Subsurface Investigation and Groundwater Monitoring

University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Center
1735 Jefferson Avenue
Tacoma, Washington

for

University of Washington

January 23, 2015

GeoEngineers
Earth Science + Technology

Subsurface Investigation and Groundwater Monitoring

University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Center
1735 Jefferson Avenue
Tacoma, Washington

for
University of Washington

January 23, 2015

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Subsurface Investigation and Groundwater Monitoring
University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Center
1735 Jefferson Avenue
Tacoma, Washington

Project No. 0183-099-00

January 22, 2015

Prepared for:

University of Washington
Capitol Projects Office
Box 352205
Seattle, Washington 98195-2205

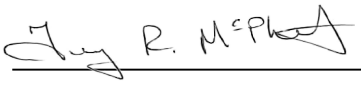
Attention: Jeannie Natta

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Tricia S. DeOme, LG
Environmental Geologist

Neil F. Morton
Senior Environmental Scientist



Terry R. McPhetridge, LG, LHG
Associate

TSD:NFM:TRM:ch:lw

Table of Contents

1.0 INTRODUCTION 1

2.0 CURRENT SITE FEATURES AND DEVELOPMENT PLANS 1

2.1. Site Features 1
2.2. Proposed Development Plans 1

3.0 HISTORICAL USE 2

4.0 AGREED ORDER 2

5.0 PREVIOUS INVESTIGATIONS 3

5.1. Chemical Analytical Results of Previous Investigation 3
5.1.1. Site 3
5.1.2. Upgradient of the Site 4
5.1.3. Downgradient of the Site – Howe Plume 4

6.0 2014 FIELD INVESTIGATION PROGRAM 4

7.0 SOIL AND GROUNDWATER CONDITIONS 5

7.1. Published Literature 5
7.2. Subsurface Explorations 5
7.3. Groundwater Conditions 6

8.0 SAMPLING AND CHEMICAL ANALYTICAL RESULTS 6

8.1. Soil 6
8.1.1. PCE 7
8.1.2. TCE 7
8.1.3. Other VOCs 7
8.2. Groundwater Sampling and Chemical Analytical Results 7
8.2.1. PCE 8
8.2.2. TCE 8
8.2.3. Other VOCs 8
8.2.4. Diesel-Range Petroleum Hydrocarbons 9

9.0 SOIL VAPOR SAMPLING AND CHEMICAL ANALYTICAL RESULTS 9

9.1. Soil Vapor Sampling 9
9.2. Soil Vapor Sample Chemical Analytical Results 9
9.3. Vapor Intrusion Evaluation 10
9.3.1. Step 1. Soil Gas Screening Levels Evaluation 10
9.3.2. Step 2. Johnson and Ettinger Vapor Intrusion Modeling 11

10.0 SUMMARY OF SUBSURFACE INVESTIGATION FINDINGS 13

11.0 SOIL AND WATER MANAGEMENT PLAN AND ENVIRONMENTAL MITIGATION MEASURES 14

11.1.General 14
11.2.Remedial Activities 14
11.3.Heating Oil UST 14
11.4.Soil and Water Management 14
11.4.1. Soil 14
11.4.2. Water 15

11.5.Building Design and Mitigation Measures 15
11.5.1. Spread Footings 15
11.5.2. Micropiles 15
11.5.3. Utility Trenches 16
11.5.4. Slab Repairs 16
11.5.5. Underslab Drain 16
11.5.6. Existing Monitoring Wells 16
12.0 LIMITATIONS 16
13.0 REFERENCES 17

LIST OF TABLES

Table 1. Summary of 2013 Chemical Analytical Results – Petroleum Hydrocarbons, PAHs, Metals - Soil
Table 2. Summary of Chemical Analytical Results During 2013 and 2014 Sampling Events - VOCs - Soil
Table 3. Summary of Chemical Analytical Results During 2013 and 2014 Sampling Events - VOCs-Groundwater
Table 4. Summary of Chemical Analytical Results During 2014 Sampling Events – Soil Gas
Table 5. Soil Gas Vapor Intrusion Evaluation

LIST OF FIGURES

Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Cross Section
Figure 4. Site Plan – Sampling Results
Figure 5. Site Plan- Soil Vapor Sample Results

APPENDICES

Appendix A. Sampling and Analysis Plan and Quality Assurance Project Plan
Appendix B. Field Program and Exploration Logs
Appendix C. Screening Level Calculation
Appendix D. Chemical Analytical Program
Appendix E. Johnson and Ettinger Model
Appendix F. Report Limitations and Guidelines for Use

1.0 INTRODUCTION

This report provides the results of the environmental subsurface investigation and groundwater monitoring performed at the new Urban Solutions Center (existing four-story building) located at 1735 Jefferson Avenue on the University of Washington-Tacoma (UWT) campus located in Tacoma, Washington for the University of Washington (UW). The Urban Solutions Center is herein referred to as the "site" as shown on Figure 1.

The purpose of this subsurface investigation was to evaluate if groundwater is contaminated with tetrachloroethene (PCE) from the soil within the building and evaluate the potential for vapor intrusion into the building.

2.0 CURRENT SITE FEATURES AND DEVELOPMENT PLANS

2.1. Site Features

The four-story building encompasses a majority of the site boundary. The first floor of the building is accessible from the Prairie Line Trail at approximately Elevation 70.5 feet[1]. The second floor is accessible from Jefferson Avenue at approximately Elevation 90 feet.

The first floor is currently occupied by UWT for storage and construction office space. The Old Spaghetti Factory restaurant currently occupies the second floor. The third and fourth floors are currently used for storage by UWT.

2.2. Proposed Development Plans

We understand UWT plans to redevelop the existing building as a "core and shell" in the next two years. The design team has developed a predesign report and is currently continuing into the initial design phase. Additional improvements will occur at a later date as the programs for the space are defined. The "core and shell" redevelopment will likely consist of a complete restoration of the building to include seismic upgrades that may require new footings and shear walls along with upgraded utilities. It is anticipated the existing shell of the building and finished floor elevation of the building will remain as-is at this time (approximately 10,000 square feet and Elevation 70.5 feet, respectively).

The project is being executed under the general contractor/construction manager (GC/CM) model of design and construction. The project team related to soils consists of Miller Hull (architect), Mortenson Construction (contractor), PSC Structural Solutions (structural engineer), and GeoEngineers (environmental and geotechnical engineering).

[1] Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, Elevation 165.15).

3.0 HISTORICAL USE

The existing building was constructed between 1904 and 1905 initially as a candy factory for the Tacoma Biscuit and Candy Company. Boilers and ovens were located on the first floor in the warehouse and storeroom. A freight elevator located on the west side of the building serviced the four floors. Offices and the shop were located on the second floor at the elevation of Jefferson Avenue. The third floor was utilized as the main stockroom. The production area was on the fourth floor.

The following summarizes the historical use of the building beginning in 1906.

- 1906. Union Pacific Railroad purchased the building and Tacoma Biscuit and Candy Company vacated the building.
- 1907. A spice company used the building as temporary quarters.
- 1911 to 1942. Tacoma Paper and Stationary Company (wholesale paper company) was in operation during this time. The south end of the building was previously used as a sign printing shop based on information provided in the 1912 Sanborn map. Solvents may be associated with ink printing.
- 1943 to 1953. Blake, Moffitt and Towne, Inc. (wholesale paper company) operated their business at the site during this time. The 1950 Sanborn map indicates the space was utilized as merchandise warehouse.
- 1953 to 1957. Vacant
- 1957 to 1961. McCormack Distributing
- 1961 to 1968. Vacant
- 1969 to 1971. Pacific Storage Company
- 1971 to Present. Old Spaghetti Factory Restaurant

Permit records indicate that repairs occurred from a fire that damaged the building in 1928. Installation of an oil burner followed the repair activities in 1929. The location and presence of the tank that stored the heating oil for the oil burner is not known. Permit records also show that a 3,000-gallon grease interceptor tank was installed on the east side of the building within the Prairie Line Trail as recently as 1999. The grease trap is associated with the Old Spaghetti Factory restaurant. The interceptor tank was replaced in 2014 during construction for the Prairie Line Trail.

4.0 AGREED ORDER

UW entered into an Agreed Order (#DE 97HW-S238) with the Washington State Department of Ecology (Ecology) in 1997 for known contaminated soil and groundwater on the UWT campus. UW and Ecology are currently in the process of issuing a new Agreed Order for the UWT campus. The site is located within the boundaries of the existing and future Agreed Orders.

5.0 PREVIOUS INVESTIGATIONS

A remedial investigation/feasibility study (RI/FS) was completed on several parcels located near the site between 2000 and 2009. Additional subsurface investigation was completed within and adjacent (upgradient and downgradient) of the site in 2013/2014. The chemical analytical results for the 2013/2014 investigation are included in Tables 1 and 2.

5.1. Chemical Analytical Results of Previous Investigation

5.1.1. Site

An environmental subsurface investigation was completed at the site in 2013. The investigation consisted of direct-push borings, installation of a new monitoring well, groundwater development and sampling of existing monitoring wells and collection of a water sample from the municipal water supply. Five borings were completed to depths ranging between 3 and 12 feet below ground surface (bgs) when practical refusal was encountered. A full reconnaissance of the ground floor was not practical due to the presence of stored materials throughout the ground floor in 2013. Therefore, we were unable to review the entire first floor for potential areas where PCE may have been disposed in the past (drywells or cisterns).

TETRACHLOROETHYLENE (PCE)

PCE was detected at concentrations greater than the Model Toxics Control Act (MTCA) Method A Unrestricted Land Use (ULU) cleanup level (0.05 milligram per kilogram [mg/kg]) in the following two soil samples:

- 2D-B2-4-5 (0.12 mg/kg) collected from 4 to 5 feet bgs in boring 2D-B2.
- 2D-B1-8-9 (0.083 mg/kg) collected from 8 to 9 feet bgs in boring 2D-B1.

PCE was detected at concentrations less than the MTCA Method A ULU cleanup level in five soil samples collected at depths ranging from below the concrete slab to approximately 12 feet bgs. Groundwater was not encountered in the borings completed inside the building. The vertical limit of the PCE contaminated- and impacted-soil was not fully evaluated due to drilling refusal because of the dense soil. Polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons, metals and other volatile organic compounds (VOCs) were either not detected or detected at concentrations less than the MTCA Method A ULU cleanup level as summarized in Table 1.

PCE and trichloroethylene (TCE) were not detected in groundwater collected within the shallow and deep aquifers in the monitoring wells (JS-MW3S and JS-MW3) located generally upgradient of the site. These results indicate the source of PCE in the soil does not appear to originate from an upgradient source. The source of the PCE is possibly from historic operations within the building, but the exact location is unknown.

Industrial uses of PCE are dry cleaning/textile processing, metal degreasing, printing inks, typewriter correction fluids, adhesive formulations and paper coatings. A wholesale paper company operated in the building between 1911 and 1953 and a sign printing shop was located in the southern portion of the building in at least 1912. Historical operations of printing or coating paper may be the source of the PCE within the building; however the actual source is unknown. The first floor was not fully investigated for potential areas where PCE may be been disposed in the past (drywells or cisterns) due to the presence of stored materials on the floor.

BENZENE

Benzene was detected in soil at concentrations less than the MTCA Method A Unrestricted Land Use (ULU) cleanup level at a depth of approximately 1 foot bgs on the northwest portion of the site. The source of the benzene is not known.

5.1.2. Upgradient of the Site

Approximately 55 groundwater monitoring wells have been installed within the shallow and deep aquifers over the course of the investigations and remediation efforts in the area west of the site. Two wells (JS-MW3 and JS-MW3S) were installed directly upgradient of the site on Jefferson Avenue as shown on Figure 3. Well JS-MW3s is screened within the shallow aquifer and well JS-MW3 is screened within the deep aquifer.

TCE

A TCE-contaminated groundwater plume is located west and south of the site. The known extent of the westerly contaminant plume generally trends from south of South 19th Street and Tacoma Avenue to north of South 19th Street and Jefferson Avenue. The plume appears to be present within the shallow and deep aquifers west of the site and in the deep aquifer south of the site.

The source(s), along with the vertical and lateral extents of the westerly groundwater contaminant plume is not known at this time. The westerly plume does not appear to have impacted the site based on the groundwater samples collected from JS-MW3 and JS-MW3S in 2013.

DIESEL-RANGE PETROLEUM HYDROCARBONS

Diesel-range petroleum hydrocarbons were detected in the groundwater sample collected in shallow monitoring well (JS-MW3S) at a concentration less than the MTCA Method A groundwater cleanup level. The source of the diesel-range petroleum hydrocarbons is unknown but may be related to the former service station located on the Jefferson Street Parcel situated upgradient of the site. Petroleum-contaminated soil was remediated from the Jefferson Parcel in 2012.

5.1.3. Downgradient of the Site – Howe Plume

The Howe plume consists of PCE-contaminated groundwater. The Howe plume is generally located along Pacific Avenue and generally trends from the Howe Building (South 19th Street Stairs and Pacific Avenue) to the Federal Courthouse located across Pacific Avenue to the northeast. An interim action consisting of EHC® reagent injections were implemented in 2013 in an effort to reduce PCE concentrations within the Howe plume. The lateral extent of the PCE-contaminated groundwater downgradient of the Urban Solutions Center has not been fully characterized and it may be comingling with the Howe Plume PCE-contaminated groundwater.

6.0 2014 FIELD INVESTIGATION PROGRAM

The field program implemented during this project was completed in general accordance with the Sampling and Analysis Plan and Quality Assurance Project Plan University of Washington Tacoma CPO Project No. 204701 Urban Solutions Center 1735 Jefferson Avenue Tacoma, Washington (SAP/QAPP) dated October 17, 2014 included in Appendix A. The field procedures, sampling methodology and borings logs are included in Appendix B. The field program consisted of the following items:

- Two hollow-stem auger soil borings and monitoring well installation

- One shallow aquifer monitoring well (USC-MW1S) east of the building to a depth of 25.5 feet bgs
- One deep aquifer monitoring well (USC-MW1D) east of the building to a depth of 56 feet bgs

- Groundwater monitoring of existing wells and new wells installed during this project (USC-MW1S, USC-MW1D, JS-MW3S and JS-MW3)
- Soil gas sampling within the building (USC-SV1 through USC-SV5)

Deviations to the SAP include the following:

- Boring USC-MW1D was completed to a depth of 60 feet bgs instead of 50 feet bgs based on the lithology observed during drilling activities.
- Bentonite was placed inside each of the holes drilled during soil vapor pin installation to help create a better seal with the vapor pin because the concrete lacked sufficient cement and contained a number of void spaces.
- The location of subslab sample USC-SV5 was moved to the north due to storage observed in the area of the proposed location.

7.0 SOIL AND GROUNDWATER CONDITIONS

7.1. Published Literature

The geology and landforms at the site are largely shaped by the advance and retreat of glaciers during late Pleistocene glaciations approximately 300,000 to 10,000 year ago. Up to 1,800 feet of unconsolidated sediments are mapped in the Tacoma area (Jones et al., 1999). Geologic units pertinent to this study were deposited during the most recent glaciation (Vashon Stade of Frasier Glaciation) that retreated between 13,000 and 10,000 years ago. The entire surface of the UWT campus was recently mapped as ice-contact deposits (Qvi) (Troost in review). The typical geologic sequence in the Tacoma area consists of Vashon Drift that is composed of the following from youngest to oldest: recessional outwash deposits, recessional lacustrine deposits, Steilacoom Gravel, ice-contact deposits, Vashon till, and advance outwash deposits; Lawton Clay. The Vashon drift is underlain by pre-Fraser deposits (Troost in review).

7.2. Subsurface Explorations

Subsurface explorations conducted on portions of the site during this and previous investigations indicate soil conditions similar to those described in the published literature. Subsurface conditions consist of fill, ice-contact deposits and advance outwash. A general cross section of our interpretation of subsurface conditions is included as Figure 3.

The fill within the building consists of silt and sand (silt with sand and/or sand with silt) from the ground surface to depths ranging from 0.5 to 2 feet below ground surface (bgs). The fill observed at the location of USC-MW1D is described as a silty sand with occasional gravel and was observed to depths of approximately 5 feet bgs.

The ice-contact deposits were observed below the fill to depths of 46 to 51 feet bgs. We interpret the ice contact deposits having separate characteristics at depth. Silty sand and sands with silt were generally

encountered from below the fill to depths of 22.5 to 25 feet bgs. We interpret this silty sand layer as a shallow aquifer water-bearing unit.

A silt layer was also observed on the west side of the building from depths of 22.5 to 25 feet bgs as described in our SAP/QAPP. We did not observe this silt unit in USC-MW1D.

Ice-contact deposits generally consisted of a mixture of silty sand with gravel and silty gravel from approximately 25 to 50 feet bgs in USC-MW1D. On the west side of the building, the ice contact deposits described near these depths (JS-MW3) contain less gravel than observed in USC-MW1D. The ice-contact deposits described at these depths were not observed to be saturated.

Fine to coarse sand with trace silt was typically encountered below ice-contact deposits. We interpret this material to be advance outwash. The advance outwash was observed to be saturated during drilling.

7.3. Groundwater Conditions

It appears that groundwater conditions consist of a shallow aquifer located within the ice-contact deposits and deep aquifer located within the advance outwash. The shallow and deep aquifers appear to be separated by semi-confining to confining layer of a mixture of silty sand with gravel and silty gravel located at the base of the ice-contact deposits.

It appears that the groundwater within the shallow aquifer is continuous across the project site based on the groundwater information observed in USC-MW1S. The elevation ranged from approximately 70.10 feet on the west side of the site to approximately 49.02 feet on the east side of the site in October 2014 as shown on Figure 3 and in Table 3. The groundwater levels were also measured after a heavy rain event on December 9, 2014. During this event, the groundwater level increased in both the wells screened within the shallow aquifer. The measured groundwater level change in both these wells is listed below.

- Water level in well JS-MW3S rose approximately 0.65 feet to Elevation 71.1.
- Water level in well USC-MW1S rose approximately 0.36 feet to Elevation 49.38 feet.

Groundwater within the deep aquifer appears to be continuous. The deep aquifer appears to be under a confined condition within the advance outwash. The depth of the saturated soils observed during drilling and the measured depth to groundwater following well installation varied by approximately 10 to 29 feet. The elevation of the potentiometric surface of the deep aquifer in October 2014 ranges from approximately 52.88 feet on the west side of the site (JS-MW3) to 47.55 feet on the east side of the site (USC-MW1D) as shown on Figure 3 and in Table 3.

Groundwater was not encountered in the subsurface explorations completed inside the building. Groundwater levels will vary depending on season, precipitation and other factors.

8.0 SAMPLING AND CHEMICAL ANALYTICAL RESULTS

8.1. Soil

A total of eight soil samples were submitted for chemical analysis from boring USC-MW1D to evaluate the vertical extent of PCE-contaminated soil. The samples collected from the boring were identified using the following identification system: Location-MW#Letter-start depth-end depth, where Location is the

general UWT building location-MW# is the monitoring well number and screen location and start depth-end depth is the depth interval of specific sample (e.g., USC-MW1D-10-11.5 was collected from Urban Solutions Center monitoring well number 1 in the deep aquifer between 10 and 11.5 feet bgs).

The soil samples were analyzed for VOCs by United State Environmental Protection Agency (EPA) Method 8260D. The chemical analytical results are summarized in Table 2. The chemical analytical data are described below relative to MTCA Method A ULU cleanup levels for soil. MTCA Method B ULU cleanup levels were used for comparison of barium, selenium and silver and specific VOCs and semi-volatile organic compounds (SVOCs) because Method A cleanup levels have not been established for these compounds.

8.1.1. PCE

PCE was detected at concentrations greater than the MTCA Method A ULU cleanup level in the following four soil samples:

- USC-MW1D-11.5-13 (0.22 mg/kg) from 11.5 to 13 feet bgs
- USC-MW1D-16.5-18 (0.24 mg/kg) from 16.5 to 18 feet bgs
- USC-MW1D-20-21.5 (0.070 mg/kg) from 20 to 21.5 feet bgs
- USC-MW1D-40-40.5 (0.079 mg/kg) from 40 to 40.5 feet bgs

PCE was detected at concentrations less than the MTCA Method A ULU cleanup level in the following three soil samples:

- USC-MW1D-10-11.5 (0.048 mg/kg) from 10 to 11.5 feet bgs
- USC-MW1D-21.5-22 (0.034 mg/kg) from 21.5 to 22 feet bgs
- USC-MW1D-27.5-28 (0.016 mg/kg) from 27.5 to 28 feet bgs

PCE was not detected in one soil sample collected from 51 to 52 feet bgs within the saturated zone of the deep aquifer (advance outwash).

8.1.2. TCE

TCE was detected at concentrations less than the MTCA Method A ULU cleanup in two soil samples collected from 20 to 22 feet bgs. The soil samples were collected within the shallow groundwater aquifer. TCE was not detected in the remaining analyzed soil samples.

8.1.3. Other VOCs

Other VOCs were either not detected or detected at concentrations less the respective MTCA Method A ULU or Method B cleanup levels.

8.2. Groundwater Sampling and Chemical Analytical Results

A total of four groundwater samples were submitted for chemical analysis. The groundwater samples were collected from two upgradient wells (shallow [JS-MW3S] and deep [JS-MW3]) and two downgradient wells (shallow [USC-MW1S] and deep [USC-MW1D] and). The samples collected from the boring were identified using the following identification system: Location-MW#Letter-date collected, where Location is the general UWT building location-MW# is the monitoring well number and dated collected (year, month, day)

(e.g., USC-MW1D-141027 was collected from Urban Solutions Center monitoring well number 1 between on October 22, 2014).

The chemical analytical data are described below relative to MTCA Method A Groundwater cleanup levels and MTCA B Groundwater Screening Levels Protective of Indoor Air. Method B groundwater criteria were used for comparison of barium, selenium and silver and specific VOCs and SVOCs because Method A cleanup levels have not been established for these compounds. Updated TCE, PCE and trans-1,2-dichloroethene groundwater screening levels protective of indoor air were calculated using Equation 1 from Ecology's review draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" dated October 2009 (draft VI guidance; Ecology, 2009) and updated MTCA Method B air cleanup levels from Ecology's May 2014 Excel workbook "CLARC Master Spreadsheet.xlsx." The other screening level values were obtained from Ecology's draft VI guidance. The calculation to update screening levels is included in Appendix C.

The groundwater samples were analyzed for VOCs by EPA method 8260D. One groundwater sample was analyzed for diesel-range petroleum hydrocarbons by Ecology-approved method NWPTH-Dx due to detections of diesel-range petroleum hydrocarbons in groundwater samples collected in 2013. The chemical analytical results are summarized in Table 3.

8.2.1. PCE

PCE was detected at a concentration (330 micrograms per liter [µg/L]) greater than the MTCA Method A Groundwater cleanup level (5 µg/L) and the MTCA Method B Groundwater Screening Levels Protective of Indoor Air (24 µg/L) in groundwater samples collected from well USC-MW1S. Well USC-MW1S is located downgradient of the existing building and screened within the shallow aquifer. PCE was detected in the deep aquifer at a concentration (1.5 µg/L) less than the MTCA Method A Groundwater cleanup level (5 µg/L) and the MTCA Method B Groundwater Screening Levels Protective of Indoor Air (24 µg/L) in the groundwater samples collected from well USC-MW1D. Well USC-MW1D is located downgradient of the existing building and screened within the deep aquifer.

PCE was not detected in the two upgradient wells screened in the shallow and deep aquifers (JS-MW1S and JS-MW1D).

8.2.2. TCE

TCE was detected at a concentration (3 µg/L) less than the MTCA Method A Groundwater cleanup level (5 µg/L), but greater than the MTCA Method B Groundwater Screening Levels Protective of Indoor Air (1.5 µg/L) in the groundwater sample collected from well USC-MW1S. TCE was not detected in the remaining analyzed groundwater samples.

8.2.3. Other VOCs

Other VOCs were either not detected or were detected at concentrations less than the respective MTCA Method A Groundwater, Method B cleanup levels, or Method B Groundwater Screening Levels Protective of Indoor Air.

8.2.4. Diesel-Range Petroleum Hydrocarbons

Diesel-range petroleum hydrocarbons were not detected in the analyzed groundwater sample collected from JS-MW3S.

9.0 SOIL VAPOR SAMPLING AND CHEMICAL ANALYTICAL RESULTS

Vapor intrusion has increasingly become a concern at chlorinated volatile organic compounds (CVOCs) sites that have been partially or fully developed with structures. CVOC vapors in the subsurface that volatilize from impacted groundwater and/or soil may collect beneath building foundations and intrude into the building's indoor air through cracks in the foundation or other preferential pathways (e.g., utility penetrations, floor sumps, crawlspaces, etc.).

PCE has been detected in soil and groundwater beneath the Urban Solutions Center, a TCE-contaminated groundwater plume is located immediately upgradient (southwest) of the building, and PCE, TCE and cis-1,2-Dichloroethylene (DCE) have been detected in soil and/or groundwater east of the site. Therefore, soil gas samples were submitted for chemical analysis of these three CVOCs, along with PCE and TCE daughter products 1,1-DCE, trans-1,2-DCE, and vinyl chloride.

9.1. Soil Vapor Sampling

Five sub-slab soil vapor samples (locations USC-SV1 through USC-SV5) were obtained on October 24, 2014 to evaluate the potential for vapor intrusion. These five locations were selected to sample sub-slab soil gas across the building footprint, with a focus on the southwest side of the building because of the TCE-contaminated groundwater plume and because PCE was detected in soil at concentrations greater than the MTCA Method A soil cleanup level on the southwest side of the building during the 2013 soil sampling. The five locations are shown on Figure 3.

The samples collected from the sub-slab vapor samples were identified using the following identification system: Location-SV#Letter-date collected, where Location is the general UWT building location-MW# is the soil vapor probe number and dated collected (year, month, day) (e.g., USC-SV1-141024 was collected from Urban Solutions Center soil vapor probe number 1 on October 24, 2014).

Sub-slab soil gas samples were collected using Vapor Pin™ sampling devices; sample collection and handling was consistent with Ecology's draft VI guidance (Ecology, 2009). The Vapor Pins™ were installed following the manufacturers' standard operating procedures (SOPs). The detailed sampling protocol is also described in Appendix B. As noted in Appendix B, bentonite was placed inside each of the holes drilled during Vapor Pin™ installation to help create a better seal with the vapor pin because the concrete lacked sufficient cement and contained a number of void spaces.

9.2. Soil Vapor Sample Chemical Analytical Results

The soil vapor samples were submitted to Eurofins Air Toxics in Folsom, California for analysis of CVOCs (PCE, TCE, 1,1-DCE,cis-1,2-DCE, trans-1,2-DCE and vinyl chloride) by EPA Method TO-15 SIM and helium by ASTM Method D-1946. Soil vapor chemical analytical results are summarized in Table 4. Laboratory reports are presented in Appendix D.

The results indicate that PCE was detected in each sample submitted for analysis. The other five CVOCs were not detected in the analyzed samples.

Helium was not detected in sample SV1, but was detected in the other four samples at concentrations ranging from 1.4 to 7.3 percent. Helium detections in the soil gas samples indicate that some ambient air was collected in the Summa Canister, thereby diluting the soil gas sample. However, helium concentrations less than 5 percent are considered acceptable (California Environmental Protection Agency/Department of Toxic Substances Control; Cal-EPA/DTSC, 2012). Therefore, the soil gas results at location USC-SV5 are considered suspect due to a helium concentration at 7.3 percent. As noted in Appendix B, the concrete slab lacked sufficient cement and contained a number of void spaces requiring the placement of bentonite inside of the hole to help create a better seal with the vapor pin. Location SV5 was sampled twice as our field representative was unable to adequately seal the vapor pin on the first sampling attempt. On the second attempt the shut-in test and field portion of the leak test (helium testing using the hand-held helium meter) demonstrated the integrity of the soil vapor assembly. Therefore, the elevated helium results on the second attempt were unexpected.

A vapor intrusion (VI) evaluation was conducted for the proposed Urban Solutions Center in a manner consistent with the Tier 1 Assessment presented in Ecology's draft 2009 VI guidance (Ecology, 2009). The first step was to compare PCE soil gas concentrations to soil gas screening levels. The second step was to use EPA's Johnson and Ettinger Model (J&E) Excel workbook (SG-ADV-Feb04.xls) to predict indoor air concentration and compare these predicted air concentrations to TCE indoor air risk-based concentrations.

9.3. Vapor Intrusion Evaluation

The MTCA Method B air cleanup level and a calculated Method B air remediation level were used to evaluate the soil gas concentrations. The MTCA Method B air cleanup level is 9.6 micrograms per cubic meter (µg/m^3) for PCE based on a residential exposure use (365 days/year, 24 hours/day, 30 years). However, the Method B air cleanup level likely overestimates potential exposure at the building because the intended use of the building is identified as office and classroom space. A MTCA Method B air remediation level for PCE was calculated based on instructors and students being in the classroom space (based on a typical commercial/occupational scenario [250 days/year, 8 hours/day, 20 years]). The calculated Method B air remediation level is 63 µg/m^3.

9.3.1. Step 1. Soil Gas Screening Levels Evaluation

Following Ecology's draft VI guidance, soil gas screening levels are calculated by dividing the acceptable air concentration (cleanup or remediation level) by a vapor attenuation factor. The default MTCA vapor attenuation factor for sub-slab soil gas is 0.1. That is, soil gas concentrations are assumed to be 10 times higher than indoor air concentrations. EPA recently developed attenuation factors for chlorinated compounds and residential buildings and updated their VI guidance and EPA now recommends a sub-slab soil gas vapor attenuation factor of 0.03 (EPA, 2012).

The following sub-slab soil gas screening levels were used in the Tier 1 Assessment:

MTCA Indoor Air Levels[1]	Sub-Slab Soil Gas Screening Levels	
	MTCA Attenuation Factor = 0.1	EPA Attenuation Factor = 0.03
Cleanup Level = 9.6 µg/m^3	96 µg/m^3	320 µg/m^3

MTCA Indoor Air Levels[1]	Sub-Slab Soil Gas Screening Levels	
	MTCA Attenuation Factor = 0.1	EPA Attenuation Factor = 0.03
Remediation Level = 63 µg/m^3	630 µg/m^3	2,100 µg/m^3

[1] MTCA Method air cleanup and remediation levels calculated using exposure assumptions noted above.

As shown in Table 4, PCE was detected at concentrations ranging from 670 µg/m^3 to 6,000 µg/m^3, with an average PCE concentration of 2,750 µg/m^3. These concentrations are greater than the four sub-slab soil gas screening levels. PCE concentrations at USC-SV2 (1,000 µg/m^3), USC-SV4 (1,000 µg/m^3), and USC-SV5 (670 µg/m^3) are less than the highest screening level of 2,100 µg/m^3. The average PCE concentration noted above was calculated without using the result from USC-SV5, which as noted above, is suspect due to elevated helium in that sample.

9.3.2. Step 2. Johnson and Ettinger Vapor Intrusion Modeling

Ecology's draft VI guidance allows the use of the J&E Model to predict indoor air concentrations when soil gas concentrations are greater than screening levels. Further VI assessment is not needed if:

- Measured soil gas concentrations predict indoor air concentrations less than acceptable levels,
- The J&E model is used in a conservative manner (outlined in Ecology's draft VI guidance), and
- Utility lines penetrating the floors or walls do not leave "large unsealed openings," there are no sumps in the floor that are "open" to soil gas, and the building does not have an earthen floor.

Ecology's draft VI guidance does allow changes to the default MTCA J&E model assumptions to evaluate existing buildings. The specifics of the model data entry are included in Appendix E. One parameter the J&E model estimates is Q_{soil}; the average volumetric flow rate into a building from the subsurface in liters per minute. Ecology, Cal-EPA/DTSC, (2011) and New Jersey (2013) VI guidance recommends adjusting Q_{soil} when evaluating VI for buildings that are considerably larger than an average residence. Ecology's draft VI guidance includes an approach recommended by the State of New Jersey that is appropriate for buildings where the soil gas entry routes are likely to be primarily located at the perimeter. Cal-EPA/DTSC recommends an approach that is appropriate where the soil gas entry routes are located throughout the building slab. The two equations to adjust the Q_{soil} to a larger building space are as follows:

- New Jersey: Q_{soil} = default Q_{soil} for a residence (5 liters per minute) multiplied by the ratio of the target building perimeter (X Feet) and the perimeter of a default residence (131 feet).
- California: Q_{soil} = default Q_{soil} for a residence (5 liters per minute) multiplied by the ratio of the target building surface area (Y square feet) to default residence surface area (1,076 square feet)

J&E model evaluations were conducted for two "buildings;" the ground floor of the Urban Solutions Center and a 125-square foot office space.

GROUND FLOOR OF URBAN SOLUTIONS CENTER

- Building dimensions = approximately 100 feet by 100 feet.
- Enclosed space height = 16 feet (page 111 of Predesign Report, reduced from 17.75 feet to 16 feet to be conservative).
- Air exchange rate = 0.5 exchange per hour (MTCA commercial default).

- Floor cracks. EPA's J&E Excel workbook assumes that cracks in a building slab are located around the building perimeter. Therefore, the assumed crack length in the model is equal to the length of the building perimeter, or 400-feet for the Urban Solutions Center. In addition to the potential perimeter cracks, the Urban Solutions Center slab also includes significant expansion joints. GeoEngineers estimated a total of approximately 2,200 feet of cracks in the slab.
- Q_{soil} 46.5 liters per minute. The Q_{soil} was calculated using the New Jersey and the California methods.
  - The New Jersey approach multiplies the default Qsoil for a residence (5 liters per minute) by the ratio of the target building perimeter (400 feet) and the perimeter of a residence (131 feet). Using the New Jersey approach the Q_{soil} for the Urban Solutions Center would be 15.2 liters per minute.
  - Cal-EPA/DTSC approach uses 5 liters per minute multiplied by the ratio of the target building surface area (10,000 square feet) to default residence building surface area (1,075 square feet) resulting in a Q_{soil} of 46.5 liters per minute (Cal-EPA/DTSC 2011).

Because potential soil gas entry routes are not limited to the building perimeter, the Cal-EPA/DTSC approach was used.

SMALL OFFICE SPACE IN URBAN SOLUTIONS CENTER

A smaller room inside the ground floor of the Urban Solutions Center was modeled to evaluate if the indoor air concentrations are different within a smaller space as opposed to the entire ground floor.

- Room dimensions = approximately 10 feet by 12.5 feet (smallest office size on UWT campus).
- Enclosed space height = 16 feet (page 111 of Predesign Report, reduced from 17.75 feet to 16 feet to be conservative).
- Air exchange rate = 0.5 exchange per hour (MTCA commercial default).
- Q_{soil} = 0.58 liters per minute (5 liters per minute * 125 square feet/1,075 square feet). The New Jersey approach does not apply because office space within the building would not be expected to have perimeter cracks. Rather, any potential soil gas entry routes could be located at any portion of the slab within the office space. Therefore the California EPA approach was used it allows an adjustment of Q_{soil} based on the surface area.

Using the PCE soil gas concentrations from locations USC-SV1 through USC-SV5 and the building assumptions presented above, the table below and in Table 5 presents the estimated indoor air concentrations calculated using EPA's J&E Model Excel workbook (SG-ADV-Feb04.xls).

ESTIMATED PCE INDOOR AIR CONCENTRATIONS VIA JOHNSON AND ETTINGER MODEL

Sample ID	Soil Gas (µg/m³)	Entire Building (10,000 square feet with 16 foot Ceiling (µg/m³)	Small Office (125 square feet with 16 foot Ceiling) (µg/m³)
		Cal-EPA/DTSC	Cal-EPA/DTSC
USC-SV1	3,000	3.7	3.7
USC-SV2	1,000	1.2	1.2
USC-SV3	6,000	7.3	7.3

Sample ID	Soil Gas (µg/m³)	Entire Building (10,000 square feet with 16 foot Ceiling (µg/m³)	Small Office (125 square feet with 16 foot Ceiling) (µg/m³)
		Cal-EPA/DTSC	Cal-EPA/DTSC
USC-SV4	1,000	1.2	1.2
USC-SV5	670	0.82	0.82
Average (without SV5)	2,750	3.4	3.4

The estimated PCE indoor air concentrations are less than the MTCA Method B air cleanup level of 9.6 µg/m³ and remediation level of 63 µg/m³. Therefore, further VI assessment is not required as noted in Ecology's draft VI guidance,

10.0 SUMMARY OF SUBSURFACE INVESTIGATION FINDINGS

The existing four-story building was used historically by candy manufacturing, general storage and wholesale paper companies. UW plans to redevelop the interior of the building starting in late summer of 2015. PCE-contaminated soil and groundwater is present beneath the USC Building.

Results from subsurface explorations indicate general geologic units consist of ice-contact deposits and advance outwash. The base of the ice-contact deposits appears to act as semi-confining till-like layer. The shallow aquifer appears to be an unconfined aquifer. The deep aquifer appears to be a confined aquifer. The geologic units and the groundwater aquifers slope to the east across the site as shown in Figure 3. The existing building is located within the ice-contact deposits. The foundation of the utilidor appears to intersect the shallow groundwater based on the groundwater elevations in nearby wells and the presence of water within the utilidor.

PCE-contaminated groundwater is present within the shallow aquifer downgradient of the site. PCE-impacted and contaminated soil is present within the ice-contact deposits to depths of at least 40.5 feet bgs. PCE is present in the deep aquifer as concentrations less than the respective cleanup levels and approximately 100 times less than the PCE concentration in the shallow aquifer. The semi-confining to confining layer at the base of the ice-contact deposits appears to restrict the flow of water, however PCE is appears to be migrating through the unit. The source of the PCE is unknown, but does not appear to be migrating from a site upgradient of USC.

Vapor intrusion does not appear to be a risk at the site based on the sub-slab sampling results and subsequent modeling completed in accordance with Ecology's "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action- Review draft" dated October 2009.

Petroleum, PAHs, metals and other VOCs were either not detected or were detected at concentrations less than the respective MTCA method cleanup/criteria levels in the soil and groundwater.

11.0 SOIL AND WATER MANAGEMENT PLAN AND ENVIRONMENTAL MITIGATION MEASURES

11.1. General

The soil and water management plan and environmental mitigation measures are identified in this section. The soil and water management plans and mitigation measures discussed below are based on our interpretation of subsurface conditions identified to date. The recommendations may change based on field conditions observed during the construction activities.

11.2. Remedial Activities

Remedial activities on the site will be addressed on a campus-wide approach during the remedial investigation and feasibility study to be implemented in the future under the new Agreed Order (currently under negotiation). Remediation of the PCE-contaminated soil and groundwater is not planned prior to or during construction of the USC Building. If PCE-contaminated soil and groundwater are encountered during construction, the removed material will be properly managed and disposed as described in Section 11.5.

11.3. Heating Oil UST

An oil burner was installed in 1929 based on our review the historical records. The type (above ground storage tank or underground storage tank) of tank is not known. The location and current status of the tank is also not known. If the tank is encountered during construction, the project team should plan for removal and potential remediation of petroleum-contaminated soils. The project team shall incorporate specifications that require the contractor to contact UW EH&S if petroleum contaminated soil or an UST is encountered.

11.4. Potential Cisterns or Drywells

Following removal of the storage material located within the ground floor, GeoEngineers will complete a reconnaissance to evaluate for the presence of cistern and drywells. The contractor will also notify GeoEngineers, UW CPO and UW EH&S if a cistern or drywell is encountered during demolition activities. If a cistern or drywell is encountered GeoEngineers will assess if it is a potential source of PCE to the soil and groundwater prior to sealing the cistern or drywell.

11.5. Soil and Water Management

11.5.1. Soil

Soil will be generated during construction during the structural upgrades and trenching within the building for utilities as described in Section 11.5. The exact location of the excavations is now known at this time. PCE was detected in the soil, however the source is not known. We recommend soil characterization in the area of the proposed excavations be completed approximately five months prior to construction activities. Based on the chemical concentrations detected in previous investigations, it does not appear the soil will be characterized as hazardous waste. This will provide suitable time period to evaluate the soil, obtain a "Contained In" approval from Ecology (if necessary) and approval from a UW-approved Subtitle D landfill. Soil disposed at a UW-approved Subtitle D landfill must not contain free liquids. The landfill will also require the soil to pass the Paint Filter Liquids Test in accordance with EPA method 9095B.

11.5.2. Water

Water that will be generated on the site will likely consist of dewatered water. Stormwater is not anticipated to be generated because the project will be located within the existing building footprint. Dewatered water consists of water removed from the subsurface via dewatering wells and from open excavations. Stormwater originates during precipitation events. Based on the location and depths of the excavation relative to the depth of groundwater, the design team should evaluate the volume of water and obtain a discharge permit to the City of Tacoma sanitary sewer, if necessary. Alternatively, the design team may choose to dispose of the water at a UW-approved disposal facility. Water that is generated during construction will be sampled and properly disposed in accordance with local, state and federal requirements.

