Work Plan

US GSA Richland Federal Building
Site Assessment
Richland, Washington

for
Washington State Department of Ecology

April 27, 2021

GeoEngineers
Earth Science + Technology

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File No. 0504-175-00

April 27, 2021

Prepared for:

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1.0 INTRODUCTION

This Work Plan presents the scope of work and approach to conduct a soil and, if encountered, groundwater assessment at the US GSA Richland Federal Building site (herein designated the site) located at 825 Jadwin Avenue in Richland, Washington, as shown in the Vicinity Map, Figure 1.

This Work Plan has been prepared by GeoEngineers for the State of Washington Department of Ecology (Ecology) under Ecology Master Contract No. C1900044, work assignment number GEI035. The purpose of this assessment is to collect groundwater samples from four existing monitoring wells, advance direct-push soil borings and collect soil and groundwater samples from the borings to investigate a potential solvent release at the site. Data generated from this assessment will support a no further action (NFA) determination or planning potential remedial actions within the defined project area to address ecological and human health risks associated with historical contamination.

A sampling plan, with a description of field assessment procedures is provided in Appendix A; the Quality Assurance Project Plan (QAPP) and the Health and Safety Plan (HASP) are presented as Appendices B and C, respectively. The Work Plan is organized as follows:

- Site Description and Background – Section 2.0
- Field Investigation Activities – Section 3.0
- Schedule – Section 4.0
- References – Section 5.0

2.0 SITE DESCRIPTION AND BACKGROUND

The site is located at 825 Jadwin Avenue in Richland, Washington. The site is bound by South Columbus Avenue to the west, residential property to the north and east, and an alley to the south.

Three underground storage tanks (USTs) containing solvents were removed from the site in 1997. Soil samples collected from below the former solvent USTs were analyzed for volatile organic compounds (VOCs). VOCs were not detected in the analyzed soil samples from the UST excavation at that time. We understand that the solvent UST closure report indicated that the USTs and piping appeared to be in good condition and that no evidence of leakage from the UST system was observed.

Four groundwater monitoring wells (MW-1 through MW-4) were installed at the site between 1998 and 2000. Analytical results from groundwater monitoring events indicate that VOC contamination (tetrachloroethane [PCE] and chloroform) was present in groundwater beneath the site.

Based on our review of previous site reports and professional experience in the area, groundwater is likely to occur at depths ranging from 12 to 20 feet below ground surface (bgs) and likely flows to the northeast. Subsurface soils likely consist of sand and gravel with various amounts of silt. To assess the potential extent of VOC contamination in soil and groundwater, we plan to sample the existing on-site monitoring wells, advance soil borings, collect soil and groundwater samples from the borings and submit the samples for chemical analyses of VOCs to an accredited laboratory.

2.1. Previous Site Investigations

Our review of available records indicated there have been significant soil and groundwater investigations at the site.

- In July 1998, Shannon & Wilson, Inc. (S&W) conducted a site assessment following the in-place closure of one UST at the site (S&W 1998). One soil sample collected from a depth of 8.5 feet bgs contained a diesel-range petroleum concentration (DRPH) of 2,600 milligrams per kilogram (mg/kg), which exceeded the 200 mg/kg action level. S&W's representative contacted the Central Region Ecology office to report the preliminary findings of the site assessment as a Leaking Underground Storage Tank (LUST).
- In September 1998, S&W conducted a limited Phase 2 investigation to collect soil and groundwater samples near the UST where subsurface soil contamination had previously been detected (S&W 1998b). One boring was placed through the closed, former UST basin and completed as a monitoring well (MW-1) with groundwater depth recorded at 12.65 feet bgs. S&W collected soil and groundwater samples that indicated petroleum concentrations in soil were less than risk-based calculated cleanup levels. Benzene, toluene, ethylbenzene and xylene (BTEX) and methyl tert-butyl ether (MTBE) were not detected in groundwater and very low concentrations of non-carcinogenic polycyclic aromatic hydrocarbons (PAHs) were detected. Chrysene was detected at a concentration less than the Model Toxics Control Act (MTCA) Method A cleanup level. The total volatile petroleum hydrocarbons (VPH) + extractable petroleum hydrocarbons (EPH) concentration in the groundwater sample beneath the source area was 4,900 micrograms per liter (µg/L), greater than the MTCA Method A cleanup level.
- In December of 1998, S&W conducted a supplemental Phase 2 Environmental Site Assessment (ESA) to install two new groundwater monitoring wells (MW-2 and MW-3), collect samples from the three monitoring wells and perform a records review for on-site and off-site sources of solvent contamination in groundwater (S&W 1999). The new monitoring wells were positioned downgradient and crossgradient of MW-1. PCE was detected in all three monitoring wells. TCE was detected in MW-2. The highest concentration of PCE detected was in the sample obtained from MW-3, located closest to the former solvent UST basin on site. S&W concluded that the pattern of contamination detected in groundwater at the site is not entirely consistent with the former, on-site solvent USTs being the source.
    - An on-site records review found that three USTs formerly located to the east of the Federal Building had reportedly contained solvents used in the maintenance of printing equipment. An off-site records review found two nearby sites (New City Cleaners and the City of Richland Wellsian Way Well Field) had solvents detected in groundwater. New City Cleaners at 747 Stevens Drive is located approximately 1,500 feet southwest of the Federal Building property. The Wellsian Way Well Field is between 3,200 and 6,000 feet southwest of the Federal Building property. Another dry cleaner (Richland Laundry and Dry Cleaners, 1106 Harding Street) has been in operation for many years and is located about 1,100 feet southwest of the Federal Building but the impact on the subject property is unknown. The city of Richland representatives also indicated that solvent contamination in groundwater was found at monitoring wells located south of the former city shop facility located at 1300 Mansfield Street (about 900 feet west northwest of the Federal Building property).
- On March 22, 2000, Ecology issued a NFA Determination for the Underground Storage Tank Decommissioning and Assessment of the Emergency Generator Fuel Tank, Federal Building, Richland, Washington (Ecology 2000).

- On September 9, 2000, S&W installed monitoring well MW-4 to sample and analyze groundwater at a location near the south property boundary and upgradient of monitoring well MW-3 (S&W 2000). Monitoring wells MW-1 through MW-4 were sampled and chloroform was detected in samples from all four wells. PCE was detected in all wells, except the sample obtained from MW-2.
- In June 2001, S&W performed groundwater monitoring and hydrogeologic testing (slug tests) on the four on-site monitoring wells. PCE and chloroform were detected in all the 2001 groundwater samples, except the July sample from MW-2. The highest concentrations of PCE were identified in the samples from MW-3 (81 and 70 µg/L). The hydrogeologic studies performed at the site indicated a relatively high linear velocity for groundwater movement of 1.9 feet per day (S&W 2001). Based on the low organic carbon content of the soil, S&W estimated the PCE linear velocity as relatively high at 0.95 feet per day.
- On April 11, 2002, S&W advanced three hand-auger borings along the supply piping alignment. Hand borings were excavated from 2.3 to 3.3 feet bgs. The only VOCs detected in the soil samples, acetone, MEK and toluene, were identified below regulatory requirements and chloroform, TCE and PCE were not detected in these samples. S&W concluded that the groundwater contaminant of primary concern was PCE at the site and that contaminated groundwater is present near the southern (upgradient) site boundary, which appears to be generated from an off-site source.
- On December 23, 2002, Ecology responded to S&W regarding installation of another groundwater monitoring well (MW-5) directly upgradient of the on-site UST locations (Ecology 2002). The proposed monitoring well groundwater concentrations would be compared with other wells at the site to confirm that the solvent contamination was mobilizing on site from an off-site source. It is unknown if this well was ever installed.
- On July 21, 2005, S&W collected samples from four monitoring wells at the Federal Building site. Groundwater elevations were the lowest recorded (about 0.5 to 2.8 feet lower) during the 6.5-year period, which monitoring was conducted on this site. Chloroform was detected in samples from all four wells and PCE was detected in samples obtained from MW-2 and MW-3 (S&W 2005).

To assess the potential extent of possible chlorinated solvent contamination in soil and groundwater, we plan to sample the four on-site monitoring wells using appropriate methodologies prior to sampling. The site was previously issued an NFA for petroleum contamination and therefore, assessment activities will not focus on chemicals associated with a petroleum release. Section 3.0 provides additional details.

3.0 FIELD INVESTIGATION ACTIVITIES

The tasks described below reflect the proposed field activities. The specific tasks conducted at the site may change in response to conditions encountered in the field or as additional information is obtained. Adjustments to the tasks listed will be mutually-agreed upon by Ecology and GeoEngineers and authorized prior to implementation.

Field investigation activities will include the following:

- Mobilize to/from the site from Spokane, Washington to conduct the groundwater sampling event.
- Measure and record the depth to groundwater and the depth of each well.

- Purge each groundwater monitoring well using low-flow, low-stress methods. Measure and record water quality parameters including temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential and turbidity.
- Collect a groundwater sample from each viable well per procedures outlined in Appendix A and one duplicate sample.
- Submit a minimum of one groundwater sample from each monitoring well and one trip blank for water to Eurofins TestAmerica Laboratories (Eurofins TA) for laboratory analysis. Samples will be submitted for analysis under standard turnaround time (TAT) of 10 business days. Groundwater samples submitted from the site will be analyzed for VOCs using Environmental Protection Agency (EPA) Method 8260D. If groundwater results indicate potential contamination from an on-site source, a groundwater monitoring report will be prepared and remaining scope items will not be completed, except for investigation-derived waste (IDW) disposal and uploading data to Ecology's Environmental Information Management (EIM) system.
- If VOCs are detected at concentrations less than applicable MTCA Method A cleanup levels, we will remobilize to/from the site from Spokane, Washington on a separate date after obtaining Ecology approval, to conduct one day of subsurface assessment using direct-push drilling techniques. The number, location and depth of the borings will depend on field conditions (such as field screening evidence of contamination, accessibility, soil conditions and depth to groundwater). Proposed exploration locations are shown in Figure 2. Soil samples will be collected from 5-foot intervals using a continuous core sampler for field screening and potential chemical analysis. Borings will be advanced to a maximum depth of 25 feet bgs or a minimum of 2 feet below the groundwater interface, whichever is shallower. Soil samples will be collected per procedures outlined in Appendix A for direct push sampling.
- Observe, field screen and document subsurface soil conditions using a qualified field engineer or geologist. Field screening will consist of visual observation, water sheen testing and headspace vapor measurements using a photoionization detector (PID).
- If groundwater is encountered, then the boring will be advanced a minimum of 2 feet below the groundwater interface and a temporary groundwater sampling point will be installed to collect a grab groundwater sample. Grab groundwater samples will be collected per procedures outlined in Appendix A.
- Backfill borings with bentonite clay and surface completed with gravel, asphalt or concrete patch to match the existing ground surface.
- Submit a minimum of one soil sample and one grab groundwater sample (if groundwater is encountered) from each boring to Eurofins TA for chemical analysis under standard turnaround time of 10 business days. The soil sample with the greatest field screening indication of potential contamination or the closest sample collected above the groundwater interface, if present, will be submitted for analysis. Soil and groundwater samples submitted from the site will be analyzed for VOCs using EPA Method 8260D.
- Submit a minimum of one trip blank for soil and one for water (if groundwater is encountered) for analysis of VOCs.
- Drum and label IDW. A qualified contractor will be retained to profile and transport the IDW for disposal at a permitted facility if contaminants greater than the respective MTCA Method A cleanup levels are

detected in the soil and groundwater samples analyzed by the laboratory. We assume IDW will be nonhazardous if the IDW requires off-site disposal.

- Compare soil and groundwater chemical analysis results to MTCA Method A cleanup levels.
- Prepare a site assessment report that provides field and laboratory data, comparison of the analytical results to MTCA and further recommendations. The report will include field procedures, tables, figures and historical information.
- Enter laboratory analytical data results into Ecology's Environmental Information Management (EIM) database.

4.0 SCHEDULE

The initial monitoring well sampling will be conducted in early May 2021 and completed in 1 day. We expect to receive laboratory analytical reports within 2 weeks after submitting the samples to the laboratory. After review of the analytical data, we will meet with Ecology to discuss collection of soil and grab groundwater samples using direct push drilling. Our report will be completed within a month following receipt of analytical data from the direct push borings. Additional soil borings will be conducted following receipt of initial monitoring well laboratory sample data and Ecology approval.

