Sampling and Analysis Plan/Quality Assurance Project Plan Update

Coldeen Property Site Characterization

15631 Westside Highway SW
Vashon, WA

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program

September 23, 2019
19500-08

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Sampling and Analysis Plan/Quality Assurance Project Plan Update

Coldeen Property Site Characterization

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1.0 INTRODUCTION

This Sampling and Analysis Plan/Quality Assurance Project Plan Update (SAP/QAPP) describes the proposed field activities, sample collection procedures, laboratory analytical methods, data evaluation procedures, and quality control criteria that Hart Crowser will use to complete the field work for a site characterization at the Coldeen property (Site) located at 15631 Westside Highway SW in Vashon, Washington (Figure 1). The purpose of the site characterization is to determine current Site conditions and to determine if supplemental cleanup is required to achieve a No Further Action (NFA) determination from the Washington State Department of Ecology (Ecology).

2.0 BACKGROUND

2.1 Site Description and Operational History

The Site is approximately 3.2 acres in area and is located on the west side of Westside Highway SW, between SW 158th Street and SW Ober Beach Road. The surrounding area is primarily undeveloped or residential.

The Site formerly contained a general store and gasoline station that operated from the early 1920s to 1940. The station building, which is on the King County Historic Register, was then converted into an occupied residence. As part of real estate due diligence activities, a 700-gallon underground storage tank (UST) was discovered in front of the former station building. The historic fuel pump is still in place.

2.2 UST Decommissioning

The gasoline UST was removed in 1994 and was found to contain approximately 100 gallons of water. No evidence of petroleum sheens was observed, and groundwater was not encountered in the excavation. However, soil samples collected from the UST excavation contained concentrations of gasoline-range hydrocarbons, benzene, and xylenes above Model Toxics Control Act (MTCA) cleanup levels. According to the Site Hazard Assessment (SHA) conducted for the Site in 2013, approximately 12 cubic yards of petroleum-contaminated soils were excavated during the 1994 UST removal but elevated concentrations of gasoline-range hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds were still observed.

2.3 Geology and Hydrogeology

The Site is in the Puget Sound lowland, which is characterized by north–south trending ridges capped by Vashon till. According to the Washington Geologic Information Portal, accessed March 15, 2019, the surface geologic unit on the Site is Vashon Stade till, consisting mostly of compact diamict with subangular to rounded clasts, glacially transported and deposited. This is generally consistent with well logs reviewed from near the Site which generally indicated sandy to silty clay, clay, hard pan, and/or gravelly to sandy till up to depths ranging from approximately 100 to 345 feet below ground surface (bgs); one boring encountered sand and gravel in the upper 39 feet. Additionally, soil samples collected during the UST investigation at the Site in 1994 encountered clay at 4.5 feet bgs.

During removal of the UST in 1994, groundwater was not observed in the UST excavation. The SHA indicated that groundwater may not be encountered until 60 feet bgs, although the SHA also included a reference to an estimated 20 feet to the top of the water table. Well logs from near the Site found in Ecology’s Well Report database indicated water levels were generally between 118 and 245 feet bgs in wells installed from 1981 to 2007, though one surrounding well had a water level of 14 feet bgs. Based on surrounding area topography, the inferred groundwater flow at the Site is to the west toward Ober Creek and/or Puget Sound. However, local flow directions in the area may be complex and influenced by utility trenches, foundation backfill, or other subsurface structures, which may act as preferential pathways for near-surface groundwater.

3.0 PROJECT SUMMARY AND OBJECTIVES

For this project, we will:

- Advance up to ten soil borings using push-probe and hollow-stem auger (HSA) drilling to approximately 25 feet bgs around the Site. We will select up to 30 soil samples for chemical analyses.

- Advance one angled soil boring below the existing building using HSA drilling to a length of approximately 30 feet. We will select up to four soil samples and one soil vapor sample collected from the angled soil boring for chemical analysis.

- If groundwater is encountered within the upper 50 feet, complete three of the HSA soil borings as permanent groundwater monitoring wells. The wells will be developed and two groundwater samples from each well will be collected for chemical analyses.

- Collect one indoor air sample from inside the existing building and one ambient upwind air sample outside for chemical analysis.

- Submit the soil and groundwater samples to OnSite Environmental Inc. (OnSite) for chemical analyses.

- Submit the soil vapor, indoor air, and ambient upwind air samples to Fremont Analytical, Inc. (Fremont) for chemical analyses.

- Review and validate the analytical results for quality assurance.

- Compile laboratory results and compare them with Model Toxics Control Act (MTCA) Method A soil cleanup levels for unrestricted land uses, MTCA Method A cleanup levels for groundwater, MTCA Method B groundwater screening levels for vapor intrusion, MTCA Method B sub-slab soil gas screening levels for vapor intrusion, and MTCA Method B indoor air cleanup levels.

Our objective is to conduct additional site characterization to determine current Site conditions and to determine if supplemental cleanup is required to achieve an NFA determination from Ecology.

Sampling locations, procedures, analytical methods, and evaluation of results are discussed in subsequent sections of this SAP/QAPP.

4.0 PROJECT TEAM AND RESPONSIBILITIES

This section outlines the individuals and subcontractors directly involved with this project and their specific responsibilities.

- Diane Escobedo (Ecology) – Ecology Site Manager. Ms. Escobedo is responsible for reviewing and providing comments on Hart Crowser's Draft SAP/QAPP/Health and Safety Plan (HASP) and Draft Site Characterization Report, obtaining access to the Site, and signing manifests for the investigative-derived waste (IDW).

- Mike Ehlebracht, LHG (Hart Crowser) – Contract Manager. Mr. Ehlebracht will provide final review of all project deliverables and serve as a technical resource throughout the project.

- Marissa Goodman, EIT (Hart Crowser) – Project Manager. Ms. Goodman will maintain primary responsibility for project quality, schedule, and budget; coordinate field activities; and prepare project deliverables. Ms. Goodman will also monitor project QA procedures to ensure compliance with this SAP/QAPP, and if any problems or deficiencies are observed, she will facilitate appropriate corrective action. She will also act as the Project Health and Safety Manager as identified in the site-specific HASP (Appendix A).

- TBD (Hart Crowser) – Field Staff. The field staff will be responsible for implementing the SAP, including preparing for and implementing field activities, and maintaining chain of custody with the analytical laboratory. The field staff will also be the Field Health and Safety Manager for the project as identified in the site-specific HASP (Appendix A).

- OnSite – Laboratory. OnSite of Redmond, Washington, will provide analytical services for soil and groundwater samples. OnSite is accredited by Ecology.

- Fremont – Laboratory. Fremont of Seattle, Washington, will provide analytical services for soil vapor and air (indoor air and ambient upwind) samples. Fremont is accredited by Ecology.

- ESN Northwest (ESN) – Drilling (first phase of site characterization activities). ESN will conduct drilling and install monitoring wells with drillers licensed in the State of Washington.

- Cascade Drilling, L.P. (Cascade) – Drilling (second phase of site characterization activities). Cascade will conduct drilling of the angled soil boring with drillers licensed in the State of Washington.

- LineScape of Washington (LineScape) – Utility Locating. LineScape will provide private utility locating services including sewer and stormwater utilities (when accessible).

- Bush, Roed & Hitchings (BRH) – Surveying. BRH will provide land surveying with Washington State licensed surveyors.

- Cascade – IDW Disposal. Cascade will provide waste disposal services for IDW generated on the Site.

5.0 FIELD AND SAMPLING PROCEDURES

Fieldwork for this project will include advancing borings; installing and developing permanent groundwater monitoring wells; collecting samples for chemical analyses; and disposing of IDW. Chemical data will be used to characterize the Site and evaluate potential remedial actions. Field and sampling procedures will consist of the following:

- Utility locating;
- Boring advancement, including field screening and soil sampling;
- Monitoring well installation, development, and groundwater sampling;
- Soil vapor, indoor air, and ambient upwind sampling;
- Sample management (e.g., containers, storage, and shipment);
- Decontamination procedures; and
- IDW management.

A Hart Crowser representative will be present during the site characterization activities to provide field oversight, document Site activities and subsurface conditions encountered, and collect samples for analyses. Sampling activities will be conducted in accordance with this SAP. Proposed boring, monitoring well, and air sample locations are shown on Figure 2.

5.1 Utility Location

Hart Crowser will arrange to have underground utilities located and marked prior to beginning any site characterization activities. Hart Crowser will contact the Washington Utility Notification Center, who will in turn notify the various utilities in the area to mark any underground installations in the vicinity of the Site. We will also subcontract with a private utility locator to mark utilities on the Site. We will review provided Site plans for locations of specific utilities. Exploration locations will be adjusted if necessary, to avoid any underground utilities that are identified.

5.2 Soil Boring Advancement

Four borings (HC-1 through HC-4) will be advanced using push-probe and/or HSA drilling and up to three borings (MW-1 through MW-3) will be advanced using HSA drilling on a push-probe/HSA combination drill rig. If field screening of the soil while advancing borings indicates potential contamination at the Site, up to three additional borings (HC-5 through HC-7) will be advanced using push-probe and/or HSA drilling (contingency borings). The contingency borings will be advanced one at a time until field screening of the soil indicates we have reached the lateral extent of the potential contamination. One angled boring (HC-8) will be advanced below the existing building using an HSA drill rig. The boring locations may be modified after work begins based on our field observations. There may be underground obstacles such as concrete slabs that cannot be detected by a utility locator; therefore, multiple soil boring attempts near each target location may be necessary.

We anticipate that most of the proposed borings HC-1 through HC-7 and MW-1 through MW-3 will be installed to depths of approximately 25 feet bgs. However, if field screening indicates that contamination may be present at depth in any of the borings, we may continue advancing the borings until we have delineated the vertical extent of contamination or until we hit refusal, up to a maximum depth of 35 feet bgs. Additionally, if we do not encounter groundwater in boring MW-1, we will continue advancing the boring until we encounter groundwater or until we hit refusal, up to a maximum depth of 50 feet bgs. If groundwater is not encountered to 50 feet bgs, we will not advance borings MW-2 and MW-3. Angled boring HC-8 will be advanced until we have delineated the western lateral extent of contamination (if any) or until we hit refusal, up to a maximum length of 30 feet. Each boring location will be located by a licensed surveyor or with a handheld GPS unit. Field screening and sampling procedures during boring advancement are discussed below.

5.2.1 Field Screening Techniques

Soils obtained from drilling explorations will be field-screened for contamination by physical observation, performing sheen tests, and measuring headspace vapor using a photoionization detector (PID). The effectiveness of field screening methods varies with temperature, moisture content, organic content, soil type, and age of the constituents. Soil screening tests may not be completed if limited soil volume is recovered. These techniques are discussed below.

Observation. For soil with relatively higher petroleum concentrations there will likely be observable indicators of contamination. Soil may be stained or discolored so that it is visibly noticeable compared to typical soil colors. Sheens may also cause the soil to have a shiny or glossy appearance. Odors may also be present ranging from very faint to strong and from sweet smelling to pungent. Odors are usually detected inadvertently during field activities and are usually noticeably different than typical odors in air.

Sheen Tests. A sheen test is a visual test to assess if a sheen is produced on water by the soil. A small volume of soil is placed in a pan partially filled with water and the water surface is observed for signs of sheen. Sheens are classified as described below.

Sheen Classification

Classification	Description
No sheen (NS)	No visible sheen on water surface.
Slight sheen (SS)	Light colorless film, spotty to globular; spread is irregular, not rapid, areas of no sheen remain, film dissipates rapidly.
Moderate sheen (MS)	Light to heavy film, may have some color or iridescence, globular to stringy, spread is irregular to flowing; few remaining areas of no sheen on water surface.
Heavy sheen (HS)	Heavy colorful film with iridescence; stringy, spread is rapid; sheen flows off the sample; most of the water surface may be covered with sheen.

PID Headspace Measurements. Headspace vapor measurements will be made on soil using a PID with 10.4 eV lamp to assess the possible presence of volatile organic compounds (VOCs). The PID is not compound-specific and only provides a semi-quantitative indication of the presence of VOCs. The PID measures concentrations in parts per million (ppm) and is calibrated to isobutylene. Soil is placed in a Ziploc® bag (filled less than half full), sealed with some air, and allowed to warm to ambient temperatures. PID measurements are made within 30 minutes of collection by opening the bag slightly and inserting the probe into the air space in the bag. The highest PID measurement for each sample is recorded on the field logs.

5.2.2 Soil Sample Collection

Soil samples will be collected from each exploration location. Soil samples from borings HC-1 through HC-7 and MW-1 through MW-3 will be collected for possible chemical analysis approximately every 2.5 feet. Soil samples from angled boring HC-8 will be collected for possible chemical analysis approximately every 5 feet. Soil samples will be labeled according to the boring number, the order the sample was collected, and the sample depth (e.g., HC1-S1-2.5). Field staff will put on clean nitrile gloves (or equivalent) for each sample. Soil samples for VOC analysis will be collected first using EPA Method 5035 procedures, by placing a 5-gram soil plug in a laboratory-supplied, methanol-preserved, 40-milliliter volatile organic analysis (VOA) bottle. Soil samples for non-VOC analysis will then be transferred to labeled, pre-cleaned glassware provided by the sample receiving laboratory. Each soil sample will be transferred using a stainless-steel sampling spoon or disposal sampling equipment.

Soil sampling analytical methods, containers, and holding times are listed in Table 1.

5.2.3 Completion and Abandonment

The borings will be abandoned in accordance with Washington Administrative Code (WAC) and Revised Code of Washington (RCW) rules and regulations (except those being converted to monitoring wells which are discussed in Section 5.3). Abandonment will consist of filling the boring with granular bentonite and hydrating the bentonite with water. For paved areas, a cold asphalt or concrete patch will complete the surface seal.

5.2.4 Documentation

We will document our observations, field screening results, sampling activities, and any deviations from this SAP/QAPP in our field notes and forms. Samples will be classified in general accordance with ASTM D2488 (ASTM 2009), and pertinent characteristics of the subsurface conditions will be recorded on the boring logs. The sampling depths will be clearly documented on the boring logs.

5.3 Monitoring Well Construction and Development

Up to three borings (MW-1 through MW-3) will be advanced using HSA drilling on a push-probe/HSA combination drill rig and if groundwater is encountered in the upper 50 feet, completed as monitoring wells after soil screening and sampling are completed. All wells will be installed and constructed in accordance with WAC and RCW rules and regulations. If groundwater is not encountered in the upper 50 feet of MW-1, we will not advance MW-2 or MW-3.

