

Former Chevron Property Long-Term Groundwater Monitoring Plan

Prepared for
City of Bremerton

January 2013

Prepared by
Parametrix



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Prepared for

City of Bremerton

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CITATION

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a geologist licensed to practice as such, is affixed below.



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KEY TERMS

µg/l	micrograms per liter
µm	micron
AO	Agreed Order
ARI	Analytical Resources Inc.
ASTs	aboveground storage tanks
bgs	below ground surface
C	Celsius
City	City of Bremerton
cy	cubic yards
DO	Dissolved Oxygen
DQIs	data quality indicators
Ecology	Washington State Department of Ecology
EDDs	electronic data deliverables
EIM	Environmental Information Management
EPA	Environmental Protection Agency
GW	Groundwater
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HNO ₃	nitric acid
IA	Interim Action
IDW	Investigation-derived waste
LTGMP	Long-Term Groundwater Monitoring Plan
MDL	method detection limit
mg/l	milligrams per liter
ml	milliliters
MS/MSD	material sources/material sources data
MTCA	Model Toxics Control Act
mV	millivolts
MW	monitoring well
NTUs	nephelometric turbidity units
Onsite	Onsite Environmental Inc.
ORP	Oxidation-Reduction Potential
PID	Photoionization detector
PID	photoionization detector

KEY TERMS (CONTINUED)

PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QC	Quality Control
RI/FS	Remedial Investigation/Feasibility Study
Site	Former Chevron Property
SOPs	standard operating procedures
USCS	Unified Soil Classification System
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WWTP	Wastewater Treatment Plant

1. INTRODUCTION

This Long-Term Groundwater Monitoring Plan (LTGMP) describes monitoring activities for the Former Chevron Property (Site) located at 1310 Highland Avenue in Bremerton, Washington (Figure 1). Preparation of a LTGMP is a requirement of the Site's Draft Cleanup Action Work Plan (Parametrix 2012) and Agreed Order Number DE-07TCPHQ-5024 established between the Washington State Department of Ecology (Ecology) and the City of Bremerton (City). This LTGMP represents the next phase of work for the Site.

1.1 DESCRIPTION AND SITE HISTORY

The Former Chevron Property is a 1.4-acre waterfront property located adjacent to Evergreen Rotary Park on the Port Washington Narrows. The historical bulk fuel tank farm operated at the site from prior to 1946 until circa 1988 (Figure 2). Based on aerial photographs, the facility was expanded northward to its present boundaries between 1946 and 1963 (Figure 3) by the placement of fill in the intertidal zone. This filling created a relatively level "lower yard" area where commercial fueling operations were conducted. The site uplands or "upper yard" are the former location of the aboveground bulk fuel tanks (Figure 4). The majority of the site's shoreline is armored with concrete rubble or steel and wooden bulkheads.

Products handled at the tank farm consisted primarily of diesel and gasoline (Hart Crowser 1989). Fuel was offloaded from barges at a fueling pier in the Port Washington Narrows and pumped through piping to twelve aboveground storage tanks (ASTs) located in the upper yard. Fuel transfer likely occurred through underground piping as evidenced by observations made during the Interim Action (IA), when corroded steel piping was exposed in soil excavations conducted to remove hot spot soils in the lower yard. Leaks from this underground piping are the likely source of the majority of the subsurface contamination at the site. Fuel was loaded from the ASTs to tank trucks at four loading racks located in the lower yard. All aboveground structures were removed by the end of 1988 (GeoEngineers 1988).

An unknown amount of petroleum was released into the site's soil and groundwater during site tank farm operations. Site contamination was discovered by Chevron in 1988 when the tank farm was decommissioned. Chevron conducted cleanup at the site from 1988 through 2003, including the installation and operation of a vapor extraction remediation system. The City of Bremerton purchased the property in 2005 with the intention of completing the cleanup and developing the property as an addition to Evergreen Rotary Park. At the time the City purchased the property, significant contamination remained in the former tank area and operations area where tanker trucks were loaded.

Initial cleanup activities by the City consisted of a review of the site's historical data and development of cleanup approaches and preliminary cost estimates. Following this work, the City began negotiations with Ecology for establishing an Agreed Order (AO) for cleanup. Negotiations included agreement on an IA approach consisting of hot spot removal and in-place treatment of soil using chemical oxidation. Establishment of an AO provided the City with a funding opportunity under Ecology's Remedial Action Grant program. The AO was finalized on November 20, 2007, and the City began the Remedial Investigation/Feasibility Study (RI/FS) process.

RI sampling was conducted to evaluate the extent of contamination at the site. The sampling showed that the extent was similar to that seen historically, but that concentrations in soil and groundwater were generally lower. The IA was performed during the summer of 2009 and consisted of the removal of approximately 1,200 cubic yards (cy) of contaminated soil from three hot-spot areas and the in-place treatment of approximately 4,000 cy of contaminated

soil by soil mixing using a proprietary chemical oxidant (RegenOx). Results of confirmatory soil samples collected during the IA indicated that approximately 70 percent of the soil contaminant mass was destroyed by the RegenOx application. In late 2010, the City and Ecology negotiated an agreement to perform additional work including a quarterly sampling round and injection of oxygen releasing compound in select areas where elevated groundwater concentrations were observed. The results of the additional testing completed in 2011 indicated that natural attenuation is continuing to occur in groundwater.

1.2 PURPOSE AND OBJECTIVE

The primary purpose and objective of the LTGMP is to outline the long-term monitoring program to demonstrate that natural attenuation continues to occur and that a consistent reduction in contaminant concentration occurs over time.

2. PROJECT ORGANIZATION AND QUALITY ASSURANCE PLAN

2.1 PROJECT ORGANIZATION

Specific project roles and responsibilities for monitoring activities are described in Table 2-1.

Table 2-1. Project Roles and Responsibilities

Personnel	Responsibilities
David Dinkuhn Parametrix Project Manager (360) 850-5319 ddinkuhn@parametrix.com	Oversees technical team performance to ensure successful accomplishment of the project objectives.
Lara Linde Parametrix Task Manager/Field Sampler/Field Health and Safety Officer (360) 850-5332 llinde@parametrix.com	Reports directly to the Project Manager. Scopes and coordinates field effort; oversees day-to-day project activities; coordinates site access with property owner; conducts field sampling activities; coordinates sample deliveries to lab; ensures that all field sampling and handling procedures are followed and documented, and ensures that field quality assurance (QA) objectives are met. Reports to the Project Manager any deviations from the LTGMP.
Walter Harvey Parametrix Alternate Field Sampler/Field Health and Safety Officer (360) 377-0014 wharvey@parametrix.com	Reports directly to the Task Manager. Ensures all project health and safety requirements are followed; conducts field sampling activities; coordinates sample deliveries to lab; reports to the Task Manager any deviations from the LTGMP.
Lisa Gilbert Parametrix Data QA Manager (425) 458-6320 lgilbert@parametrix.com	Reports directly to Task Manager and works directly with laboratory QA manager. Reviews laboratory data; ensures chemical data quality; and performs QA evaluations of data.
David Baumeister Prime Laboratory QA Manager Onsite Environmental, Inc. (425) 883-3881 dbaumeister@onsite-env.com	Works with Subcontract Laboratory QA Manager, Data QA Manager, and Task Manager to ensure that all laboratory QA objectives are met and data package QA/QC deliverables from the laboratory are correctly documented and reported.
Mark Harris Subcontract Laboratory QA Manager Analytical Resources Inc. (206) 695-6200 markh@arilabs.com	Works with prime laboratory Data QA Manager and Task Manager to ensure that subcontract laboratory QA objectives are met and data package QA/QC deliverables from the laboratory are correctly documented and reported.

The Field Sampler will be responsible for the initial coordination of sampling and analysis activities with the analytical laboratory. The Data QA Manager may review laboratory procedures to establish that protocols for chemical analysis, quality assurance/quality control (QA/QC), and reporting are acceptable. The Data QA Manager will also act at the primary point of contact with the laboratory for any analysis or QA/QC issues arising during project completion.

The Field Sampler will be responsible for coordinating daily sampling and analysis activities with the project laboratory and for notifying the laboratory of sample delivery, ensuring samples are packaged properly for transportation and delivering samples to the laboratory.

The Data QA Manager will assess data quality by conducting data review/verification, and validation, as needed.

2.2 SPECIAL TRAINING AND CERTIFICATION

All personnel conducting sampling activities on the Site must be 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) trained per 29 CRF 1910.120 and be current with their annual 8-hour refresher course.

All personnel working at the Site will be briefed on potential site hazards, health and safety procedures, and sampling procedures. Following completion of this training, all personnel will be required to sign an acknowledgement form verifying that they have completed the task-specific training contained within the site specific Health and Safety Plan (Appendix A).

2.3 SAMPLING DOCUMENTATION AND RECORDS

The sampling records provided in Table 2-2 will be maintained for the project.

Table 2-2. Sampling and Sample Handling Records

Record	Use	Responsibility/Requirements
Field Notebook	Record significant events and observations.	Maintained by field sampler/geologist; must be bound; all entries must be factual, detailed, objective; entries must be signed and dated.
Sampling Field Data Sheet	Provide a record of each sample collected (Appendix B).	Completed, dated, and signed by sampler; maintained in project file.
Sample Label	Accompanies sample; contains specific sample identification information.	Completed and attached to sample container by sampler.
Chain-of-Custody Form	Documents chain-of-custody for sample handling (Appendix B).	Documented by sample number. Original accompanies sample.
Chain-of-Custody Seal	Seals sample shipment container (e.g., cooler) to prevent tampering or sample transference.	Completed, signed, and applied by sampler at time samples are transported.
Sampling and Analysis Request	Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed.	Completed by sampler at time of sampling/transport; copies distributed to laboratory project file.

2.3.1 Field Notebook and Field Data Sheets

A bound field notebook and/or field data sheets (Appendix B) will be maintained to provide daily records of significant events and observations that occur during field investigations. All entries are to be made in waterproof ink, signed, and dated. Pages of the field notebook are not to be removed, destroyed, or thrown away. Corrections will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated. Most corrected errors will require a footnote explaining the correction.

If an error made on a document is assigned to one person, that individual may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on a document should be corrected by the person who made the entry.

All field logs and forms will be retained in the project files.

2.3.2 Photographs

All photographs taken of field activities will be documented with the following information noted in the field notebook:

- Date, time, and location of photograph taken.
- Description of photograph taken.
- Reasons photograph was taken.
- Viewing direction.

Digital photographs will be reviewed in the field to assess quality and need to reshoot the photograph. For non-digital photographs, the photographer will review the photographs or slides when they return from developing, and compare them to the log, to ensure that the log and the photographs match.

3. QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) checks consist of measurements performed in the field and the laboratory.

3.1 FIELD METHODS

Table 3-1. Guidelines for Minimum QA/QC Samples for Field Sampling

Media	Field Duplicate	Field	
		Trip Blank	Equipment Blank
Groundwater	1 per 20 samples per analysis.	1 per cooler containing water volatile organic compounds (VOCs) samples.	1 per 20 samples (per non-disposable equipment type).

3.1.1 Field Duplicates

A minimum of one blind field duplicate will be analyzed per 20 samples. Field duplicates will be collected following field samples. Duplicate samples will be coded so the laboratory cannot discern which samples are field duplicates.

3.1.2 Trip Blanks

A trip blank shall accompany each cooler containing groundwater samples for VOCs analysis. The trip blank shall be obtained from the laboratory or will be made by filling the appropriate sample containers with certified analyte-free deionized water. Trip blanks will be analyzed for VOCs with the field samples.

3.1.3 Equipment Blanks

One equipment blank will be collected per 20 samples when non-disposable equipment is used for sampling. Equipment blanks will be collected by capturing deionized water rinsed over (or through) sampling equipment after decontamination. Equipment blanks will be analyzed for the same constituents as the field samples.

3.2 LABORATORY QA/QC METHODS

Specific procedures and frequencies for laboratory QA procedures and Quality Control (QC) analyses are detailed in the laboratory's QA Plan and standard operating procedures (SOPs) for each method. QC analyses will be performed by the laboratory according to their Ecology-approved SOPs.

3.3 FIELD INSTRUMENT/EQUIPMENT CALIBRATION, INSPECTION, AND MAINTENANCE

The types of field instruments and equipment that are anticipated to be used during sampling include, but are not limited to:

- Photoionization detector (PID).
- Multi-parameter water quality meter.

Equipment maintenance will be performed according to manufacturers' specifications by the equipment supplier. Field personnel will be responsible for inspection and calibration of field equipment. An equipment user's manual will be provided to all field personnel working with the equipment. All equipment will be inspected and calibrated prior to use. The results of calibration, as well as any problems encountered and corrective actions, will be documented in the field notebook.

3.4 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field supplies such as sample containers and trip/rinsate blank water shall be obtained from reputable suppliers and shall be certified analyte free. Records of certification shall be kept by the laboratory (for laboratory-supplied supplies) or by Parametrix in the project file. Sampling spoons and bowls shall be food-grade and shall be purchased new.

4. LONG-TERM GROUNDWATER MONITORING PROGRAM

The monitoring program will consist of two parts: installation and development of an additional monitoring well (MW) and the long-term groundwater monitoring. Both activities are described in detail in the following sections.

4.1 MONITORING WELL INSTALLATION

At Ecology's request, the City will install and develop one additional groundwater monitoring well to add to the existing monitoring well network at the Site prior to the beginning of the long-term monitoring period. This well will be installed to replace MW-20 at the location shown on Figure 5. MW-20R will provide more complete coverage of downgradient groundwater conditions and will establish a conditional point of compliance.

4.1.1 Monitoring Well Construction

Prior to drilling, a utility locate will be performed to ensure utilities will not be impacted by drilling activities. MW-20R will be installed to a depth of 15 feet below ground surface (bgs) using a hollow stem auger drill rig (or equivalent direct push/hollow stem auger combination) by a Washington State licensed driller. The diameter of the borehole is expected to be approximately 8 inches to facilitate installation of a 2-inch diameter well. During the well installation, soils will be sampled continuously, logged using the Unified Soil Classification System (USCS) on a field log (Appendix B), and screened using a photoionization detector (PID) for the presence of volatile organics. No soil samples will be collected for chemical analysis.

The well casing will be constructed of 2-inch diameter polyvinyl chloride (PVC) with the bottom 10 feet consisting of a 0.010-inch slot screen or equivalent. A sand pack (10/20 silica sand or equivalent) will be installed surrounding the well screen in addition to 2 feet above the top of the screen. The surface completion will consist of a flush monument with a locking cap. Cuttings will be contained within drums and staged at the site until disposal can be arranged. The elevation of the top of the new well casing will be surveyed using the same elevation datum as the existing wells.

Washington Administrative Code (WAC) 173-160, Minimum Standards for Construction and Maintenance of Wells, will be followed during the drilling, installation, and construction of MW-20R.

4.1.2 Well Development

Development will be accomplished by surging and over pumping to clear fines from the formation and the sand pack after a 24 hour period of inactivity to allow the grout or bentonite chip seal to set. An inertial lift pump fitted with a surge block and length of tubing will be placed in the well and temporarily attached to an electrically operated actuator to produce the pumping motion needed to discharge water. Development will be complete when the water evacuated equals a turbidity of equal to or less than 10 nephelometric turbidity units (NTUs). The 10 NTU criteria is based on the Environmental Protection Agency (EPA) sampling guidelines (EPA 2002). Water collected from the development will be containerized at the site and will be disposed of by a vacuum truck at the City's Wastewater Treatment Plant (WWTP).

Following the installation and development, MW-20R will be allowed to sit for a minimum of 24 hours prior to sampling so that undisturbed water can enter the well column. MW-20R will be surveyed with an accuracy of plus or minus 0.1 foot horizontally and plus or minus 0.01 foot vertically following installation.

4.2 LONG-TERM MONITORING

Eleven lower yard wells (MW-4R, MW-9R, MW-10R, MW-11, MW-13R, MW-20R, MW-21R, MW-22R, MW-25, MW-26R, and MW-27) shown on Figure 5 will be monitored for an initial period of 4 years on a semi-annual basis to monitor to assess both wet and dry conditions. Following the initial 4 years of monitoring, 1 year of quarterly monitoring will occur at the same wells for a total of 5 years of monitoring. Rationale for the selected wells is described in Table 4-1.

Table 4-1. Long-Term Monitoring Location Rationale

MW-4R	Hot spot monitoring near the center of the Site
MW-9R	Hot spot monitoring near the center of the Site
MW-10R	Hot spot monitoring near the center of the Site
MW-11	Monitoring south and southwestern extent of plume
MW-13R	Monitoring eastern extent of plume and conditional point of compliance
MW-20R	Monitoring western extent of plume and conditional point of compliance
MW-21R	Monitoring north and northwestern extent of plume and conditional point of compliance
MW-22R	Monitoring northeastern extent of plume and conditional point of compliance
MW-25	Monitoring south and southeastern extent of plume and conditional point of compliance
MW-26R	Monitoring north and northeastern extent of plume and conditional point of compliance
MW-27	Off-site location monitoring downgradient conditions and conditional point of compliance

The three upper yard wells (MW-16R, MW-18R, and MW-19R) will not be monitored since COCs were not detected above cleanup levels in these wells during four consecutive rounds of monitoring (Parametrix 2012).

4.2.1 Time-Series Water Levels

At the beginning of each sampling event, depths-to-groundwater will be collected at eleven lower yard wells in accordance with SOPs in Appendix C. Data from the time-series water level collection will be used to generate a potentiometric surface map for each monitoring event (Section 10).

4.2.2 Groundwater Monitoring and Sampling

Groundwater samples will be collected at each of the eleven locations shown in Figure 5 using a peristaltic pump and low flow purging methods through a multi-parameter water quality meter to monitor field parameter stabilization. Appendix C outlines SOPs for the groundwater sampling. A peristaltic pump was selected since the majority of the existing wells have an internal diameter of 1/2 inch. New disposable polyethylene tubing will be used at each sample location.

The measured purging and sampling flow rate shall be 0.5 liters per minute or less. Water quality parameters will be measured during sampling; purging shall be considered complete when the criteria shown in Table 4-2 are met over at least three 3- to 5-minute monitoring periods. A minimum of five sets of field parameters must be recorded prior to sample collection. Samples requiring field filtration will be collected using a 0.45 micron (µm) disposable in-line groundwater filter.

Table 4-2. Purging Stabilization Criteria

pH	+/- 0.1 standard unit
Specific Conductance (conductivity)	+/- 3 percent
Oxidation-Reduction Potential (ORP)	+/- 10 millivolts (mV)
Turbidity	+/- 10 percent (when greater than 10 NTUs)
Dissolved Oxygen (DO)	+/- 10 percent

4.2.3 Monitoring Analyses

Table 4-3 summarizes the analytical program for the long-term monitoring at the Site.