5.0 REFERENCES

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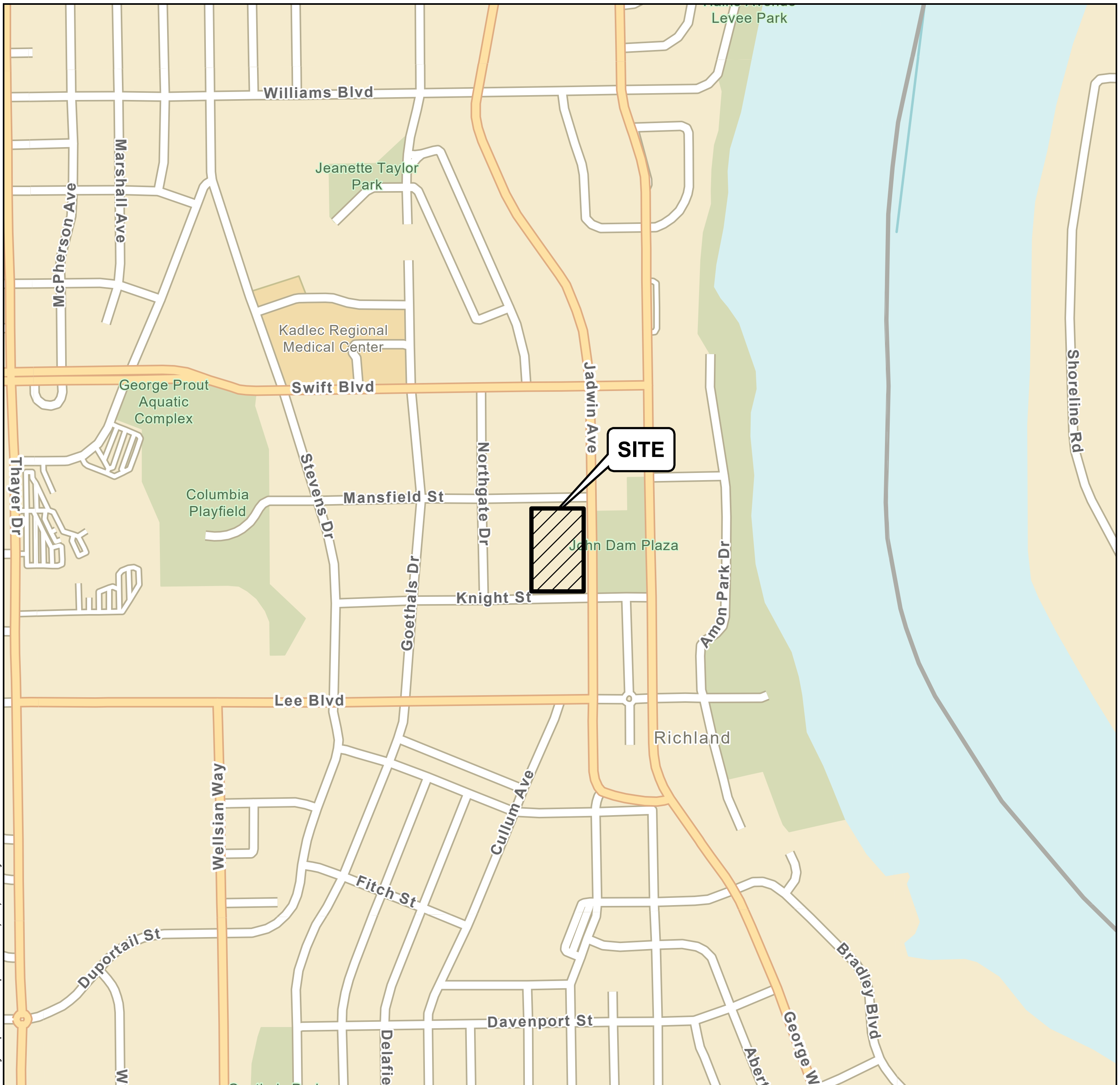
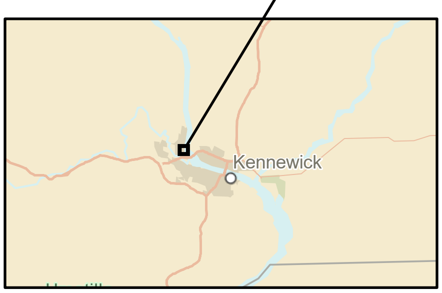
FIGURES





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Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Vicinity Map

US GSA Richland Federal Building
Richland, Washington

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Figure 1

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Legend

- Proposed Boring Location
- Historical Soil Sample Locations (hand augers from 1.8 to 2.7 feet bgs) with Results Less Than MTCA Method A Cleanup Levels. (Shannon & Wilson, 2002)
- Historical Groundwater Samples Indicate One or More Contaminants of Concern Exceed MTCA Method A Cleanup Levels
- Approximate Location of Three Former Solvent USTs
- Federal Building

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Bing Maps Aerial

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Site Plan

US GSA Richland Federal Building
Richland, Washington

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Figure 2

APPENDICES

APPENDIX A
Field Assessment Procedures

APPENDIX A
ASSESSMENT PROCEDURES

STANDARD PROCEDURES

This section contains standard procedures for field data collection that are anticipated during the site assessment at the US GSA Richland Federal Building in Richland, Washington including the following:

- Locate, assess viability and recondition/redevelop site monitoring wells;
- Collecting groundwater samples from site wells;
- Collecting soil samples from direct-push soil borings;
- Groundwater sampling (if encountered);
- Field screening methods;
- Decontamination procedures;
- Handling of investigation-derived waste (IDW);
- Sample location control;
- Field measurement and observation documentation; and
- Sample identification.

Groundwater Sampling

Groundwater will be collected from existing monitoring wells or as a grab, if encountered, in the direct-push soil borings.

Depth to Groundwater

Depth to groundwater measurements from site monitoring wells will be collected and recorded on the field forms. Depth to groundwater relative to the north side of the top of the well casing will be measured to the nearest 0.01 foot using an electronic water-level indicator and recorded in the field notebook. Product thickness (if any) will be measured with an oil-water interface probe and recorded in the field notebook. Groundwater elevation will be calculated by subtracting the depth-to-water measurement from the surveyed casing rim elevation provided in the available site documentation. The electronic water-level indicator will be decontaminated with Liquinox® solution wash and a distilled water rinse prior to use in each well.

Well Sampling

Following depth-to-groundwater measurement, a groundwater sample will be collected from each well consistent with the EPA's low-flow groundwater sampling procedure, as described in EPA (2017) and Puls and Barcelona (1996). Dedicated tubing and a peristaltic pump will be used for groundwater purging and sampling. During purging activities, water quality parameters, including pH, temperature, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP) and turbidity, will be measured using a multi-parameter meter equipped with a flow-through cell. Groundwater samples will be collected after (1) water quality parameters stabilize; or (2) a maximum purge time of 60 minutes is reached. During purging and sampling, drawdown will not be allowed to exceed 0.3 feet, if possible, and the purge rate will not be allowed to exceed 400 milliliters per minute. Water quality parameter stabilization criteria will include the following:

- Turbidity: ±10 percent for values greater than 5 nephelometric turbidity units;
- Conductivity: ±3 percent;
- pH: ±0.1 unit;
- Temperature: ±3 percent; and
- DO: ± 10 percent for values greater than 0.5 milligrams per liter.

Samples will not be collected from the well if it has measurable (>0.1 inches) free product. Field water quality measurements and depth-to-water measurements will be recorded on a Well Purging-Field Water Quality Measurement Form. Groundwater samples will be transferred in the field to laboratory-prepared sample containers and kept cool during transport to the testing laboratory. Chain-of-custody procedures will be observed from the time of sample collection to delivery to the testing laboratory consistent with the Quality Assurance Project Plan (QAPP, Appendix B).

Collecting Soil Samples from Soil Borings

Drilling will be conducted by a State of Washington licensed driller and supervised by a trained GeoEngineers field engineer or geologist. Soil samples will be collected continuously during drilling (direct-push) using 4-foot acrylic slip-sleeve samplers.

Each boring will be monitored by a GeoEngineers field representative to observe and classify the soil encountered and prepare a detailed log of each boring. Soil encountered in the borings will be classified in the field in general accordance with ASTM International (ASTM) D2488-17, the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

Soil samples from each sampling interval will be field screened for the presence of contaminants using the procedures described below to determine which sample will be submitted for chemical analysis. Field screening protocol will be selected, based on anticipated contaminants at the site (i.e., petroleum or metals). Based on field indicators, a minimum of one soil sample from each boring will be submitted for laboratory analysis. Additional samples might be submitted based on field screening results and as approved by the Washington State Department of Ecology (Ecology).

Soil selected for analysis will be removed from the sampler using a new or decontaminated soil knife or new or new nitrile gloves, transferred into a laboratory-prepared container, labeled with a waterproof pen, and placed on “blue ice” or wet ice in a clean plastic-lined cooler. Each sample will be documented on a boring log and chain-of-custody (COC) and will include sample name, sample collection date and time, sample type, sample depth (relative to ground surface), requested analyses and sampler name. Soil samples for volatile organic compound (VOC) analyses (e.g., benzene, toluene, ethylbenzene and xylenes [BTEX]) will be collected consistent with Environmental Protection Agency (EPA) Method 5035A (EPA 2002) and preserved in accordance with Ecology Implementation Memorandum 5 (Ecology 2004) and EPA (1998).

Sampling equipment will be decontaminated between each sampling attempt, as described in the Decontamination Procedures Section. The sample coolers will be delivered to the analytical laboratory under standard COC procedures described in the QAPP (Appendix B).

Groundwater Grab Sampling

If groundwater is encountered in the soil borings, grab samples will be collected and analyzed. Depth to groundwater relative to the top of the drill casing will be measured to the nearest 0.01 foot using an electronic water-level indicator, as with sampling from a monitoring well (see previous Depth to Groundwater Section) and recorded in the field notes. The water level-indicator will be decontaminated with Liquinox® solution wash and a distilled water rinse prior to use in each boring.

Following depth to groundwater measurement, a groundwater sample will be collected from the open boring consistent with the EPA's low-flow groundwater sampling procedure, as described in EPA (2017) and Puls and Barcelona (1996). Dedicated tubing and a peristaltic pump will be used for groundwater purging and sampling. Each boring will be purged for approximately 15 minutes before collecting the sample. During purging activities, water quality parameters, including pH, temperature, conductivity, DO, ORP and turbidity, will be measured using a multi-parameter meter equipped with a flow-through cell.

Samples will not be collected from the boring if it has measurable free product. Field water quality measurements and depth-to-water measurements will be recorded on a Well Purging-Field Water Quality Measurement Form. Groundwater samples will be transferred in the field to laboratory-prepared sample containers and kept cool during transport to the testing laboratory. COC procedures will be observed from the time of sample collection to delivery to the testing laboratory consistent with the QAPP.

Field Screening Methods

Field screening methods will be used to select samples for laboratory chemical analysis.

A GeoEngineers field representative will perform visual and physical field screening tests on soil samples and record the observations on the field boring log and in the field notebook. Field screening results will be used to aid in the selection of soil samples for laboratory chemical analysis. The sample from each boring showing the highest likelihood of petroleum contamination, based on field screening, will be selected for laboratory analysis. The remaining samples might be submitted to the laboratory and held, pending the results of the samples submitted for analysis.

Screening methods will include (1) visual examination; (2) water-sheen screening; and (3) headspace vapor screening using a photo-ionization detector (PID). Visual screening consists of inspecting the soil for discoloration indicative of the presence of petroleum-impacted material in the sample.

Water-sheen screening involves placing soil in water and observing the water surface for signs of sheen. Sheen classifications are as follows:

- **No Sheen (NS)** No visible sheen on the water surface;
- **Slight Sheen (SS)** Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly. Natural organic matter in the soil might produce a slight sheen;
- **Moderate Sheen (MS)** Light to heavy sheen; might have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on water surface; and
- **Heavy Sheen (HS)** Heavy sheen with color/iridescence; spread is rapid; entire water surface might be covered with sheen.

Water sheen testing equipment will be disposable or decontaminated before field screening each sample using a Liquinox® soap solution with a water rinse. Used testing equipment and/or decontamination water will be stored on-site in a labeled Washington State Department of Transportation (WSDOT)-approved drum pending disposal with other IDW.

Headspace vapor screening involves placing a soil sample into a sealed plastic bag and measuring the airspace volatile organic compound (VOC) vapor concentrations in parts per million (ppm) with a PID. Once a soil sample is placed in a sealed plastic bag with air space, the bag is shaken to expose the soil to the air trapped in the bag. The probe of the PID, calibrated to isobutylene following the manufacturer's instructions, is inserted into a small opening in the bag seal and the VOC concentration is measured. The PID typically is designed to quantify VOC vapor concentrations in the range between 1 and 2,000 ppm with an accuracy of ±10 percent of the reading, and between 2,000 and 10,000 ppm with an accuracy of ±20 percent of the reading.

Decontamination Procedures

The objective of the decontamination procedures described herein is to minimize the potential for cross-contamination between sample locations. A designated decontamination area will be established for decontamination of drilling equipment and reusable sampling equipment. Drilling equipment will be cleaned by water jetting using high-pressure/low-volume cleaning equipment.

Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

1. Brush equipment with a nylon brush to remove large particulate matter.
2. Rinse with potable tap water.
3. Wash with non-phosphate detergent solution (Liquinox® and potable tap water).
4. Rinse with potable tap water.
5. Rinse with distilled water.

Handling of IDW

IDW, which consists mainly of drill cuttings and decontamination/purge water, typically will be placed in DOT-approved 55-gallon drums. Each drum will be labeled with the project name, general contents and date. The drummed IDW will be stored on site at a location approved by the site owner pending analysis and disposal.

Disposable items, such as sample tubing, disposable bailers, bailer line, gloves and protective overalls, paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

Sample Location Control

Horizontal sample control will be maintained throughout the project. Horizontal control will be established using measuring tapes or a hand-held global positioning system (GPS) meter accurate to approximately ±15 lateral feet. Boring locations also will be established by measuring their distance relative to permanent site features.

Sample Handling and Custody Requirements

Samples will be handled in accordance with the QAPP (Appendix B). A complete discussion of the sample identification and custody procedures is provided in the QAPP.