5.3.1 Monitoring Well Construction

Each monitoring well will be constructed of a 2-inch-diameter Schedule 40 PVC casing with a 10-foot long, 0.010-inch-slot screen placed at the appropriate screen interval as determined during field conditions. The well screens will be installed across the water table. A clean silica sand pack (10/20 sand) will be placed between the boring wall and PVC screen from the bottom of the well to approximately 1 to 2 feet above the screened interval. A minimum 3-foot bentonite seal will be placed above the sand to within 1 or 2 feet of the ground surface. A concrete surface seal will secure a flush-mounted, traffic-rated monument. The monument cover will be secured with bolts. A unique Ecology well tag ID will be placed in each monument. The wells will be secured with locks.

5.3.2 Elevations

To calculate subsequent groundwater level elevations, the tops of the casings of the monitoring wells will be measured to the nearest 0.01 foot by a licensed surveyor. Elevations will be surveyed to the NAVD88 datum as defined by the National Geodetic Survey.

5.3.3 Monitoring Well Development

Following installation, monitoring wells will be developed at least 24 hours after construction. The depth to water and depth to sediment in each well will be measured using an electronic water-level probe before starting well development. Wells will be developed by surging groundwater with a stainless-steel or disposal polyethylene bailer and pumping with a submersible pump until either (1) water from the wells becomes visibly clear, (2) turbidity measurements stabilize to within 10 percent for three successive casing volumes, (3) a minimum of 10 well volumes are purged, or (4) the well bails dry. See Section 5.9 for well development water storage and disposal.

5.3.4 Documentation

We will document our observations and development activities in our field notes and forms. Observations will include, but are not limited to, groundwater levels, development water characteristics (e.g., color, turbidity, sheen), and development purge volumes. Any deviations from this SAP/QAPP will be recorded in field notes.

5.4 Monitoring Well Sampling

The new monitoring wells will be sampled at least 48 hours after development.

5.4.1 Measurement of Groundwater Levels

Prior to purging, groundwater levels in the wells will be measured to the nearest 0.01 foot using an electronic water-level probe. The wells will be opened and allowed to equilibrate for up to a half hour before measurements are taken. If any free product is encountered, we will measure the thickness of the product using an electronic interface probe.

5.4.2 Purging

After groundwater levels are measured, each well will be purged at a low flow rate using a peristaltic or submersible pump fitted with clean, disposable tubing. The tubing inlet will be placed approximately at the middle of the well screen. Tubing will be used one time and disposed of as described in Section 5.9.2. To assess the effectiveness of purging, dissolved oxygen, turbidity, temperature, electrical conductivity, oxidation-reduction potential, and pH will be measured by means of a flow-through cell. Results of these measurements will be included on a well observation form. Purging will be considered complete when three casing volumes of water have been removed, the well purges dry, or field parameters stabilize to within 10 percent for three consecutive readings (whichever is less). If the well is purged dry, it will be allowed to recover before sampling is performed. Purge water will be handled in accordance with Section 5.9.

5.4.3 Groundwater Sample Collection Procedures

After purging of a well is complete, a groundwater sample will be collected using the same equipment for purging and low-flow sampling techniques. Field staff will put on a clean pair of nitrile gloves (or equivalent) for each sample. The laboratory-supplied, pre-cleaned sample bottles will be filled directly from the polyethylene tubing. For dissolved metals testing, the water will be field-filtered using a new dedicated 0.45-micron filter for each sample collected, and the groundwater will be filtered directly into the appropriate preserved sample container. VOA containers will be collected first and filled leaving no headspace. For QA/QC purposes, a field duplicate will be collected per Section 7.0.

Groundwater sampling analytical methods, containers, and holding times are listed in Table 1.

5.4.4 Documentation

Observations made during groundwater sampling activities will be documented in field notes. Observations will include, but are not limited to, groundwater levels, purge water characteristics (e.g., color, turbidity, sheens), purge volumes, field parameter measurements, and sampling time. Any deviations from this SAP/QAPP will be recorded in field notes.

5.5 Soil Vapor Sampling

One soil vapor sample (SV-1) will be collected from the angled boring advanced below the existing building (HC-8). The soil vapor sample will be collected from approximately one foot bgs to evaluate the vadose zone above the anticipated groundwater table. The soil vapor sample will be hand-measured to known building features or located with a handheld GPS unit. Sampling procedures are discussed below.

5.5.1 Soil Vapor Sample Collection Procedures

The sample will be collected over an approximately five-minute period using a one-liter, pre-cleaned, laboratory-supplied Summa canister. The soil vapor sample will be labeled SV-1.

Prior to collecting the soil vapor sample, the initial canister vacuum will be confirmed, and a shut-in leak test will be performed. If the initial canister vacuum is less than 25 inches of mercury (in Hg), a new canister will be requested from the laboratory. To perform the shut-in leak test, the brass cap will be placed at the end of the critical orifice to create an air-tight train, and the canister valve will be quickly opened and closed to check for leaks. If the needle on the gauge drops, the train is not air-tight, and the connections will be refit and/or tightened until the needle holds steady. Once the shut-in leak test passes, the brass cap will be removed from the critical orifice and the canister valve opened when ready to begin sampling.

A temporary probe casing and vapor collection screen (soil vapor implant) will be advanced into the bore hole to approximately one foot bgs. The soil vapor implant consists of a six-inch stainless-steel screen, or equivalent, and 1/4-inch Teflon tubing. The sampling assembly will then be shrouded with helium gas as a helium detector is used to draw representative soil vapor from the sample point and confirm that the sampling assembly is airtight. The tubing will be purged using a peristaltic pump to remove ambient air, and approximately one liter of soil vapor will be withdrawn through the tubing into a Summa canister, using a flow controller set to a rate of no more than 200 milliliters per minute (mL/min).

After the canister valve is opened to begin sampling, the initial vacuum will be recorded. After approximately five minutes, sample collection will be stopped by closing the valve. Sample collection will be stopped when approximately five in Hg vacuum remains in the canister. The final time and vacuum will be recorded. The critical orifice will be detached, and the brass cap placed on the canister. After sample collection is completed, we will remove the temporary casing and sampling assembly and continue drilling to the desired length (maximum of 30 feet).

Soil vapor sampling analytical methods, containers, and holding times are listed in Table 1.

5.5.2 Documentation

Observations made during soil vapor sampling activities will be documented in field notes and forms. Observations will include, but are not limited to, sampling time, Summa canister identification number, Summa canister initial and final pressure readings, purge vapor characteristics (e.g., odor), and helium concentration in the shroud. Any deviations from this SAP/QAPP will be recorded in field notes.

5.6 Indoor Air Sampling

One indoor air sample (IA-1) will be collected from inside the existing building and one sample (UA-1) will be a control sample collected outside and upwind of the building. IA-1 will be collected from an occupied space (i.e., not a closet or other area where human receptors are not anticipated to spend a lengthy amount of time). The air sample locations may change at the time of work based on the field conditions encountered, including access considerations and wind direction. The samples will be collected approximately three to five feet above ground surface to evaluate air in the breathing zone. The samples will be hand-measured to known building features or located with a handheld GPS unit. Sampling procedures are discussed below.

5.6.1 Pre-Sampling Building Survey

We will visually survey the building interior prior to the sampling to identify any potential sources inside the building. During the building survey, we will interview the property owner to help us identify potential background sources and determine building features, such as the heating and ventilation system. We will also discuss indoor activities that should be avoided immediately before and during sample collection to the extent practicable with the property owner (e.g., smoking cigarettes indoors, applying wood varnish). A PID will be used during the building survey to assist in identifying potential background sources and preferential pathways for vapor intrusion. Potential sources will be removed from the building to the extent practicable at least three days prior to collecting the indoor air samples to allow time for air to ventilate throughout the building.

5.6.2 Indoor Air Sample Collection Procedures

Samples will be collected over a 24-hour period using a 6-liter, pre-cleaned, laboratory-supplied Summa canister, with an environmental field representative checking canisters and weather conditions occasionally in the beginning and end stages of the sampling. Indoor air samples will be labeled IA-1 (indoor air sample) and UA-1 (outdoor upwind control sample).

Prior to collecting indoor air samples, the initial canister vacuum will be confirmed, and a shut-in leak test will be performed. If the initial canister vacuum is less than 25 in Hg, a new canister will be requested from the laboratory. To perform the shut-in leak test, the brass cap will be placed at the end of the flow regulator to create an air-tight train, and the canister valve will be quickly opened and closed to check for leaks. If the needle on the gauge drops, the train is not air-tight, and the connections will be refit and/or tightened until the needle holds steady. Once the shut-in leak test passes, the brass cap will be removed from the flow regulator and the canister valve opened to begin sampling.

The initial vacuum will be recorded. The canister vacuum will be monitored approximately one hour and 23 hours after beginning sample collection, and the corresponding times, vacuum pressures, and weather conditions will be recorded. After approximately 24 hours, sample collection will be stopped by closing the valve. Sample collection will be stopped when approximately five in Hg vacuum remains in the canister. The final time and vacuum will be recorded. The flow regulator will be detached, and the brass cap placed on the canister.

Indoor air sampling analytical methods, containers, and holding times are listed in Table 1.

5.6. Documentation

Observations made during indoor air sampling activities will be documented in field notes and forms. Observations will include, but are not limited to, sampling time, Summa canister identification number, Summa canister initial and final pressure readings, weather conditions, and potential background sources observed. Any deviations from this SAP/QAPP will be recorded in field notes.

5.7 Sample Management

5.7.1 Sample Containers

Pre-cleaned sample containers will be provided by the analytical laboratory ready for sample collection, including preservative, if required (see Table 1). Sample containers will be cleaned following the requirements described in Specifications and Guidance for Contaminant-Free Sample Containers (EPA 1992). Specific container requirements for samples that will undergo multiple analyses will be discussed with the analytical laboratory prior to sample collection. Soil samples for VOC analyses will be collected specifically using the EPA Method 5035 sampling method.

5.7.2 Labeling Requirements

A sample label will be affixed to each container before sample collection. All containers will be marked with the project number, a sample number, date and time of collection, sampler's initials, and preservation type. Each sample will have a unique identification number that will be referenced by entry into our notes. Soil samples will be identified by the boring number, the order the sample was collected, and the sample depth (e.g., HC1-S1-2.5). Groundwater samples will be identified from the monitoring well number (e.g., MW-1). The soil vapor, indoor air, and ambient upwind samples will be identified as SV-1, IA-1, and UA-1, respectively.

5.7.3 Chain of Custody Procedures

Chain of custody forms will be used to document the collection, custody, and transfer of samples from their initial collection location to the laboratory. Each sample will be entered on the custody form immediately after it is collected.

Sample custody procedures will be followed to provide a record that can accompany a sample as it passes from collection through analysis. A sample is considered to be in custody if it meets at least one of the following conditions:

- It is in someone's physical possession or view;
- It is secured to prevent tampering (i.e., custody seals); and/or
- It is locked or secured in an area restricted to authorized personnel.

A chain of custody form will be completed in the field as samples are packaged. At a minimum, the information on the custody form will include the sample number, date and time of sample collection, sampler, analysis, and number of containers. A copy of the custody form will be placed in the cooler or box with its respective samples before the container is sealed for delivery to the laboratory. Another copy will be retained and placed in the project files after review by the project manager. Custody seals will be placed on each cooler or box containing samples, so the cooler or box cannot be opened without breaking the seals.

5.7.4 Sample Storage and Shipping Procedures

After sample containers for soil and groundwater have been filled, they will be stored in a cooler cooled with ice or blue ice to approximately 4°C. The coolers will be transferred to OnSite for chemical analysis. After sample containers for soil vapor and indoor/ambient air have been filled, they will be stored in the boxes provided by the laboratory and transferred to Fremont for chemical analysis. Chain of custody procedures will be maintained and documented at all times, from commencement in the field until delivery of the samples to the analytical laboratory, as discussed in the previous section. Specific procedures are:

- Individual sample containers will be packed to prevent breakage;
- Custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler or box;
- Signed and dated custody seals will be placed on all coolers or boxes before shipping;
- Samples will be hand-delivered to OnSite or Fremont by Hart Crowser personnel or courier;
- When sample possession is transferred to the laboratory, the custody form will be signed by the persons transferring custody of the coolers or boxes; and
- Upon receipt of samples at the laboratory, the shipping container custody seal will be broken, and the sample-receiving custodian will compare samples with information on the chain of custody form and record the condition of the samples received.

5.8 Decontamination Procedures

5.8.1 Personnel Decontamination

Personnel decontamination procedures depend on the level of protection specified for a given activity. The site-specific HASP in Appendix A identifies the appropriate level of protection for the type of work and conditions involved in this project. Field personnel will thoroughly wash their hands at the end of each day and before taking any work breaks.

5.8.2 Equipment Decontamination

To prevent cross contamination between sampling events, clean disposable sampling equipment (e.g., disposable gloves, groundwater sampling tubing) will be used for each sample location and discarded after use. Cleaning of all non-disposable field equipment (e.g., sampling spoons) will consist of washing in a detergent (Liquinox®) solution, rinsing with tap water, followed with a deionized water rinse. Decontamination water will be collected and handled as IDW as discussed in the following section.

The drilling subcontractor will use disposable push-probe sleeves for push-probe borings and a specialized, self-contained decontamination trailer with a pressure washer and steam cleaner to clean the drilling equipment, such as drill rods and casing, prior to beginning each new HSA boring. The IDW will be contained and transferred to drums stored on the site as discussed in the following section.

5.9 IDW Management

During the above activities, soil cuttings, development and purged groundwater, decontamination water, and other IDW will be generated and will require appropriate management. The handling and disposal of specific types of IDW are discussed below.

5.9.1 Soil and Water

Soil and water IDW will be placed in separate, labeled, 55-gallon steel drums. Associated samples from the site characterization activities will be used to profile the soil and water IDW for disposal. As a contingency, however, up to three composite soil IDW samples and one water IDW sample will be collected from the drummed soil and water and only analyzed if requested by the receiving facility. Upon receipt of the chemical analysis, the IDW will be appropriately disposed of at a permitted disposal or treatment facility.

5.9.2 Disposable Sampling Equipment and Personal Protective Equipment (PPE)

Disposable sampling equipment (e.g., sample tubing) and PPE (e.g., nitrile gloves) will be placed in plastic trash bags after use and disposed of as solid waste.

6.0 LABORATORY ANALYSIS

Hart Crowser will submit soil and groundwater samples to OnSite of Redmond, Washington, for chemical analyses. Hart Crowser will submit soil vapor, indoor air, and ambient upwind air samples to Fremont of Seattle, Washington, for chemical analysis. Samples will be analyzed on a standard turnaround time, usually 10 business days. Table 2 presents the minimum reporting limit goals for each analytical method and media type.

6.1 Soil Samples

Soil samples will be analyzed for the following constituents by the methods listed below to assess whether the constituents are present and, if so, to determine the nature, extent, magnitude, and potential risk posed to human health and the environment. Sample selection and analysis is described below.