Table 4-3. Groundwater Sample Analyses

	Gasoline/BTEX	Diesel/Lube Oil	Conventional ^a	Dissolved Methane	Total Lead	Dissolved Lead ^b	Dissolved Manganese ^b	Total Ferrous Iron	Field Parameters
MW-4R	X	X	X	X	—	—	X	X	X
MW-9R	X	X	X	X	X	X	X	X	X
MW-10R	X	X	X	X	—	—	X	X	X
MW-11	X	X	X	X	—	—	X	X	X
MW-13R	X	X	X	X	—	—	X	X	X
MW-20R	X	X	X	X	—	—	X	X	X
MW-21R	X	X	X	X	—	—	X	X	X
MW-22R	X	X	X	X	—	—	X	X	X
MW-25	X	X	X	X	—	—	X	X	X
MW-26R	X	X	X	X	—	—	X	X	X
MW-27	X	X	X	X	—	—	X	X	X

^a Nitrate, sulfate, alkalinity, chloride.

^b Field filtered through 0.45 µm disposable groundwater filter.

4.3 DECONTAMINATION PROCEDURES

Decontamination of reusable equipment is not anticipated, however, if decontamination of non-disposable tools and equipment is required, it will be conducted prior to each sampling event and between each sampling location. Appendix C describes the SOP for decontaminating reusable field equipment.

For decontamination of larger tools and equipment, such as push-probe rods, a high-pressure, hot water washer, or similar device will be used. Loose soil materials will be removed from equipment using a “dry” decontamination technique consisting of the removal of loose soil using a shovel or brush.

4.4 INVESTIGATION DERIVED WASTE

Investigation-derived waste (IDW) from monitoring well installation, development, and sampling activities will be containerized on-site in 55-gallon drums. All drums will be labeled indicating date filled, content, location, company, and a unique identification number. Waste soils from the well installation will be managed by the City of Bremerton and purge water from the well development and sampling will be collected periodically and disposed of at the City's WWTP via vactor truck.

All disposable sampling materials and personal protective equipment, such as disposable coveralls, gloves, and paper towels used in sample processing, will be placed inside polyethylene bags or other appropriate containers. Disposable materials will be placed in a refuse container and disposed of as solid waste.

5. SAMPLE HANDLING AND CUSTODY

5.1 SAMPLE IDENTIFICATION AND LABELING

Each sample collected at the site will be pre-assigned an identification code using the sampling site followed by other specific information describing the sample. The sample numbering convention is shown in Table 5-1.

Table 5-1. Sample Numbering Convention

Site	CHEV = Former Chevron Property
Matrix	GW = Groundwater
Sampling Station	MW04 = Monitoring Well 4
Sample Type/Sample Depth	0110 = Field sample collected at a depth of 11.0 feet. 1100 = Field duplicate collected at a depth of 11.0 foot.

Example: CHEV-GW-MW04-0120 = Groundwater sample collected from monitoring well MW04 at a depth of 12.0 feet.

5.2 SAMPLE STORAGE, PACKAGING, AND TRANSPORTATION

Samples will be placed in a cooler and held at approximately 4 degrees Celsius (C) until they are received by the analytical laboratory. Samples which are routinely delivered to the laboratory on the same day as collection may not have sufficient time to chill to 4 degrees C. Upon sample receipt, the laboratory will comply with storage temperatures and maximum holding times required for the specific analyses to be performed (Table 5-2).

Table 5-2. Sample Storage Temperatures and Maximum Holding Times for Sample Analyses

Sample Analysis	Container and Preservation	Holding Time
Gasoline/BTEX	3 x 40 ml HCl preserved vials ^b	14 days
Diesel and lube oil range organics	2 x 500 ml HCl preserved amber	14 days
Nitrate	500 ml unpreserved poly	48 hours
Sulfate	500 ml unpreserved poly	28 days
Alkalinity	500 ml unpreserved poly	14 days
Chloride	500 ml unpreserved poly	28 days
Dissolved methane	3 x 40 ml HCl preserved vials ^b	14 days
Total and dissolved metals (lead and manganese)	1 – 500 ml HNO ₃ preserved poly 1 – field filtered 500 ml HNO ₃ preserved poly	6 months
Total ferrous iron ^a	250 ml unpreserved amber ^a	24 hours

ml = milliliters, HCl = hydrochloric acid, HNO₃ = nitric acid

^a Subcontracted to Analytical Resources Inc.

^b Zero headspace

Samples will be hand delivered or couriered to Onsite Environmental Inc. (Onsite) for analysis. Total ferrous iron will be subcontracted to Analytical Resources Inc. (ARI). Because of short holding times for the total ferrous iron, samples will be delivered directly to ARI rather than received by Onsite and sent to ARI. Generally, sample collection will be avoided on Fridays; however, if it is necessary to collect samples on a Friday or a day prior to a

holiday, each laboratory will be contacted ahead of time to verify whether they will accept samples. If a laboratory will not receive samples on a specified date, the sample collection date(s) will be altered to meet sample receiving requirements.

A standard 10-day turnaround time for the sample results will be requested along with Ecology Environmental Information Management (EIM) electronic data deliverables (EDDs).

5.3 SAMPLE CUSTODY

The chain-of-custody procedures used for this project will provide an accurate written or computerized record that can be used to trace the possession of each sample from the time each is collected until the completion of all required analyses (Appendix B). A sample is in custody if it is in any of the following places:

- In someone's physical possession.
- In someone's view.
- In a secured container.
- In a designated secure area.

The following information will be provided on the chain-of-custody form:

- Sample identification numbers.
- Matrix type for each sample.
- Analytical methods to be performed for each sample.
- Number of containers for each sample.
- Sampling date and time for each sample.
- Names of all sampling personnel.
- Signature and dates indicating the transfer of sample custody.

All samples will be maintained in custody until formally transferred to the laboratory under a written chain-of-custody. Samples will be kept in sight of the sampling crew or in a secure, locked vehicle at all times. Samples that leave the custody of field personnel will be sealed by placing a signed and dated custody seal across the seam of the shipping container.

6. LABORATORY ANALYTICAL METHODS

All samples will be submitted to a commercial analytical laboratory certified by Ecology to perform the required analyses. The selected laboratory for the project is Onsite located in Redmond, Washington. Total ferrous iron samples will be subcontracted by Onsite to ARI located in Tukwila, Washington.

Laboratory reporting limits will be verified prior to analysis to ensure that, at a minimum, reporting limits for each analyte are equal to or lower than Model Toxics Control Act (MTCA) Method A cleanup levels for groundwater. Matrix interferences may make it impossible to achieve the desired reporting limits and associated QC criteria. In such instances, the laboratory shall report the reason for noncompliance with QC criteria or elevated detection limits.

Project related detection and quantitation limits are listed in Table 6-1.

Table 6-1. Laboratory Detection and Quantitation Limits

Analyte	Analytical Method	Units	MDL	PQL
Gasoline	NWTPH-Gx	µg/l	7.19	100
Benzene	EPA 8021B	µg/l	0.116	1.0
Toluene	EPA 8021B	µg/l	0.129	1.0
Ethylbenzene	EPA 8021B	µg/l	0.134	1.0
m,p-Xylene	EPA 8021B	µg/l	0.127	1.0
o-Xylene	EPA 8021B	µg/l	0.117	1.0
Diesel	NWTPH-Dx	mg/l	0.0712	0.25
Lube Oil	NWTPH-Dx	mg/l	0.144	0.40
Nitrate	EPA 353.2	mg/l	0.00381	0.050
Sulfate	ASTM D516-02	mg/l	0.237	5.0
Alkalinity	EPA 310.2	mg/l	7.46	10
Chloride	SM4500-CIE	mg/l	0.499	2.0
Dissolved Methane	EPA 8015B	µg/l	0.0584	0.50
Total Lead	EPA 200.8	µg/l	0.228	1.1
Dissolved Lead	EPA 200.8	µg/l	0.0455	1.0
Dissolved Manganese	EPA 200.8	µg/l	0.0815	10
Total Ferrous Iron ^a	SM3500 FeD	mg/l	0.003	0.04 ^b

^a Subcontracted analysis to Analytical Resources Inc. (ARI).

^b Value is the laboratory reporting limit.

MDL = method detection limit

µg/l = micrograms per liter)

mg/l = milligrams per liter

PQL = practical quantitation limit

7. DATA MANAGEMENT

The objectives of data management are to ensure that large volumes of information and data are technically complete, accessible, and efficiently handled when received from the field and the laboratory.

7.1 FIELD DATA

The original hard (paper) copies of all field notes and laboratory reports will be stored in the project file. Photocopies of these documents should be prepared for working copies as needed.

Field data should be recorded in bound notebooks or individual sampling sheets. The field team members should review the field data for completeness prior to placing it in the files.

7.2 LABORATORY DATA

The laboratory data reports will be archived in the project files. The electronic data will be incorporated into Excel spreadsheets and archived on electronic media and placed in the project file. An electronic laboratory data submittal consistent with the requirements of Ecology's EIM system will be submitted with each report and archived in the project file.

8. DATA VERIFICATION AND VALIDATION

Techniques for data verification and validation will be in accordance with the Guidance on Environmental Data Validation and Verification (EPA 2001).

8.1 DATA REVIEW, VERIFICATION AND VALIDATION

Analytical data will be reviewed by the Laboratory QA Officer to assure that the method-specific QC objectives have been met. These reviews will identify the occurrence of deficiencies in time to take corrective action. If the required QC objectives are not met after the corrective action is performed, the Task Manager will be notified by the laboratory before data submittal. The Task Manager and Data QA Manager will determine if additional corrective action should be taken, such as re-analysis, if applicable. All data packages provided by the laboratory will provide a summary of QC results adequate to enable reviewers to determine the quality of the data.

The Data QA Manager is responsible for conducting checks for internal consistency, transmittal errors, and for adherence to the field and laboratory QC elements. The Data QA Manager will review the data package submitted by the laboratory to ensure that documentation has been provided, appropriate QC checks have been performed, that appropriate corrective actions have been taken, and that the data is valid and useable. The Data QA Manager will also determine the potential effects of any deviations or corrective actions on the suitability of the data.

8.2 VERIFICATION AND VALIDATION METHODS

The Data QA Manager will review the following:

- Chain-of-custody documentation.
- Holding times.
- Equipment/trip blank results.
- Field Duplicate results.
- Method blank results.
- Compliance with project data quality indicators (DQIs); i.e. precision, accuracy, bias, sensitivity, completeness, compatibility, and representativeness.

A limited review (minimum 20 percent) of the following laboratory QC data results will be conducted:

- Laboratory material sources/material sources data (MS/MSD) and/or matrix duplicate results.
- Laboratory surrogate recoveries.
- Laboratory check samples.

If, based on this limited review, the QC data results indicate potential data quality problems, further evaluations will be conducted.

8.3 RECONCILIATION AND USER REQUIREMENTS

The Data QA Manager will prepare a technical memorandum for each data package describing the results of the data review and describing any qualifiers that were added to the data. The technical memorandum will include recommendations on whether additional actions such as re-sampling are necessary. The technical memorandum will be submitted with the technical report.

9. SCHEDULE

The project schedule is provided below in Table 9-1. At the completion of each sampling event, a technical memorandum will be prepared and submitted presenting the groundwater results. A 5-year summary monitoring report will be prepared at the end of the initial 5-year monitoring period.

Table 9-1. Schedule

Work Element	Complete or Submitted By
Long Term Groundwater Monitoring Program Finalized	January 2013
First Year Semi-Annual Sampling	Winter – January 2013 Summer – July 2013
Second Year Semi-Annual Sampling	Winter – January 2014 Summer – July 2014
Third Year Semi-Annual Sampling	Winter – January 2015 Summer – July 2015
Fourth Year Semi-Annual Sampling	Winter – January 2016 Summer – July 2016
Fifth Year Quarterly Sampling	Fall – October 2016 Winter – January 2017 Spring – April 2017 Summer – July 2017
Draft 5-Year Summary Monitoring Report	August 2017
Final 5-Year Summary Monitoring Report	Within 60 days of receipt of Ecology comments to Draft 5-Year Summary Monitoring Report

10. REPORTING

A short two-page technical memorandum will be prepared at the conclusion of each sampling effort. The technical memoranda will include the following and will be organized in a similar format to the *Former Chevron Property Performance Groundwater Monitoring Results* technical memorandum dated January 13, 2012 (Parametrix 2012):

- Dates and locations of groundwater sample collection.
- Copies of field forms.
- Table of final water quality parameters at each location sampled.
- Copies of all laboratory reports for each monitoring event.
- Water level and flow direction figure with concentrations.
- Table of laboratory results.
- Data validation technical memorandum.
- General summary of results for the monitoring period.

Each technical memorandum will be submitted to Ecology for informational purposes and will not require Ecology review or comment. It will be submitted to Ecology within 6 weeks of receipt of the laboratory results. In addition, the Ecology EIM data for the site will be perpetually updated as electronic EIM information becomes available.

At the conclusion of the 5-year monitoring period, a summary monitoring report will be prepared for the site to evaluate the initial monitoring period. The summary report will include similar information as technical memoranda and will also include:

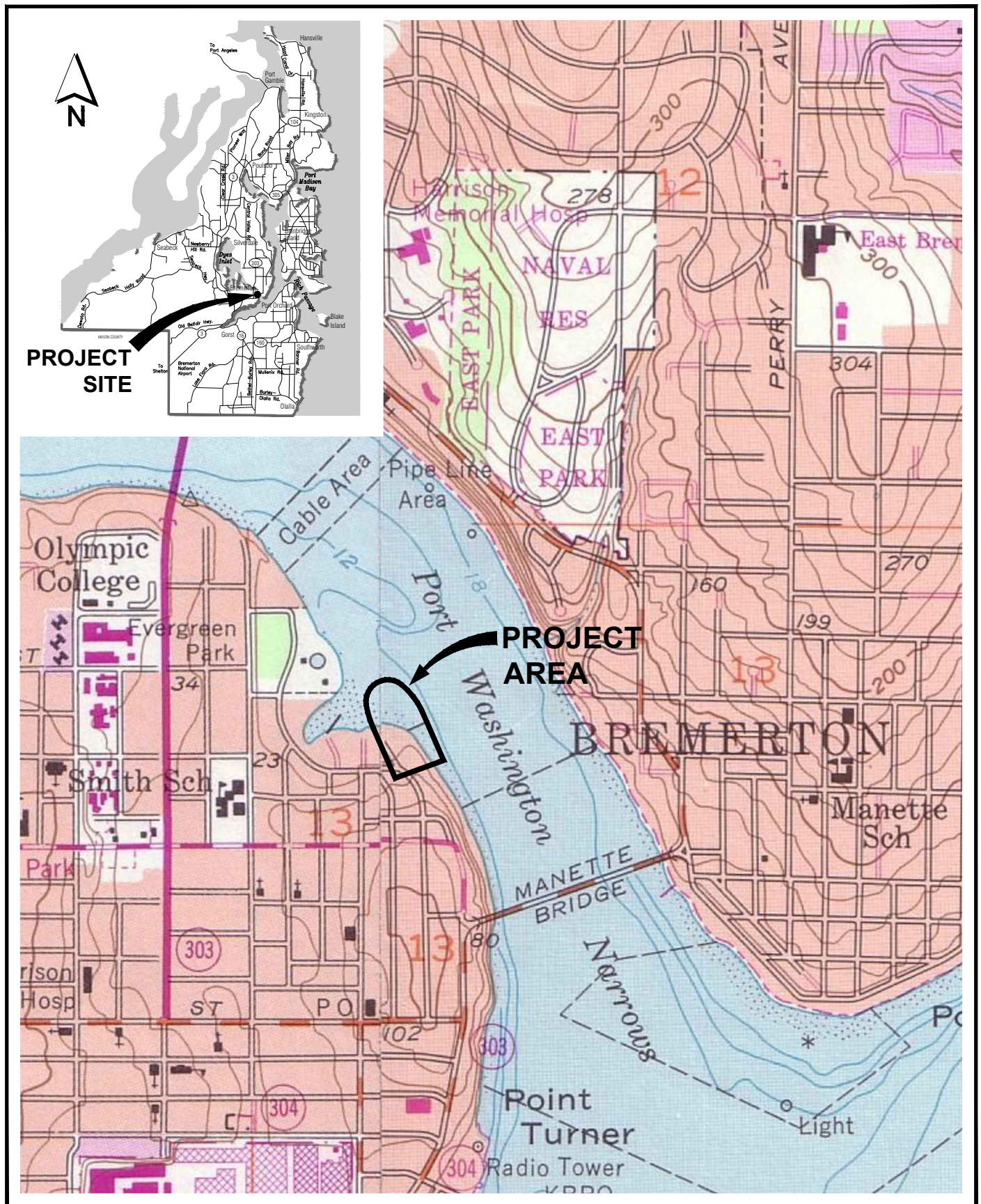
- Brief history of the site and the development of the long-term monitoring program.
- Overall evaluation of the results of the 5-year monitoring period to determine whether the expected reduction in contaminants has occurred during the 5-year timeframe.
- Recommendations for alteration to long term monitoring program. This may include, but is not limited to, reduction or addition of monitoring locations or analytes.

The 5-Year Summary Report will be submitted to Ecology for review and comment within three months of the final sample collection. Following the Ecology review and comment period, updates to the long-term monitoring program may be necessary.

11. REFERENCES

- EPA (Environmental Protection Agency). 2001. Guidance on environmental data validation and verification. EPA QA/G-8.
- EPA. 2002. Groundwater sampling guidelines for Superfund and RCRA project managers. Groundwater Forum Issue Paper. EPA 542-S-01-001.
- GeoEngineers. 1988. Report of geotechnical services, subsurface contamination study, Chevron Bulk Fuel Terminal, Bremerton, Washington. Prepared for Chevron U.S.A. November.
- Hart Crowser. 1989. Summary of work accomplished to date and pending, Former Chevron bulk plan, Bremerton, Washington. Prepared for Chevron U.S.A. Inc., Seattle, Washington. November.
- Parametrix. 2011. Former Chevron Property remedial investigation/feasibility study report. Prepared for City of Bremerton. September.
- Parametrix. 2012. Former Chevron Property cleanup action work plan. Draft Version. Prepared for City of Bremerton. April.

