors	Thermal burns/impaction/dismemberment	☐	FLD09 - Hot Work
Improper lifting	Back strain/abdomen/arm/leg muscle/joint injury	☒	FLD10 - Manual Lifting/Handling Heavy Objects
Uneven surfaces	Vehicle accidents/slips/trips/falls	☐	FLD11 - Rough Terrain
Poor housekeeping	Slips/trips/falls/punctures/cuts/fires	☒	FLD12 - Housekeeping
Structural integrity	Crushing/overhead hazards/compromised floors	☐	FLD13 - Structural Integrity
Hostile persons	Bodily injury	☒	FLD14 - Site Security
Remote area	Slips/trips/falls/back strain/communication	☐	FLD15 - Remote Area
Improper cyl. handling	Mechanical injury/fire/explosion/suffocation	☐	FLD16 - Pressure Systems - Compressed Gases
Water hazards	Poor visibility/entanglement/drowning/cold stress	☐	FLD17 - Diving
Water hazards	Drowning/heat/cold stress/hypothermia/falls	☐	FLD18 - Operation and Use of Boats
Water hazards	Drowning/frostbite/hypothermia/falls/electrocution	☐	FLD19 - Working Over Water
Vehicle hazards	Struck by vehicle/collision	☒	FLD20 - Traffic
Explosions	Explosion/fire/thermal burns	☐	FLD21 - Explosives
Moving mechanical parts	Crushing/pinch points/overhead hazards/electrocution	☐	FLD22 - Heavy Equipment Operation
Moving mech. parts	Overhead hazards/electrocution	☐	FLD23 - Cranes/Lifting Equipment Operation
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD24 - Aerial Lifts/Manlifts
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD25 - Working at Elevation
Working at elevation	Overhead hazards/falls/electrocution/slips	☐	FLD26 - Ladders
Working at elevation	Slips/trips/falls/overhead hazards	☐	FLD27 - Scaffolding
Trench cave-in	Crushing/falling/overhead hazards/suffocation	☐	FLD28 - Excavating/Trenching
Improper material handling	Back injury/crushing from load shifts	☐	FLD29 - Materials Handling
Physiochemical	Explosions/fires from oxidizing, flam./corr. Material	☐	FLD30 - Hazardous Materials Use/Storage
Physiochemical	Fire and explosion	☐	FLD31 - Fire Prevention/Response Plan Required
Physiochemical	Fire	☐	FLD32 - Fire Extinguishers Required
Structural integrity	Overhead/electrocution/slips/trips/falls/fire	☐	FLD33 - Demolition
Electrical	Electrocution/shock/thermal burns	☒	FLD34 - Utilities
Electrical	Electrocution/shock/thermal burns	☐	FLD35 - Electrical Safety
Burns/fires	Heat stress/fires/burns	☐	FLD36 - Welding/Cutting/Burning
Impact/thermal	Thermal burns/high pressure impaction/heat stress	☐	FLD37 - High Pressure Washers
Impaction/electrical	Smashing body parts/pinching/cuts/electrocution	☒	FLD38 - Hand and Power Tools
Poor visibility	Slips/trips/falls	☐	FLD39 - Illumination
Fire/explosion	Burns/impaction	☐	FLD40 - Storage Tank Removal/Decommissioning
Communications	Disruption of communications	☐	FLD41 - Std. Hand/Emergency Signals
Energy/release	Unexpected release of energy	☐	FLD42 - Lockout/Tagout
General field work	Insects, plants, animals, snakes, reptiles (Haz. Eval. Form 2)	☒	FLD43 - Biological Hazards
Providing first aid	HBV, HIV (Haz. Eval. Form 2)	☒	FLD44 - BBP for First Aid Providers
Handling infectious waste	HBV, HIV (Haz. Eval. Form 2)	☐	FLD45 - BBP for Infectious Waste
Lead contaminated sites	Lead poisoning	☒	FLD46 - Control of Exposure to Lead
Puncture/cuts	Cuts/dismemberment/gouges	☐	FLD47 – Clearing, Grubbing and Logging Operations
Not applicable	Not applicable	☐	FLD48 – OSHA Inspections
Drilling hazards	Electrocution/overhead hazards/pinch points	☒	FLD56 - Drilling Safety Guide

TASK-BY-TASK RISK ASSESSMENT-FORM 8
(COMPLETE ONE SHEET FOR EACH TASK)

TASK DESCRIPTION

TASK 1 – Soil Sampling

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Hard hat	First Aid Kit	Sample Containers
Safety Boots	Plastic Scoops	Zip-Lock Bags
Protective Glasses	Paper Towels	TerraCore Soil Sampler
Nitrile Surgical Gloves	Sample Coolers	Direct-Push Drill Rig

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What justifies risk level?