6.1.1 First Phase of Site Characterization

We will analyze at least one (typically collected within the smear zone/top of water table if groundwater is encountered; if no groundwater is encountered, we will analyze soil samples based on field screening measurements; if no groundwater is encountered and field screening does not indicate a potential for contamination in any of the soil samples within a boring, we will analyze a soil sample within the 5 to 10 foot depth range based on the depth of the former UST excavation) and up to three soil samples from each boring. In borings advanced in the former UST excavation (i.e., MW-1), we will analyze the soil sample below the backfill/native interface. Soil samples will be selected for chemical analysis based on field screening results and Site geology.

Up to 30 selected soil samples will be analyzed for:

- Gasoline-range petroleum hydrocarbons (TPH-G) by Ecology Method NWTPH-Gx;
- Total lead by EPA Method 6020B;
- BTEX by EPA Method 8021; and
- Total solids (percent moisture) by Standard Method 2540B or equivalent.

If MTBE, EDB, and/or EDC are detected at or above the laboratory reporting limits in any of the groundwater samples, up to 3 soil samples containing elevated TPH-G concentrations will be analyzed for MTBE, EDB, and EDC by EPA Method 8260.

6.1.2 Second Phase of Site Characterization

We will analyze at least one (typically collected within the smear zone/top of the water table) and up to four soil samples from the angled boring HC-8. Soil samples will be selected for chemical analysis based on field screening results, sample depth in relation to previous exceedances identified in the first phase of site characterization, and Site geology.

Up to four selected soil samples will be analyzed for:

- TPH-G by Ecology Method NWPTH-G;
- BTEX by EPA Method 8021B; and
- Percent moisture.

6.2 Groundwater Samples

If groundwater is encountered, groundwater samples will be analyzed for the following constituents by the methods listed below to assess whether the constituents are present and, if so, to determine the nature, extent, magnitude, and potential risk posed to human health and the environment. Sample selection and analysis is described below.

6.2.1 First Phase of Site Characterization

We will analyze one groundwater sample from each monitoring well and one field duplicate.

Four groundwater samples will be analyzed for the following:

- BTEX, MTBE, EDB, and EDC by EPA Method 8260;
- TPH-G by Ecology Method NWTPH-Gx; and
- Total and dissolved lead by EPA Method 200.7/200.8.

6.2.2 Second Phase of Site Characterization

If groundwater is encountered, we will analyze one groundwater sample from each monitoring well and one field duplicate.

Four groundwater samples will be analyzed for the following:

- BTEX by EPA Method 8021B; and
- TPH-G by Ecology Method NWTPH-Gx.

6.3 Soil Vapor Sample

The soil vapor sample will be analyzed for the following constituents by the methods listed below to assess whether the constituents are present and, if so, to determine the magnitude and potential risk posed to human health and the environment. Sample analysis is described below.

We will analyze one soil vapor sample from the angled boring HC-8 (from approximately one foot bgs) for the following:

- BTEX, naphthalene, and air-phase petroleum hydrocarbon (APH) fractionation by EPA Method TO-15;
- Helium by GC-TCD; and
- Oxygen, carbon dioxide, and methane by EPA Method 3C.

6.4 Indoor Air Samples

The indoor air samples will be analyzed for the following constituents by the methods listed below to assess whether the constituents are present and, if so, to determine the nature, extent, magnitude, and potential risk posed to human health and the environment. Sample analysis is described below.

We will analyze one indoor air sample from inside the building and one control ambient sample collected from outside and upwind of the building.

The indoor and ambient air samples will be analyzed for BTEX, naphthalene, and APH fractionation by EPA Method TO-15 low level.

6.5 IDW Samples

IDW will be generated as part of the site characterization activities (See Section 5.9) and will require appropriate management. Associated soil and groundwater samples collected from the site characterization activities will be used to profile the IDW for disposal. As a contingency, however, up to three composite IDW samples will be collected from the drummed soil and one IDW sample will be collected from the drummed water and only analyzed if requested by the receiving facility. IDW samples will be analyzed for requested analyses by the receiving facility and/or the constituents detected at or above laboratory reporting limits from the soil and groundwater samples.

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

The quality of analytical data is assessed by quality control checks developed for each analysis type. The quality of laboratory measurements will be assessed by reviewing analytical results for method blanks, matrix spikes (MSs), duplicate samples, laboratory control samples, surrogate compound recoveries, and so forth, as specified in the analytical methods to be used.

During each site characterization field activity, a duplicate groundwater sample will be collected to serve as a check on laboratory quality as well as on potential variability in the sampling method and the sample matrix. Containers for the primary and duplicate samples will be alternately filled. In the first phase of site characterization, the duplicate groundwater sample will be analyzed for BTEX, MTBE, EDB, and EDC by EPA Method 8260; TPH-G by NWTPH-Gx; and total and dissolved lead by EPA Method 200.7/200.8. In the second phase of site characterization, the duplicate groundwater sample (if encountered) will be analyzed for TPH-G by NWTPH-Gx and BTEX by EPA Method 8021B. The field duplicate results will be compared to the primary sample to assess the precision of the sampling and analytical methods. Precision will also be evaluated using laboratory duplicates and matrix spike duplicates (MSDs) as described in Section 7.1.1.

No trip blank analysis will be conducted.

Table 1 presents the anticipated sample numbers and analyses for each media type. The reporting limits listed in Table 2 are the expected reporting limits, based upon laboratory calculations and experience. Laboratory quality control procedures, criteria, and corrective actions are summarized in Tables 3 through 8.

7.1 Data Quality Indicators

The overall quality assurance objectives for field sampling, field measurements, and laboratory analysis are to produce data of known and appropriate quality. The procedures and quality control checks specified herein will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy and precision for measurement data. These goals are primarily expressed in terms of acceptance criteria for the quality control checks performed.

7.1.1 Precision

Precision is the degree of reproducibility or agreement between independent or repeated measurements. Analytical variability will be expressed as the relative percent difference (RPD) between field replicates, laboratory replicates, and between MS and MSD analyses. RPD will be used to measure precision for this investigation and is defined as follows:

$$\mathrm{RPD} = \frac{(D_1 - D_2)}{(D_1 + D_2)/2} \times 100$$

Where
D_1 = sample value
D_2 = duplicate sample value

7.1.2 Accuracy

Accuracy is the agreement between a measured value and its true or accepted value. While it is not possible to determine absolute accuracy for environmental samples, analysis of standards and spiked samples provides an indirect assessment of accuracy.

Laboratory accuracy will be assessed as the percent recovery of MSs, MSDs, surrogate spiked compounds (for organic analyses), and laboratory control samples. Accuracy will be defined as the percentage recovery compared with the true or accepted value and is defined as follows:

$$\%\ \mathrm{Recovery} = \frac{(\mathrm{SSR} - \mathrm{SR})}{\mathrm{SA}} \times 100$$

Where:
SSR = spiked sample result
SR = sample results (not applicable for surrogate recovery)
SA = amount of spike added

7.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The sampling program will be designed carefully to see that sample locations are selected properly, sufficient numbers of samples are collected to accurately reflect conditions at the Site, and samples are representative of sampling locations. A sufficient sample volume will be collected at each sampling point to minimize bias or errors associated with sample particle size and heterogeneity.

7.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. So that results are comparable, samples will be analyzed using standard EPA methods and protocols as described in Test Methods for Evaluating Solid Wastes, Physical/Chemical

Methods (EPA 1986). Data will also be reviewed to verify that precision and accuracy criteria have been achieved and, if not, that data have been appropriately qualified.

As discussed in Sections 5.2.2 and 5.4.3, field personnel will collect samples in a consistent manner at all sampling locations so that all data collected as part of this study are comparable. Comparability is attained by careful adherence to standardized sampling and analytical procedures, based on rigorous documentation of sample locations (including depth, time, and date).

7.1.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid. Completeness will be calculated separately for each analytical group (e.g., TPHs and VOCs). For results to be considered complete, all quality control check analyses required to verify precision and accuracy must have been performed. Data qualified as estimated during the validation process will be considered complete. Results that are rejected during the validation review or samples for which no analytical results were obtained will be considered non-valid measurements. Completeness will be calculated for each analysis using the following equation:

$$\text{Completeness} = \frac{\text{valid data points obtained}}{\text{total data points planned}} \times 100$$

The target goal for completeness is a minimum of 95 percent. Completeness will be monitored on an on-going basis so that archived sample extracts can be reanalyzed, if required, without remobilization.

7.2 Data Quality Assurance Review

Hart Crowser will independently review the quality of the chemical analytical results provided by the laboratory. The data quality report will assess the adequacy of the reported detection limits in achieving the project MTCA cleanup levels for soil, groundwater, and indoor air and MTCA groundwater and soil vapor screening levels for vapor intrusion; the precision, accuracy, representativeness, and completeness of the data; and the usability of the analytical data for project objectives. Exceedances of analytical control limits will be summarized and evaluated.

A data evaluation review will be performed on all results using quality control summary sheet results provided by the laboratory for each report. Data evaluation reviews are based on the quality control requirements previously described and follow the format of the EPA National Functional Guidelines for Superfund Organic Methods Data Review (EPA 2008), modified to include specific criteria of individual analytical methods. The laboratory will be contacted to obtain raw data (instrument tuning, calibrations, instrument printouts, bench sheets, and laboratory worksheets) if any problems or discrepancies are discovered during the routine evaluation. The results of the quality assurance review will be presented in an appendix to the Site Characterization Report.

The data evaluation review will verify:

- That sample numbers and analyses match the chain of custody request;

- Sample preservation and holding times;
- That laboratory blanks were analyzed at the proper frequency and that no analytes were present in the blanks;
- That laboratory duplicates, MSs, surrogate compounds, and laboratory control samples were run at the proper frequency and that control limits were met; and
- That required detection limits were achieved, unless raised due to high analyte concentrations in the sample or matrix effects.

Data qualifier flags, beyond any applied by the laboratory, will be added to sample results that fall outside the quality control acceptance criteria. Typical data qualifiers are:

U	The compound was analyzed for but was not detected above the reporting limit. The associated numerical value is the sample reporting limit.
J	The associated numerical value is an estimated quantity because quality control criteria were slightly exceeded.
UJ	The compound was analyzed for, but not detected. The associated numerical value is an estimated reporting limit because quality control criteria were not met.
T	The associated numerical value is an estimated quantity because reported concentrations were less than the practical quantitation limit (lowest calibration standard).
R	Data are not usable because of significant exceedance of quality control criteria. The analyte may or may not be present; resampling and/or reanalysis is necessary for verification.

8.0 DATA ANALYSIS AND REPORTING

8.1 Laboratory Report

The laboratory data reports will consist of summary data packages that will include:

- Case narrative identifying the laboratory analytical batch number, matrix and number of samples included, analyses performed and analytical methods used, and description of any problems or exceedance of quality control criteria and corrective action taken. The laboratory manager or a designee must sign the narrative.
- Copy of chain of custody forms for all samples included in the analytical batch.
- Tabulated sample analytical results with units, data qualifiers, percent solids, sample weight or volume, dilution factor, laboratory batch and sample number, Hart Crowser sample number, and dates sampled, received, extracted, and analyzed all clearly specified.

- Blank summary results indicating samples associated with each blank.
- MS/MSD result summaries, when applicable, with calculated percent recovery and relative percent differences.
- Laboratory control sample results, when applicable, with calculated percent recovery.
- Electronically formatted data deliverable results in Ecology Environmental Information Management (EIM) format.

8.2 Data Evaluation and Analysis

After the planned field work, sample analyses, and data quality review, results will be compared with MTCA Method A soil cleanup levels for unrestricted land uses, MTCA Method A cleanup levels for groundwater, MTCA Method B cleanup levels for indoor air, MTCA Method B soil vapor screening levels for vapor intrusion, and/or MTCA Method B groundwater screening levels for vapor intrusion. We will present our findings from our field observations and analytical results and our recommendations in a summary report (see Section 8.3).

8.3 Hart Crowser Report

Hart Crowser will prepare a Draft Site Characterization Report summarizing sampling procedures and laboratory testing results. The report will include a map with sampling locations; a hydrogeologic cross section; a groundwater elevation contour map; tabulated boring and monitoring well depths, elevations, and screened intervals; tabulated analytical testing data compared with MTCA cleanup levels with sampling depths clearly documented; boring logs; a terrestrial ecological evaluation (TEE); the chemical data quality review; laboratory analytical reports; and IDW manifests. The report will include statements on any limitations on the data use that are the result of adverse QC exceedances, as identified in Section 7.2. The report will also include recommendations regarding data gaps and future steps needed to continue progress towards a Site NFA determination. A final report will be completed after discussions with the Ecology Site Manager.

9.0 REFERENCES

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Table 1 - Sample Containers, Preservation, and Holding Times

Analysis	Sample Matrix	Preservation and Storage	Holding Time[a]	Container	Estimated Number of Samples[b]
BTEX, MTBE, EDB, EDC (EPA 8021, 8011, and/or 8260)	Soil	Cool to 6 °C	14 days	2 40 mL VOA vials with stirbar; 2 40 mL VOA vials without stirbar[c]	d
	Groundwater	HCl; Cool to 6 °C		5 40 mL VOA vials	8
Gasoline-range Petroleum Hydrocarbons (NWTPH-Gx)	Soil	Cool to 6 °C	14 days	2 40 mL VOA vials with stirbar; 2 40 mL VOA vials without stirbar[c]	34
	Groundwater	HCl; Cool to 6 °C		2 40 mL VOA vials	8
Total and Dissolved Lead (EPA 200.7/200.8/6020B)	Soil	Cool to 6 °C	6 months	1 wide-mouth glass jar, 4-ounce[e]	30
	Groundwater	HNO3; Cool to 6 °C		1 500 mL HDPE jar	4
Total Solids (SM 2540B)	Soil	Cool to 6 °C	14 days	1 wide-mouth glass jar, 4-ounce[e]	34
BTEX, Naphthalene, and APH Fractionation (EPA TO-15/TO-15 low level)	Air	None	30 days	1 Summa canister[f]	3
Helium (GC-TCD)	Air	None	30 days	1 Summa canister[g]	1
Oxygen, Carbon Dioxide, and Methane (EPA 3C)	Air	None	72 hours	1 Tedlar bag	1

Table 1 - Sample Containers, Preservation, and Holding Times

Notes:

The methods and number and type of required sample containers will be determined and supplied by the analytical laboratory.

a. Holding times are from date of sample collection.

b. These are estimated number of samples for analyses and are subject to change based on field observations. This excludes IDW samples.

c. BTEX, MTBE, EDB, EDC, and gasoline-range hydrocarbons can be combined into two VOA vials with a stirbar and two VOA vials without a stirbar.

d. 34 for BTEX; 3 for MTBE, EDB, and EDC

e. Total solids and total lead can be combined into one 4-ounce glass jar.

f. One liter Summa canister with 5-minute fill time for soil vapor sample; six liter Summa canister with 24-hour fill time for indoor air samples.

g. Helium, BTEX, naphthalene, and APH fractionation can be combined into one Summa canister.