11.6. Building Design and Mitigation Measures

The building design discussed in the following sections are based on information provided in the by Mortenson Construction in November 2013. The building design is preliminary and is subject to change. We recommend the design team coordinate with GeoEngineers and UW EH&S as the design is further developed. The depths below the surface are described relative to the top of the existing slab.

The building subsurface upgrades will likely include additional spread foundations, micropiles, utility trenches, and repairs to the concrete slab. Upgrades may also include an underslab drain. This section described mitigation measures associated with these design elements.

11.6.1. Spread Footings

Additional spread footings will require excavation of PCE impacted and potentially contaminated soil. Soil characterization and handling shall be completed as discussed in Section 11.4. The depth to the shallow aquifer appears to vary from approximately 3-feet bgs on the west side of the building to 17 feet bgs on the east side of the building. If water is encountered during installation of the spread footings, the water shall be managed as discussed in Section 11.4.

11.6.2. Micropiles

Micropiles may be used as part of the foundation design. In the preliminary design, the micropiles at limited to less than 30 feet bgs. The top and bottom of the semiconfining layer vary from the west to east side of the building as follows:

- West side of building 5 to 30 feet bgs
- East side of building 20 to 50 feet bgs

We understand the current design the micropiles are grouted with concrete or control density fill to reduce the risk of cross contamination between the two aquifers. Micropiles are an acceptable design and construction method as discussed with Ecology. The depth to the shallow aquifer appears to vary from approximately 3-feet bgs on the west side of the building to 17 feet bgs on the east side of the building. If the micropiles are cased we recommend the project team consult GeoEngineers during the design. The project team should also be aware, the deep aquifer has subartesian conditions. If the deep aquifer is penetrated the water level may rise to approximately 15 feet bgs. Soil and water generated during installation of the micropiles shall be managed as discussed in Section 11.4.

11.6.3. Utility Trenches

The location and depth of the utility trenches is not known at this time. Soil and water generated during installation of utilities shall be managed as discussed in Section 11.4.

11.6.4. Slab Repairs

At the time of this report the existing slab is planned to remain in place. A vapor mitigation is not planned because vapor intrusion is not a concern based on the J&E modeling completed for the project as described in Section 11.4. However, mitigation measures to reduce the potential for vapor intrusion and adhere to the assumptions in the J&E model are planned as part of the construction. The design teams' current plan includes the following repairs to the existing slab:

- Areas where the slab areas currently missing or cut during construction activities will be replaced.
- Existing cracks will be sealed with standard construction techniques.
- Existing and new penetrations will be sealed with standard construction techniques.
- If large unsealed areas (cisterns) are encountered during construction, the contractor will notify UW CPO, GeoEngineers and UW EH&S to evaluate if the cistern or drywell is a source of the PCE in the soil and groundwater. The areas will be sealed following the evaluation to be performed by GeoEngineers.

11.6.5. Underslab Drain

At the time of this report, it has not been determined by the design team if an underslab or footing drain will be part of the design. If under slab drains are installed, the water will be routed to either the sanitary sewer or storm sewer based on water test results. We recommend the project team consult with GeoEngineers and UW EH&S for coordinate with the City of Tacoma publicly owned treatment works (POTW) regarding final disposition of the water.

11.6.6. Existing Monitoring Wells

We recommend the existing monitoring wells are protected during construction activities in order to maintain these wells for future groundwater monitoring events. We recommend monitoring wells JS-MW3, JS-MW3S, UCS-MW1D and USC-MW1S be added to the existing conditions plan set and be treated as live utilities during construction.

12.0 LIMITATIONS

This report has been prepared for the University of Washington Tacoma Urban Solutions Center located in Tacoma, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix F titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

13.0 REFERENCES

Cal-EPA/DTSC, 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). California Environmental Protection Agency, Department of Toxic Substances Control. October 2011.

Cal-EPA/DTSC, 2012. Advisory, Active Soil Gas Investigations. California Environmental Protection Agency, Department of Toxic Substances Control; Los Angeles Regional Water Quality Control Board; and San Francisco Regional Water Quality Control Board. April 2012.

DTSC, 2012. Advisory Active Soil Gas Investigation. Department of Toxic Substances Control, California Environmental Protection Agency. Los Angeles Regional Water Quality Control Board. San Francisco Regional Water Quality Control Board. April 2012.

Ecology, 2009. Review Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action. Publication No. 09-09-047. October 2009.

Ecology, 2013. Model Toxics Control Act Regulation and Statute: MTCA Cleanup Regulation Chapter 173-340 WAC, Model Toxics Control Act Chapter 70.105D RCW, Uniform Environmental Covenants Act Chapter 64.70 RCW.

EPA, 2002. Method 5035A Closed-System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples http://www.epa.gov/osw/hazard/testmethods/pdfs/ 5035a_r1.pdf

EPA, 2012. EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings. EPA 530-R-10-002. March 16, 2012.

GeoEngineers, Inc. Draft Environmental Subsurface Investigation, UWT Environmental Assessment – CPO Project No. 204277, South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue, Tacoma, Washington dated August 8, 2014.

GeoEngineers, Inc. Hood Corridor Soil Sampling Results, UWT – Tioga Library Building Project. November 29, 2011.

GeoEngineers, Inc. Jefferson Street Association Parcel – UST Closure and Remediation, 1742 Jefferson Avenue, Tacoma, Washington, March 14, 2013.

GeoEngineers, Inc. Report Phase II a Geotechnical Engineering Services Proposed Science and Keyhole Buildings, 1745 Jefferson Avenue, Tacoma Washington, September 20, 1999.

GeoEngineers, Inc. Report - Remedial Excavation Services Science Building, 1745 Jefferson Avenue, Tacoma, Washington, September 12, 2000.

NJDEP, 2013. Site-Specific Adjustments Using the New Jersey J&E Spreadsheets. January 2013

United States Geological Survey (USGS) topographic map. USGS 7.5 Minute Quadrangle – Tacoma North, Scale 1:24,000, 2011.

United States Geological Survey (USGS) topographic map. USGS 7.5 Minute Quadrangle – Tacoma South, Scale 1:24,000, 2011.

URS Corporation. Third Quarterly Report, Post-Injection Groundwater Monitoring, Howe Parcel Interim Action, University of Washington Tacoma, Tacoma Washington, Agreed Order No. DE 97HW-S238, September 11, 2014.

URS Corporation. Final Phase I ESA Pierce Transit Parcel, 1722 Broadway, Tacoma, Washington, September 15, 2011.

URS Corporation. Status Report: Additional Investigation of Market Street and Tacoma Avenue Groundwater TCE Plumes, UW Tacoma Campus. June 9, 2009.

URS Corporation. Feasibility Study, Tacoma Campus. April 29, 2008.

URS Corporation. Work Plan Investigation of Upgradient Groundwater Solvent Plumes - UWT Campus. October 27, 2006.

URS Corporation. Phase II Soil Investigation Kosin Parcel, 1902-1914 Market Street, Tacoma, Washington, July 14, 2003.

URS Corporation. Agency Review Draft Feasibility Study, University of Washington Tacoma Campus. April 14, 2003.

URS, 2003. Remedial Investigation Report, University of Washington, Tacoma Campus, Tacoma, Washington. Prepared for University of Washington. February 26, 2003.

URS Corporation. Report - Groundwater Quality Investigation Merlino and Laborers Parcels. August 26, 2002.

URS Corporation. Results of Supplemental Remedial Investigation-Jefferson Street Association & Sound Care Parcels. June 10, 2002.

URS Corporation. Results of Supplemental Remedial Investigation-Jet Parking & Jefferson Street Association Parcels. April 30, 2002.

TABLES

GeoEngineers

Table 1

Summary of 2013 Chemical Analytical Results - Petroleum Hydrocarbons, PAHs, Metals[1] - Soil

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

Boring/Test Pit	2D-B1	2D-B1	2D-B2	2D-B2	2D-B3	2D-B3	2D-B4	2D-B5	2D-B5	
Sample Identification[2]	2D-B1-0-1	2D-B1-8-9	2D-B2-0-1	2D-B2-4-5	2D-B3-0-1	2D-B3-11-12	2D-B4-0-1	2D-B5-0-1	2D-B5-6-7	
Sample Depth (feet bgs)	0 to 1	8 to 9	0 to 1	4 to 5	0 to 1	11 to 12	0 to 1	0 to 1	6 to 7	MTCA Method A
Soil Type	Fill	Qvi	Fill	Qvi	Fill	Qvi	Fill	Fill	Qvi	ULU Cleanup Level
NWTPH-HCID[3] (mg/kg)										
Gasoline-Range	23 U	24 U	27 U	27 U	29 U	27 U	23 U	23 U	26 U	30/100[6]
Diesel-Range	57 U	59 U	67 U	66 U	74 U	66 U	57 U	57 U	65 U	2,000
Lube Oil-Range	110 U	120 U	130 U	130 U	150 U	130 U	110 U	120 U	130 U	2,000
PAHs[4] (mg/kg)										
1-Methylnaphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	35[7]
2-Methylnaphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	320[7]
Acenaphthene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	4,800[7]
Anthracene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	24,000[7]
Fluoranthene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	3,200[7]
Fluorene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	3,200[7]
Naphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	5
Pyrene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	2,400[7]
cPAHs[4] (mg/kg)										
Benzo (a) anthracene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	MTCA ULU cleanup level for the sum of all cPAHs is 0.1 mg/kg
Benzo (a) pyrene (TEF 1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Benzo (b) fluoranthene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Benzo (J,k) fluoranthene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Chrysene (TEF 0.01)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Dibenz (a,h) anthracene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Indeno (1,2,3-cd) pyrene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	
Total TTEC of cPAHs (detect only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Metals[5] (mg/kg)										
Arsenic	11 U	12 U	13 U	13 U	15 U	13 U	11 U	11 U	13 U	20
Barium	**78**	**66**	**120**	**170**	**150**	**120**	**65**	**94**	**130**	16,000[7]
Cadmium	0.57 U	0.59 U	0.67 U	0.66 U	0.74 U	0.66 U	0.57 U	0.57 U	0.65 U	2.0
Chromium	**49**	**30**	**55**	**130**	**53**	**43**	**43**	**32**	**57**	2,000[8]
Lead	5.7 U	5.9 U	6.7 U	**6.8**	7.4 U	6.6 U	5.7 U	5.7 U	6.5 U	250
Mercury	0.29 U	0.29 U	0.34 U	0.33 U	0.37 U	0.33 U	0.28 U	0.29 U	0.33 U	2.0
Selenium	11 U	12 U	13 U	13 U	15 U	13 U	11 U	11 U	13 U	400[7]
Silver	1.1 U	1.2 U	1.3 U	1.3 U	1.5 U	1.3 U	1.1 U	1.1 U	1.3 U	400[7]

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc., of Redmond, Washington.

[2] Sample ID = Area number - boring/test pit number - starting depth of sample [feet bgs] -end depth [feet bgs], Area 2D Boring 1 collected 8-9 feet bgs = 2D-B1-8-9.

[3] Washington State Department of Ecology (Ecology)-approved method NWTPH-HCID.

[4] Polycyclic aromatic hydrocarbons (PAHs) and carcinogenic PAHs (cPAHs) were analyzed by U.S. Environmental Protection Agency (EPA) method 8270D/SIM.

[5] Resource Conservation Recovery Act (RCRA) metals analyzed by EPA 6000/7000 series method.

[6] MTCA Method A cleanup level for gasoline is 30 mg/kg if benzene is detected or if the sum of toluene, ethylbenzene and xylenes are equal to or greater than 1% of the total gasoline detection.

[7] MTCA Method B criteria represented because MTCA Method A cleanup level has not been established.

[8] MTCA Method A cleanup level for Trivalent Chromium.

mg/kg = milligram per kilogram
N/A = not applicable
Qvi = Ice-contact deposit
MTCA = Model Toxics Control Act
bgs = below ground surface
DET = Detected greater than laboratory reporting limits
U = Analyte was not detected at or greater than the listed reporting limit
J = Estimated result
TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2
Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.
Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.
Bold font type and gray shading indicates that the detected concentration is greater than the respective MTCA cleanup level.

Table 2

Summary of Chemical Analytical Results During 2013 and 2014 Sampling Events - VOCs[1] - Soil

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

Boring	Sample Identification[2]	Sample Depth (feet bgs)	Soil Type	VOCs[3] (mg/kg)							
				PCE and Breakdown Products						Miscellaneous VOCs	
				Tetrachloroethene (PCE)	Trichloroethene (TCE)	1,1-Dichloroethene	(cis) 1,2-Dichloroethene	(trans) 1,2-Dichloroethene	Vinyl Chloride	Benzene	Acetone
October 2014 Investigation											
USC-MW1D	USC-MW1D-10-11.5	10 to 11.5	Qvi	**0.048**	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.022 U
USC-MW1D	USC-MW1D-11.5-13	11.5 to 13	Qvi	**0.22**	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.024 U
USC-MW1D	USC-MW1D-16.5-18	16.5 to 18	Qvi	**0.24**	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.021 U
USC-MW1D	USC-MW1D-20-21.5	20 to 21.5	Qvi	**0.070**	**0.0013**	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.019 U
USC-MW1D	USC-MW1D-21.5-22	21.5 to 22	Qvi	**0.034**	**0.0015**	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.021 U
USC-MW1D	USC-MW1D-27.5-28	27.5 to 28	Qvi	**0.016**	0.00095 U	0.00095 U	0.00095 U	0.00095 U	0.00095 U	0.00095 U	0.014 U
USC-MW1D	USC-MW1D-40-40.5	40 to 40.5	Qva	**0.079**	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.021 U
USC-MW1D	USC-MW1D-51-52	51 to 52	Qva	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	**0.019**
Previous Investigation (2013)											
2D-B1	2D-B1-0-1	0 to 1	Fill	**0.0042**	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.0048 U
2D-B1	2D-B1-8-9	8 to 9	Qvi	**0.083**	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.0042 U
2D-B2	2D-B2-0-1	0 to 1	Fill	**0.041 J**	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0059 U
2D-B2	2D-B2-4-5	4 to 5	Qvi	**0.12**	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.012 U
2D-B3	2D-B3-0-1	0 to 1	Fill	**0.0024**	0.0010 U	0.001 U	0.0010 U	0.0010 U	0.0010 U	0.0010 U	0.0052 U
2D-B3	2D-B3-11-12	11 to 12	Qvi	**0.018**	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0056 U
2D-B4	2D-B4-0-1	0 to 1	Fill	**0.0061**	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.007 U
2D-B5	2D-B5-0-1	0 to 1	Fill	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U	**0.0078**	0.0048 U
2D-B5	2D-B5-6-7	6 to 7	Qvi	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0054 U
JS-MW3S	JS-MW3S-8-9	8 to 9	Qvi	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.0045 U
JS-MW3S	JS-MW3S-10.5-11.5	10.5 to 11.5	Qvi	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.0044 U
JS-MW3S	JS-MW3S-12-12.5	12 to 12.5	Qvi	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0053 U
JS-MW3S	JS-MW3S-13-14	13 to 14	Qvi	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.00088 U	0.0044 U
JS-MW3S	JS-MW3S-18-19	18 to 19	Qvi	0.00092 U	0.00092 U	0.00092 U	0.00092 U	0.00092 U	0.00092 U	0.00092 U	0.0046 U
JS-MW3S	JS-MW3S-21-22	21 to 22	Qvi	0.00082 U	0.00082 U	0.00082 U	0.00082 U	0.00082 U	0.00082 U	0.00082 U	0.0041 U
JS-MW3S	JS-MW3S-23-24	23 to 24	Qvi	0.00089 U	0.00089 U	0.00089 U	0.00089 U	0.00089 U	0.00089 U	0.00089 U	0.0045 U
JS-MW3S	JS-MW3S-24-25	24 to 25	Silt	0.00083 U	0.00083 U	0.00083 U	0.00083 U	0.00083 U	0.00083 U	0.00083 U	0.0041 U
MTCA Method A ULU Soil Cleanup Levels				0.05	0.03	4,000[4]	160[4]	1,600[4]	0.67[4]	0.03	72,000[4]

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc., of Redmond, Washington.

[2] Sample ID = Area number/Well identification - boring/test pit number - starting depth of sample [feet bgs] -end depth [feet bgs], Area 2D Boring 1 collected 8-9 feet bgs = 2D-B1-8-9.

[3] Volatile organic compounds (VOCs) were analyzed by EPA method 8260C. Other VOCs were analyzed but not detected.

[4] MTCA Method B criteria represented because MTCA Method A cleanup level has not been established.

mg/kg = milligram per kilogram

MTCA = Model Toxics Control Act

U = Analyte was not detected at or greater than the listed reporting limit

N/A = not applicable

bgs = below ground surface

Qvi = Ice-contact deposits

Qva = Advance Outwash

ULU = unrestricted land use

Silt = Semiconfining Layer

J = Estimated result by the analytical laboratory

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective MTCA cleanup level.

Table 3

Summary of Chemical Analytical Results During 2013 and 2014 Sampling Events[1] - Groundwater

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

Boring Identification	JS-MW3S				USC-MW1S[8]		JS-MW3		USC-MW1D[8]	MTCA Method A Groundwater Cleanup Level	MTCA Method B Groundwater Cleanup Level	MTCA Method B Groundwater Screening Levels Protective of Indoor Air [9]
Top of Well Casing Elevation (feet)[4]	88.86				70.13		89.35		69.97			
Top of Well Screen Elevation (feet)[4]	77				60		51		25			
Bottom of Well Screen Elevation (feet)[4]	67				45		36		15			
Sample ID[2]	JS-MW3S-130913	JS-MW3S-140122	JS-MW3S-141027	N/A	USC-MW1S-141027	N/A	JS-MW3-130625	JS-MW3-141017	USC-MW1D-141027			
Sample Date	9/13/2013	1/22/2014	10/27/2014	12/9/2014	10/27/2014	12/9/2014	6/25/2013	10/27/2014	10/27/2014			
Approximate Depth to Groundwater (feet btoc)[3]	19	19.00	18.40	17.76	21.11	20.75	36.52	36.47	22.42			
Approximate Elevation of Groundwater[4]	69.86	69.86	70.46	71.10	49.02	49.38	52.83	52.88	47.55			
Lithology At Well Screen	Qvi				Qvi		Qva		Qva			
NWTPH-Dx[5] (mg/L)												
Diesel-Range	**0.31**	--	0.26 U	--	--	--	--	--	--	0.5	NE	NE
Lube Oil-Range	0.43 U	--	0.41 U	--	--	--	--	--	--	0.5	NE	NE
VOCs[6] (µg/L)												
Tetrachloroethene (PCE)	0.20 U	0.20 U	0.20 U	--	**330**	--	0.20 U	0.20 U	**1.5**	5	21	24
Trichloroethene (TCE)	0.20 U	0.20 U	0.20 U	--	**3.0**	--	0.20 U	0.20 U	0.20 U	5	0.54	1.5
1,1-Dichloroethene	0.20 U	0.20 U	0.20 U	--	2 U	--	0.20 U	0.20 U	0.20 U	NE	400	130
(cis) 1,2-Dichloroethene	0.20 U	0.20 U	0.20 U	--	2.0 U	--	0.20 U	0.20 U	0.20 U	NE	16	160
(trans) 1,2-Dichloroethene	0.20 U	0.20 U	0.20 U	--	2.0 U	--	0.20 U	0.20 U	0.20 U	NE	160	110
Vinyl Chloride	0.20 U	0.20 U	0.20 U	--	2.0 U	--	0.10 U	0.20 U	0.20 U	0.2	0.029	0.35
Chloroform[7]	**8.7**	0.28	0.20 U	--	2 U	--	0.2 U	0.20 U	**0.39**	NE	1.41	1.2
Field Water Quality Parameters												
pH	6.87	N/A	6.59	--	6.60	--	6.89	6.75	7.41	N/A	N/A	N/A
Conductivity (µS/cm)	302	N/A	239	--	311.1	--	542	210.6	208.4	N/A	N/A	N/A
Turbidity (NTU)	88	N/A	8.32	--	10.6	--	15.38	4.85	111	N/A	N/A	N/A
Dissolved O2 (ppm)	2.57	N/A	4.02	--	2.79	--	0.90	1.82	1.09	N/A	N/A	N/A
Temperature (°C)	19.52	N/A	17.90	--	16.60	--	16.56	15.60	15.30	N/A	N/A	N/A
ORP (mV)	-48.7	N/A	95.6	--	189.1	--	119.5	134.4	-182.3	N/A	N/A	N/A

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc. in Redmond, Washington.

[2] Sample ID = Area number - Boring number - Date (i.e., a water sample collected from JS-MW3 on June 25, 2013 = JS-MW3-130625) .

[3] Groundwater level was measured below the top of casing on November 8, 2013.

[4] Based on survey completed by AHBL November 6, 2013. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal Control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, Elevation 165.15). The elevations for USC-MW1S and USC-MW1D are estimated based on topography and were not surveyed.

[5] Ecology-approved method NWTPH-Dx.

[6] Volatile organic compounds (VOCs) were analyzed by U.S. Environmental Protection Agency (EPA) method 8260C. Other VOCs were analyzed but not detected.

[7] Chloroform is a byproduct of chlorinated water and likely caused by water introduced during drilling and development.

[8] Elevation estimated based on topography. Professional land survey will be completed in the future.

[9] MTCA Method B groundwater screening level based on protection of indoor air. Values calculated using Method B air cleanup levels from Ecology's "CLARC Master Spreadsheet.xls" dated May 2014 and Equation 1 from Ecology's 2009 draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action."

MTCA = Model Toxics Control Act | Qvi = Ice-contact deposits | Qva = Advance Outwash | µS/cm = microSiemens per centimeter | ppm = parts per million | mV = millivolt

-- = Analyte or sample not analyzed | N/A = not applicable | btoc = below top of casing | NTU = Nephelometric Turbidity Units | °C = degrees Celsius

µg/L = microgram per liter | mg/L = milligram per liter

U = Analyte was not detected at or greater than the listed reporting limit

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates analyte is detected at a concentration greater than the respective MTCA Method groundwater cleanup/criteria level.

Dashed outline indicates analyte is detected at a concentration greater than the MTCA Method B Indoor Air Screening Level.

Table 4

Summary of Chemical Analytical Results During 2014 Sampling Event[1] - Soil Gas

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

		VOCs[2] (µg/m^3)						
Locations	Sample ID	Tetrachloroethene (PCE)	Trichloroethene (TCE)	1,1-Dichloroethene	(cis) 1,2-Dichloroethene	(trans) 1,2-Dichloroethene	Vinyl Chloride	Helium[3] (percent)
USC-SV1	USC-SV1-141024	3,000	1.7 U	0.64 U	1.3 U	6.4 U	0.41 U	0.80 U
USC-SV2	USC-SV2-141024	1,000	1.5 U	0.54 U	1.1 U	5.4 U	0.35 U	3.3
USC-SV3	USC-SV3-141024	6,000	17 U	12 U	12 U	12 U	8.1 U	3.5
USC-SV4	USC-SV4-141024	1,000	1.7 U	0.61 U	1.2 U	6.1 U	0.40 U	1.4
USC-SV5	USC-SV5-141028	670	1.2 U	0.35 U	0.69 U	3.5 U	0.22 U	7.3
MTCA Method B Shallow Soil Gas Screening Level (AF = 0.1)[4]		96	3.7	910	270 (160)	270	2.8	Not Applicable
MTCA Method B Shallow Soil Gas Screening Level (AF = 0.03)[4]		320	12	3,000	900 (530)	900	9.3	

Notes:

[1] Chemical analysis performed by Eurofin Air Toxics, California.

[2] Analyzed by EPA method TO-15SIM.

[3] Analyzed by modified ASTM D-1946.

[4] MTCA Method B shallow soil gas screening levels are calculated by dividing MTCA Method B air cleanup levels by an attenuation factors of 0.1 (Ecology 2009) and 0.03 (EPA 2012). MTCA Method B air cleanup levels are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2014. The value for cis-1,2-DCE is the MTCA Method B air cleanup level for trans-1,2-DCE. The cis-1,2-DCE value of 16 µg/m3 (in parentheses), previously available in Ecology's former CLARC on-line database, has been withdrawn.

MTCA - Model Toxics Control Act

µg/m^3 = micrograms per cubic meter AF = attenuation factor

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective MTCA cleanup level.

Table 5

Soil Gas Vapor Intrusion Evaluation[1]

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

Locations	Sample ID	PCE Soil Gas Results (µg/m^3)[2]	Estimated PCE Indoor Air Concentrations (µg/m^3)			
			Step One - Compare to Default Attenuation Factors		Step Two - Model the Indoor Air Concentrations Using the Johnson Ettinger Model	
			Via Default Attenuation Factors		Johnson and Ettinger Model[3]	
			MTCA (AF = 0.1)	EPA (AF = 0.03)	Building Footprint[4] (AF = 0.0012)	Small Office Space[5] (AF = 0.0012)
USC-SV1	USC-SV1-141024	3,000	**300**	**90**	3.7	3.7
USC-SV2	USC-SV2-141024	1,000	**100**	**30**	1.2	1.2
USC-SV3	USC-SV3-141024	6,000	**600**	**180**	7.3	7.3
USC-SV4	USC-SV4-141024	1,000	**100**	**30**	1.2	1.2
USC-SV5	USC-SV5-141028	670	**67**	**20.1**	0.82	0.82
Average (no SV5)		2,750	**275**	**83**	3.4	3.4
MTCA Method B Indoor Air Cleanup Level (Residential)[6]			9.6			
MTCA Method B Indoor Air Remediation Level (Occupational/Commercial)[7]			63			

Notes:

[1] Chemical analysis performed by Eurofin Air Toxics, in Folsom, California.

[2] Analyzed by EPA method TO-15SIM.

[3] Modeling was completed as described in the text of the report using the EPA California method to calculate the $Q_{soil.}$

[4] The building footprint assumes 10,000 square feet, 16 foot ceilings, 2,200 feet of cracks in the floor and 0.5 exchanges of air per hour (MTCA commercial default).

[5] The office space footprint assumes 125 square feet, 16 foot ceilings, and 0.5 exchanges of air per hour (MTCA commercial default).

[6] MTCA Method B air cleanup levels are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2014. Assumes exposures of 365 days/year, 24 hours/day, 30 years.

[7] MTCA Method B Indoor Air Remediation Level (Occupational/Commercial) assumes exposure of 250 days/year, 8 hours/day, 20 years.

AF = Attenuation Factor

EPA = United States Environmental Protection Agency

MTCA - Model Toxics Control Act

PCE = Tetrachloroethylene

µg/m^3 = microgram per cubic meter

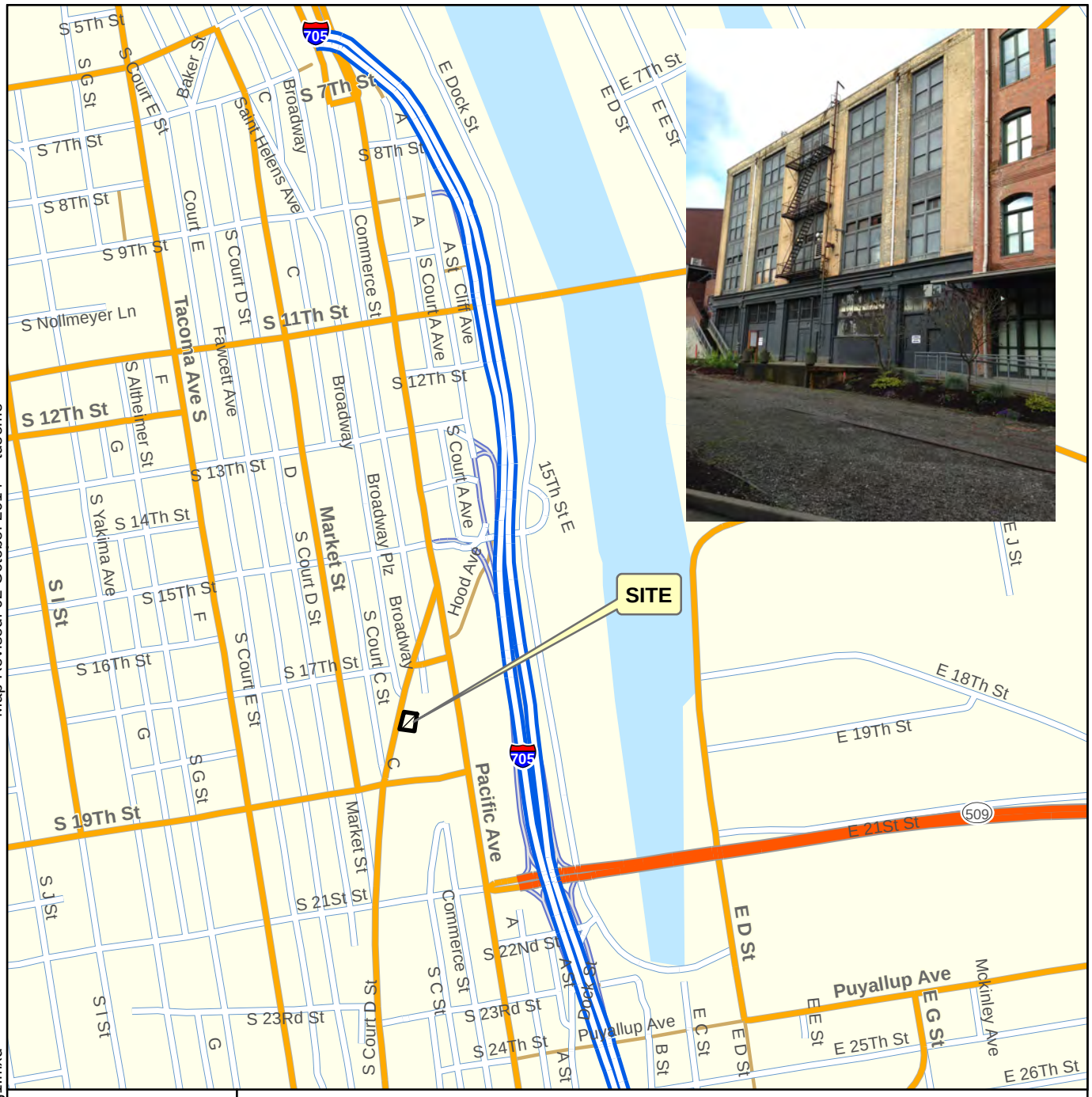
Q_{soil} = Volumetric flow rate of soil gas into the enclosed space

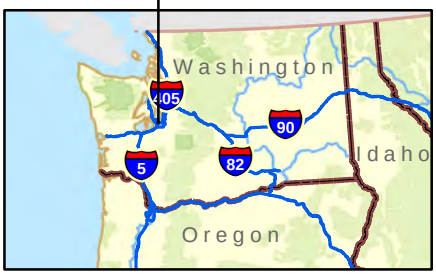
Bold font type indicates the estimated PCE Indoor Air Concentration exceeds the MTCA Method B Indoor Air Cleanup Level (Residential)

Gray Shading indicates the estimated PCE Indoor air concentration exceeds the MTCA Method B Indoor Air Remediation Level (Occupational/Commercial)

FIGURES

GeoEngineers





N
W E
S

1,000 0 1,000

Feet

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. can not 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.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Urban Solutions Building - UWT Campus
Tacoma, Washington

GeoEngineers

Figure 1

Office: TACO Path: P:\0\0183099\GIS\0183099_VM_fig1.mxd Map Revised: 02 October 2014 tdeome

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.

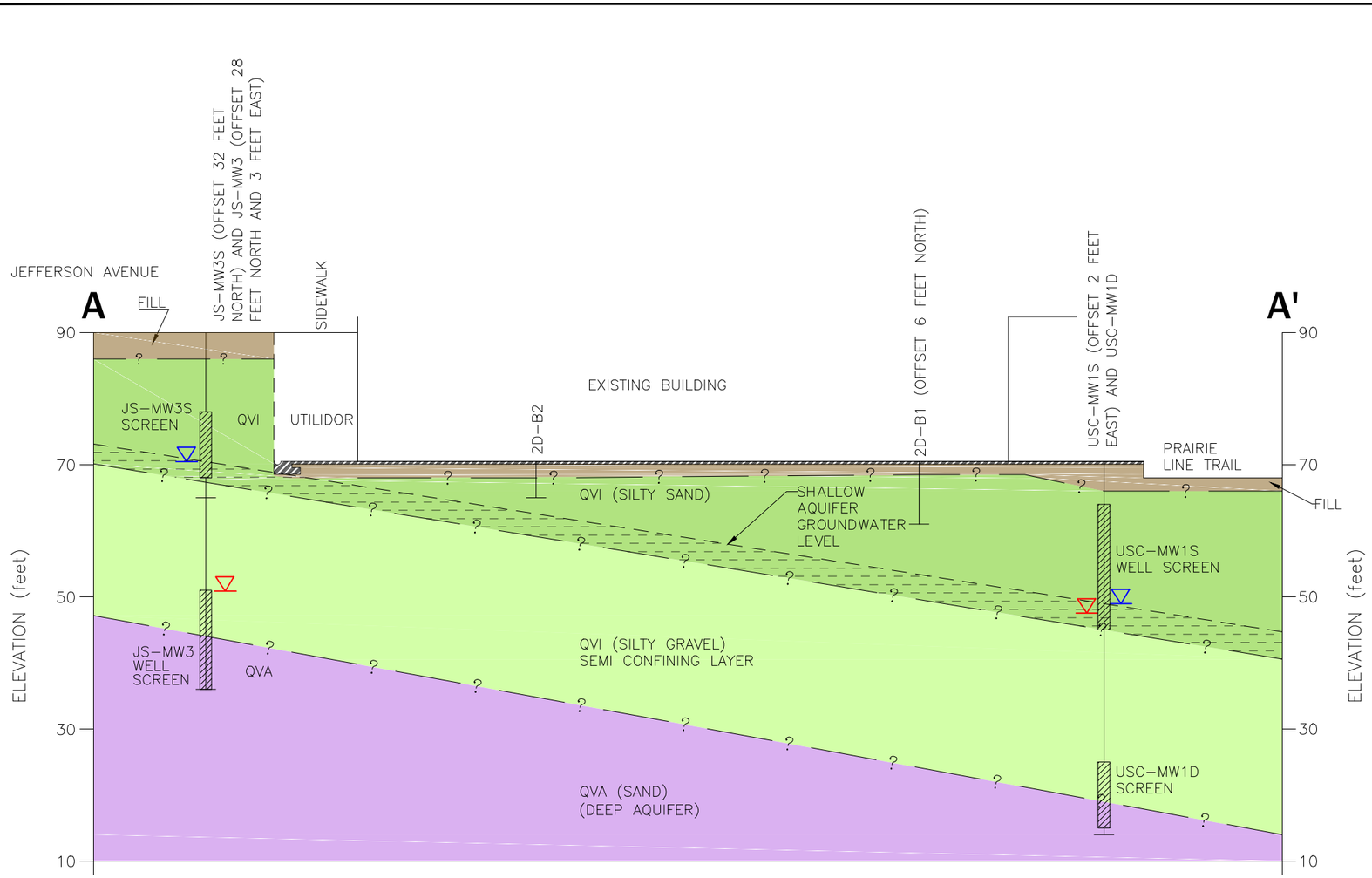
Data Source: CAD file provided by Sitts and Hill Engineers Date: 9/29/2014. Additional information provided by GeoEngineers staff.

Site Plan

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 2



Legend

- Shallow Aquifer Groundwater Level (October 2014)
- Deep Aquifer Potentiometric Surface (October 2014)
- Fill
- Ice Contact Deposits (Qvi)
  - Silty Sand (Shallow Aquifer Water Bearing Unit)
  - Silty Gravel (Semi-Confining Layer)
- Advance Outwash (Qva)
- Shallow Aquifer within Qvi
- Existing Concrete Slab or Footing

USC–MW1D

- Boring
- Soil contact line
- Groundwater Level Observed in Monitoring Well
- Well Screen Interval

N W E S

20 0 20
FEET

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.
3. Location and depth of footing not known. Top of boring rounded to nearest 0.5 foot.

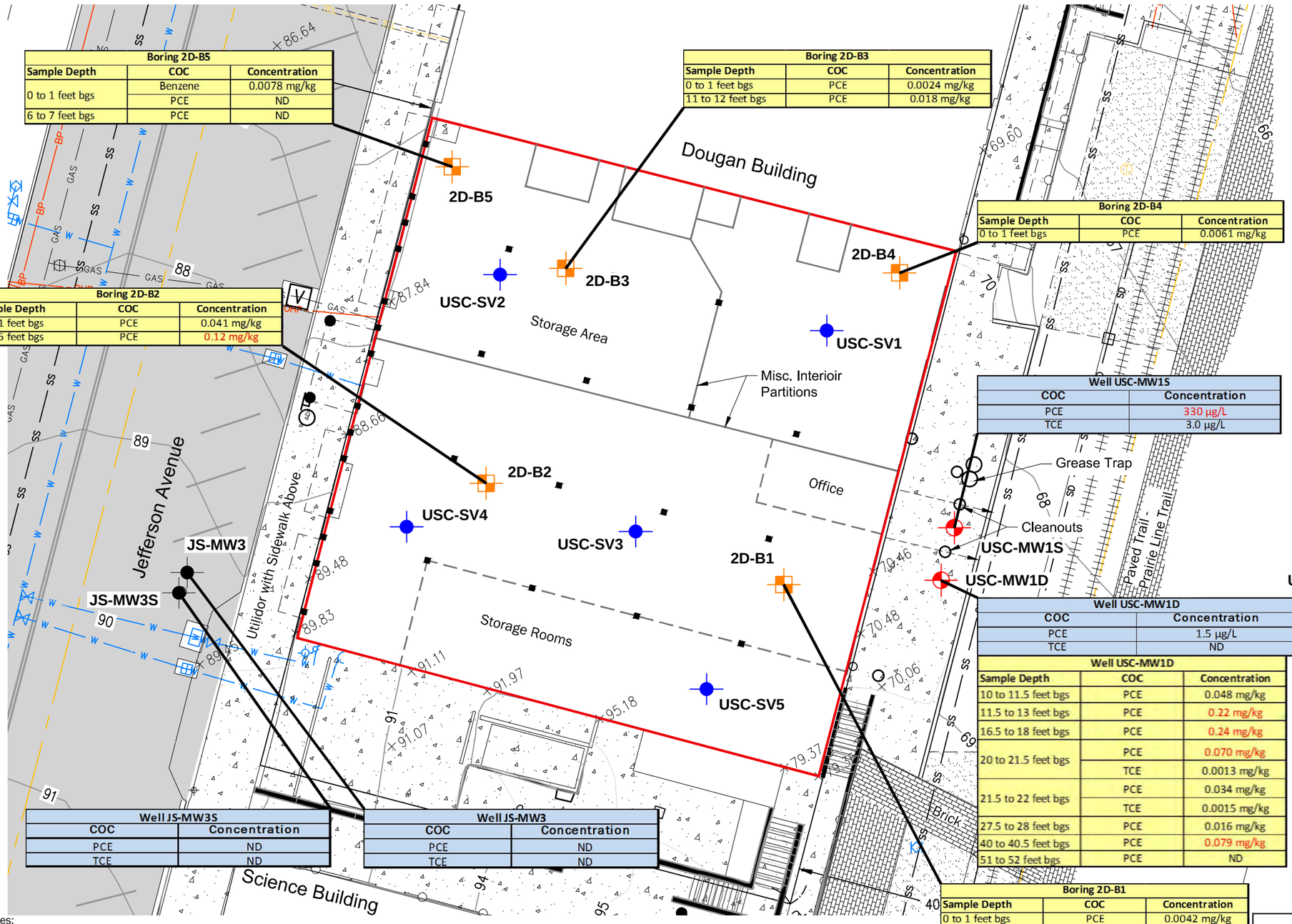
Data Source: Based on observed conditions by GeoEngineers and survey from Sitts and Hill.

Cross-Section A-A'

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 3



Legend

Soil Results* (October 2014)

Boring 2D-B3		
Sample Depth	COC	Concentration
0 to 1 feet bgs	PCE	0.0024 mg/kg
11 to 12 feet bgs	PCE	0.018 mg/kg

Groundwater Results* (October 2014)

USC-MW1D	
COC	Concentration
TCE	110 µg/L
PCE	1.4 µg/L

*Chemicals shown in red were detected at concentrations greater than the respective MTCA Method A cleaup levels.