Field Measurements and Observations Documentation

Field measurements and observations will be recorded in a project field notebook. Daily logs will be dated, and pages will be consecutively numbered. Entries will be recorded directly and legibly in the daily log and signed and dated by the person conducting the work. If changes are made, the changes will not obscure the previous entry, and the changes will be signed and dated. At a minimum, the following data will be recorded in the log book:

- Purpose and location of investigation;
- Location of activity;
- Site or sampling area sketch showing sample locations and distances to fixed reference points;
- Date and time of sampling;
- Type of sample (matrix);
- Designation as a discrete or composite sample;
- Sample identification number (should match with what is on jar and COC);
- Soil sample top and bottom depth (below ground surface [bgs]);
- Sample preservation (if any);
- Sampling equipment used;
- Field measurements and screening observations (e.g., odor, color, staining, sheens, etc.);
- Field conditions that are pertinent to the integrity of the samples (e.g., weather conditions, performance ;of the sampling equipment, sample depth control, sample disturbance, etc.);
- Relevant comments regarding field activities; and
- Shipping arrangements (including overnight air bill number, if applicable) and receiving laboratory.

Information will be recorded in the log book with enough detail so that field activities can be reconstructed without reliance on personnel memory. In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Team members and their responsibilities;
- Time of arrival/entry on site and time of site departure;
- Other personnel present at the site;
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel;
- Deviations from sampling plans, site safety plans and QAPP procedures;
- Changes in personnel and responsibilities with reasons for the changes;

- Levels of safety protection; and
- Calibration readings for any equipment used and equipment model and serial number.

Sample Identification

Sample identification is important to provide concise data management and to quickly determine sample location and date when comparing multiple samples. Soil samples for each site will adhere to the following general format:

Site Number - Location ID (Depth)

Site numbers are established by Ecology's work assignment number in the format GEIxxx. For example, a soil sample collected at the US GSA Richland Federal Building (work assignment No. GEI035) at boring location B1 at a depth interval of 5 to 6 feet shall be labeled as GEI035-B1(5-6).

Groundwater samples collected from site monitoring wells will have the following general format:

Site Number-Location ID-Date

For example, groundwater sampled from MW-1 at the US GSA Richland Federal Building on May 1, 2021 will be labeled as GEI035-MW-1-050121.

Grab groundwater samples will have the following general format:

Site Number-Location ID-Date

For example, groundwater sampled from boring location B1 at the US GSA Richland Federal Building on May 1, 2021 will be labeled as GEI035-B1-050121.

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APPENDIX B
Quality Assurance Project Plan

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) was developed to guide laboratory analyses for soil and groundwater samples collected as part of the assessment conducted for the Washington State Department of Ecology (Ecology) under Ecology Contract C1900044, individual work assignment GEI035. The QAPP presents the objectives, procedures, organization, functional activities and specific Quality Assurance (QA) and Quality Control (QC) activities designed to achieve data quality goals established for the projects. This QAPP is based on Ecology guidelines (Ecology 2016) and the Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001) and related guidelines (EPA 2002).

Throughout the projects, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness and comparability (PARCC) of data generated meet the specified data quality objectives to the extent possible.

PROJECT ORGANIZATION AND RESPONSIBILITY

Descriptions of the responsibilities, lines of authority and communication for the key positions to QA/QC are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review and permits resolution of QA issues before submittal.

Project Leadership and Management

The Project Manager's (PM) duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. Jedidiah R. Sugalski, Professional Engineer (PE) is the PM for activities at the site. The Principal-in-Charge, Bruce Williams, is responsible to Ecology for fulfilling contractual and administrative control of the project.

Field Coordinator

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff.
- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Supervises the compilation of field data and laboratory analytical results.
- Assures that data are correctly and completely reported.
- Implements and oversees field sampling in accordance with project plans.
- Supervises field personnel.
- Coordinates work with on-site subcontractors.

- Schedules sample shipment, if necessary, with the analytical laboratory.
- Monitors that appropriate sampling, testing and measurement procedures are followed.
- Coordinates the transfer of field data, sample tracking forms, and log books to the PM for data reduction and validation.
- Participates in QA corrective actions, as required.

The Field Coordinator for each work assignment will be drawn from our pool of experienced staff, since fieldwork will be conducted concurrently at multiple sites. Staff that will serve as Field Coordinator could include Joshua Lee, Bryce Hanson or Justin Orr.

QA Leader

The GeoEngineers QA Leader is under the direction of Jedidiah Sugalski and Bruce Williams, who are responsible for the project's overall QA. The QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. Denell Warren is the QA Leader. The QA Leader has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues, and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions, as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing and analysis procedures are followed and that correct QC checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

Laboratory Management

The Ecology-accredited subcontracted laboratory (Eurofins TestAmerica Laboratories [Eurofins TA] of Spokane Valley, Washington) conducting sample analyses for this project is required to obtain approval from the QA Leader before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator (Randee Arrington) administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensures implementation of the QA Plan.
- Serves as the laboratory point of contact.
- Activates corrective action for out-of-control events.
- Issues the final laboratory QA/QC report.
- Administers QA sample analysis.

- Complies with the specifications established in the project plans as related to laboratory services.
- Participates in QA audits and compliance inspections.

DATA QUALITY OBJECTIVES

The QA objective for technical data is to collect environmental monitoring data of known, acceptable and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for PARCC, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQO) associated with these data quality factors are summarized in Tables B-1 (soil) and B-2 (groundwater) and are discussed below.

Analytes and Matrices of Concern

Samples of soil and/or groundwater will be collected from up to 10 direct-push explorations during the assessment. Tables B-3 (soil) and B-4 (groundwater) summarize the analyses to be performed at the site for soil and groundwater, respectively.

Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, QA dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL). The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. The PQL for contaminants of potential concern (COPCs) at the site is presented in Tables B-1 and B-2 for soil and groundwater, respectively. These reporting limits were obtained from TestAmerica, the Ecology-accredited lab that will be analyzing the samples. Other criteria include State of Washington (WAC 173-201) water quality criteria and federal ambient water quality criteria (AWQC). The analytical methods and processes selected will provide PQLs less than the TRLs under ideal conditions. However, the reporting limits in Tables B-1 through B-2 are considered targets because several factors may influence final detection limits. First, moisture and other physical conditions of soil affect detection limits. Second, analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value much higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions.

Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for water samples. This value is calculated by:

$$RPD\,(\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \; X\ 100,$$

Where

D_1	=	Concentration of analyte in sample.
D_2	=	Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates) and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D) between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (EPA 2017a,b) that address criteria exceedances and courses of action. Relative percent difference goals for this effort are 30 percent in groundwater and 40 percent in soil for all analyses, unless the duplicate sample values are within 5 times the reporting limit. In this case, the absolute difference is used instead of the RPD. The absolute difference control limit is equal to the lowest reporting limit of the two samples for water and two times the lowest reporting limit of the two samples for soil.

Accuracy

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact, these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as "system monitoring compound"), a matrix spike (MS) result, or from a standard reference material where:

$$Recovery\,(\%) = \frac{Sample\ Result}{Spike\ Amount}\ X\ 100$$

Persons performing the evaluation must review one or more pertinent documents (EPA 2017a,b) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, MS and laboratory control spikes (LCS) are found in Tables B-1 and B-2 of this QAPP.

Representativeness, Completeness and Comparability

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within the Work Plan and this QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Invalidating non-representative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved, an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents have volatilized from the sample or degraded. Results for that analysis will be qualified as estimated to indicate that the reported results may be lower than actual site conditions. Holding times are presented in Tables B-3 and B-4.

Blanks

According to the *National Functional Guidelines for Organic Data Review* (EPA 2017b), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment.

SAMPLE COLLECTION, HANDLING AND CUSTODY

Sampling procedures are provided in Section 3 and Appendix A of this Work Plan.

Sampling Equipment Decontamination

Sampling equipment decontamination procedures are described in Appendix A of the Work Plan.

Sample Containers and Labeling

The Field Coordinator will establish field protocol to manage field sample collection, handling and documentation. Soil and groundwater samples obtained during this study will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Tables B-3 and B-4.

Sample containers will be labeled with the following information at the time of collection:

- Project name and number;
- Sample name, which will include a reference to depth if appropriate; and
- Date and time of collection.

The sample collection activities will be noted in the field log books. The Field Coordinator will monitor consistency between the Work Plan, sample containers/labels, field log books and the chain-of-custody (COC).

Sample Storage

Samples will be placed in a cooler with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Holding times will be observed during sample storage. Holding times for the project analyses are summarized in Tables B-3 and B-4.

Sample Shipment

The samples will be transported and delivered to the analytical laboratory in the coolers. Field personnel will transport and hand-deliver samples that are being submitted to a local laboratory for analysis. Samples that are being submitted from a remote location for analysis will be transported by a commercial express mailing service on an overnight basis or returning field personnel. The Field Coordinator will monitor that the shipping container (cooler) has been properly secured using clear packing tape and custody seals.

Measures will be implemented to minimize the potential for sample breakage, which includes packaging materials and placing sample bottles in the cooler in a manner intended to minimize damage. Sample bottles will be wrapped with bubble wrap or other protective material before being place in coolers. Trip blanks will be included in coolers with groundwater samples.

Chain-of-Custody Records

Field personnel are responsible for the security of samples from the time the samples are taken until the samples have been received by the shipper or laboratory. A COC form will be completed at the end of each field day for samples being shipped to the laboratory. Information to be included on the COC form includes:

- Project name and number.
- Sample identification number.
- Date and time of sampling.
- Sample matrix (soil, water, etc.) and number of containers from each sampling point, including preservatives used.
- Depth of subsurface soil sample.
- Analyses to be performed.
- Names of sampling personnel and transfer of custody acknowledgment spaces.
- Shipping information including shipping container number.

The original COC record will be signed by a member of the field team and bear a unique tracking number. Field personnel shall retain carbon copies and place the original and remaining copies in a sealed plastic bag, placed within the cooler or taped to the inside lid of the cooler before sealing the container for shipment. This record will accompany the samples during transit by carrier to the laboratory.

Laboratory Custody Procedures

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include at a minimum, the analyst's name or initial, time and date.

CALIBRATION PROCEDURES

Field Instrumentation

Equipment and instrumentation calibration facilitate accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on the type of equipment, stability characteristics, required accuracy, intended use and environmental conditions. The basic calibration frequencies are described below.

The photoionization detector (PID) used for vapor measurements will be calibrated daily, if required (based on the model used), for site safety monitoring purposes in general accordance with the manufacturer's specifications. If daily calibration is not required for a specific PID model, calibration of the PID will be checked to make sure it is up to date. The calibration results will be recorded in the field log book.

Laboratory Instrumentation

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory SOPs. Calibration documentation will be retained at the laboratory and readily available for a period of 6 months.

DATA REPORTING AND LABORATORY DELIVERABLES

Laboratories will report data in formatted hardcopy and digital form. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the laboratory identification, reporting units, qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates, and detection limit (PQL only). Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverable (EDD) formats will be established by GeoEngineers, Inc., with the contract laboratory. Final results will be sent to the PM.

Chromatograms will be provided for samples analyzed by Northwest Methods NWTPH-Gx. The laboratory will assure the full heights of all peaks appear on the chromatograms and the same horizontal time scale is used to allow for comparisons to other chromatograms.

INTERNAL QC

Table B-5 summarizes the types and frequency of QC samples to be collected during the site characterization, including both field QC and laboratory QC samples.

Field QC

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the influence of off-site factors on environmental samples. Off-site factors include airborne volatile organic compounds (VOCs) and potable water used in drilling activities.

Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Under ideal field conditions, field duplicates (referred to as splits), are created when a volume of the sample matrix is thoroughly mixed, placed in separate containers and identified as different samples. Analysis of duplicates test both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

One field duplicate will be collected during each groundwater sampling event, including groundwater samples collected from direct-push borings. The duplicate sample will be analyzed for the COPCs specified for the given well.

Trip Blanks

Trip blanks will accompany soil and groundwater sample containers submitted for VOC analyses during shipment and sampling periods. Trip blanks will be analyzed on a one per cooler basis.

Laboratory QC

Laboratory QC procedures will be evaluated through a formal data validation process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include:

- Method blanks
- Internal standards
- Calibrations
- MS/matrix spike duplicates (MSD)
- LCS/laboratory control spike duplicates (LCSD)
- Laboratory replicates or duplicates
- Surrogate spikes

Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process or high-performance liquid-chromatography (HPLC) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank, then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, ". . . there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is 'in control' by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations and continuing calibration verification.

MS/MSD

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH affects the results of semivolatile organic compounds (SVOCs). Or, the presence of a compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A MS is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a boring or sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

LCS/LCSD

Also known as blanks spikes, LCSs are similar to MSs in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are calculated. The primary difference between a MS and LCS is that the LCS media is considered “clean” or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs and/or replicates to assess precision. Replicates are a second analysis of a field-collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

DATA REDUCTION AND ASSESSMENT PROCEDURES

Data Reduction

Data reduction involves the conversion or transcription of field and analytical data to a useable format. The laboratory personnel will reduce the analytical data for review by the QA Leader and PM.

Field Measurement Evaluation

Field data will be reviewed at the end of each day by following the QC checks outlined below and procedures in the Work Plan. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation and volume.
- Field QC samples collected at the frequency specified.
- Sample documentation and COC protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

Field QC Evaluation

A field QC evaluation will be conducted by reviewing field log books and daily reports, discussing field activities with staff and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

Precision for field duplicate soil will not be evaluated because even a well-mixed sample is not entirely homogenous due to sampling procedures, soil conditions and contaminant transport mechanisms. Grab groundwater duplicate samples are also highly variable because of sampling procedures and borehole conditions and are therefore not reliable measures of precision.