Figures



Parametrix DATE: Dec 19, 2012 FILE: BR1896063P04T1304 098 F01-1

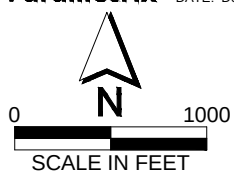


Figure 1
Former Chevron Property
Long-Term Groundwater Monitoring Plan
Project Vicinity



Parametrix DATE: Dec 19, 2012 FILE: BR1896063P04T1304 098 F02-1

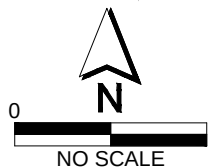


Figure 2
Former Chevron Property
Long-Term Groundwater Monitoring Plan
1963 Aerial Photograph



Parametrix DATE: Dec 19, 2012 FILE: BR1896063P04T1304 098 F02-1

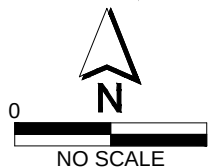
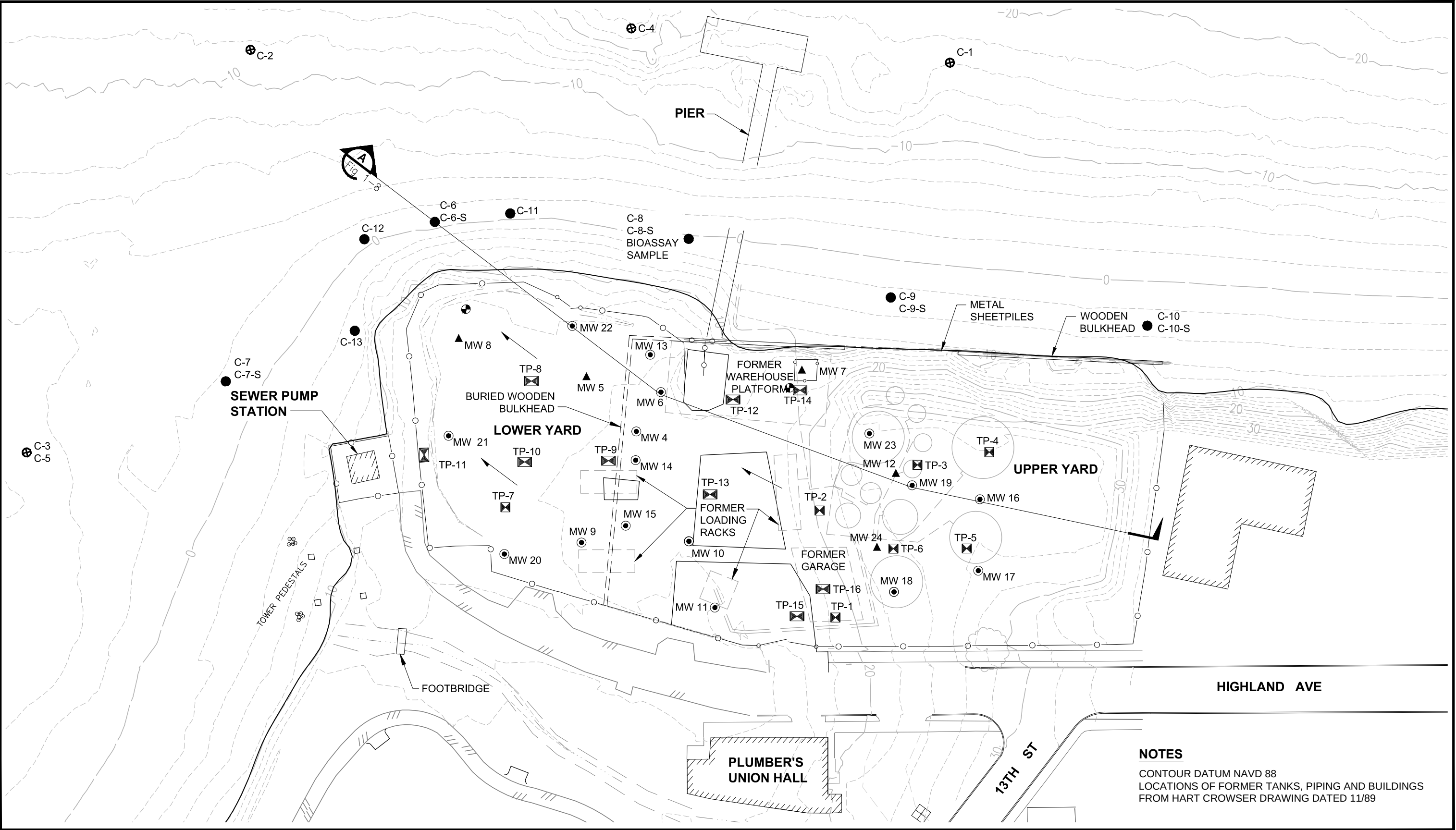
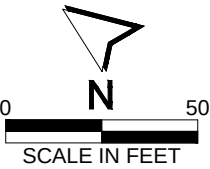


Figure 3
Former Chevron Property
Long-Term Groundwater Monitoring Plan
CIRCA 2005 Aerial Photograph



Parametrix DATE: Dec 19, 2012 FILE: BR1896063P04T1304 098 F04-1



LEGEND

- INTERTIDAL SEDIMENT SAMPLE
- ⊕ SUBTIDAL SEDIMENT SAMPLE
- ⦿ EXISTING MONITORING WELL

- ⊠ TEST PIT, GEO ENGINEERS 1988
- ⊡ TEST PIT, HART CROWSER 1989
- ▲ DESTROYED MONITORING WELL
- EXISTING CONCRETE PAD

- ▨ EXISTING BUILDING
- CHAIN LINK FENCE
- - - DRAINAGE DITCH
- - - FORMER PIPING/BUILDING/LOADING RACK

- C-6 SURFACE SEDIMENT SAMPLE
- C-6-S SEDIMENT SAMPLE COLLECTED AT 2 FT DEPTH
- FORMER ABOVEGROUND STORAGE TANK
- ➔ GENERAL GROUNDWATER FLOW DIRECTION

NOTES
CONTOUR DATUM NAVD 88
LOCATIONS OF FORMER TANKS, PIPING AND BUILDINGS
FROM HART CROWSER DRAWING DATED 11/89

Figure 4
Former Chevron Property
Long-Term Groundwater Monitoring Plan
Historical Site Features

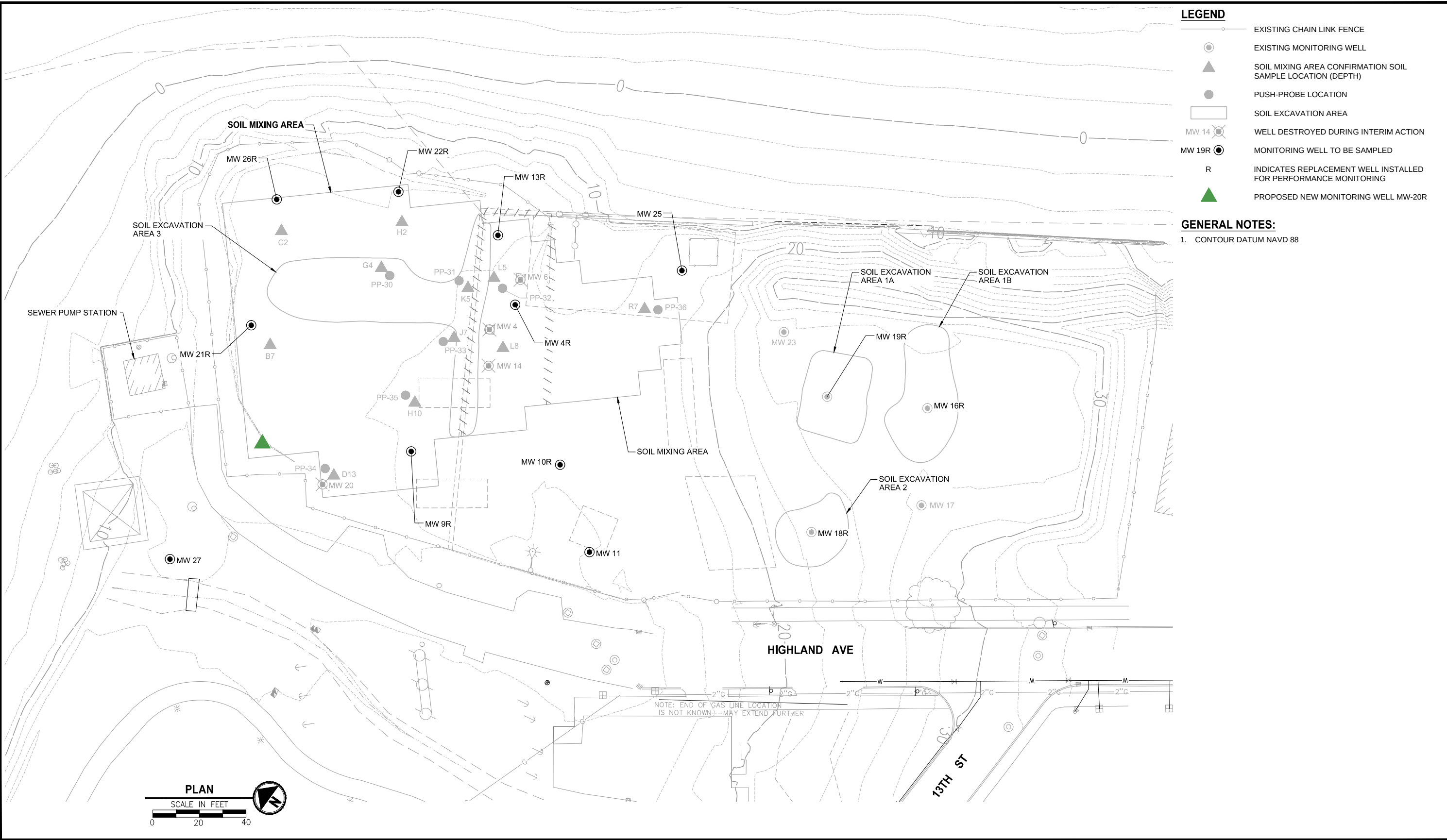


Figure 5
Former Chevron Property
Long-Term Groundwater Monitoring Plan

Appendix A

Project Health and Safety Plan

Former Chevron Property Long-Term Groundwater Monitoring Plan Health and Safety Plan

Prepared for
City of Bremerton

January 2013

Prepared by
Parametrix



Former Chevron Property Long-Term Groundwater Monitoring Plan Health and Safety Plan

Prepared for

City of Bremerton

3037 Olympus Drive
Bremerton, WA 98310

Prepared by

Parametrix

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Bremerton, WA 98312-2357
T. 360.377.0014 F. 360.479.5961
www.parametrix.com

CITATION

Parametrix. 2013. Former Chevron Property
Long-Term Groundwater Monitoring Plan Health
and Safety Plan. Prepared by Parametrix, Bremerton,
Washington. January 2013.

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.

Prepared by Lara Linde, LG

Checked and Approved by David Dinkuhn, P.E.

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APPENDICES

A Site Health and Safety Plan Consent Agreement

B Standard Operating Procedures

C Map and Directions to Hospital

KEY TERMS

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
City	City of Bremerton
CPR	Cardiopulmonary Resuscitation
employer	Parametrix, Inc.
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
IDW	Investigation Derived Waste
mg/m ³	milligrams per cubic meter
MSDS	Material Safety Data Sheet
MTCA	Model Toxics Control Act
MW	Monitoring Well
OSHA	U.S. Department of Labor Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts per Million
TCE	Trichloroethylene

1. INTRODUCTION

The City of Bremerton (City) has contracted Parametrix to provide environmental consultation for conducting long-term groundwater monitoring activities at the Former Chevron Property, located at 1310 Highland Avenue in Bremerton, Washington (Figure 1). The site, which formerly contained a bulk fuel distribution facility, was purchased by the City of Bremerton in 2005 for development as an addition to the adjacent Evergreen Park.

This project Health and Safety Plan (HASP) presents project-specific health and safety requirements for environmental sampling. This project HASP is designed for use in conjunction with the Parametrix Health and Safety Manual (Parametrix 2003).

This plan applies only to authorized employees of Parametrix, Inc. (employer).

Federal (OSHA, 29 CFR Part 1910.120[b][1][iv] and [v]) and State of Washington (WAC 296-62-3010[1][d] and [e]) regulations require that the employer provide relevant health and safety information, including but not limited to this Health and Safety Plan, to contractors, subcontractors or their representatives, and U.S. Department of Labor Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), Washington Department of Labor and Industries, and Washington Department of Ecology personnel.

However, any party other than Parametrix remains responsible for providing its own site-specific Health and Safety Plan that addresses its own site-specific activities, which may differ from those addressed in this HASP for Parametrix staff. Hence, Parametrix, Inc. assumes no responsibility or liability for the use or misuse of its HASP by such other party, its employees, agents, or subcontractors. Such other party must develop and implement its own Health and Safety Plan, and further ensure that the provisions and implementation of its Health and Safety Plan will smoothly interface with other HASPs in effect at this site. This project HASP is designed for use in conjunction with the Parametrix Health and Safety Manual (Parametrix 2003).

This Health and Safety Plan has been prepared according to the following regulations and guidelines:

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA March 6, 1989), Hazardous Waste Operations and Emergency Response; Final Rule, 29 CFR Part 1910.120.
- Washington Department of Labor and Industries (WISHA December 15, 1989, plus addenda), Hazardous Waste Operations and Emergency Response, WAC 296-62-300 (Part P).
- NIOSH/OSHA/USCG/EPA (October 1985), Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.
- U.S. Environmental Protection Agency (U.S. EPA November 1984; updated July 1988), Standard Operating Safety Guides.

Text taken verbatim from applicable regulations is shown in italics; for other text, citations to specific applicable regulations follow the text of this HASP, and are also provided in italics (example: OSHA, 29 CFR Part 1910.120; WAC 296-62-300).

1.1 DAILY SITE SAFETY MEETINGS

Site safety meetings (pre-entry briefings) will be held before initiating any site activity (that is, before each day's fieldwork), and at such other times as necessary, to ensure that employees are familiar with the provisions of this HASP.

1.2 SCOPE OF WORK

The long-term groundwater monitoring for this project will evaluate residual groundwater contamination. First, one additional monitoring well will be installed, developed, and sampled to assess conditions between MW-9R and MW-21R. Figure 2 shows the proposed new well location (MW-20R).

A long-term groundwater monitoring plan was developed for the site which consists of four semi-annual sampling events followed by four quarterly events which will compose the fifth year of monitoring.

1.2.1 Long-Term Monitoring Goals

The primary goal of the long-term monitoring program is to meet the requirements of Model Toxics Control Act (MTCA) for the protection of human health and the environment and demonstrate a reduction in residual contaminants of interest.

2. HAZARD ASSESSMENT

A hazard analysis was conducted for the subsurface and surface sampling to identify potential health and safety concerns. The results of the hazard analysis for the proposed site activities are presented in Table 2-1. The hazard analysis will be updated if additional project-related hazards are identified during remedial action.

Table 2-1. Hazard Analysis for Project Activities

Activity	Hazard	Mitigation
Drilling	Slips/Trips/Falls	• Keep work areas free of debris, etc. • Clean-up work areas following completion of activities. • Watch for debris and other hazards that may be present from past site operations. • Follow required safety procedures. • Use proper illumination
	Flying Debris/Soil and Splashing Liquids	• Wear safety glasses or other applicable eye protection.
	Overhead	• Wear hardhat and steel toed footwear. • Know the location of drill emergency stop switch. • Maintain eye contact with driller. • Don't move drill rig with mast up.
	Pinch Points	• Identify pinch points prior to drilling. • Be aware of equipment location and body placement. • Know the location of drill emergency stop switch. • Maintain eye contact with driller.
	Noise	• Wear earplugs during drilling.
	Falling Objects	• Wear hardhat and steel toed footwear.
	Utility Contact	• Perform a utility locate prior to drilling. • Keep at least three feet from utility markings.
	Heat or Cold Stress	• Wear several layers of clothing during cold weather • Dress in cotton clothing. • Take frequent breaks to warm up in running vehicles during cold weather. • Take frequent breaks to cool down in the shade during warm weather. • Watch other workers on site for signs of heat or cold stress during the workday.

Table Continues

Table 2-1. Hazard Analysis for Project Activities (Continued)

Activity	Hazard	Mitigation
Environmental Sampling (groundwater)	Slips/Trips/Falls	• Keep work areas free of debris, etc. • Cleanup work areas following completion of activities. • Watch for debris and other hazards that may be present from past site operations. • Follow required safety procedures.
	Flying Debris/Soil and Splashing Liquids	• Wear safety glasses or other applicable eye protection
	Working Around Water	• Use buddy system. • Wear shaded safety glasses to reduce glare from water. • Do not enter or work over water unless wearing a personal floatation device
	Contact with Contaminated Media and Preservatives	• Collect and handle samples wearing appropriate personal protective equipment (PPE). • Employ proper shipping and packing procedures.
	Cuts/Abrasions	• Use proper cutting tools. • Be careful with sharp objects. • Do not cut towards yourself. • Conduct sampling using proper operation of the sampling equipment. • Use colorimetric tube breaker when possible
	Overhead	• Wear hardhat and steel toed footwear. • Maintain eye contact with driller and other heavy equipment operators.
	Lifting	• Use proper lifting equipment and techniques when moving equipment, tools, drums, etc.

Parametrix has conducted several investigations at this site. The most recent investigations describe subsurface contamination at lower yard locations of the site. Parametrix personnel will be observing drilling and well installation, developing monitoring wells, and collecting groundwater samples at several locations. Precautions will be taken by all persons conducting activities at the site to minimize exposure to potential chemicals of concern. (See Tables 2-2 through 2-5 on pages 2-3 and 2-4).