All PCE chemical analytical results for soil in the new wells and borings completed within the building are shown. TCE and benzene results area shown where detected in soil. All PCE and TCE chemical analytical results are shown in groundwater. Other chemicals of concern were either not detected or considered laboratory or break down products of chlorinated water used during drilling.

- 2D-B1 — Previous Direct Push Borings Completed in 2013 (GeoEngineers)
- JS-MW3 — Existing Monitoring Well
- USB-MW1S — New Monitoring Well (Deep and Shallow)
- USC-SV1 — Sub Slab Sample Location
- Perimeter of Urban Solutions Building
- Topographic Contour and Elevation
- +70.46 — Spot Elevations (feet)
- Building Columns
- Interior Wall Partitions
- Temporary Interior Partitions

Notes:
Vertical Datum = City of Tacoma NGVD 1929
*Soil vapor concentration may have been diluted with indoor air due to leakage during test.
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: CAD file provided by Sitts and Hill Engineers Date: 9/29/2014. Additional information provided by GeoEngineers staff.

COC = Chemical of Concern
UWT = University of Washington Tacoma
TCE = trichloroethene
PCE = tetrachloroethene
mg/kg = milligram per kilogram
µg/L = microgram per Liter
bgs = Below Ground Surface
ND = Chemical not detected at concentrations greater than laboratory report limit

MTCA Cleanup Levels/Screening Levels (Concentration Shown in Red If Exceeds Cleanup/Screening Levels)
Soil:
PCE = 0.05 mg/kg (Method A ULU Cleanup Level)
TCE = 0.03 mg/kg (Method A ULU Cleanup Level)
Benzene = 0.03 mg/kg (Method A ULU Cleanup Level)
Groundwater:
TCE = 5 µg/L (MTCA Method A Cleanup Level): 1.5 µg/L (Protective of Indoor Air Screening Level)
PCE = 5 µg/L (MTCA Method A Cleanup Level): 24 µg/L (Protective of Indoor Air Screening Level)

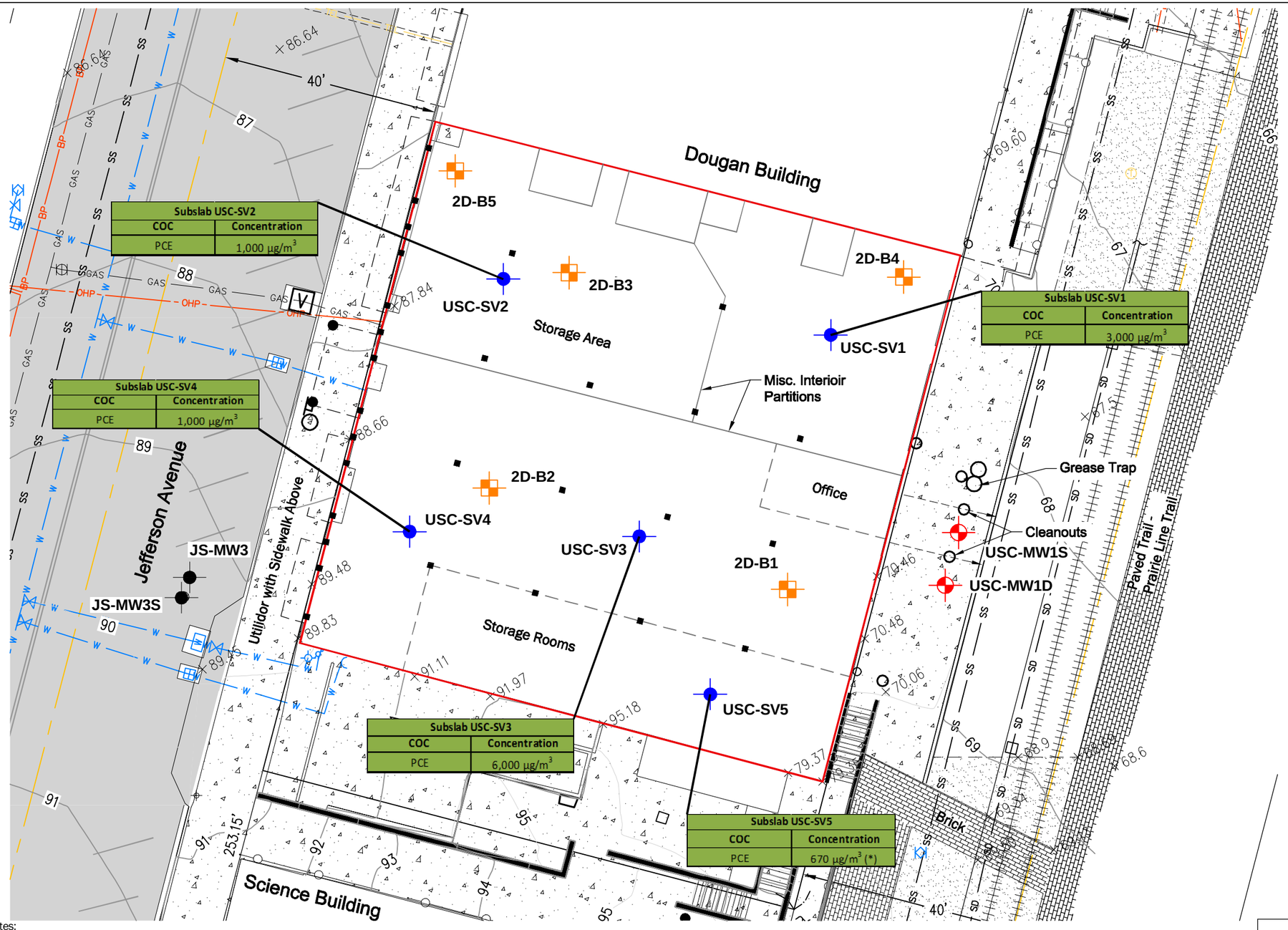
Site Plan- Soil and Groundwater Sample Results

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 4

Office: TAC \\TAC\Projects\0\0183099\00\CAD\03_Sheet Files\0183099900_F4_report.dwg TAB:F4 cvanslyke January 23, 2015



Legend

Subslab Results (October 2014)

Subslab USC-SV1	
COC	Concentration
PCE	3,000 µg/m^3

Only PCE chemical results are shown because other chemicals of concern were not detected.

- 2D-B1 — Previous Direct Push Borings Completed in 2013 (GeoEngineers)
- JS-MW3 — Existing Monitoring Well
- USB-MW1S — New Monitoring Well (Deep and Shallow)
- USC-SV1 — Sub Slab Sample Location
- Perimeter of Urban Solutions Building
- Topographic Contour and Elevation
- +70.46 — Spot Elevations (feet)
- Building Columns
- Interior Wall Partitions
- Temporary Interior Partitions

Notes:
Vertical Datum = City of Tacoma NGVD 1929
*Soil vapor concentration may have been diluted with indoor air due to leakage during test.
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: CAD file provided by Sitts and Hill Engineers Date: 9/29/2014. Additional information provided by GeoEngineers staff.

Abbreviations:

COC = Chemical of Concern
UWT = University of Washington Tacoma
TCE = trichloroethene
PCE = tetrachloroethene
µg/m^3 = microgram per Cubic Meter

N W E S

20 0 20
FEET

Site Plan- Soil Vapor Sample Results

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 5

APPENDICES

GeoEngineers

APPENDIX A
Sampling and Analysis Plan and Quality Assurance Project Plan

Sampling and Analysis Plan and Quality Assurance Project Plan

University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Center
1735 Jefferson Avenue
Tacoma, Washington

for
University of Washington

October 17, 2014

GeoEngineers
Earth Science + Technology

Sampling and Analysis Plan and Quality Assurance Project Plan

University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Center
1735 Jefferson Avenue
Tacoma, Washington

for
University of Washington

October 17, 2014

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Sampling and Analysis Plan and Quality Assurance Project Plan University of Washington Tacoma CPO Project No. 204701 Urban Solutions Center 1735 Jefferson Avenue Tacoma, Washington

Project No. 0183-099-00

October 17, 2014

Prepared for:

University of Washington
Capitol Projects Office
Box 352205
Seattle, Washington 98195-2205

Attention: Jeannie Natta

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Tricia S. DeOme, LG
Environmental Geologist

Neil F. Morton
Senior Environmental Scientist

Terry R. McPhetridge, LG, LHG
Associate

TSD:NFM:TRM:ch:tt

GeoEngineers

Table of Contents

1.0 INTRODUCTION 1

2.0 CURRENT SITE FEATURES AND DEVELOPMENT PLANS 1

2.1. Site Features 1
2.2. Proposed Development Plans 1

3.0 HISTORICAL USE 1

4.0 AGREED ORDER 2

5.0 PREVIOUS INVESTIGATIONS 2

5.1. Soil and Groundwater Conditions 2
5.1.1. Soil Conditions 2
5.1.2. Groundwater Conditions 3
5.2. Chemical Analytical Results 3
5.2.1. Site 3
5.2.2. Upgradient of the Site 4
5.2.3. Downgradient of the Site – Howe Plume 4

6.0 GENERAL SCOPE 4

6.1. Project Organization, Roles and Responsibilities 5
6.2. Schedule of Activities 6
6.3. Health and Safety 6

7.0 SUBSURFACE INVESTIGATION PROGRAM 6

7.1. Hollow-Stem Auger Drilling and Associated Monitoring Wells 6
7.1.1. General 6
7.1.2. Hollow-Stem Auger Soil Sampling Methodology and Chemical Analysis 7
7.1.3. Groundwater Monitoring Well Installation 7
7.1.4. Monitoring Well Survey 8
7.2. Groundwater Monitoring of New and Existing Permanent Monitoring Wells 8
7.2.1. Permanent Monitoring Well Development 8
7.2.2. Permanent Groundwater Monitoring Well Groundwater Sampling and Chemical Analysis 9
7.3. Vapor Intrusion – Sub-slab Soil Gas Sampling 9

8.0 GENERAL SOIL SAMPLING PROTOCOLS 10

8.1. General Procedures 10
8.1.1. Field Screening 10

9.0 FIELD DOCUMENTATION 11

9.1. Soil, Groundwater and Soil Gas Sample Containers and Labeling 11
9.2. Sample Handling 12
9.3. Field Observations Documentation and Records 12
9.4. Decontamination 13

10.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE 14

10.1. Soil 14
10.2. Groundwater and Decontamination Water 14

10.3. Incidental Waste 14
11.0 QUALITY ASSURANCE AND QUALITY CONTROL 14
11.1. Field Quality Control 14
11.1.1. Field Duplicates 14
11.1.2. Trip Blanks 15
11.1.3. Rinsate 15
11.2. Data Management and Documentation 15
11.3. Data Validation and Usability 15
11.4. Environmental Information Management System Submittal 15
12.0 REFERENCES 15

LIST OF TABLES

Table 1. Summary of Chemical Analytical Results During 2013 Sampling Event - Soil
Table 2. Summary of Chemical Analytical Results During 2013 Sampling Event - Groundwater
Table 3. Test Methods, Sample Containers, Preservation and Hold Times
Table 4. Quality Control Samples - Type and Frequency
Table 5. Methods of Analysis and Target Reporting Limits for Soil Samples
Table 6. Methods of Analysis and Target Reporting Limits for Water Samples
Table 7. Methods of Analysis and Target Reporting Limits for Air Samples

LIST OF FIGURES

Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Groundwater Plumes Near Site

APPENDICES

Appendix A. Previous Boring Logs
Appendix B. Health and Safety Plan
Appendix C. Field Forms
Appendix D. Sub-slab Soil Gas Probe Installation

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) has been prepared to identify the soil, soil gas and groundwater sampling and analysis methods to be performed during the subsurface investigation within and adjacent to the new Urban Solutions Center (existing four-story building) located at 1735 Jefferson Avenue on the University of Washington – Tacoma (UWT) campus located in Tacoma, Washington, shown on Figure 1. The Urban Solutions Center is herein referred to as the "site."

2.0 CURRENT SITE FEATURES AND DEVELOPMENT PLANS

2.1. Site Features

The four-story building is situated within the site boundary. The first floor of the building is accessible from the Prairie Line Trail at approximately Elevation 70 feet. The second floor is accessible from Jefferson Avenue at approximately Elevation 90 feet.

The first floor is currently occupied by UWT for faculty and staff working space. The Old Spaghetti Factory currently occupies the second floor. The third and fourth floors are currently used for storage by UWT.

2.2. Proposed Development Plans

We understand UWT plans to redevelop the existing building as a "core and shell" in 2016. The design team has developed a predesign report and is currently in the initial stages of the design process. Additional improvements will occur at a later date as the programs for the space are defined. The "core and shell" redevelopment will likely consist of a complete restoration of the building to include seismic upgrades that may require new footings and shear walls along with upgraded utilities. It is anticipated the existing shell of the building and finished floor elevation of the building will remain as is at this time (approximately 10,000 square feet and Elevation 70 feet, respectively). The depth of the footings may extend up to 5 feet below the existing finished floor.

3.0 HISTORICAL USE

The four-story building was constructed in 1904 and 1905 initially as a candy factory for the Tacoma Biscuit and Candy Company. Boilers and ovens were located on the first floor in the warehouse and storeroom. A freight elevator located on the west side of the building serviced the four floors. Offices and the shop were located on the second floor at the elevation of Jefferson Avenue. The third floor was utilized as the main stockroom. The production area was on the fourth floor. The following summarizes the historical uses of the building beginning in 1906.

- 1906. Union Pacific Railroad purchased the building and Tacoma Biscuit and Candy Company vacated the building.
- 1907. A spice company used the building as temporary quarters.

- 1911 to 1942. Tacoma Paper and Stationary Company (wholesale paper company) was in operation during this time. The south end of the building was previously used as a sign printing shop based on information provided in the 1912 Sanborn map. Solvents may be associated with ink printing.
- 1943 to 1953. Blake, Moffitt and Towne, Inc. (wholesale paper company) operated their business at the site during this time. The 1950 Sanborn map indicates the space was utilized as merchandise warehouse.
- 1953 to 1957. Vacant
- 1957 to 1961. McCormack Distributing
- 1961 to 1968. Vacant
- 1969 to 1971. Pacific Storage Company
- 1971 to Present. Old Spaghetti Factory

Permit records indicate that repairs occurred from a fire that damaged the building in 1928. Installation of an oil burner followed the repair activities in 1929. Permit records also show that a 3,000-gallon grease interceptor tank was installed on the east side of the building within the Prairie Line Trail as recently as 1999. The grease trap is associated with the Old Spaghetti Factory restaurant.

4.0 AGREED ORDER

UW entered into an Agreed Order (#DE 97HW-S238) with the Washington State Department of Ecology (Ecology) in 1997 for known contaminated soil and groundwater on the UWT campus. UW and Ecology are currently in the process of issuing a new agreed order for the UWT campus. The site is located within the boundaries of the old and new Agreed Orders.

5.0 PREVIOUS INVESTIGATIONS

A remedial investigation/feasibility study (RI/FS) was completed on several parcels located near the site between 2000 and 2009. Additional investigation was completed in 2013 and 2014 within the site and upgradient and downgradient of the site. The chemical analytical results for the 2013/2014 investigation are included in Tables 1 and 2.

5.1. Soil and Groundwater Conditions

5.1.1. Soil Conditions

Subsurface conditions consist of fill, ice-contact deposits, silt layer and advance outwash. The fill within the building consists of silt and sand (silt with sand and/or sand with silt) from the ground surface to depths ranging from 0.5 to 2 feet below ground surface (bgs).

Ice-contact deposits consisting of fine silty sand were observed in the direct-push borings and monitoring wells on and adjacent to the site. Ice-contact deposits were observed at approximately 20 feet bgs in the monitoring wells. The ice-contact deposits are underlain by a silt layer consisting of brown to gray fine sandy silt with a thickness of approximately 1 to 2 feet. The silt layer is underlain by advance outwash consisting of silty fine to coarse sand with gravel.

5.1.2. Groundwater Conditions

It appears that groundwater conditions observed consist of a shallow aquifer (ice-contact deposits) and deep aquifer (advance outwash) to the depths explored during this investigation. The shallow and deep aquifers appear to be separated by the silt layer located between the ice-contact deposits and advance outwash.

Groundwater within the shallow aquifer appears to be present within the sand and gravel seams of the ice-contact deposits. The hydraulic connection of the sand seams within the shallow aquifer is unknown in and around the project site. Groundwater within the deep aquifer appears to be continuous. The deep aquifer appears to be under a confined condition within the advance outwash.

Groundwater elevation of the shallow aquifer is approximately 70 feet in the area west of the site. Groundwater elevation of the deep aquifer is approximately 53 feet just west of the site. Groundwater was not encountered in the subsurface explorations completed inside the building. Groundwater levels will vary depending on season, precipitation and other factors.

5.2. Chemical Analytical Results

5.2.1. Site

An environmental subsurface investigation was completed on the site in 2013. The investigation consisted of direct-push borings, installation of a new monitoring well, groundwater development and sampling of existing monitoring wells and collection of a water sample from the municipal water supply.

TETRACHLOROETHYLENE (PCE)

Five borings were completed to depths ranging between 3 and 12 feet bgs when practical refusal was encountered. PCE was detected at concentrations greater than the MTCA Method A ULU cleanup level (0.05 milligram per kilogram [mg/kg]) in the following two soil samples:

- 2D-B2-4-5 (0.12 mg/kg) collected from 4 to 5 feet bgs in boring 2D-B2
- 2D-B1-8-9 (0.083 mg/kg) collected from 8 to 9 feet bgs in boring 2D-B1.

PCE was detected at concentrations less than the MTCA Method A ULU cleanup level in five soil samples collected at depths ranging from below the concrete slab to approximately 12 feet bgs. PCE-contaminated soil may extend deeper than 12 feet bgs. Groundwater was not encountered in the borings completed inside the building.

PCE and trichloroethylene (TCE) were not detected in groundwater collected within the shallow and deep aquifers in the monitoring wells (JS-MW3S and JS-MW3) located generally upgradient of the site. These results indicate the source of PCE in the soil does not appear to originate from an upgradient source. The source of the PCE is possibly from historic operations within the building, but the exact location is unknown.

Industrial uses of PCE are dry cleaning/textile processing, metal degreasing, printing inks, typewriter correction fluids, adhesive formulations and paper coatings. A wholesale paper company operated in the building between 1911 and 1953 and a sign printing shop was located in the southern portion of the building in at least 1912. Historical operations of printing or coating paper may be the source of the PCE within the building; however the actual source is unknown. The first floor was not fully investigated for

potential areas where PCE may be been disposed in the past (drywells or cisterns) due to the presence of stored materials on the floor.

BENZENE

Benzene was detected in soil at concentrations less than the Model Toxics Control Act (MTCA) Method A Unrestricted Land Use (ULU) cleanup level at a depth of approximately 1 foot bgs on the northwest portion of the site.

5.2.2. Upgradient of the Site

Approximately 55 groundwater shallow and deep aquifer monitoring wells have been installed over the course of the investigations and remediation efforts in the area west of the site. Two wells (JS-MW3 and JS-MW3S) were installed directly upgradient of the site in Jefferson Avenue as shown on Figure 3. Well JS-MW3s is installed in the shallow aquifer and well JS-MW3 is installed in the deep aquifer. The well logs are included in Appendix A.

TCE

A TCE-contaminated groundwater plume is located west and south of the site. The known extent of the westerly groundwater contaminant plume generally trends from south of South 19th Street and Tacoma Avenue to north of South 19th Street and Jefferson Avenue. The plume appears to be present in the shallow and deep aquifers west of the site and in the shallow aquifer south of the site.

The source(s), along with the vertical and lateral extents of the westerly groundwater contaminant plume is not known at this time. The westerly plume does not appear to have impacted the site based on the groundwater samples collected from JS-MW3 and JS-MW3S in 2013.

DIESEL-RANGE PETROLEUM HYDROCARBONS

Diesel-range petroleum hydrocarbons were detected in the groundwater sample collected in shallow monitoring well (JS-MW3S) at a concentration less than the MTCA Method A groundwater cleanup level. The source of the diesel-range petroleum hydrocarbons is unknown, but may be related to the former service station located on the Jefferson Street Parcel situated upgradient of the site. Petroleum-contaminated soil was remediated from the Jefferson Parcel in 2012.

5.2.3. Downgradient of the Site – Howe Plume

The Howe plume consists of PCE-contaminated groundwater. The Howe plume is generally located along Pacific Avenue and generally trends from the Howe Building (South 19th Street Stairs and Pacific Avenue) to the Federal Courthouse located across Pacific Avenue to the northeast. An interim action consisting of EHC® reagent injections were implemented in 2013 in an effort to reduce PCE concentrations within the Howe plume. Quarterly groundwater monitoring of the existing wells indicate the PCE concentrations have decreased since 2013 in the southern and eastern portions of the Howe plume. However, PCE concentrations in groundwater remain generally unchanged on the northern portion of the plume.

6.0 GENERAL SCOPE

The purpose of this subsurface investigation is to evaluate if groundwater is contaminated with PCE from the soil within the building and if PCE is present within the soil vapors beneath have been impacted with PCE. The general scope of services consists of the following:

- Review the results of previous investigations completed on the site and evaluate potential contaminant sources.
- Install two groundwater monitoring wells located downgradient of the site (USC-MW1S and USC-MW1D).
- Perform groundwater monitoring in four monitoring wells (USC-MW1S, USC-MW1D, JS-MW3S and JS-MW3).
- Collect five sub-slab soil gas samples.
- Additional wells may be installed in the future based on the findings of this investigation. Additional well installation and sampling will follow the protocols described in this SAP/QAPP.

6.1. Project Organization, Roles and Responsibilities

This section outlines the individuals directly involved with the project and their specific responsibilities. Services completed under this SAP will be in cooperation with the following key personnel.

Affiliation	Contact Information
Washington State Department of Ecology (Ecology) Site Manager	Marv Coleman MCOL461@ECY.WA.GOV (360) 407-6259 Lacey, Washington
University of Washington, Capital Projects Office (CPO), Project Manager	Jeannie Natta jnatta@uw.edu (206) 616-7579 Seattle, Washington
University of Washington, Environmental Health and Safety, Agreed Order Compliance and Technical Support	Erin McKeown mstoxic@u.washington.edu (206) 616-0585 Seattle, Washington
University of Washington, Facility Services - Campus Engineering, Agreed Order Project Manager and Technical Support	David Ogrodnik dmo@u.washington.edu (206) 221-4285 Seattle, Washington
Consultant Principal-in-Charge (GeoEngineers, Inc.)	Terry McPhetridge tmcphetridge@geoengineers.com (253) 383-4940 Tacoma, Washington
Consultant Senior Scientists (GeoEngineers, Inc.)	Neil Morton nmorton@geoengineers.com (206) 239-3238 Seattle, Washington
Consultant Project Manager (GeoEngineers, Inc.)	Tricia DeOme tdeome@geoengineers.com (253) 383-4940 Tacoma, Washington

6.2. Schedule of Activities

The subsurface investigation tasks to be performed including the anticipated schedule are summarized in the following table.

ANTICIPATED SCHEDULE

Task	Date(s) for Environmental Schedule
Develop Draft Sampling and Analysis Plan (SAP) for Environmental Sampling	Draft to UW October 17, 2014
UW and Ecology Review Draft	October 2 through 15, 2014
GeoEngineers submit final SAP and prepare for field activities	October 15 through 24, 2014
Field Activities - Subsurface Investigation, Groundwater Monitoring and Sub-slab Sampling	October 20 through 27, 2014
Chemical Analysis (Rushed)	October 21 through November 31, 2014
Review Data and Develop Preliminary Recommendations	November 1 through 7, 2014
Reporting on Subsurface Investigation Results*	November 24, 2014

*Includes one round of review comments.

6.3. Health and Safety

A site-specific Health and Safety Plan (HASP) has been developed for use during the subsurface investigation field activities. The HASP is provided in Appendix B of this SAP. The Field Coordinator will be responsible for implementing the HASP during the field activities. The Project Manager will discuss health and safety issues with the Field Coordinator on a routine basis during the completion of field activities.

The Field Coordinator will conduct a tailgate safety meeting each morning prior to beginning daily field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP. Companies providing services for this project on a subcontracted basis will be responsible for developing and implementing their own HASP for use by their employees.

7.0 SUBSURFACE INVESTIGATION PROGRAM

The investigation methods to be implemented for this project are listed below and described further in the subsequent sections:

- Hollow-stem Auger Soil Borings and Monitoring Well Installation
- Groundwater Monitoring of Existing Wells and New Wells Installed During This Project
- Soil Gas Sampling

7.1. Hollow-Stem Auger Drilling and Associated Monitoring Wells

7.1.1. General

Two new permanent groundwater monitoring wells will be installed downgradient of the existing building as shown on Figure 2. The borings will be completed to depths of 25 and 50 feet bgs based on the

lithology observed in previous investigation borings. Boring USC-MW1S will be installed within the shallow aquifer. Boring USC-MW1D will be installed within the deep aquifer.

7.1.2. Hollow-Stem Auger Soil Sampling Methodology and Chemical Analysis

Soil borings will be advanced using hollow-stem auger drilling methods. A split-spoon sampler will be used to collect soil samples at 2.5-foot to 5-foot depth intervals. The following methodology will be implemented to minimize potential cross contamination between the two aquifers during drilling.

- An 8-inch steel casing will be driven through the ice-contact deposits unit just into the anticipated silt layer at the base of the ice-contact deposits (if encountered) in each boring. If groundwater is observed to be present within the ice-contact deposits, the 8-inch casing will be terminated at the silt unit to seal the 8-inch casing and allow for telescoping further down using a smaller diameter steel casing into the glacial outwash unit. The 8-inch casing will be lifted approximately 1 foot as the borehole is filled with at least 3 feet of bentonite. The bentonite will be hydrated with potable water and allowed to set for up to 1 hour. Water within the casing will be removed via a bailer or pump. The smaller diameter casing will be placed inside the larger casing used to seal off the groundwater within the shallow aquifer. The inner casing will continue to be driven until the desired depth within the deep aquifer is reached.
- A single-steel casing will be used in locations where the well depth is anticipated to be completed within the ice-contact deposits (shallow aquifer), the confining silt layer is not observed between the ice-contact deposits and the advance outwash (deep aquifer) or groundwater is not observed within the ice-contact deposits at the time of drilling.

Discrete soil samples collected during drilling will be submitted for volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) method 8260. Soil samples to be submitted for chemical analysis will meet the following criteria:

- Where field screening indicates the soil is impacted, particularly sand and gravel lenses within the ice-contact deposits (see Section 8.0 for field screening protocols)
- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater table if groundwater is encountered.
- At the top of confining layers if encountered.
- Selected soil samples may be collected and retained by the analytical laboratory for follow-up analysis to further delineate the vertical extent of contaminated soil.
- Soil samples to be submitted for VOC analysis will be collected directly from the split spoon using the EPA SW-846 5035A (EPA, 2002). The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 9.0. Soil cuttings will be stored in a drum at a secure facility on UWT campus pending off-site disposal. Section 10.0 of this SAP discusses the disposal of investigation derived waste (IDW).

7.1.3. Groundwater Monitoring Well Installation

WELL CASING

The monitoring wells will be constructed using 2-inch-diameter, Schedule 40, threaded polyvinyl chloride (PVC) casing that meets the following requirements: 1) casing will be new (unused); 2) casing sections will be joined only by tightening the threaded sections, glue will not be used to join casing sections; and 3) casing will be generally straight.

WELL SCREEN

Well screens will consist of 2-inch diameter, Schedule 40, 0.010-inch or 0.020-inch machine-slotted, PVC well screens. PVC end caps will be installed on the bottom of the well screens. The estimated depth of the borings and well screens is anticipated to be as follows:

- Monitoring Well USC-MW1S will be completed within the shallow aquifer (ice-contact deposits). The length of the well screen is estimated to be 15 feet. The length of the well screen may be adjusted to enable the top of the monitoring well screen to be located above the observed depth to groundwater and the base of the screen will be set on a confining layer that may limit vertical groundwater flow (silt). If a silt layer is not observed, then a monitoring well will not be installed at this location.
- Monitoring well USC-MW1D will be completed within the deep aquifer (advance outwash). The length of the well screen will be limited to 15 feet. The top of the well screen interval will be set at approximately 10 feet below the top of the advance outwash.

SAND PACK

The sand pack for the wells will consist of silica sand with the appropriate grain size distribution to reduce entry of fine-grained particulates from the surrounding formation into the wells (e.g., 10-20 sand). The sand pack will extend from the bottom of the well screen to at least 1 foot above the top of the well screen. The top of the sand pack will be sounded to verify its depth during placement.

ANNULAR SEAL

The annular seal will consist of a minimum 1-foot-thick layer of hydrated bentonite pellets or chips installed between the sand pack and the concrete surface seal.

SURFACE COMPLETION

The new monitoring wells will be completed using flush monuments at the ground surface. The well casing will be cut approximately 3 inches bgs, and a locking J-plug (compression) or similar well cap will be installed to prevent surface water from entering the well. The well monument will be installed in a concrete surface seal. The well number will be marked on the well monument lid and/or the well cap. A concrete surface seal will hold the flush monument in place.

7.1.4. Monitoring Well Survey

A licensed surveyor will perform an elevation and location survey of the two new monitoring wells to the following vertical datum used on previous wells: City of Tacoma benchmark book published by City of Public Works, July 1, 1990, NGVD 1929 and horizontal datum of NAD 1983.

7.2. Groundwater Monitoring of New and Existing Permanent Monitoring Wells

Well development and sampling will be performed in the two existing (JS-MW3S and JS-MW3) and/or the two new groundwater monitoring wells (USC-MW1S and USC-MW1D). The monitoring well locations are shown on Figure 2.

7.2.1. Permanent Monitoring Well Development

Newly installed groundwater monitoring wells will be developed prior to sampling. Prior to development, a field form will be completed with details describing location, condition, water levels, sediment depths, and product levels (if any) observed during inventory activities. Each groundwater monitoring well will be developed to stabilize the sand pack and formation materials surrounding the well screen, and restore

the hydraulic connection between the well screen and the surrounding soil. The head space vapors in the monitoring wells will be measured upon removing the cap to the well. The depth to groundwater in the monitoring wells will be measured prior to development using an electric water level indicator. The potential presence of product will be measured with an interface probe prior to development. The well screen will be gently surged and purged of water. Development will continue until a minimum of five casing volumes of water has been removed or the turbidity of the discharged water is relatively low. The goal of well development will be to reduce the turbidity content of the water to approximately 25 nephelometric turbidity units (NTU). The removal rate and volume of groundwater removed will be recorded on field forms during well development procedures (Appendix C). Water that is removed during well development activities will be stored temporarily drums at a secure facility on UWT campus pending approved sewer discharge or off-site disposal.

7.2.2. Permanent Groundwater Monitoring Well Groundwater Sampling and Chemical Analysis

Groundwater monitoring will be completed in the existing two permanent monitoring wells (JS-MW3 and JS-MW3S) and the two additional monitoring wells (USC-MW1S and USC-MW1D) to evaluate groundwater conditions. The depth to water will be measured and recorded in these four wells prior to sampling using an electronic water level indicator.

Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of particulates in the samples. Groundwater samples will be obtained from monitoring wells using a decontaminated bladder pump with disposable bladder and tubing will be placed at the mid-portion of the well screen interval or half way within the water column if the water column height is less than the screen length. Groundwater will be pumped at a rate of approximately 0.5 liters per minute. A water quality measuring system with a flow-through-cell will be used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, oxidation-reduction potential and temperature. Turbidity will be measured with a turbidimeter. Groundwater samples will be collected when these parameters vary by less than 10 percent for three consecutive measurements or three well volumes have been removed. Field measurements will be documented on the field log (Appendix C). After well purging, the flow-through-cell will be disconnected and the groundwater sample will be obtained in laboratory-prepared containers.

The water samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 9.0. The chemical analysis for groundwater samples will be submitted for chemical analysis of VOCs by EPA method 8260. The water sample collected from JS-MW3S will be submitted for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx. Purge water will be temporarily stored in labeled 55-gallon drums at a secure facility on UWT campus pending UW approval for either discharge to the sewer system or off-site disposal. Section 10.0 of this SAP/QAPP discusses the disposal of IDW.

7.3. Vapor Intrusion – Sub-slab Soil Gas Sampling

Vapor intrusion has increasingly become a concern on carcinogenic volatile organic compounds (CVOCs) sites that have been partially or fully developed with structures. CVOC vapors in the subsurface that volatilize from impacted groundwater and/or soil can collect beneath building foundations and may intrude into the building's indoor air through cracks in the foundation or other preferential pathways (e.g., utility penetrations, floor sumps, crawlspaces, etc.).

PCE has been detected in soil beneath the Urban Solutions Center, a TCE-contaminated groundwater plume is located immediately upgradient (southwest) of the building, and PCE, TCE and cis-1,2-Dichloroethylene (DCE) have been detected in soil and/or groundwater east of the site. Therefore, soil gas samples will be submitted for chemical analysis of these three CVOCs, along with PCE and TCE daughter products 1,1-DCE, trans-1,2-DCE, and vinyl chloride.

Five locations within the Urban Solutions Center will be evaluated to study the potential for vapor intrusion to occur. The five locations are shown on Figure 2. These five locations were selected to sample sub-slab soil gas across the building footprint, with a focus on the southwest side of the building for the following reasons 1) the TCE-contaminated groundwater plume and 2) PCE was detected in soil at concentrations greater than the MTCA Method A soil cleanup level on the southwest side of the building.

Sub-slab soil gas samples will be collected using Vapor Pin™ sampling devices; sample collection and handling will be consistent with Ecology's draft VI guidance (Ecology, 2009). The Vapor Pin™ will be installed following the manufacturers' standard operating procedures (SOPs); see Appendix D). The detailed sampling protocol is also described in Appendix D. Leak testing, purging and soil gas sampling will not take place for at least 30 minutes hours after sub-slab vapor probe installation (DTSC, 2012). GeoEngineers will keep detailed notes describing sampling activities. After collection of each soil gas sample, the tubing will be disconnected and discarded, and the vapor port will be securely capped.

8.0 GENERAL SOIL SAMPLING PROTOCOLS

8.1. General Procedures

Investigation explorations will be conducted to collect soil samples for chemical analysis and to further document the lithologic conditions. A representative from GeoEngineers' staff will examine and classify the soils encountered and prepare a detailed log of each exploration. The field representative will visually classify the soil in accordance with ASTM International (ASTM) Method D 2488 and record soil descriptions and other relevant field screening details (e.g., staining, debris, odors, etc.) in the field log. ASTM Method D 2488 is the visual-manual soil description method that corresponds to laboratory ASTM Method D 2487 (Unified Soil Classification System method). Example logs are included in Appendix C.

Samples will be placed in a clean plastic-lined cooler with ice after collection. The objective of the cold storage will be to attain a sample temperature of 2 to 6 degrees Celsius. GeoEngineers' field personnel will provide for the security of samples from the time the samples are collected until the samples have been received by the courier service or laboratory personnel. A chain of custody form (Appendix C) will be completed for each group of samples being shipped to the laboratory per standard chain of custody protocol. Samples will be transported and delivered to the analytical laboratory in the sample coolers by field personnel, laboratory personnel, by courier service, or by a commercial shipping company.

8.1.1. Field Screening

Soil samples will be field-screened for evidence of possible petroleum hydrocarbons and VOCs. Field screening results will be recorded on the field logs and the results will be used as a general guideline to delineate areas of possible contamination related to petroleum hydrocarbons and VOCs. The following field screening methods will be used: 1) visual screening, 2) water sheen screening, and 3) headspace vapor screening.

VISUAL SCREENING

The soil will be observed for indications of petroleum impacts, including unusual color, stains and/or odor indicative of possible contamination.

WATER SHEEN SCREENING

This is a qualitative field screening method that can help identify the presence or absence of petroleum hydrocarbons. A portion of the soil sample will be placed in a plastic sheen pan containing water. The water surface will be observed for signs of sheen. The following sheen classifications will be used during field screening:

Classification	Identifier	Description
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
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

HEADSPACE VAPOR SCREENING

This is a semi-quantitative field screening method that can help identify the presence or absence of volatile chemicals. Following soil sample collection, a portion of the sample is placed in a resealable plastic bag for headspace vapor screening. Ambient air is captured in the bag; the bag is sealed, left for approximately five minutes, and then shaken gently for approximately 10 seconds to expose the soil to the air trapped in the bag. Vapors present within the sample bag's headspace are measured by inserting the probe of a PID through a small opening in the bag. A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt lamp (standard) in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm and 2,000 ppm (isobutylene-equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum ppm value will be recorded on the field report for each sample. The PID will be calibrated to fresh air of similar relative humidity experienced at the site and to 100 ppm isobutylene. The PID will be recalibrated if site conditions change (ambient temperature, relative humidity, etc.).

9.0 FIELD DOCUMENTATION

9.1. Soil, Groundwater and Soil Gas Sample Containers and Labeling

The Field Coordinator will manage field protocols related to sample collection, handling and documentation. Soil and water samples will be placed in appropriate laboratory-prepared containers. Soil and groundwater samples will be submitted for VOCs by EPA method 8260. Soil gas samples will be submitted for chemical analysis of CVOCs (PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride) by EPA method TO-15 SIM.

Sample containers and preservatives are listed in Table 3.

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

- Project number
- Sample name, which will include a reference to the location, sampling depth (if applicable)
- Date and time of collection
- Samplers initials
- Preservative type (if applicable)

Sample collection activities will be noted on the field logs contained in Appendix C and the Field Coordinator will monitor consistency between sample containers/labels, field logs, and chain of custody forms. Sample numbering conventions are described below:

Soil Samples – Each sample will be labeled with the Building Number- boring number, depth the sample was initiated, depth the samples was ended. For example, if a soil sample is collected from 10 to 12 feet bgs from boring USC-MW1D, the sample ID would be USC-MW1D-10-12.

Groundwater Sample – Each sample will be labeled with the monitoring well number and the year, month, day of sample collection. For example, if a groundwater sample is collect from monitoring well USC-MW1D on October 31, 2014, the sample identification would be USC-MW1D-20141031.

Soil Gas Sample – Each sample will be labeled with the soil gas sub-slab number, and the year, month, day of sample collection. For example, if a soil gas sample is collect from sub-slab USC-SV1 on October 28, 2014, the sample identification would be SV1-141018.

9.2. Sample Handling

Samples will be placed in a clean plastic-lined cooler with ice after collection. The objective of the cold storage will be to attain a sample temperature of 2 to 6 degrees Celsius. Each sample will be documented on a boring log, groundwater collection form or soil gas collection form including sample name, sample collection date and time, sample type, sample depth, soil classification, requested analytical methods, and sampler name.

GeoEngineers' field personnel will provide for the security of samples from the time the samples are collected until the samples have been received by the courier service or laboratory personnel. A chain of custody form will be completed for each group of samples being shipped to the laboratory per standard chain of custody protocol. Samples will be transported and delivered to the analytical laboratory in the sample coolers. The samples will either be transported by field personnel, laboratory personnel, by courier service or shipping company.

9.3. Field Observations Documentation and Records

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will record information for each boring and groundwater well sampling information on field logs and will maintain a daily field report. Entries in the field logs will be made in pencil or water-resistant ink on water-resistant paper, and corrections will consist of line-out deletions. Individual logs and reports will become part of the project files at the conclusion of the field work.

At a minimum, the following information will be recorded during the collection of each sample.

- Sample location and description
- Sampler's name(s)
- Date and time of sample collection
- Sample matrix (soil or water)
- Type of sampling equipment used
- Field instrument (e.g., electronic water level indicator) readings
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.)
- Preliminary sample descriptions (e.g., lithology, field screening results)
- Sample preservation

In addition to the sampling information, the following specific information will also be recorded in the field log for each boring or in a daily field report.

- Sampling team members
- Time of arrival/entry on site and time of site departure
- Other personnel present at the site
- Summary of pertinent meetings or discussions with contractor personnel
- Deviations from sampling plans and HASP
- Air monitoring results
- Changes in field personnel and responsibilities with reasons for the changes
- Levels of safety protection

The handling, use, and maintenance of field logs and reports are the Field Coordinator's responsibility.

9.4. Decontamination

The objective of the decontamination procedures described herein is to minimize the potential for cross-contamination between sample locations. Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

- Brush equipment with a nylon brush to remove large particulate matter
- Rinse with potable tap water
- Wash with non-phosphate detergent solution (Alconox® and potable tap water)
- Rinse with potable tap water
- Rinse with distilled water

Equipment will either be decontaminated immediately prior to use or wrapped in aluminum foil between decontamination and use.

10.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE

Procedures for handling IDW specific to this investigation are detailed in the following sections.