Laboratory Data QC Evaluation

The laboratory data assessment will consist of a formal review of the following QC parameters:

- Holding times
- Method blanks
- MS/MSD
- LCS/LCSD
- Surrogate spikes
- Replicates

In addition to these QC mechanisms, other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC.

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U.S. Environmental Protection Agency). 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA/240/B-01/003. Office of Environmental Information, Washington, D.C. March 2001.

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Table B-1

Soil Measurement Quality Objective and Target Reporting Limits

US GSA Richland Federal Building

Richland, Washington

				LCS/LCSD			MS/MSD				
Analyte	**Method**	**MDL (mg/kg)**	**PQL (mg/kg)**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**	**MTCA Method A Cleanup Level (mg/kg)**	**MTCA Method B (Cancer) Cleanup Level (mg/kg)**
VOCs											
1,1,1,2-Tetrachloroethane	EPA 8260D	0.0192	0.100	80	128	25	80	128	25	--	18
1,1,1-Trichloroethane	EPA 8260D	0.0173	0.100	80	130	19	80	130	19	2	2
1,1,2,2-Tetrachloroethane	EPA 8260D	0.0291	0.100	75	128	22	75	128	22	--	5
1,1,2-Trichloroethane	EPA 8260D	0.0353	0.100	80	125	31	80	125	31	--	18
1,1-Dichloroethane	EPA 8260D	0.0264	0.100	80	129	25	80	129	25	--	180
1,1-Dichloroethene	EPA 8260D	0.0341	0.100	73	135	18	73	135	18	--	--
1,1-Dichloropropene	EPA 8260D	0.0174	0.100	78	132	24	78	132	24	--	--
1,2,3-Trichlorobenzene	EPA 8260D	0.0334	0.100	66	130	25	66	130	25	--	0.011
1,2,3-Trichloropropane	EPA 8260D	0.0366	0.200	67	131	27	67	131	27	--	0.0063
1,2,4-Trichlorobenzene	EPA 8260D	0.0185	0.100	79	126	25	79	126	25	--	34
1,2,4-Trimethylbenzene	EPA 8260D	0.0234	0.100	76	132	21	76	132	21	--	0.072
1,2-Dibromo-3-Chloropropane	EPA 8260D	0.0600	0.500	49	139	40	49	139	40	--	1.3
1,2-Dibromoethane (EDB)	EPA 8260D	0.0335	0.100	80	121	18	80	121	18	0.005	0.5
1,2-Dichlorobenzene	EPA 8260D	0.0233	0.100	80	124	25	80	124	25	--	0.4
1,2-Dichloroethane (EDC)	EPA 8260D	0.0154	0.100	80	129	25	80	129	25	--	11
1,2-Dichloropropane	EPA 8260D	0.0303	0.120	75	121	20	75	121	20	--	27
1,3,5-Trimethylbenzene	EPA 8260D	0.0320	0.100	76	133	20	76	133	20	--	0.071
1,3-Dichlorobenzene	EPA 8260D	0.0126	0.100	80	123	18	80	123	18	--	--
1,3-Dichloropropane	EPA 8260D	0.0297	0.100	76	125	16	76	125	16	--	0.057
1,4-Dichlorobenzene	EPA 8260D	0.0206	0.100	80	125	16	80	125	16	--	190
2,2-Dichloropropane	EPA 8260D	0.0243	0.100	80	138	22	80	138	22	--	--
2-Chlorotoluene	EPA 8260D	0.0163	0.100	77	135	20	77	135	20	--	--
4-Chlorotoluene	EPA 8260D	0.00870	0.100	77	133	25	77	133	25	--	--
Benzene	EPA 8260D	0.0100	0.0200	76	129	25	76	129	25	0.03	18
Bromobenzene	EPA 8260D	0.0223	0.100	75	129	25	75	129	25	--	0.033
Bromochloromethane	EPA 8260D	0.0399	0.100	75	135	25	75	135	25	--	--
Bromodichloromethane	EPA 8260D	0.0621	0.100	80	128	26	80	128	26	--	16
Bromoform	EPA 8260D	0.0191	0.200	72	133	34	72	133	34	--	130
Bromomethane	EPA 8260D	0.0331	0.500	56	138	21	56	138	21	--	0.0033
Carbon tetrachloride	EPA 8260D	0.0110	0.100	72	138	25	72	138	25	--	14
Chlorobenzene	EPA 8260D	0.0207	0.100	80	129	25	80	129	25	--	0.051

Analyte	Method	MDL (mg/kg)	PQL (mg/kg)	LCS/LCSD Lower	LCS/LCSD Upper	LCS/LCSD RPD	MS/MSD Lower	MS/MSD Upper	MS/MSD RPD	MTCA Method A Cleanup Level (mg/kg)	MTCA Method B (Cancer) Cleanup Level (mg/kg)
Chloroethane	EPA 8260D	0.0564	0.200	50	142	25	50	142	25	--	--
Chloroform	EPA 8260D	0.0235	0.100	80	130	25	80	130	25	--	32
Chloromethane	EPA 8260D	0.0417	0.500	63	120	22	63	120	22	--	--
cis-1,2-Dichloroethene	EPA 8260D	0.0208	0.100	80	124	23	80	124	23	--	0.0052
cis-1,3-Dichloropropene	EPA 8260D	0.0204	0.100	80	126	24	80	126	24	--	10
Dibromochloromethane	EPA 8260D	0.0162	0.200	78	127	25	78	127	25	--	12
Dibromomethane	EPA 8260D	0.0223	0.100	80	123	24	80	123	24	--	--
Dichlorodifluoromethane	EPA 8260D	0.0281	0.100	34	120	24	34	120	24	--	0.53
Ethylbenzene	EPA 8260D	0.0162	0.100	77	126	25	77	126	25	6	0.34
Hexachlorobutadiene	EPA 8260D	0.0164	0.100	80	136	25	80	136	25	--	13
Isopropylbenzene	EPA 8260D	0.0309	0.100	78	139	24	78	139	24	--	--
m,p-Xylene	EPA 8260D	0.0287	0.400	78	130	23	78	130	23	--	0.77; 0.96
Methyl tert-butyl ether (MTBE)	EPA 8260D	0.0300	0.0500	80	123	25	80	123	25	0.1	560
Methylene Chloride	EPA 8260D	0.200	0.350	30	150	40	30	150	40	0.02	94
Naphthalene	EPA 8260D	0.0280	0.200	53	144	36	53	144	36	5	0.24
n-Butylbenzene	EPA 8260D	0.0275	0.100	80	131	20	80	131	20	--	--
N-Propylbenzene	EPA 8260D	0.0264	0.100	77	131	25	77	131	25	--	0.88
o-Xylene	EPA 8260D	0.0230	0.200	77	129	25	77	129	25	--	0.84
p-Isopropyltoluene	EPA 8260D	0.0204	0.100	80	130	26	80	130	26	--	--
sec-Butylbenzene	EPA 8260D	0.0186	0.100	76	130	34	76	130	34	--	--
Styrene	EPA 8260D	0.0236	0.100	80	128	25	80	128	25		5
tert-Butylbenzene	EPA 8260D	0.0195	0.100	76	130	16	76	130	16	--	--
Tetrachloroethene (PCE)	EPA 8260D	0.0176	0.0400	77	134	24	77	134	24	0.05	480
Toluene	EPA 8260D	0.0133	0.100	77	131	25	77	131	25	7	0.27
trans-1,2-Dichloroethene	EPA 8260D	0.0229	0.100	80	126	25	80	126	25	--	--
trans-1,3-Dichloropropene	EPA 8260D	0.0263	0.100	80	124	28	80	124	28	--	--
Trichloroethene (TCE)	EPA 8260D	0.00760	0.0250	79	133	25	79	133	25	0.03	12
Trichlorofluoromethane	EPA 8260D	0.0328	0.200	64	143	25	64	143	25	--	0.79
Vinyl chloride	EPA 8260D	0.0202	0.0600	66	129	20	66	129	20	--	0.67
Xylenes (total)	EPA 8260D	Derived as sum of m, o, and p isomers								9	0.83

Notes:

Practical quantitation limits (PQLs) based on information provided by Eurofins TestAmerica Laboratories.

mg/kg = milligrams per kilogram; -- = Not established;

MDL = method detection limit; LCS = laboratory control spike; LCSD = laboratory control spike duplicate; MS = matrix spike; MSD = matrix spike duplicate; RPD = relative percent difference;

EPA = Environmental Protection Agency; VOCs = volatile organic compounds

(shaded) Indicates the analyte does not have a MTCA Method B (Cancer) value; Value shown is for soil protective of groundwater saturated (MTCA EQ. 747-1, CLARC Master Table Fe

Table B-2

Groundwater Measurement Quality Objective and Target Reporting Limits

US GSA Richland Federal Building

Richland, Washington

				LCS/LCSD			MS/MSD			DUP	MTCA Method A Cleanup Level (µg/L)	MTCA Method B (Cancer) Cleanup Level (µg/L)	Washington State MCL (µg/L)
Analyte	Method	MDL (µg/L)	PQL (µg/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD			
VOCs													
1,1,1,2-Tetrachloroethane	EPA 8260D	0.480	1.00	75	125	23	75	125	23	--	--	1.7	--
1,1,1-Trichloroethane	EPA 8260D	0.165	1.00	80	130	18	80	130	18	--	--	--	200
1,1,2,2-Tetrachloroethane	EPA 8260D	0.319	2.00	60	140	21	60	140	21	--	--	0.22	--
1,1,2-Trichloroethane	EPA 8260D	0.431	2.00	80	126	16	80	126	16	--	--	0.77	5
1,1-Dichloroethane	EPA 8260D	0.291	1.00	79	121	16	79	121	16	--	--	7.7	--
1,1-Dichloroethene	EPA 8260D	0.202	1.00	75	140	24	75	140	24	--	--	--	--
1,1-Dichloropropene	EPA 8260D	0.500	1.00	76	125	24	76	125	24	--	--	--	--
1,2,3-Trichlorobenzene	EPA 8260D	0.327	1.00	53	135	35	53	135	35	--	--	6.4	--
1,2,3-Trichloropropane	EPA 8260D	0.501	2.00	53	143	32	53	143	32	--	--	0.00038	--
1,2,4-Trichlorobenzene	EPA 8260D	0.160	1.00	62	136	26	62	136	26	--	--	1.5	--
1,2,4-Trimethylbenzene	EPA 8260D	0.306	1.00	69	133	17	69	133	17	--	--	80	--
1,2-Dibromo-3-Chloropropane	EPA 8260D	1.53	10.0	47	136	34	47	136	34	--	--	0.055	--
1,2-Dibromoethane (EDB)	EPA 8260D	0.200	1.00	74	120	17	74	120	17	--	0.01	0.022	--
1,2-Dichlorobenzene	EPA 8260D	0.233	1.00	73	127	16	73	127	16	--	--	600	600
1,2-Dichloroethane (EDC)	EPA 8260D	0.310	1.00	76	127	16	76	127	16	--	5	0.48	--
1,2-Dichloropropane	EPA 8260D	0.231	1.00	80	121	18	80	121	18	--	--	1.2	5
1,3,5-Trimethylbenzene	EPA 8260D	0.316	1.00	69	134	17	69	134	17	--	--	80	--
1,3-Dichlorobenzene	EPA 8260D	0.143	1.00	74	128	17	74	128	17	--	--	--	--
1,3-Dichloropropane	EPA 8260D	0.213	2.00	73	126	23	73	126	23	--	--	160	--
1,4-Dichlorobenzene	EPA 8260D	0.282	1.00	74	121	18	74	121	18	--	--	8.1	75
2,2-Dichloropropane	EPA 8260D	0.656	2.00	69	143	25	69	143	25	--	--	--	--
2-Chlorotoluene	EPA 8260D	0.363	1.00	63	131	25	63	131	25	--	--	--	--
4-Chlorotoluene	EPA 8260D	0.256	1.00	70	132	18	70	132	18	--	--	--	--
Benzene	EPA 8260D	0.0930	0.400	80	126	18	80	126	18	--	5	0.8	5
Bromobenzene	EPA 8260D	0.279	1.00	68	128	18	68	128	18	--	--	64	--
Bromochloromethane	EPA 8260D	0.442	2.00	70	133	25	70	133	25	--	--	--	--