Potential risk of exposure to TPHs, VOCs, metals, and/or SVOCs. Use of nitrile gloves and good housekeeping protocols will minimize contact with potential contaminants. A PID will be utilized for monitoring during sampling in the UST area.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What justifies risk level?

Potential hazards include the presence of heavy drilling equipment and machinery; focus on the placement of hands and feet, as well as avoidance of unsafe lifting practices will prevent physical injuries. During site activities, emphasis will be placed on minimizing possibility of slips, trips, and falls.

Biological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

Insects, such as spiders, may be present at work locations. The property shows signs of homeless people activity. Use of insect repellant, gloves and general awareness will be implemented.

Radiological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

Given the time of year and work location, sun exposure is expected. Use of sunscreen and consumption of fluids will be implemented during field activities.

LEVELS OF PROTECTION/JUSTIFICATION

Level D; no inhalation pathway hazards are known or suspected.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All field activities will be performed in accordance with this HASP and WESTON's standard operating procedures outlined in WESTON's Safety Officer Field Manual.

FLD01, FLD02, FLD05, FLD10, FLD12, FLD14, FLD20, FLD34, FLD38, FLD43, FLD44, FLD46, and FLD56.

TASK-BY-TASK RISK ASSESSMENT-FORM 8
(COMPLETE ONE SHEET FOR EACH TASK)

TASK DESCRIPTION

TASK 2 – Soil Gas Sampling

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Hard hat	First Aid Kit	Sample Containers
Safety Boots	Plastic Tubing	PID
Protective Glasses	Silicone Tubing	Multi-Gas Meter
Nitrile Surgical Gloves	Sample Coolers	Direct-Push Drill Rig

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What justifies risk level?

Potential risk of exposure to TPHs, VOCs, metals, and/or SVOCs. Use of nitrile gloves and good housekeeping protocols will minimize contact with potential contaminants. A PID will be utilized for monitoring during sampling in the UST area.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What justifies risk level?

Potential hazards include the presence of heavy drilling equipment and machinery; focus on the placement of hands and feet, as well as avoidance of unsafe lifting practices will prevent physical injuries. During site activities, emphasis will be placed on minimizing possibility of slips, trips, and falls.

Biological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

Insects, such as spiders, may be present at work locations. The property shows signs of homeless people activity. Use of insect repellant, gloves and general awareness will be implemented.

Radiological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

Given the time of year and work location, sun exposure is expected. Use of sunscreen and consumption of fluids will be implemented during field activities.

LEVELS OF PROTECTION/JUSTIFICATION

Level D; no inhalation pathway hazards are known or suspected.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All field activities will be performed in accordance with this HASP and WESTON's standard operating procedures outlined in WESTON's Safety Officer Field Manual.

FLD01, FLD02, FLD05, FLD10, FLD12, FLD14, FLD20, FLD34, FLD38, FLD43, FLD44, FLD46, and FLD56.

PERSONNEL PROTECTION PLAN-FORM 9 (REVISED 02/1998)

Engineering Controls
Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s)

1	Level D Personal Protection Equipment
2	Level D Personal Protection Equipment

Administrative Controls
Describe Administrative Controls used as part of Personnel Protection Plan:

Task(s)

1, 2	An initial health and safety tailgate meeting will be held at the site before work commences. Work will be completed in accordance with this HASP under the supervision/guidance of the SHSC.

Personal Protective Equipment
Action Levels for Changing Levels of Protection. Refer to HASP Form 13, Site Air Monitoring Program—Action Levels. Define Action Levels for up or down grade for each task:

Task(s)

1, 2	Level D. Persistent dust that does not dissipate – stop work..