Acronyms:
EPA = Environmental Protection Agency
HCl = Hydrochloric Acid
HNO3 = Nitric Acid
HDPE = High Density Polyethylene
VOA = Volatile Organic Analysis
mL = millilter
IDW = Investigative-Derived Waste
SM = Standard Method
BTEX = Benzene, toluene, ethylbenzene, xylenes
APH = Air-phase Petroleum Hydrocarbon

Table 2 - Cleanup Levels and Reporting Limit Goals

Method	Analyte	MTCA Method A Cleanup Level		MTCA Method B Cleanup Level	MTCA Method B Screening Level
		Soil [mg/kg]	Groundwater [µg/L]	Indoor Air [µg/m^3]	Sub-Slab Soil Gas [µg/m^3]
BTEX, MTBE, EDB, EDC by EPA 8021, 8011, and/or 8260	Benzene	0.03	5		
	Toluene	7	1,000		
	Ethylbenzene	6	700		
	m,p-Xylene				
	o-Xylene				
	Xylenes	9	1,000		
	MTBE	0.1	20		
	EDB	0.005	0.01		
	EDC		5		
Gasoline-range Petroleum Hydrocarbons by NWTPH-Gx	Gasoline-range Petroleum Hydrocarbons	30/100[a]	800/1,000[b]		
Total and Dissolved Lead by EPA 200.7/200.8/6020B	Lead	250	15[c]		
BTEX, Naphthalene, and APH Fractionation by EPA TO-15/TO-15 low level[d]	Benzene			0.32	11
	Toluene			2,300	76,000
	Ethylbenzene			460	15,000
	m,p-Xylene				
	o-Xylene				
	Xylenes			46	1,500
	Naphthalene			0.074	2.5
	Aliphatic Hydrocarbon (EC5-8)				
	Aliphatic Hydrocarbon (EC9-12)				
	Aromatic Hydrocarbon (EC9-10)				
	TPH[f]			140	4,700
Helium by GC-TCD	Helium				
Oxygen, Carbon Dioxide, and Methane by EPA 3C	Oxygen				
	Carbon Dioxide				
	Methane				

Table 2 - Cleanup Levels and Reporting Limit Goals

Method	Analyte	Laboratory Reporting Limit Goal			
		Soil [mg/kg]	Groundwater [µg/L]	Indoor Air [µg/m^3]	Sub-Slab Soil Gas [µg/m^3]
BTEX, MTBE, EDB, EDC by EPA 8021, 8011, and/or 8260	Benzene	0.02	1		
	Toluene	0.05	1		
	Ethylbenzene	0.05	1		
	m,p-Xylene	0.05	1		
	o-Xylene	0.05	1		
	Xylenes				
	MTBE	0.05	10		
	EDB	0.001	0.01		
	EDC	0.001	0.2		
Gasoline-range Petroleum Hydrocarbons by NWTPH-Gx	Gasoline-range Petroleum Hydrocarbons	5	100		
Total and Dissolved Lead by EPA 200.7/200.8/6020B	Lead	5	1.1		
BTEX, Naphthalene, and APH Fractionation by EPA TO-15/TO-15 low level[d]	Benzene			0.0715	0.286
	Toluene			0.377	1.51
	Ethylbenzene			0.434	1.74
	m,p-Xylene			0.868	3.47
	o-Xylene			0.434	1.74
	Xylenes				
	Naphthalene			0.0167[e]	0.524
	Aliphatic Hydrocarbon (EC5-8)			7.13	28.5
	Aliphatic Hydrocarbon (EC9-12)			11.0	44.2
	Aromatic Hydrocarbon (EC9-10)			7.86	31.4
	TPH[f]				
Helium by GC-TCD	Helium				50[g]
Oxygen, Carbon Dioxide, and Methane by EPA 3C	Oxygen				0.05[h]
	Carbon Dioxide				0.05[h]
	Methane				0.05[h]

Table 2 - Cleanup Levels and Reporting Limit Goals

Notes:

mg/kg = milligram per kilogram

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

Actual reporting limits may be above the laboratory reporting limit goals due to high analyte concentrations in the sample or matrix effects.

BTEX = Benzene, Toluene, Ethylbenzene, Xylenes

EPA = Environmental Protection Agency

APH = Air-phase Petroleum Hydrocarbon

TPH = Total Petroleum Hydrocarbons.

a. 100 mg/kg for gasoline mixtures without benzene and the total of ethylbenzene, toluene, and xylene are less than 1% of the gasoline mixture; 30 mg/kg for other gasoline mixtures.

b. 800 µg/L when benzene present in groundwater; 1,000 µg/L when no detectable benzene in groundwater.

c. Cleanup level is for total lead.

d. Soil vapor sample will be analyzed by EPA TO-15 and indoor air samples will be analyzed by EPA TO-15 low level; reporting limit goals are for the appropriate analysis.

e. Naphthalene will be reported to method detection limit.

f. TPH is calculated as the sum of BTEX, naphthalene, aliphatic hydrocarbons (EC5-8), aliphatic hydrocarbons (EC9-12), and aromatic hydrocarbons (EC9-10). The sub-slab soil gas screening level is based on an attenuation factor of 0.03 per Ecology's PVI Implementation Memo No. 18.

g. Unit is parts per thousand.

h. Unit is percent.

Table 3 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Volatile Organic Compound Analysis

Laboratory Quality Control: VOCs – EPA 8260			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Instrument tuning	Before initial calibration and every 12 hours	See EPA Method 8260	Retune and recalibrate instrument
Initial calibration	See EPA Method 8260	< 20% relative percent difference	Laboratory to recalibrate and re-analyze affected samples
Continuing calibration verification	Every 12 hours	See EPA Method 8260 < 20% percent difference	Laboratory to recalibrate if correlation coefficient or response factor does not meet method requirements
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware or reagents or analytical system; re-analyze affected samples
Laboratory control samples	One per analytical batch or every 20 samples, whichever is more frequent	Laboratory control chart limits	Laboratory to correct problem to verify the analysis can be performed in a clean matrix with acceptable precision and recovery; then re-analyze affected samples
Surrogates	Added to every organics sample as specified in analytical protocol	Laboratory control chart limits	Follow corrective actions specified in EPA Method 8260
Matrix spikes	One per sample batch or every 20 samples, whichever is more frequent; spiked with the same analytes at the same concentration as the laboratory control sample	Laboratory control chart limits	Matrix interferences should be assessed and explained in case narrative accompanying the data package.
Laboratory control sample duplicate or Matrix spike duplicates	One duplicate analysis with every sample batch or every 20 samples	Compound- and matrix-specific RPD ≤ 35%, applied when the analyte concentration is > PQL	Laboratory to re-analyze samples if analytical problems suspected, or to qualify the data if sample homogeneity problems are suspected and the project manager is consulted

Note:
RPD = relative percent difference

Table 4 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Gasoline Analysis

Laboratory Quality Control: NWTPH-Gx (GC/FID)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 5 x blank level
Initial calibration	5-point external calibration before sample analysis	< 15% difference from true value, correlation coefficient ≥ 0.99	Recalibrate instrument
Continuing calibration	Beginning and end of instrument run	NWTPH-Gx ≤ 20% difference from initial calibration.	Recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	Laboratory control chart limits	Evaluate data for usability
Laboratory duplicate	1 per 20 or fewer samples	< 30% RPD	Evaluate data for usability

Note:
RPD = relative percent difference

Table 5 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Metals Analysis

Laboratory Quality Control: Total and Dissolved Metals – EPA 200/6000/7000 Series			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial calibration verification	Daily or each time instrument is set up	90 to 110% of initial calibration	Recalibrate instrument
Initial calibration blank	After each instrument calibration	All analytes < reporting limit	Correct source of contamination
Continuing calibration verification	Every 10 analytical samples and at the beginning and end of each run	90 to 110% of initial calibration	Correct instrument calibration and re-analyze affected samples
Continuing calibration blank	After each continuing calibration verification	All analytes < reporting limit	Correct source of contamination
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 3 times the blank level
Matrix spike	1 per batch of 20 or fewer samples	75 to 125% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples	< 20% RPD	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability

Note:
RPD = relative percent difference

Table 6 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Volatile Organic Compound and Air-Phase Petroleum Hydrocarbon Analysis

Laboratory Quality Control: VOCs and APH Fractionation -- EPA TO-15/TO-15 Low Level

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Instrument tuning	Before initial calibration and every 24 hours	See EPA Method TO-15	Retune and recalibrate instrument
Method blank	Once per day and after any samples with concentrations outside the calibration range	All analytes < reporting limit	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware or reagents or analytical system; re-analyze affected samples
Initial calibration	5-point external calibration before sample analysis, every 24 hours, or following corrective action	See EPA Method TO-15	Recalibrate instrument
Continuing calibration	Every 24 hours	< 30% percent difference	Recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	70 to 130% recovery	Evaluate data for usability
Laboratory duplicate	1 per 20 or fewer samples	< 30% RPD	Evaluate data for usability
Laboratory control samples	1 per 20 or fewer samples	70 to 130% recovery	Evaluate data for usability

Note:

RPD = relative percent difference

Table 7 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Major Gases Analysis

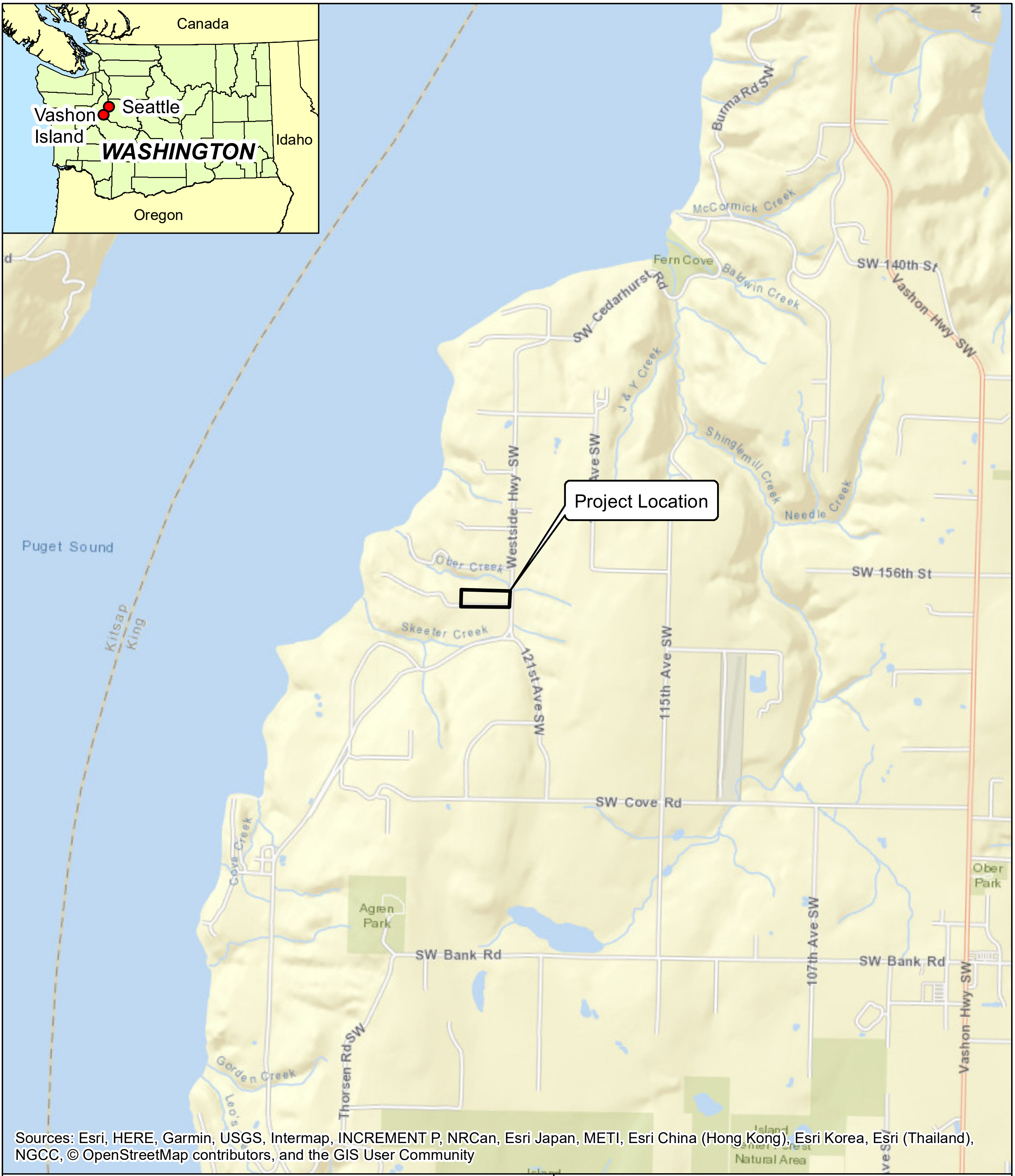
Laboratory Quality Control: Major Gases – EPA 3C			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Laboratory duplicate	1 per batch of 20 or fewer samples	< 30% RPD	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	70 to 130% recovery	Evaluate data for usability

Note:
RPD = relative percent difference

Table 8 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Helium Analysis

Laboratory Quality Control: Helium (GC-TCD)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 3 times the blank level
Laboratory duplicate	1 per batch of 20 or fewer samples	< 30% RPD	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability

Note:
RPD = relative percent difference



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

0 1,000 2,000 4,000 Feet

Note: Feature locations are approximate.