Analyte	Method	MDL (µg/L)	PQL (µg/L)	LCS/LCSD Lower	LCS/LCSD Upper	LCS/LCSD RPD	MS/MSD Lower	MS/MSD Upper	MS/MSD RPD	DUP RPD	MTCA Method A Cleanup Level (µg/L)	MTCA Method B (Cancer) Cleanup Level (µg/L)	Washington State MCL (µg/L)
Bromodichloromethane	EPA 8260D	0.289	1.00	73	135	19	73	135	19	--	--	0.71	80
Bromoform	EPA 8260D	0.664	5.00	65	134	20	65	134	20	--	--	5.5	80
Bromomethane	EPA 8260D	0.757	5.00	64	133	25	64	133	25	--	--	11.2	--
Carbon tetrachloride	EPA 8260D	0.397	1.00	75	126	17	75	126	17	--	--	0.63	5
Chlorobenzene	EPA 8260D	0.321	1.00	79	125	17	79	125	17	--	--	--	100
Chloroethane	EPA 8260D	0.404	2.00	69	129	25	69	129	25	--	--	--	--
Chloroform	EPA 8260D	0.242	1.00	80	126	18	80	126	18	--	--	1.4	80
Chloromethane	EPA 8260D	0.501	3.00	55	144	21	55	144	21	--	--	--	--
cis-1,2-Dichloroethene	EPA 8260D	0.227	1.00	80	121	18	80	121	18	--	--	--	7
cis-1,3-Dichloropropene	EPA 8260D	0.248	1.00	72	129	20	72	129	20	--	--	0.44	--
Dibromochloromethane	EPA 8260D	0.327	2.00	72	122	19	72	122	19	--	--	0.52	80
Dibromomethane	EPA 8260D	0.500	2.00	70	126	21	70	126	21	--	--	--	--
Dichlorodifluoromethane	EPA 8260D	0.636	2.00	48	142	25	48	142	25	--	--	1,600	--
Ethylbenzene	EPA 8260D	0.198	1.00	80	128	18	80	128	18	--	700	--	700
Hexachlorobutadiene	EPA 8260D	0.207	2.00	71	128	22	71	128	22	--	--	0.56	--
Isopropylbenzene	EPA 8260D	0.240	1.00	77	123	17	77	123	17	--	--	--	--
m,p-Xylene	EPA 8260D	0.280	2.00	80	127	18	80	127	18	--	--	1,600	--
Methyl tert-butyl ether (MTBE)	EPA 8260D	0.160	1.00	77	128	20	77	128	20	--	--	24	
Methylene Chloride	EPA 8260D	2.23	5.00	20	150	32	20	150	32	--	5	5.8	5
Naphthalene	EPA 8260D	0.632	2.00	50	142	32	50	142	32	--	160	160	--
n-Butylbenzene	EPA 8260D	0.203	1.00	71	127	19	71	127	19	--	--	--	--
N-Propylbenzene	EPA 8260D	0.250	1.00	67	138	18	67	138	18	--	--	800	--
o-Xylene	EPA 8260D	0.162	1.00	80	126	17	80	126	17	--	--	1,600	--
p-Isopropyltoluene	EPA 8260D	0.268	1.00	72	127	18	72	127	18	--	--	--	--
sec-Butylbenzene	EPA 8260D	0.223	1.00	67	131	19	67	131	19	--	--	--	--
Styrene	EPA 8260D	0.238	1.00	67	136	17	67	136	17	--	--	100	100
tert-Butylbenzene	EPA 8260D	0.120	1.00	68	132	19	68	132	19	--	--	--	--
Tetrachloroethene (PCE)	EPA 8260D	0.217	1.00	77	132	22	77	132	22	--	--	21	5
Toluene	EPA 8260D	0.312	1.00	80	129	18	80	129	18	--	--	1,000	1,000
trans-1,2-Dichloroethene	EPA 8260D	0.201	1.00	75	132	17	75	132	17	--	--	--	--
trans-1,3-Dichloropropene	EPA 8260D	0.453	1.00	49	148	35	49	148	35	--	--	--	--
Trichloroethene (TCE)	EPA 8260D	0.199	1.00	75	129	17	75	129	17	--	--	0.54	5

Analyte	Method	MDL (µg/L)	PQL (µg/L)	LCS/LCSD Lower	LCS/LCSD Upper	LCS/LCSD RPD	MS/MSD Lower	MS/MSD Upper	MS/MSD RPD	DUP RPD	MTCA Method A Cleanup Level (µg/L)	MTCA Method B (Cancer) Cleanup Level (µg/L)	Washington State MCL (µg/L)
Trichlorofluoromethane	EPA 8260D	0.200	1.00	78	132	19	78	132	19	--	--	2,400	--
Vinyl chloride	EPA 8260D	0.130	0.400	68	136	25	68	136	25	--	0.2	0.029	2
Xylenes (total)	EPA 8260D	Derived as sum of m, o and p isomers									1,000	--	10,000

Notes:

Practical quantitation limits (PQLs) based on information provided by Eurofins TestAmerica Laboratories.

µg/L = micrograms per liter; -- = Not established; DUP = duplicate; MCL = maximum contaminant level

MDL = method detection limit; LCS = laboratory control spike; LCSD = laboratory control spike duplicate; MS = matrix spike; MSD = matrix spike duplicate; RPD = relative percent difference;

EPA = Environmental Protection Agency; VOCs = volatile organic compounds; MCL = Maximum Contaminant Level

Indicates the analyte does not have a MTCA Method B (Cancer) value; Target Cleanup Level for Soil to Groundwater Pathway (CLARC Master Table February 2021)

Washington State MCL based on Washington Administrative Code (WAC) 246-290

Table B-3

Soil Test Methods, Sample Containers, Preservation and Holding Time[1]

US GSA Richland Federal Building

Richland, Washington

Analysis	Matrix	Method	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
VOCs	Soil	EPA 8260D	30 g	2 pre-weighed 40 mL VOA vials preserved with MeOH; 4 oz jar (for dry-weight correction)	MeOH; <Cool 6°C	14 days from collection to analysis

Notes:

[1]Holding times are based on elapsed time from date of collection.

VOCs = volatile organic compounds; MeOH = Methanol; VOA = volatile organic analysis

g = gram; mL = milliliters; C = Celsius

EPA = United States Environmental Protection Agency

Table B-4

Water Test Methods, Sample Containers, Preservation and Holding Time[1]

US GSA Richland Federal Building

Richland, Washington

Analysis	Matrix	Method	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
VOCs	Water	EPA 8260D	120ml	3 - 40 mL VOA	HCL pH<2, Cool <6°C	14 days from collection to analysis

Notes:

[1]Holding times are based on elapsed time from date of collection.

VOC = volatile organic compound; VOA = volatile organic analysis; HCl = hydrochloric acid;

g = gram; mL = milliliters; C = Celsius

EPA = United States Environmental Protection Agency

Table B-5

Quality Control Samples Type and Frequency

US GSA Richland Federal Building

Richland, Washington

Parameter	Field QC		Laboratory QC			
	Field Duplicate	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
VOCs	1 per groundwater event	1 per soil event and 1 per water event	1/batch	1/batch	1/batch	1/batch

Notes:

No more than 20 field samples can be contained in one batch.

QC = Quality Control; VOCs = volatile organic compounds;

LCS = Laboratory control sample; MS = Matrix spike sample; MSD = Matrix spike duplicate sample

APPENDIX C
Health and Safety Plan

APPENDIX C
SITE HEALTH AND SAFETY PLAN
US GSA RICHLAND FEDERAL BUILDING
CENTRAL REGION
MASTER CONTRACT C1900044. GEI035

GENERAL PROJECT INFORMATION

This Health and Safety Plan (HASP) is to be used in conjunction with the GeoEngineers Safety Program Manual. Together, the written safety programs and this HASP constitute the site safety plan for this site. This plan is to be used by GeoEngineers personnel on this site and must be available on site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included, and the plan will be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

TABLE C-1. PROJECT INFORMATION

Project Name:	**US GSA Richland Federal Building, Richland, Washington**
Project Number:	0504-175-00
Type of Project:	Direct-Push Site Assessment
Project Address:	825 Jadwin Avenue, Richland, Washington
Start/Completion:	April 2021/December 2021
Subcontractors:	Cascade Drilling – direct-push drilling Eurofins TestAmerica, Inc. – laboratory analyses TBD – IDW disposal Utilities Plus, Inc. – private utility locating

Liability Clause - This Site Safety Plan is intended for use by GeoEngineers Employees only. It does not extend to the other contractors or subcontractors working on this site. If requested by subcontractors, this site safety plan may be used as a minimum guideline for those entities to develop safety plans or procedures for their own staff to work under. In this case, Form 3 shall be signed by the subcontractor.

All personnel participating in this project must receive initial health and safety orientation (Form 1). Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety and Health Supervisor.

The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

TABLE C-2. ORGANIZATION CHART

Chain of Command	Title	Name	Telephone Numbers
1	Principal-in-Charge	Bruce Williams	O: 509.363.2814 C: 509.954.6614
2	Project Manager	Jedidiah R. Sugalski	O: 509.209.2830 C: 509.991.4471
3	Site Safety and Health Officer (SSO); will vary by site	Bryce Hanson	O: 509.209.2818 C: 360.269.3237
		Joshua Lee	O: 509.209.2832 C: 406.239.7810
		Justin Orr	O: 509.209.3125 C: 406.890.1310
4	Health and Safety Program Manager (HSM)	Mary Lou Sullivan	O: 253.722.2425 C: 360.633.9821
5	Field Engineer/Geologist; will vary by site	Bryce Hanson/Joshua Lee/ /Justin Orr	See SSO contact info above
6	Subcontractor(s)	Cascade Drilling Utilities Plus, LLC (utility locate) Eurofins TestAmerica (chemical analysis) TBD (IDW)	O: 509.534.2740 O: 509.945.9840 O: 509.924.9200 TBD
7	Current Owner (c/o Ecology Project Manager)	Jill Scheffer	O: 509.454.7834 C: 509.571-4162

Functional Responsibility

Project Manager (PM), Jedidiah R. Sugalski

A PM is assigned to manage the activities of various projects and is responsible to the principal-in-charge of the project. The PM is responsible for assessing the hazards present at a job site and incorporating the appropriate safety measures for field staff protection into the field briefing and/or Site Safety Plan. He or she is also responsible for assuring that appropriate HASPs complying with this manual are developed. The PM will provide a summary of chemical analysis to personnel completing the HASP. PMs shall also see that their project budgets consider health and safety costs. The PM shall keep the HSM informed of the project's health- and safety-related matters as necessary. The PM shall designate the project Site Safety Officer (SSO) and help the SSO implement the specifications of the HASP. The PM is responsible for communicating information in site safety plans and checklists to appropriate field personnel. Additionally, the PM and SSO shall hold a site safety briefing before any field activities begin. The PM is responsible for transmitting health and safety information to the Site Safety Officer (SSO) when appropriate.

Site Safety and Health Supervisor

The SSO will have the on-site responsibility and authority to modify and stop work, or remove personnel from the site if working conditions change that may affect on-site and off-site health and safety. The SSO will be the main contact for any on-site emergency situation. The SSO is First Aid and CPR qualified and has current Hazardous Waste Operations and Emergency Response (HAZWOPER) training. The SSO is responsible for implementing and enforcing the project safety program and safe work practices during site activities. The SSO shall conduct daily safety meetings, perform air monitoring as required, conduct site safety inspections as required, coordinate emergency medical care and ensure personnel are wearing the appropriate personal protective equipment (PPE). The SSO shall have advanced fieldwork experience and shall be familiar with health and safety requirements specific to the project. The SSO has the authority to suspend site activities if unsafe conditions are reported or observed.

Duties of the SSO include the following:

- Implementing the HASP in the field and monitoring compliance with its guidelines by staff.
- Being sure that all GeoEngineers field personnel have met the training and medical examination requirements. Advising other contractor employees of these requirements.
- Maintaining adequate and functioning safety supplies and equipment at the site.
- Setting up work zones, markers, signs and security systems, if necessary.
- Performing or supervising air quality measurements. Communicating information on these measurements to GeoEngineers field staff and subcontractor personnel.
- Communicating health and safety requirements and site hazards to field personnel, subcontractors and contractor employees, and site visitors.
- Directing personnel to wear PPE and guiding compliance with all health and safety practices in the field.
- Consulting with the PM regarding new or unanticipated site conditions, including emergency response activities. If monitoring detects concentrations of potentially hazardous substances at or above the established exposure limits, notify/consult with the PM. Consult with the PM and the HSM regarding new or unanticipated site conditions, including emergency response activities. If field monitoring indicates concentrations of potentially hazardous substances at or above the established exposure limits, the HSM must be notified and corrective action taken.
- Documenting all site accidents, illnesses and unsafe activities or conditions, and reporting them to the PM and the HSM.
- Directing decontamination operations of equipment and personnel.

Field Employees

All employees working on site that have the potential of coming in contact with hazardous substances or physical hazards are responsible for participating in the health and safety program and complying with the site-specific health and safety plans. These employees are required to:

- Participate and be familiar with the health and safety program as described in this manual.
- Notify the SSO that when there is need to stop work to address an unsafe situation.
- Comply with the HASP and acknowledge understanding of the plan.
- Report to the SSO, PM or HSM any unsafe conditions and all facts pertaining to incidents or accidents that could result in physical injury or exposure to hazardous materials.

- Participate in health and safety training, including initial 40-hour Occupational Safety and Health Administration (OSHA) course, annual 8-hour HAZWOPER refresher and First Aid/cardiopulmonary resuscitation (CPR) training.
- Participate in the medical surveillance program if applicable.
- Schedule and take a respirator fit test annually.
- Any field employee working on site may stop work if the employee believes the work is unsafe.

Contractors under GeoEngineers Supervision

Contractors working on the site under GeoEngineers supervision or direct control that have the potential of coming in contact with hazardous substances or physical hazards shall have their own health and safety program that is in line with the site-specific health and safety plan.

Health and Safety Manager, Mary Lou Sullivan

GeoEngineers' Health and Safety Program Manager (HSM) is responsible for implementing and promoting employee participation in the program. The HSM issues directives, advisories and information regarding health and safety to the technical staff. Additionally, the HSM has the authority to audit on-site compliance with HASPs, suspend work or modify work practices for safety reasons, and dismiss from the site any GeoEngineers or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others.