Table 2-2. Hazardous Media

Media	Present
Liquid	Yes
Solid	Yes
Sludge	No
Gas/Vapor	Yes
Other	No

Table 2-3. Hazardous Material Type

Material Type	Present
Corrosive	No
Volatile	Yes
Carcinogenic	Yes

Table 2-4. Hazardous Materials Characteristics

Material Type	Present
Ignitable	Yes
Reactive	No
Other	No

Table 2-5. Potential Chemicals of Concern

Substance	PEL ^{a,b,c}	Routes of Exposure ^{d,e,f}	Acute Exposure Symptoms ^{d,e,f}	Odor Threshold ^{d,e,f}
PRIMARY PRODUCTS				
Gasoline	300 ppm †	Inhalation; skin and/or eye absorption; ingestion	Irritation of mucous membranes. Stimulation followed by depression of central nervous system; dizziness, headache, and in-coordination. In more severe exposures, anesthesia, coma, and respiratory arrest.	0.25 ppm
Diesel Oil	–	Sin and/or eye contact, ingestion	Irritation of mucous membranes and skin, diarrhea.	Data not available
Motor Oil	Not available	Dermal, inhalation	Dermatitis, moderate irritation of nose and throat.	Not available, unpleasant
PRODUCT COMPONENTS				
Benzene*	1 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, excitation; skin pallor followed by flushing, weakness, headache, breathlessness, chest constriction, coma and possible death, carcinogen.	4.68 ppm
Toluene	100 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritates eyes and upper respiratory tract. Vapor causes dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.	0.17 ppm
Xylenes	100 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Headache or dizziness. Liquid irritates eyes and skin. Inhalation of liquid causes severe coughing, distress, and rapidly developing pulmonary edema. Ingestion causes nausea, vomiting, cramps, headache, and coma. Can be fatal; kidney and liver damage can occur.	0.05 ppm
Ethyl Benzene	100 ppm	Inhalation, ingestion, skin and/or eye contact	Inhalation causes nose irritation, dizziness, depression. Moderate injury to eye with corneal injury possible. Irritates skin and may cause blisters.	140 ppm
Lead	0.05 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Lassitude, insomnia, pallor, eye “grounds”, weight loss, anorexia, abdominal pain.	Not available

† Parts per Million (ppm)

* Known or Suspected Human Carcinogen

a American Conference of Government Industrial Hygienists, 1987. Threshold Limit Values and Biological Exposure Indices for 1987-1988.

b Occupational Safety and Health Administration; 1989. Air contaminants; Final Rule. Federal Register Vol. 54 pp 2331 to 2983.

c California Code of Regulations, Title 8, Section 5155 Table AC-1.

d National Institute for Occupational Safety and Health, 1985. Pocket Guide to Chemical Hazards, September. Publication No. 85-144.

e Sax, N.I. Dangerous Properties of Industrial Materials, 6th ed. VanNostrand Reinold Company, Inc., New York, 1985.

f U.S. Coast Guard, 1987. Chemical Hazard Response Information System (CHRIS) Volumes I and II, Commandant Instruction M. 16465. 12A. November 17.

3. PERSONAL PROTECTIVE EQUIPMENT

Based on available chemical information for the project sites, Level C or D PPE will be required while conducting field activities. This level of protection generally includes:

Level D for Monitoring Activities:

- Steel-toe/shank leather or rubber boots.
- Nitrile surgical weight gloves to be used as inner gloves.
- Work gloves, nitrile gloves, or equivalent, to use as outer gloves, as needed.
- Hardhat.
- Safety glasses or goggles for general site work.
- Hearing protection for all activities in areas where heavy machinery is being operated.

Additional information on PPE is presented the Parametrix Health and Safety Manual (Parametrix 2003) and Standard Operating Procedure HS-002, Appendix B of this document.

At least one first aid kit and cellular phone will be available on-site in the company vehicle during sampling activities.

Table 3-1. Site Safety Hazards and Precautions

Areas of Concern	Hazard Potential	Precautions
Oxygen Deficiency	None	
Radiation	None	
Toxic Compounds <u>General:</u> Gasoline, Diesel, Kerosene, Motor Oil, Lead <u>Specific:</u> Benzene, Xylene, Toluene, Ethyl Benzene, Lead, Arsenic, Cadmium, Chromium, PCBs, and TCE	Low-Moderate	Monitor breathing zone with photoionization detector; downwind monitoring. If breathing zone concentrations reach or exceed 10 ppm, don Level C protection. Have respirators on hand with organic vapor/acid gas cartridges on standby. Control visible dust with water spray.
Skin/Eye Contact	Medium	Tyvek, gloves, chemical resistant or neoprene safety boots, safety glasses.
Heat Stress	Medium	Frequent rest periods (every 30 minutes at a minimum), liquid refreshments.
Biological Hazards	None suspected	
Falling Objects	Low	Hard hat, safety boots.
Mechanical Equipment	Moderate	Watch for and avoid trucks, cars, and heavy equipment operating in vicinity of excavation. Set up safety cones.
Falls	Low-Moderate	Watch for slip and trip hazards; stand back from the edge of excavated areas.
Confined Spaces	Low	Do not enter trenches, excavations, pits, or vaults.
Noise	Low-Moderate	Use ear plugs or ear muffs.

3.1 AIR MONITORING

The following sections describe the air monitoring protocols for sampling activities. All air monitoring and instrumentation calibration data will be recorded in daily field logs. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications.

3.1.1 Monitoring Well Drilling

Air monitoring with a photoionization detector (PID) will be conducted during monitoring well drilling to determine potential personnel exposure to hazardous airborne contaminants. Monitoring for airborne particulates (dust) will be conducted visually. Action levels for potential contaminants of concern are shown in Table 3-2.

Table 3-2. Air Monitoring and Action Levels

Exposure	Method	Monitoring Description	Action Level	Actions
Screening for organic and inorganic vapors	PID ^a	A PID will be used to assess potential exposures to organic vapors	>10 ppm ^b sustained for 5 minutes >50 ppm sustained for 5 minutes	• Terminate operation and move upwind. • Ventilate area, as needed. • Investigate cause. • Upgrade to Level C Respirator with organic vapor/HEPA^c cartridge. • Contact Project Manager for further direction if either action level is exceeded.
Airborne Particulates	Visuals	Exposure to airborne particulates (dust) will be assessed visually	Visible Dust	• Control with water spray. • Upgrade to level C respiratory protection with HEPA cartridge.

a PID = Photoionization Detector.

b ppm = parts per million.

c HEPA = high efficiency particulate air

If a change in conditions (i.e., odor, etc.) indicates a need to upgrade personal protective equipment (PPE), the Parametrix Project Manager or Technical Lead will be notified immediately. The situation will be reviewed and evaluated by the Project Manager or Technical Lead, with input as needed from the Corporate Health and Safety Manager, Sheila McConnell.

Only those employees working in direct contact with contaminants will be monitored for potential exposure. If any conditions or monitoring shows those employees having potential exposure, the monitoring plan will be re-evaluated, and other employees may be added for monitoring. The Project Manager will be notified with questions or adjustments to air monitoring procedures.

Table 3-3. Exposure Concentrations for Potential Chemicals of Concern

Analyte	Threshold Limit Value/ Permissible Exposure Limit	Immediately Dangerous to Life and Health
Benzene	0.1 ppm ^a	500 ppm
Ethylbenzene	100 ppm	800 ppm
Toluene	100 ppm	500 ppm
Xylene	100 ppm	900 ppm
Lead	0.050 mg/m ³ ^b	100 mg/m ³
Benzo(a)pyrene	0.2 mg/m ³	80 mg/m ³

Source: EPA, 2005 (www.epa.gov)

a ppm = parts per million

b mg/m³ = milligrams per cubic meter

4. MEDICAL SURVEILLANCE AND TRAINING

4.1 MEDICAL SURVEILLANCE

Per Parametrix, Inc. policy, all employees conducting on-site field activities must participate in a medical surveillance program designed to determine their fitness for working in hazardous environments. Records of each employee's medical testing are reviewed by the Corporate Health and Safety Officer and filed in the employee's individual personnel file. The frequency of medical exams will be determined by the Corporate Health and Safety Officer, in consultation with Virginia Mason Occupational Medicine Clinics and in accordance with guidelines provided in 29 C.F.R. 1910.120(f) and WAC 296-62-3050.

4.2 TRAINING

Per Parametrix, Inc. policy, all field team members have received health and safety training, according to the regulations listed below:

- Minimum of 40 hours training, or acceptable equivalent. WAC 296-62-3040(2).
- A minimum of three days actual field experience, under the direct supervision of a trained, experienced supervisor. WAC 296-62-3040(2).
- All employees covered by the above receive eight hours of refresher training annually on the items specified in WAC 296-62-3040(1) and other relevant topics. WAC 296-62-3040(8).

At least one field team member is currently certified in first aid and cardiopulmonary resuscitation (CPR) through the American Red Cross or equivalent program.

5. SITE RESOURCES

5.1 GENERAL INFORMATION

Project Team:	The members of the project team for the implementation of this project are listed on Table 5-1.
Water Supply:	None available on-site.
Telephone:	Field personnel cell phone (360) 710-2054.
Facilities:	Restrooms available at Evergreen Park, located adjacent to the project site. Potable water will be either carried with field staff in the field vehicle or obtained at the restrooms available at the adjacent park facilities.

Table 5-1. Project Team

Team Member	Responsibility
David Dinkuhn, Parametrix	Project Manager
Lara Linde, Parametrix	Field Team Leader/Site Safety Officer
Lara Linde, Walter Harvey, Parametrix	Field Crew
Lisa Gilbert, Parametrix	Project Chemist/Data QA Manager

6. EMERGENCY ACTION PLAN

6.1 LIST OF EMERGENCY CONTACTS

Table 6-1. Emergency Telephone Numbers and Emergency Route

Phone Location	(360) 710-2054 In Parametrix field vehicle
Ambulance	911
Hospital Emergency Room	(360) 377-3911 Harrison Memorial Hospital 2520 Cherry Ave. Bremerton, WA 98310
Poison Control Center	(800) 732-6985
Police	911
Fire Department	911
Dave Dinkuhn, Project Manager	(360) 850-5319 (360) 471-3917 (cell)
Lara Linde: Field Sampler, Field Health and Safety Officer	(360) 850-5332 (360) 710-2054 (cell)
Health and Safety Officer	Sheila McConnell, Parametrix, Inc. (425) 452-8655 (office) (425) 681-7516 (cell)
State/County Contact	N/A
Client	Tom Knuckey, City of Bremerton (360) 473-2376
Emergency Equipment	Location
First Aid Kit	Parametrix Field Vehicle

6.2 EMERGENCY ASSISTANCE

Table 6-1 provides a list of emergency telephone numbers. This list is to be conspicuously posted near the telephone or other communication network set up at the site to summon outside emergency assistance.

In case of emergency, at least one cell phone will be available onsite at all times during sampling activities. A map and directions to the nearest hospital (Harrison Memorial Hospital) is contained in Appendix C.

6.3 POTENTIAL INCIDENTS

Although considered unlikely, the following situations could occur and would require an emergency response action:

- Sudden release of hazardous vapors/combustible gases
- Chemical Spill
- Problems due to contacting utility lines (gas, electric, water)
- Fire
- Medical emergency
- Overt exposure (skin contact, inhalation, ingestion)

6.3.1 Release of Hazardous Vapors/Combustible Gases

In the event of a sudden release of hazardous vapors or gases constituting a potentially hazardous situation (e.g., adequate respiratory protection is unavailable, atmospheres are immediately dangerous to life or health or explosive, there is an imminent public health and safety hazard), the Field Health and Safety Officer will suspend operations and evacuate the site. All personnel will be required to evacuate to a pre-designated safe area upwind of the release.

The Field Health and Safety Officer, in consultation with the emergency response agencies, fire department, and facility or system owner/operator, will attempt to control or secure the spread of contamination whenever possible.

6.3.2 Chemical Spill

In the event of a chemical spill, the Field Health and Safety Officer will suspend operations and contact the Project Manager. If the spill is minor (less than 5 gallons), absorbent booms will be placed around the area of the spill and work will continue. If the spill is of a larger volume, the Field Health and Safety Officer could potentially suspend operations, and report the spill to the Washington State Department of Ecology.

6.3.3 Utilities

If aboveground or underground utilities are damaged or contacted, notify the local fire department. If injury occurs, see Medical Emergency section below.

6.3.4 Fire

In the event of a small fire, field staff will use the fire extinguisher located inside of the field vehicle to extinguish the fire. For larger fires that cannot be managed with a single fire extinguisher, field staff will immediately summon the fire department. Regardless of fire size, field staff will notify the project manager and the client, City of Bremerton, of the incident as soon as reasonably feasible.

6.3.5 Medical Emergency

At least one Parametrix employee or onsite worker will have current certification in first aid and CPR. In the event of a serious injury or illness, paramedics (i.e., fire department) must be summoned immediately. Workers with suspected back or neck injuries are not to be moved until professional emergency assistance arrives. If there is evidence of serious trauma or unknown chemical exposure, the employee should be stabilized by the Field Health and Safety Officer or designee while the paramedics or an ambulance is immediately summoned.

For non-life threatening injuries that do not impair driving ability, site personnel will drive to Harrison Memorial Hospital. Appendix C illustrates the route to the hospital.

A first aid kit will be available at the site for use in case of minor injuries. First aid responders should protect themselves from contact with blood and other human body fluids by wearing latex gloves, or establishing an equivalent barrier. Any contact with blood should be reported to the Field Health and Safety Officer.

6.3.6 Exposure

In the event of respiratory exposure, dermal or eye contact, or ingestion, the following procedures will be followed:

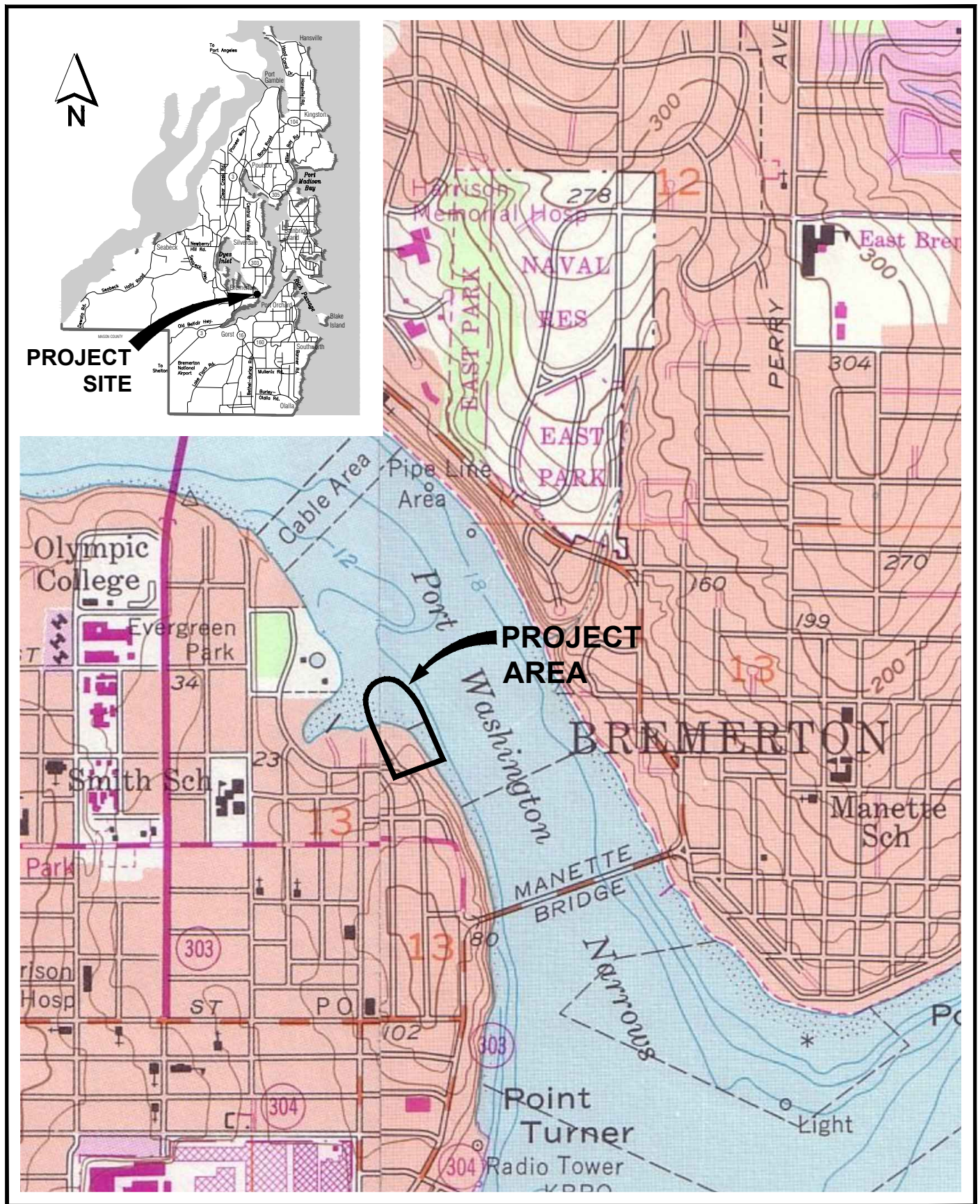
- Respiratory Exposure (Inhalation): Move to fresh air. Summon paramedics and notify facility or system owner/operator. Any loss of consciousness or exposure to elevated levels of known toxic contaminants, even if the individual appears to have fully recovered, will require immediate treatment and/or surveillance by a qualified physician.
- Dermal Contact: Flush area with copious amounts of soap and water. Wash/rinse effected area for at least 15 minutes. Decontaminate and provide medical attention.
- Eye Contact: Flush eye(s) for a period of 15 minutes and transport worker to the nearest emergency medical facility. Treatment and/or surveillance by a qualified physician is required.
- Ingestion: Notify the national or local Poison Control Center and/or emergency medical facility, and immediately transport to the facility.

6.4 ADVERSE WEATHER CONDITIONS

In the event of adverse weather conditions, the Field Health and Safety Officer will determine if sampling activities can continue without endangering field personnel. Some of the conditions to be considered prior to determining if activities should continue are as follows:

- Potential for thermal stress (e.g., heat or cold stress) and related injuries.
- Dangerous weather related working conditions that would preclude working from a boat (e.g., high winds, rain, snow, fog, lightning, etc.).
- Limited visibility.
- Potential for electrical storms. No outside activities will be permitted during electrical storms.