N

Coldeen Property Site Characterization
Vashon Island, Washington

Vicinity Map

19500-08

3/19

HARTCROWSER

Figure

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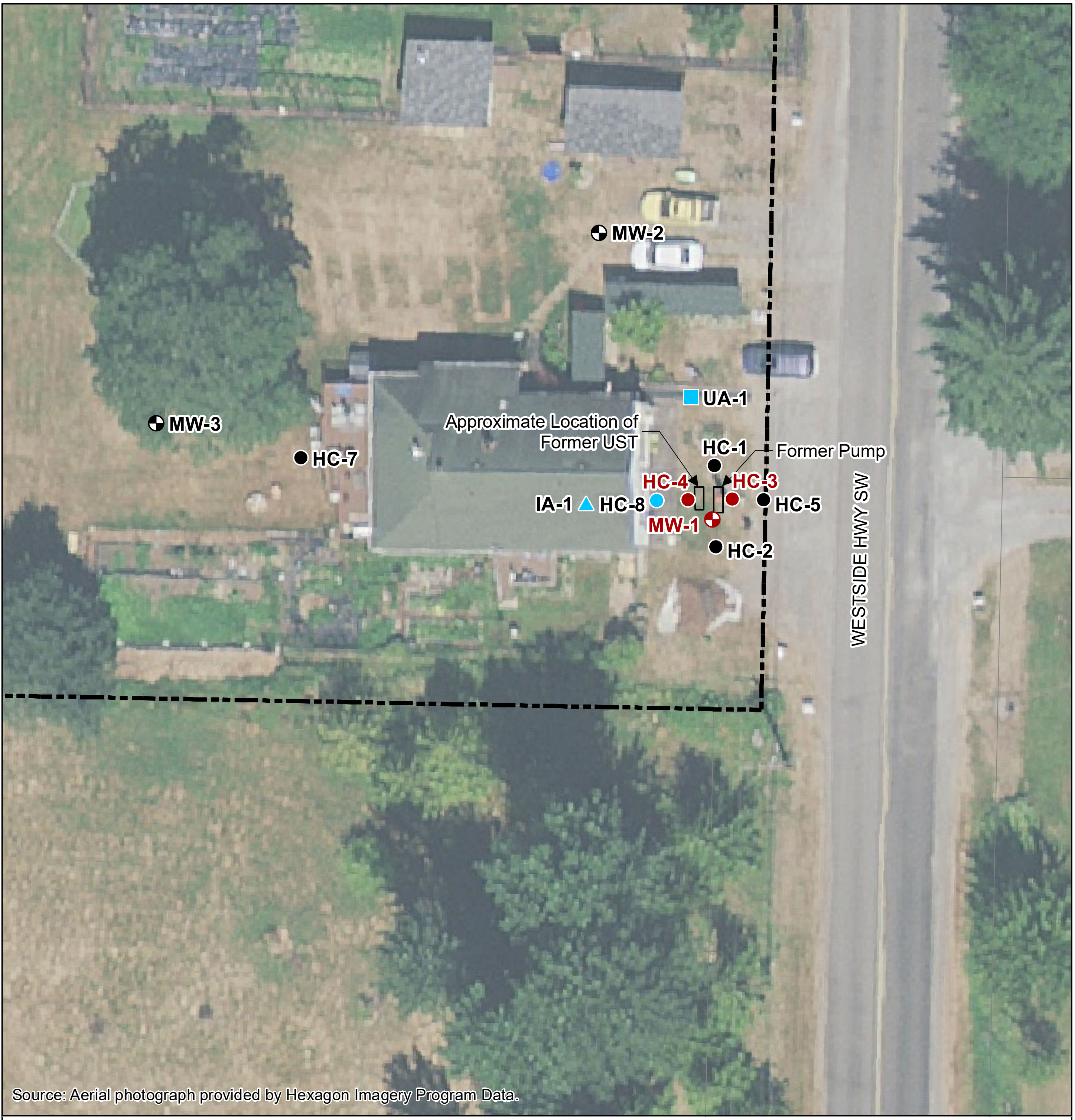

Source: Aerial photograph provided by Hexagon Imagery Program Data.

Legend

■	Proposed Upwind Ambient Air Sample
▲	Proposed Indoor Air Sample
●	Proposed Angled Boring with Soil Vapor Sample
◕	Monitoring Well (Hart Crowser 2019)
●	Boring (Hart Crowser 2019)
⬚	Property Boundary

0 15 30 60 Feet

N

Note: Feature locations are approximate. Red indicates soil sample with concentration(s) exceeding MTCA Method A cleanup levels. The location of UA-1 will be dependent on the wind direction at the time of sampling.

Coldeen Property Site Characterization
Vashon Island, Washington

Site and Proposed Exploration Plan

19500-08 9/19

HARTCROWSER

Figure
2

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APPENDIX A
Health and Safety Plan

Health and Safety Plan

Coldeen Property

15631 Westside Highway SW
Vashon Island, Washington
Date Prepared: March 15, 2019, Updated: September 23, 2019

EMERGENCY INFORMATION

SITE LOCATION	Coldeen Property 15631 Westside Highway SW Vashon Island, Washington
NEAREST HOSPITALS	CALL 911 for Emergency – Nearest Hospital is more than 1 hour away Highline Medical Center 16251 Sylvester Road SW Burien, Washington 206-244-9970 The route to the hospital is shown on Figure 1.
CONTACTS	**Hart Crowser** Seattle Office……………………………………………….(206) 324-9530 ►Project Manager, Marissa Goodman…………………(209) 312-0424 (C) ►Corporate Health and Safety Director, Anne Conrad… (206) 940-6728 (C) **Client** ►Ecology PM, Diane Escobedo ....(425) 649-7097 **State agency local office** **To report environmental problems or spills**……………..(425) 649-7000 Poison Control Center ……………………………………(800) 222-1222
EMERGENCY RESPONDERS **Police, Fire, Ambulance**	**911**
IN EVENT OF EMERGENCY CONTACT 911 FOR HELP AS SOON AS POSSIBLE	Give the following information: ➔ **Where You Are** - address, cross streets, or landmarks ☎ **Phone Number** you are calling from ?? **What Happened** - type of injury, accident # **How many persons** need help ?? **What is being done** for the victim(s) !! **You hang up last** – let emergency dispatcher hang up first

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Note: Feature locations are approximate.

Coldeen Property Site Characterization
Vashon Island, Washington

Route to Hospital

19500-08

3/19

HARTCROWSER

Figure

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HOSPITAL ROUTE DRIVING DIRECTIONS

Depart 15631 Westside Highway Southwest, Vashon Island, Washington

Head north on Westside Hwy SW toward SW Ober Beach Rd – 0.9 miles

Continue onto SW Cedarhurst Rd – 1.9 miles

Merge onto 104th Ave SW/Vashon Hwy SW – 1 mile

Turn left onto 103rd Ave SW – 0.7 miles

Turn left onto Ferry Dock – 0.1 miles

Take the Southworth – Vashon Island ferry to Seattle – 3.4 miles

Continue straight onto SW Barton St/Fauntleroy Ferry Terminal – 0.2 miles

Turn right onto Fauntleroy Way SW – 466 feet

Slight left onto SW Wildwood Pl – 0.1 miles

Turn right onto 45th Ave SW – 0.2 miles

Continue onto Marine View Dr SW

Continue left onto SW 106th St – 1 mile

Turn right onto 26th Ave SW – 0.6 miles

Turn left onto SW 116th St – 0.5 miles

Turn right onto Ambaum Blvd SW – 2.5 miles

Take 8th Ave SW to your destination – 0.6 miles

Arrive at 16251 Sylvester Rd SW

SITE HEALTH AND SAFETY PLAN SUMMARY

Location: 15631 Westside Highway SW in Vashon Island, Washington.

Proposed dates of activities: One week during April 2019 and two days during October 2019.

Type of facility: Former general store and gas station that operated from the early 1920s to 1940. Currently an occupied residence.

Land use of area surrounding facility: Residential and farmland.

Potential site contaminants: Gasoline-range petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX).

Routes of entry: Skin contact with soil and groundwater, inhalation of volatiles, and incidental ingestion of soil and groundwater.

Other specific safety hazards: Driving to and from the site; cold stress/hypothermia; noise; working around heavy equipment; biological hazards; and slips, trips, and falls.

Protective measures: Safety glasses or goggles (if splash hazard exists), Class II high visibility safety vest, rubber work gloves, nitrile gloves, long pants and shirt with minimum 4-inch sleeve, rain gear, foot protection (e.g., steel-toed boots or shoes with slip-resistant soles).

Air monitoring equipment: MultiRAE or MiniRAE photoionization detector (PID) with a 10.6 electron volt (eV) lamp. Dust will be monitored visually and engineering controls (wetting soil) will be implemented as necessary.

1.0 INTRODUCTION

1.1 Purpose and Regulatory Compliance

This site-specific Health and Safety Plan (HASP) provides information and procedures for protecting Hart Crowser personnel who handle or contact hazardous substances or may be exposed to physical hazards while collecting soil, groundwater, soil vapor, and indoor air samples at the Coldeen property located in Vashon Island, Washington. The HASP is to be used by Hart Crowser personnel and is written for the specific site conditions, purposes, dates, and personnel specified herein; it will be amended if conditions change. This HASP was amended in September 2019 to address new job activities on the site.

This HASP is to be used in conjunction with Hart Crowser's Corporate Accident Prevention Program (APP), located on the Hart Crowser Intranet. Together the APP and this HASP constitute the health and safety plan for this site.

A field copy of this HASP is to be used by Hart Crowser personnel and must be available on site throughout the duration of the project. If site conditions, field activities, personnel, dates, or other conditions change over time, this HASP will be updated to address these changes as they occur. Hart Crowser personnel may make minor changes to the field copy by hand in ink (with date and initials). The signed HASP will be retained with the project files when the project is completed.

1.2 Distribution and Approval

This HASP will be made available to all Hart Crowser personnel working at the project site. Hart Crowser workers will read, sign, and return the form titled "Record of Health and Safety Communication" provided in Appendix A of this HASP to certify their agreement to comply with the minimum requirements of this HASP. The Hart Crowser project manager will route the signed Appendix A form to the project files upon completion of field activities covered under the HASP.

This HASP will be provided to subcontractors for informational purposes only. Subcontractors will sign the form titled "Record of Health and Safety Communication" and will be told clearly by the Field Health and Safety Manager that that this HASP represents minimum safety procedures for Hart Crowser workers and that subcontractors are responsible for their own safety while on the site. Nothing herein will be construed as granting rights to Hart Crowser subcontractors or any others working on this site to use or legally rely on this HASP.

This HASP has been approved by the Hart Crowser Corporate Health and Safety Director.

1.3 Chain of Command

The Hart Crowser chain of command for health and safety on this project includes the following individuals:

Corporate Health and Safety Director: Anne Conrad

The Hart Crowser Corporate Health and Safety Director has overall responsibility for preparation and modification of this HASP. If health and safety issues arise during site operations, the director will attempt to resolve them with the appropriate members of the project team.

Project Manager: Marissa Goodman

The Project Manager has overall responsibility for the successful outcome of the project. In consultation with the corporate health and safety director, the project manager makes final decisions about implementing this site-specific HASP. The project manager may delegate this responsibility and the accompanying authority to another project worker as needed.

Project Health and Safety Manager: Marissa Goodman

The Project Health and Safety Manager has overall responsibility for health and safety on this project and will verify compliance with applicable requirements. This individual will communicate all relevant health and safety issues to Hart Crowser's workers.

Field Health and Safety Manager: TBD

The Field Health and Safety Manager is responsible for implementing this HASP in the field and for maintaining it at the project site. This individual conducts safety briefings, observes workers to verify that they are following HASP procedures, and assures that proper personal protective equipment (PPE) is available and used correctly and that employees have knowledge of the local emergency response system. The field health and safety manager will see that the field HASP is updated as needed to address changes in field conditions or procedures.

1.4 Work Activities

Site characterization will be in accordance with the final SAP/QAPP developed in March 2019 and updated in September 2019. Hart Crowser will complete the public one-call notification through the Washington Utility Notification Center per state regulations and utilize a private utility locating service before the start of work. Additionally, scope includes:

- Observing, preparing geologic logs, field screening soil, developing and sampling wells, and documenting all field activities during field activities;
- Collecting up to 34 soil samples and 8 groundwater samples (2 from each well and 2 field duplicates) per the SAP/QAPP. Up to 4 soil samples will be selected from each boring for chemical analysis based on field screening results (photoionization detector [PID] readings, sheen tests, etc), site geology, and location relative to the groundwater table (at least one soil sample collected within the smear zone/top of water table will be analyzed);
- Collecting one soil vapor sample from the angled boring advanced below the existing building, one indoor air sample from inside the building, and one control ambient air sample located outside and upwind of the building per the SAP/QAPP; and

- IDW will be placed at a location designated by Ecology in properly secured and labeled 20- to 55-gallon drums and will be removed from the Site before December 30, 2019;

We assume that field activities will take up to 3 days to complete for the first phase of site characterization activities, up to two days to complete for the second phase of site characterization activities, and a cultural resources assessment is not required for this property. The sampling will be completed in one week during April 2019 for the first phase of site characterization activities and in two days during October 2019 for the second phase of site characterization activities.

1.5 Site Description

The 3.2-acre Coldeen Property formerly contained a general store and gas station that operated from the early 1920s to 1940. The station building, which is on the King County Historic Register, was then converted into an occupied residence. As part of real estate due diligence activities, a 700-gallon Underground Storage Tank (UST) was discovered in front of the former station building. The historic pump is also still in place.

The gasoline UST was removed in 1994 and was found to contain approximately 100 gallons of water. No evidence of petroleum sheens was observed, and groundwater was not encountered in the excavation. However, soil samples collected from the UST excavation contained concentrations of gasoline-range hydrocarbons, benzene, and xylenes above Model Toxics Control Act (MTCA) cleanup levels. According to the Site Hazard Assessment (SHA) conducted for the Site in 2013, approximately 12 cubic yards of petroleum-contaminated soils were excavated during the 1994 UST removal but elevated concentrations of gasoline-range hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds were still observed.

2.0 HAZARD EVALUATION AND CONTROL MEASURES

2.1 Hazardous Substances

A 700-gallon gasoline UST was removed in 1994 and soil samples collected from the UST excavation contained concentrations of gasoline-range hydrocarbons, benzene, and xylenes above Model Toxics Control Act (MTCA) cleanup levels. The first phase of site characterization activities indicated that gasoline-range hydrocarbons are present at concentrations exceeding the MTCA Method A cleanup levels in soil and groundwater, and benzene, ethylbenzene, and xylenes were present at concentrations exceeding the MTCA Method A cleanup level in soil. No other contaminants of concern were present in soil or groundwater samples. The contaminants of concern for this site are gasoline-range hydrocarbons, benzene, toluene, ethylbenzene, and xylenes.

The potential health hazards of these hazardous substances are discussed in individual fact sheets provided in Attachment A to this HASP. The fact sheets describe effects that might occur if acute (short-term) and/or chronic (occurring over a long period – more than 1 year) exposures were to happen. Inclusion of this information does not mean that these effects will occur during the work activities conducted by Hart Crowser.

In general, the hazardous substances that may be encountered during soil, groundwater, soil vapor, and indoor air sampling at the Coldeen property are not expected to be present at concentrations or in a form that could produce significant adverse health effects. The types of work activities to be conducted and the use of personal protective equipment (PPE) will limit potential exposure.

2.2 Potential Exposure Routes

Exposure to the hazardous substances listed above could occur by accidental inhalation of, direct contact with, or ingestion of potentially contaminated soil, groundwater, soil vapor, and indoor air. To prevent contact with potential contaminants, the Hart Crowser sampling team will wear the personal protective equipment (PPE) specified in Section 3.0 while sampling and while decontaminating equipment.

Inhalation

Workers could be exposed by inhaling dust when soil is moved, through volatilization of chemicals from soil, or by inhaling potentially contaminated soil vapor or indoor air. Dust will be monitored visually, and dust-control measures such as soil wetting will be implemented as needed. Air monitoring and control measures specified in this plan will minimize the possibility for inhalation of volatile organic compounds (VOCs).