TABLE C-3. PERSONNEL TRAINING RECORDS

Name of Employee On-Site	Level of HAZWOPER Training (24-/40-hour)	Date of 40-Hour/8-Hour Refresher Training	First Aid/ Cardiopulmonary Resuscitation (CPR)
Joshua Lee	40-hr (Supervisor)	1/22/2021	1/28/2020
Bryce Hanson	40-hr	3/31/2021	2/3/2021
Justin Orr	40-hr	1/13/2021	11/12/2020

SITE DESCRIPTION, MAP AND FIELD ACTIVITIES

The project description and a map of the site layout are provided as part of the work plan on Figures 1 and 2. Work zones will be established around the drill rig, backhoe, excavator, borings and monitoring wells, if applicable, at each site. In general, work zones will be within a 10-foot radius of an investigation activity.

TABLE C-4. LIST OF FIELD ACTIVITIES

Check the Activities to be Completed during the Project	
X	Site reconnaissance
X	Direct-Push exploration
	Test Pit exploration
	SVE system operation
X	Soil sample collection
X	Groundwater Sampling

Check the Activities to be Completed during the Project	
X	Field screening of contaminated media
X	Soil Vapor measurements
X	Product sample measurement (if any)
	Soil stockpile testing
	Remedial excavation

EMERGENCY INFORMATION

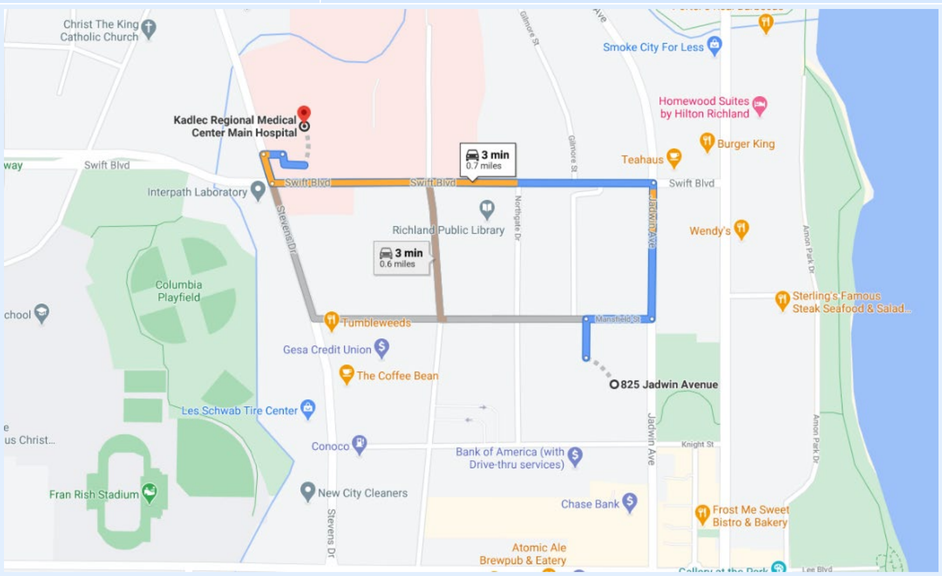
In the case on an emergency requiring medical treatment, the location of the nearest hospital and route is provided in Table C-5. Other emergency procedures are described in the following section.

TABLE C-5. EMERGENCY INFORMATION

Hospital Name and Address:	**Kadlec Regional Medical Center** 888 Swift Blvd Richland, Washington
Phone Numbers (Hospital ER):	509.946.4611 or 911
Distance:	0.7 mile

Route to Hospital:

1. Head north toward Mansfield St
2. Turn right at the 1st cross street onto Mansfield St
3. Turn left onto Jadwin Ave
4. Turn left onto Swift Blvd
5. Turn right onto Stevens Dr
6. Turn right
7. Turn right
8. Hospital will be on the left.



Ambulance:	911
Poison Control:	800.222.1222
Police:	911
Fire:	911
Location of Nearest Telephone:	Cell phones are carried by field personnel.
Nearest Fire Extinguisher:	Located in the GeoEngineers' vehicle on site.
Nearest First-Aid Kit:	Located in the GeoEngineers' vehicle on site.

Standard Emergency Procedures

1. Get help
    a. Send another worker to phone 911 (if necessary)
    b. As soon as feasible, notify GeoEngineers' project manager
2. Reduce risk to injured person
    c. Turn off equipment
    d. Move person from injury location (if possible)
    e. Keep person warm
    f. Perform CPR (if necessary)
3. Transport injured person to medical treatment facility (if necessary)
    g. By ambulance (if necessary) or GeoEngineers vehicle
    h. Stay with person at medical facility
    i. Keep GeoEngineers manager apprised of situation and notify human resources manager of situation

HAZARD ANALYSIS

A hazard analysis will be completed prior to initiation of fieldwork. The hazard analysis will account for the known and potential hazards at the site and surrounding areas, as wells as the planned work activities. The hazard assessment will be evaluated each day before beginning work at a given site. Updates will be made as necessary and documented in a daily field log. Physical and biological hazards may be encountered. Ergonomic hazards may occur as part of investigation activities. Chemical hazards are associated with exposure to contaminated site media or site features such as barrels, tanks or other containers. These hazards and procedures to mitigate the risks are discussed below.

Physical Hazards and Procedures

A hazard analysis has been completed as part of preparation of this HASP. The hazard analysis was performed taking into account the known and potential hazards at the site and surrounding areas, as wells as the planned work activities. The results of the hazard analysis are presented in this section. The hazard assessment will be evaluated each day before beginning work. Updates will be made as necessary and documented in the Job Hazard Analyses (JHA) Form 3 or daily field log.

Physical Hazards

The following are known applicable physical hazards.

TABLE C-6. PHYSICAL HAZARDS

X	Drill rigs and concrete coring
	Backhoes
X	Overhead hazards/powerlines

X	Tripping/puncture hazards (debris on site, steep slopes or pits)
X	Snow, rain, ice, freezing temperatures
X	Heat/Cold, Humidity
X	Utilities/utility locate
X	Contaminated soil
X	Contaminated groundwater
X	Unusual traffic hazard – Street traffic
X	Loud noise
	Excavators
	Front End Loader/Forklifts
X	Excavations/trenching (1:1.5 slopes for Type C soil if entering the excavation)
	Shored/braced excavation if greater than 4 feet of depth

- Utility checklist will be completed as required for the location to prevent drilling or digging into utilities. Note: These procedures should be added to the standard GeoEngineers utility checklist.
- Lifting hazards: use proper techniques, mechanical devices where appropriate.
- Terrain obstacles: terrain could be soft, and activities will be conducted to minimize lawn damage and the potential for vehicles to get stuck.
- Personnel will wear high-visibility vests for increased visibility by vehicle and equipment operators.
- Field personnel will be aware at all times of the location and motion of heavy equipment in the area of work to ensure a safe distance between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated that it is safe to do so through hand signal or other acceptable means.
- Heavy equipment and/or vehicles are not anticipated.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet, depending on the client and the use of a safety watch. Note: If it is later determined that overhead lines are a hazard on this job site, a copy the overhead lines safety section from the HASP Supplemental document shall be attached.
- Don't operate equipment around overhead power lines unless you are authorized and trained to do so. If an object (scaffolds, crane, etc.) must be moved in the area of overhead power lines, appoint a competent worker whose sole responsibility is to observe the clearance between the power lines and the object. Warn others if the minimum distance is not maintained.
- Never touch an overhead line if it has been brought down by machinery or has fallen. Never assume lines are dead. When a machine is in contact with an overhead line, DO NOT allow anyone to come near or touch the machine. Stay away from the machine and summon outside assistance. Never touch a person who is in contact with a live power line.

- If you are in a vehicle that is in contact with an overhead power line, DON'T LEAVE THE VEHICLE. As long as you stay inside and avoid touching metal on the vehicle, you may avoid an electrical hazard. If you need to get out to summon help or because of fire, jump out without touching any wires or the machine, keep your feet together and hop to safety.
- Personnel will avoid tripping hazards, steep slopes, pit and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope, pier or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with Occupational Safety and Health Administration (OSHA)/Division of Occupational Safety and Health (DOSH) regulations and the GeoEngineers Safety Program manual.
- Excessive levels of noise (exceeding 85 decibels [dBA]) are anticipated. Personnel potentially exposed will wear ear plugs or muffs with a noise reduction rating of at least 25 dBA whenever it becomes difficult to carry on a conversation 6 feet away from a co-worker or whenever noise levels become bothersome. (Increasing the distance from the source will decrease the noise level noticeably.)
- Cold stress control measures will be implemented according to the GeoEngineers Health and Safety Program to prevent frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature). Heated break areas and warm beverages shall be available during periods of cold weather.
- Heat stress control measures required for this site will be implemented according to GeoEngineers Health and Safety Program with water provided on site.

TABLE C-7. ENGINEERING CONTROLS

	Trench shoring (1:1 slope for Type B Soils)
	Locate work spaces upwind/wind direction monitoring
	Other soil covers (as needed)
	Other (specify ______________

Chemical Hazards

This section includes all chemical hazards that have been identified to date at the site.

TABLE C-8 POTENTIAL CHEMICAL HAZARDS AT THE SITE

Compound/ Description	OSHA PEL Exposure Limits	NIOSH.ACGIH TLV Exposure Limits/IDLH	Exposure Routes	Toxic Characteristics
Tetrachloroethene (PCE) Colorless liquid with a mild, chloroform-like odor	TWA = 100 ppm, C = 200 ppm (with a maximum of 300 ppm for 5 minutes in any 3-hour period)	IDLH = 150 ppm ACGIH TLV TWA = 25 ppm, ACGIH STEL = 100 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]
Trichloroethene (TCE) Colorless liquid (unless dyed blue) with a chloroform-like odor	TWA = 100 ppm, C = 200 ppm (300 ppm 5-minute peak in any 2 hours)	NIOSH REL TWA = 25 ppm (10 hour), ACGIH TLV TWA= 50 ppm ACGIH STEL = 100 ppm NIOSH IDLH = 1,000 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Notes:

If Washington State has established a PEL more restrictive than the OSHA limits, then the applicable State limit becomes the legal limit.

IDLH = immediately dangerous to life or health

NIOSH = National Institute for Occupational Safety and Health

ACGIH = American Conference of Governmental Industrial Hygienists

mg/m^3 = milligrams per cubic meter

TWA = time-weighted average (Over 8 hrs.)

PEL = permissible exposure limit

TLV = threshold limit value (over 10 hrs)

NE = Not Established

C = Ceiling Recommended Exposure Limit

ppm = parts per million

PCE

The Washington State PEL- (TWA) is 25 ppm over an 8-hour period and a STEL of 38 ppm. The odor threshold for PCE is 1 5 ppm; the odor is sharp and sweet. PCE is detected by the PID.

Tetrachloroethene (PCE), or perchloroethylene is used primarily for commercial dry cleaning and metal degreasing. Exposure to this compound can cause effects on the central nervous system, mucous membranes, eyes and skin, and to a lesser extent the lungs, liver and kidneys. Symptoms of nervous system effects include incoordination, followed at increasing concentrations by dizziness, headache, vertigo, light narcosis and unconsciousness. Skin burns, blistering and reddening of the skin have been reported upon skin exposure to the pure product. Eye irritation occurs when exposure to vapor or liquid occurs. PCE is a confirmed animal carcinogen with unknown relevance to humans.

TCE

The Washington State PEL- (TWA) is 50 ppm over an 8-hour period and a STEL of 200 ppm. The PEL is 100 ppm (OSHA) or 50 ppm (ACGIH) for an 8-hour average. The PID will detect TCE.

Central nervous system effects are the primary effects noted from acute inhalation exposure to TCE in humans, with symptoms including sleepiness, confusion and feelings of euphoria. Effects on the gastrointestinal system, liver, kidneys and skin have also been noted.

TCE absorption by inhalation, dermal and oral exposure is very rapid. TCE is metabolized in humans and animals to a number of substances which themselves are known to be toxic: chloral hydrate, trichloroacetic acid, dichloroacetic acid and trichloroethanol.

TCE is very lipophilic; hence, all routes of exposure can contribute to TCE absorption. Inhalation is the most important route of TCE uptake by which absorption is very rapid. The initial rate of uptake of inhaled TCE is quite high, leveling off after a few hours of exposure.

TCE defats the skin and disrupts the stratum corneum, thereby enhancing its own absorption. The rate of absorption probably increases with greater dermal disruption. However, dermal route is generally not a significant route of exposure.

TCE is a nonflammable colorless liquid with an odor similar to ether or chloroform. The odor threshold for TCE is 28 ppm.

Biological Hazards

Site personnel shall avoid contact with or exposures to potential biological hazards encountered.

TABLE C-9. BIOLOGICAL HAZARDS AND PROCEDURES

Y/N	Hazard	Procedures
N	Poison Ivy or other vegetation	Avoid contact
N	Insects or snakes	Avoid contact
X	COVID-19	Refer to COVID-specific JHA

Site personnel shall avoid contact with or exposures to potential biological hazards encountered. Follow JHA specific to COVID-19 required protocols.