10.1. Soil

Soil cuttings generated from the borings will be stored in sealed 55-gallon drums. The drums will be temporarily stored in a secure area on the UWT campus pending receipt of analytical results of soil samples and off-site disposal at a permitted facility. If the results for a soil sample exceeds the "20 times" rule, the sample will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) to further evaluate disposal requirements. Each drum will be labeled with the following information:

- Material/media (i.e., soil, drill cuttings) contained in the drum.
- Source of the material in the drum (i.e., investigation locations and depths where appropriate).
- Date material was generated.
- Name and telephone number of GeoEngineers contact person.

10.2. Groundwater and Decontamination Water

Purge water removed from the groundwater monitoring wells and decontamination water generated during the sampling activities will be placed in a drum. The tank will be periodically emptied into a temporary storage tank stored at a secure facility. A water sample will be collected at the end of the groundwater monitoring events for chemical analysis for disposal purposes.

10.3. Incidental Waste

Incidental waste to be generated during sampling activities includes items such as gloves, plastic sheeting, sample tubing, paper towels and similar expended and discarded field supplies. These materials are considered *de minimis* and will be disposed in a local trash receptacle or county disposal facility.

11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality and that meet established objectives. QA/QC procedures will be implemented so that the precision, accuracy, representativeness, completeness and comparability (PARCC) of the data generated meet the specified data quality objectives within standard industry guidelines as described in Tables 3 through 7.

11.1. Field Quality Control

11.1.1. Field Duplicates

Field duplicates serve as a measure for precision. Under ideal field conditions, field duplicates (sometimes referred to as splits), are created by thoroughly mixing a volume of the sample matrix, placing aliquots of the mixed sample in separate containers, and identifying one of the aliquots as the primary sample and the other as the duplicate sample. Field duplicates measure the precision and consistency of laboratory analytical procedures and methods, as well as the consistency of the sampling techniques

used by field personnel. Field duplicates will be collected during this investigation as described in Table 4. Field duplicates will be labeled in consecutive order with the date in year, month, date and type of material. For example the first soil field duplicate for June 23, 2013, will be labeled DUPE-130623-S-1.

11.1.2. Trip Blanks

Trip blanks accompany samples for VOC analysis during field sampling and delivery to the laboratory. Trip blanks will be analyzed during this investigation only if VOCs are detected in the original data set to rule out sample containers and coolers as potential sources of the detections. Trip blanks will be labeled in consecutive order with the date identified in year, month, and date. For example the first trip blank for October 31, 2014, will be labeled TRIP-130623-1.

11.1.3. Rinsate

Field rinsate blanks will not be collected as part of this investigation.

11.2. Data Management and Documentation

Data logs and data report packages will be located in the project file system in GeoEngineers' Sharepoint. Laboratory data reports will include internal laboratory quality control checks and sample results. Data logs and packages that are anticipated to be generated during the investigation include laboratory data report packages, field report, field sampling data sheets, site plan of sample locations and chain-of-custody forms.

Analytical data will be supplied to GeoEngineers in both electronic data deliverable (EDD) format and PDF format. The PDF will serve as the official record of laboratory results. The EDDs will contain only data reported in the hard copy reports (e.g., only reportable results).

Upon receipt of the analytical data, the EDD will be uploaded to a project database and reduced into summary tables for each group of analytes and media. Upon completion of the summary tables, the accuracy of the data reduction will be verified using the hard copy of the data received from the laboratory. Any exceptions will be noted and corrections will be made.

11.3. Data Validation and Usability

Upon receipt of the sample data from the laboratory, the data will be validated and evaluated for usability.

11.4. Environmental Information Management System Submittal

Chemical analytical results for soil and groundwater samples collected will be submitted to the Ecology Environmental Information Management (EIM) database.

12.0 REFERENCES

DTSC, 2012. Advisory Active Soil Gas Investigation. Department of Toxic Substances Control, California Environmental Protection Agency. Los Angeles Regional Water Quality Control Board. San Francisco Regional Water Quality Control Board. April 2012.

Ecology, 2009. Review Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action. Publication No. 09-09-047. October 2009.

Ecology, 2013. Model Toxics Control Act Regulation and Statute: MTCA Cleanup Regulation Chapter 173-340 WAC, Model Toxics Control Act Chapter 70.105D RCW, Uniform Environmental Covenants Act Chapter 64.70 RCW.

EPA, 2002. Method 5035A Closed-System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples http://www.epa.gov/osw/hazard/testmethods/pdfs/ 5035a_r1.pdf

GeoEngineers, Inc. Draft Environmental Subsurface Investigation, UWT Environmental Assessment – CPO Project No. 204277, South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue, Tacoma, Washington dated August 8, 2014.

GeoEngineers, Inc. Hood Corridor Soil Sampling Results, UWT – Tioga Library Building Project. November 29, 2011.

GeoEngineers, Inc. Jefferson Street Association Parcel – UST Closure and Remediation, 1742 Jefferson Avenue, Tacoma, WA. March 14, 2013.

GeoEngineers, Inc. Report Phase II a Geotechnical Engineering Services Proposed Science and Keyhole Buildings, 1745 Jefferson Avenue, Tacoma, WA. September 20, 1999.

GeoEngineers, Inc. Report - Remedial Excavation Services Science Building, 1745 Jefferson Avenue, Tacoma, WA. September 12, 2000.

United States Geological Survey (USGS) topographic map. USGS 7.5 Minute Quadrangle – Tacoma North, Scale 1:24,000, 2011.

United States Geological Survey (USGS) topographic map. USGS 7.5 Minute Quadrangle – Tacoma South, Scale 1:24,000, 2011.

URS Corporation. Final Phase I ESA Pierce Transit Parcel, 1722 Broadway, Tacoma, Washington, September 15, 2011.

URS Corporation. Third Quarterly Report, Post-Injection Groundwater Monitoring, Howe Parcel Interim Action, University of Washington Tacoma, Tacoma Washington, Agreed Order No. DE 97HW-S238, September 11, 2014.

URS Corporation. Status Report: Additional Investigation of Market Street and Tacoma Avenue Groundwater TCE Plumes, UW Tacoma Campus. June 9, 2009.

URS Corporation. Feasibility Study, Tacoma Campus. April 29, 2008.

URS Corporation. Work Plan Investigation of Upgradient Groundwater Solvent Plumes - UWT Campus. October 27, 2006.

URS Corporation. Phase II Soil Investigation Kosin Parcel, 1902-1914 Market Street, Tacoma, WA. July 14, 2003.

URS Corporation. Agency Review Draft Feasibility Study, University of Washington Tacoma Campus. April 14, 2003.

URS, 2003. Remedial Investigation Report, University of Washington, Tacoma Campus, Tacoma, Washington. Prepared for University of Washington. February 26, 2003.

URS Corporation. Report - Groundwater Quality Investigation Merlino and Laborers Parcels. August 26, 2002.

URS Corporation. Results of Supplemental Remedial Investigation-Jefferson Street Association & Sound Care Parcels. June 10, 2002.

URS Corporation. Results of Supplemental Remedial Investigation-Jet Parking & Jefferson Street Association Parcels. April 30, 2002.

Table 1

Summary of Chemical Analytical Results During 2013 Sampling Event[1] - Soil

University of Washington Tacoma Urban Solutions Building

Tacoma, Washington

Boring/Test Pit	2D-B1	2D-B1	2D-B2	2D-B2	2D-B3	2D-B3	2D-B4	2D-B5	2D-B5	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	
Sample Identification [2]	2D-B1-0-1	2D-B1-8-9	2D-B2-0-1	2D-B2-4-5	2D-B3-0-1	2D-B3-11-12	2D-B4-0-1	2D-B5-0-1	2D-B5-6-7	JS-MW3S-8-9	JS-MW3S-10.5-11.5	JS-MW3S-12-12.5	JS-MW3S-13-14	JS-MW3S-18-19	JS-MW3S-21-22	JS-MW3S-23-24	JS-MW3S-24-25	MTCA Method A ULU Cleanup Level
Sample Depth (feet bgs)	0 to 1	8 to 9	0 to 1	4 to 5	0 to 1	11 to 12	0 to 1	0 to 1	6 to 7	8 to 9	10.5 - 11.5	12 to 12.5	13 to 14	18 to 19	21 to 22	23 to 24	24 to 25	
Soil Type	Fill	Qvi	Fill	Qvi	Fill	Qvi	Fill	Fill	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Silt	
NWTPH-HCID [3] (mg/kg)																		
Gasoline-Range	23 U	24 U	27 U	27 U	29 U	27 U	23 U	23 U	26 U	--	--	--	--	--	--	--	--	30/100[7]
Diesel-Range	57 U	59 U	67 U	66 U	74 U	66 U	57 U	57 U	65 U	--	--	--	--	--	--	--	--	2,000
Lube Oil-Range	110 U	120 U	130 U	130 U	150 U	130 U	110 U	120 U	130 U	--	--	--	--	--	--	--	--	2,000
VOCs [4] (mg/kg)																		
Tetrachloroethene (PCE)	**0.0042**	**0.083**	**0.041 J**	**0.12**	**0.0024**	**0.018**	**0.0061**	0.00096 U	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	0.05
Trichloroethene (TCE)	0.00096 U	0.00085 U	0.0012 U	0.0023 U	0.0010 U	0.0011 U	0.0014 U	0.00096 U	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	0.03
(cis) 1,2-Dichloroethene	0.00096 U	0.00085 U	0.0012 U	0.0023 U	0.0010 U	0.0011 U	0.0014 U	0.00096 U	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	160[8]
(trans) 1,2-Dichloroethene	0.00096 U	0.00085 U	0.0012 U	0.0023 U	0.0010 U	0.0011 U	0.0014 U	0.00096 U	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	1,600[8]
Vinyl Chloride	0.00096 U	0.00085 U	0.0012 U	0.0023 U	0.0010 U	0.0011 U	0.0014 U	0.00096 U	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	0.67[8]
Benzene	0.00096 U	0.00085 U	0.0012 U	0.0023 U	0.0010 U	0.0011 U	0.0014 U	**0.0078**	0.0011 U	0.00091 U	0.00088 U	0.0011 U	0.00088 U	0.00092 U	0.00082 U	0.00089 U	0.00083 U	0.03
PAHs [5] (mg/kg)																		
1-Methylnaphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	35[8]
2-Methylnaphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	320[8]
Acenaphthene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	4,800[8]
Acenaphthylene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	NE
Anthracene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	24,000[8]
Benzo[g,h,i]perylene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	NE
Fluoranthene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	3,200[8]
Fluorene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	3,200[8]
Naphthalene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	5
Phenanthrene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	NE
Pyrene	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	2,400[8]
cPAHs [5] (mg/kg)																		
Benzo (a) anthracene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	MTCA ULU cleanup level for the sum of all cPAHs is 0.1 mg/kg
Benzo (a) pyrene (TEF 1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Benzo (b) fluoranthene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Benzo (J,k) fluoranthene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Chrysene (TEF 0.01)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Dibenz (a,h) anthracene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Indeno (1,2,3-cd) pyrene (TEF 0.1)	0.0076 U	0.0078 U	0.0089 U	0.0089 U	0.0098 U	0.0088 U	0.0076 U	0.0076 U	0.0087 U	--	--	--	--	--	--	--	--	
Total TTEC of cPAHs (detect only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--	--	--	--	--	--	--	0.1

Boring/Test Pit	2D-B1	2D-B1	2D-B2	2D-B2	2D-B3	2D-B3	2D-B4	2D-B5	2D-B5	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	JS-MW3S	MTCA Method A ULU Cleanup Level
Sample Identification [2]	2D-B1-0-1	2D-B1-8-9	2D-B2-0-1	2D-B2-4-5	2D-B3-0-1	2D-B3-11-12	2D-B4-0-1	2D-B5-0-1	2D-B5-6-7	JS-MW3S-8-9	JS-MW3S-10.5-11.5	JS-MW3S-12-12.5	JS-MW3S-13-14	JS-MW3S-18-19	JS-MW3S-21-22	JS-MW3S-23-24	JS-MW3S-24-25	
Sample Depth (feet bgs)	0 to 1	8 to 9	0 to 1	4 to 5	0 to 1	11 to 12	0 to 1	0 to 1	6 to 7	8 to 9	10.5 - 11.5	12 to 12.5	13 to 14	18 to 19	21 to 22	23 to 24	24 to 25	
Soil Type	Fill	Qvi	Fill	Qvi	Fill	Qvi	Fill	Fill	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Qvi	Silt	
Metals [6] (mg/kg)																		
Arsenic	11 U	12 U	13 U	13 U	15 U	13 U	11 U	11 U	13 U	--	--	--	--	--	--	--	--	20
Barium	**78**	**66**	**120**	**170**	**150**	**120**	**65**	**94**	**130**	--	--	--	--	--	--	--	--	16,000 [8]
Cadmium	0.57 U	0.59 U	0.67 U	0.66 U	0.74 U	0.66 U	0.57 U	0.57 U	0.65 U	--	--	--	--	--	--	--	--	2.0
Chromium	**49**	**30**	**55**	**130**	**53**	**43**	**43**	**32**	**57**	--	--	--	--	--	--	--	--	2,000 [9]
Lead	5.7 U	5.9 U	6.7 U	**6.8**	7.4 U	6.6 U	5.7 U	5.7 U	6.5 U	--	--	--	--	--	--	--	--	250
Mercury	0.29 U	0.29 U	0.34 U	0.33 U	0.37 U	0.33 U	0.28 U	0.29 U	0.33 U	--	--	--	--	--	--	--	--	2.0
Selenium	11 U	12 U	13 U	13 U	15 U	13 U	11 U	11 U	13 U	--	--	--	--	--	--	--	--	400 [8]
Silver	1.1 U	1.2 U	1.3 U	1.3 U	1.5 U	1.3 U	1.1 U	1.1 U	1.3 U	--	--	--	--	--	--	--	--	400 [8]

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc., of Redmond, Washington.

[2] Sample ID = Area number - boring/test pit number - starting depth of sample [feet bgs] -end depth [feet bgs], Area 2D Boring 1 collected 8-9 feet bgs = 2D-B1-8-9.

[3] Washington State Department of Ecology (Ecology)-approved method NWTPH-HCID.

[4] VOCs were analyzed by EPA method 8260C. Other VOCs were analyzed but not detected.

[5] Polycyclic aromatic hydrocarbons (PAHs) and carcinogenic PAHs (cPAHs) were analyzed by U.S. Environmental Protection Agency (EPA) method 8270D/SIM.

[6] Resource Conservation Recovery Act (RCRA) metals analyzed by EPA 6000/7000 series method.

[7] MTCA Method A cleanup level for gasoline is 30 mg/kg if benzene is detected or if the sum of toluene, ethylbenzene and xylenes are equal to or greater than 1% of the total gasoline detection.

[8] MTCA Method B criteria represented because MTCA Method A cleanup level has not been established.

[9] MTCA Method A cleanup level for Trivalent Chromium.

[10] Guidance for Remediation of Petroleum Contaminated Sites (Publication 10-09-057) Ecology, October 2011; Summary Natural Background Soil Metals Concentrations in Washington State (Publication 94-115) dated October 1994; and Hazardous Waste Regulations 40 CFR Part 260.

[11] Chromium was not compared to the Reuse Criteria listed above for soils based on historic soil analytical results indicating chromium is not a prevalent chemical of concern on the UWT campus.

mg/kg = milligram per kilogram

MTCA = Model Toxics Control Act

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result

N/A = not applicable

bgs = below ground surface

Qvi = Ice-contact deposit

DET = Detected greater than laboratory reporting limits

TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective MTCA cleanup level.

Table 2

Summary of Chemical Analytical Results During 2013 Sampling Event[1] - Groundwater

University of Washington Tacoma Urban Solutions Building
Tacoma, Washington

Boring Identification	JS-MW3	JS-MW3S	JS-MW3S	Tap Water	MTCA Method A Groundwater Cleanup Level	MTCA Method B Groundwater Cleanup Level	MTCA Method B Groundwater Screening Levels Protective of Indoor Air [12]
Sample ID[2]	JS-MW3-130625	JS-MW3S-130913	JS-MW3S-140122	WATER-130924			
Sample Date	6/25/2013	9/13/2013	1/22/2014	9/24/2013			
Approximate Depth to Groundwater (feet btoc)[3]	36.52	18.81	18.85	N/A			
Approximate Elevation of Groundwater [4]	52.83	70.05		N/A			
Top of Well Screen Elevation (feet) [4]	50.97	77.36	77.36	N/A			
Bottom of Well Screen Elevation (feet) [4]	35.97	67.36	67.36	N/A			
Lithology At Well Screen	Advance Outwash	Qvi	Qvi	N/A			
NWTPH-Gx[5] (µg/L)							
Gasoline-Range	--	100 U	100 U	100 U	800/1,000[10]	NE	NE
NWTPH-Dx[6] (mg/L)							
Diesel-Range	--	**0.31**	--	0.26 U	0.5	NE	NE
Lube Oil-Range	--	0.43 U	--	0.42 U	0.5	NE	NE
VOCs[7] (µg/L)							
Trichloroethene (TCE)	0.20 U	0.20 U	0.20 U	0.20 U	5	0.54	1.5
Tetrachloroethene (PCE)	0.20 U	0.20 U	0.20 U	0.20 U	5	21	24
(cis) 1,2-Dichloroethene	0.20 U	0.20 U	0.20 U	0.20 U	NE	16	160
(trans) 1,2-Dichloroethene	0.20 U	0.20 U	0.20 U	0.20 U	NE	160	130
Vinyl Chloride	0.10 U	0.20 U	0.20 U	0.20 U	0.2	0.029	0.35
Bromodichloromethane	0.20 U	**0.98**	0.20 U	**2.2**	NE	0.71	0.09
Chloroform	0.20 U	**8.7**	**0.28**	**28**	NE	80	1.2
Carbon Disulfide	0.20 U	0.20 U	**0.25**	0.20 U	NE	800	400
Dibromochloromethane	0.20 U	**0.23**	0.20 U	**0.27**	NE	0.52	0.22
PAHs[8] (µg/L)							
Naphthalene	--	0.10 U	--	0.097 U	160	160	NE
2-Methylnaphthalene	--	0.10 U	--	0.097 U	NE	1.5	NE
1-Methylnaphthalene	--	0.10 U	--	0.097 U	NE	32	NE
Acenaphthylene	--	0.10 U	--	0.097 U	NE	NE	NE
Acenaphthene	--	0.10 U	--	0.097 U	NE	960	NE
Fluorene	--	0.10 U	--	0.097 U	NE	640	NE
Phenanthrene	--	0.10 U	--	0.097 U	NE	NE	NE
Anthracene	--	0.10 U	--	0.097 U	NE	4,800	NE
Fluoranthene	--	0.10 U	--	0.097 U	NE	640	NE
Pyrene	--	0.10 U	--	0.097 U	NE	4,800	NE
Benzo[g,h,i]perylene	--	0.10 U	--	0.097 U	NE	NE	NE
cPAHs[8] (µg/L)							
Benzo (a) anthracene (TEF 0.1)	--	0.010 U	--	0.0097 U	MTCA ULU cleanup level for the sum of all cPAHs is 0.1 µg/L	MTCA ULU B criteria level for the sum of all cPAHs is 0.012 µg/L	NE
Benzo (a) pyrene (TEF 1)	--	0.010 U	--	0.0097 U			
Benzo (b) fluoranthene (TEF 0.1)	--	0.010 U	--	0.0097 U			
Benzo (j,k) fluoranthene (TEF 0.1)	--	0.010 U	--	0.0097 U			
Chrysene (TEF 0.01)	--	0.010 U	--	0.0097 U			
Dibenz (a,h) anthracene (TEF 0.1)	--	0.010 U	--	0.0097 U			
Indeno (1,2,3-cd) pyrene (TEF 0.1)	--	0.010 U	--	0.0097 U			
Total TTEC of cPAHs (detect only)	--	N/A	--	N/A	0.1	0.012	NE
Total Metals[9] (µg/L)							
Arsenic	--	3.0 U	--	3.0 U	5	0.058	NE
Barium	--	**69**	--	25 U	NE	3,200	NE
Cadmium	--	4.0 U	--	4.0 U	5	16	NE
Chromium	--	**18**	--	10 U	50[0]	NE	NE
Lead	--	**2.0**	--	3.4	15	NE	NE
Mercury	--	0.50 U	--	0.50 U	2	NE	NE
Selenium	--	5.0 U	--	5.0 U	NE	80	NE
Silver	--	10 U	--	10 U	NE	80	NE

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc. in Redmond, Washington.

[2] Sample ID = Area number - Boring number - Date (i.e., a water sample collected from JS-MW3 on June 25, 2013 = JS-MW3-130625) .

[3] Groundwater level was measured below the top of casing on November 8, 2013

[4] Based on survey completed by AHBL November 6, 2013. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal Control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, Elevation 165.15).

[5] Washington State Department of Ecology (Ecology)-approved method NWTPH-Gx.

[6] Ecology-approved method NWTPH-Dx.

[7] Volatile organic compounds (VOCs) were analyzed by U.S. Environmental Protection Agency (EPA) method 8260C. Other VOCs were analyzed but not detected.

[8] Polycyclic Aromatic Hydrocarbons (PAHs) and carcinogenic PAHs (cPAHs) analyzed by EPA method 8270D/SIM.

[9] Metals analyzed by EPA 200.8 or 7470A method.

[10] MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 800 µg/L if benzene is present and 1,000 µg/L if benzene is not present.

[11] MTCA Method A cleanup level for total chromium shown. Cleanup level for hexavalent chromium is 48 µg/L.

[12] MTCA Method B groundwater screening level based on protection of indoor air. Values calculated using Method B air cleanup levels from Ecology's "CLARC Master Spreadsheet.xls" dated May 2014 and Equation 1 from Ecology's 2009 draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action."

MTCA = Model Toxics Control Act

-- = Analyte or sample not analyzed.

N/A = not applicable

Qvi = Ice-contact deposit

µg/L = microgram per Liter

mg/L = milligram per Liter

DET = Detected greater than laboratory reporting limits

U = Analyte was not detected at or greater than the listed reporting limit

TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit

Bold font type and gray shading indicates analyte is detected at a concentration greater than the MTCA Method groundwater cleanup/criteria level

Dashed outline indicates analyte is detected at a concentration greater than the MTCA Method B Indoor Air Screening Level.

Table 3

Test Methods, Sample Containers, Preservation and Hold Times

University of Washington Tacoma Urban Solutions Building
Tacoma, Washington

Analysis	Method	Soil				Groundwater				Soil Gas		
		Minimum Sample Size	Bottle Size	Preservation	Holding Times	Minimum Sample Size	Bottle Size	Preservation	Holding Times	Bottle Size	Preservation	Holding Times
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx	N/A	N/A	N/A	N/A	Two 500 ml	500 ml amber	HCl pH<2, 4°C	14 days	N/A	N/A	N/A
Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	N/A	N/A	N/A	N/A	Two 500 ml	500 ml amber	HCl pH<2, 4°C	14 days	N/A	N/A	N/A
Volatile Organic Compounds (VOCs)	EPA 8260B/ 5035A	Three 40 ml VOAs, 2 with stir bar	4 oz glass with Teflon-lined lid, 40 ml VOA (pre-weighted)	Cool 4°C	48 Hours to Freeze/14 days	3 Vials	40 ml VOA vial	HCl pH<2, 4°C	14 days	N/A	N/A	N/A
Volatile Organic Compounds (VOCs)	TO-15 SIM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6 Liter Summa Canister	None	30 days

Notes:

Extraction holding time is based on elapsed time from date of sample collection.
VOA = Volatile Organic Analysis
°C = degree Celsius
oz = ounce
ml = milliliter
N/A = Not Applicable
SM = Standard Method
ASTM = ASTM International
HCl = hydrochloric acid
EPA = Environmental Protection Agency

Table 4

Quality Control Samples - Type and Frequency

University of Washington Tacoma Urban Solutions Building

Tacoma, Washington

Samples Collected for Chemical Analytical Testing	Field QC			Laboratory QC			
	Field Duplicates	Trip Blanks	Rinsate	Method Blanks	LCS	MS/MSD	Lab Duplicates
Soil	10 percent of samples	If VOCs are detected in sample	One every 10 borings	1 per batch	1 per batch	1 per batch[1]	1 per batch[2]
Groundwater	1 in 20 samples	If VOCs are detected in sample	One every 20 samples	1 per batch	1 per batch	1 per batch[1 and 3]	1 per batch[2]
Soil Vapor	Not Applicable	Not Applicable	Not Applicable	1 per batch	1 per batch	1 per batch[4]	Not Applicable

Notes:

[1] MS/MSD analyses are not completed on NWTPH-Dx analysis.

[2] Lab duplicates are not completed on VOCs analysis because the MS/MSD serves as the lab duplicate sample.

[3] Two times the sample volume will be collected to provide adequate sample volume to perform MS/MSD analyses.

[4] An LSCD, not MS/MSD, will be run for soil vapor samples.

An analytical batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/MSD (or MS and lab duplicate).

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

LCS = Laboratory control sample

LCSD = Laboratory control sample duplicate

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

Table 5

Methods of Analysis and Target Reporting Limits for Soil Samples

University of Washington Tacoma Urban Solutions Building
Tacoma, Washington

Analyte	MTCA Method A Cleanup Level for Soil Unrestricted Land Use (mg/kg)	MTCA Method B Cleanup Level for Soil (mg/kg)	Target Reporting Limit (mg/kg) [1]
Volatile Organic Compounds by EPA Method 8260			
(cis) 1,2-Dichloroethene (DCE)	NE	160	0.0010
(trans) 1,2-Dichloroethene (DCE)	NE	1,600	0.0010
1,1-Dichloroethene (DCE)	NE	4,000	0.0010
Benzene	0.03	18	0.0010
Ethylbenzene	6	8,000	0.0010
m,p-Xylene	Total Xylene = 9	16,000	0.0020
Tetrachloroethene	0.05	480	0.0010
Toluene	7	6,400	0.0050
o-Xylene	Total Xylene = 9	16,000	0.0010
Trichloroethene	0.03	12	0.0010
Vinyl Chloride	NE	0.67	0.0010

Notes:

[1] Laboratory reporting limits were obtained from OnSite Environmental, Inc., an Ecology-approved laboratory.

mg/kg = Milligram per kilogram

NE = Method A Screening Level Not Established

EPA = Environmental Protection Agency

MTCA = Model Toxics Control Act

Table 6

Methods of Analysis and Target Reporting Limits for Water Samples

University of Washington Tacoma Urban Solutions Building
Tacoma, Washington

Analyte	MTCA Method A Cleanup Level for Groundwater (µg/L)	MTCA Method B Criteria for Groundwater (µg/L)	MTCA Method B Screening Level Protective of Indoor Air [3] (µg/L)	Target Reporting Limit (µg/L)[2]
Total Petroleum Hydrocarbons by NWTPH-Gx and NWTPH-Dx				
Diesel-Range Petroleum Hydrocarbons	2,000	NE	NE	25
Heavy Oil-Range Petroleum Hydrocarbons	2,000	NE	NE	50
Volatile Organic Compounds by EPA Method 8260c				
(cis) 1,2-Dichloroethene (DCE)	NE	16	not available	0.2
(trans) 1,2-Dichloroethene (DCE)	NE	160	110	0.2
1,1-Dichloroethene (DCE)	NE	400	130	0.2
Benzene	5	0.80	2.4	0.2
Chloroform	NE	1.4	1.2	0.2
Ethylbenzene	700	800	2,800	0.2
m,p-Xylene	Total Xylene = 1,000	1,600	290	0.4
Tetrachloroethene	5	21	24	0.2
Toluene	1,000	640	1.5	1.0
o-Xylene	Total Xylene = 1,000	1,600	430	0.2
Trichloroethene	5	0.54	1.5	0.2
Vinyl Chloride	0.2	0.029	0.35	0.2

Notes:

[1] MTCA Method B groundwater criteria shown because MTCA Method A groundwater cleanup level has not been established.

[2] Laboratory reporting limits were obtained from OnSite Environmental, Inc., a Washington State Department of Ecology-approved laboratory.

[3] MTCA Method B groundwater screening level based on protection of indoor air. Values calculated using Method B air cleanup levels from Ecology's "CLARC Master Spreadsheet.xls" dated May 2014 and Equation 1 from Ecology's 2009 draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action."

NE = Not established

SM = Standard Method

µg/L = Microgram per liter

MTCA = Model Toxics Control Act

NWTPH-Gx = Northwest Total Petroleum Hydrocarbon-Gasoline Range Hydrocarbons

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon-Diesel/Lube Oil Range Hydrocarbons

EPA = Environmental Protection Agency

Table 7

Methods of Analysis and Target Reporting Limits for Air Samples

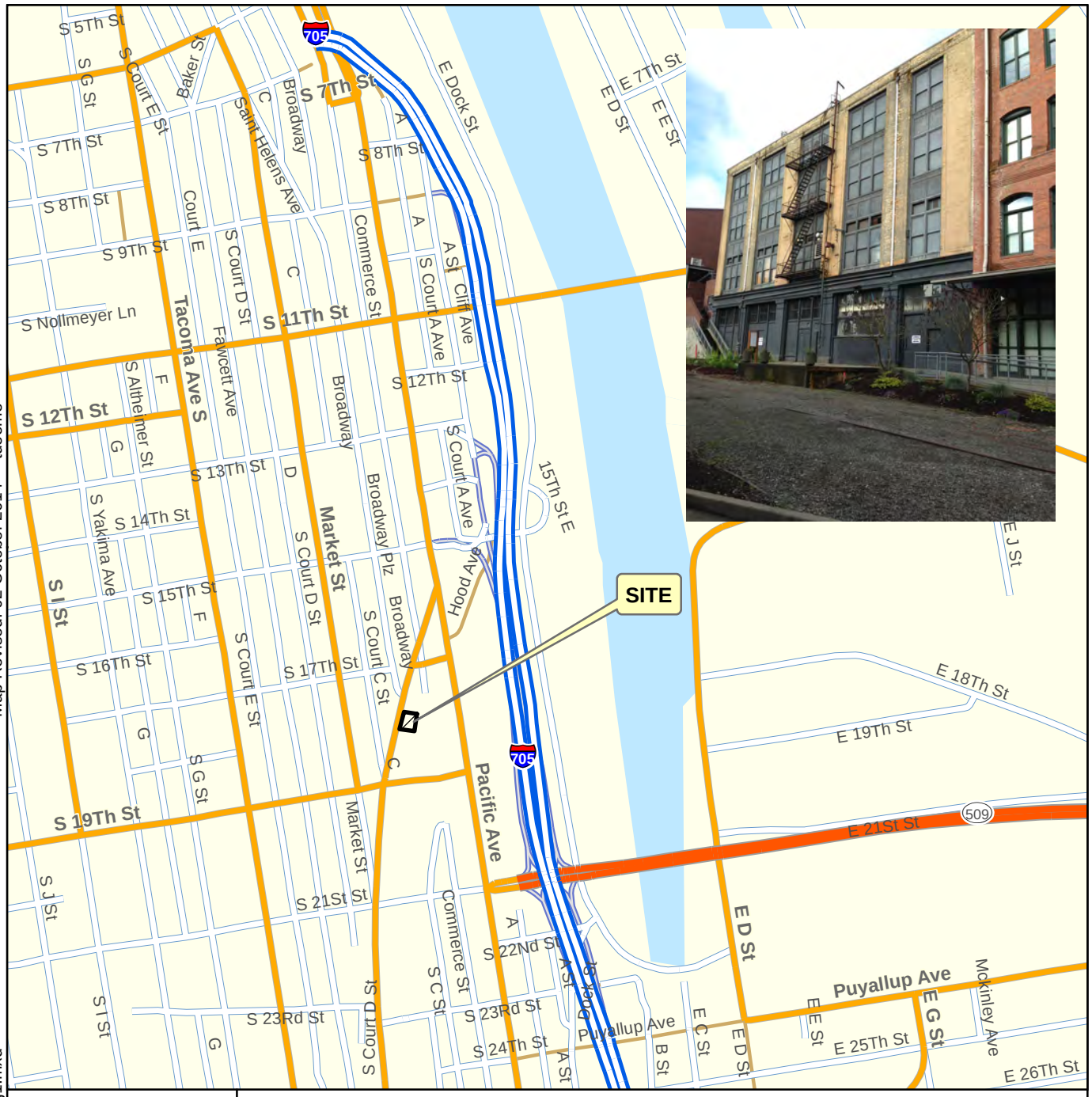
University of Washington Tacoma Urban Solutions Building
Tacoma, Washington

Matrix	Analysis Method	Analyte	MTCA Method B Soil Vapor Screening Level (µg/m ^{3})	Target Reporting Limit (µg/m^3)[1]
Air	EPA TO-15 SIM	Benzene	0.32	0.28
Air	EPA TO-15 SIM	Trichloroethene (TCE)	3.7	0.19
Air	EPA TO-15 SIM	Tetrachloroethene (PCE)	96	0.25
Air	EPA TO-15 SIM	Vinyl Chloride	2.8	0.046
Air	EPA TO-15 SIM	1,1-Dichloroethene (1,1-DCE)	910	0.070
Air	EPA TO-15 SIM	Cis-1,2-Dichloroethene (1,2-DCE)	not available	0.14
Air	EPA TO-15 SIM	Trans-1,2-Dichloroethene (1,2-DCE)	270	0.70

Notes:

µg/m^3 = microgram per cubic meter

[1] Laboratory reporting limits were obtained from Eurofins Air Toxics, Inc., a Washington State Department of Ecology-approved laboratory.



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. can not 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.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

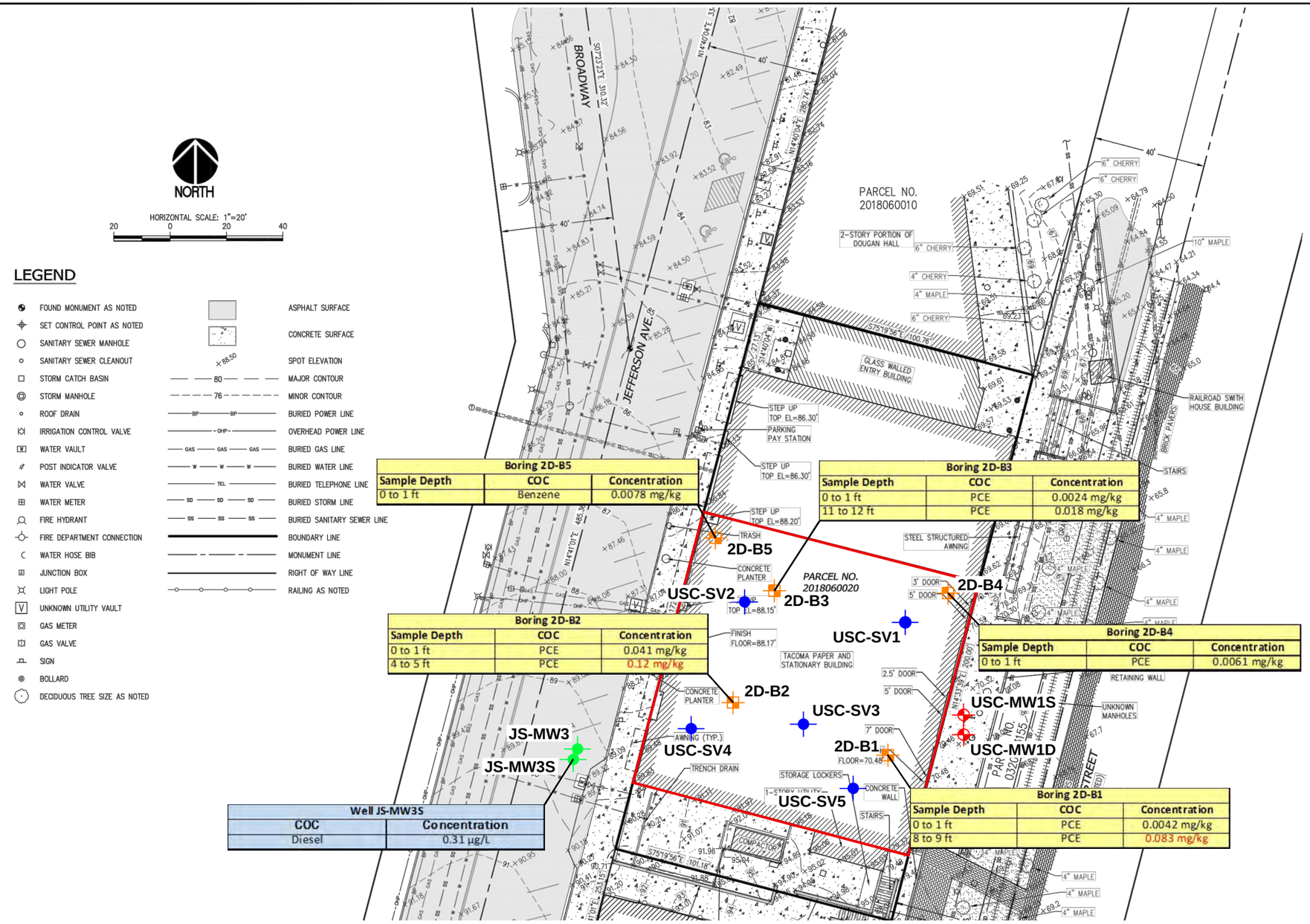
Urban Solutions Building - UWT Campus
Tacoma, Washington

GeoEngineers

Figure 1

Map Revised: 02 October 2014 tdeome

Office: TACO Path: P:\0\0183099\GIS\0183099_VM_fig1.mxd



Soil Results*

Boring 2A-B7		
Sample Depth	**COC**	**Concentration**
2.5 to 3.5 ft bgs	Lead	200 mg/kg
2.5 to 3.5 ft bgs	cPAHs	0.64 mg/kg

Groundwater Results*

Well UG-MW13	
COC	**Concentration**
TCE	110 µg/L
PCE	1.4 µg/L

*Chemicals shown in red were detected at concentrations greater than the respective MTCA Method A cleaup levels.

Only analytical results of the chemicals of concern are shown if detected. Other chemicals that were analyzed and detected are not shown unless detected at concentrations greater than the respective MTCA cleanup levels.

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: Draft survey provided by Sitts and Hill Engineering on September 30, 2014 as a PDF.