DESCRIPTION OF LEVELS OF PROTECTION

Level D		**Level D Modified**
Task(s): All		**Task(s): All**
☒ Head	Hard Hat	☐ Head
☒ Eye and Face	Safety glasses	☐ Eye and Face
☒ Hearing	Earplugs as necessary	☐ Hearing
☐ Arms and Legs Only		☐ Arms and Legs Only
☐ Appropriate Work Uniform	Coveralls, or appropriate clothing	☐ Whole Body
☒ Hand - Gloves	Nitrile	☐ Apron
☒ Foot - Safety Boots	Steel Toe	☐ Hand - Gloves
☐ Fall Protection		☐ Gloves
☐ Flotation		☐ Foot - Safety Boots
☐ Other		☐ Over Boots

DESCRIPTION OF LEVELS OF PROTECTION-FORM 10	
Level C – N/A	**Level B – N/A**
Task(s): All	**Task(s):**
☐ Head	☐ Head
☐ Eye and Face	☐ Eye and Face
☐ Hearing	☐ Hearing
☐ Arms and Legs Only	☐ Arms and Legs Only
☐ Whole Body	☐ Whole Body
☐ Apron	☐ Apron
☐ Hand - Gloves	☐ Hand - Gloves
☐ Gloves	☐ Gloves
☐ Gloves	☐ Gloves
☐ Foot - Safety Boots	☐ Foot - Safety Boots
☐ Outer Boots	☐ Outer Boots
☐ Boots (Other)	☐ Boots (Other)
☐ Half Face	☐ SAR - Airline
☐ Cart./Canister	☐ SCBA
☐ Full Face	☐ Comb. Airline/SCBA
☐ Cart./Canister	☐ Cascade System
☐ PAPR	☐ Compressor
☐ Cart./Canister	☐ Fall Protection
☐ Type C	☐ Flotation
☐ Fall Protection	☐ Other
☐ Flotation	
☐ Other	

SITE OR PROJECT HAZARD MONITORING PROGRAM-FORM 11						
Air Monitoring Instruments						
Instrument Selection and Initial Check Record Reporting Format: ☒ Field Notebook ☐ Field Data Sheets* ☐ Air Monitoring Log ☐ Trip Report ☐ Other						
Instrument	**Task No.(s)**	**Number Required**	**Number Received**	**Checked Upon Receipt**	**Comment**	**Initials**
☐ CGI				☐		
☐ O_2				☐		
☐ CGI/O_2				☐		
☐ CGI/O_2/tox-PPM, H_2S,H_2S/CO				☐		
☐ RAD				☐		
☐ GM (Pancake)				☐		
☐ NaI (Micro R)				☐		
☐ ZnS (Alpha Scintillator)				☐		
☐ Other ______				☐		
☒ PID	1,2			☐		
☐ HNu 10.2				☐		
☐ HNu 11.7				☐		
☐ Photovac, TMA				☐		
☐ OVM				☐		
☐ Other ______				☐		
☐ FID				☐		
☐ Fox 128				☐		
☐ Heath, AID, Other				☐		
☐ RAM, Mini-RAM, Other ______				☐		
☐ Monitox				☐		
Specify: _____				☐		
☐ Personal Sampling				☐		
Specify: _____				☐		
☐ Bio-Aerosol Monitor				☐		
☐ Pump - MSA, Dräeger, Sensidyne				☐		
☐ Tubes/type: ______				☐		
☐ Tubes/type: _____				☐		
☐ Other ______				☐		

*Refer to Attachment E.

SITE OR PROJECT HAZARD MONITORING PROGRAM-FORM 12								
Air Monitoring Instruments Calibration Record								
Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

SITE AIR MONITORING PROGRAM-FORM 13

Action Levels

These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/TLV/REL. That number must also be adjusted to account for instrument response factors.