Direct Contact

Workers could be exposed if contaminated soil, dust, or groundwater contacts the skin, eyes, or clothing. Wearing protective clothing and safety glasses and performing decontamination activities specified in this plan will minimize the potential for skin and eye contact with hazardous substances.

Ingestion

Workers could be exposed if they eat, drink, or perform other hand-to-mouth activities while collecting soil or groundwater samples. Personal hygiene measures will be implemented to prevent inadvertent ingestion of contaminants; for example, workers will remove their gloves and wash their hands and faces before eating, drinking, or using tobacco.

2.3 Air Monitoring

For activities in areas where VOCs are known or suspected to be present, air quality will be monitored using a MultiRAE, MiniRAE, or QRAEII photoionization detector (PID) to determine whether VOCs are present and to check the adequacy of PPE (specifically, respiratory protection). The monitoring results may trigger actions, as summarized in Table 1 and described in more detail below under “Action Levels.”

Table 1 – Air Monitoring Action Levels

Monitoring Device	Sensor	Result	Action Required	Notes

MultiRAE or MiniRAE	VOC	<5 Units above Background	Continue Monitoring	a
		5 to 10 Units above Background	Use Half-facepiece Respirator or utilize institutional controls to reduce vapor emissions	a, b, c
		>10 Units above Background	Stop Work; Contact Project Health and Safety Manager	a, b

Notes:

a. Use appropriate lamp and calibrate unit.

b. Air-purifying respirators must be used only when use criteria are met and when appropriate cartridges are available.

c. Half-facepiece respirators generally acceptable up to 10 times the PEL.

Air quality will be monitored at the discretion of the field health and safety manager by an individual trained to use the equipment. The project manager is responsible for ascertaining that each designated operator is properly trained in the use of the monitoring equipment. **The results of all air monitoring will be recorded on the project "Field Health and Safety Report" form provided as Appendix B to this HASP**. The results of air monitoring will be used to determine the need to upgrade personal protective equipment (PPE). The "Field Health and Safety Report" forms will be filed with the project records.

The specific piece of monitoring equipment item(s) to be used on this project will be indicated by Hart Crowser unit number on the project "Field Equipment & Supplies" form, which is included in this plan by reference. The equipment technician will calibrate, maintain, and repair each air monitoring equipment item, or arrange for these activities, which will be conducted in accordance with and at the frequency specified by the manufacturer or more frequently, as required by use conditions. The equipment technician will maintain calibration/repair records in the equipment log books.

The following sections describe the equipment and procedures that will be used to monitor VOCs and combustible gases.

MultiRAE or MiniRAE Photoionization Detector

Volatile Organic Compounds. A MultiRAE or MiniRAE photoionization detector (PID) will be used at locations where VOCs may be present during site activities. **This detector is non-specific**, meaning that it does not identify the chemicals present. In addition, since it is calibrated using only a single reference chemical, **the PID provides only an estimate of the actual vapor concentration present**. If chemical-specific information is necessary, other types of sampling equipment must also be used.

Monitoring Procedures. At the discretion of the field health and safety manager, air quality will be monitored using a MultiRAE or MiniRAE PID or equivalent with 10.6 eV lamp to measure organic vapor concentrations during site work activities. The 10.6 eV lamp will be specified for general hydrocarbon survey measurements for chemicals having an ionization potential of up to 10.6 eV, such as benzene (9.24 eV).

The field health and safety manager or other designated project individual is responsible for verifying that the equipment is calibrated and working properly before on-site use. For the MultiRAE or MiniRAE, this will include zeroing the instrument before work begins. Records of these activities will be maintained in the “Field Health and Safety Report” form. If there are any problems with the equipment, the item will be removed from use until repair or replacement can be coordinated with the equipment technician.

Action Levels. PID monitoring will be conducted before work begins at each individual work area where volatile chemicals may be present. Results may trigger actions, as summarized in Table 1 and described below:

- If PID measurements are **less than 5 units** above ambient background levels in the worker's breathing zones, work can proceed without respiratory protection, with monitoring repeated at 15- to 30-minute intervals, or more frequently if odors or signs of irritation are noted.
- If PID measurements are **between 5 and 10 units** above ambient background levels in the worker's breathing zones for 5 consecutive minutes, exposed workers will use air purifying respirators as specified in Table 2, with monitoring repeated at least every 15 minutes, or more frequently if any odors or signs of irritation are noted.
- If PID measurements **exceed 10 units** above ambient background levels in the worker's breathing zones, work will cease, and employees will evacuate the work area pending reevaluation of the situation by the project manager and corporate health and safety director. Action will be taken, including plan modification if required, to address any situations where such results are observed.

Calibration and Maintenance. The MultiRAE or MiniRAE PID will be calibrated and maintained according to the manufacturer instructions. If there are problems with the equipment, a completed “Notice of Returned Equipment” form or other notification indicating the equipment condition will accompany the PID returned to the equipment room. The equipment technician will perform maintenance/repair as required.

2.4 Physical Hazards

Potential physical hazards associated with the project include operating motor vehicles, doing heavy lifting, noise, working around heavy equipment, cold stress, biological hazards (insects, blood-borne pathogens [BBPs]), or slips, trips, and falls.

Operating Motor Vehicles

Hart Crowser personnel who operate motor vehicles are legally licensed to do so, will wear seat belts at all times when driving, and will obey all rules of the road while engaged in company business.

Hart Crowser employees will comply with all federal, state, and local regulations on use of cellular devices while driving. Only hands-free cellular devices may be used during vehicle operation. Under no circumstances is text messaging or any use of a keyboard allowed while operating a vehicle.

Heavy Lifting

Field work on this project will require some amount of heavy lifting, for instance, carrying coolers containing samples. Overexertion injuries to the back, shoulders, elbows, hands, or wrists can occur when a load is lifted or otherwise handled. Hands and wrists can be injured from grasping during lifting. Muscles in the forearm that are used for grasping attach to the elbow, so this joint can be injured when lifting. The shoulder can be injured by lifting any load and is especially at risk of injury from lifts done while reaching above the shoulder or away from the body. Frequent lifting and awkward lifting (i.e., above the shoulders, below the knees, at arms' length) can also result in injuries.

The best procedures for lifting vary depending on conditions and the size and shape of the object being lifted. A general rule for avoiding injuries is to assess the object and surrounding area before lifting, and never attempt to lift an object that is poorly packaged or too heavy. Before lifting, workers should make sure their path is dry and clear of obstacles that could cause a fall.

To lift heavy objects:

- Take a deep breath and relax your muscles.
- Approach the object, and in a slow, controlled movement, bend your knees (keeping your back straight) until you are squatting.
- Grip the object securely with both hands and, when ready, push up and extend your knees until reaching a standing position, with the object at chest level. Do not lift above your shoulders or below your knees.
- Do not twist your back or bend sideways.
- Walk slowly to the destination and put down the heavy object using the same slow, controlled movements, keeping your back relatively straight and bending your knees.
- Do not lift or lower with arms extended.
- Take a break between lifting each object if necessary.
- Never attempt to move any object that seems too heavy to manage alone. Get help from a co-worker as needed.

Workers who need to lift objects should be in good physical shape. Workers not accustomed to lifting or vigorous exercise should not be assigned difficult lifting or lowering tasks.

Cold Stress

Workers who are exposed to extreme cold or work outdoors in cold and wet environments may be at risk of cold stress, which can result when the core body temperature gets too low. The most common consequences of cold stress are hypothermia, frost bite, and trench foot; the latter two are not normally risks on Hart Crowser projects. Factors in cold stress include wetness, wind chill, tiredness, improper clothing, health conditions, and poor physical conditioning.

Near-freezing temperatures is a factor in cold stress. Project workers will dress appropriately for the weather conditions and pay attention to the signs and symptoms of hypothermia. When temperatures drop below normal and wind speed increases, heat can leave the body more rapidly. These weather-related conditions may lead to serious health problems.

Hypothermia

Causes. Hypothermia can result when the body loses heat faster than it can replace it, and temperature drops below 95°F. Wind chill and wetness can play a significant role in lowering core body temperature. It is important to understand that hypothermia can occur even when temperatures are not extremely cold, especially when water, wind, and/or pre-existing health conditions are involved.

Signs. Warning signs of hypothermia include shivering (only initially), confusion, loss of coordination, slurred speech, fumbling, inability to decide, disorientation, apathy, drowsiness, inability to stand or walk, dilated pupils, slowed pulse and breathing, and loss of consciousness. Confusion is a key symptom. With medium or advanced hypothermia, shivering is absent, and the person may not realize they have hypothermia. They may also be unwilling to call attention to themselves or seek help.

Treatment. Hypothermia victims should be immediately but not too rapidly re-warmed.

Rewarming involves:

- Moving the victim into a sheltered area.
- Removing any wet clothing.
- Wrapping the victim loosely with blankets or sleeping bag.
- Applying heat packs or warm containers to armpits, groin, head, neck, and chest.
- If core body temperature falls below 90°F and heated shelter is not available, using skin-to-skin contact with another individual.
- Providing warm beverages if the person is conscious.
- Getting medical help as soon as possible.

Rescue breaths and CPR for victims who are not breathing or who don’t have a pulse are not covered in this HASP.

Noise

Heavy equipment may produce noise levels that exceed 85 decibels A scale (dBA) for personnel working in or around the job site. At this level or above, hearing protection must be worn. A general guideline is if people 3 to 4 feet apart cannot converse without raising voices, the noise levels are too high and hearing protection should be worn. Ear muffs or ear plugs with a noise reduction rating (NRR) of 29 or higher (the highest NRR is 33) will be used when noise levels are too high as determined by the above guideline or by sound level measurements.

Working Around Heavy Equipment

Various heavy equipment (drill rigs) may be used at the job site. To work safely around heavy equipment, Hart Crowser on-foot workers will:

- Wear Class II high visibility vests;
- Stay out of the equipment’s swing radius;
- Never position themselves in front of or behind a moving piece of equipment, or between two moving pieces of equipment;
- Maintain eye contact with the operator (never assume the operators sees an on-foot worker);
- Be aware of the back-up alarm signal associated with the equipment; use caution if wearing hearing protection; and
- Not operate heavy equipment unless the worker has the appropriate training and/or licenses.

Heavy equipment is typically powered by diesel engines which emit diesel exhaust, a mixture of gases and particulates. Short-term exposure to diesel exhaust can irritate the eyes, nose, and throat; and cause headaches and nausea. If workers experience short-term effects, they will move away from the diesel exhaust and notify the Project Health and Safety Manager or the Corporate Health and Safety Director. Exposure to diesel exhaust fumes may lead to other health problems such as lung diseases, heart diseases, asthma, lung damage and immune system problems. These problems typically occur in people with high rates of exposure and long-term exposure (e.g., heavy equipment operators, truck drivers). Existing asthma may be exacerbated by diesel exhaust.

Biological Hazards

Biological hazards include vector-borne diseases, insects, rodents and other wild or stray animals, snakes, and poisonous plants. Vector-borne diseases may be spread to workers by insects such as mosquitoes and ticks. When a mosquito or tick bites a worker, it may transfer a disease-causing agent, such as a parasite, bacteria, or virus. Examples of mosquito-borne diseases are West Nile virus and encephalitis. Lyme disease and Rocky Mountain spotted fever are tick-borne diseases. People are exposed to biological hazards through contact with insects, soil, water, bird or bat droppings, rodent droppings, or poisonous plants.

Insects

Wearing long pants, socks, and long-sleeved shirts provides protection from insects. Using insect repellents that contain DEET or picaridin also provides protection from insects. Insect bites and stings can be treated with over-the-counter products that relieve pain and prevent infection.

Stinging insects include bees, wasps, hornets, and fire ants. Personnel can avoid attracting stinging insects by wearing light-colored clothing and avoiding perfumes or colognes. If such an insect approaches, do not wave wildly and swat blindly; instead, use a gentle pushing or brushing motion to deter them.

Bee stings can produce life-threatening allergic reactions. Symptoms include pain, swelling of the throat, redness or discoloration of the wound, itching, hives, decreased consciousness, and labored or noisy breathing. Personnel who are allergic to insect stings should carry an anaphylactic shock kit prescribed by their physician.

Blood-Borne Pathogens

Workers responding to a first-aid incident could be exposed to blood-borne pathogens (BBPs), which are infectious microorganisms in blood and other body fluids that can cause disease in humans. Examples of these pathogens include hepatitis B virus, hepatitis C virus, and HIV. Workers exposed to BBPs are at risk for serious or life-threatening illnesses.

Universal precautions will be followed if BBP exposure is a concern. Universal precautions involve treating all human blood and other potentially infectious materials as a BBP and protecting oneself from exposure. The easiest way to protect oneself from blood and body fluids is to have the injured person treat their own wound if they are conscious and capable of doing so. If injured people are unable to take care of themselves, or they need help, workers should use disposable gloves and eye protection if there is a splash hazard.

If disposable gloves are not available, a plastic bag (trash, shopping, or sandwich) can be used to create a barrier. If performing CPR, always use a pocket mask equipped with a one-way valve. After removing PPE, wash hands or other affected body parts. Place PPE in a plastic bag, seal the bag, and contact the corporate health and safety director for further instructions.

If you are exposed to BBPs or other potentially infectious materials (i.e. BBPs contact your eyes, mouth, nose, open wounds/sores, abrasions, sunburned areas, or acne), follow these steps:

- Flush the area of the body that was exposed with warm water, and then wash with soap and water. Vigorously scrub all areas. It is the abrasive action of scrubbing that removes the contamination from the skin.
- If you have an open cut, squeeze it gently to make it bleed, then wash with soap and water.
- Notify your project manager or the corporate health and safety director to document the incident. Identify the source of the exposure.

- Get medical counseling (i.e., get tested for BBPs, get vaccinated if needed).

Slips, Trips, and Falls

Hart Crowser workers will be careful to prevent slips on wet walking surfaces and will look for and avoid tripping hazards such as loose rock or debris. Wear steel-toed safety boots with slip-resistant soles on trails.

Be aware of your surroundings. Keep pathways and work areas free of debris and supplies to prevent unsafe walking and working conditions. Changes in elevation such as ruts or holes present a trip hazard and should be marked if possible. Avoid leaving tools on the ground.

Plan what you would do if you start to slip or fall. During a fall, do not try to catch yourself; try to avoid landing on your hands, elbows, or knees. Landing on the side of your body is much safer. If you are walking on a slope and know you are going to slide, lower your center of gravity by sitting down and sliding on your feet and/or bottom. If sliding while standing up, keep your weight over your feet and bend your knees; do not lean backward or forward.