Additional Hazards (Update in Daily Log)

Include evaluation of:

- Physical Hazards (equipment, traffic, tripping, heat stress, cold stress and others)
- Chemical Hazards (odors, spills, free product, airborne particulates and others present)
- Biological Hazards (COVID-19, snakes, spiders, other animals, poison ivy and others present)

AIR MONITORING PLAN

An air monitoring plan has been prepared as part of development of this HASP. The air monitoring plan is based on the results of the chemical exposure assessment and the known and potential inhalation hazards on site. The air monitoring plan addresses steps necessary to limit worker exposure. Non-occupational exposures are not addressed in this plan.

Work upwind if at all possible.

Check Instrumentation to be Used

☐ Multi-Gas Detector (may include oxygen, carbon monoxide, hydrogen sulfide, lower explosive limit)

☐ Dust Monitor

☒ Other (i.e., detector tubes or badges) Please specify: PID

Check Monitoring Frequency/Locations and Type (Specify: Work Space, Borehole, Breathing Zone):

☐ Continuous during soil disturbance activities or handling samples (work space)

☐ 15 minutes

☐ 30 minutes

☒ Hourly (breathing zone)

Additional Personal Air Monitoring for Specific Chemical Exposure

Action Levels for Volatile Organic Chemicals

- The workspace will be monitored using a photoionization detector (PID). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area in which it will be used and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area.
- An initial vapor measurement survey of the site should be conducted to detect “hot spots” if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 parts per million (ppm) above background continuously for a 5-minute period as measured in the breathing zone, upgrade to Level C personal protective equipment (PPE) or move to a non-contaminated area.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed one-half the threshold limit value (TLV). Because of the variety of chemicals, the PID will not indicate exposure to a specific permissible exposure limit (PEL). If odors are detected, then employees shall upgrade to respirators with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

AIR MONITORING ACTION LEVELS

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Drilling	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	Background to 5 ppm in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	5 to 50 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	> 50 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety Program Manager for guidance.
Combustible Atmosphere	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1,000 ppm	Depends on contaminant. The PEL is usually exceeded before the lower explosive limit (LEL).
Combustible Atmosphere	Environmental Remedial Actions	PID or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1,000 ppm	Stop work and evacuate the site. Contact Health and Safety Program Manager for guidance.
Oxygen Deficient/ Enriched Atmosphere	Environmental Remedial Actions Confined Spaces	Oxygen meter or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	<19.5 >23.5%	Continue work if inside range. If outside range, evacuate area and contact Health and Safety Program Manager.

SITE CONTROL PLAN

Work zones will be considered to be within 50 feet of the drill rig, backhoe, or other equipment. Employees should work upwind of the machinery if possible. To the extent practicable, use the buddy system. Do not approach heavy equipment unless you are sure the operator sees you and has indicated it is safe to approach. All personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.). For medical assistance, see Emergency Information section above.

Traffic or Vehicle Access Control Plans

Explorations will be located within the US GSA Richland Federal Building property, including the landscaped areas on the east side and paved parking lot on the west side of the property. Site personnel will limit the amount of space blocked on the landscaped areas/in the parking lot after a save work area is designated with traffic cones.

Site Work Zones

An exclusion zone, contamination reduction zone and support zone should be established around working areas. Personnel leaving the facility or on break should exit the exclusion zone through the contamination reduction zone. The contamination reduction zone, at a minimum, should consist of garbage bags into which used PPE should be disposed. Personnel should wash hands at the Facility before eating or leaving the facility.

Hot zone/exclusion zone: *Within 10 feet of borings or excavations*

Method of Delineation/Excluding Non-Site Personnel

☐ Fence

☐ Survey Tape

☒ Traffic Cones

☐ Other:

Buddy System

Personnel on site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on site, a buddy system can be arranged with subcontractor/ contractor personnel.

Site Communication Plan

Positive communications (within sight and hearing distance or via radio) should be maintained between pairs on site, with the pair remaining in proximity to assist each other in case of emergencies. The team should prearrange hand signals or other emergency signals for communication when voice communication becomes impaired (including cases of lack of radios or radio breakdown) and an agreed upon location for an emergency assembly area.

In instances where communication cannot be maintained, you should consider suspending work until it can be restored. If this is not an option, the following are some examples for communication:

- Hand gripping throat: Out of air, can't breathe.
- Gripping partner's wrist or placing both hands around waist: Leave area immediately, no debate.
- Hands on top of head: Need assistance.
- Thumbs up: Okay, I'm all right; or, I understand.
- Thumbs down: No, negative.

Emergency Action

In the event of an emergency, employees with convene in a designated area Identified on the Job Hazard Analyses Form (JHA) Form 3. Employees should communicate with others working on site and the PM to determine the Emergency Action Plan for each site. All personnel from GeoEngineers and subcontractor(s) should be made aware of the Emergency Action for the site at each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.). For medical assistance, see Emergency Information section above.

Decontamination Procedures

Decontamination, at a minimum, should include removing and disposing of PPE when exiting the exclusion zone; and washing your hands. Decontamination may also consist of removing outer protective gloves and washing soiled boots and gloves using bucket and brush provided on site in the contamination reduction zone. If needed, inner gloves will then be removed, and respirator, hands and face will be washed in either a portable wash station or a bathroom facility at the site. Employees will perform decontamination procedures and wash before eating, drinking or leaving the site.

Waste Disposal or Storage

Used PPE is to be placed in a plastic bag for disposal.

Drill Cutting/Excavated Sediment Disposal or Storage:

☒ On site, pending analysis and further action

☐ Secured (list method):

☐ Other (describe destination, responsible parties):

PERSONAL PROTECTIVE EQUIPMENT

After the initial and/or daily hazard assessment has been completed the appropriate personal protective equipment (PPE) will be selected to ensure worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted before the start of site operations. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted before the start of site operations.

Site activities include handling and sampling solid subsurface material (material may potentially be saturated with contaminated materials and groundwater). Depth-to-groundwater measurements will be performed as well. Site hazards include potential exposure to hazardous materials, and physical hazards such as trips/falls, heavy equipment and contaminant exposure.

Air monitoring will be conducted to determine the level of respiratory protection.

- Half-face combination organic vapor/high efficiency particulate air (HEPA) or P100 cartridge respirators will be available on site to be used as necessary. P100 cartridges are to be used only if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on site.

- Level D PPE, unless a higher level of protection is required, will be worn at all times on the site. Potentially exposed personnel will wash gloves, hands, face and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.

Check Applicable Personal Protection Gear to be Used:

☒ Hardhat (if overhead hazards, or client requests)

☒ Steel-toed boots (if crushing hazards are a potential or if client requests)

☒ Safety glasses (if dust, particles, or other hazards are present or client requests)

☒ Reflective vest (if working near traffic or equipment)

☒ Hearing protection (if it is difficult to carry on a conversation 3 feet away)

☒ Rubber boots (if wet conditions)

Gloves (Specify):

☒ Nitrile

☐ Latex

☐ Liners

☐ Leather

☐ Other (specify)

Protective Clothing:

☐ Tyvek (if dry conditions are encountered, Tyvek is sufficient) (modified Level D or Level C)

☐ Saranex (personnel shall use Saranex if liquids are handled, or splash may be an issue) (modified Level D or Level C)

☒ Cotton (Level D)

☒ Rain gear (as needed) (Level D)

☒ Layered warm clothing (as needed) (Level D)

Inhalation Hazard Protection:

☒ Level D (no respirator)

☐ Level C (respirators with organic vapor/HEPA P100 filters)

☐ Level B (Self Contained Breathing Apparatus— STOP, Consult the HSM)

Personal Protective Clothing Inspections

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.

- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

Respirator Selection, Use and Maintenance

If respirators are required, site personnel shall be trained before use on the proper use, maintenance and limitations of respirators. Additionally, they must be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel who will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used. Respirators will be stored in a protective container.

Respirator Cartridges

If the action levels identified in the Air Monitoring Action Levels Table in Section 5.0, are exceeded, site personnel should don respiratory protection appropriate for the known or suspected chemical of concern. For most sites, a half-face or full-face air purifying respirator with a National Institute for Occupational Safety and Health (NIOSH)-approved organic vapor/HEPA P100 combination cartridge (Level C), will be appropriate for the known or suspected chemicals of concern. Monitoring frequency should be continuous while using Level C respiratory protection. The SSO closely monitor personnel using respiratory protection, including observing for signs of fatigue or respiratory distress, the potential for cartridge breakthrough or increased resistance to inhalation, and the need for changes in the level of respiratory protection based on air monitoring. The frequency and duration of breaks should be increased for personnel working in respiratory protection. If at any time on-site air monitoring indicates Level B respiratory protection is warranted, personnel should leave the exclusion zone and consult with the HSM.

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be approved and NIOSH-certified. A cartridge change-out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change-out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste or feel, although breakthrough is not an acceptable method of determining the change-out schedule.

Respirator Inspection and Cleaning

The Site Safety Officer shall periodically (weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned, to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

ADDITIONAL ELEMENTS

Cold Stress Prevention

Working in cold environments presents many hazards to site personnel and can result in frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature).

The combination of wind and cold temperatures increases the degree of cold stress experienced by site personnel. Site personnel shall be trained on the signs and symptoms of cold-related illnesses, how the human body adapts to cold environments and how to prevent the onset of cold-related illnesses. Heated break areas and warm beverages shall be provided during periods of cold weather.

Heat Stress Prevention

Keep workers hydrated in a hot outdoor environment requires more water be provided than at other times of the year. When employee exposure is at or above an applicable temperature listed in the Heat Stress table below, Project Managers will ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times.
- All employees have the opportunity to drink at least 1 quart of drinking water per hour.

HEAT STRESS

Type of Clothing	Outdoor Temperature Action Levels
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
All other clothing	89°

Emergency Response

- Personnel on site should use the "buddy system" (pairs).
- Visual contact should be maintained between "pairs" on site, with the team remaining in proximity to assist each other in case of emergencies.
- If any member of the field crew experiences any adverse exposure symptoms while on site, the entire field crew should immediately halt work and act according to the instructions provided by the SSO.
- Wind indicators visible to all on-site personnel should be provided by the SSO to indicate possible routes for upwind escape. Alternatively, the SSO may ask on-site personnel to observe the wind direction periodically during site activities.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and reevaluation of the hazard and the level of protection required.

- If an accident occurs, the Site Safety Officer and the injured person are to complete, within 24 hours, an Accident Report (Form 4) for submittal to the PM, the HSM and HR. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

MISCELLANEOUS

Personnel Medical Surveillance

GeoEngineers employees are not in a medical surveillance program because they do not fall into the category of "Employees Covered" in OSHA 1910.120(f)(2), which states that a medical surveillance program is required for the following employees:

1. All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year.
6. All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations.
7. All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.
8. Members of HAZMAT teams.

Spill Containment Plans (Drum and Container Handling)

Issues to be addressed in this section include:

- Site topography is generally flat.
- Site drainage --Municipal drain.
- There are no engineered site drains.

Sampling, Managing and Handling Drums and Containers

Drums and containers used during the cleanup shall meet the appropriate Department of Transportation (DOT), OSHA and U.S. Environmental Protection Agency (EPA) regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container movement. When practicable, drums and containers shall be inspected, and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. Before drums or containers are moved, all employees involved in the transfer operation shall be warned of the potential hazards associated with the contents.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupturing may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred. Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

Entry Procedures for Tanks or Vaults (Confined Spaces)

GeoEngineers employees shall not enter confined spaces to perform work unless they have been properly trained and with hands-on experience in the use of retrieval equipment. If a project requires confined space entry, please include a copy of the confined space permit and include the training documentation in this HASP.

Trenches greater than 4 feet in depth with the potential for buildup of a hazardous atmosphere are considered confined spaces.

Sanitation

Sanitary facilities are available on site in the US GSA Richland Federal Building.

Lighting

Work is anticipated to be performed during daylight hours. Work may extend slightly into the evening provided adequate lighting is used (e.g., portable flood lights).

DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

- Daily Field Log
- FORM 1—Health and Safety Pre-Entry Briefing and Acknowledgment of Site Health and Safety Plan for use by employees, subcontractors and visitors
- FORM 2—Safety Meeting Record
- FORM 3—Job Hazard Analyses (JHA) Form
- FORM 4—Accident/Exposure Report Form

NOTE: The Field Log is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subcontractors, client or other parties, etc.;
- Air monitoring/calibration results, including: personnel, locations monitored, activity at the time of monitoring, etc.;
- Actions taken;
- Action level for upgrading PPE and rationale; and
- Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.).

APPROVALS

1. Plan Prepared

Joshua M. Lee	4/27/2021
Signature	Date

2. Plan Approval

Jedidiah R. Sugalski	4/27/2021
PM Signature	Date

3. Health & Safety Manager

Mary Lou Sullivan	4/27/2021
HSM Signature	Date

FORM 1
HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT OF THE SITE HEALTH AND SAFETY PLAN FOR GEOENGINEERS' EMPLOYEES, SUBCONTRACTORS AND VISITORS
US GSA RICHLAND FEDERAL BUILDING
FILE NO. 0504-175-00

Inform employees, contractors and subcontractors or their representatives about:

- The nature, level and degree of exposure to hazardous substances they're likely to encounter;
- All site-related emergency response procedures; and
- Any identified potential fire, explosion, health, safety or other hazards.