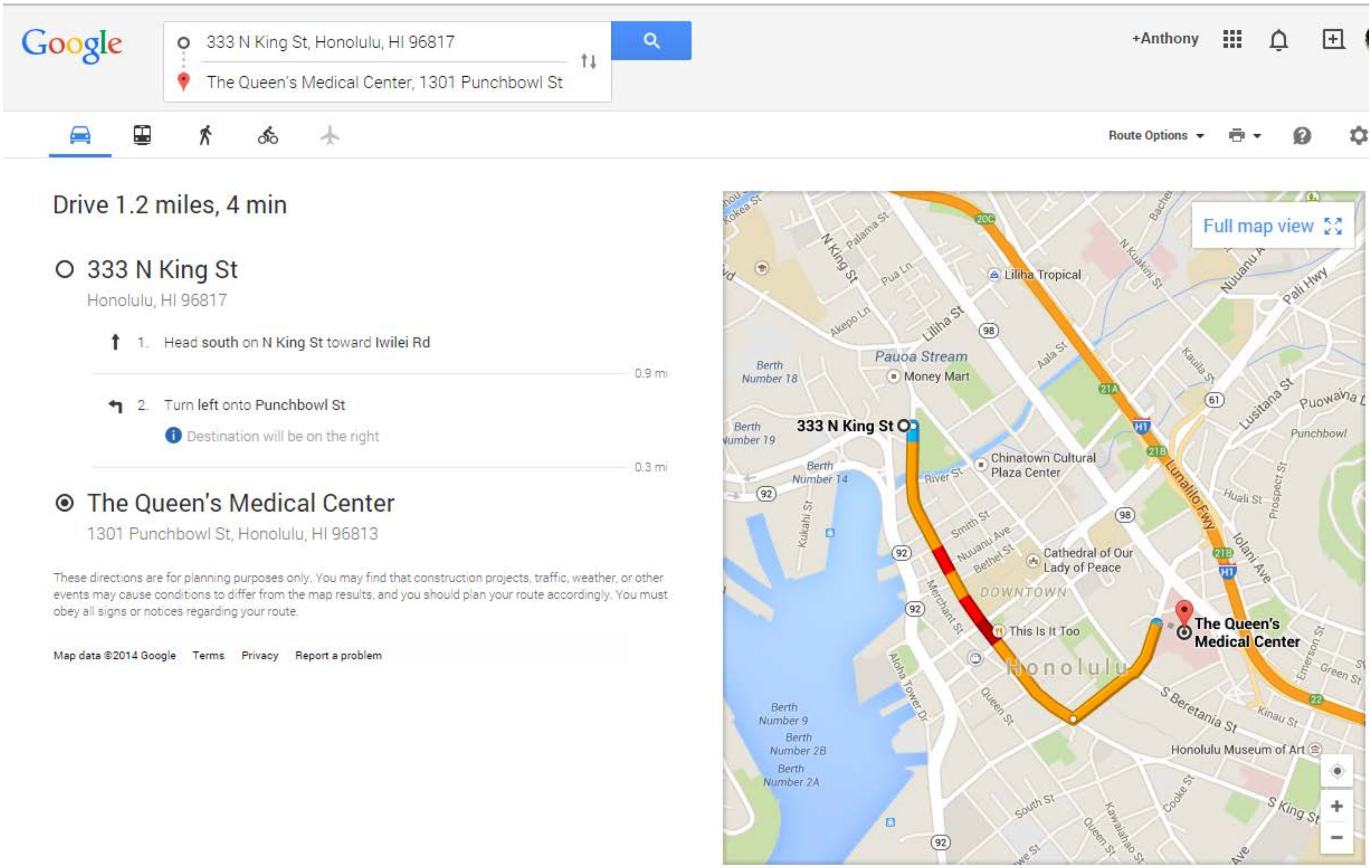
	Tasks	Action Level		Action
☐ **Explosive atmosphere**		Ambient Air Concentration	Confined Space Concentration	
		<10% LEL	0 to 1% LEL	Work may continue. Consider toxicity potential.
		10 to 25% LEL	1 to 10% LEL	Work may continue. Increase monitoring frequency.
		>25% LEL	>10% LEL	Work must stop. Ventilate area before returning.
☐ **Oxygen**		Ambient Air Concentration	Confined Space Concentration	
		<19.5% O_2	<19.5% O_2	Leave area. Re-enter only with self-contained breathing apparatus.
		19.5% to 25% O_2	19.5% to 23.5% O_2	Work may continue. Investigate changes from 21%.
		>25% O_2	>23.5% O_2	Work must stop. Ventilate area before returning.
☐ **Radiation**		< 3 times background		Continue work.
		3 times background to < 1 mR/hour		Radiation above background levels (normally 0.01-0.02 mR/hr) signifies possible radiation source(s) present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist.
		> 1 mrem/hour		Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
☒ **Organic gases and vapors**		PID readings in breathing zone (BZ) ≤ 1 ppm unit above background.		Continue working in Level D.
		PID readings in BZ consistently > 50 ppm unit above background that do not dissipate.		Cease work.
		Although PID readings greater than 50 ppm are not anticipated, the breathing zone action guidance document will be implemented if PID detects over 50 ppm.		
☐ **Inorganic gases, vapors, and particulates**	1	Negligible visible dust.		Continue working in Level D.
		Visible dust that does not dissipate.		Cease work.