Figures



Parametrix DATE: Dec 19, 2012 FILE: BR1896063P04T1304 098 F01-1

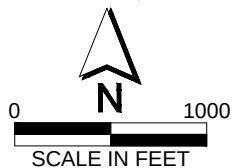


Figure 1
Former Chevron Property
Long-Term Groundwater Monitoring Plan
Project Vicinity

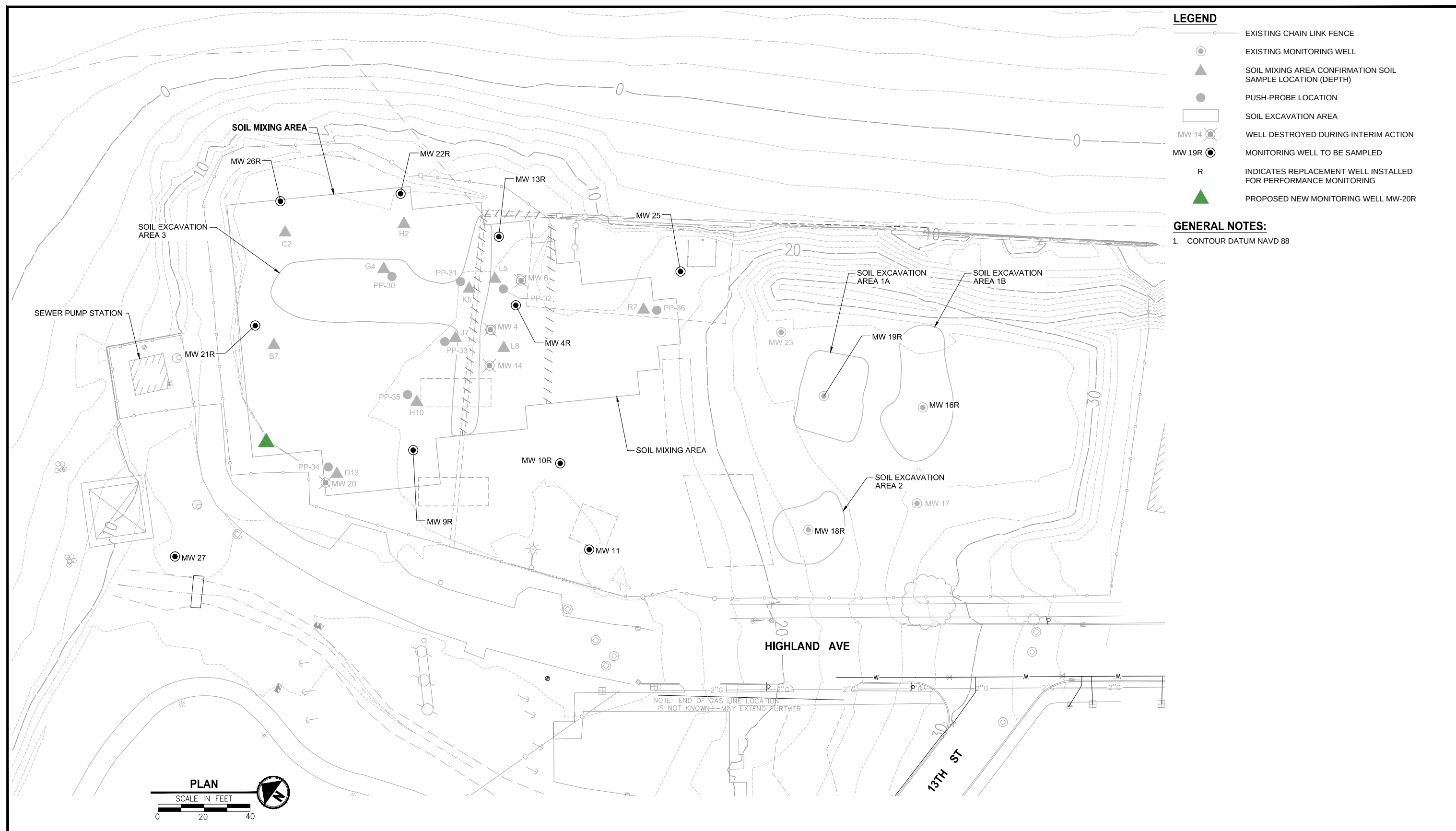


Figure 2
Former Chevron Property
Long-Term Groundwater Monitoring Plan

Appendix A

Site Health and Safety Plan Consent Agreement

Parametrix, Inc. Site Health and Safety Plan Consent Agreement

I have reviewed the safety plan prepared for Parametrix dated January 2013, for the site fieldwork. I understand the purpose of the plan, and I consent to adhere to its policies, procedures, and guidelines while an employee of Parametrix or its subcontractors.

Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
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Employee signature	Firm	Date

Appendix B

Standard Operating Procedures

PERSONAL PROTECTIVE EQUIPMENT

Prepared By: Jung A. Bukonobi
Health and Safety Committee Chair

Date: 3-10-03

Reviewed By: SPM C. Connell
Corporate Health and Safety Officer

Date: 3/11/03

Approved By: ML
Chief Operating Officer

Date: 3/11/03

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for selection and use of Personal Protective Equipment (PPE) used to protect Parametrix employees from the risk of injury by creating a barrier against workplace hazards.

2.0 Scope

29 CFR 1910, Subpart I requires the use of PPE to reduce employees' exposures to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. Employers are required to determine all exposures to hazards in their workplace and determine if PPE should be used to protect their workers. OSHA requires employers to conduct inspections of all workplaces to determine the need for PPE and to help in selecting the proper PPE for each task performed.

This SOP addresses eye, face, head, foot, hand, and body protection. Respiratory protection is discussed in SOP HS-003.

3.0 Responsibilities

There are specific responsibilities for Parametrix personnel in the care and use of PPE, depending on an individual's role within the company or on a given project. These responsibilities are outlined below:

- **Corporate Health and Safety Officer (CHSO):** The Corporate Health and Safety Officer is responsible for developing the PPE Program and updating PPE procedures, as necessary.
- **Project Manager:** The Project Manager is responsible for field implementation of the PPE Program. This includes assurance that all personnel on site comply with the policy and that all on-site personnel have had proper training in using PPE.
- **Site-specific Health and Safety Officer (SHSO):** The Site-specific Health and Safety Officer is responsible for initial on-site coordination of the cold stress. The SHSO assures that all personal potentially exposed to potential environmental hazards have proper PPE.
- **Team Member:** Each Team Member is responsible for understanding and complying with all site requirements.

PERSONAL PROTECTIVE EQUIPMENT

4.0 Requirements

Eye and Face Protection

Eye and face protection shall be used when employees are exposed to potential hazards from flying particles, molten metal, acids or caustic liquids, chemicals, or gases. Eye and face protection requirements include:

- Appropriate eye and face protection devices in hazardous environments for personnel who wear contact lenses.
- Side protectors when there is a hazard from flying objects.
- Goggles and face shields when there is a hazard from chemical splash.
- Face shields worn only over primary eye protection (safety glasses or goggles).
- Eye protectors that incorporate an employee's corrective eye prescription in the design or that fit properly over the prescription lenses.

Emergency eyewash facilities meeting the requirements of ANSI Z358.1 will be provided in all areas where the eyes of any employee may be exposed to corrosive materials. All such emergency facilities will be located where they are easily accessible in an emergency.

Protective eye and face devices purchased after July 5, 1994 shall comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection."

Head Protection

Head protection (hard hat) must be worn by all employees when overhead hazards from falling or fixed objects are present. Also, when an employee is near exposed electrical conductors that could come in contact with the head, the employee must wear a protective helmet designed to reduce electrical shock hazard.

Protective headgear shall comply with ANSI Z89.1-1986, "American National Standard for Personnel Protection-Protective Headwear for Industrial Workers-Requirements."

Foot Protection

Steel-toed boots or shoes must be worn in work areas where carrying or handling materials such as packages, objects, parts, or heavy tools could be dropped or fall onto the feet. Safety shoes or boots with puncture protection are required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal, etc., could be stepped on by employees and cause foot injury.

When working with hazardous chemicals or waste, chemical-resistant, steel-toed boots may be required.

All safety footwear shall comply with ANSI Z41-1991, "American National Standard for Personal Protection – Protective Footwear."

PERSONAL PROTECTIVE EQUIPMENT**Hand Protection**

Suitable gloves shall be worn when hazards from chemicals, cuts, lacerations, abrasions, punctures, burns, and other hazards to the hands are present. Glove selection shall be based on performance characteristics of the gloves, conditions, durations of use, and hazards present.

The first consideration in the selection of gloves for use against chemicals is to determine, if possible, the nature of the substances to be encountered. Employees must read instructions and warnings on chemical container labels and MSDSs before working with any chemical.

Body Protection

Suitable body protection (torso and legs) must be worn while completing job tasks. Depending on the hazards present, body protection may include coveralls, Tyvek or Saranex suits, totally encapsulating suits, etc. The type of body protection required to perform a specific task will be determined by the Corporate or Site-specific Health and Safety Officer, as necessary.

5.0 Training

Any worker required to wear PPE shall receive training in the proper use and care of PPE. The training shall include, but not necessarily be limited to, the following subjects:

- Determining when wearing PPE is necessary.
- Determining the appropriate and necessary PPE.
- Learning how to properly wear, adjust, and remove PPE.
- Understanding the limitations of PPE.
- Understanding the proper care, maintenance, and disposal of PPE.

6.0 References

U.S. Department of Labor, OSHA Standard 29 CFR 1910, Subpart I.

RESPIRATORY PROTECTION PROGRAM

Prepared By: *James A. Bukowski*
Health and Safety Committee Chair

Date: 3-10-03

Reviewed By: *Tom Connors*
Corporate Health and Safety Officer

Date: 3/11/03

Approved By: *ML*
Chief Operating Officer

Date: 3/11/03

1.0 Purpose

To establish the minimum requirements for Parametrix, Inc. employees to use respiratory protection.

2.0 Scope

This Standard Operating Procedure (SOP) applies in its entirety to all Parametrix projects unless the Corporate Health and Safety Officer (CHSO) grants a variance.

3.0 Responsibilities

There are specific responsibilities for Parametrix personnel in complying with the Respiratory Protection Program, depending on an individual's role within the company or on a given project. These responsibilities are outlined below:

- **Project Manager:** Overall responsible for establishing and ensuring compliance with this procedure.
- **Field Health and Safety Staff:** Responsible for implementing and/or monitoring activities associated with this procedure.
- **Managers and Supervisory Personnel:** Responsible for enforcing this procedure and ensuring that each employee is properly following the procedure.

4.0 General Requirements

Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal. Facial hair, head hair, and eyeglasses are among these physical obstructions. While eyeglasses are in the category of obstructions that prevent a gas-tight face seal, primarily in the case of full-face supplied-air respirators, this problem is correctable by using mounting devices to hold the eyeglass frames inside the respirator face piece. The criteria state that there can be no obstruction of contact between the wearer's skin and the mask. Beard stubble constitutes a physical obstruction. Affected employees shall be required to be clean-shaven, as a condition of employment.

RESPIRATORY PROTECTION PROGRAM

Candidates for employment who object to this policy shall be made aware that their versatility on work assignments may be limited and that this factor can affect their job assignments.

Parametrix shall provide respirators whenever a qualified person determines that such equipment is necessary to protect the health of the employee from significant inhalation exposure.

Only respirator equipment that has been jointly approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) shall be provided.

Employees shall be instructed and trained in the need, use, sanitary care, and limitations of such respiratory equipment prior to being assigned to activities that require respiratory protection.

Parametrix shall provide, repair, or replace respiratory protective equipment as may be required due to wear and deterioration.

Means of cleaning all respiratory protective equipment shall be provided.

Only those employees who are trained and medically qualified to wear respirators shall be assigned to work requiring use of respirators.

5.0 Implementation

Respiratory Selection

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA-approved respirators shall be used. Single-use respirators (dust masks) may only be used with specific approval by the Corporate Health and Safety Officer.

Employees shall be allowed to pick the most comfortable respirator from a selection, including respirators of various sizes from different manufacturers.

Selection of respirators shall be approved by the Field Health and Safety Staff in all cases, and shall be based on the following considerations:

- Nature of the Hazard – The chemical and physical properties, toxicity, and concentration of hazardous material or mixture of materials.
- Oxygen-deficient Atmospheres – Entry into oxygen-deficient atmospheres is prohibited without prior approval of the Corporate Health and Safety Officer.
- Immediate Dangerous to Life and Health (IDLH) Atmospheres – Entry into any IDLH atmosphere is prohibited without prior approval of the Corporate Health and Safety Officer.
- Irritant or Corrosive Atmospheres – Respirators selected must provide adequate face and eye protection. The contaminant or mixture of contaminants must have adequate warning properties (odor, irritation, or taste) to indicate respirator breakthrough if an air-purifying device is used.

RESPIRATORY PROTECTION PROGRAM

- Regulated Materials – In all cases where OSHA has required that a specific respirator is used (carcinogen standards, etc.), the specified respirator, or one providing equal or better protection, shall be used.
- Air-purifying respirators shall NOT be used for protection against the materials listed below. Note that this is only a partial list; please contact the Field Health and Safety Staff for further information:

Acrolein	Methyl chloride
Aniline	Methylene chloride
Arsine	Nickel carbonyl
Bromine	Nitrobenzene
Carbon monoxide	Nitrogen oxides
Isocyanates	Nitroglycerine
Dimethylaniline	Nitromethane
Dimethyl sulfate	Ozone
Hydrogen cyanide	Phosgene
Hydrogen fluoride	Phosphine
Hydrogen selenide	Phosphorus trichloride
Hydrogen sulfide	Stibine
Methanol	Sulfur chloride
Methyl bromide	

Parametrix subcontracts most asbestos inspections and all asbestos abatement. Inspection personnel may use half-mask respirators in areas where asbestos is present if they are qualitatively-fit tested.

Full-facepiece, negative-pressure, air-purifying respirators are not acceptable for protection against asbestos exposure unless the wearer meets the quantitative fit testing requirement.

Use of Corrective Lens Eyewear with Respirators

The wearing of contact lenses in work environments that involve exposure to chemical fumes, vapors, splashes, intense heat, molten metals, or highly particulate-contaminated atmosphere is prohibited.

Management shall assess which employees in their operations wear eye glasses routinely, determine what respiratory protective masks (makes and models) are used, and assure that the appropriate frames or ophthalmic device hangers are obtained and provided at company expense.

RESPIRATORY PROTECTION PROGRAM**Employee Training and Instruction**

The basic respiratory training program shall include, as a minimum, the following:

- Instruction in the need for, use, sanitary care, and limitations of each respirator type.
- Opportunity for "hands-on" experience with respirators.
- Proper fitting, including demonstrations and practice in wearing, adjusting, and determining the fit of the respirator. A selection of respirators shall be available to determine the most comfortable respirator and the best fit.
- How to perform a positive and negative pressure test of the face piece to face seal.
- A familiarization period of wear in normal air.
- For negative pressure respirators, qualitative fit testing will be conducted by wearing the respirator in an irritant fume test atmosphere. A qualified person using the protocol found in Attachment A of this procedure shall perform all qualitative fit testing or other protocol, as designated by specific standards (e.g., asbestos, benzene). Powered air-purifying respirators (PAPRs) shall be worn in a test atmosphere with the power supply disconnected to evaluate fit in the negative pressure modes.
- Qualitative fit testing shall be performed annually, or more frequently as required by law. Quantitative fit testing may be required for some respirator or contaminants. The Field Health and Safety Staff will determine fit test requirements. Fit testing procedures are presented in Attachment A.
- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.
- Classroom and field training to recognize and cope with emergency situations (including respirator failure).

Training provided as part of this procedure shall be performed in accordance with applicable regulations.

Respirator Inspection, Cleaning, Maintenance, and Storage

General: The Field Health and Safety Staff will define and provide a program to area/facility management regarding maintenance and care of respirators, and which shall be adjusted to the type of facility, working conditions, and hazards involved. This program shall include the following basic elements:

- Inspection for defects and/or deterioration.
- Cleaning and disinfecting in accordance with manufacturers' instruction.
- Repair, as necessary.

RESPIRATORY PROTECTION PROGRAM

- Establishment and maintenance of a record-keeping system to document respiratory inspection, repair, and maintenance.
- Proper storage.

Inspection, Maintenance, and Storage

Users shall inspect all respirators routinely before, during, and after each use. Any defects shall be reported to the supervisor. No defective respirators shall be issued or worn. Defective respirators shall be tagged and returned for repair.

Respirators maintained for emergency use (such as SCBA) shall be inspected and sanitized after each use and inspected at least monthly. A record of the most recent inspection shall be maintained on the respirator or the storage container and shall include the inspector's identification, the date, and a respirator identification number.

An individual who is qualified by experience or training shall regularly clean, inspect, and sanitize routinely-used respiratory equipment.

Other types of respiratory equipment shall be maintained according to the manufacturers' instructions.

Where respirators are assigned to individual employees, area management shall ensure compliance with cleaning and maintenance requirements by periodically inspecting respiratory equipment and conducting field audits.

Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.

When not in use, respirators shall be stored to protect against dust, sunlight, extreme temperatures, excessive moisture, damaging chemicals, and physical damage.

Air Purifying Respirators (APR)

Fit testing shall be accomplished in accordance with Attachment A of this procedure.

When APRs are worn, employees shall change the filter-cartridge elements daily, in the case of cartridges used for non-particulate contaminants, or sooner if "breakthrough" is occurring. For other filter cartridges, the filter-cartridge should be replaced whenever an increase in breathing resistance is detected.

Powered Air Purifying Respirators (PAPR)

When PAPRs are worn, employees shall change filter/cartridge elements daily, in the case of cartridges used for non-particulate contaminants, or sooner if "breakthrough" is occurring. For other filter cartridges, the filter-cartridge should be replaced if any of the following scenarios occur:

RESPIRATORY PROTECTION PROGRAM

- Whenever an increase in breathing resistance is detected, or
- When airflow through filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

Compressed Air Systems

- Air Quality
 - Compressed air used for respiration shall be of high purity, and shall meet, as a minimum, the requirements for the specification for Grade D or better breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1-1973). The supplier shall certify compliance with these requirements for each lot of breathing air supplied.
 - Breathing air shall be free from harmful dusts, fumes, mists, vapors, gases, or odors.
 - Oxygen shall NOT be used at any time in open-circuit SCBAs or in air-line respirators.
 - Mixed or blended air shall not be used for breathing purposes.

Compressed Air Cylinder Systems (Cascade)

Breathing air cylinders shall be legibly identified with the word AIR, by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cascade systems shall be equipped with low-pressure warning bells or similar warning devices to indicate air pressure in the manifold below 500 psi.

When a cascade system is used to supply breathing air, one employee shall be assigned as a safety standby within audible range of the low-pressure alarm.

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and a coupling rated at a capacity of at least 3,000 psi.

Air-line couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with non-respirable gases or oxygen.

The air pressure at the hose connection to positive pressure respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve. Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g., supported with substantial rope or chain in the upper one-third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling. Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 125°F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.

Only cylinders within current hydrostatic test periods shall be used.

RESPIRATORY PROTECTION PROGRAM**Compressor Supplied Breathing Air**

All compressors used for supplying breathing air shall be equipped with the following safety and standby devices:

- Compressor intakes that are located to ensure that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere upon compressor failure shall be provided.
- Oil Lubricated Compressors – If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:
 - A continuous-reading carbon monoxide monitoring system that is set to alarm should the carbon monoxide concentration exceed 10 ppm.
 - A high-temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit,
- A designated employee shall be assigned as a safety standby and shall remain continuously within audible range of the alarms.
- An inline purifying filter assembly to remove oil, condensed water, particulate, odors, and organic vapors shall be used in conjunction with the air compressor.