COC = Chemical of Concern
UWT = University of Washington Tacoma
PCE = tetrachloroethene
mg/kg = milligram per kilogram
µg.L = microgram per Liter
bgs = Below Ground Surface
ft = feet

MTCA Cleanup Levels
Soil:
PCE = 0.05 mg/kg (Method A ULU)
Benzene = 0.03 mg/kg (Method A ULU)
Groundwater:
PCE = 5 µg/L (Method A) ; 24 µg/L (Indoor Air)
Diesel-Range Petroleum Hydrocarbons = 0.5 mg/L (Method A)

Legend

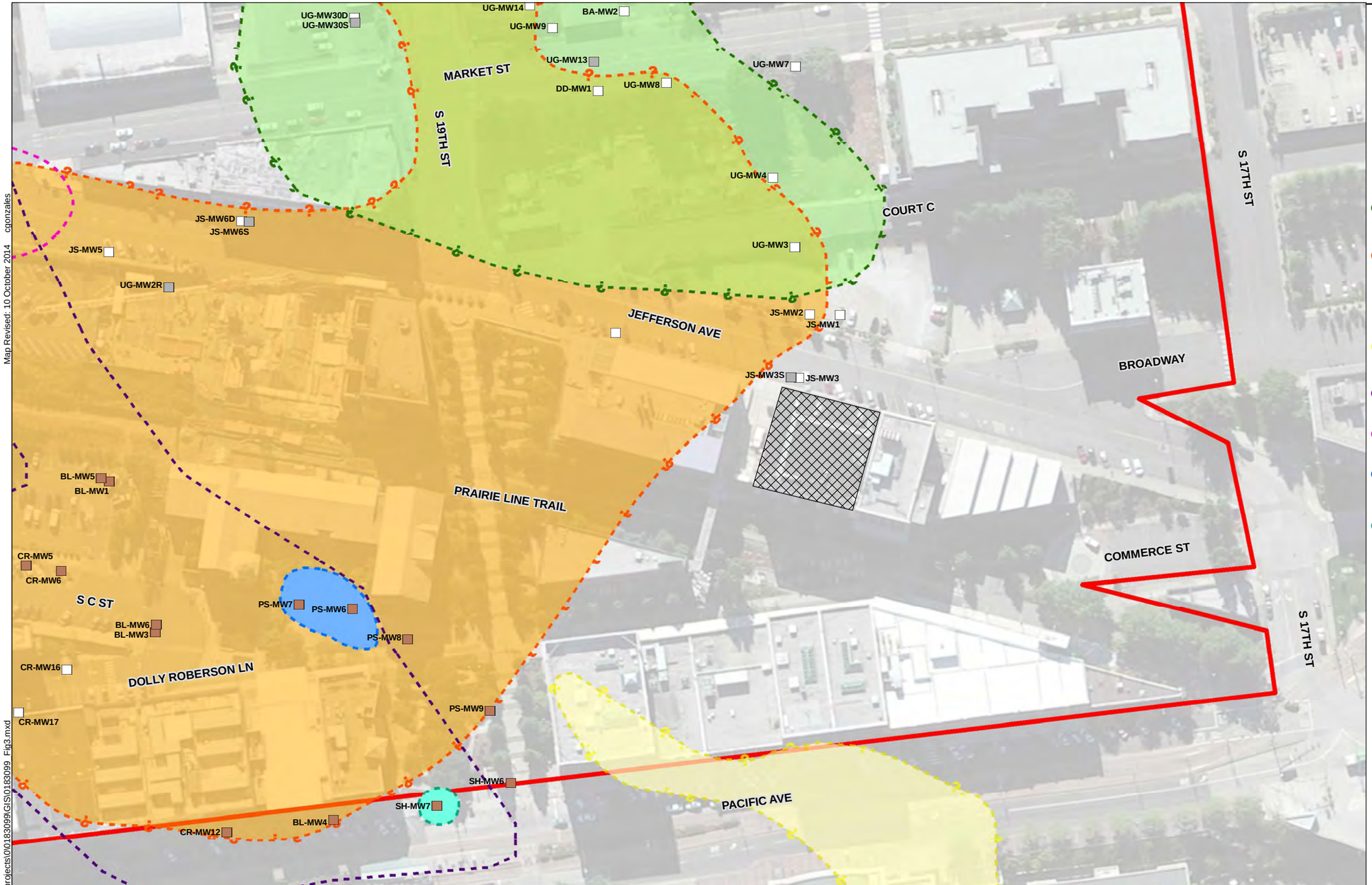
- 2D-B1 — Previous Direct Push Borings Completed in 2013 (GeoEngineers)
- JS-MW3 — Existing Monitoring Well
- USB-MW1S — New Monitoring Well (Deep and Shallow)
- USC-SV1 — Sub Slab Sample Location
- Perimeter of Urban Solutions Building

Site Plan
Sampling and Analysis Plan

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 2



Legend

- Site
- UWT Master Plan Campus Boundary
- Approximate Lateral Extent of TCE-Contaminated Groundwater Plume in Shallow Aquifer
- Approximate Lateral Extent of TCE-Contaminated Groundwater Plume in Deep Aquifer
- Approximate Lateral Extent of TCE-Contaminated Groundwater Plume in Shallow and Deep Aquifer
- Approximate Lateral Extent of PCE-Contaminated Groundwater Plume (Howe)
- Approximate Lateral Extent of Vinyl Chloride Contaminated Groundwater Plume
- Approximate Lateral Extent of Benzene Contaminated Groundwater Plume
- Approximate Lateral Extent of Diesel-Range Hydrocarbons Groundwater Contaminated Groundwater Plume
- Approximate Lateral Extent of Gasonline-Range Hydrocarbons Groundwater Contaminated Groundwater Plume
- Shallow Aquifer Well and Identification
- Deep Aquifer Well and Identification
- Lithology of Well Screen Not Determined

Map Revised: 10 October 2014 cgonzales

Path: \\tac\projects\0018309\GIS\0183099_Fig3.mxd

Office: TAC

Notes:
ULU = Unrestricted Land Use
UWT = University of Washington Tacoma
COC = Chemical of Concern
TCE = Trichloroethene
PCE = Tetrachloroethene
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbon
TTEC = Total Toxicity Equivalency Concentration
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.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater:
PCE = 5 µg/L (Method A); 24 µg/L (Indoor Air)
TCE = 5 µg/L (Method A); 1.5 µg/L (Indoor Air)
Vinyl Chloride = 0.2 µg/L (Method A); 0.35 µg/L (Indoor Air)
Benzene = 5 µg/L (Method A); 2.4 µg/L (Indoor Air)
Diesel-Range Petroleum Hydrocarbons = 0.5 mg/L (Method A)
Gasoline-Range Petroleum Hydrocarbons = 1,000 or 800 µg/L (If Benzene is Present) (Method A)

W N S E

100 0 100
Feet

Groundwater Plumes Near Site

Urban Solutions Center UWT Campus
Tacoma, Washington

GeoEngineers

Figure 3

APPENDIX A
Previous Boring Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
9/4/2013	9/4/2013	25	JCD / TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	89.36	Top of Casing Elevation (ft)	88.86
Vertical Datum	NGVD29		
Easting (X)	1158971.6868	Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703355.072314		

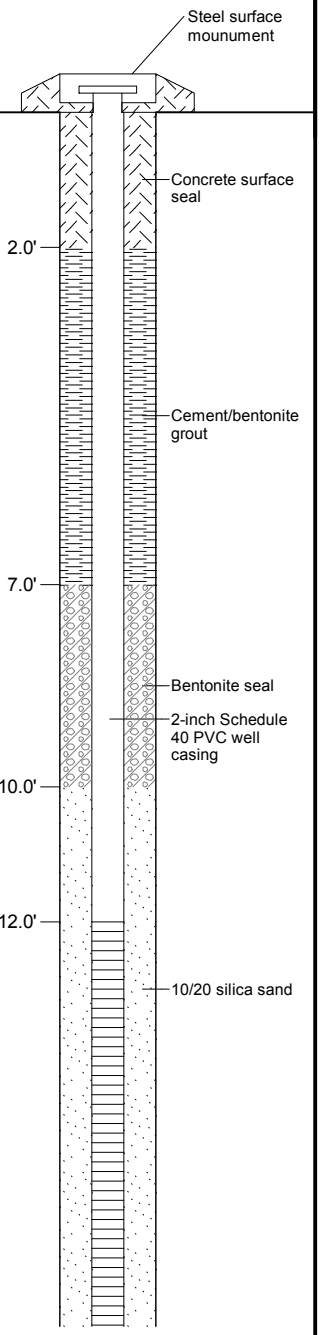
A 2 (in) well was installed on 9/4/2013 to a depth of 22 (ft).

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	18.8	70.1

Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
89	0						Unknown	Vaccuumed to 7 feet		
85	5	36					SM	Brown silty fine sand with occasional medium to coarse sand (moist) (Ice-Contact Deposits)	NS	<1
				JS-MW3S-8-9 CA						
80			33							
	10	60					GM	Brown to gray silty fine to coarse gravel with sand and cobbles (moist) (Ice-Contact Deposits)	NS	<1
				JS-MW3S-10.5-11.5 CA						
				JS-MW3S-12-12.5 CA			SP-SM	Brown to gray fine sand with medium to coarse sand and fine gravel and silt (moist) (Ice-Contact Deposits)		
			25	JS-MW3S-13-14 CA						
75							SM	Brown to gray silty fine sand (moist) (Ice-Contact Deposits)	NS	<1
	15	60						Becomes moist to wet and occasionally laminated with silty fine sand		
			23						NS	<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

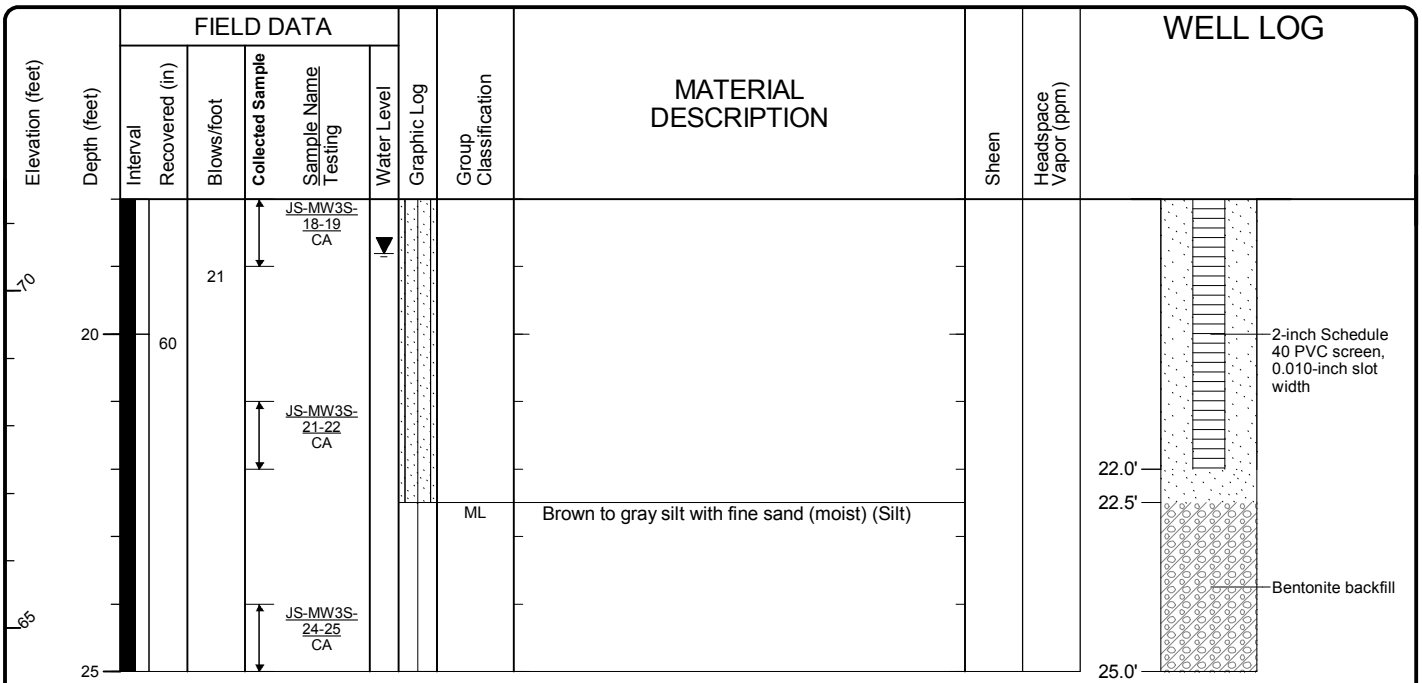
Log of Monitoring Well JS-MW3S

GeoEngineers

Project:	UWT Field Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure A-2
Sheet 1 of 2

Tacoma: Date:10/17/14 Path:\\TAC\PROJECTS\0018308500\GINT\0183085 00.GPJ DBTemplate/LibTemplate/GEOENGINEERS8.GDT/GE18_ENVIRONMENTAL_WELL



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW3S (continued)

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-3
Sheet 2 of 2

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
6/18/2013	6/18/2013	9	JCD / TSD	Holt Drilling	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Pneumatic	Geoprobe 7822 DT

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		50			2D-B1-0-1 CA			CC	Approximately 4-inches concrete (actual depth not measured)	NS	<1	
									SM-ML	Brown to gray silty fine to medium sand to fine to medium sandy silt; iron staining (moist) (fill)			
									SP-SM	Brown to gray fine to medium sand with silt (moist)			
	5		48								NS	<1	
						2D-B1-8-9 CA							
										Practical refusal at 9 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2D-B1

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-4
Sheet 1 of 1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
6/18/2013	6/18/2013	5	JCD / TSD	Holt Drilling	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Pneumatic	Geoprobe 7822 DT

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0				2D-B2-0-1 CA			CC	Approximately 4-inches concrete (actual depth not measured)	NS	<1	
								ML	Brown to gray silt with fine sand and occasional coarse sand to fine gravel (moist) (fill to approximately 2 feet bgs)			Difficult drilling at approximately 2 feet
					2D-B2-4-5 CA							
	5								Practical refusal at 5 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2D-B2

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-5
Sheet 1 of 1

Drilled	Start 6/20/2013	End 6/20/2013	Total Depth (ft) 12	Logged By JCD / Checked By TSD	Driller Holt Drilling	Drilling Method Direct Push
Surface Elevation (ft) Vertical Datum	Undetermined		Hammer Data	Pneumatic	Drilling Equipment	Geoprobe 7822 DT
Easting (X) Northing (Y)			System Datum		Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)
Notes:						

Elevation (feet) / Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
0		40		2D-B3-0-1 CA			CC	Approximately 4-inches concrete (actual depth not measured)	NS	<1	
							ML	Brown to gray fine sandy silt with occasional medium to coarse sand (moist)			
								Fine sandy silt lens (2-inches)			
		48						Fine sandy silt lens (3-inches)	NS	<1	
5							SM	Brown to gray silty fine sand (moist)			
							ML	Brown to gray silt with fine sand; occasional iron staining (moist)			
10				2D-B3-11-12 CA					NS	<1	
								Practical refusal at 12 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2D-B3

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-6
Sheet 1 of 1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
6/20/2013	6/20/2013	3	JCD / TSD	Holt Drilling	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Pneumatic	Hand operated microsampler

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0									Approximately 4-inches concrete (actual depth not measured)	NS	<1	
		10			2D-B4-0-1	CA			CC / SM	Brown to gray fine to medium sand with occasional coarse sand; iron staining (moist) (fill to 1.5 feet)			
		12											
										Practical refusal at 3 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2D-B4

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-7
Sheet 1 of 1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
6/20/2013	6/20/2013	8	JCD / TSD	Holt Drilling	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Pneumatic	Geoprobe 7822 DT

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Boring completed in existing hole in the concrete slab

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		42			2D-B5-0-1 CA			SP	Brown to black fine to coarse sand with gravel (moist) (fill)	NS	<1	
									ML	Brown to gray fine sandy silt with occasional medium sand to fine gravel (moist) (fill)			
									ML	Grades to gray fine sandy silt			Difficult drilling at approximately 2 feet
									SM	Brown to gray silty fine to coarse sand with gravel (moist)	NS	<1	
	5								ML	Brown to gray fine sandy silt with occasional medium to coarse sand (moist)			
						2D-B5-6-7 CA							
									SM	Brown to gray silty fine to coarse sand with gravel (moist)			
										Practical refusal at 8 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2D-B5

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-8
Sheet 1 of 1

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

Log of Boring JS-MW3

Sheet 1 of 2

Date(s) Drilled	3/30/01	Logged By	ALZ	Checked By	MPM
Drilling Method	8" HSA	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	54 feet
Drill Rig Type	CME-75	Drill Bit Size/Type		Ground Surface Elevation	NA
Groundwater Level	45' feet	Sampling Method	Split Spoon	Hammer Data	300 lb. 30"
Borehole Backfill		Location			

Elevation, feet / Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0						SM	Surface conditions: Concrete Brown, silty SAND (fill)	
							Brown, silty SAND with trace gravel (very dense) (moist) (no apparent odor or staining) (glacial till)	
5		1	18 24 25					
10		2	17 23 23					
15		3	28 24 25					
20		4	20 22 25					
25		5	23 28 27					
						SM/ ML	Brown grading gray, sandy SILT with trace gravel (moist) (very dense) (no apparent odor or staining)	
30								

ENV W/O \\...\GRAPHICS\BLOGS\GINTBO~1\00681094.GPJ URSSEA3.GLB URSSEA3.GDT 7/27/01

URS

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

Log of Boring JS-MW3

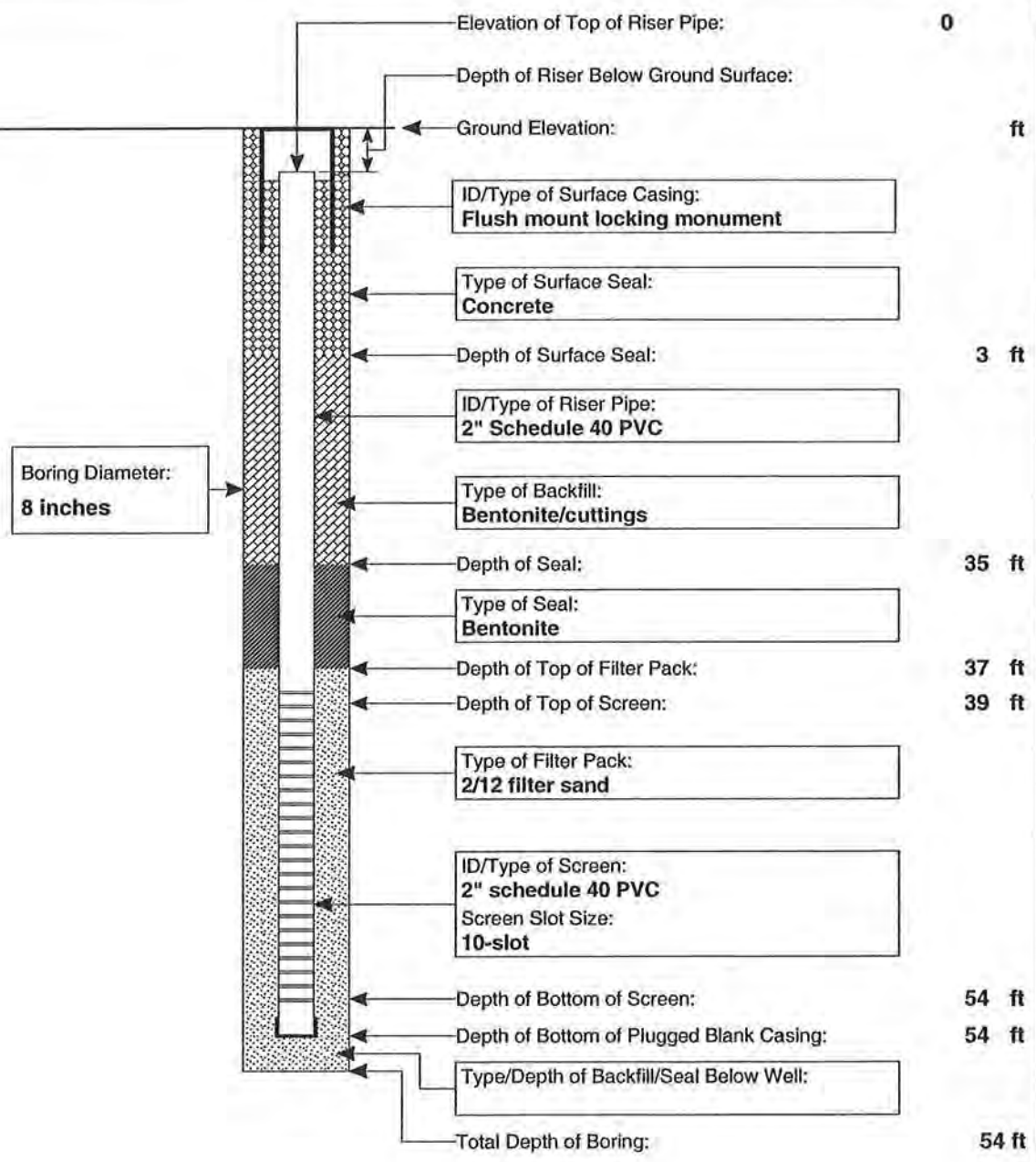
Sheet 2 of 2

Elevation, feet / Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
30								
		6	18 20 23					
35								
		7	15 17 18					
40								
		8	16 18 20				Gray grading dark gray SILT with some sand (no apparent odor or staining)	
45							▽	
		9	15 17 19					
						SP	Gray SAND with some silt and clay lenses (very dense) (wet) (no apparent odor or sheen) (glacial outwash)	
							Groundwater	
50								
		10	50-6"					
		11						
55							Boring completed to 54' bgs. Groundwater encountered at 48' bgs, rose to 45' bgs. Boring completed as monitoring well.	
60								
65								

URS

Project: University of Washington Project Location: Tacoma, Washington Project Number: 53-00681094.00	**MONITORING WELL CONSTRUCTION LOG FOR WELL JS-MW3**

Well Location	**Jefferson Street Association**			Date(s) Installed **3/30/01**	Time
Installed By	**Cascade Drilling**	Observed By	**ALZ**	Total Depth (ft)	**54**
Method of Installation	**Hollow Stem Auger**				
Screened Interval	**39'-54'**	Completion Zone			
Remarks					



NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONS...BELOW_GROUND K:\GRAPHICS\BLOGS\GINTBO~1\00681094.GPJ URSSEA3.GLB URSSEA3.GDT 7/27/01

URS

APPENDIX B
Health and Safety Plan

Site Health & Safety Plan

University of Washington Tacoma
CPO Project No. 204701
Urban Solutions Building
1735 Jefferson Avenue
Tacoma, Washington

for
University of Washington

October 15, 2014

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Table of Contents

1.0 GENERAL PROJECT INFORMATION 1

2.0 WORK PLAN 1

2.1 Site Description 2
2.2 Site History 2
2.3 List of Field Activities 2

3.0 LIST OF FIELD PERSONNEL AND TRAINING 3

4.0 EMERGENCY INFORMATION 4

4.1 Standard Emergency Procedures 5

5.0 HAZARD ANALYSIS 5

5.1 Physical Hazards 5
5.2 Biological Hazards and Procedures 6
5.3 Ergonomic Hazard Mitigation Measures and Procedures 7
5.3.1 Avoiding Lifting Injuries 7
5.3.2 Proper Lifting Techniques 7
5.4 Chemical Hazards 7
5.5 Summary of Selected Chemical Hazard 8
5.5.1 Tetrachloroethene (PCE) 8
5.6 Additional Hazards 9

6.0 AIR MONITORING PLAN 9

7.0 SITE CONTROL PLAN 11

7.1 Traffic or Vehicle Access Control Plans 11
7.2 Site Work Zones 11
7.3 Buddy System 12
7.4 Site Communication Plan 12
7.5 Decontamination Procedures 12
7.6 Waste Disposal or Storage 12

8.0 PERSONAL PROTECTIVE EQUIPMENT 12

8.1 Personal Protective Equipment Inspections 14
8.2 Respirator Selection, Use and Maintenance 14
8.3 Respirator Cartridges 14
8.4 Respirator Inspection and Cleaning 14

9.0 ADDITIONAL ELEMENTS 15

9.1 Cold Stress Prevention 15
9.2 Heat Stress Prevention 15
9.3 Emergency Response 15

10.0 MISCELLANEOUS 16

10.1 Personnel Medical Surveillance 16
10.2 Spill Containment Plans (Drum and Container Handling) 16
10.3 Sampling, Managing and Handling Drums and Containers 16
10.4 Sanitation 17
10.5 Lighting 17

11.0 DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS 17

12.0 APPROVALS 18

FORM 1 HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT OF SITE SAFETY PLAN FOR USE BY EMPLOYEES, SUBCONTRACTORS AND VISITORS 19

FORM 2 SAFETY MEETING RECORD 20

FORM 3 JOB HAZARD ANALYSES FORM 21

FORM 4 ACCIDENT/EXPOSURE REPORT FORM URBAN SOLUTIONS BUILDING 22

GEOENGINEERS, INC.
SITE HEALTH AND SAFETY PLAN
UWT- TACOMA URBAN SOLUTIONS CENTER
FILE NO. 0183-099-00

This HASP is to be used in conjunction with the GeoEngineers Safety Programs. 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 need to 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 Programs.

Liability Clause: If requested by subcontractors, this site safety plan may be provided for informational purposes only. In this case, Form 1 shall be signed by the subcontractor. Please be advised that this Site Safety Plan 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 Site Safety Plan. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by them.

1.0 GENERAL PROJECT INFORMATION

Project Name:	UWT- Tacoma Urban Solutions Center
Project Number:	0183-099-00
Type of Project:	Subsurface Investigation
Start/Completion:	October 15 through November 15, 2014
Subcontractors:	Cascade Drilling, APS, On-site, Eurofin

2.0 WORK PLAN

The purpose of the work plan is to define the scope of fieldwork. Activities at the site will be as follows:

- Locate and mark two preferred well locations and five subslab at the site.
- Coordinate one-call and private utility locates of the proposed boring locations.
- Observe the drilling of two borings at the site to depths of 25 and 50 feet each.
- Collect soil samples from the borings.
- Place drill cuttings in 55-gallon drums.
- Measure groundwater levels in the borings.
- Observe and document the construction of 2-inch-diameter monitoring wells in each of the borings.
- Develop the wells by surging and bailing. The bailed water will be placed in 55-gallon drums.

- Collect samples of the groundwater in the groundwater wells.
- Install Vapor Pins and collect subslab samples.
- Submit soil, water and air samples to an analytical laboratory.
- Coordinate disposal of the soil and water to the appropriate disposal facility.
- Coordinate a survey of the monitoring point locations and elevations.

2.1 Site Description

The four-story building is situated within the site boundary. The first floor of the building is accessible from the Prairie Line Trail at approximately Elevation 70 feet. The second floor is accessible from Jefferson Avenue at approximately Elevation 90 feet.

The first floor is currently occupied by UWT for faculty and staff working space. The Old Spaghetti Factory currently occupies the second floor. The third and fourth floors are currently used for storage by UW.

2.2 Site History

The four-story Tacoma Paper Supply building was constructed in 1904 and 1905 initially as a candy factory for the Tacoma Biscuit and Candy Company. Major tenants have been Tacoma Paper and Stationary Company (wholesale paper company) between 1911 to 1942, Blake, Moffitt and Towne, Inc. (wholesale paper company) between 1943 to 1953 and Old Spaghetti Factory between 1971 to Present.

2.3 List of Field Activities

Check the activities to be completed during the project

X	Job Hazard Analyses (Form 3)		
X	Site reconnaissance	X	Field Screening of Soil Samples
X	Exploratory Borings	X	Vapor Measurements
	Construction Monitoring	X	Groundwater Sampling
	Surveying		Groundwater Depth and Free Product Measurement
	Test Pit Exploration		Product Sample Collection
X	Monitoring Well Installation		Soil Stockpile Testing
X	Monitoring Well Development		Remedial Excavation
	Soil Sample Collection		Underground Storage Tank (UST) Removal Monitoring
	Remediation System Monitoring		Recovery of Free Product

3.0 LIST OF FIELD PERSONNEL AND TRAINING

Name of Employee on Site	Level of HAZWOPER Training (24-/40-hr)	Date of 8-Hr Refresher Training	First Aid/ CPR	Date of Respirator Fit Test
Paul Robinette	40	1/23/2014	2/3/2014	2/12/2014
Cris Watkins	40	5/1/2014	5/1/2012 - In Progress	5/1/2014
Tricia DeOme	40	1/23/2014	9/10/2014	2/13/2014
Brandon Brayfield	40	7/12/14	6/27/13	2/13/14

Chain of Command	Title	Name	Telephone Numbers
1	Principal/Associate	Terry McPhetridge	253-383-4940
2	Project Manager	Tricia DeOme	253-267-2114
3	Site Safety and Health Supervisor (SSO)	Paul Robinette	253-278-0273
4	Health and Safety Program Manager	Wayne Adams	253-350-4387
5	Field Engineer/Geologist	Paul Robinette	253-278-0273
6	Client Assigned Site Supervisor	N/A	N/A
		Holt	253-604-4063
		APS	425-888-2590
		On-site	425-883-3881
7	Subcontractor(s)	Eurofin	800-985-5955
8	Current Owner	UW – Jeannie Natta	206-616-7579

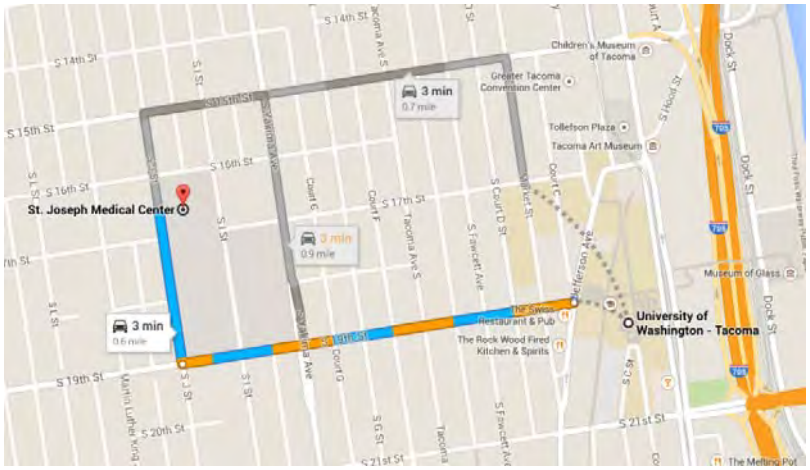
4.0 EMERGENCY INFORMATION

Hospital Name and Address:
St. Joseph Hospital
1717 South J Street
Tacoma, Washington 98405
Phone: 253-426-4101

Directions:

1. Head South on Jefferson Avenue toward South 19th Street.
2. Take the first right onto South 19th Street.
3. Turn right onto South J Street.

Map:



Ambulance:	9-1-1
Poison Control:	Seattle (206) 253-2121; Other (800) 732-6985
Police:	9-1-1
Fire:	9-1-1
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.

4.1 Standard Emergency Procedures

Get help

- send another worker to phone 9-1-1 (if necessary)
- as soon as feasible, notify GeoEngineers' Project Manager

Reduce risk to injured person

- turn off equipment
- move person from injury location (if in life-threatening situation only)
- keep person warm
- perform CPR (if necessary)

Transport injured person to medical treatment facility (if necessary) -

- by ambulance (if necessary) or GeoEngineers vehicle
- stay with person at medical facility
- keep GeoEngineers manager apprised of situation and notify Human Resources Manager of situation

5.0 HAZARD ANALYSIS

A hazard assessment will be completed at every site prior to beginning field activities. Updates will be included in the daily log. This list is a summary of hazards listed on the form.

5.1 Physical Hazards

X	Drill rigs and Concrete Coring, including working inside a warehouse
	Backhoe
	Trackhoe
	Crane
	Front End Loader
	Excavations/trenching (1:1 slopes for Type B soil)
	Shored/braced excavation if greater than 4 feet of depth
X	Overhead hazards/power lines
X	Tripping/puncture hazards (debris on-site, steep slopes or pits)
	Unusual traffic hazard – Street traffic
X	Heat/Cold, Humidity
X	Utilities/ utility locate
X	Noise
	Other:_____

- Utility checklist will be completed as required for the location to preventing drilling or digging into utilities.

- Work areas will be marked with reflective cones, barricades and/or caution tape. High-visibility vests will be worn by on-site personnel to ensure they can be seen 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 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 will be attached.
- Personnel entry into unshored or unsloped excavations deeper than 4 feet is not allowed. Any trenching and shoring requirements will follow guidelines established in WAC 296-155, the Washington State Construction Standards or OSHA 1926.651 Excavation Requirements. In the event that a worker is required to enter an excavation deeper than 4 feet, a trench box or other acceptable shoring will be employed or the side walls of the excavation will be sloped according to the soil type and guidelines as outlined in DOSH/OSHA regulations. If the shoring/sloping deviates from that outlined in the WAC, it will be designed and stamped by a PE. Prior to entry, personnel will conduct air monitoring as described later in this plan. All hazardous encumbrances and excavated material will be stockpiled at least 2 feet from the edge of a trench or open pit. If concentrations of volatile gases accumulate within an open trench or excavation, the means of entering shall adhere to confined space entry and air monitoring procedures outlined under the air monitoring recommendations in this Plan and/or the GeoEngineers Health and Safety Program.
- Personnel will avoid tripping hazards, steep slopes, pits and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with OSHA/DOSH regulations and the GeoEngineers Health and Safety Program.
- 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.

5.2 Biological Hazards and Procedures

Y/N	Hazard	Procedures
	Poison Ivy or other vegetation	
X	Insects or snakes	
	Used hypodermic needs or other infectious hazards	
	Wildlife	
	Others:	

5.3 Ergonomic Hazard Mitigation Measures and Procedures

5.3.1 Avoiding Lifting Injuries

Back injuries often result from lifting objects that are too heavy or from using the wrong lifting technique. Keep your back healthy and pain-free by following common sense safety precautions.

- Minimize reaching by keeping frequently used items within arm's reach, moving your whole body as close as possible to the object.
- Avoid overextending by standing up when retrieving objects on shelves.
- Keep your back in shape with regular stretching exercises.
- Get help from a coworker or use a hand truck if the load is too heavy or bulky to lift alone.

5.3.2 Proper Lifting Techniques

- Face the load; don't twist your body. Stand in a wide stance with your feet close to the object.
- Bend at the knees, keeping your back straight. Wrap your arms around the object.
- Let your legs do the lifting.
- Hold the object close to your body as you stand up straight. To set the load down, bend at the knees, not from the waist.

5.4 Engineering Controls

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

5.5 Chemical Hazards

CHEMICAL HAZARDS (POTENTIALLY PRESENT AT SITE)

SUBSTANCE
Tetrachloroethene (PCE)
Trichloroethylene (TCE)
Benzene
Diesel Fuel

SPECIFIC CHEMICAL HAZARDS AND EXPOSURES (POTENTIALLY PRESENT AT SITE)

Compound/ Description	Exposure Limits/IDLH NIOSH/ACGIH TLV Exposure Limits/IDLH	Exposure Routes	Symptoms/Health Effects
Tetrachloroethene (PCE) colorless liquid with a mild, chloroform-like odor	OSHA = TWA 100 ppm, C 200 ppm NIOSH = 100 ppm, C 200 ppm, IDLH 150 pmm TLV TWA = 25 ppm, 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)
Trichloroethylene (TCE) colorless liquid (unless dyed blue) with a chloroform-like odor	OSHA = TWA 100 ppm, C 200 ppm TLV TWA = 50 ppm, 269 mg/m^3 TWA; STEL =100 ppm, 537 mg/m^3	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)
Benzene	OSHA TWA = 1 ppm STEL = 5 ppm NIOSH = TWA 0.1 ppm STEL= 1 ppm TLV-TWA = 0.5 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
Diesel Fuel—liquid with a characteristic Odor	None established by OSHA TLV-TWA = 100 mg/m^3 (as total hydrocarbons	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis

Notes:

IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
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)
STEL = short-term exposure limit (15 min)
ppm = parts per million

5.6 Summary of Selected Chemical Hazard

5.6.1 Tetrachloroethene (PCE)

Tetrachloroethene is a manufactured chemical that is widely used in the dry-cleaning of fabrics, including clothes. It is also used for degreasing metal parts and in manufacturing other chemicals. Tetrachloroethene is found in consumer products, including some paint and spot removers, water repellents, brake and wood

cleaners, glues, and suede protectors. Other names for Tetrachloroethene include PERC, tetrachloroethylene, perchloroethylene and PCE.

5.7 Additional Hazards

Additional hazards can be identified using the Job Hazard Analyses form (Form 3).

Daily field logs should include evaluation of:

- *Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- *Biological Hazards* (snakes, spiders, other animals, discarded needles, poison ivy, pollen, bees/wasps and others present)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)

6.0 AIR MONITORING PLAN

Work upwind if at all possible.

Check instrumentation to be used:

X Photoionization Detector (PID)

_____ Other (i.e., detector tubes): _____

_____

Check monitoring frequency/locations and type (specify: work space, borehole, breathing zone):

X **15 minutes - Continuous during soil disturbance activities or handling samples**

_____ 15 minutes

_____ 30 minutes

_____ Hourly (in breathing zone during excavations, drilling, sampling)

_____

Additional personal air monitoring for specific chemical exposure:

Action levels:

- 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. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on-site. It can be tuned to detect one chemical with the response factor entered into the equipment, but the PID picks up all volatile organic compounds (VOCs) present. The ionization potential (IP) of the chemical has to be less than the PID lamp

(11.7/10.6eV), and the PID does not detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas), so conversion must be made in order to estimate ppm of the chemical on-site.

- 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 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 noncontaminated 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 TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is therefore not a preferred tool for determining worker exposure to chemicals. 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	Environmental Remedial Actions	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 25 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	> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety 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).

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
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 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 Manager.

7.0 SITE CONTROL PLAN

Work zones will be considered to be within 25 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 Section 4.0 above.

A contamination reduction zone should be established for personnel before leaving the Facility or before breaking for lunches etc. The zone 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.

7.1 Traffic or Vehicle Access Control Plans

Explorations will be located within the Prairie Line Trail that is located on the east side of the Urban Solutions building. Site personnel will access the trail via the ramp to the north during drilling and groundwater sampling activities (see attached map).

7.2 Site Work Zones

Hot zone/exclusion zone (Define and indicate on site map): *Within 10 feet of borings*

	Method of delineation/ excluding non-site personnel
	Fence
	Survey Tape
X	Traffic Cones
	Other

7.3 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.

7.4 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). In these instances, you should consider suspending work until communication can be restored; if not, the following are some examples for communication:

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

7.5 Decontamination Procedures

Decontamination consists 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 prior to eating, drinking or leaving the site.

7.6 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

_X_ Secured (list method) _____ Drums stored at UWT Laydown Yard at 19th and Tac Ave.

_____ Other (describe destination, responsible parties):

8.0 PERSONAL PROTECTIVE EQUIPMENT

After the initial and/or daily hazard assessment has been completed the appropriate protective 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 prior to the start of site operations. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to 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:

X Hardhat (if overhead hazards, or client requests)
X Steel-toed boots (if crushing hazards are a potential or if client requests)
X Safety glasses (if dust, particles, or other hazards are present or client requests)
X Hearing protection (if it is difficult to carry on a conversation 3 feet away)
X Rubber boots (if wet conditions)

Gloves (specify):

X Nitrile
_____ Latex
_____ Liners
_____ Leather
_____ Other (specify) _____

Protective clothing:

_____ **Tyvek (if dry conditions are encountered, Tyvek is sufficient)**
_____ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
_____ Cotton
X Rain gear (as needed)
X Layered warm clothing (as needed)

Inhalation hazard protection:

_____ Level D
X Level C (respirators with organic vapor/HEPA or P100 filters)

8.1 Personal Protective Equipment 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.

8.2 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 a 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.

8.3 Respirator Cartridges

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 certified and approved by the National Institute for Occupational Safety and Health (NIOSH). 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.

8.4 Respirator Inspection and Cleaning

The Site Safety and Health Supervisor 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.

9.0 ADDITIONAL ELEMENTS

9.1 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.

9.2 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 Table 1, Project Managers will ensure that:

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

TABLE 1. 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°

9.3 Emergency Response

Indicate what site-specific procedures you will implement.

- 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 Site Safety and Health Supervisor.
- Wind indicators visible to all on-site personnel should be provided by the Site Safety and Health Supervisor to indicate possible routes for upwind escape. Alternatively, the Site Safety and Health Supervisor 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 and Health Supervisor and the injured person are to complete, within 24 hours, an Accident Report (Form 4) for submittal to the PM, the Health and Safety Program Manager and Human Resources. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

10.0 MISCELLANEOUS

10.1 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 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;

(2) All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations;

(3) 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; and

(4) Members of HAZMAT teams.

10.2 Spill Containment Plans (Drum and Container Handling)

Issues to be addressed in this section include:

- Site topography is generally flat, gently sloping to the east
- Site drainage --Municipal drain. Surface water drainage is to the east
- There are no engineered site drains

10.3 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 rupture 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.

10.4 Sanitation

Sanitary facilities are available on site.

10.5 Lighting

All 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).

11.0 DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

- Field Log
- FORM 1 – Health and Safety Pre-Entry Briefing and Acknowledgment of Health and Safety Plan for use by employees, subcontractors and visitors.
- FORM 2 – Safety Meeting Record
- FORM 3 – Job Hazard Analyses 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.).

12.0 APPROVALS

1.	Plan Prepared	Jodie Sheldon Plan Preparer	October 15, 2014 Date
2.	Plan Approval	Tricia DeOme Project Manager	October 15, 2014 Date
3.	Health & Safety Officer	Wayne Adams Health & Safety Program Manager	October 15, 2014 Date

FORM 1
HEALTH AND SAFETY PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT OF SITE SAFETY PLAN
FOR USE BY EMPLOYEES, SUBCONTRACTORS AND VISITORS
URBAN SOLUTIONS BUILDING
FILE NO. 0183-099-00

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

(All GeoEngineers' Site workers shall complete this form, which should remain attached to the Safety Plan and filed with other project documentation).