CONTINGENCIES-FORM 14

Emergency Contacts and Phone Numbers		
Agency	Contact	Phone Number
Local Medical Emergency Facility (LMF)	Queens Medical Center	(808) 538-9011
WESTON Medical Emergency Contact	Dr. Patrice Marshall	(800) 874-4676
WESTON Health and Safety	Corporate Health and Safety	(505) 837-6566
Fire Department	911	911
Police Department	911	911
On-Site Coordinator- SHSC	Shawn Carrier	(808) 275-2931
Client Site Contact	Christine Kinimaka	(808)586-0499
Site Telephone or Nearest Telephone	Shawn Carrier	(808) 275-2931

Local Medical Emergency Facility(s)		
Name of Hospital: Queen's Medical Center		
Address: 1301 Punchbowl St. Honolulu, HI 96813		**Phone No:** (808) 538-9011
Name of Contact: Emergency Room		**Phone No:** 911
Type of Service: ☒ Physical trauma only ☒ Chemical exposure only ☒ Physical trauma and chemical exposure ☒ Available 24 hours	**Route to Hospital (written detail):** See following pages	**Travel time from site:** Approximately 10 minutes **Distance to hospital:** Approximately 1.2 miles **Name/no. of 24-hr ambulance service:** **911 /**

Figure 1—Route to Hospital (Map)-Form 15



CONTINGENCIES-FORM 16

Response Plans

Medical - General	First Aid Kit:	Type	Location	Special First-Aid Procedures:
Provide first aid, if trained; assess and determine need for further medical assistance. Transport, or arrange for transport, after appropriate decontamination.	(1) 5 man	General field first aid kit	WESTON field vehicle	Cyanides on-site ☐ Yes ☒ No If yes, contact LMF. Do they have antidote kit? ☐ Yes ☐ No
	Eyewash required ☒ Yes ☐ No	Type 15 min Portable Kit	Location	**HF** on-site ☐ Yes ☐ No If yes, need neutralizing ointment for first-aid kit. Contact LMF.
	Shower required ☐ Yes ☒ No	Type	Location	

Plan for Response to Spill/Release		**Plan for Response to Fire/Explosion**		**Fire Extinguishers ABC**
In the event of a spill or release, ensure safety, assess situation, and perform containment and control measures, as appropriate.	a. Cleanup per MSDSs if small; or sound alarm, call for assistance, notify Emergency Coordinator b. Evacuate to pre-determined safe place c. Account for personnel d. Determine if team can respond safely e. Mobilize per Site Spill Response Plan	In the event of a fire or explosion, ensure personal safety, assess situation, and perform containment and control measures, as appropriate:	a. Sound alarm and call for assistance, notify Emergency Coordinator b. Evacuate to predetermined safe place c. Account for personnel d. Use fire extinguisher <u>only if safe and trained</u> in its use e. Stand by to inform emergency responders of materials and conditions	Type/Location ABC/WESTON field vehicle ____/______ ____/______ ____/______ ____/______ ____/______
Description of Spill Response Gear ______ ______ ______ ______	Location ______ ______ ______ ______	Description (Other Fire Response Equipment) ______ ______ ______ ______		Location ______ ______ ______ ______

Plan to Respond to Security Problems

Local police shall be contacted in the event of a security problem – Dial 911.

DECONTAMINATION PLAN-FORM 17

Personnel Decontamination

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each level of protection are attached.

Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐ Level B ☐ Level C ☒ Level D

Modifications include: None

Disposition of Decontamination Wastes

Used PPE and disposable sampling equipment will be bagged in plastic trash bags and disposed of as municipal trash.

Decontamination fluids and rinse-water generated during sampling will consist of dilute isopropanol/methanol, deionized water, residual contaminants, and water with non-phosphate detergent. The small quantity of liquids will be allowed to evaporate onsite.

Excess soil obtained from collecting sub-surface soil samples with the direct-push hydraulic rig will be returned to the borings from which they were derived.

Equipment Decontamination

Not Applicable.

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

If non-dedicated sampling equipment is used, it will be washed in a tub with a mixture of potable water and non-phosphate detergent and scrubbed with brushes; 10% nitric acid rinse, rinsed three times with deionized water, and allowed to air dry between sample locations. Decontamination fluids and rinse-water that will be generated in the sampling event will consist of dilute isopropanol/methanol, HNO3, deionized water, residual contaminants, and water with non-phosphate detergent. The decontamination fluid will be allowed to evaporate onsite.