Routine inspection and maintenance of the air compressor shall be performed in accordance with manufacturer's specifications.

Escape/Egress Units

These respirators are intended for use in areas where escape with a short-term (5-10 minute) air supply is necessary. They may be used as adjuncts to airline pressure demand respirators as a backup air supply; or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be accomplished and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

Escape/egress units shall never be used as primary standby respirators for confined space entry.

RESPIRATORY PROTECTION PROGRAM**Medical Screening**

All potential candidates shall complete a medical questionnaire prior to respiratory use and once every three years. A more comprehensive medical evaluation may be required based on the results of the questionnaire.

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that the employee is physically able to perform the work while using the required respirator.

If an employee demonstrates difficulty in breathing during the fitting test or during use, the employee shall be re-examined by a physician to determine whether the employee can wear a respirator while performing the required duty.

Once a medical determination has been made to physical ability to wear a respirator, a review of the employee's health status shall be conducted annually, at a minimum.

RESPIRATORY PROTECTION PROGRAM**ATTACHMENT A****PARAMETRIX MANDATORY QUALITATIVE RESPIRATOR FIT TEST PROTOCOL**

NOTE: This protocol does not satisfy the fit test requirements for certain materials, including asbestos and benzene. Contact the Field Health and Safety Staff for assistance.

Respirator Selection

Respirators shall be selected as described in this procedure. The respirator shall be equipped with HEPA filters.

Fit Test

The test conductor shall review this protocol with the test subject before testing.

The test subject shall perform the following conventional positive and negative pressure fit checks:

- Negative Pressure Test – Cover the cartridge filter inlets with your palm and gently inhale, the face piece should collapse against the face.
- Positive Pressure Test – Cover the exhalation valve cover with your palm and gently exhale. The face piece should expand away from the face.
- If either test fails, loosen and readjust the respirator straps and check for obstructions to the sealing surface. Repeat both tests. If the test fails again, select an alternate respirator.

A test atmosphere shall be generated with irritant smoke.

The test subject shall be advised that the smoke can be irritating to the eyes and instructed to keep the eyes closed while the test is being conducted (applies to half-mask respirators).

While wearing the selected respirator, the test subject shall enter the test atmosphere and perform the following exercises:

- Breathe normally.
- Breathe deeply. Be certain breaths are deep and regular.
- Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.
- Nod head up and down. Be certain motions are complete and made every second. Inhale on each side. Do not bump the respirator against the shoulders.
- Nod head up and down. Be certain motions are complete and made every second. Inhale when head is in the full, up position (looking toward ceiling). Do not bump the respirator against the chest.

RESPIRATORY PROTECTION PROGRAM

- Talk aloud and slowly in a fashion that will generate a wide range of facial movements.
- Breathe normally.

The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

Each test subject passing the smoke test (i.e., without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. This may be performed by cracking the mask and gently inhaling while inside the test atmosphere. Failure to evoke a response shall void the fit test. This may trigger an asthmatic response; verify before beginning.

The test shall not be conducted if there is any hair growth between the skin and the face-piece sealing surface.

If hair growth or apparel interferes with a satisfactory fit, then the obstruction(s) shall be altered or removed to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator, such as a powered, air-purifying respirator, supplied air respirator, or self-contained breathing apparatus.

If a test subject exhibits difficulty in breathing during the tests, the subject shall be referred to a physician trained in respiratory diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing required duties.

Qualitative fit testing shall be repeated at least every year, or more often, as required by law. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the last subject has experienced:

- A weight change of 20 pounds or more.
- Significant facial scarring in the area of the face-piece seal.
- Significant dental changes (i.e., multiple extractions without prosthesis, or acquisition of dentures).
- Reconstructive or cosmetic surgery.
- Any other conditions that may interfere with face-piece sealing.

RESPIRATORY PROTECTION PROGRAM**Record Keeping**

The following fit test forms shall be maintained in each office for three years. The Corporate Health and Safety Officer shall maintain permanent records. The summary shall include:

- Name of test subject.
- Date of testing.
- Name of test conductor.
- Respirator selected (indicate manufacturer, model, size, and approval number).
- Testing agent.

HANDLING OF INVESTIGATION-DERIVED WASTE

Prepared By: Jung A. Bukowski Date: 3-10-03
Health and Safety Committee Chair

Reviewed By: G. McConnell Date: 3/11/03
Corporate Health and Safety Officer

Approved By: MLZ Date: 3/11/03
Chief Operating Officer

1.0 Purpose

Management of investigation-derived waste (IDW) minimizes the potential for the spread of hazardous waste on site or off site through investigation activities. The purpose of this Standard Operating Procedure (SOP) is to provide instructions for the proper management of contaminated materials derived from field investigations.

2.0 Scope

The procedures outlined are to be followed by all personnel who participate in site activities in areas where IDW is generated.

Materials that are known or suspected to be contaminated with hazardous substances through the actions of sample collection or personnel and equipment decontamination were said to be investigation-derived wastes. These wastes include decontamination solutions, disposable equipment, drill cuttings and fluids, and groundwater monitoring well development and purge waters. To the extent possible, the Site Manager will attempt to minimize the generation of these wastes through careful design of decontamination schemes and groundwater sampling programs. Testing conducted on soil and water investigation-derived wastes will show if they were also hazardous wastes as defined by RCRA. This will determine the proper handling and ultimate disposal requirements.

The criteria for designating a substance as a hazardous waste, according to RCRA, is provided in 40 CFR 261.3 if investigation-derived wastes meet these criteria, RCRA requirements must be followed for packaging, labeling, transporting, storing and record keeping as described in 40 CFR 262.34. Those wastes judged to potentially meet the criteria for hazardous wastes, shall be stored in Department of Transportation-approved, 55-gallon steel drums.

Wastes that can be shown not to be RCRA-designated hazardous wastes may be handled and disposed on site or off site to municipal wastewater and/or solid waste systems at the direction of the EPA RPM. Investigation-derived waste is assumed to be RCRA-designated hazardous waste unless analytical evidence indicates otherwise.

**HANDLING OF
INVESTIGATION-DERIVED WASTE**

3.0 Investigation-Derived Waste Management

Procedures that minimize the potential for the spread of hazardous waste include minimizing the volume of waste generated, waste segregation, appropriate storage, and disposal, according to RCRA requirements.

Waste Minimization

Within the absolute constraints demanded by worker health and safety and project quality assurance/quality control, the generation of investigation-derived wastes is to be limited. In the development of the investigation work plan, each aspect of the investigation is to be reviewed to identify areas where excess waste generation can be eliminated. General procedures that will eliminate waste include avoidance of unnecessary exposure of materials to hazardous waste, and coordination of sampling schedules to avoid repetitious purging of wells and use of sampling equipment.

Waste Segregation

Waste storage and handling procedures to be used depend on the type of generated waste. For this reason, investigation-derived hazardous wastes described below are segregated into separate, 55-gallon storage drums. Waste materials that are known to be free of hazardous waste contamination (such as broken sample bottles or equipment containers and wrappings), must be collected separately for disposal to municipal systems. Large plastic garbage or lawn and leaf bags are useful for collecting this trash.

Decontamination Solutions

Decontamination solutions are generated from washing and rinsing of personal protective equipment (PPE) and sampling equipment. Solutions considered investigation-derived wastes range from detergents, organic solvents, and acids used to decontaminate small hand samplers to steam cleaning rinsate used to wash drill rigs and other large equipment. These solutions are to be stored in 55-gallon drums with bolt-sealed lids.

Soil Cuttings and Drilling Mud

Soil cuttings are solid to semisolid soils generated during trenching activities, drilling for the collection of subsurface soil samples, or the installation of monitoring wells. Depending on the type of drilling, drilling fluids known as "muds" may be used to remove soil cuttings. Drilling fluids flushed from boreholes must be directed into a settling section of a mud pit. This allows reuse of the decanted fluids after removal of the settled sediments. Drill cuttings, whether generated with or without drilling fluids, are to be removed with a flat-bottomed shovel and stored in 55-gallon drums with bolt-sealed lids.

Well Development and Purge Water

Well development and purge waters consists of groundwater removed from monitoring wells to repair damage to the aquifer following well installation, obtain characteristic aquifer groundwater samples, or measure aquifer hydraulic properties. The volume of groundwater to be generated will determine the appropriate storage procedure. These activities can generate significant volumes of groundwater depending on the well yield and the duration of the test or activity. Use of drums or large-volume, portable tanks such as "Baker Tanks" should be considered for temporary storage of purge water.

**HANDLING OF
INVESTIGATION-DERIVED WASTE****Disposable Equipment**

Disposable equipment includes used personal protective equipment such as Tyvek coveralls, gloves, booties and APR cartridges, and some inexpensive sampling equipment such as trowels or disposable bailers. This equipment is assumed to be contaminated if it was used at a hazardous waste site because it is impractical to submit these items for analysis. These materials should be stored on site in 55-gallon drums, pending final disposal.

Waste Storage

The wastes that accumulate through investigations must be stored on site prior to disposal. An on-site waste staging area should be designated to provide secure and controlled storage for the drums. Per RCRA requirements, storage cannot exceed 90 days for materials presumed or shown to be RCRA-designated hazardous wastes. Waste that is known not to be RCRA-designated, should be promptly disposed to municipal waste systems.

Storage Containers

Containers shall be DOT-approved (DOT 17H 18/16GA OH unlined), open top, steel drums. The lids should lift completely off the drum, and be secured by a bolt ring. Enough drums should be ordered to store all anticipated waste, including extra drums for solid waste and decontamination water. Solid and liquid wastes are not to be mixed in the drums.

Pallets are often required to allow transport of filled drums to the staging area with a forklift. Normal pallets are 3' x 4' and will hold two to three, 55-gallon drums, depending on the filled weight. If pallets are required for drum transport or storage, Parametrix field personnel are responsible for ensuring that the empty drums are placed on pallets before they are filled and that the lids are sealed on the drums with the bolt tighten ring after the drums are filled. Because the weight of one drum can exceed 500 pounds, under no circumstances should Parametrix personnel attempt to move the drums by hand. In addition, Parametrix personnel should not operate forklifts as part of their regular field activities. Removal of drums to the staging area is normally the responsibility of the client, unless other arrangements have been made.

Drum Labeling

Each drum that is used will be assigned a unique number that will remain with that drum for the life of the drum. This number will be written in permanent marker on the drum itself. Do not label drum lids. Drum labels shall contain the following information:

- Waste accumulation start date.
- Well number or boring number, if applicable.
- Drum number.
- Contents matrix (soil, water, slurry, etc.).

**HANDLING OF
INVESTIGATION-DERIVED WASTE**

- Generation location.
- Project name.

4.0 Waste Disposal

Responsibility for the final disposal of investigation-derived waste will be determined before field activities are begun and shall be described in the investigation work plan. Disposal or long-term storage (over 90 days) of RCRA-designated hazardous wastes requires procedures that are beyond the scope of this SOP. The Parametrix Hazardous Waste Management Program is presented in SOP HS-005.

DECONTAMINATION

Prepared By: James A. Bakonki
Health and Safety Committee Chair

Date: 3-10-03

Reviewed By: McConnell
Corporate Health and Safety Officer

Date: 3/11/03

Approved By: ML
Chief Operating Officer

Date: 3/11/03

1.0 Purpose

This Standard Operating Procedures (SOP) provides instructions for personnel and equipment decontamination that are to be followed during field operations.

2.0 Scope

Decontamination is the process of removing or neutralizing contaminants that have accumulated on personnel and/or equipment at hazardous waste sites. Decontamination is required to protect personnel from the potential effects of hazardous substances and to minimize the spread of those substances. Decontamination methods include physical removal of contaminants, detoxification, and disinfection/sterilization.

This SOP describes decontamination responsibilities and procedures to be implemented at hazardous waste sites. The procedures outlined are to be followed by all personnel who participate in site activities in areas that may contain hazardous substances. The scenarios of decontamination procedures presented here will not necessarily all be appropriate for a given site. Project procedures may be prepared as part of the Site-specific Health and Safety Plan (HSP) that focus on site-specific conditions and incorporate the appropriate procedures presented in this SOP.

This procedure applies in its entirety to all Parametrix projects unless the Corporate Health and Safety Manager (CHSO) grants a variance. Modifications to these procedures may be appropriate on a project-specific basis.

3.0 Responsibilities

There are specific responsibilities for Parametrix personnel in complying with the required decontamination procedures, depending on an individual's role within the company or on a given project. These responsibilities are outlined below:

- **Site-specific Health and Safety Officer:** The Site-specific Health and Safety Officer (SHSO) is responsible for maintaining and enforcing the project decontamination program. HSP decontamination procedures for all projects shall be reviewed and authorized by the

CHSO. All modifications and/or changes must be noted in the field logbook, documented as HSP revisions, and initialed by all field personnel.

- **Site Manager:** The Site Manager is responsible for assuring that all site personnel become familiar with and follow the decontamination procedures described in this SOP or in the Site-specific HSP.

4.0 Personnel Decontamination Procedures

Contamination avoidance is the best way to prevent the spread of contaminants. Direct contact with contaminants should be minimized by not leaning against objects, and not kneeling or sitting on the ground; through the use of remote sample-handling and container-opening techniques, wherever appropriate; and through the use of disposable equipment, wherever appropriate.

Decontamination Program Planning

The SHSO shall research the background information on a particular site when planning decontamination procedures for the fieldwork at that site. The physical, chemical, toxicological, and pathogenic properties (if any), as well as the amounts and concentrations of each contaminant present at the site, are the determining factors in selecting the levels of protection for personnel and the extent of decontamination required. Sources of information for the characterization of hazardous waste sites include site records, state and federal agency files, and interviews with knowledgeable people. Hazardous and toxicological references, industrial process references, and manufacturers' handbooks are also good sources of information. Topography, local meteorological conditions (most probable wind direction, rainfall, etc.), and other site-specific features, are factors to consider in defining decontamination measures.

Decontamination Station Layout

When site conditions require, a dedicated area shall be established as a decontamination station. The decontamination station shall be located upwind of the Exclusion Zone. This is especially important when airborne contaminants are detected at above-background levels, or when such a potential exists. This is to prevent the airborne contamination of the Contamination Reduction Zone (CRZ) and the Support Zone. Exclusion, CRZ, and Support Zones are depicted in Figure I and defined as follows:

- **Exclusion Zone:** The zone encompassing the contaminated area that must be large enough to prevent the spread of contaminants beyond its boundaries. The extent of the Exclusion Zone will depend on:
 - Toxicity of the contaminants.
 - Physical form of the contaminants (solid, liquid, or gas).
 - Amounts and concentrations of the contaminants.
 - Fire and explosive potential of contamination.
 - Site-specific conditions such as topography and meteorology, and potential and active migration pathways to air, water, and soil.

DECONTAMINATION

- **Contamination Reduction Zone (CRZ):** The area between the Exclusion and Support Zones where contamination is controlled and/or removed. A contamination reduction corridor is an area within the CRZ that is the point of entry and exit for personnel to and from the Exclusion Zone.
- **Support Area:** The Support Area is separated from the CRZ by the contamination control line (CCL). The Support Area must be free from all contamination at all times.

The boundaries of the decontamination station should be clearly visible to all field personnel. The decontamination line should be set up along a straight line to facilitate identifying each station in the decontamination process. Movements to and from the exclusion zone will only be via the decontamination corridor.

Site-specific conditions to consider when locating the decontamination station are the location(s) of field investigation activities, accessibility to site personnel, and site terrain and safety. The decontamination station should be moved if site investigation activities are moved significantly.

The SHSO will determine if gross contamination has spread beyond the Exclusion Zone if wind direction changes (when airborne contaminants are suspected), inclement weather develops, or other site-specific factors arise.

Multiple decontamination stations may be deemed necessary by the SHSO, depending on the particular project.

Decontamination equipment materials and supplies are generally selected on the basis of availability and compatibility with contaminants encountered. Other considerations include ease of equipment decontamination, disposability, and site-specific requirements. Recommended equipment for a decontamination station includes the following:

- Plastic sheeting, or other suitable materials, on which the decontamination tubs, clean equipment, and contaminated equipment can be set down.
- Long-handled, soft-bristled wire or other scrub brushes to help scrub off contaminants.
- Large plastic or steel tubs or other suitable tubs. These should be large enough for a worker to step in.
- Paper towels for drying protective clothing and equipment.
- DOT-approved drums with lids for contaminated wash and rinse solutions, for contaminated disposal items and for trash cans.
- Washcloths, soap, and towels for hand rinse.
- Pressurized spray cans for deionized/distilled water.
- Portable shower facilities for full-body wash (it needed).
- Folding chairs and tables.

- Pocket knife.
- Stakes and rope for marking the hot zone limits.
- First Aid kit.
- Decontamination solutions and detergents.
- Distilled and deionized water. Potable tap water for decontamination.

Personnel Decontamination Solutions

Personnel will generally use household soap and water. The detergents Alconox or Liquinox and water are the preferred surfactants for most decontamination procedures relating to equipment. Selection of specific solvents and decontamination solutions are to be defined in the site work plan.

The effectiveness of decontamination solutions will be continuously verified. Visual observations of discoloration, stains, and arid substances adhering to objects, are indications that the decontamination solution is not effective in removing contamination. Decontamination solutions must be replenished frequently with use, to ensure their continued effectiveness.

The quality of rinse water used in the decontamination process shall be verified. A distilled/deionized rinse is the final step in the decontamination of equipment and in removing all traces of contaminants.

Personnel Decontamination

Personnel decontamination procedures depend on the level of personal protection worn by the field crew, as required by the Site-specific Health and Safety Plan, and upon the degree of contamination the crewmembers experience. The objective of personal decontamination is to protect the health of all crewmembers and to prevent the spread of contamination from the site. Therefore, the following procedures should be extended and modified by the SHSO until all field personnel are satisfied that complete decontamination has been accomplished. In the event of an emergency, the SHSO may judge it necessary to curtail these decontamination procedures to evacuate the site or initiate First Aid.

- **Level B Decontamination:** Level B personal protection equipment (PPE) includes chemical-resistant disposable coveralls, SCBA, hardhat, steel-toe/shank boots, boot covers, and inner and outer gloves. Level B decontamination procedures also can be divided into four sublevels: (1) highly-contaminated personnel exiting the Exclusion Zone, (2) minimally-contaminated personnel exiting the Exclusion Zone, (3) highly-contaminated personnel crossing the hot line to exchange SCBA tank, and (4) minimally-contaminated personnel crossing the hot line to exchange SCBA tank. These distinctions are noted in the decontamination station descriptions below.
 - Station 1 – Segregated Equipment Drop (All Sublevels): Before crossing the hot line, personnel returning from the field must deposit all equipment and/or sample bottles in segregated areas on plastic sheeting. Highly-contaminated equipment, such as samplers and sample containers, are kept separate from minimally-contaminated and difficult-to-clean equipment, such as air monitoring equipment.