I hereby verify that a copy of the current Safety Plan 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
URBAN SOLUTIONS BUILDING
FILE NO. 0183-099-00

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

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

Date:_____

Site Safety Officer (SSO):_____

Topics:_____

Attendees:
Print name and Signature:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

FORM 3
JOB HAZARD ANALYSES FORM
URBAN SOLUTIONS BUILDING
FILE NO. 0183-099-00

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

<table>
<tr><td colspan="2">Task:</td><td>Date:</td></tr>
<tr><td colspan="2">Prepared by (SSO):</td><td></td></tr>
<tr><td><u>Possible issues:</u>
Noise
Traffic
Heavy Equipment
Ventilation
Ergonomics
Temperature
Slip / trip / Pinching
Electric shock
Adjacent activities
Lighting
Other:</td><td colspan="2"><u>Engineering Controls</u>

<u>Work Practice Controls</u>

<u>Personal Protective Equipment</u></td></tr>
<tr><td>Specific Tasks</td><td>Hazard</td><td>Preventative Measures</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

FORM 4
ACCIDENT/EXPOSURE REPORT FORM
URBAN SOLUTIONS BUILDING
FILE NO. 0183-099-00

To (Supervisor): _____ From (Employee): _____

_____ _____

Telephone (include 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 _____

_____

_____

_____

Probable 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 corrective action that remains to be taken:
(by whom and when):

_____

_____

Employee Signature _____ Date _____

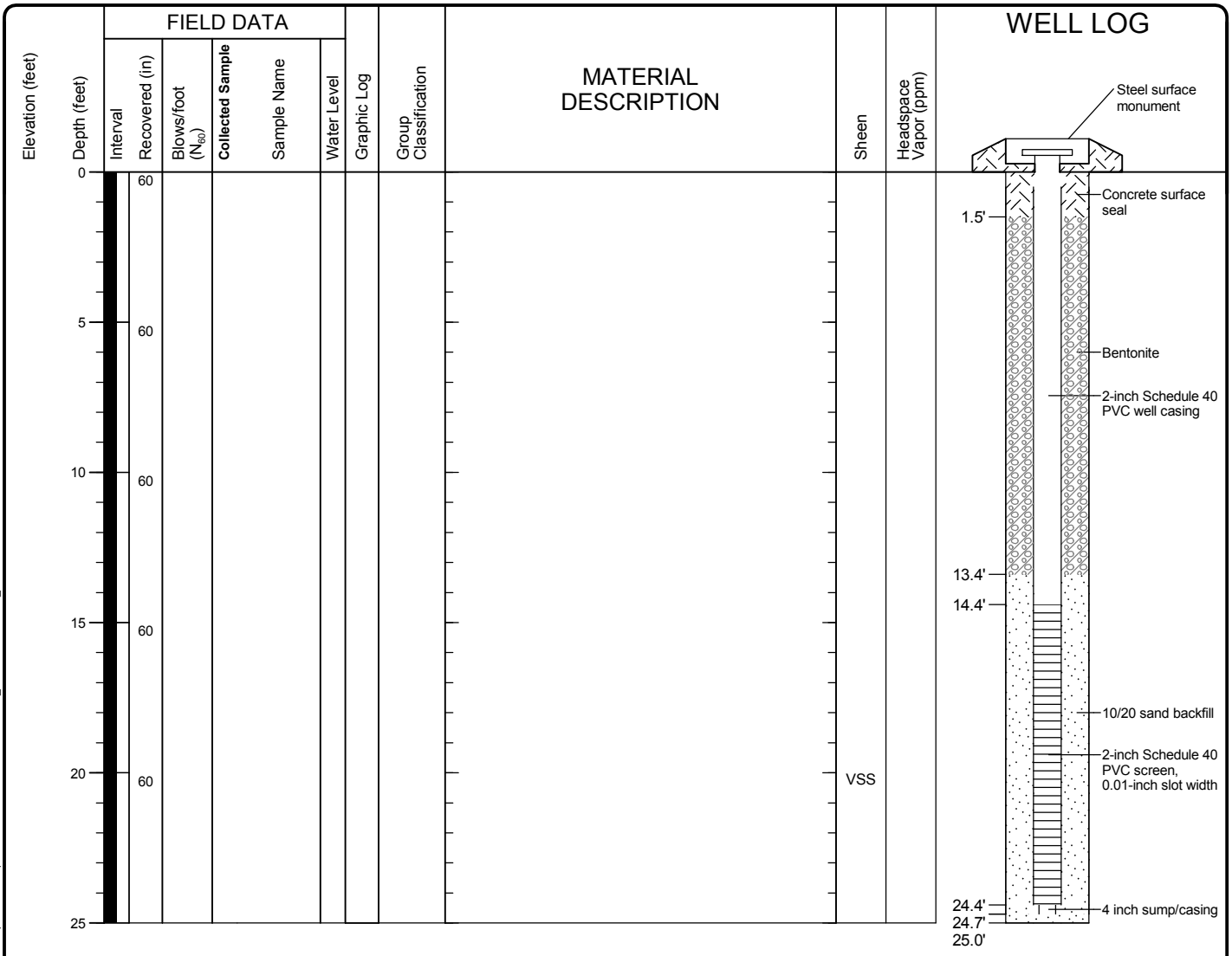
Name of Supervisor (Print) _____

APPENDIX C
Field Forms

Drilled Start	End	Total Depth (ft)	25	Logged By	TSD	Driller	Drilling Method	Rotosonic Core
				Checked By	MEH			

Hammer Data	Pneumatic	Drilling Equipment	AMS Compact Rotosonic	DOE Well I.D.: BAH-346 A 2 (in) well was installed on 5/22/2012 to a depth of 25.27 (ft).
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)	100.0	Groundwater Date Measured / Depth to Water (ft) / Elevation (ft)
Easting (X) Northing (Y)		Horizontal Datum		

Notes:



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well MW-1

GeoEngineers

Project:
Project Location:
Project Number: --

Figure A-27
Sheet 1 of 1

Tacoma: Date:3/20/13 Path:T:\TACOMA TEMP\TRICIA\ENVIRONMENTAL WELL SAMPLE.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

LOCATION OF BORING

North Arrow

Datum

Elevation

Job No.	Project Name	Boring No.
Drilling Method:		Location
Hammer Data:		
Auger Data:		
Drilling Equipment:		
Sampling Method:		Sheet of
		Drilling Time

Water Level:				Start	Finish
Time:					
Date:				Date	Date
Casing Depth:					

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	SAMPLE NO. / SAMPLE DEPTH	BLOW/FT.	SHEEN	PID (ppm)	DEPTH IN FEET	GROUP SYMBOL	SOIL DESCRIPTION	Other Tests/Notes
						0			
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						0			
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						0			

DRILLING CONTR.

LOGGED BY

CHK'D BY

DATE

GeoEngineers

1101 Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Field Report

File Number: 0183-099-00

Project: UW-Urban Solutions Center

Date:

Owner:		Time of Arrival:	Report Number:
Prepared by:	Location:	Time of Departure:	Page:
Purpose of visit:	Weather:	Travel Time:	Permit Number:

Upon arrival to the site I assessed personal safety hazards: ☐ Yes or ☐ Referred to Site Safety Plan and Safety Tailgate if applicable

Safety Hazards Were Addressed by : ☐ Staying Alert to Construction and Equipment Hazards ☐ Other (describe)

☐ **THIS FIELD REPORT IS PRELIMINARY**
A preliminary report is provided solely as evidence that field observation was performed. Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those indicated in a preliminary report.

FIELD REPRESENTATIVE **DATE**

☐ **THIS FIELD REPORT IS FINAL**
A final report is an instrument of professional service. Any conclusions drawn from this report should be discussed with and evaluated by the professional involved.

REVIEWED BY **DATE**

Attachments:

Distribution:

GROUNDWATER SAMPLE COLLECTION FORM

Project **UWT Urban Solutions Center** Job No. **0183-099-00** Collector _____ Sample Time _____ Sample ID _____

PURGE DATA

Well Condition: Secure [ ] Yes [ ] No Describe Damage _____

(Padlock brand and number) _____

Depth to Water (from top of well casing) _____

Depth to Base of Well _____ Height of Water Column _____

Well Casing Type/Diameter _____

One Casing Volume (gal.) _____

Purge Method Pump (type) _____ Bailer (type) _____

Gallons Purged _____

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal _____

(Drum identification, sample analysis, sample results, storage location, etc.) _____

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

SAMPLING DATA

Date Collected (mo/dy/yr) _____

Sample Location and Depth _____ Time Collected _____

Tidal Cycle NA [ ] High Tide at _____ Low Tide at _____ Weather _____

Sample type (Groundwater, Product, Other) _____

Sample Collected with [ ] Bailer [ ] Pump [ ] Other _____

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [ ] Disposable LDPE [ ] Other

Sampler Decon Procedure _____

Sample Description (color, free product thickness, odor, turbidity, etc.) _____

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (S/ m)	Turbidity (NTU)	Dissolved O2 (mg/l)	Temperature (deg C)	Salinity (%)	TDS (g/l)	Seawater Potential (σ_t)	ORP (mV)

Meters Used for Measurement _____

pH/Con./DO Instrument Calibration [ ] Yes [ ] No Spectrophotometer _____ E-Tape _____

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance **ml/min purge rate**

Analyses, Number and Volume of Sample Containers _____

Duplicate Sample Number(s) _____

Comments: (Filtered, Not Filtered, Calculations, etc.) _____

Signature _____ Date _____ Page 1 of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project **UWT Urban Solutions Center** Job No. **0183-099-00** Collector ______ Sample Time ______ Sample ID ______

FIELD PARAMETERS (cont.)

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (__S/__m)	Turbidity (NTU)	Dissolved O2 (mg/l)	Temperature (deg C)	Salinity (%)	TDS (g/l)	Seawater Potential (σ_t)	ORP (mV)

Page 2 of 2

Chain of Custody

Page _____ of _____

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Days ☐ 3 Days

☐ Standard (7 Days)
(TPH analysis 5 Days)

☐ _____
(other)

Laboratory Number:

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals/ MTCA Metals (circle one)	TCLP Metals	HEM (oil and grease) 1664A						% Moisture

	Signature	Company	Date	Time
Relinquished				
Received				
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

Chromatograms with final report ☐

Data Package: Level III ☐ Level IV ☐

Electronic Data Deliverables (EDDs) ☐ _____

Summa Canister Field Data Form - Soil Vapor Sampling

GeoEngineeers

Sample ID	Sample Date	Canister ID	Shut-in Vac Test (Start/End time and in. Hg)	PID Reading (ppm)	Methane Reading (%LEL)	CO2 Reading (%)	O_2 Reading (%)	Shoud Helium Reading (Start/End ppm)	Sample Train Helium Reading (Start/End ppm)	Canister Vac (Start/End in. Hg)	Sample Time Interval (Start/End hr:min)

Field Meters Used:_____ Photionization Detector,_____ Mulitgas Meter,_____ Helium Monitor

Groundwater Well Development Form

Client/Project: _____ **Well ID:** _____

Project Number: _____ **Field Staff:** _____

ECY Well Tag ID#: _____ - _____ **Weather:** _____ **Date:** _____

Well Condition: Secure [ ] yes [ ] no **Lock ID:** _____ **Describe Damage:** _____

Monument: [ ] Flush **Diameter (in):** _____ **or** **[ ] Stick-up** **Top of Casing (TOC) Height (ft):** _____ **(Measure to nearest 1/100th. Negative value for flush well.)**

Initial Depth to Water (bTOC): _____ **Initial Total Depth (bTOC):** _____ **Bottom of Well: [ ] Soft [ ] Hard** _____

Final Depth to Water (bTOC): _____ **Final Total Depth (bTOC):** _____ **Bottom of Well: [ ] Soft [ ] Hard** _____

Well Diameter (in): _____ **Water Column (ft):** _____ **Well Volume (gal):** _____ **(2" = 0.17 gal/ft, 4" = 0.66 gal/ft)**

Well Purging Method: [ ] Pump: Type _____ **[ ] Bailer: Type** _____ **Screen Surge Method: [ ] Slug [ ] Surge Rods [ ] SS Bailer**

Development Method (describe): _____

_____

Approximate Purge Rate (gpm): _____ **Purge Water Storage/Disposal:** _____

Time	DTW (ft)	Surge Interval	Gallons Purged	Turbidity (NTUs)	Color	Sheen				Odor		Description
						NS	SS	MS	HS	No	Yes	

Comments: _____

_____

_____

_____

Signature: _____ Date: _____ Page _____ of _____

GeoEngineers

APPENDIX D
Sub-slab Soil Gas Probe Installation

APPENDIX D
SUB-SLAB SOIL GAS PROBE INSTALLATION

Sub-slab soil gas samples will be collected using Vapor Pin™ sampling devices. The Vapor Pins™ will be installed following the manufacturers' standard operating procedures (SOPs; attached to this appendix).

General installation procedures for the permanent sub-slab sampling device are as follows:

- Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.
- Set up vacuum to collect drill cuttings.
- Drill a 1.5-inch diameter hole at least 1.75 inches into the slab.
- Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.
- Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.
- Place the lower end of sampling device assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the sampling device to protect the barb fitting and cap, and tap the sampling device into place using a dead blow hammer. Make sure the extraction/installation tool is aligned parallel to the sampling device to avoid damaging the barb fitting.
- During installation, the silicone sleeve will form a slight bulge between the slab and the sample device shoulder. Place the protective cap on sampling device to prevent vapor loss prior to sampling.
- Cover the sampling device with a stainless steel secured cover.
- Allow at least two hours for the sub-slab soil gas conditions to equilibrate prior to sampling.

SUB-SLAB SOIL GAS SAMPLING PROCEDURE

The following procedure will be followed to collect sub-slab soil gas samples:

- New fluoropolymer (Teflon®) tubing will be connected to the sub-slab soil gas probe, using the barb fitting on the top of the sampling device.
- The tubing (aboveground) will be connected to a sampling manifold.
- The sampling manifold will be vacuum-tested (shut-in test) by briefly introducing a vacuum to the aboveground portion of the sampling train and checking for loss of vacuum. If vacuum loss is observed, connections and fittings in the sample train will be checked and adjusted, then will be vacuum-tested again. This test will be repeated until the sampling train has demonstrated that tightness has been achieved. If the tightness cannot be achieved, then the sample train will be replaced and the new one will be retested.
- A tracer gas shroud (clear plastic bag) will be placed around the entire sample train (that is, the sub-slab soil gas probe where it enters the ground surface, the 6.0-liter Summa canister and associated tubing and manifold).

- The shroud will be charged (filled) with a tracer gas (spec-grade 99.995% helium gas) and the tracer gas concentration within the shroud will be measured using a hand-held monitor (e.g., Ion/Gascheck G3, or equivalent, which is capable of measuring helium in air to a concentration of 0.5 percent) prior to, during and after completion of the sampling event. To charge the shroud a Teflon tube with a ball valve will be inserted under the shroud to connect with the compressed helium bottle. This same tube will be used to monitor the helium concentration within the shroud periodically throughout the sampling process. The purpose of the periodic monitoring is to make sure helium is in contact with the sample train and the ground surface while the sub-slab gas sample is collected. According to the California Environmental Protection Agency, Department of Toxic Substances Control (CalEPA/DTSC), shroud target concentrations of tracer gas should be two orders of magnitude higher than the reporting limit of the laboratory analytical (DTSC, 2012). The Eurofins Air Toxics reporting limit for helium by ASTM D 1946 is 0.05 percent. Therefore, the helium concentration in the shroud will be maintained at a minimum concentration of 5 percent.
- The sampling train (aboveground and below ground components) will be purged using a vacuum purge pump or a multi-gas meter. Purge volumes will be calculated based on the flow rate of the purge pump and the volume of the soil gas probe and sample train. After purging three sampling train volumes, the helium concentration within the sampling train will be measured and recorded. If the helium concentration in the sample train is greater than or equal to 5 percent of the helium concentration in the shroud, the bentonite seal will be re-applied, fittings will be tightened, and the previous purging and measurement tests will be repeated (DTSC, 2012).
- In addition to helium, the purge air will be monitored for oxygen, carbon dioxide, methane, and in some cases carbon monoxide and hydrogen sulfide to detect if ambient air is diluting the probe and/or to evaluate if stabilized purge conditions have been met prior to sampling.
- The soil gas sample will be obtained using a 6 liter evacuated Summa canister (with approximately 30 inches of mercury vacuum set by the laboratory), with a regulated flow rate of less than or equal to approximately 200 milliliters per minute (DTSC, 2012). Also, vacuums induced on the vapor probe of less than 100 inches of water will be maintained during sample collection. The canister will be filled with soil gas for approximately 30 minutes or until a vacuum equivalent of approximately 5 inches of mercury remains in the Summa canister, whichever comes first. The initial and final canister vacuum will be recorded on a soil gas sampling field form (an example form is provided in Appendix C).
- The canisters will be provided by an analytical laboratory subcontractor. Instructions on the use of Summa canisters and flow controllers are included in Appendix C. Field personnel will review these instructions in advance of sampling, and will have the opportunity to have any questions answered by the laboratory.

- Summa canisters will be submitted to the analytical laboratory for chemical analysis of TCE, PCE, vinyl chloride, 1,1-DCE, cis-l,2-DCE, and trans-1,2-DCE, by EPA method TO-15-SIM.

APPENDIX B
Field Program and Exploration Logs

APPENDIX B
FIELD PROGRAM AND EXPLORATION LOGS
HOLLOW-STEM AUGER DRILLING AND ASSOCIATED MONITORING WELLS

General

Two new permanent groundwater monitoring wells were installed downgradient of the existing building as shown on Figure 2. The borings were completed to depths of 25 and 56 feet bgs based on the lithology observed. Boring USC-MW1S was installed within the shallow aquifer. Boring USC-MW1D was installed within the deep aquifer.

Hollow-Stem Auger Soil Sampling Methodology and Chemical Analysis

Soil borings were advanced using hollow-stem auger drilling methods. A split-spoon sampler was used to collect soil samples at 2.5-foot to 5-foot depth intervals. The sampling methodology varied from a down hole sampler and a standard penetration test (SPT) sampler. SPT test were collected for geotechnical purposes. The following methodology was implemented to minimize potential cross contamination between the two aquifers during drilling.

- A 14-inch steel casing was driven through the ice-contact deposits unit just into the semiconfining layer in each boring because groundwater was observed in the ice-contact deposits. The 14-inch casing was terminated at the semi-confining layer to seal the 14-inch casing and allow for telescoping further down using a smaller diameter steel casing into the glacial outwash unit. The 8-inch casing was be lifted approximately 1 foot as the borehole is filled with at least 3 feet of bentonite. The bentonite was hydrated with potable water and allowed to set for up to 1 hour. The smaller diameter casing was placed inside the larger casing used to seal off the groundwater within the shallow aquifer. The inner casing was driven until the desired depth within the deep aquifer is reached.

Discrete soil samples collected during drilling were submitted for volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) method 8260. Soil samples to be submitted for VOC analysis were collected directly from the split spoon using the EPA SW-846 5035A (EPA, 2002). The soil samples were placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in the SAP. Soil cuttings were stored in a drum at a secure facility on UWT campus pending off-site disposal.

Groundwater Monitoring Well Installation

Well Casing

The monitoring wells were constructed using 2-inch-diameter, Schedule 40, threaded polyvinyl chloride (PVC) casing that meets the following requirements: 1) casing will be new (unused); 2) casing sections were joined only by tightening the threaded sections, glue was not be used to join casing sections; and 3) casing will be generally straight.

Well Screen

Well screens consisted of 2-inch diameter, Schedule 40, 0.010-inch or 0.020-inch machine-slotted, PVC well screens. PVC end caps will be installed on the bottom of the well screens. The estimated depth of the borings and well screens was installed as follows:

- Monitoring Well USC-MW1S was completed within the shallow aquifer (ice-contact deposits). The length of the well screen is 19 feet.
- Monitoring well USC-MW1D was completed within the deep aquifer (advance outwash). The length of the well screen was 10 feet.

Sand Pack

The sand pack for the wells consisted of silica sand with the appropriate grain size distribution to reduce entry of fine-grained particulates from the surrounding formation into the wells (e.g., 10-20 sand). The sand pack extended from the bottom of the well screen to 2 feet above the top of the well screen. The top of the sand pack will be sounded to verify its depth during placement.

Annular Seal

The annular seal consisted of a minimum 1-foot-thick layer of hydrated bentonite pellets or chips installed between the sand pack and the concrete surface seal.

Surface Completion

The new monitoring wells was completed using flush monuments at the ground surface. The well casing was cut approximately 3 inches bgs, and a locking J-plug (compression) or similar well cap was installed to prevent surface water from entering the well. The well monument was installed in a concrete surface seal. The well number was marked on the well monument lid and/or the well cap. A concrete surface seal holds the flush monument in place.

GROUNDWATER MONITORING OF NEW AND EXISTING PERMANENT MONITORING WELLS

Well development and sampling was performed in the two existing (JS-MW3S and JS-MW3) and/or the two new groundwater monitoring wells (USC-MW1S and USC-MW1D.

Permanent Monitoring Well Development

Newly installed groundwater monitoring wells were developed prior to sampling. Prior to development, a field form was completed with details describing location, condition, water levels, sediment depths, and product levels (if any) observed during inventory activities. Each groundwater monitoring well was developed with a hydrolift pump and surge block to stabilize the sand pack and formation materials surrounding the well screen, and restore the hydraulic connection between the well screen and the surrounding soil. The head space vapors in the monitoring wells was measured upon removing the cap to the well. The depth to groundwater in the monitoring wells was measured prior to development using an electric water level indicator. The potential presence of product was measured with an interface probe prior to development. The well screen was gently surged and purged of water. Approximately 6.5 gallons was removed from USC-MW1S and 28 gallons from USC-MW1D. The removal rate and volume of groundwater removed was recorded on field forms during well development procedures. Water that is

removed during well development activities was stored temporarily drums at a secure facility on UWT campus pending approved sewer discharge.

Permanent Groundwater Monitoring Well Groundwater Sampling and Chemical Analysis

Groundwater monitoring was completed in the existing two permanent monitoring wells (JS-MW3 and JS-MW3S) and the two additional monitoring wells (USC-MW1S and USC-MW1D) to evaluate groundwater conditions. The depth to water were measured and recorded in these four wells prior to sampling using an electronic water level indicator.

Groundwater samples were obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of particulates in the samples. Groundwater samples were obtained from monitoring wells using a decontaminated bladder pump with disposable bladder and tubing will be placed at the mid-portion of the well screen interval or half way within the water column if the water column height is less than the screen length. Groundwater was pumped at a rate of approximately 0.3 liters per minute. A water quality measuring system with a flow-through-cell was used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, oxidation-reduction potential and temperature. Turbidity was measured with a turbidimeter. Groundwater samples were collected when these parameters vary by less than 10 percent for three consecutive measurements or three well volumes have been removed. Field measurements were documented on the field log. After well purging, the flow-through-cell was disconnected and the groundwater sample was obtained in laboratory-prepared containers.

The water samples were placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in the SAP. The chemical analysis for groundwater samples were submitted for chemical analysis of VOCs by EPA method 8260. The water sample collected from JS-MW3S was submitted for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx. Purge water was temporarily stored in labeled 55-gallon drums at a secure facility on UWT campus pending UW approval for either discharge to the sewer system or off-site disposal.

SUB-SLAB SOIL GAS PROBE INSTALLATION

Sub-slab soil gas samples was collected using Vapor Pin™ sampling devices. The Vapor Pins™ were installed following the manufacturers' standard operating procedures (SOPs; attached to this appendix).

General installation procedures for the permanent sub-slab sampling device are as follows:

- Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.
- Set up vacuum to collect drill cuttings.
- Drill a 1.5-inch diameter hole at least 1.75 inches into the slab.
- Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.
- Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

- Place the lower end of sampling device assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the sampling device to protect the barb fitting and cap, and tap the sampling device into place using a dead blow hammer. Make sure the extraction/installation tool is aligned parallel to the sampling device to avoid damaging the barb fitting.
- During installation, the silicone sleeve will form a slight bulge between the slab and the sample device shoulder. Place the protective cap on sampling device to prevent vapor loss prior to sampling.
- Cover the sampling device with a stainless steel secured cover.
- Allow at least two hours for the sub-slab soil gas conditions to equilibrate prior to sampling.

SUB-SLAB SOIL GAS SAMPLING PROCEDURE

The following procedure was followed to collect sub-slab soil gas samples:

- New fluoropolymer (Teflon®) tubing were connected to the sub-slab soil gas probe, using the barb fitting on the top of the sampling device.
- The tubing (aboveground) was connected to a sampling manifold.
- The sampling manifold was vacuum-tested (shut-in test) by briefly introducing a vacuum to the aboveground portion of the sampling train and checking for loss of vacuum. If vacuum loss is observed, connections and fittings in the sample train was checked and adjusted, then was vacuum-tested again. This test was repeated until the sampling train has demonstrated that tightness has been achieved. If the tightness cannot be achieved, then the sample train was replaced and the new one was retested.
- A tracer gas shroud (clear plastic bag) was placed around the entire sample train (that is, the sub-slab soil gas probe where it enters the ground surface, the 6.0-liter Summa canister and associated tubing and manifold).
    - The shroud was charged (filled) with a tracer gas (spec-grade 99.995% helium gas) and the tracer gas concentration within the shroud was measured using a hand-held monitor (e.g., Ion/Gascheck G3, or equivalent, which is capable of measuring helium in air to a concentration of 0.5 percent) prior to, during and after completion of the sampling event. To charge the shroud a Teflon tube with a ball valve was inserted under the shroud to connect with the compressed helium bottle. This same tube was used to monitor the helium concentration within the shroud periodically throughout the sampling process. The purpose of the periodic monitoring is to make sure helium is in contact with the sample train and the ground surface while the sub-slab gas sample is collected. According to the California Environmental Protection Agency, Department of Toxic Substances Control (CalEPA/DTSC), shroud target concentrations of tracer gas should be two orders of magnitude higher than the reporting limit of the laboratory analytical (DTSC, 2012). The Eurofins Air Toxics reporting limit for helium by ASTM D 1946 is 0.05 percent. Therefore, the helium concentration in the shroud was maintained at a minimum concentration of 5 percent.
    - The sampling train (aboveground and below ground components) was purged using a vacuum purge pump or a multi-gas meter. Purge volumes were calculated based on the flow rate of the purge pump and the volume of the soil gas probe and sample train. After purging three sampling train volumes, the helium concentration within the sampling train was measured and recorded. If the helium concentration in the sample train is greater than or equal to 5 percent of the helium

concentration in the shroud, the bentonite seal was re-applied, fittings were tightened, and the previous purging and measurement tests was repeated (DTSC, 2012).

- In addition to helium, the purge air was monitored for oxygen, carbon dioxide, methane, and in some cases carbon monoxide and hydrogen sulfide to detect if ambient air is diluting the probe and/or to evaluate if stabilized purge conditions have been met prior to sampling.
- The soil gas sample was obtained using a 6 liter evacuated Summa canister (with approximately 30 inches of mercury vacuum set by the laboratory), with a regulated flow rate of less than or equal to approximately 200 milliliters per minute (DTSC, 2012). Also, vacuums induced on the vapor probe of less than 100 inches of water was maintained during sample collection. The canister was filled with soil gas for approximately 30 minutes or until a vacuum equivalent of approximately 5 inches of mercury remains in the Summa canister, whichever comes first. The initial and final canister vacuum were recorded on a soil gas sampling field form (an example form is provided in Appendix C).
- The canisters were provided by an analytical laboratory subcontractor. Instructions on the use of Summa canisters and flow controllers are included in Appendix C. Field personnel will review these instructions in advance of sampling, and will have the opportunity to have any questions answered by the laboratory.

- Summa canisters were submitted to the analytical laboratory for chemical analysis of TCE, PCE, vinyl chloride, 1,1-DCE, cis-l,2-DCE, and trans-1,2-DCE, by EPA method TO-15-SIM.

Drilled	Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
	10/20/2014	10/21/2014	56	PDR / BEL/PSD	Cascade	HSA

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	CMW136 CME Limited Access Rig
Surface Elevation (ft) Vertical Datum	70.48 City of Tacoma (NGVD 1929)	Top of Casing Elevation (ft)	69.97
Easting (X) Northing (Y)		Horizontal Datum	

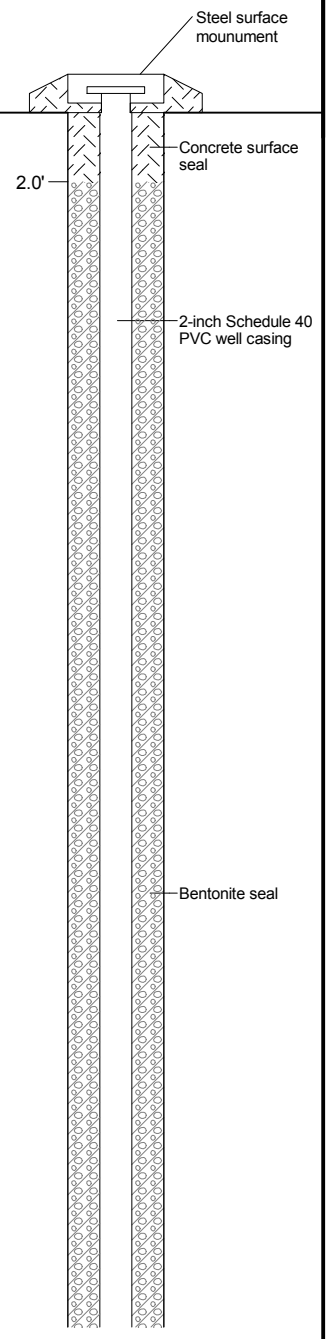
A 2 (in) well was installed on 10/21/2014 to a depth of 55 (ft).

Groundwater	Depth to Water (ft)	Elevation (ft)
Date Measured		
10/27/2014	22.4	47.6

Notes: Vertical elevation estimated from topography

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
70	0								CC	4 inches concrete		
									SM	Brown silty fine to coarse sand with occasional fine to coarse gravel (loose to medium dense, moist) (fill)		
			14	8							NS	<1
65	5		10	50/6"		5-6 SA			SM	Brown silty isand with gravel (very dense, moist) (Qvi)	NS	1.3
			18								NS	<1
			18								NS	<1
60	10		18			10-11.5 CA				Grades to dense	NS	2.2
			18			11.5-13 CA			SM	Brown silty fine to medium sand with occasional gravel (medium dense, moist) (Qvi)	NS	3.6
			18								NS	1.8
55	15		18	22							NS	1.4
						15.5-16.5 SA						
			18			16.5-18 CA				Grades to without gravel	NS	2.8
			18								NS	1.4
50	20		18			20-21.5 CA				Increased moisture content	NS	<1
			18			21.5-22 CA	▼		SP-SM	Brown fine to coarse sand with silt and fine to coarse gravel with 1-inch silt interbeds (dense, wet) (Qvi)	NS	<1
			18								NS	<1
45	25		9	50/3"					GM	Brown silty fine to coarse gravel with sand (very dense, moist to wet) (Qvi - semiconfining layer)	NS	<1
			0						GP-GM	Brown fine to coarse gravel with silt and sand (very dense,moist to wet) (Qvi - semiconfining layer)	NS	<1
			12			27.5-28.5 CA						
			10						SP-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (Qvi - semiconfining layer)	NS	<1
40	30		12							Rock in shoe, low recovery		
			6							Grades to very dense	NS	<1
	35											

WELL LOG



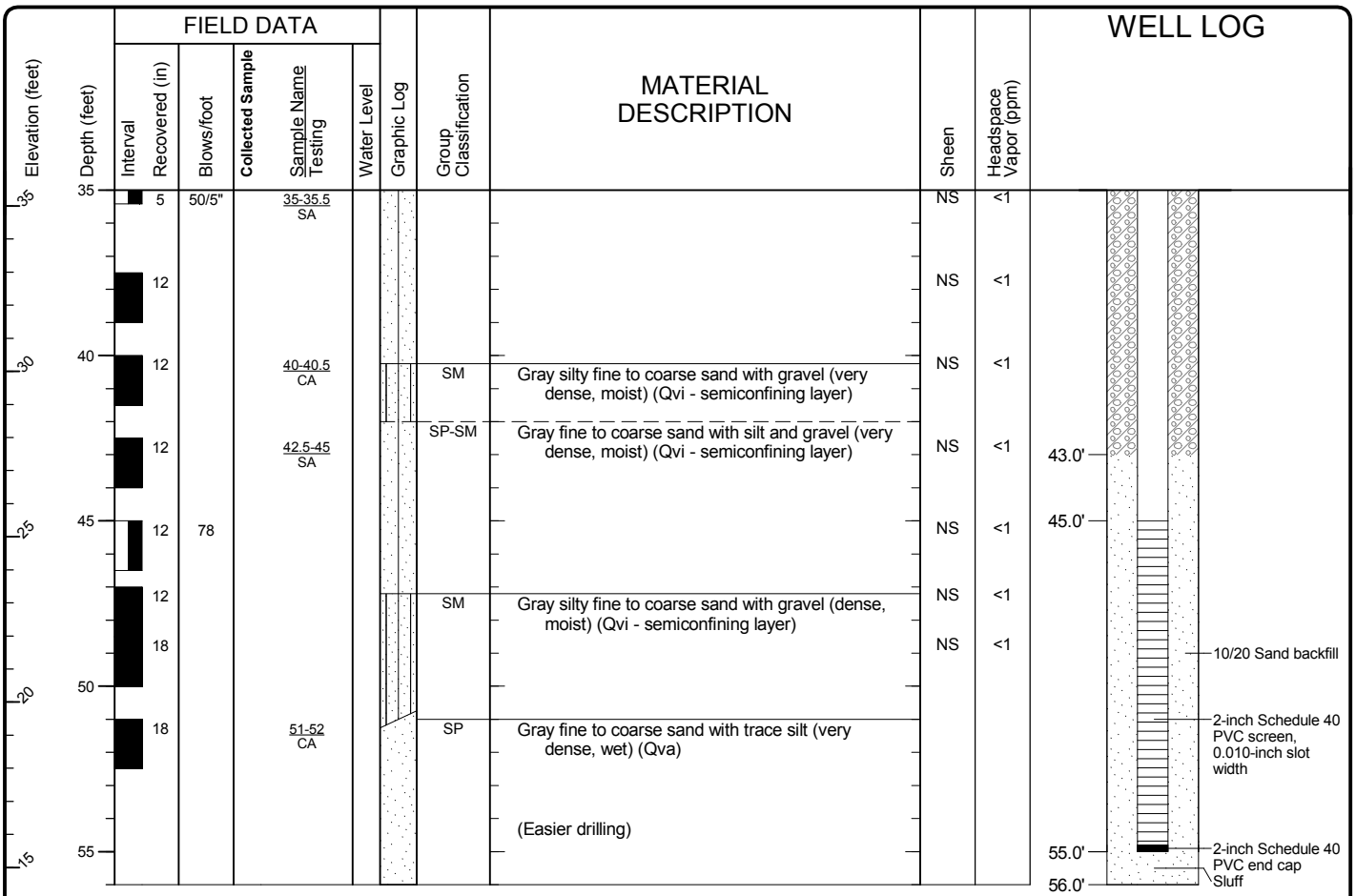
Notes: See Figure A-1 for explanation of symbols.

Log of Monitoring Well USC-MW1D

GeoEngineers

Project:	UWT Tacoma Urban Solutions Center
Project Location:	Tacoma, Washington
Project Number:	0183-099-00

Figure A-2
Sheet 1 of 2



Notes: See Figure A-1 for explanation of symbols.

Log of Monitoring Well USC-MW1D (continued)

GeoEngineers

Project: UWT Tacoma Urban Solutions Center
Project Location: Tacoma, Washington
Project Number: 0183-099-00

Figure A-2
Sheet 2 of 2

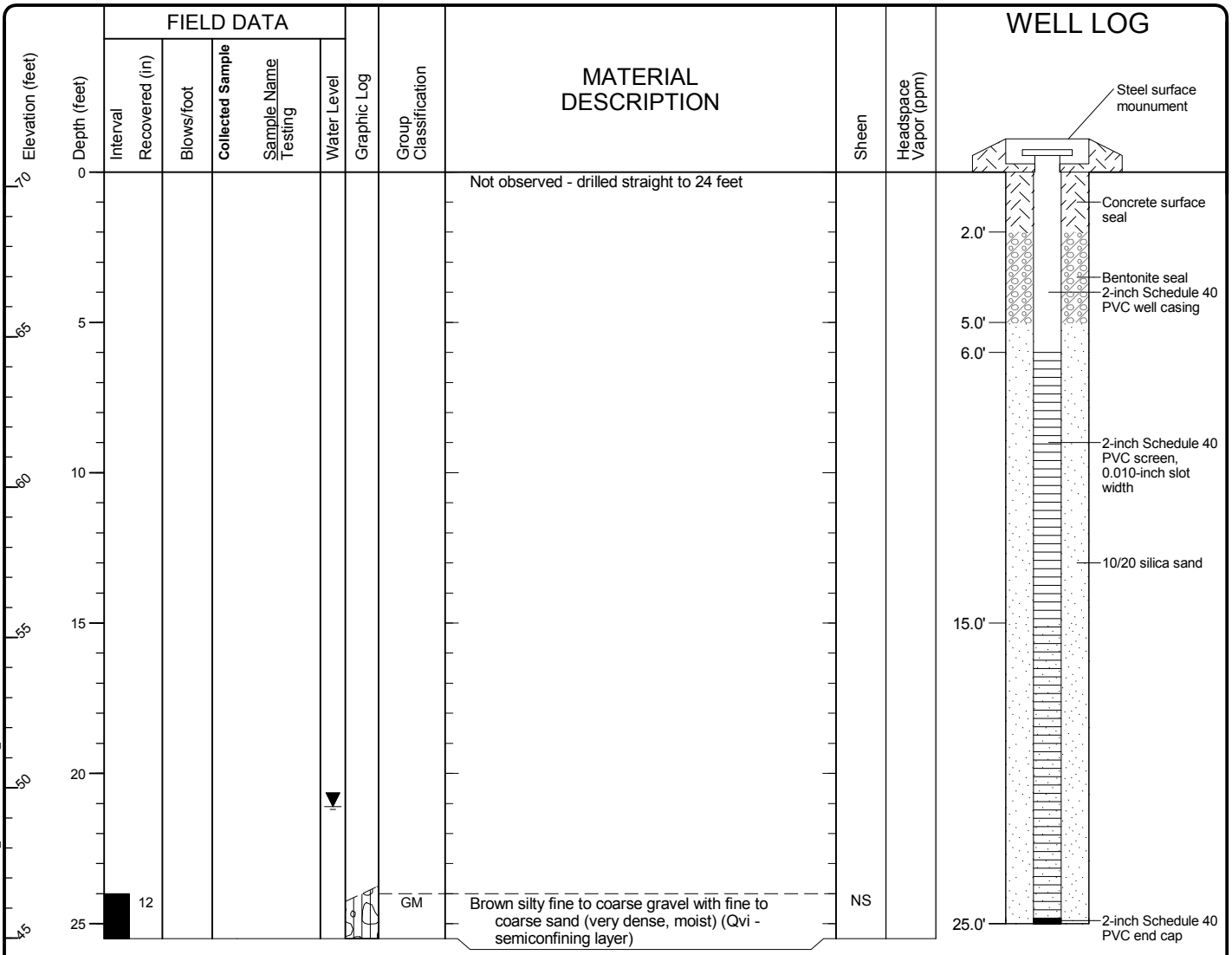
Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
10/20/2014	10/20/2014	25.5	PDR / BEL/PSD	Cascade	HSA

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	CMW136 CME Limited Access Rig
Surface Elevation (ft) Vertical Datum	70.48 City of Tacoma (NGVD 1929)	Top of Casing Elevation (ft)	70.13
Easting (X) Northing (Y)		Horizontal Datum	

A 2 (in) well was installed on 10/20/2014 to a depth of 25 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/27/2014	21.1	49.0

Notes: Vertical elevation estimated from topography



Notes: See Figure A-1 for explanation of symbols.

Log of Monitoring Well USC-MW1S

GeoEngineers

Project: UWT Tacoma Urban Solutions Center
Project Location: Tacoma, Washington
Project Number: 0183-099-00

Figure A-3
Sheet 1 of 1

APPENDIX C
Screening Level Calculation

Table C-1

Method B Groundwater Vapor Intrusion Screening Level Calculations

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

VOC	Method B Air CUL[1] (µg/m^3)			Vapor Attenuation Factor[3]	Temperature-Adjusted Henry's Law (Unitless)[4]- 13C	Method B Groundwater VI SL[5] (µg/L)		
	Non-Cancer (Eq. 750-1)	Cancer (Eq. 750-2)	Method B			Non-Cancer	Cancer	Method B
1,1-Dichloroethene	91	--	91	0.001	0.706	130	--	130
cis-1,2-Dichloroethene	16	--	16	0.001	0.1	160	--	160
Tetrachloroethene[2]	18	9.6	9.6	0.001	0.398	45	24	24
Trichloroethene[2]	0.91	0.37	0.37	0.001	0.239	3.8	1.5	1.5
trans-1,2-Dichloroethene[2]	27	--	27	0.001	0.241	110	--	110
Vinyl chloride	46	0.28	0.28	0.001	0.807	57	0.35	0.35

Notes:

[1] Method B Air Cleanup Levels (CUL) from Ecology's May 2014 Excel workbook "CLARC Master Spreadsheet.xlsx"

[2] Method B Air CULs have been updated since publication of Ecology's review draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" dated October 2009 (draft VI guidance; Ecology,

[3] Default vapor attenuation factor from Ecology's draft VI guidance.