LEVEL D/MODIFIED LEVEL D DECONTAMINATION PLAN-FORM 18	
Check indicated functions or add steps, as necessary:	
Function	**Description of Process, Solution, and Container**
☒Segregated equipment drop	Plastic sheeting and/or clean with a damp towel.
☐Boot cover and glove wash	
☐Boot cover and glove rinse	
☐Tape removal - outer glove and boot	
☐Boot cover removal	
☒Outer glove removal	Remove inside-out. Double-bag for disposal.
HOTLINE	
☐Suit/safety boot wash	
☐Suit/boot/glove rinse	
☐Safety boot removal	
☐Suit removal	
☐Inner glove wash	
☐Inner glove rinse	
☐Inner glove removal	
☐Inner clothing removal	
CONTAMINATION REDUCTION ZONE (CRZ)/SAFE ZONE BOUNDARY	
☐Field wash	
☐Redress	

Disposal Plan, End of Day:
All waste will be double-bagged in plastic trash bags.

Disposal Plan, End of Week:
All waste will be double-bagged in plastic trash bags.

Disposal Plan, End of Project:
All investigation derived waste will be non-hazardous and will be disposed of in a municipal landfill.

SITE PERSONNEL AND CERTIFICATION STATUS-FORM 21	
WESTON	
Name: Shawn Carrier **Title: Project Manager/Field Sampling QC Coordinator/SHSC** **Task(s): All** **Certification Level or Description:** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name: Travis Defries** **Title: Field Assistant** **Task(s): 1, 2** **Certification Level or Description:** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: Christine Kline **Title: Field Assistant** **Task(s): 1, 2** **Certification Level or Description:** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)

TRAINING CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926, or 29 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing: All persons, including visitors, entering any area requiring the use or potential use of any negative pressure respirator must have had, as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI, within the last 12 months. If site conditions require the use of a full-face, negative-pressure, air-purifying respirator for protection from asbestos or lead, employees must have had a qualitative fit test, administered according to OSHA 29 CFR 1910.1001 or 1025/1926, within the last 6 months.

MEDICAL CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/1910, or 29 CFR 1910.120.

The Site Health and Safety Coordinator is responsible for verifying all certifications and fit tests.

HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM-FORM 23	
Site Name: North King Street TBA	**WO#:** 20074.063.510.1007
Honolulu, Honolulu County, Oahu, Hawaii	
I understand, agree to, and will conform with the information set forth in this Health and Safety Plan (and attachments) and discussed in the personnel health and safety briefing(s).	

Name	**Signature**	**Date**

TRAINING AND BRIEFING TOPICS-FORM 24	
The following items will be covered at the site-specific training meeting, daily or periodically.	
☒ Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 I	☐ Level A
☒ Physical hazards, HASP Form 07	☐ Level B
☒ Chemical hazards, HASP Form 04	☐ Level C
☒ Animal bites, stings, and poisonous plants	☒ Level D
☐ Etiologic (infectious) agents	☐ Monitoring, 29 CFR 1910.120 (h)
☐ Site control, 29 CFR 1910.120 d	☒ Decontamination, 29 CFR 1910.120 (k)
☒ Engineering controls and work practices, 29 CFR 1910.120 (g)	☐ Emergency response, 29 CFR 1910.120 (l)
☐ Heavy machinery	☐ Elements of an emergency response, 29 CFR 1910.120 (l)
☐ Forklift	☒ Procedures for handling site emergency incidents, 29 CFR 1910.120 (l)
☐ Backhoe	☐ Off-site emergency response, 29 CFR 1910.120 (l)
☐ Equipment	☐ Handling drums and containers, 29 CFR 1910.120 (j)
☐ Tools	☐ Opening drums and containers
☐ Ladder, 29 CFR 1910.27 (d)/29 CFR 1926	☐ Electrical material handling equipment
☐ Overhead and underground utilities	☐ Radioactive waste
☐ Scaffolds	☐ Shock-sensitive waste
☐ Structural integrity	☐ Laboratory waste packs
☐ Unguarded openings - wall, floor, ceilings	☐ Sampling drums and containers
☐ Pressurized air cylinders	☐ Shipping and transport, 49 CFR 172.101, IATA
☒ Personal protective equipment, 29 CFR 1910.120 (g); 29 CFR 1910.134	☐ Tank and vault procedures
☐ Respiratory protection, 29 CFR 1910.120 (g); ANSI Z88.2	☐ Illumination, 29 CFR 1910.120 (m)
☒ Drilling Safety	☐ Sanitation, 29 CFR 1910.120 (n)
☐	☐
☐	☐
☐	☐