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- Station 2 – Boot Cover and Outer Glove Wash, Rinse, and Removal: Personnel must step into a washtub containing a detergent solution. Boot covers and outer gloves are scrubbed with a long-handled, soft-bristled brush. All surfaces of the boots and gloves are washed, including boot soles and duct tape used to seal covers and gloves to coverall. Boot covers, including soles and outer gloves, are rinsed with a long-handled, soft-bristled brush. Tape is removed from boot covers and outer gloves and deposited into a plastic-lined disposal drum. Boot covers, and outer gloves are removed and deposited into a plastic-lined disposal drum. A knife may be used to aid in the removal of tight-fitting boot covers.

- Station 3 – Coverall, SCBA, and Safety Boot Wash and Rinse: At this station, all exposed surfaces of PPE are washed with the detergent solution. Personnel must step into a washtub containing a detergent solution. All gear is scrubbed with a long-handled, soft-bristled brush. All surfaces of gear should be scrubbed, including boot soles, until visible contamination is removed. All exposed surfaces of PPE are rinsed to remove detergent.

Personnel must step into a washtub containing tap water. All gear is rinsed with a long-handled, soft-bristled brush. Pressure sprayers containing tap water may be used to aid in rinsing.

- Station 4 – Safety Boot, SCBA Backpack, and Chemically-Resistant Overall Removal: Boots must be removed and set on plastic sheeting. While still wearing the face-piece, the SCBA backpack is removed and set on a chair or table. The air supply hose is disconnected from the regulator valve. Chemically-resistant overalls are removed and disposed to a plastic-lined disposal drum.
- Station 5 – Inner Glove Wash and Rinse and SCBA Face Piece Removal: Inner gloves are scrubbed by rubbing hands together with a detergent solution then rinsed in tap water. The SCBA face piece is removed without touching inner gloves to face. Deposit face piece on plastic sheeting.
- Station 6 – Inner Glove Removal: Inner gloves are removed and disposed to a plastic-lined disposal drum.
- Station 7 – Field Wash/Field Shower: Hands and face are washed with hand soap, then rinsed and dried with paper towels. If highly-toxic, skin-corrosive, or skin-absorbable materials are at the site, shower entire body.

- **Level C Decontamination:** Level C personal protection includes chemical-resistant disposable coverall, APR, hardhat, steel-toe/shank boots, boot covers, and inner and outer gloves. Depending on exposure hazards, boot covers and outer gloves may not be required, and Tyvek coveralls may be substituted for chemical-resistant coveralls. Station decontamination activities include the following:

- Station 1 – Segregated Equipment Drop: Before crossing the hot line, personnel returning from the field must deposit all equipment and/or sample bottles in segregated areas on plastic sheeting. Highly-contaminated equipment, such as samplers and sample containers, are kept separate from minimally-contaminated and difficult-to-clean equipment, such as air monitoring equipment.

DECONTAMINATION

- Station 2 – Boot Covers and Outer Glove Wash, Rinse, and Removal: Personnel must step into a wash tub containing a detergent solution. Boot covers and outer gloves are scrubbed with a long-handled, soft-bristled brush. All surfaces of the boots and gloves are washed including boot soles and duct tape used to seal covers and gloves to coveralls.

Personnel must step into a washtub containing tap water. Boot covers, including bottoms and outer gloves, are rinsed with a long-handled, soft-bristled brush. Tape that seals boot covers and outer gloves is removed and deposited into a plastic-lined disposal drum. Boot covers and outer gloves are removed and deposited into a plastic-lined disposal drum. A knife may be used to aid in the removal of tight-fitting boot covers.

- Station 3 – Safety Boots and Coveralls Wash, Rinse, and Removal: Personnel must step into a wash tub containing a detergent solution. Boots are scrubbed with a long-handled, soft-bristled brush. If leather safety boots are worn, the soles are scrubbed and the upper surfaces are wiped with a paper towel dipped in detergent solution. If waterproof coveralls are worn, they are scrubbed also. All surfaces of gear, including boot soles, are scrubbed until visible contamination is removed.

Personnel must step into a washtub containing a tap water. Boots and coveralls are rinsed with a long-handled, soft-bristled brush. Boots are removed and set on plastic sheeting. Coveralls are removed and disposed to a plastic-lined disposal drum.

- Station 4 – Inner Glove Wash and Rinse: Inner gloves are scrubbed by rubbing hands together with a detergent solution. Finish with a rinse in tap water.
 - Station 5 – APR and Inner Glove Removal: The APR is removed without touching inner gloves to face, and then deposited on plastic sheeting. Inner gloves are removed and disposed to a plastic-lined disposal drum.
- **Level D Decontamination:** Level D is the lowest level of personal protection and is worn when exposure to contaminants is not expected. Level D personal protection includes hardhat and steel-toe/shank leather boots. Depending on the anticipated activities, Level D may also include Tyvek coveralls and gloves. Station decontamination activities include the following:
 - Station 1 – Segregated Equipment Drop: Personnel returning from the field must deposit all equipment and/or sample bottles in segregated areas on plastic sheeting. Highly-contaminated equipment, such as samplers and sample containers, are kept separate from minimally-contaminated and difficult-to-clean equipment, such as air-monitoring meters.
 - Station 2 – Safety Boot Wash, Rinse, and Removal: Boot soles must be scrubbed with a long-handled, soft-bristled brush. All surfaces of gear, including boot soles, must be scrubbed until visible contamination is removed. Boot soles are rinsed with tap water using a long-handled, soft-bristled brush. Boots are removed and set on plastic sheeting.

- Station 3 – Coveralls Removal (if needed): If worn, remove coveralls and dispose to a plastic-lined disposal drum.
- Station 4 – Glove Wash, Rinse, and Removal (if needed): If worn, inner gloves are scrubbed by rubbing hands together with a detergent solution. Finish with a rinse in tap water. Gloves are removed and disposed to a plastic-lined disposal drum.

Priorities for Worker Decontamination

The following members of the work team returning from the Exclusion Zone shall have priority over others when being decontaminated.

- A worker who is in need of First Aid, or is in physical discomfort.
- A worker who is low on air or whose SCBA is malfunctioning.
- A worker who has been highly contaminated.
- A worker who did the major part of physical activity required on site.

It is the responsibility of the SHSO to decide which workers receive priority.

Emergency Decontamination

In an emergency, the primary concern shall be to prevent the loss of life or severe injury to personnel. If immediate administration of medical treatment is required to prevent further deterioration of health, then decontamination may be eliminated, modified, or performed later when the condition has stabilized. The SHSO and the team leader must weigh the consequences of delaying, modifying, or eliminating decontamination against the consequences of delaying treatment, before making a decision on a case-by-case basis.

First Aid equipment shall be readily available in the Support Area and, as specified in the Site-specific HSP. At least one response team member shall be trained in First Aid and CPR.

Arrangements shall be made to advise medical personnel on the nature of contaminants to which the patient was exposed and the extent of decontamination. In some cases, the SHSO will need to contact nearby emergency response medical facilities in advance to alert them of the possibility of a problem. This will help the medical facility to prepare for the specific sort of health care that may be required in an emergency.

Cold Weather Decontamination

In freezing temperatures, a small quantity of ethanol can be added to the washtubs containing decontamination and tap water to prevent freezing. Deionized water and distilled water containers shall be kept warm in the heated van or car for use when needed. Orchard sprayers shall also be kept in a warm place when not in use.

5.0 Decontamination of Equipment

Protection of Monitoring Instruments

All equipment and monitoring instruments shall be protected from contamination while in use by wrapping them in clean plastic bags and sealing them with tape.

Heavy Equipment

Heavy equipment like bulldozers, trucks and drilling equipment are difficult to decontaminate. Decontamination shall consist of either steam cleaning or washing with suitable detergent solutions and then water under high pressure. Decontamination equipment that may be needed include long-handled brushes, pressurized sprayers, curtains and enclosures to contain splashes from pressurized sprayers, and wire brushes. A decontamination pad lined with heavy-duty plastic sheeting may be needed for the decontamination of heavy equipment.

Tools/Sampling Equipment

Disposable tools shall be used wherever possible. Typically, decontamination of tools will include brushing with decontamination solution followed by tap water. This procedure shall be followed by spraying with distilled water and then deionized water. The tools shall be segregated and wrapped in clean plastic bags and taped securely.

Decontamination of sampling equipment such as split spoons, stainless steel buckets, and filtration transfer vessels shall be in accordance with the following steps:

- Set up clean tubs or buckets to collect wash and rinse solutions.
- Scrub item with Alconox or Liquinox and water until visually clean. Use Liquinox when phosphate is an analytical parameter.
- Rinse with tap water.
- Rinse with distilled or deionized water, the variety that can be found in any grocery store. A garden sprayer or squirt bottles may be used.

6.0 Level of Protection for Decontamination Team

Decontamination workers who initially come into contact with personnel and equipment returning from the Exclusion Zone shall be required to wear the same level of protection as the returning team, or one level lower. The level of protection for decontamination workers can be progressively decreased, without compromising worker safety, the further away the stations are located from the hot line. The SHSO shall determine the level of protection required for the decontamination team.

7.0 Investigation-Derived Waste

SOP HS-006 contains more detail on disposal of decontamination solutions and other decontaminated items such as paper towels and Tyvek. Typically, the wash tubs containing decontamination solution and

rinse water shall be emptied into DOT-approved drums. The wash tubs shall be sprayed with decontamination solution and tap water, and then also emptied into the drums. All solid waste shall be double-bagged and disposed of in drums. The drums shall be securely fastened and labeled as "decontamination water" or "solid waste." Include the name of the site, the date, the company name, and the level of fullness.

COLD STRESS

Prepared By: *Jan A. Bukowski* Date: 3-10-03
Health and Safety Committee Chair

Reviewed By: *Jim McConnell* Date: 3/11/03
Corporate Health and Safety Officer

Approved By: *MLG* Date: 3/11/03
Chief Operating Officer

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines to protect workers from the effects of cold stress (hypothermia) and cold injury.

2.0 Scope

Most cold-related worker fatalities have resulted from failure to escape low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is a fall in the deep core temperature of the body.

Hypothermia occurs when a person's body loses heat faster than it can be produced. The body's "normal" deep body temperature is 99.6°F. If your body temperature drops to 95°F, uncontrollable shivering occurs. If cooling continues, other symptoms, listed below, or even death may occur:

- Vague, slow, slurred speech.
- Forgetfulness, memory lapses.
- Inability to use hands.
- Frequent stumbling.
- Drowsiness.
- Unconsciousness.

Hypothermia can occur at temperatures above freezing. Cold, wet, windy conditions make prime hypothermia weather.

Hypothermia impairs judgment. A worker may not be able to make good decisions about his/her situation. Preventing hypothermia is the best way to avoid being a victim.

Frostbite is the freezing of some part of the body. Fingers, toes, and whole arms and legs can be lost as a result of frostbite.

Pain in the hands and feet is felt only when the temperature of the tissue is changing rapidly. There may be no pain with gradual freezing.

Loss of the sensations of touch, pressure, and pain may occur without awareness of any numbness or other sensation. Therefore, it is important to test these sensations often and to wear clothing that is loose and does not restrict the flow of blood to the limbs.

Exposed parts of the body should be inspected routinely. This is done best by a partner. Just before freezing, the skin, especially the face, becomes bright red. Then, small patches of white appear as freezing occurs.

At the same time, the skin also becomes less elastic. This is best noted in the finger pads, which remain pitted when touched or squeezed. Any further cooling will surely result in frostbite.

Serious freezing is most common in the feet because of less awareness of them, poor circulation and sensation, and inadequate foot gear. Hands are second to feet in order of serious injury. Exposed hands are less likely to become frostbitten than feet because they are conditioned to exposure and have a better blood supply.

Next to the extent of freezing, inadequate or improper treatment of a frozen part of the body is the most common cause of serious loss of tissue. If a worker experiences frostbite, the worker should seek medical attention immediately.

3.0 Responsibilities

Project Managers, Supervisors, and SHSOs shall prepare for work in cold environments by providing heated break areas, adequate protective clothing, the availability of warm beverages, and shelter or clothing to keep site personnel dry.

The responsibilities of various personnel on the project site for monitoring and responding to various types of cold stress are provided below:

- **Site-specific Health and Safety Officer:** The Site-specific Health and Safety Officer (SHSO) is responsible for initial on-site coordination of the cold stress. The SHSO ensures that all personnel potentially exposed to cold have had proper training, that suitable warm clothing is available, and that an on-site supervisor can implement the program in his/her absence.
- **Project Manager:** The Project Manager is responsible for field implementation of the cold stress policy. This includes assurance that all personnel on site comply with the policy. The Project Manager shall also be responsible for taking temperatures, selecting proper clothing, and establishing work practices in the absence of the Site-specific Health and Safety Officer.
- **Team Member:** Team Members are responsible for understanding and complying with all site requirements.

4.0 Requirements

Workers shall be provided with warm clothing, such as mittens, heavy socks, etc., when the air temperature is below 40–45°F. Chemical-protective clothing may be used to protect the employee from cold.

When the air temperature is below 30–40°F (depending on employee comfort), clothing for warmth, in addition to chemical-protective clothing, shall be provided. This will include:

- Insulated suits, such as whole-body thermal underwear.
- Wool or polypropylene socks to keep moisture off the feet if there is a potential for work activity that would cause sweating.
- Insulated gloves (when air temperatures are extremely low (less than 5–10°F), gloves with reflective surfaces, which reflect body heat back to the hand, should be used).
- Boots.
- Insulated head covers, such as knit caps (ski caps).
- At air temperatures below 35°F, the following work practices must be followed:
 - If the clothing of an employee becomes wet on a project site, the outer layer of the clothing must be impermeable to water.
 - If an employee's underclothing (socks, mittens, etc.) becomes wet in any way, the employee must change into dry clothing immediately. If the clothing becomes wet from sweating, the employee may finish the task that caused the sweating before changing into dry clothing.
 - Employees must be provided a warm area (65°F or above) to change from work clothing into street clothing.
 - Employees must be provided a warm break area (60°F or above).
 - If appropriate, space heaters may be provided in the work area to warm the hands, feet, etc. Necessary fire and electrical safety practices shall be observed when using space heaters. Space heaters shall be shut off when the site is not occupied.
 - Hot liquids, such as soups, warm, sweet drinks, and the like, shall be provided in the break area. The intake of caffeinated beverages shall be limited because of diuretic and circulatory effects.
 - The "buddy system" shall be practiced at all times. Any employee who is observed with severe shivering shall leave the cold area immediately.
 - Employees should layer their clothing (i.e., wear thinner, lighter clothing next to the body, with heavier clothing layered outside the inner clothing).

- Avoid overdressing when going into warm areas or when performing activities that are strenuous. This could lead to heat stress problems.
- Auxiliary-heated versions of hand wear, footwear, etc., can be used in lieu of mittens, insulated socks, and the like, if extremely cold conditions exist and if they are compatible with hazards in the work area.
- Employees handling evaporator liquids (gasoline, hexane, alcohol, etc.) shall take special precautions to avoid soaking clothing or gloves with the liquids because of the added danger of cold injury resulting from evaporative cooling.
- Work shall be arranged in such a way that sitting still or standing for long periods is minimized.
- All employees who may work in cold areas shall be trained in:
 - Proper First Aid treatment.
 - Proper clothing practices.
 - Proper eating and drinking habits.
 - Recognition of impending, adverse health effects.
 - Safe work practices.

Clothing for warmth, which is worn under chemical-protective clothing, can be laundered in a normal fashion, without the wash water being collected as contaminated water so long as the chemical-protective clothing remains intact. If there is a rip or tear in the chemical protective clothing in a contaminated area, the clothing for warmth must be handled as potentially contaminated, and the water in which it is washed must be collected as potentially-contaminated water. More rigorous steps may be required if materials handled are extremely toxic (e.g., dioxin).

5.0 Procedure – First Aid Treatment

Treatment of Hypothermia

Employees must be trained to adequately understand the symptoms and treatments for hypothermia, at least to include the following:

- Be able to recognize the symptoms of hypothermia in yourself and others. Victims may deny they are in trouble. Even mild symptoms demand attention.
- Get the victim out of wet and windy weather.
- Remove all wet clothing.

- If the person is only mildly affected:
 - Give warm drinks.
 - Place the victim into dry clothing and a warm sleeping bag.
- If more seriously affected (very clumsy, confused, unable to shiver):
 - Treat the person gently.
 - Place the victim naked into a warm sleeping bag.
 - Place a rescuer, also naked, into the same sleeping bag. If you have a double bag, place the victim between two naked rescuers. Warmth from skin-to-skin contact is the safest method of rewarming. Any warm objects, such as rocks, hot water bottles, or heat packs, should be wrapped in towels or clothing. Arrange for evacuation. Do not give warm drinks until the victim has regained a clear level of consciousness, the ability to swallow, and is already starting to warm up.

Early Treatment of Frostbite

Next to the extent of freezing, inadequate or improper treatment of a frozen part of the body is the most common cause of serious loss of tissue.

For proper rewarming, the following additional procedures should be considered:

- In many cases, rewarming cannot be accomplished without the part again becoming frozen. For example, removing clothing from other parts of the body to warm a frozen part may only result in the loss of more body heat, greater extent of injury, and the ultimate refreezing of the afflicted part. Thawing and refreezing should always be avoided. It is best to continue, even if it means walking on a frozen foot, until shelter is available and rewarming can be done satisfactorily.
- Limbs should be rewarmed in stirred water just above normal body temperature (about 100-105°F). Using a thermometer is the only accurate way to measure this temperature. Never try to thaw in cold water or snow. Since feeling is lost, fires, stoves, exhaust pipes, etc., should never be used. Serious damage to the tissue could result.
- If a major part of a limb is frozen when rewarming begins, deep-body temperature will fall as the cooled blood begins to flow throughout the body. To prevent such cooling, warm liquids by mouth should be given. Even total immersion of the body in a warm bath may be necessary.
- Rewarming is an acutely painful experience and medication to alleviate pain should be given, if available. After thawing, a deep aching pain may persist for several days, depending upon severity of the injury. Pain is actually a good sign, since it indicates that nerve function is still present.

- The afflicted part should be moved gently and voluntarily during rewarming.
- A dull, purple color indicates more serious injury and requires medical attention. Swelling or blisters also indicate more serious problems. Other means for improving circulation are available but must be administered by medical personnel.