Hazards requiring fall protection are not expected at this site. A written Fall Protection Work Plan is required where fall hazards of 10 feet or more exist. Fall prevention or fall protection measures is required for any walking surface of 4 feet or higher, and when working within the affected area (the distance away from the edge of an excavation equal to the depth of the excavation up to a maximum distance of fifteen feet) of any excavation more than 10 feet deep. If there is a fall hazard of 4 feet or more on a hazardous slope (i.e., a slope where normal footing cannot be maintained without the use of devices because of the pitch of the surface, weather conditions, or surface material), a personal fall restraint system or positioning device system is required. Work will not be performed on slopes steeper than 75 percent or near vertical drop-offs without fall protection equipment.

2.5 Hazard Analysis and Applicable Safety Procedures by Task

Table 2 lists the tasks and associated hazards that may be anticipated during the work activities described in this HASP and associated control measures.

Table 2 – Hazard Analysis by Task

Work Task	Potential Hazards	Protective Measures
Observing and logging soil borings	Working around heavy equipment; slips, trips and falls; heavy lifting; noise; and skin contact with contaminated media.	Level D or Level C PPE (see Section 3.0), hard hat, high-visibility safety vest or jacket, caution around moving equipment and traffic, safe lifting practices, and hearing protection.
Collecting soil samples	Skin contact with contaminated media; working near heavy equipment; slips, trips and falls; and heavy lifting.	Level D or Level C PPE (see Section 3.0), caution around moving equipment and traffic, hearing protection, and air monitoring (as needed).
Well development/ groundwater sampling	Skin contact with contaminated media; slips, trips and falls; and heavy lifting.	Level D or Level C PPE (see Section 3.0), and air monitoring (as needed).
Soil vapor/indoor air sampling	Inhalation of contaminated media; working near heavy equipment; noise; slips, trips, and falls	Level D or Level C PPE (see Section 3.0), hard hat, high-visibility safety vest or jacket, caution around moving equipment and traffic, hearing protection, and air monitoring (as needed).

3.0 PERSONAL PROTECTIVE EQUIPMENT

When fieldwork is performed in contaminated areas, the primary objective is to minimize worker exposure using engineering controls such as ventilating, working up-wind or away from contaminated materials, or wetting soil to reduce dust. If engineering controls are not feasible or may not provide adequate control, and before they are fully implemented, workers will wear specified personal protective equipment (PPE) to minimize potential exposure to hazardous substances.

Contact with hazardous substances at harmful levels is not expected for this project; therefore, PPE is based on the lowest Occupational Safety and Health Administration (OSHA) requirements, Level D. Conditions requiring Level A, B, or C protection are not anticipated for this project. If they do occur, work will stop and the HASP will be amended as required before work is resumed.

Table 3 summarizes the minimum PPE requirements for Hart Crowser workers based on the potential routes of exposure and the potential hazardous substances.

Table 3 – Specific Personal Protection Level Requirements for this Site

Potential Route of Contact: Type of Contaminant	Required Protection Level	Safety Glasses	Hard Hat	Steel-toed Safety Boots or shoes	Tyvek	Poly Tyvek	Nitrile Gloves	Respirator	
								Half-Face piece	Full-Face piece
None anticipated	Level D (a)	X	b	X					
Minor skin contacts possible	Level D (a)	X	b	X	g		X		
Skin contamination possible: organics	Level C (c)	X	b	X		X	X		
Inhalation possible: organics	Level C (c)	X	b	X	g		X	d, e	f

Notes:

a. Level D protection required when atmosphere contains no known hazard and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

b. Hard hat required where risk of striking overhead objects exists.

c. Level C protection required when atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin; this assumes that the types of air contaminants have been identified, concentrations have been measured or modeled/estimated, an appropriate respirator cartridge is available, and all air-purifying respirator criteria are met.

d. Appropriate respirator cartridges include organic vapor (MSA GMA or equivalent), combination (MSA GMC-H or equivalent), and others as required for the particular contaminants.

e. Half-facepiece respirator required when PID concentrations range from 5 to 10.

f. Full-facepiece respirators will not be used unless field representative has been properly fit-tested for a full-facepiece respirator.

g. Tyvek or protective clothing should be worn if body contact with impacted materials is likely.

3.1 Level D Activities

Level D protection will be used when the atmosphere contains no known hazards and Hart Crowser workers will not perform activities where skin contact with free-phase product or contaminated materials is likely to occur. These workers will wear regular work clothes (long pants, shirt with minimum 4-inch sleeve), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or neoprene-coated work gloves), and foot protection (steel-toed boots or shoes).

3.2 Modified Level D Activities

Modified Level D protection will be used when the atmosphere contains no known hazards and there is a potential that Hart Crowser workers may have skin contact with hazardous substances. These workers will wear regular work clothes (long pants, shirt with minimum 4-inch sleeve), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or neoprene-coated work gloves), and foot protection (steel-toed, boots or shoes), and will supplement this equipment with chemical resistant outer clothing (e.g. Tyvek or rain gear) and chemical resistant gloves. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site.

3.3 Level C Activities

Workers performing site activities where skin contact with free product or contaminated materials is likely will wear chemical-resistant gloves (nitrile, neoprene, or other appropriate outer gloves, and surgical inner gloves) and polyethylene-coated Tyvek® or other chemical-resistant suits or rain gear. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site. Workers will use face shields or goggles as necessary to avoid splashes in the eyes or face.

When performing activities in which inhalation of chemical vapors and dusts is a concern, workers will wear half-facepiece or full-facepiece air-purifying respirators as specified in Table 3. If respirators are used, cartridges should be changed on a daily basis, at minimum. They should be changed more frequently if chemical vapors are detected inside the respirator or other symptoms of breakthrough are noted (respiratory irritation, dizziness, or breathing difficulty).

4.0 SAFETY SUPPLIES AND EQUIPMENT LIST

The following safety supplies and equipment must be available on site:

- Fire extinguisher – 3 to 4-pound ABC,
- First aid kit in a sturdy weatherproof carrying case,
- Bottled sterile hand-held eyewash solution,
- Mobile telephone,
- Class II high visibility safety vest or jacket,
- Goretex (or similar) rainsuit,
- Head protection – hard hat,
- Hearing protection,
- Half-facepiece respirator with combination cartridges (as needed),
- Foot protection – steel-toed boots or shoes with slip-resistant soles,
- Hand protection – nitrile outer gloves/nitrile inner gloves or neoprene-coated work gloves, and
- Eye protection – safety glasses or safety goggles if a splash hazard is present.

All non-disposable safety gear and PPE must be cleaned after use and stored securely to avoid damage. Avoid storing gear in direct sunlight or exposed to weather conditions. Safety equipment and PPE should be checked before use and damaged or worn-out gear should be disposed of and replaced.

5.0 SITE CONTROL

Field work for this project consists primarily of low-impact sampling activities that will not result in the migration of contaminants or increased exposure to human health or the environment. Therefore, formal exclusion zones, contaminant reduction zones, and support zones are not necessary for this field work.

Although a formal contaminant reduction zone is not necessary, project workers will use precautions during sampling activities. The amount of equipment and number of personnel allowed in sampling areas will be minimized and the number of samples collected should not exceed what is needed for laboratory analysis.

6.0 DECONTAMINATION

Decontamination for this project is limited to decontaminating sampling equipment.

Hart Crowser workers will practice good hygiene by washing their hands and faces prior to taking rest breaks, drinking liquids, and so forth. They will also wash their hands and faces fully before eating, using tobacco, or as soon as possible upon leaving a work area.

7.0 SITE SECURITY

Security at the Coldeen Property Site will be the responsibility of the field health and safety manager. Approved site visitors will need to complete a safety briefing with the field health and safety manager upon arrival and keep a safe distance from the drill rig and sampling activities. If the site visitor is not current on the HAZWOPER training requirements, they will need to remain outside of the exclusion zone designated by the field health and safety manager. Any security problems will be reported to the appropriate authorities and to the client.

8.0 SPILL CONTAINMENT

Sources of bulk chemical subject to spillage are not expected for this project. Accordingly, a spill containment plan is not required for this project.

9.0 EMERGENCY RESPONSE PLAN

This Emergency Response Plan outlines the steps necessary for appropriate response to emergency situations that could reasonably occur during Hart Crowser's work at the Coldeen property. The following paragraphs summarize the key emergency responses for this project.

9.1 Plan Content and Review

The principal hazards addressed by this plan are fire, medical emergencies, and situations such as inadequate PPE for the hazards present. However, to help anticipate other potential emergency situations, field personnel will exercise caution and look for signs of potentially hazardous situations, including:

- General physical hazards (slippery or uneven surfaces, inclement weather, noise);
- Poisonous plants or dangerous animals;
- Underground pipelines or cables; and
- Live electrical wires or equipment.

These and other potential conditions should be anticipated, and steps should be taken to prevent problems before they occur.

This emergency response plan will be reviewed and rehearsed, as necessary, during the on-site health and safety briefing so all personnel will know what their duties are if an emergency occurs.

9.2 Plan Implementation

The field health and safety manager will evaluate the situation and act as the lead if an emergency occurs. That individual will determine the need to implement the emergency response, in concert with other resource personnel including client representatives, the project manager, and the corporate health and safety director. Other on-site field personnel will assist the field health and safety manager as needed during an emergency.

If the plan is implemented, the field health and safety manager or designee is responsible for alerting all personnel at the affected area by use of a signal device (such as a hand-held air horn) or visual or shouted instructions, as appropriate.

The field health and safety manager will identify a safe assembly area for workers to gather if it is necessary to evacuate the area and will communicate this location to workers during the on-site health and safety briefing. The “buddy” system will be employed during evacuation to facilitate safe evacuation. The field health and safety manager is responsible for roll call at the assembly area to account for all personnel. As only one Hart Crowser worker will be on-site, a buddy system will be established with other contractors or subcontractors.

9.3 Emergency Response Contacts

Emergency contact information is provided in this HASP (see Page 1). A copy of this HASP will be maintained at the project site. Emergency information includes:

- Emergency telephone numbers,

- Route to nearest hospital (Figure 1), and

- Site description (Section 1.4).

A significant environmental release of contaminants is not likely to occur from work activities subject to this HASP. If it does, the field health and safety manager will contact the project manager or corporate health and safety director to make any required notifications.

If an emergency situation occurs requiring implementation of the emergency response plan (fire, serious injury, or inadequate personal protection equipment for the hazards present, for instance), Hart Crowser staff will cease all work immediately, pending approval from the field health and safety manager to restart work. The general emergency actions described below will be followed.

9.4 Fires

Hart Crowser personnel may attempt to control only very small fires. If the fire expands, or an explosion appears likely, Hart Crowser field workers will evacuate the area immediately. If a fire occurs that cannot be controlled with a 3 to 4-pound ABC fire extinguisher, immediate intervention by the local fire department or other appropriate agency is imperative. Use these steps:

- Immediately call **911**,
- Evacuate to a safe area away from the danger to a previously agreed upon upwind location, and
- Inform the project manager or field health and safety manager of the situation.

9.5 Medical Emergencies

Hart Crowser staff will call **911** immediately if a medical emergency (such as a serious injury or an unconscious worker) occurs. If workers are unsure about the severity of an accident or exposure, they will take a conservative approach and seek medical attention. The field health and safety manager will notify the project manager of the outcome of the medical incident as soon as possible.

No Hart Crowser employees are trained to perform rescue duties or medical duties beyond basic CPR and first aid. Hart Crowser employees certified in CPR and first aid may respond to work-related incidents requiring first aid services. First aid will be treatment for such things as minor cuts and bruises as needed. When rendering first aid, Hart Crowser workers will take necessary precautions to avoid exposure to BBPs. Section 2.4, Physical Hazards, provides information on BBPs and precautions for avoiding exposure.

9.6 Uncontrolled Contaminant Release

Work activities for this project do not present the potential for an uncontrolled contaminant release as defined by

Washington

- Chapter 296-24, Washington Administrative Code (WAC), General Safety and Health Standards.
- Chapter 296-62, WAC, General Occupational Health Standards.

- Chapter 296-155, WAC, Safety Standards for Construction Work.
- Chapter 296-800, WAC, Core Rules. Core Rules are the basic safety and health rules needed by most employers in Washington State.

Federal OSHA

- 29 Code of Federal Regulations (CFR) 1910, General Occupational Safety and Health Standards.
- 29 CFR 1926, Safety and Health Regulations for Construction
- 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.

Hart Crowser staff are not trained as emergency responders as defined by federal and state regulations; therefore, they are not qualified to respond to hazardous material emergencies.

9.7 Potentially High Chemical Exposure Situations

Work activities for this project do not present the potential for high chemical exposure situations.

10.0 NOTIFICATION AND REPORTING

The project manager will be informed immediately if an emergency, accident, or injury occurs at the project location. The project manager will notify the client immediately. The field health and safety manager will notify the corporate health and safety director as soon as possible after the situation has been stabilized. The project manager or corporate health and safety director will notify the appropriate client contacts and regulatory agencies, if applicable. If an individual is injured or suffers a work-related illness, the field health and safety manager or designee will complete an injury/accident report and submit it to human resources or the corporate health and safety director within 24 hours. A blank report is provided as Appendix C.

The project manager, the field health and safety manager, and the corporate health and safety director will evaluate emergency response following the incident. The results of the evaluation will be used in follow-up training exercises to improve the emergency response plan.

11.0 MEDICAL SURVEILLANCE

Hart Crowser employees working on this project participate in a medical surveillance program as described in Section 11 of Hart Crowser’s APP.

12.0 SAFETY TRAINING REQUIREMENTS

Hart Crowser employees who work at sites where there is potential for exposure to hazardous substances, health hazards, or safety hazards will have completed 40 hours of hazardous waste operations and emergency response (HAZWOPER) training and 3 days of supervised field experience. In addition, employees will have completed an 8-hour annual refresher training within the past 12 months or will possess equivalent documented training by experience. Site supervisors will have completed 8 hours of HAZWOPER supervisor training. The project manager will ensure that all employees working on this site have completed required HAZWOPER training. The Hart Crowser safety records coordinator maintains employee health and safety training records.

Employees performing some tasks will require additional safety training on performing the task safely (without injury or property damage) and in compliance with safety regulations. Examples of these tasks include entering confined spaces, wearing a respirator, operating equipment or machinery, working at heights, handling or using hazardous substances, and working in excessive outdoor heat. Safety training requirements are specified in Section 7.2 of the Hart Crowser APP. Hart Crowser personnel will complete hazard-specific safety training as needed based on the tasks to be performed.

Before each work day starts, the field health and safety manager will review applicable health and safety issues with Hart Crowser employees and subcontractors. At these briefings the work to be accomplished will be reviewed and there will be an opportunity for questions to be asked. The "Field Health and Safety Report" form (Appendix B) will be completed daily by the Hart Crowser field health and safety manager or designated individual.

13.0 REPORTING, REPORTS, AND DOCUMENTATION

All incidents (accidents, injuries, near-misses) that occur during field work on this project will be reported to the project manager immediately. The project manager will notify the client and the corporate health and safety director.