Table C-2

Method B Groundwater Vapor Intrusion Screening Level Calculations

University of Washington Tacoma - Urban Solutions Center Building

Tacoma, Washington

VOC	Method B Air CUL[1] (µg/m^3)			Exposure Frequency[2]	Method B Air Remediation Level[3] (µg/L)		
	Non-Cancer (Eq. 750-1)	Cancer (Eq. 750-2)	Method B		Non-Cancer	Cancer	Method B
Tetrachloroethene[2]	1.8E+01	9.6E+00	9.6	0.15	1.2E+02	6.3E+01	6.3E+01

Notes:

[1] Method B Air Cleanup Levels (CUL) from Ecology's May 2014 Excel workbook "CLARC Master Spreadsheet.xlsx"

[2] Exposure frequency = (8 hours/day * 250 days/year * 20 years)/(24 hours/day * 365 days/year * 30 years). Hours of assumed exposure for the occupational/commercial worker divided by hours of assumed exposure assumed for the MTCA MEthod B Air CUL.

[3] Method B Air Remediation level based on a typical Occupational/Commercial scenario with an assumed exposure of 250 days/year, 8 hours/day, 20 years.☐

APPENDIX D
Chemical Analytical Program

eurofins | Air Toxics

11/5/2014
Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle WA 98101

Project Name:
Project #: Urban Solutions Bldg
Workorder #: 1410462A

Dear Mr. Neil Morton

The following report includes the data for the above referenced project for sample(s) received on 10/29/2014 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 SIM are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Kelly Buettner at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Kelly Buettner

Project Manager

eurofins | Air Toxics

WORK ORDER #: 1410462A

Work Order Summary

CLIENT:	Mr. Neil Morton GeoEngineers, Inc. 600 Stewart Street Suite 1700 Seattle, WA 98101	**BILL TO:**	CORP Accounts Payables GeoEngineers, Inc. 8410 154th Avenue NE Redmond, WA 98052
PHONE:	206-728-2674	**P.O. #**	0183-099-00
FAX:	206-728-2732	**PROJECT #**	Urban Solutions Bldg
DATE RECEIVED:	10/29/2014	**CONTACT:**	Kelly Buettner
DATE COMPLETED:	11/05/2014		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
02A	USC-SV3-141024	Modified TO-15 SIM	4.5 "Hg	5 psi
03A	USC-SV4-141024	Modified TO-15 SIM	4.0 "Hg	5 psi
04A	USC-SV1-141024	Modified TO-15 SIM	5.0 "Hg	5 psi
04B	USC-SV1-141024	Modified TO-15 SIM	5.0 "Hg	5 psi
05A	USC-SV2-141024	Modified TO-15 SIM	5.5 "Hg	5 psi
06A	USC-SV5-141028	Modified TO-15 SIM	7.0 "Hg	5 psi
07A	Lab Blank	Modified TO-15 SIM	NA	NA
07B	Lab Blank	Modified TO-15 SIM	NA	NA
07C	Lab Blank	Modified TO-15 SIM	NA	NA
08A	CCV	Modified TO-15 SIM	NA	NA
08B	CCV	Modified TO-15 SIM	NA	NA
08C	CCV	Modified TO-15 SIM	NA	NA
09A	LCS	Modified TO-15 SIM	NA	NA
09AA	LCSD	Modified TO-15 SIM	NA	NA
09B	LCS	Modified TO-15 SIM	NA	NA
09BB	LCSD	Modified TO-15 SIM	NA	NA
09C	LCS	Modified TO-15 SIM	NA	NA
09CC	LCSD	Modified TO-15 SIM	NA	NA

CERTIFIED BY: Heidi Hayes DATE: 11/05/14

Technical Director

Certification numbers: AZ Licensure AZ0775, NJ NELAP - CA016, NY NELAP - 11291,
TX NELAP - T104704343-14-7, UT NELAP CA009332014-5, VA NELAP - 460197, WA NELAP - C935
Name of Accreditation Body: NELAP/ORELAP (Oregon Environmental Laboratory Accreditation Program)
Accreditation number: CA300005, Effective date: 10/18/2014, Expiration date: 10/17/2015.
Eurofins Air Toxics Inc.. certifies that the test results contained in this report meet all requirements of the NELAC standards

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 9563
(916) 985-1000 . (800) 985-5955 . FAX (916) 985-1020

LABORATORY NARRATIVE
Modified TO-15 SIM
GeoEngineers, Inc.
Workorder# 1410462A

Five 6 Liter Summa Canister (SIM Certified) samples were received on October 29, 2014. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the SIM acquisition mode.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	***TO-15***	***ATL Modifications***
ICAL %RSD acceptance criteria	</=30% RSD with 2 compounds allowed out to < 40% RSD	Project specific; default criteria is </=30% RSD with 10% of compounds allowed out to < 40% RSD
Daily Calibration	+- 30% Difference	Project specific; default criteria is </= 30% Difference with 10% of compounds allowed out up to </=40%.; flag and narrate outliers
Blank and standards	Zero air	Nitrogen
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

Sample collection date was incomplete on the Chain of Custody (COC) for samples USC-SV3-141024, USC-SV4-141024, USC-SV1-141024, USC-SV2-141024 and USC-SV5-141028. The sampling date was taken from the tag.

Analytical Notes

Dilution was performed on samples USC-SV3-141024, USC-SV4-141024, USC-SV1-141024, USC-SV1-141024, USC-SV2-141024 and USC-SV5-141028 due to the presence of high level target species.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction not performed).

J - Estimated value.

E - Exceeds instrument calibration range.

S - Saturated peak.

Q - Exceeds quality control limits.

U - Compound analyzed for but not detected above the reporting limit, LOD, or MDL value. See data page for project specific U-flag definition.

UJ- Non-detected compound associated with low bias in the CCV

N - The identification is based on presumptive evidence.

File extensions may have been used on the data analysis sheets and indicates as follows:

a-File was requantified

b-File was quantified by a second column and detector

r1-File was requantified for the purpose of reissue

eurofins | Air Toxics

Summary of Detected Compounds
EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: USC-SV3-141024

Lab ID#: 1410462A-02A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	3.2	890	21	6000

Client Sample ID: USC-SV4-141024

Lab ID#: 1410462A-03A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	0.31	150	2.1	1000

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462A-04A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	1.6	440	11	3000

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462A-04B

No Detections Were Found.

Client Sample ID: USC-SV2-141024

Lab ID#: 1410462A-05A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	0.27	150	1.8	1000

Client Sample ID: USC-SV5-141028

Lab ID#: 1410462A-06A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	0.18	99	1.2	670

eurofins | Air Toxics

Client Sample ID: USC-SV3-141024

Lab ID#: 1410462A-02A

EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**3110309**	**Date of Collection:**	**10/24/14 1:02:00 PM**
Dil. Factor:	**6.31**	**Date of Analysis:**	**11/3/14 04:29 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	3.2	Not Detected	8.1	Not Detected
1,1-Dichloroethene	3.2	Not Detected	12	Not Detected
cis-1,2-Dichloroethene	3.2	Not Detected	12	Not Detected
Trichloroethene	3.2	Not Detected	17	Not Detected
trans-1,2-Dichloroethene	3.2	Not Detected	12	Not Detected
Tetrachloroethene	3.2	890	21	6000

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
Toluene-d8	106	70-130
1,2-Dichloroethane-d4	88	70-130
4-Bromofluorobenzene	107	70-130

eurofins | Air Toxics

Client Sample ID: USC-SV4-141024

Lab ID#: 1410462A-03A

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103108sim**	**Date of Collection: 10/24/14 1:44:00 PM**	
Dil. Factor:	**15.5**	**Date of Analysis: 10/31/14 11:06 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.16	Not Detected	0.40	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.61	Not Detected
cis-1,2-Dichloroethene	0.31	Not Detected	1.2	Not Detected
Trichloroethene	0.31	Not Detected	1.7	Not Detected
Tetrachloroethene	0.31	150	2.1	1000
trans-1,2-Dichloroethene	1.6	Not Detected	6.1	Not Detected

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	102	70-130

eurofins | Air Toxics

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**v103109**	**Date of Collection: 10/24/14 2:28:00 PM**	
Dil. Factor:	**16.1**	**Date of Analysis: 10/31/14 11:46 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	1.6	440	11	3000

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	92	70-130
Toluene-d8	101	70-130
4-Bromofluorobenzene	105	70-130

eurofins | Air Toxics

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462A-04B

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103109sim**	**Date of Collection: 10/24/14 2:28:00 PM**	
Dil. Factor:	**16.1**	**Date of Analysis: 10/31/14 11:46 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.16	Not Detected	0.41	Not Detected
1,1-Dichloroethene	0.16	Not Detected	0.64	Not Detected
cis-1,2-Dichloroethene	0.32	Not Detected	1.3	Not Detected
Trichloroethene	0.32	Not Detected	1.7	Not Detected
trans-1,2-Dichloroethene	1.6	Not Detected	6.4	Not Detected

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	104	70-130
4-Bromofluorobenzene	107	70-130

eurofins | Air Toxics

Client Sample ID: USC-SV2-141024

Lab ID#: 1410462A-05A

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103111sim**	**Date of Collection: 10/24/14 3:09:00 PM**	
Dil. Factor:	**13.7**	**Date of Analysis: 10/31/14 01:36 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.14	Not Detected	0.35	Not Detected
1,1-Dichloroethene	0.14	Not Detected	0.54	Not Detected
cis-1,2-Dichloroethene	0.27	Not Detected	1.1	Not Detected
Trichloroethene	0.27	Not Detected	1.5	Not Detected
Tetrachloroethene	0.27	150	1.8	1000
trans-1,2-Dichloroethene	1.4	Not Detected	5.4	Not Detected

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	103	70-130
4-Bromofluorobenzene	104	70-130

eurofins | Air Toxics

Client Sample ID: USC-SV5-141028

Lab ID#: 1410462A-06A

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103112sim**	**Date of Collection:**	**10/28/14 10:26:00 A**
Dil. Factor:	**8.75**	**Date of Analysis:**	**10/31/14 02:17 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.088	Not Detected	0.22	Not Detected
1,1-Dichloroethene	0.088	Not Detected	0.35	Not Detected
cis-1,2-Dichloroethene	0.18	Not Detected	0.69	Not Detected
Trichloroethene	0.18	Not Detected	0.94	Not Detected
Tetrachloroethene	0.18	99	1.2	670
trans-1,2-Dichloroethene	0.88	Not Detected	3.5	Not Detected

Container Type: 6 Liter Summa Canister (SIM Certified)

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	103	70-130
4-Bromofluorobenzene	104	70-130

eurofins | Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1410462A-07A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**v103107**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 09:12 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Tetrachloroethene	0.10	Not Detected	0.68	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	99	70-130
4-Bromofluorobenzene	100	70-130

eurofins | Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1410462A-07B

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103107sim**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 09:12 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.010	Not Detected	0.026	Not Detected
1,1-Dichloroethene	0.010	Not Detected	0.040	Not Detected
cis-1,2-Dichloroethene	0.020	Not Detected	0.079	Not Detected
Trichloroethene	0.020	Not Detected	0.11	Not Detected
Tetrachloroethene	0.020	Not Detected	0.14	Not Detected
trans-1,2-Dichloroethene	0.10	Not Detected	0.40	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	96	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	102	70-130

eurofins | Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1410462A-07C

EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**3110307**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/3/14 03:03 PM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Vinyl Chloride	0.50	Not Detected	1.3	Not Detected
1,1-Dichloroethene	0.50	Not Detected	2.0	Not Detected
cis-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Trichloroethene	0.50	Not Detected	2.7	Not Detected
trans-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Tetrachloroethene	0.50	Not Detected	3.4	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	105	70-130
1,2-Dichloroethane-d4	90	70-130
4-Bromofluorobenzene	101	70-130

eurofins | Air Toxics

Client Sample ID: CCV

Lab ID#: 1410462A-08A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**v103102**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 05:32 AM**	

Compound	**%Recovery**
Tetrachloroethene	84

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	92	70-130
Toluene-d8	103	70-130
4-Bromofluorobenzene	111	70-130

eurofins | Air Toxics

Client Sample ID: CCV

Lab ID#: 1410462A-08B

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103102sim**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 05:32 AM**	

Compound	%Recovery
Vinyl Chloride	86
1,1-Dichloroethene	83
cis-1,2-Dichloroethene	85
Trichloroethene	79
Tetrachloroethene	76
trans-1,2-Dichloroethene	85

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	95	70-130
Toluene-d8	104	70-130
4-Bromofluorobenzene	112	70-130

eurofins | Air Toxics

Client Sample ID: CCV

Lab ID#: 1410462A-08C

EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**3110305**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/3/14 01:49 PM**	

Compound	%Recovery
Vinyl Chloride	78
1,1-Dichloroethene	87
cis-1,2-Dichloroethene	98
Trichloroethene	92
trans-1,2-Dichloroethene	77
Tetrachloroethene	91

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	106	70-130
1,2-Dichloroethane-d4	85	70-130
4-Bromofluorobenzene	105	70-130

eurofins | Air Toxics

Client Sample ID: LCS

Lab ID#: 1410462A-09A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**v103103**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 06:18 AM**	

Compound	%Recovery	Method Limits
Tetrachloroethene	88	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	90	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	110	70-130

eurofins | Air Toxics

Client Sample ID: LCSD

Lab ID#: 1410462A-09AA

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**v103104**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 07:09 AM**	

Compound	%Recovery	Method Limits
Tetrachloroethene	88	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	94	70-130
Toluene-d8	103	70-130
4-Bromofluorobenzene	112	70-130

eurofins | Air Toxics

Client Sample ID: LCS

Lab ID#: 1410462A-09B

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103103sim**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 06:18 AM**	

Compound	%Recovery	Method Limits
Vinyl Chloride	91	70-130
1,1-Dichloroethene	90	70-130
cis-1,2-Dichloroethene	89	70-130
Trichloroethene	82	70-130
Tetrachloroethene	79	70-130
trans-1,2-Dichloroethene	84	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	94	70-130
Toluene-d8	104	70-130
4-Bromofluorobenzene	112	70-130

eurofins | Air Toxics

Client Sample ID: LCSD

Lab ID#: 1410462A-09BB

MODIFIED EPA METHOD TO-15 GC/MS SIM

File Name:	**v103104sim**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 07:09 AM**	

Compound	%Recovery	Method Limits
Vinyl Chloride	90	70-130
1,1-Dichloroethene	89	70-130
cis-1,2-Dichloroethene	89	70-130
Trichloroethene	82	70-130
Tetrachloroethene	78	70-130
trans-1,2-Dichloroethene	84	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	96	70-130
Toluene-d8	103	70-130
4-Bromofluorobenzene	112	70-130

eurofins | Air Toxics

Client Sample ID: LCS

Lab ID#: 1410462A-09C

EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**3110303**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/3/14 11:50 AM**	

Compound	%Recovery	Method Limits
Vinyl Chloride	77	70-130
1,1-Dichloroethene	88	70-130
cis-1,2-Dichloroethene	99	70-130
Trichloroethene	90	70-130
trans-1,2-Dichloroethene	72	70-130
Tetrachloroethene	87	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	107	70-130
1,2-Dichloroethane-d4	92	70-130
4-Bromofluorobenzene	103	70-130

eurofins | Air Toxics

Client Sample ID: LCSD

Lab ID#: 1410462A-09CC

EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**3110304**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/3/14 12:15 PM**	

Compound	%Recovery	Method Limits
Vinyl Chloride	77	70-130
1,1-Dichloroethene	86	70-130
cis-1,2-Dichloroethene	96	70-130
Trichloroethene	89	70-130
trans-1,2-Dichloroethene	71	70-130
Tetrachloroethene	85	70-130

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	107	70-130
1,2-Dichloroethane-d4	88	70-130
4-Bromofluorobenzene	102	70-130

Eurofins Air Toxics, Inc. Sample Receipt Confirmation Cover Page

Thank you for choosing Eurofins Air Toxics, Inc. (EATL). We have received your samples and have listed any Sample Receipt Descrepancies below.

In order to expedite analysis and reporting, please review the attached information for accuracy.

For corrections call: **Air Toxics, Ltd. at 916-985-1000**

EATL will proceed with the analysis as specified on the Chain of Custody (COC) and Sample Receipt Summary page.

Please note : The Sample Receipt Confirmation, including the total workorder charge, is subject to change upon secondary review. Our aim is to provide a confirmation to you in a timely manner. Sample Receipt Discrepancies, if any, may not include discrepancies regarding sample receipt pressure(s). Additionally, the COC will be provided with the final report.

The following discrepancy has been observed:

Sample collection date was incomplete on the Chain of Custody for samples SC-SV5-141024, USC-SV3-141024, USC-SV4-141024, USC-SV1-141024, USC-SV2-141024 and USC-SV5-141028. The sample collection date was taken from the sample tags. EATL will proceed with the analysis unless otherwise notified.

Sample USC-SV5-141024 was placed on hold at your request.

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630

(916) 985-1000 .FAX (916) 985-1020
Hours 6:30 A.M to 5:30 P.M. PST

eurofins | Air Toxics

SAMPLE RECEIPT SUMMARY

WORKORDER 1410462A

Client

Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle, WA 98101

Sales Rep: N/A

Phone

206-728-2674

Fax

206-728-2732

Date Promised: 11/05/14 5:00 pm
Date Completed:
Date Received: 10/29/14
PO#: 0183-099-00
Project#: Urban Solutions Bldg

Total $: $ 1,344.16
Logged By: HK

Fraction	Sample #	Analysis	Collected	Amount$
02A	USC-SV3-141024	Modified TO-15 SIM	10/24/2014	$126.50
03A	USC-SV4-141024	Modified TO-15 SIM	10/24/2014	$126.50
04A	USC-SV1-141024	Modified TO-15 SIM	10/24/2014	$126.50
05A	USC-SV2-141024	Modified TO-15 SIM	10/24/2014	$126.50
06A	USC-SV5-141028	Modified TO-15 SIM	10/28/2014	$126.50

Misc. Charges	6 Liter Summa Canister (SIM Certified) (7) @ $65.00 each., Shipmen	$455.00
	6 Liter Summa Canister (SIM Certified) (2) @ $65.00 each., Shipmen	$130.00
	Blue Body Flow Controller (SIM Certified) (7) @ $10.00 each., Shipm	$70.00
	Blue Body Flow Controller (SIM Certified) (2) @ $10.00 each., Shipm	$20.00
	Shipping Charges (shipped via Fed-Ex NEXT DAY PRIORITY on 10	$36.66

Note: Samples received after 3 P.M. PST are considered to be received on the following work day.
Atlas Project Name/Profile#: Urban Solutions Center/McDonald Smith/19807

BILL TO: CORP Accounts Payables
GeoEngineers, Inc.
8410 154th Avenue NE
Redmond, WA 98052

Analysis Code: pptv

REMARKS: A 15% surcharge is applied for a 5 day turnaround time.

TERMS:

Reporting Method: Modified TO-15 SIM (Sh)-1,1-DCE, c/t-1,2 DCE, PCE, TCE & VC

eurofins | Air Toxics

SAMPLE RECEIPT SUMMARY

WORKORDER 1410462B

Client

Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle, WA 98101

Sales Rep: N/A

Phone

206-728-2674

Fax

206-728-2732

Date Promised: 11/05/14 5:00 pm
Date Completed:
Date Received: 10/29/14
PO#: 0183-099-00
Project#: Urban Solutions Bldg

Total $: $ 0.00
Logged By: HK

Fraction	Sample #	Analysis	Collected	Amount$
01A(on hold)	USC-SV5-141024	Modified TO-15 SIM	10/24/2014	$0.00

Note: Samples received after 3 P.M. PST are considered to be received on the following work day.
Atlas Project Name/Profile#: Urban Solutions Center/McDonald Smith/19807

BILL TO: CORP Accounts Payables
GeoEngineers, Inc.
8410 154th Avenue NE
Redmond, WA 98052

Analysis Code: pptv

REMARKS: A 15% surcharge is applied for a 5 day turnaround time.

TERMS: NET 60

Reporting Method: Modified TO-15 SIM (Sh)-1,1-DCE, c/t-1,2 DCE, PCE, TCE & VC

eurofins | Air Toxics

SAMPLE RECEIPT SUMMARY

WORKORDER 1410462C

Client

Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle, WA 98101

Sales Rep: N/A

Phone

206-728-2674

Fax

206-728-2732

Date Promised: 11/05/14 5:00 pm
Date Completed:
Date Received: 10/29/14
PO#: 0183-099-00
Project#: Urban Solutions Bldg

Total $: $ 345.00
Logged By: HK

Fraction	Sample #	Analysis	Collected	Amount$
02A	USC-SV3-141024	Modified ASTM D-1946	10/24/2014	$69.00
03A	USC-SV4-141024	Modified ASTM D-1946	10/24/2014	$69.00
04A	USC-SV1-141024	Modified ASTM D-1946	10/24/2014	$69.00
05A	USC-SV2-141024	Modified ASTM D-1946	10/24/2014	$69.00
06A	USC-SV5-141028	Modified ASTM D-1946	10/28/2014	$69.00

Note: Samples received after 3 P.M. PST are considered to be received on the following work day.
Atlas Project Name/Profile#: Urban Solutions Center/McDonald Smith/19807

BILL TO: CORP Accounts Payables
GeoEngineers, Inc.
8410 154th Avenue NE
Redmond, WA 98052

Analysis Code: ASTM

REMARKS: A 15% surcharge is applied for a 5 day turnaround time.

TERMS: NET 60

Reporting Method: Modified ASTM D-1946 (Sh)-He only

eurofins | Air Toxics

SAMPLE RECEIPT SUMMARY

WORKORDER 1410462D

Client

Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle, WA 98101

Sales Rep: N/A

Phone

206-728-2674

Fax

206-728-2732

Date Promised: 11/05/14 5:00 pm
Date Completed:
Date Received: 10/29/14
PO#: 0183-099-00
Project#: Urban Solutions Bldg

Total $: $ 0.00
Logged By: HK

Fraction	Sample #	Analysis	Collected	Amount$
01A(on hold)	USC-SV5-141024	Modified ASTM D-1946	10/24/2014	$0.00

Note: Samples received after 3 P.M. PST are considered to be received on the following work day.
Atlas Project Name/Profile#: Urban Solutions Center/McDonald Smith/19807

BILL TO: CORP Accounts Payables
GeoEngineers, Inc.
8410 154th Avenue NE
Redmond, WA 98052

Analysis Code: ASTM

REMARKS: A 15% surcharge is applied for a 5 day turnaround time.

TERMS: NET 60

Reporting Method: Modified ASTM D-1946 (Sh)-He only

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOre
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeore@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days (specify)

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE, TCE,	26.5	3		
02A	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE and	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	96112	10/24	1439/1509	helium ASTM D-1946	28.5	5		
06A	USC-SV5-141028	25254	10/28	950/1026	on all samples except	27	6.5		
					USC-SV5-141024				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	10/28 1115	[signature] ATL	10/29/14 0930
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	UPS		NA	Good	Yes No (None)	1410462

Form 1293 rev.11

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOme
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeome@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days
specify

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
01A	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE,TCE,	26.5	3		
~~02A~~	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE, carbon	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	9611C	10/24	1439/1509	helium ASTM D-1946	28.5	5		
~~06A~~	USC-SV5-141028	25254	10/28	1556/1626	on all samples except	27	5.5		
					USC-SV5-141024				

29/14

Relinquished by: (signature) Date/Time 10/28 1115
Received by: (signature) Date/Time [illegible] 10/29/14 0930

Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time

Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	UPS		NA	Good	Yes No (None)	141042

Form 1293 rev.11

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOre
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeore@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days (specify)

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE, TCE,	26.5	3		
02A	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE and	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	96112	10/24	1439/1509	helium ASTM D-1946	28.5	5		
06A	USC-SV5-141028	25254	10/28	950/1026	on all samples except	27	6.5		
					USC-SV5-141024				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	10/28 1115	[signature] ATL	10/29/14 0930
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	UPS		NA	Good	Yes No (None)	1410462

Form 1293 rev.11

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOme
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeome@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days
specify

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
01A	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE,TCE,	26.5	3		
~~02A~~	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE, carbon	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	9611C	10/24	1439/1509	helium ASTM D-1946	28.5	5		
~~06A~~	USC-SV5-141028	25254	10/28	1556/1626	on all samples except	27	5.5		
					USC-SV5-141024				

29/14

Relinquished by: (signature) Date/Time 10/28 1115
Received by: (signature) Date/Time [illegible] 10/29/14 0930

Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time

Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	UPS		NA	Good	Yes No (None)	141042

Form 1293 rev.11

eurofins | Air Toxics

Method : Modified TO-15 SIM (Sh)-1,1-DCE, c/t-1,2 DCE, PCE, TCE & VC

CAS Number	Compound	Rpt. Limit (ppbv)
75-01-4	Vinyl Chloride	0.010
75-35-4	1,1-Dichloroethene	0.010
156-59-2	cis-1,2-Dichloroethene	0.020
79-01-6	Trichloroethene	0.020
127-18-4	Tetrachloroethene	0.020
156-60-5	trans-1,2-Dichloroethene	0.10

CAS Number	Surrogate	Method Limits
17060-07-0	1,2-Dichloroethane-d4	70-130
2037-26-5	Toluene-d8	70-130
460-00-4	4-Bromofluorobenzene	70-130

eurofins | Air Toxics

Method : Modified ASTM D-1946 (Sh)-He only

CAS Number	Compound	Rpt. Limit (%)
7440-59-7	Helium	0.050

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOme
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeome@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days (specify)

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE, TCE,	26.5	3		
02A	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE and	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	96112	10/24	1439/1509	helium ASTM D-1946	28.5	5		
06A	USC-SV5-141028	25254	10/28	950/1026	on all samples except	27	6.5		
					USC-SV5-141024				

Relinquished by: (signature) Date/Time 10/28 1115
Received by: (signature) Date/Time ZATL 10/29/14 0930
Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time
Received by: (signature) Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only

Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
UPS		NA	Good	Yes No (None)	1410462

Form 1293 rev.11

eurofins | Air Toxics

11/5/2014
Mr. Neil Morton
GeoEngineers, Inc.
600 Stewart Street
Suite 1700
Seattle WA 98101

Project Name:
Project #: Urban Solutions Bldg
Workorder #: 1410462C

Dear Mr. Neil Morton

The following report includes the data for the above referenced project for sample(s) received on 10/29/2014 at Air Toxics Ltd.

The data and associated QC analyzed by Modified ASTM D-1946 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Kelly Buettner at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Kelly Buettner

Project Manager

eurofins | Air Toxics

WORK ORDER #: 1410462C

Work Order Summary

CLIENT:	Mr. Neil Morton GeoEngineers, Inc. 600 Stewart Street Suite 1700 Seattle, WA 98101	**BILL TO:**	CORP Accounts Payables GeoEngineers, Inc. 8410 154th Avenue NE Redmond, WA 98052
PHONE:	206-728-2674	**P.O. #**	0183-099-00
FAX:	206-728-2732	**PROJECT #**	Urban Solutions Bldg
DATE RECEIVED:	10/29/2014	**CONTACT:**	Kelly Buettner
DATE COMPLETED:	11/05/2014		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
02A	USC-SV3-141024	Modified ASTM D-1946	4.5 "Hg	5 psi
03A	USC-SV4-141024	Modified ASTM D-1946	4.0 "Hg	5 psi
04A	USC-SV1-141024	Modified ASTM D-1946	5.0 "Hg	5 psi
05A	USC-SV2-141024	Modified ASTM D-1946	5.5 "Hg	5 psi
06A	USC-SV5-141028	Modified ASTM D-1946	7.0 "Hg	5 psi
07A	Lab Blank	Modified ASTM D-1946	NA	NA
08A	LCS	Modified ASTM D-1946	NA	NA
08AA	LCSD	Modified ASTM D-1946	NA	NA

CERTIFIED BY: Heidi Mayo DATE: 11/05/14

Technical Director

Certification numbers: AZ Licensure AZ0775, NJ NELAP - CA016, NY NELAP - 11291,
TX NELAP - T104704343-14-7, UT NELAP CA009332014-5, VA NELAP - 460197, WA NELAP - C935
Name of Accreditation Body: NELAP/ORELAP (Oregon Environmental Laboratory Accreditation Program)
Accreditation number: CA300005, Effective date: 10/18/2014, Expiration date: 10/17/2015.
Eurofins Air Toxics Inc.. certifies that the test results contained in this report meet all requirements of the NELAC standards

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 9563
(916) 985-1000 . (800) 985-5955 . FAX (916) 985-1020

LABORATORY NARRATIVE
Modified ASTM D-1946
GeoEngineers, Inc.
Workorder# 1410462C

Five 6 Liter Summa Canister (SIM Certified) samples were received on October 29, 2014. The laboratory performed analysis via Modified ASTM Method D-1946 for Helium in air using GC/TCD. The method involves direct injection of 1.0 mL of sample.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	***ASTM D-1946***	***ATL Modifications***
Calibration	A single point calibration is performed using a reference standard closely matching the composition of the unknown.	A minimum of 5-point calibration curve is performed. Quantitation is based on average Response Factor.
Reference Standard	The composition of any reference standard must be known to within 0.01 mol % for any component.	The standards used by ATL are blended to a >/= 95% accuracy.
Sample Injection Volume	Components whose concentrations are in excess of 5 % should not be analyzed by using sample volumes greater than 0.5 mL.	The sample container is connected directly to a fixed volume sample loop of 1.0 mL on the GC. Linear range is defined by the calibration curve. Bags are loaded by vacuum.
Normalization	Normalize the mole percent values by multiplying each value by 100 and dividing by the sum of the original values. The sum of the original values should not differ from 100% by more than 1.0%.	Results are not normalized. The sum of the reported values can differ from 100% by as much as 15%, either due to analytical variability or an unusual sample matrix.
Precision	Precision requirements established at each concentration level.	Duplicates should agree within 25% RPD for detections > 5 X's the RL.

Receiving Notes

Sample collection date was incomplete on the Chain of Custody (COC) for samples USC-SV3-141024, USC-SV4-141024, USC-SV1-141024, USC-SV2-141024 and USC-SV5-141028. The sampling date was taken from the tag.

Analytical Notes

There were no analytical discrepancies.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:
B - Compound present in laboratory blank greater than reporting limit.
J - Estimated value.
E - Exceeds instrument calibration range.
S - Saturated peak.
Q - Exceeds quality control limits.
U - Compound analyzed for but not detected above the detection limit.
M - Reported value may be biased due to apparent matrix interferences.
File extensions may have been used on the data analysis sheets and indicates as follows:
a-File was requantified
b-File was quantified by a second column and detector
r1-File was requantified for the purpose of reissue

eurofins | Air Toxics

Summary of Detected Compounds
NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

Client Sample ID: USC-SV3-141024

Lab ID#: 1410462C-02A

Compound	Rpt. Limit (%)	Amount (%)
Helium	0.079	3.5

Client Sample ID: USC-SV4-141024

Lab ID#: 1410462C-03A

Compound	Rpt. Limit (%)	Amount (%)
Helium	0.078	1.4

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462C-04A

No Detections Were Found.

Client Sample ID: USC-SV2-141024

Lab ID#: 1410462C-05A

Compound	Rpt. Limit (%)	Amount (%)
Helium	0.082	3.3

Client Sample ID: USC-SV5-141028

Lab ID#: 1410462C-06A

Compound	Rpt. Limit (%)	Amount (%)
Helium	0.088	7.3

eurofins | Air Toxics

Client Sample ID: USC-SV3-141024

Lab ID#: 1410462C-02A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103119b**	**Date of Collection: 10/24/14 1:02:00 PM**	
Dil. Factor:	**1.58**	**Date of Analysis: 10/31/14 02:27 PM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.079	3.5

Container Type: 6 Liter Summa Canister (SIM Certified)

eurofins | Air Toxics

Client Sample ID: USC-SV4-141024

Lab ID#: 1410462C-03A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103120b**	**Date of Collection: 10/24/14 1:44:00 PM**	
Dil. Factor:	**1.55**	**Date of Analysis: 10/31/14 03:04 PM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.078	1.4

Container Type: 6 Liter Summa Canister (SIM Certified)

eurofins | Air Toxics

Client Sample ID: USC-SV1-141024

Lab ID#: 1410462C-04A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103121b**	**Date of Collection: 10/24/14 2:28:00 PM**	
Dil. Factor:	**1.61**	**Date of Analysis: 10/31/14 03:52 PM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.080	Not Detected

Container Type: 6 Liter Summa Canister (SIM Certified)

eurofins | Air Toxics

Client Sample ID: USC-SV2-141024

Lab ID#: 1410462C-05A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103122b**	**Date of Collection: 10/24/14 3:09:00 PM**	
Dil. Factor:	**1.64**	**Date of Analysis: 10/31/14 04:38 PM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.082	3.3

Container Type: 6 Liter Summa Canister (SIM Certified)

eurofins | Air Toxics

Client Sample ID: USC-SV5-141028

Lab ID#: 1410462C-06A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103123b**	**Date of Collection: 10/28/14 10:26:00 A**	
Dil. Factor:	**1.75**	**Date of Analysis: 10/31/14 05:59 PM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.088	7.3

Container Type: 6 Liter Summa Canister (SIM Certified)

eurofins | Air Toxics

Client Sample ID: Lab Blank

Lab ID#: 1410462C-07A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103104b**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 08:14 AM**	

Compound	**Rpt. Limit (%)**	**Amount (%)**
Helium	0.050	Not Detected

Container Type: NA - Not Applicable

eurofins | Air Toxics

Client Sample ID: LCS

Lab ID#: 1410462C-08A

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103102b**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 07:27 AM**	

Compound	%Recovery	Method Limits
Helium	100	85-115

Container Type: NA - Not Applicable

eurofins | Air Toxics

Client Sample ID: LCSD

Lab ID#: 1410462C-08AA

NATURAL GAS ANALYSIS BY MODIFIED ASTM D-1946

File Name:	**9103127b**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 10/31/14 09:30 PM**	

Compound	%Recovery	Method Limits
Helium	100	85-115

Container Type: NA - Not Applicable

3 boxes

eurofins | Air Toxics

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager Tricia DeOre
Collected by: (Print and Sign) Paul Robinette
Company GeoEngineers Email tdeore@geoengineers.com
Address 1101 S. Fawcett St City Tacoma State WA Zip 98402
Phone 253-383-4940 Fax

Project Info:
P.O. # 0183-099-00
Project # Urban Solutions Bldg
Project Name

Turn Around Time:
☐ Normal
☒ Rush 5 days (specify)

Lab Use Only
Pressurized by:
Date:
Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
	USC-SV5-141024	34486	10/24	1122/1152	TO15-Stm-PCE, TCE,	26.5	3		
02A	USC-SV3-141024	33773	10/24	1232/1302	1,1 DCE, cis-1,2 DCE,	27	4		
03A	USC-SV4-141024	34475	10/24	1314/1344	trans 1,2 DCE and	27	4		
04A	USC-SV1-141024	25276	10/24	1358/1428	vinyl chloride;	28	5		
05A	USC-SV2-141024	96112	10/24	1439/1509	helium ASTM D-1946	28.5	5		
06A	USC-SV5-141028	25254	10/28	950/1026	on all samples except	27	6.5		
					USC-SV5-141024				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	10/28 1115	[signature] ATL	10/29/14 0930
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
Hold USC-SV5-141024

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	UPS		NA	Good	Yes No (None)	1410462

Form 1293 rev.11

OnSite Environmental Inc.