6.0 References

Threshold Limit Values and Biological Exposure Indices for 1985 1986, American Conference of Governmental Industrial Hygienists.

Alaska Department of Labor, *Physical Agent Data Sheet Cold Stress*, December 1987.

Appendix C

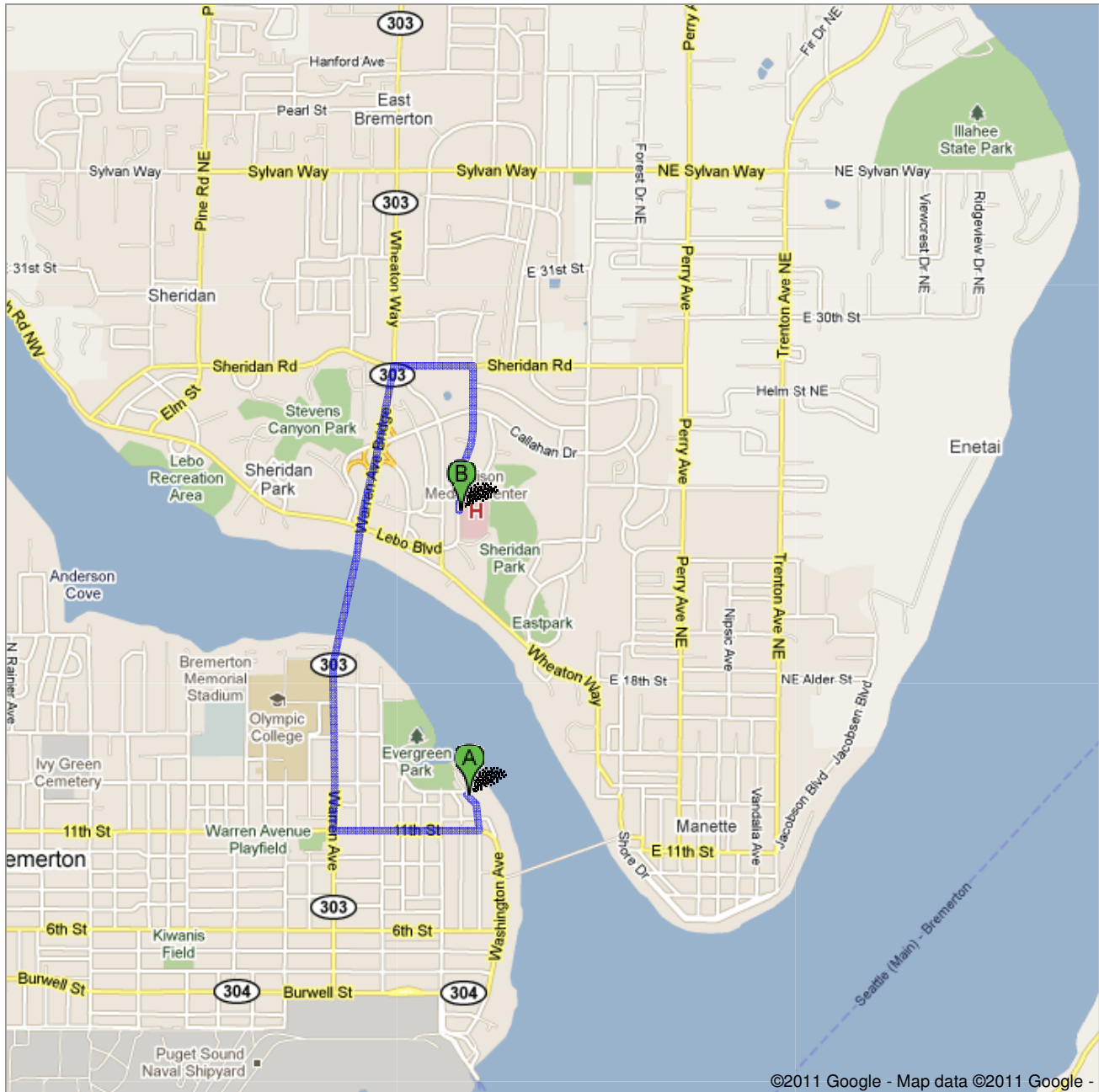
Map and Directions to Hospital



Directions to 2520 Cherry Ave, Bremerton, WA
98310
2.3 mi – about 6 mins

Save trees. Go green!

Download Google Maps on your
phone at google.com/gmm



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1310 Highland Ave, Bremerton, WA 98337

1. Head **southeast** on **Highland Ave** toward **11th St Pl**go 0.1 mi
total 0.1 mi2. Take the 2nd right onto **11th St**
About 1 mingo 0.4 mi
total 0.5 mi3. Turn right at **Warren Ave**
About 2 minsgo 0.7 mi
total 1.2 mi4. Continue onto **Warren Ave Bridge**go 0.5 mi
total 1.7 mi5. Turn right at **Sheridan Rd**go 0.2 mi
total 1.9 mi6. Take the 2nd right onto **Cherry Ave**
Destination will be on the left
About 1 mingo 0.4 mi
total 2.3 mi

2520 Cherry Ave, Bremerton, WA 98310

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2011 Google

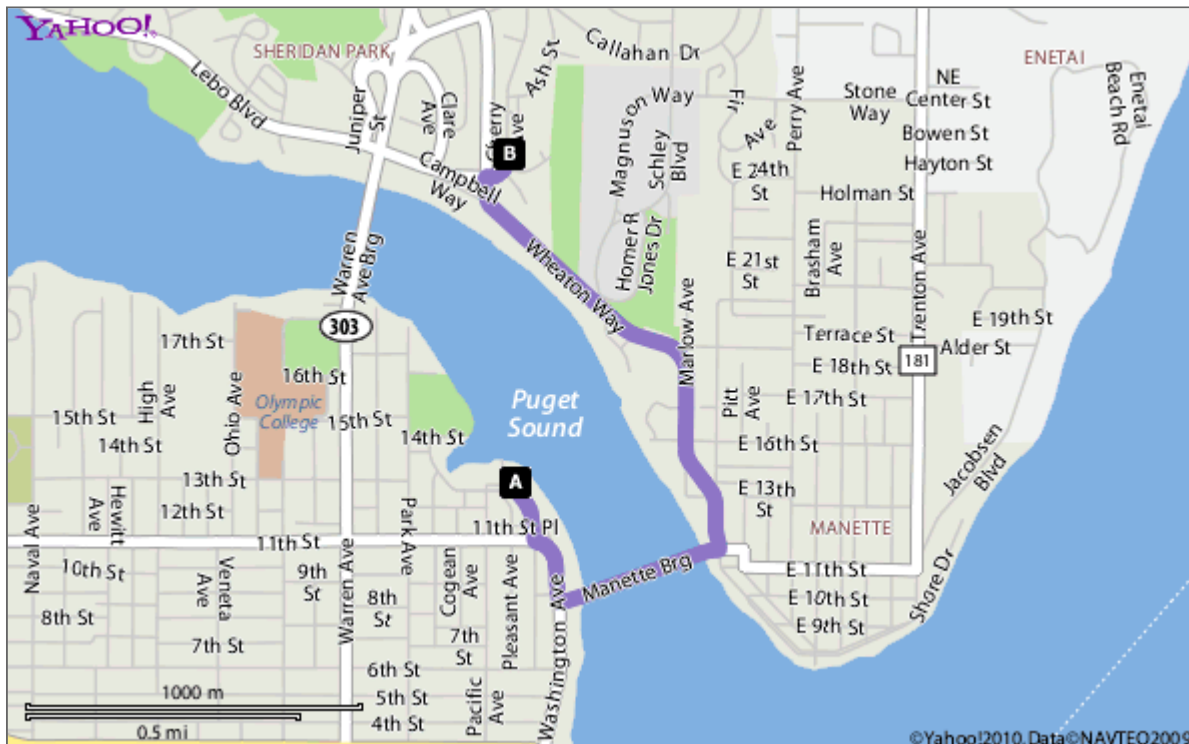
Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

Directions to 2520 Cherry Ave, Bremerton, WA 98310-4229 **YAHOO!**

Total Time: 6 mins, Total Distance: 1.64 mi

	Distance
A 1. Start at 1310 HIGHLAND AVE, BREMERTON going toward 13TH ST	go 0.12 mi
2. Turn L on 11TH ST	go 348 ft
3. Continue on WASHINGTON AVE	go 423 ft
4. Turn L on MANETTE BRG	go 0.34 mi
5. Turn L on WHEATON WAY	go 0.96 mi
6. Turn R on CHERRY AVE	go 387 ft
B 7. Arrive at 2520 CHERRY AVE, BREMERTON, on the R	

Time: 6 mins, Distance: 1.64 mi



When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

Appendix B

Field Forms

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER _____	BORING/WELL NUMBER # _____
PROJECT NAME _____	DATE COMPLETED _____
LOCATION _____	TOTAL DEPTH OF BORING _____
COORDINATES _____	INITIAL WATER LEVEL ▽ _____
DRILLING METHOD _____	STATIC WATER LEVEL ▽ _____
SAMPLING METHOD _____	LOGGED BY _____
GROUND ELEVATION _____	TOP OF CASING ELEVATION _____

PID (ppm)	BLOW COUNTS	RECOVERY (inches)	SAMPLE ID.	EXTENT	DEPTH (ft.)	U.S.C.S.	GRAPHIC LOG	DESCRIPTION SOIL: Group Name, Group Symbol, Color, Plasticity, Grain Size, Moisture Content, Density/Compaction, Miscellaneous	DEPTH (ft.)	WELL DIAGRAM
					5				5	
					10				10	
					15				15	
					20				20	
					25				25	

Continued Next Page



Chain of Custody

Environmental Inc. 14648 NE 95th Street • Redmond, WA 98052 Phone: (425) 883-3881 • www.onsite-env.com Company: Project Number: Project Name: Project Manager: Sampled by:						Turnaround Request (in working days)				Laboratory Number:																				
						(Check One)																								
						☐ Same Day ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ Standard (7 Days) (TPH analysis 5 Days) ☐ _____ (other)																								
						Number of Containers																								
						NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260B	Halogenated Volatiles 8260B	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082	Organochlorine Pesticides 8081A	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA / MTCA Metals (circle one)	TCLP Metals	HEM (oil and grease) 1664								% Moisture		
Lab ID	Sample Identification					Date Sampled	Time Sampled	Matrix																						
		Signature				Company				Date		Time		Comments/Special Instructions																
Relinquished																														
Received																														
Relinquished																														
Received																														
Relinquished																														
Received																														
Reviewed/Date						Reviewed/Date										Chromatograms with final report ☐														

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number:		Turn-around Requested:			Date:									
ARI Client Company:		Phone:			Page: of									
Client Contact:					No. of Coolers: Cooler Temps:									
Client Project Name:					Analysis Requested								Notes/Comments	
Client Project #:		Samplers:												
Sample ID	Date	Time	Matrix	No. Containers										
Comments/Special Instructions	Relinquished by: (Signature)			Received by: (Signature)				Relinquished by: (Signature)				Received by: (Signature)		
	Printed Name:			Printed Name:				Printed Name:				Printed Name:		
	Company:			Company:				Company:				Company:		
	Date & Time:			Date & Time:				Date & Time:				Date & Time:		



Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, notwithstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Appendix C

Sampling SOPs

STATIC WATER LEVEL MEASUREMENT

1.0 PURPOSE AND SCOPE

The objective of this document is to establish a method for measuring static water levels in groundwater monitoring wells. Measurements will be made accurate to the nearest 0.01 foot from a standard reference point on the well casing.

2.0 MATERIALS

The following materials are required for measuring static water levels:

- Well keys
- Electronic water-level indicator
- Weighted steel tape measure
- Paper towels
- Deionized water
- Health and safety equipment

3.0 PROCEDURES

Take the following steps to measure static water levels in groundwater monitoring wells:

1. Unlock and open the well and verify well integrity in notes.
2. Turn on and lower the electronic water level indicator to the water surface.
3. When the sounder indicates that the probe has contacted water, raise and lower the probe to verify the exact point at which the measurement should be taken.
4. Measure the depth to water to the nearest 0.01 foot from the reference point (notch or mark on well casing). If there is no mark on the well casing, measure to north or the highest point on the casing.
5. Record the measurement, to the nearest 0.01 foot, in the field notebook or on the Groundwater Sampling Field Data Sheet.
6. Measure the total well depth to the nearest 0.01 foot using a weighted steel tape measure.
7. Replace the well cap and close and lock the protective well casing.

4.0 DECONTAMINATION INSTRUCTIONS

Take the following steps to decontaminate down-hole measuring equipment:

1. While winding the equipment up from the well, thoroughly rinse with deionized water.
2. Remove excess water from the equipment with clean paper towels before rewinding equipment on the reel.

LOW-FLOW GROUNDWATER PURGING AND SAMPLING

1.0 PURPOSE AND SCOPE

The objective of this document is to collect representative groundwater samples from monitoring wells by minimizing stress on the stratigraphic formation and minimizing disturbance of sediment that has collected in the wells.

2.0 MATERIALS

- Wrench or socket set
- Well keys
- Electronic water level indicator
- Steel tape measure
- Appropriate diameter polyethylene (and silicone tubing if using a peristaltic pump)
- Multi-parameter water quality meter with flow cell
- Grundfos or peristaltic groundwater sampling pump with variable speed control
- Generator or portable battery
- Buckets
- Paper towels
- QAPP or SAP with well construction logs
- Graduated cylinder or other measuring container marked in milliliters
- Stop watch
- Groundwater Sampling Field Data Sheets and pen
- Traffic control cones, if needed
- Extension cord, if needed
- Health and safety equipment

3.0 PROCEDURES

Take the following steps to collect groundwater samples from monitoring wells:

1. Unlock the well and remove the cover and plug.
2. Measure the initial water level from the reference point to the nearest 0.01 foot. Reconfirm the measurement and record it on the Groundwater Sampling Field Data Sheet.
3. Calibrate the water quality meter according to the manufacturer's specifications.
4. Locate the screen interval of the well or target elevation by referring to the QAPP, SAP, or Well Construction Log. If a particular elevation isn't specified for the groundwater sample depth, choose an elevation as close to the center of the screen as possible. If the water level is below the top of the screen, choose an elevation half way between the water elevation and the bottom of the screen.
5. Measure and cut enough polyethylene tubing to achieve the target elevation plus adequate length for connections at the surface.
6. Using previously decontaminated equipment, connect the polyethylene tubing to the pump outlet and lower the pump and tubing into the well until the desired elevation is reached by reading incremental measurements on the pump power cord.
7. Connect the tubing to the inlet of the water quality meter. Cut enough extra tubing to transfer water from the water quality meter outlet to the purge bucket or container.
8. Start the generator, ensuring the exhaust is facing away from the well as exhaust fumes can impact sample quality. Connect the pump power cord to the control box and the control box power cord to the generator. Ensure the connection from pump to the control box is secure. Begin purging by pressing the forward button on the control box. Increase the pump speed by pressing the up arrow. As the pump speed is increased water will begin to flow through the water quality meter and into the bucket.
9. Measure the flow rate using a stop watch and graduated cylinder or other equivalent measuring device. Adjust the flow rate so that it falls between 300 and 500 milliliters per minute (ml/min). Record the flow rate on the Groundwater Sampling Field Data Sheet.
10. Monitor the water level at intervals of 3 to 5 minutes and record this information on the Groundwater Sampling Field Data Sheet. Adjust the flow rate so that the water level stabilizes (drawdown of 0.3 foot or less).
11. Monitor field parameters (pH, specific conductivity, and temperature) every 3 to 5 minutes during purging of the well and record this information on the Groundwater Sampling Field Data Sheet. Additional indicator parameters may include oxidation-reduction potential, dissolved oxygen, and turbidity. The well is considered stabilized and ready for sample collection when the parameters have stabilized for three consecutive readings as follows:
 - a. +/- 0.1 for pH
 - b. +/- 3% for specific conductance

- c. +/- 10 mV for oxidation reduction potential
- d. +/- 10% for turbidity and dissolved oxygen

In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen, and turbidity.

12. As a rule of thumb, sample collection can begin when a minimum of five sets of field parameters are collected and those parameters have stabilized. When ready to sample, hold the polyethylene tubing while disconnecting the water quality meter and allow water from the meter to flow into the bucket.
13. Collect samples directly from tubing into pre-labeled sample containers at a flow rate between 300 and 500 ml/min so that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 foot. Ensure samples are not collected through the water quality meter since the meter is not typically decontaminated between locations.
14. Fill sample containers in a manner to ensure minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container. Volatile organic compound (VOC) samples should be collected first so that no headspace exists to prevent air from remaining in the bottle; after capping, invert and tap the container to ensure no air bubbles are present. If metals samples are required, ensure that these samples are field-filtered. To filter, place a 0.45-micron membrane filter on the end of the tubing and pump water through the filter to fill sample containers.
15. When all sample containers are filled, turn off pump; disconnect power to the control box and the pump. Retrieve the pump and tubing from the well by reeling the power cord onto the spool and coiling the tubing separately. If desired, save the tubing for future events by labeling it and placing it in a garbage bag.
16. Measure and record the total depth of the well to the nearest 0.5 foot using a stainless-steel tape.
17. Close and lock the well.
18. Discard purge water in bucket, in drum, or other designated area in accordance with QAPP, SAP, or other guidance.

4.0 ADDITIONAL INFORMATION

4.1 Sample Handling

Ensure that samples for chemical analysis are thoroughly iced and stored at 4°C and shipped or hand carried under chain of-custody procedures to the analytical laboratory.

5.0 DECONTAMINATION PROCEDURES

All reusable groundwater sampling equipment should be decontaminated prior to sampling the first well, between each well, and at the conclusion of the sampling event. Clean reusable equipment using the method described in SOP 001 Decontamination.

DECONTAMINATION

1.0 PURPOSE AND SCOPE

The objective of this document is to establish decontamination procedures to be followed when conducting field activities.

2.0 MATERIALS

The following materials are required for performing equipment decontamination:

- Scrub brush
- Alconox or equivalent soap
- Deionized water
- Water tubs or buckets
- Aluminum foil
- Health and safety equipment

3.0 PROCEDURES

Take the following steps to decontaminate equipment and materials that may affect sample quality:

1. Remove gross contamination by brushing or wiping off equipment.
2. Scrub with non-phosphate detergent.
3. Rinse with deionized water.
4. Rinse a second time with tap water or deionized water.
5. Allow equipment to air dry.
6. Wrap reusable equipment in aluminum foil.

4.0 ADDITIONAL INSTRUCTIONS

- Dispose of decontamination wastes according to project-specific considerations.
- Conduct decontamination under level D health and safety procedures. Site-specific conditions may require additional health and safety precautions.