The field health and safety manager is responsible for maintaining records demonstrating that the provisions of this HASP are implemented throughout the course of this project.

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APPENDIX A
Record of Health and Safety Communication

Record of Health and Safety Communication

PROJECT NAME: Coldeen Property

PROJECT NUMBER: 19500-08

SITE CONTAMINANTS: Gasoline-range hydrocarbons, benzene, toluene, ethylbenzene, and xylenes.

PPE REQUIREMENTS (check all that apply):

X	Eye protection	X	Gloves (specify)	Nitrile or neoprene-coated work gloves
X	Foot protection	X	Clothing (specify)	Long pants, shirt with minimum 4-inch sleeve
X	Head protection		Respirator (specify)	Half-face respirator (if needed)
		X	Other (specify)	Hearing protection

The following personnel have reviewed a copy of the site-specific HASP. By signing below, these personnel indicate they have read the plan, including all referenced information, and that they understand the requirements detailed for this project.

PRINTED NAME	SIGNATURE	PROJECT DUTIES	DATE

Project manager: please route a copy of this form to the job files when completed.

Benzene - ToxFAQs™

CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHTLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

Benzene

CAS # 71-43-2

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the bloodforming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR) 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Ethylbenzene- ToxFAQs™

CAS # 100-41-4

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Breathing lower levels has resulted in hearing effects and kidney damage in animals. Ethylbenzene has been found in at least 829 of 1,699 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

Ethylbenzene is a colorless, flammable liquid that smells like gasoline.

It is naturally found in coal tar and petroleum and is also found in manufactured products such as inks, pesticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- Ethylbenzene can move through soil into groundwater.
- In soil, it is broken down by bacteria.

How might I be exposed to ethylbenzene?

- If you live in a city or near many factories or heavily traveled highways, you may be exposed to ethylbenzene in air.
- Releases of ethylbenzene into the air occur from burning oil, gas, and coal and from industries using ethylbenzene.
- Ethylbenzene is not often found in drinking water. Higher levels may be found in residential drinking water wells near landfills, waste sites, or leaking underground fuel storage tanks.
- Exposure can occur if you work in an industry where ethylbenzene is used or made.
- Exposure can occur if you use products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Exposure to high levels of ethylbenzene in air for short periods can cause eye and throat irritation. Exposure to higher levels can result in dizziness.

Irreversible damage to the inner ear and hearing has been observed in animals exposed to relatively low concentrations of ethylbenzene for several days to weeks.

Exposure to relatively low concentrations of ethylbenzene in air for several months to years causes kidney damage in animals.

How likely is ethylbenzene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is a possible human carcinogen.

Ethylbenzene

CAS # 100-41-4

How does ethylbenzene affect children?

There are no studies evaluating the effects of ethylbenzene exposure on children or immature animals. It is likely that children would have the same health effects as adults. We do not know whether children would be more sensitive than adults to the effects of ethylbenzene.

We do not know if ethylbenzene will cause birth defects in humans. Minor birth defects and low birth weight have occurred in newborn animals whose mothers were exposed to ethylbenzene in air during pregnancy.

How can families reduce the risk of exposure to ethylbenzene?

- Use adequate ventilation to reduce exposure to ethylbenzene vapors from consumer products such as gasoline, pesticides, varnishes and paints, and newly installed carpeting.
- Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.
- Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers that children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. Because these substances leave the body very quickly, this test needs to be done within a few hours after exposure occurs.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to ethylbenzene in drinking water at concentrations of 30 mg/L for 1 day or 3 mg/L for 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.7 mg/L ethylbenzene is not expected to cause any adverse effects.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 100 ppm for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. Toxicological Profile for Ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

AUTOMOTIVE GASOLINE

CAS # 8006-61-9

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about automobile gasoline. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to automotive gasoline most likely occurs from breathing its vapor at a service station while filling a car's fuel tank. At high levels, automotive gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Exposure to high levels may also cause harmful effects to the nervous system. Automotive gasoline has been found in at least 23 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is automotive gasoline?

(Pronounced ô′tə-mō′tĭv găs′ə-lēn′)

The gasoline discussed in this fact sheet is automotive used as a fuel for engines in cars. Gasoline is a colorless, pale brown, or pink liquid, and is very flammable.

Gasoline is a manufactured mixture that does not exist naturally in the environment. Gasoline is produced from petroleum in the refining process.

Typically, gasoline contains more than 150 chemicals, including small amounts of benzene, toluene, xylene, and sometimes lead. How the gasoline is made determines which chemicals are present in the gasoline mixture and how much of each is present. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

What happens to automotive gasoline when it enters the environment?

- ☐ Small amounts of the chemicals present in gasoline evaporate into the air when you fill the gas tank in your car or when gasoline is accidentally spilled onto surfaces and soils or into surface waters.
- ☐ Other chemicals in gasoline dissolve in water after spills to surface waters or underground storage tank leaks into the groundwater.
- ☐ In surface releases, most chemicals in gasoline will probably evaporate; others may dissolve and be carried away by water; a few will probably stick to soil.
- ☐ The chemicals that evaporate are broken down by sunlight and other chemicals in the air.
- ☐ The chemicals that dissolve in water also break down quickly by natural processes.

How might I be exposed to automotive gasoline?

- ☐ Breathing vapors at a service station when filling the car's fuel tank is the most likely way to be exposed.
- ☐ Working at a service station.
- ☐ Using equipment that runs on gasoline, such as a lawn mower.
- ☐ Drinking contaminated water.
- ☐ Being close to a spot where gasoline has spilled or leaked into the soil.

How can automotive gasoline affect my health?

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture, such as benzene and lead. Inhaling or swallowing large amounts of gasoline can cause death.

Inhaling high concentrations of gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods or swallowing large amounts of gasoline may also cause harmful effects on the nervous system.

Serious nervous system effects include coma and the inability to breathe, while less serious effects include dizziness and headaches.

There is not enough information available to determine if gasoline causes birth defects or affects reproduction.

How likely is automotive gasoline to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified automotive gasoline for carcinogenicity. Automotive gasoline is currently undergoing review by the EPA for cancer classification.

Some laboratory animals that breathed high concentrations of unleaded gasoline vapors continuously for 2 years developed liver and kidney tumors. However, there is no evidence that exposure to gasoline causes cancer in humans.

Is there a medical test to show whether I’ve been exposed to automotive gasoline?

Laboratory tests are available that can measure elevated blood or urine levels of lead (as an indication of exposure to leaded gasoline only), benzene, or other substances that may result from exposure to gasoline or other sources. These methods are sensitive enough to measure background levels and levels where health effects may occur. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has established many regulations to control air pollution. These are designed to protect the public from the possible harmful health effects of gasoline.

The American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 890 milligrams of gasoline per cubic meter of air (890 mg/m^3) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Crude petroleum: Petroleum that has not been processed.

Dissolve: To disappear gradually.

Evaporate: To change into a vapor or a gas.

Irritant: A substance that causes an abnormal reaction.

Mixture: A combination of two or more components.

Refining process: The process by which petroleum is purified to form gasoline.

Tumor: An abnormal mass of tissue.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for automotive gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Toluene - ToxFAQs™

CAS # 108-88-3

This fact sheet answers the most frequently asked health related questions (FAQs) regarding exposure to toluene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important that you understand this information because this substance may harm you, or your family. The health effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, automobile exhaust, or by using products such as paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found in at least 1,012 of the 1,699 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. It is a good solvent (a substance that can dissolve other substances). Toluene occurs naturally in crude oil and in the tolú tree. It is produced in the process of making gasoline and other fuels from crude oil and in making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. Toluene is also used in the manufacture of other chemicals, nylon, and plastics. It is also added to gasoline along with benzene and xylene to improve octane ratings.

What happens to toluene when it enters the environment?

- Toluene enters the environment when you use materials that contain it. It can also enter surface water and ground water from spills of solvents and petroleum products as well as leaking underground storage tanks at gasoline stations and other facilities.
- When toluene-containing products are placed in landfills or waste disposal sites, toluene can enter the soil or water near the waste site.
- Toluene in subsurface water can be degraded by anaerobic microorganisms.
- Toluene in surface water or soil will readily evaporate to the air or be degraded by bacteria.
- Toluene does not usually stay in the environment long.

How might I be exposed to toluene?

- Breathing contaminated workplace air or automobile exhaust.
- Individuals who work with gasoline, paint, lacquer, or dyes have greater exposures to toluene, as do individuals who smoke or intentionally inhale products containing toluene for its euphoric effects or to get high.
- Living near uncontrolled hazardous waste sites containing toluene products.
- Toluene is not frequently detected in drinking water or food.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure stops.

Long-term daily inhalation exposure to toluene in the workplace may cause some hearing and color vision loss. Repeatedly breathing toluene from glue or paint thinners may permanently damage the brain.

The effects of toluene in animals are similar to those seen in humans.

How likely is toluene to cause cancer?

Studies in workers and animals exposed to toluene generally indicate that toluene is not carcinogenic

Toluene

CAS # 108-88-3

The International Agency for Research on Cancer (IARC) determined that toluene is not classifiable as to its carcinogenicity in humans. The EPA determined there is inadequate information to assess the carcinogenic potential of toluene. The National Toxicology Program (NTP) has not considered the carcinogenic potential of toluene.

How can toluene affect children?

The effects of toluene on children have not been studied very much, but toluene seems to produce the same types of effects in children as it does in adults.

Some older children and adolescents who have repeatedly breathed large amounts of toluene to get high have developed loss of muscle control, loss of memory, poor balance, and decreased mental abilities. Some of these changes may last for a long time after toluene has left the body.

Some mothers who breathed large amounts of toluene during pregnancy to get high have had children with birth defects, including retardation of mental abilities and growth.

How can families reduce the risk of exposure to toluene?

- Families can reduce their risk of exposure to toluene by using consumer products containing the chemical (such as paints, glues, inks, and stain removers) in well-ventilated areas and reading the labels of the products.
- When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.
- Household chemicals should be stored out of the reach of young children to prevent accidental poisonings.
- Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles.
- Use bottled water if you have concerns about the presence of toluene in your tap water.
- Prevent children from eating or playing in the dirt if you live near a waste site that has been contaminated with toluene.
- Talk with children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to toluene?

Toluene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of toluene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because toluene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure. The tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA has recommended a drinking water limit of 1 mg/L for toluene.

The Occupational Safety and Health Administration (OSHA) has set a legal limit for workers of 200 ppm for toluene in air averaged over an 8 hour workday.

The National Institute for Occupational Safety and Health (NIOSH) has set a recommended limit of 100 ppm for toluene in air averaged over a 10-hour workday.

References

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Toluene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ on the web: www.atsdr.cdc.gov/toxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

- ☐ TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.
- ☐ TPH may be released directly into water through spills or leaks.
- ☐ Some TPH fractions will float on the water and form surface films.
- ☐ Other TPH fractions will sink to the bottom sediments.
- ☐ Bacteria and microorganisms in the water may break down some of the TPH fractions.
- ☐ Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

- ☐ Everyone is exposed to TPH from many sources.
- ☐ Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.
- ☐ Drinking water contaminated with TPH.
- ☐ Working in occupations that use petroleum products.
- ☐ Living in an area near a spill or leak of petroleum products.
- ☐ Touching soil contaminated with TPH.

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called “peripheral neuropathy,” consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I’ve been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 840 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

❏ Xylene evaporates quickly from the soil and surface water into the air.
❏ In the air, it is broken down by sunlight into other less harmful chemicals in a couple of days.
❏ It is broken down by microorganisms in soil and water.
❏ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

❏ Using a variety of consumer products including gasoline, paint varnish, shellac, rust preventatives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
❏ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
❏ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy

How can families reduce the risks of exposure to xylene?

❏ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.
❏ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.
❏ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Xylene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX B
Field Health & Safety Report

15631 Westside Highway SW
Vashon Island, Washington

Field Health & Safety Report

19500-08 March 2019

HARTCROWSER

Appendix
B

Job No. ______________________________

Date ______________________________

S M T W Th F S

Arrival time: ______________________________

Departure time: ______________________________

Job ______________________________

Location ______________________________

Client ______________________________

Field representative ______________ Project manager ______________

Field H&S manager ______________ Project H&S manager ______________

Names of personnel on site ______________________________

Site activities ______________________________

Potential hazards ______________________________

Hazard control used ______________________________

Protective measures taken ______________________________

Comments or observations ______________________________

Sketch position of equipment relative to exploration (attach separate diagram if needed); indicate monitoring point(s) and prevailing wind direction.

Exploration No. ______________________________

Air Monitoring Log

Meter Number 1, Type ____________ Calibrated ____________ Checked ____________

Meter Number 2, Type ____________ Calibrated ____________ Checked ____________

Background Reading: Meter 1 ________________ Meter 2 ________________

Time	**Meter 1**	**Meter 2**	**Comments**

APPENDIX C
Hart Crowser Incident/Accident Investigation Report

Hart Crowser Incident/Accident Investigation Report*

Hart Crowser Office: ____________________
Incident/Accident
Site Location: ____________________
Address: ____________________
State: County:

Project number: ____________________
Date/time of
occurrence: ___AM ___PM

Name(s) of Hart Crowser personnel involved in the incident/accident:

Name(s) and Affiliation of any other personnel involved in the incident/accident:

What happened? Describe cause and nature of incident, injury or illness.

Was the incident/accident caused by actions of another individual: __Yes __No If yes, provide name, address, phone and details:

Describe any unsafe action, equipment, conditions that contributed to the incident/accident:

Was first aid given? **__Yes __No __ Unknown**

Was person referred to medical evaluation/treatment? **___Yes ___No ___ Unknown**

If yes, indicate date, where and to whom:

Did the employee(s) receive medical treatment beyond first aid __Yes __No __ Unknown If yes, describe medical treatment given:

Will lost time be involved? **__Yes __No __N/A**

Will restricted work days be involved? **__Yes __No __N/A**

If yes to either lost time or restricted work, complete the following:

____________________ Last normal work date
____________________ Date of return to normal work
____________________ Number of days lost time involved or expected
____________________ Number of days restricted work involved or expected

What actions will be taken to prevent recurrence? Give responsibilities and expected completion dates for each action.

Witnesses (Provide name, company, address, and phone number):

Reported By:
Date:

Reviewed by:
Corporate health and safety director:
Date:
Employee(s) manager or supervisor:
Date:
Human resources:
Date:

Will the work-related injury/illness results in a Workers' Compensation claim? __Yes __No ____N/A

If yes, provide claim number and date claim filed:

*The supervisor of the employee(s) involved in the incident/accident must ensure that this form is filled out within 24 hours of the incident/or accident and forwarded to Corporate Health and Safety Director. Attach additional sheets if necessary. If the incident is a recordable work-related injury or illness, OSHA Form 301 must be completed in addition to this form.