Conduct briefings for employees, contractors and subcontractors, or their representatives as follows:

- A pre-entry briefing before any site activity is started.
- Additional briefings, as needed, to make sure that the Site-specific HASP is followed.
- Make sure all employees working on the Site are informed of any risks identified and trained on how to protect themselves and other workers against the Site hazards and risks.
- Update all information to reflect current sight activities and hazards.
- All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety Officer.
- The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

(All of GeoEngineers' Site workers shall complete this form, which should remain attached to the HASP and be filed with other project documentation). Please be advised that this site-specific HASP is intended for use by GeoEngineers employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.

I hereby verify that a copy of the current HASP has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required, specified safety regulations and procedures.

Print Name	Signature	Date

FORM 2
SAFETY MEETING RECORD
US GSA RICHLAND FEDERAL BUILDING
FILE NO. 0504-175-00

Safety meetings should include a discussion of emergency response, site communications and site hazards.

- Use in conjunction with the HASP and Job Hazard Analyses (JHA) Form 3 to help identify hazards.

Date: ______________________________ **Site Safety Officer (SSO):** ____________________________________

Topics: ____

Attendees:
Print Name **Signature:**

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FORM 3
JOB HAZARD ANALYSES (JHA) FORM
EXAMPLE
US GSA RICHLAND FEDERAL BUILDING
FILE NO. 0504-175-00

This form can be used for analyses of daily hazards where there are multiple tasks and ongoing projects and for record keeping purposes. Make copies as needed.

Project: US GSA Richland Federal Building **File No:** 0504-175-00	**Date:** date	**Site Location:** Site address

Development Team:	**Position/Title:**	**Reviewed by:**	**Position/Title:**
Name	Position	Name	Position
Name	Position	Name	Position

Minimum Required Protective Equipment: (see critical actions for task-specific requirements)

PPE	**Equipment**	**Tools**	**Actions**
☒ Hard Hat	☐ Safety Beacons	☒ Cell/Satellite Phone	☒ Stay Visible
☒ High Visibility Vest	☐ Safety Cones	☐ Digital Camera	☒ Equipment Inspection
☐ Safety Shoes/Waders	☒ First Aid Kit	☐ iPad	☒ Work in Pairs
☒ Gloves	☒ Fire Extinguisher	☐	☒ Safety Control/Traffic Plan
☒ Safety Glasses	☐ Eye Wash/ Drinking Water	☐	☐

Job Steps	**Potential Hazards**	**Critical Actions to Mitigate Hazards**
Pre-Job Activities	Example: Unfamiliar locations, congestion, unpaved roads, Mechanical Failure, Flat Tires Vehicle Fire, Exhaust Leaks, Vehicle Collision, Internal Projectiles	■ Inspect the vehicle before departure: ▪ Check for tire cuts, fluid leaks, flat tires, body damage, windshield cracks, and other damage. ▪ Check lights, wipers, fluid levels, and seat belts. ■ Study the area maps, photos and use GPS and compass skills. ■ Identify the safest spot to park field vehicles.
Familiarize crew with the task and location of site	Crew does not notify site owner / manager. Unaware of the job site hazards and steps to prevent injury. Appropriate personnel protective equipment not worn. Other Hazards	■ Example: Conduct a tailgate safety meeting discussing the jobs, the hazards and actions that will be taken to prevent injury. ■ Discuss "Stop Work Authority" as it applies to each site member. ■ Discuss appropriate PPE including high visibility clothing such as reflective vest. ■ Notify attendant and/or site owner/manager of work activities and location. ■ Discuss appropriate PPE including high visibility clothing such as reflective vest. ■ Set up exclusion zone surrounding work area.

Driving to work site location (Highway Driving)	Unfamiliar road, Mechanical Failure, Flat Tires, Vehicle Fire, Vehicle Collision. Other Hazards	■ Inspect the vehicle before departure: o Check for tire cuts, fluid leaks, flat tires, body damage, windshield cracks, and other damage. o Check lights, wipers, fluid levels, and seat belts. ■ Study the area maps, photos and use GPS and compass skills. ■ Use only vehicles appropriate for the work needs and the driving conditions expected. ■ Ensure the vehicle has a complete and current first aid kit and fire extinguisher. ■ Place heavy objects behind a secure safety cage if they must be carried in a passenger compartment. ■ Use parking brake, and don't leave vehicle unattended while it is running. ■ Ensure vehicle has fuel to get to and from your destinations. ■ Inform your Project Manager of your destination and estimated time of return. ■ Carry extra food, water, and clothing. ■ Drive defensively.
Driving on Unimproved Roads **(Off-Highway Driving)**	Encountering Other Vehicles on Narrow Unfamiliar Road, Narrow, Rough Roads, Animal / Object Collision, Running / Skidding Off Road, Icy / Muddy Roads Flying Debris (Rocks, etc.), Poor Visibility Backing, Run-Away Vehicle, Roadway Obstacles Project Manager unaware of location.	■ Stay on the main roadway. Pull over on firm ground and avoid soft shoulders, if a stop is necessary. ■ Drive on maintained trails when possible. ■ Drive with care in tall brush and grass. Watch for wildlife, fallen trees, rocks, and other obstacles. ■ Slow down, especially on corners. Maintain a safe speed at all times. ■ Follow from a safe distance. ■ Know when and how to use 4WD. ■ Use only vehicles appropriate to the road conditions. Learn these conditions before you go. ■ Pull over to allow larger vehicles (i.e.: trucks and trailers) to pass from either direction. ■ Don't travel the road at all if there is high potential for vehicle damage. ■ Park so that backing up will not be necessary. ■ Use a spotter or get out to check behind vehicle.

		■ Use ground guide to walk the path on questionable roadways. ■ When removing debris from the roadway, use care, lift properly, and use proper equipment and PPE. ■ When descending a long grade, use lower gears to control speed rather than brakes. ■ Keep vehicle well ventilated by opening a window at least 6 inches, when idling or heating for a period. ■ Keep all windows clear of snow, ice, mud, and anything else obstructing the driver's view. ■ Keep vehicle windows clean, inside and out, and washer fluid full. Replace damaged or worn wipers.
Traveling on Foot	Falls, Foot Injuries, and Stress and Impact Injuries Forest Fires Lightning Personal Safety	■ Identify and use safe travel routes. Do not exceed physical abilities or equipment design. ■ Use pack equipment properly. Carry weight on hips, not back. ■ Warm up and stretch the appropriate muscle groups before and after hitting the trail. ■ Test and use secure footing. Move cautiously and deliberately. Never run. ■ In heavy undergrowth, particularly off-trail, slow down and watch carefully. ■ Carry tools on the downhill side. ■ Wear safety-toed boots with good, non-skid soles that are tall enough to support ankles. ■ Know basic first aid. Completion of a basic first aid course is required. ■ Use footwear appropriate to the terrain and load being carried. ■ Know how to fall. Roll, protect the head and neck, and do not extend arms to break the fall. ■ Wear fire retardant clothing ■ Refer to GeoEngineers Personal Safety Program - Never you're your personal safety. Leave the area and contact your Project Manager. ■ Travel on maintained trails when possible.
	Biological Hazards	■ Discuss applicable hazard mitigation measures - Insects, Snakes, Wildlife, Vegetation

<table>
<tr><td rowspan="1">Slope Evaluation</td><td>Slips, Trips and Falls</td><td>
■ Travel on maintained trails when possible.
■ Take extra precautions when encountering steep, loose, wet trail conditions.
■ Always carry tools on your downhill side.
■ Use a rope for stability if needed / tie off to trees / have throw rope with on-shore buddy.
■ Take slow deliberate steps as conditions dictate.
■ Use a flashlight after dark.
■ Travel after dark only in an emergency.
■ Wear appropriate footwear for conditions.</td></tr>
<tr><td rowspan="2">Communication</td><td>Additional Hazards, i.e., No communication in case of emergency</td><td>
■ Verify cell phone is working.
■ Maintain communication with Project Manager throughout job task.
■ Verify location and contact numbers for emergency medical assistance or 911.</td></tr>
<tr><td>Additional Hazards, i.e., Emergency</td><td>
■ Dial 911
■ Hospital Route (Attached Fall Protection Plan)</td></tr>
<tr><td colspan="3">Required Control Measures: (check the box when complete)</td></tr>
<tr><td colspan="3">☐ Perform a pre-work vehicle inspection (First Aid kit, fire extinguisher).</td></tr>
<tr><td colspan="3">☐ Drive defensively looking out for the other guy.</td></tr>
<tr><td colspan="3">☐ Conduct a pre-work safety meeting.</td></tr>
<tr><td colspan="3">☐ Use a Safety Watch to monitor equipment Minimum Approach Distance (MAD) and to keep personnel clear if needed.</td></tr>
<tr><td colspan="3">☐ Wear Personal Protective Equipment (PPE).</td></tr>
<tr><td colspan="3">☐ Ensure training is current (First Aid, defensive driving, etc.).</td></tr>
<tr><td colspan="3">☐ Conduct Task Safety Assessments throughout the job.</td></tr>
<tr><td colspan="3">Additional Comments:</td></tr>
<tr><td colspan="3"></td></tr>
</table>

DAILY HAZARD ASSESSMENT RECORD OF SAFETY MEETINGS

Signature	**Date**	**Signature**	**Date**

Directions to Nearest Hospital

FORM 4
ACCIDENT/EXPOSURE REPORT FORM
US GSA RICHLAND FEDERAL BUILDING
FILE NO. 0504-175-00

To (Supervisor): ____________________ From (Employee): ____________________

Telephone (with area code): ____________________

Name of injured or ill employee: ____________________

Date of accident: Time of accident: Exact location of accident:

Narrative description of: **accident/exposure** (circle one):

Medical attention given on site:

Nature of illness or injury and part of body involved: Lost Time? Yes ☐ No ☐

Probably Disability (check one):

Fatal	Lost work day with days away from work	Lost work day with days of restricted activity	No lost work day	First Aid only
☐	☐	☐	☐	☐

Corrective action taken by reporting unit and corrective action that remains to be taken (by whom and when):

Employee Signature: Date:

Name of Supervisor:

Project Name: File No:	Date:	Site Location:

Application:

This COVID-19 supplementary JHA is designed to meet the requirements of GeoEngineers' Field Safety During COVID-19 protocols and the COVID-19 Response Plan as well as the recommendations provided by the Centers for Disease Control and Prevention (CDC) and other applicable state or federal agencies.

PPE/Supplies/Actions Equipment: (select those applicable to this jobsite)

PPE	Supplies	Tools	Actions
☐ Eye Protection	☐ Hand Washing Soap	☐ Cell Phone/Satellite	☐ Maximize Social Distance (≥6ft)
☐ Gloves	☐ Hand Washing Water Supply	☐ Scanning Thermometer	☐ Meeting Location Planning
☐ Cloth Face Covering	☐ Hand Sanitizer	☐ Water Basin	☐ Hand Washing
☐ N95 Mask	☐ Sanitizing Wipes		☐ High Touch Surface Sanitation
☐ Disposable Coveralls			

Job Steps	Potential Hazard	Critical Actions to Mitigate Hazard
Mobilization to worksite	Transmission of COVID-19 Virus	■ Pack hand sanitizer and wipes for use during all modes of business travel. ■ Assign hand sanitizer to vehicle when able. ■ Sanitize "high touch" areas: keys, steering wheels, dash controls, door handles, mirror adjustments, shifter, blinkers, head rests, etc. ■ Re-Fueling: Use sampling gloves or wash hands after using the pump at a gas station. When possible, do this before you get back into the vehicle. ■ Intra-Site Transportation: Maintain social distancing on transport skiffs or multi- passenger ATVs. Request multiple trips if overcrowded. Keep your field PPE on during travel.

Pre-work Safety Meetings	Transmission of COVID-19 Virus	■ Review site maps, photos and routes prior to site arrival to anticipate present staffing or public density areas. ■ Conduct a tailgate safety meeting in location that can accommodate greater than 6 feet social distancing. ■ Keep group sizes as small as possible (≤ 10 people or smaller depending on individual state guidance). ■ Meeting attendance should be verbally announced and recorded by a single representative to avoid contact with shared supplies/ equipment/computers/work surfaces. ■ Use verbal greetings. Do not shake hands, hug, fist bump, or high five. ■ Wear face coverings if social distances cannot be maintained. ■ Use own supply of pens, notebooks and similar field supplies.
Site Operations	Transmission of COVID-19 Virus	■ Maximize social distances to the greatest extent feasible. ■ If tasks or locations require sharing workspaces in proximity to others with less than 6 feet separation, wear a face covering. ■ Sanitize shared tools or equipment. ■ Use own vehicle as site office rather than shared spaces. ■ Wash ungloved hands after contacting shared surfaces. ■ Sanitize personal items regularly (cell phone, water bottle, clipboards, notebooks). ■ Set up exclusion zones surrounding public interface areas if less than 6 feet separation. ■ Wear face covering if traveling off site for lunch/coffee/supplies and recommended social distances cannot be maintained. ■ Leave job site if experiencing onset of COVID-19 symptoms.
Positive or Assumed Positive COVID-19 Result at Job Site	Transmission of COVID-19 Virus	■ Contact your manager as soon as information is received of a positive or assumed positive result on the jobsite. ■ Determine if you have had close and prolonged personal proximity to the individual. ■ Based on proximity, you may be asked to remove yourself from the worksite. ■ Your manager will provide guidance for how to proceed safely following worksite withdrawal.
Additional Comments:		

Daily JHA Record of Safety Meetings

Name of Attendees Date

Signature of Individual Verifying the Above Date

GeoEngineers