14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

November 4, 2014

Tricia DeOme
GeoEngineers, Inc.
1101 Fawcett Avenue South, Suite 200
Tacoma, WA 98402

Re: Analytical Data for Project 0183-099-00
Laboratory Reference No. 1410-328

Dear Tricia:

Enclosed are the analytical results and associated quality control data for samples submitted on October 28, 2014.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

Case Narrative

Samples were collected on October 27, 2014 and received by the laboratory on October 28, 2014. They were maintained at the laboratory at a temperature of 2°C to 6°C.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
USC-MW1S-141027	10-328-01	Water	10-27-14	10-28-14	
USC-MW1D-141027	10-328-02	Water	10-27-14	10-28-14	
JS-MW3-141027	10-328-03	Water	10-27-14	10-28-14	
JS-MW3s-141027	10-328-04	Water	10-27-14	10-28-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

NWTPH-Dx

Matrix: Water
Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**JS-MW3s-141027**					
Laboratory ID:	10-328-04					
Diesel Range Organics	**ND**	0.26	NWTPH-Dx	10-31-14	11-1-14	
Lube Oil Range Organics	**ND**	0.41	NWTPH-Dx	10-31-14	11-1-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
o-Terphenyl	*76*	*50-150*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1S-141027**					
Laboratory ID:	10-328-01					
Dichlorodifluoromethane	ND	4.2	EPA 8260C	10-31-14	10-31-14	
Chloromethane	ND	10	EPA 8260C	10-31-14	10-31-14	
Vinyl Chloride	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Bromomethane	ND	3.0	EPA 8260C	10-31-14	10-31-14	
Chloroethane	ND	10	EPA 8260C	10-31-14	10-31-14	
Trichlorofluoromethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Acetone	ND	50	EPA 8260C	10-31-14	10-31-14	
Iodomethane	ND	16	EPA 8260C	10-31-14	10-31-14	
Carbon Disulfide	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Methylene Chloride	ND	10	EPA 8260C	10-31-14	10-31-14	
(trans) 1,2-Dichloroethene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Methyl t-Butyl Ether	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Vinyl Acetate	ND	10	EPA 8260C	10-31-14	10-31-14	
2,2-Dichloropropane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
(cis) 1,2-Dichloroethene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
2-Butanone	ND	50	EPA 8260C	10-31-14	10-31-14	
Bromochloromethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Chloroform	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1,1-Trichloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Carbon Tetrachloride	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloropropene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Benzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Trichloroethene	3.0	2.0	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloropropane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Dibromomethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Bromodichloromethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
2-Chloroethyl Vinyl Ether	ND	20	EPA 8260C	10-31-14	10-31-14	
(cis) 1,3-Dichloropropene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Methyl Isobutyl Ketone	ND	20	EPA 8260C	10-31-14	10-31-14	
Toluene	ND	10	EPA 8260C	10-31-14	10-31-14	
(trans) 1,3-Dichloropropene	ND	2.0	EPA 8260C	10-31-14	10-31-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1S-141027**					
Laboratory ID:	10-328-01					
1,1,2-Trichloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Tetrachloroethene	330	2.0	EPA 8260C	10-31-14	10-31-14	
1,3-Dichloropropane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
2-Hexanone	ND	20	EPA 8260C	10-31-14	10-31-14	
Dibromochloromethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromoethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Chlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1,1,2-Tetrachloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Ethylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
m,p-Xylene	ND	4.0	EPA 8260C	10-31-14	10-31-14	
o-Xylene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Styrene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Bromoform	ND	10	EPA 8260C	10-31-14	10-31-14	
Isopropylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Bromobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,1,2,2-Tetrachloroethane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichloropropane	ND	2.0	EPA 8260C	10-31-14	10-31-14	
n-Propylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
2-Chlorotoluene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
4-Chlorotoluene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,3,5-Trimethylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
tert-Butylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trimethylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
sec-Butylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,3-Dichlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
p-Isopropyltoluene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,4-Dichlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2-Dichlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
n-Butylbenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromo-3-chloropropane	ND	10	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trichlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Hexachlorobutadiene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Naphthalene	ND	10	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichlorobenzene	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*103*	*79-122*				
Toluene-d8	*108*	*80-120*				
4-Bromofluorobenzene	*97*	*80-120*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-141027**					
Laboratory ID:	10-328-02					
Dichlorodifluoromethane	ND	0.42	EPA 8260C	10-31-14	10-31-14	
Chloromethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Vinyl Chloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromomethane	ND	0.30	EPA 8260C	10-31-14	10-31-14	
Chloroethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Trichlorofluoromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Acetone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Iodomethane	ND	1.6	EPA 8260C	10-31-14	10-31-14	
Carbon Disulfide	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methylene Chloride	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl t-Butyl Ether	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Vinyl Acetate	ND	1.0	EPA 8260C	10-31-14	10-31-14	
2,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
(cis) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Butanone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Bromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chloroform	0.39	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Carbon Tetrachloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Benzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Trichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Dibromomethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromodichloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chloroethyl Vinyl Ether	ND	2.0	EPA 8260C	10-31-14	10-31-14	
(cis) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl Isobutyl Ketone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Toluene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-141027**					
Laboratory ID:	10-328-02					
1,1,2-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Tetrachloroethene	1.5	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Hexanone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Dibromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromoethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Ethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
m,p-Xylene	ND	0.40	EPA 8260C	10-31-14	10-31-14	
o-Xylene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Styrene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromoform	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Isopropylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,2,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Propylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
4-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3,5-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
tert-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
sec-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
p-Isopropyltoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,4-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromo-3-chloropropane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Hexachlorobutadiene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Naphthalene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*115*	*79-122*				
Toluene-d8	*105*	*80-120*				
4-Bromofluorobenzene	*95*	*80-120*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**JS-MW3-141027**					
Laboratory ID:	10-328-03					
Dichlorodifluoromethane	ND	0.42	EPA 8260C	10-31-14	10-31-14	
Chloromethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Vinyl Chloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromomethane	ND	0.30	EPA 8260C	10-31-14	10-31-14	
Chloroethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Trichlorofluoromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Acetone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Iodomethane	ND	1.6	EPA 8260C	10-31-14	10-31-14	
Carbon Disulfide	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methylene Chloride	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl t-Butyl Ether	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Vinyl Acetate	ND	1.0	EPA 8260C	10-31-14	10-31-14	
2,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
(cis) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Butanone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Bromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chloroform	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Carbon Tetrachloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Benzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Trichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Dibromomethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromodichloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chloroethyl Vinyl Ether	ND	2.0	EPA 8260C	10-31-14	10-31-14	
(cis) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl Isobutyl Ketone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Toluene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**JS-MW3-141027**					
Laboratory ID:	10-328-03					
1,1,2-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Tetrachloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Hexanone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Dibromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromoethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Ethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
m,p-Xylene	ND	0.40	EPA 8260C	10-31-14	10-31-14	
o-Xylene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Styrene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromoform	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Isopropylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,2,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Propylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
4-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3,5-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
tert-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
sec-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
p-Isopropyltoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,4-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromo-3-chloropropane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Hexachlorobutadiene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Naphthalene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*110*	*79-122*				
Toluene-d8	*108*	*80-120*				
4-Bromofluorobenzene	*99*	*80-120*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**JS-MW3s-141027**					
Laboratory ID:	10-328-04					
Dichlorodifluoromethane	ND	0.42	EPA 8260C	10-31-14	10-31-14	
Chloromethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Vinyl Chloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromomethane	ND	0.30	EPA 8260C	10-31-14	10-31-14	
Chloroethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Trichlorofluoromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Acetone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Iodomethane	ND	1.6	EPA 8260C	10-31-14	10-31-14	
Carbon Disulfide	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methylene Chloride	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl t-Butyl Ether	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Vinyl Acetate	ND	1.0	EPA 8260C	10-31-14	10-31-14	
2,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
(cis) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Butanone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Bromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chloroform	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Carbon Tetrachloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Benzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Trichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Dibromomethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromodichloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chloroethyl Vinyl Ether	ND	2.0	EPA 8260C	10-31-14	10-31-14	
(cis) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl Isobutyl Ketone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Toluene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**JS-MW3s-141027**					
Laboratory ID:	10-328-04					
1,1,2-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Tetrachloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Hexanone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Dibromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromoethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Ethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
m,p-Xylene	ND	0.40	EPA 8260C	10-31-14	10-31-14	
o-Xylene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Styrene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromoform	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Isopropylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,2,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Propylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
4-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3,5-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
tert-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
sec-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
p-Isopropyltoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,4-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromo-3-chloropropane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Hexachlorobutadiene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Naphthalene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*109*	*79-122*				
Toluene-d8	*107*	*80-120*				
4-Bromofluorobenzene	*99*	*80-120*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

NWTPH-Dx
QUALITY CONTROL

Matrix: Water
Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB1031W1					
Diesel Range Organics	**ND**	0.25	NWTPH-Dx	10-31-14	11-1-14	
Lube Oil Range Organics	**ND**	0.40	NWTPH-Dx	10-31-14	11-1-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
o-Terphenyl	*81*	*50-150*				

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	10-328-04										
	ORIG	DUP									
Diesel Range	**ND**	**ND**	NA	NA		NA		NA	NA	NA	
Lube Oil Range	**ND**	**ND**	NA	NA		NA		NA	NA	NA	
Surrogate:											
o-Terphenyl						*76*	*77*	*50-150*			

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 1 of 2

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1031W1					
Dichlorodifluoromethane	ND	0.42	EPA 8260C	10-31-14	10-31-14	
Chloromethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Vinyl Chloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromomethane	ND	0.30	EPA 8260C	10-31-14	10-31-14	
Chloroethane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Trichlorofluoromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Acetone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Iodomethane	ND	1.6	EPA 8260C	10-31-14	10-31-14	
Carbon Disulfide	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methylene Chloride	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl t-Butyl Ether	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Vinyl Acetate	ND	1.0	EPA 8260C	10-31-14	10-31-14	
2,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
(cis) 1,2-Dichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Butanone	ND	5.0	EPA 8260C	10-31-14	10-31-14	
Bromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chloroform	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Carbon Tetrachloride	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Benzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Trichloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Dibromomethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromodichloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chloroethyl Vinyl Ether	ND	2.0	EPA 8260C	10-31-14	10-31-14	
(cis) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Methyl Isobutyl Ketone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Toluene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
(trans) 1,3-Dichloropropene	ND	0.20	EPA 8260C	10-31-14	10-31-14	

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1031W1					
1,1,2-Trichloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Tetrachloroethene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Hexanone	ND	2.0	EPA 8260C	10-31-14	10-31-14	
Dibromochloromethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromoethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Chlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,1,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Ethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
m,p-Xylene	ND	0.40	EPA 8260C	10-31-14	10-31-14	
o-Xylene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Styrene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromoform	ND	1.0	EPA 8260C	10-31-14	10-31-14	
Isopropylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Bromobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,1,2,2-Tetrachloroethane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichloropropane	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Propylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
2-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
4-Chlorotoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3,5-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
tert-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trimethylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
sec-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,3-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
p-Isopropyltoluene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,4-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
n-Butylbenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
1,2-Dibromo-3-chloropropane	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,4-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Hexachlorobutadiene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Naphthalene	ND	1.0	EPA 8260C	10-31-14	10-31-14	
1,2,3-Trichlorobenzene	ND	0.20	EPA 8260C	10-31-14	10-31-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*99*	*79-122*				
Toluene-d8	*105*	*80-120*				
4-Bromofluorobenzene	*95*	*80-120*				

Date of Report: November 4, 2014
Samples Submitted: October 28, 2014
Laboratory Reference: 1410-328
Project: 0183-099-00

VOLATILES by EPA 8260C
SB/SBD QUALITY CONTROL

Matrix: Water
Units: ug/L

Analyte	Result		Spike Level		Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
SPIKE BLANKS										
Laboratory ID:	SB1031W1									
	SB	SBD	SB	SBD	SB	SBD				
1,1-Dichloroethene	**10.8**	**9.16**	10.0	10.0	108	92	64-138	16	16	
Benzene	**11.2**	**10.3**	10.0	10.0	112	103	76-125	8	14	
Trichloroethene	**9.96**	**9.07**	10.0	10.0	100	91	75-125	9	16	
Toluene	**11.5**	**10.7**	10.0	10.0	115	107	75-125	7	15	
Chlorobenzene	**9.86**	**9.10**	10.0	10.0	99	91	80-140	8	15	
Surrogate:										
Dibromofluoromethane					*107*	*103*	*79-122*			
Toluene-d8					*104*	*104*	*80-120*			
4-Bromofluorobenzene					*100*	*99*	*80-120*			

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

Chain of Custody

Page 1 of _____

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: GEI
Project Number: 0183-099-00
Project Name: UWT
Project Manager: TRICIA DeOme
Sampled by: PDR

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☐ Standard (7 Days) (TPH analysis 5 Days)
☒ 5days (other)

Laboratory Number: 10-328

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A	% Moisture
1	USC-MW15-141027	10/27	1015	W	3					X												
2	USC-MW1D-141027		1155	W	3					X												
3	JS-MW3-141027		1405	W	3					X												
4	JS-MW3S-141027		1515	W	5				X	X												

	Signature	Company	Date	Time
Relinquished		GeoEngineers	10/28/14	850
Received	Van	Spdy	10/28/14	850
Relinquished				1210
Received			10/28/14	1210
Relinquished				
Received				

Comments/Special Instructions

Reviewed/Date

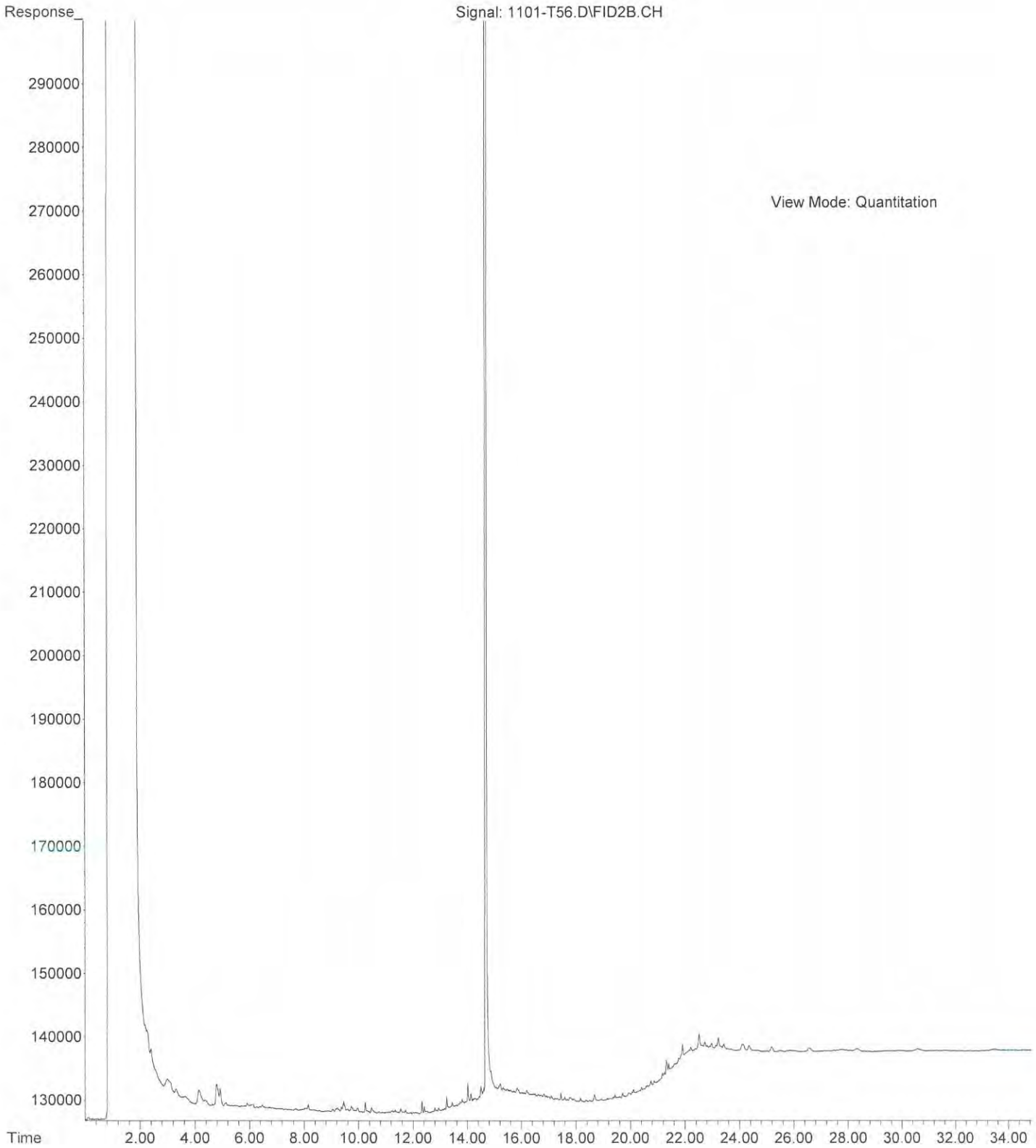
Reviewed/Date

Chromatograms with final report ☐

Data Package: Standard ☐ Level III ☐ Level IV ☐

Electronic Data Deliverables (EDDs) ☐ _____

File :X:\DIESELS\TERI\DATA\T141101.SEC\1101-T56.D
Operator : ZT
Acquired : 01 Nov 2014 21:27 using AcqMethod T140401F.M
Instrument : Teri
Sample Name: 10-328-04
Misc Info :
Vial Number: 56



OnSite Environmental Inc.

14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

October 28, 2014

Tricia DeOme
GeoEngineers, Inc.
1101 Fawcett Avenue South, Suite 200
Tacoma, WA 98402

Re: Analytical Data for Project 0183-099-00
Laboratory Reference No. 1410-257

Dear Tricia:

Enclosed are the analytical results and associated quality control data for samples submitted on October 22, 2014.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

Case Narrative

Samples were collected on October 20 and 21, 2014 and received by the laboratory on October 22, 2014. They were maintained at the laboratory at a temperature of 2°C to 6°C.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Volatiles EPA 8260C Analysis

Per EPA Method 5035A, samples were received by the laboratory in pre-weighed 40 mL VOA vials within 48 hours of sample collection. They were stored in a freezer at between -7°C and -20°C until extraction or analysis.

Any other QA/QC issues associated with this extraction and analysis will be indicated with a footnote reference and discussed in detail on the Data Qualifier page.

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
USC-MW1D-10-11.5	10-257-01	Soil	10-20-14	10-22-14	
USC-MW1D-11.5-13	10-257-02	Soil	10-20-14	10-22-14	
USC-MW1D-16.5-18	10-257-03	Soil	10-20-14	10-22-14	
USC-MW1D-20-21.5	10-257-04	Soil	10-20-14	10-22-14	
USC-MW1D-21.5-22	10-257-05	Soil	10-20-14	10-22-14	
USC-MW1D-27.5-28	10-257-06	Soil	10-20-14	10-22-14	
USC-MW1D-40-40.5	10-257-07	Soil	10-21-14	10-22-14	
USC-MW1D-51-52	10-257-08	Soil	10-21-14	10-22-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-10-11.5**					
Laboratory ID:	10-257-01					
Dichlorodifluoromethane	ND	0.0017	EPA 8260C	10-24-14	10-24-14	
Chloromethane	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Vinyl Chloride	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromomethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chloroethane	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Trichlorofluoromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Acetone	ND	0.022	EPA 8260C	10-24-14	10-24-14	
Iodomethane	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Carbon Disulfide	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methylene Chloride	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
(trans) 1,2-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methyl t-Butyl Ether	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Vinyl Acetate	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
2,2-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
(cis) 1,2-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Butanone	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Bromochloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chloroform	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,1-Trichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Carbon Tetrachloride	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Benzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Trichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Dibromomethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromodichloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Chloroethyl Vinyl Ether	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
(cis) 1,3-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methyl Isobutyl Ketone	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Toluene	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
(trans) 1,3-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-10-11.5**					
Laboratory ID:	10-257-01					
1,1,2-Trichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Tetrachloroethene	0.048	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Hexanone	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Dibromochloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromoethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,1,2-Tetrachloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Ethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
m,p-Xylene	ND	0.0025	EPA 8260C	10-24-14	10-24-14	
o-Xylene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Styrene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromoform	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Isopropylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,2,2-Tetrachloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
n-Propylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Chlorotoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
4-Chlorotoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3,5-Trimethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
tert-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trimethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
sec-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
p-Isopropyltoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,4-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
n-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromo-3-chloropropane	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Hexachlorobutadiene	ND	0.0064	EPA 8260C	10-24-14	10-24-14	
Naphthalene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*109*	*76-131*				
Toluene-d8	*108*	*82-129*				
4-Bromofluorobenzene	*105*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-11.5-13**					
Laboratory ID:	10-257-02					
Dichlorodifluoromethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Chloromethane	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Vinyl Chloride	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Bromomethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Chloroethane	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Trichlorofluoromethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Acetone	ND	0.024	EPA 8260C	10-27-14	10-27-14	
Iodomethane	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Carbon Disulfide	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Methylene Chloride	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
(trans) 1,2-Dichloroethene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Methyl t-Butyl Ether	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Vinyl Acetate	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
2,2-Dichloropropane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
(cis) 1,2-Dichloroethene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
2-Butanone	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Bromochloromethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Chloroform	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1,1-Trichloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Carbon Tetrachloride	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloropropene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Benzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Trichloroethene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloropropane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Dibromomethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Bromodichloromethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
2-Chloroethyl Vinyl Ether	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
(cis) 1,3-Dichloropropene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Methyl Isobutyl Ketone	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Toluene	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
(trans) 1,3-Dichloropropene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-11.5-13**					
Laboratory ID:	10-257-02					
1,1,2-Trichloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Tetrachloroethene	0.22	0.0016	EPA 8260C	10-27-14	10-27-14	
1,3-Dichloropropane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
2-Hexanone	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Dibromochloromethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromoethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Chlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1,1,2-Tetrachloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Ethylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
m,p-Xylene	ND	0.0031	EPA 8260C	10-27-14	10-27-14	
o-Xylene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Styrene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Bromoform	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Isopropylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Bromobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,1,2,2-Tetrachloroethane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichloropropane	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
n-Propylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
2-Chlorotoluene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
4-Chlorotoluene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,3,5-Trimethylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
tert-Butylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trimethylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
sec-Butylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,3-Dichlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
p-Isopropyltoluene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,4-Dichlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2-Dichlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
n-Butylbenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromo-3-chloropropane	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trichlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Hexachlorobutadiene	ND	0.0079	EPA 8260C	10-27-14	10-27-14	
Naphthalene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichlorobenzene	ND	0.0016	EPA 8260C	10-27-14	10-27-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*109*	*76-131*				
Toluene-d8	*111*	*82-129*				
4-Bromofluorobenzene	*108*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-16.5-18**					
Laboratory ID:	10-257-03					
Dichlorodifluoromethane	ND	0.0016	EPA 8260C	10-24-14	10-24-14	
Chloromethane	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Vinyl Chloride	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Bromomethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Chloroethane	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Trichlorofluoromethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Acetone	ND	0.021	EPA 8260C	10-24-14	10-24-14	
Iodomethane	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Carbon Disulfide	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Methylene Chloride	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
(trans) 1,2-Dichloroethene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Methyl t-Butyl Ether	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Vinyl Acetate	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
2,2-Dichloropropane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
(cis) 1,2-Dichloroethene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
2-Butanone	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Bromochloromethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Chloroform	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1,1-Trichloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Carbon Tetrachloride	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloropropene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Benzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Trichloroethene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloropropane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Dibromomethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Bromodichloromethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
2-Chloroethyl Vinyl Ether	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
(cis) 1,3-Dichloropropene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Methyl Isobutyl Ketone	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Toluene	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
(trans) 1,3-Dichloropropene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-16.5-18**					
Laboratory ID:	10-257-03					
1,1,2-Trichloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Tetrachloroethene	0.24	0.0012	EPA 8260C	10-24-14	10-24-14	
1,3-Dichloropropane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
2-Hexanone	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Dibromochloromethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromoethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Chlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1,1,2-Tetrachloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Ethylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
m,p-Xylene	ND	0.0024	EPA 8260C	10-24-14	10-24-14	
o-Xylene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Styrene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Bromoform	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Isopropylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Bromobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,1,2,2-Tetrachloroethane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichloropropane	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
n-Propylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
2-Chlorotoluene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
4-Chlorotoluene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,3,5-Trimethylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
tert-Butylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trimethylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
sec-Butylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,3-Dichlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
p-Isopropyltoluene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,4-Dichlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2-Dichlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
n-Butylbenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromo-3-chloropropane	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trichlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Hexachlorobutadiene	ND	0.0061	EPA 8260C	10-24-14	10-24-14	
Naphthalene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichlorobenzene	ND	0.0012	EPA 8260C	10-24-14	10-24-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*108*	*76-131*				
Toluene-d8	*112*	*82-129*				
4-Bromofluorobenzene	*109*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-20-21.5**					
Laboratory ID:	10-257-04					
Dichlorodifluoromethane	ND	0.0014	EPA 8260C	10-24-14	10-24-14	
Chloromethane	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Vinyl Chloride	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Bromomethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Chloroethane	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Trichlorofluoromethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Acetone	ND	0.019	EPA 8260C	10-24-14	10-24-14	
Iodomethane	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Carbon Disulfide	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Methylene Chloride	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
(trans) 1,2-Dichloroethene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Methyl t-Butyl Ether	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Vinyl Acetate	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
2,2-Dichloropropane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
(cis) 1,2-Dichloroethene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
2-Butanone	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Bromochloromethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Chloroform	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1,1-Trichloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Carbon Tetrachloride	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloropropene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Benzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Trichloroethene	0.0013	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloropropane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Dibromomethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Bromodichloromethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
2-Chloroethyl Vinyl Ether	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
(cis) 1,3-Dichloropropene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Methyl Isobutyl Ketone	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Toluene	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
(trans) 1,3-Dichloropropene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-20-21.5**					
Laboratory ID:	10-257-04					
1,1,2-Trichloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Tetrachloroethene	0.070	0.0011	EPA 8260C	10-24-14	10-24-14	
1,3-Dichloropropane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
2-Hexanone	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Dibromochloromethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromoethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Chlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1,1,2-Tetrachloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Ethylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
m,p-Xylene	ND	0.0022	EPA 8260C	10-24-14	10-24-14	
o-Xylene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Styrene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Bromoform	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Isopropylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Bromobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,1,2,2-Tetrachloroethane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichloropropane	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
n-Propylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
2-Chlorotoluene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
4-Chlorotoluene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,3,5-Trimethylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
tert-Butylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trimethylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
sec-Butylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,3-Dichlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
p-Isopropyltoluene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,4-Dichlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2-Dichlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
n-Butylbenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromo-3-chloropropane	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trichlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Hexachlorobutadiene	ND	0.0056	EPA 8260C	10-24-14	10-24-14	
Naphthalene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichlorobenzene	ND	0.0011	EPA 8260C	10-24-14	10-24-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*107*	*76-131*				
Toluene-d8	*108*	*82-129*				
4-Bromofluorobenzene	*107*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-21.5-22**					
Laboratory ID:	10-257-05					
Dichlorodifluoromethane	ND	0.0016	EPA 8260C	10-24-14	10-24-14	
Chloromethane	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Vinyl Chloride	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromomethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chloroethane	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Trichlorofluoromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Acetone	ND	0.021	EPA 8260C	10-24-14	10-24-14	
Iodomethane	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Carbon Disulfide	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methylene Chloride	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
(trans) 1,2-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methyl t-Butyl Ether	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Vinyl Acetate	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
2,2-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
(cis) 1,2-Dichloroethene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Butanone	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Bromochloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chloroform	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,1-Trichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Carbon Tetrachloride	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Benzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Trichloroethene	0.0015	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Dibromomethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromodichloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Chloroethyl Vinyl Ether	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
(cis) 1,3-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Methyl Isobutyl Ketone	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Toluene	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
(trans) 1,3-Dichloropropene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-21.5-22**					
Laboratory ID:	10-257-05					
1,1,2-Trichloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Tetrachloroethene	0.034	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3-Dichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Hexanone	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Dibromochloromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromoethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,1,2-Tetrachloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Ethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
m,p-Xylene	ND	0.0025	EPA 8260C	10-24-14	10-24-14	
o-Xylene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Styrene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromoform	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Isopropylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Bromobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,1,2,2-Tetrachloroethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichloropropane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
n-Propylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
2-Chlorotoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
4-Chlorotoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3,5-Trimethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
tert-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trimethylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
sec-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,3-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
p-Isopropyltoluene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,4-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
n-Butylbenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromo-3-chloropropane	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Hexachlorobutadiene	ND	0.0063	EPA 8260C	10-24-14	10-24-14	
Naphthalene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichlorobenzene	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*102*	*76-131*				
Toluene-d8	*104*	*82-129*				
4-Bromofluorobenzene	*100*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-27.5-28**					
Laboratory ID:	10-257-06					
Dichlorodifluoromethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Chloromethane	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Vinyl Chloride	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Bromomethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Chloroethane	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Trichlorofluoromethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Acetone	ND	0.014	EPA 8260C	10-27-14	10-27-14	
Iodomethane	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Carbon Disulfide	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Methylene Chloride	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
(trans) 1,2-Dichloroethene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Methyl t-Butyl Ether	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Vinyl Acetate	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
2,2-Dichloropropane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
(cis) 1,2-Dichloroethene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
2-Butanone	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Bromochloromethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Chloroform	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1,1-Trichloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Carbon Tetrachloride	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloropropene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Benzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Trichloroethene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloropropane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Dibromomethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Bromodichloromethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
2-Chloroethyl Vinyl Ether	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
(cis) 1,3-Dichloropropene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Methyl Isobutyl Ketone	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Toluene	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
(trans) 1,3-Dichloropropene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-27.5-28**					
Laboratory ID:	10-257-06					
1,1,2-Trichloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Tetrachloroethene	0.016	0.00095	EPA 8260C	10-27-14	10-27-14	
1,3-Dichloropropane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
2-Hexanone	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Dibromochloromethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromoethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Chlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1,1,2-Tetrachloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Ethylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
m,p-Xylene	ND	0.0019	EPA 8260C	10-27-14	10-27-14	
o-Xylene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Styrene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Bromoform	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Isopropylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Bromobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,1,2,2-Tetrachloroethane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichloropropane	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
n-Propylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
2-Chlorotoluene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
4-Chlorotoluene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,3,5-Trimethylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
tert-Butylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trimethylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
sec-Butylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,3-Dichlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
p-Isopropyltoluene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,4-Dichlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2-Dichlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
n-Butylbenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromo-3-chloropropane	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trichlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Hexachlorobutadiene	ND	0.0048	EPA 8260C	10-27-14	10-27-14	
Naphthalene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichlorobenzene	ND	0.00095	EPA 8260C	10-27-14	10-27-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*111*	*76-131*				
Toluene-d8	*113*	*82-129*				
4-Bromofluorobenzene	*110*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-40-40.5**					
Laboratory ID:	10-257-07					
Dichlorodifluoromethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Chloromethane	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Vinyl Chloride	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Bromomethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Chloroethane	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Trichlorofluoromethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Acetone	ND	0.021	EPA 8260C	10-27-14	10-27-14	
Iodomethane	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Carbon Disulfide	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Methylene Chloride	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
(trans) 1,2-Dichloroethene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Methyl t-Butyl Ether	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Vinyl Acetate	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
2,2-Dichloropropane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
(cis) 1,2-Dichloroethene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
2-Butanone	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Bromochloromethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Chloroform	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1,1-Trichloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Carbon Tetrachloride	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloropropene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Benzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Trichloroethene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloropropane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Dibromomethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Bromodichloromethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
2-Chloroethyl Vinyl Ether	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
(cis) 1,3-Dichloropropene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Methyl Isobutyl Ketone	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Toluene	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
(trans) 1,3-Dichloropropene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-40-40.5**					
Laboratory ID:	10-257-07					
1,1,2-Trichloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Tetrachloroethene	0.079	0.0014	EPA 8260C	10-27-14	10-27-14	
1,3-Dichloropropane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
2-Hexanone	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Dibromochloromethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromoethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Chlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1,1,2-Tetrachloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Ethylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
m,p-Xylene	ND	0.0028	EPA 8260C	10-27-14	10-27-14	
o-Xylene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Styrene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Bromoform	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Isopropylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Bromobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,1,2,2-Tetrachloroethane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichloropropane	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
n-Propylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
2-Chlorotoluene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
4-Chlorotoluene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,3,5-Trimethylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
tert-Butylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trimethylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
sec-Butylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,3-Dichlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
p-Isopropyltoluene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,4-Dichlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2-Dichlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
n-Butylbenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromo-3-chloropropane	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trichlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Hexachlorobutadiene	ND	0.0070	EPA 8260C	10-27-14	10-27-14	
Naphthalene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichlorobenzene	ND	0.0014	EPA 8260C	10-27-14	10-27-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*105*	*76-131*				
Toluene-d8	*106*	*82-129*				
4-Bromofluorobenzene	*101*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-51-52**					
Laboratory ID:	10-257-08					
Dichlorodifluoromethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Chloromethane	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Vinyl Chloride	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Bromomethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Chloroethane	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Trichlorofluoromethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Acetone	0.019	0.016	EPA 8260C	10-27-14	10-27-14	Y
Iodomethane	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Carbon Disulfide	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Methylene Chloride	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
(trans) 1,2-Dichloroethene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Methyl t-Butyl Ether	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Vinyl Acetate	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
2,2-Dichloropropane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
(cis) 1,2-Dichloroethene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
2-Butanone	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Bromochloromethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Chloroform	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1,1-Trichloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Carbon Tetrachloride	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloropropene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Benzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Trichloroethene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloropropane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Dibromomethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Bromodichloromethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
2-Chloroethyl Vinyl Ether	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
(cis) 1,3-Dichloropropene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Methyl Isobutyl Ketone	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Toluene	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
(trans) 1,3-Dichloropropene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES EPA 8260C
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**USC-MW1D-51-52**					
Laboratory ID:	10-257-08					
1,1,2-Trichloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Tetrachloroethene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,3-Dichloropropane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
2-Hexanone	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Dibromochloromethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromoethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Chlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1,1,2-Tetrachloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Ethylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
m,p-Xylene	ND	0.0022	EPA 8260C	10-27-14	10-27-14	
o-Xylene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Styrene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Bromoform	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Isopropylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Bromobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,1,2,2-Tetrachloroethane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichloropropane	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
n-Propylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
2-Chlorotoluene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
4-Chlorotoluene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,3,5-Trimethylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
tert-Butylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trimethylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
sec-Butylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,3-Dichlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
p-Isopropyltoluene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,4-Dichlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2-Dichlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
n-Butylbenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromo-3-chloropropane	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trichlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Hexachlorobutadiene	ND	0.0055	EPA 8260C	10-27-14	10-27-14	
Naphthalene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichlorobenzene	ND	0.0011	EPA 8260C	10-27-14	10-27-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*110*	*76-131*				
Toluene-d8	*110*	*82-129*				
4-Bromofluorobenzene	*107*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1024S1					
Dichlorodifluoromethane	ND	0.0013	EPA 8260C	10-24-14	10-24-14	
Chloromethane	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Vinyl Chloride	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Bromomethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Chloroethane	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Trichlorofluoromethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Acetone	ND	0.017	EPA 8260C	10-24-14	10-24-14	
Iodomethane	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Carbon Disulfide	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Methylene Chloride	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
(trans) 1,2-Dichloroethene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Methyl t-Butyl Ether	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Vinyl Acetate	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
2,2-Dichloropropane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
(cis) 1,2-Dichloroethene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
2-Butanone	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Bromochloromethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Chloroform	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1,1-Trichloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Carbon Tetrachloride	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1-Dichloropropene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Benzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Trichloroethene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2-Dichloropropane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Dibromomethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Bromodichloromethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
2-Chloroethyl Vinyl Ether	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
(cis) 1,3-Dichloropropene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Methyl Isobutyl Ketone	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Toluene	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
(trans) 1,3-Dichloropropene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1024S1					
1,1,2-Trichloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Tetrachloroethene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,3-Dichloropropane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
2-Hexanone	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Dibromochloromethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromoethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Chlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1,1,2-Tetrachloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Ethylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
m,p-Xylene	ND	0.0020	EPA 8260C	10-24-14	10-24-14	
o-Xylene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Styrene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Bromoform	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Isopropylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Bromobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,1,2,2-Tetrachloroethane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichloropropane	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
n-Propylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
2-Chlorotoluene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
4-Chlorotoluene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,3,5-Trimethylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
tert-Butylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trimethylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
sec-Butylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,3-Dichlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
p-Isopropyltoluene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,4-Dichlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2-Dichlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
n-Butylbenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2-Dibromo-3-chloropropane	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
1,2,4-Trichlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Hexachlorobutadiene	ND	0.0050	EPA 8260C	10-24-14	10-24-14	
Naphthalene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
1,2,3-Trichlorobenzene	ND	0.0010	EPA 8260C	10-24-14	10-24-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*100*	*76-131*				
Toluene-d8	*103*	*82-129*				
4-Bromofluorobenzene	*101*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 1 of 2

Matrix: Soil
Units: mg/kg

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1027S1					
Dichlorodifluoromethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Chloromethane	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Vinyl Chloride	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Bromomethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Chloroethane	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Trichlorofluoromethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Acetone	ND	0.015	EPA 8260C	10-27-14	10-27-14	
Iodomethane	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Carbon Disulfide	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Methylene Chloride	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
(trans) 1,2-Dichloroethene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Methyl t-Butyl Ether	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Vinyl Acetate	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
2,2-Dichloropropane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
(cis) 1,2-Dichloroethene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
2-Butanone	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Bromochloromethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Chloroform	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1,1-Trichloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Carbon Tetrachloride	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1-Dichloropropene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Benzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Trichloroethene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2-Dichloropropane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Dibromomethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Bromodichloromethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
2-Chloroethyl Vinyl Ether	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
(cis) 1,3-Dichloropropene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Methyl Isobutyl Ketone	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Toluene	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
(trans) 1,3-Dichloropropene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
METHOD BLANK QUALITY CONTROL
page 2 of 2

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Laboratory ID:	MB1027S1					
1,1,2-Trichloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Tetrachloroethene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,3-Dichloropropane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
2-Hexanone	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Dibromochloromethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromoethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Chlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1,1,2-Tetrachloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Ethylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
m,p-Xylene	ND	0.0020	EPA 8260C	10-27-14	10-27-14	
o-Xylene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Styrene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Bromoform	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Isopropylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Bromobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,1,2,2-Tetrachloroethane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichloropropane	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
n-Propylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
2-Chlorotoluene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
4-Chlorotoluene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,3,5-Trimethylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
tert-Butylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trimethylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
sec-Butylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,3-Dichlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
p-Isopropyltoluene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,4-Dichlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2-Dichlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
n-Butylbenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2-Dibromo-3-chloropropane	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
1,2,4-Trichlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Hexachlorobutadiene	ND	0.0050	EPA 8260C	10-27-14	10-27-14	
Naphthalene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
1,2,3-Trichlorobenzene	ND	0.0010	EPA 8260C	10-27-14	10-27-14	
Surrogate:	*Percent Recovery*	*Control Limits*				
Dibromofluoromethane	*102*	*76-131*				
Toluene-d8	*102*	*82-129*				
4-Bromofluorobenzene	*103*	*79-126*				

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
SB/SBD QUALITY CONTROL

Matrix: Soil
Units: mg/kg

Analyte	Result		Spike Level		Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
SPIKE BLANKS										
Laboratory ID:	SB1024S1									
	SB	SBD	SB	SBD	SB	SBD				
1,1-Dichloroethene	**0.0475**	**0.0460**	0.0500	0.0500	95	92	66-129	3	15	
Benzene	**0.0506**	**0.0481**	0.0500	0.0500	101	96	71-123	5	15	
Trichloroethene	**0.0500**	**0.0478**	0.0500	0.0500	100	96	75-115	4	15	
Toluene	**0.0490**	**0.0481**	0.0500	0.0500	98	96	75-120	2	15	
Chlorobenzene	**0.0474**	**0.0465**	0.0500	0.0500	95	93	75-121	2	15	
Surrogate:										
Dibromofluoromethane					*103*	*101*	*76-131*			
Toluene-d8					*102*	*100*	*82-129*			
4-Bromofluorobenzene					*99*	*98*	*79-126*			

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

VOLATILES by EPA 8260C
SB/SBD QUALITY CONTROL

Matrix: Soil
Units: mg/kg

Analyte	Result		Spike Level		Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
SPIKE BLANKS										
Laboratory ID:	SB1027S1									
	SB	SBD	SB	SBD	SB	SBD				
1,1-Dichloroethene	**0.0470**	**0.0483**	0.0500	0.0500	94	97	66-129	3	15	
Benzene	**0.0497**	**0.0498**	0.0500	0.0500	99	100	71-123	0	15	
Trichloroethene	**0.0498**	**0.0495**	0.0500	0.0500	100	99	75-115	1	15	
Toluene	**0.0481**	**0.0489**	0.0500	0.0500	96	98	75-120	2	15	
Chlorobenzene	**0.0467**	**0.0464**	0.0500	0.0500	93	93	75-121	1	15	
Surrogate:										
Dibromofluoromethane					*102*	*103*	*76-131*			
Toluene-d8					*102*	*103*	*82-129*			
4-Bromofluorobenzene					*100*	*101*	*79-126*			

Date of Report: October 28, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257
Project: 0183-099-00

% MOISTURE

Date Analyzed: 10-24&27-14

Client ID	Lab ID	% Moisture
USC-MW1D-10-11.5	10-257-01	6
USC-MW1D-11.5-13	10-257-02	23
USC-MW1D-16.5-18	10-257-03	19
USC-MW1D-20-21.5	10-257-04	18
USC-MW1D-21.5-22	10-257-05	18
USC-MW1D-27.5-28	10-257-06	11
USC-MW1D-40-40.5	10-257-07	12
USC-MW1D-51-52	10-257-08	11

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

Chain of Custody

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: GeoEngineers
Project Number: UWT USC
Project Name: 0183-099-00
Project Manager: Tricia DeOme
Sampled by: Paul Robinette

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☐ Standard (7 Days) (TPH analysis 5 Days)
☒ 4-day turnaround (other)

Laboratory Number: 10-257

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	No. of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260B	Halogenated Volatiles 8260B	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082	Organochlorine Pesticides 8081A	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664				% Moisture
1	USC-MW1D-10-11.5	10/20	1310	S	4					X															
2	USC-MW1D-11.5-13		1315		4					X															
3	USC-MW1D-16.5-18		1330		4					X															
4	USC-MW1D-20-21.5		1340		4					X															
5	USC-MW1D-21.5-22		1355		4					X															
6	USC-MW1D-27.5-28		1510		4					X															
7	USC-MW1D-40-40.5	10/21	1155		4					X															
8	USC-MW1D-51-52	10/21	1340		4					X															

	Signature	Company	Date	Time	Comments/Special Instructions
Relinquished		GeoEngineers	10/22/14	1:23 PM	
Received		Speedy	10/22/14	1:24 PM	
Relinquished		Speedy	10/22/14	3:03 PM	
Received		ONE	10/22/14	1503	
Relinquished					
Received					
Reviewed/Date		Reviewed/Date			Chromatograms with final report ☐

Data Package: Level III ☐ Level IV ☐ Electronic Data Deliverables (EDDs) ☐ _____

OnSite Environmental Inc.

14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

November 7, 2014

Tricia DeOme
GeoEngineers, Inc.
1101 Fawcett Avenue South, Suite 200
Tacoma, WA 98402

Re: Analytical Data for Project 0183-099-00
Laboratory Reference No. 1410-257B

Dear Tricia:

Enclosed are the analytical results and associated quality control data for samples submitted on October 22, 2014.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

Case Narrative

Samples were collected on October 20 and 21, 2014 and received by the laboratory on October 22, 2014. They were maintained at the laboratory at a temperature of 2°C to 6°C.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
USC-MW1D Comp. A	10-257-01,02,03,04,05,06,07,08 Comp.	Soil	10-20-14	10-22-14	

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

TOTAL METALS
EPA 6010C/7471B

Matrix: Soil
Units: mg/kg (ppm)

Analyte	Result	PQL	EPA Method	Date Prepared	Date Analyzed	F
Lab ID:	10-257-01,02,03,04,05,06,07,08 Comp.					
Client ID:	**USC-MW1D Comp. A**					
Arsenic	**ND**	12	6010C	11-6-14	11-6-14	
Barium	**49**	2.9	6010C	11-6-14	11-6-14	
Cadmium	**ND**	0.59	6010C	11-6-14	11-6-14	
Chromium	**35**	0.59	6010C	11-6-14	11-6-14	
Lead	**ND**	5.9	6010C	11-6-14	11-6-14	
Mercury	**ND**	0.29	7471B	11-6-14	11-6-14	
Selenium	**ND**	12	6010C	11-6-14	11-6-14	
Silver	**ND**	1.2	6010C	11-6-14	11-6-14	

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

TOTAL METALS
EPA 6010C/7471B
METHOD BLANK QUALITY CONTROL

Date Extracted:	11-6-14
Date Analyzed:	11-6-14
Matrix:	Soil
Units:	mg/kg (ppm)
Lab ID:	MB1106SM1

Analyte	Method	Result	PQL
Arsenic	6010C	**ND**	10
Barium	6010C	**ND**	2.5
Cadmium	6010C	**ND**	0.50
Chromium	6010C	**ND**	0.50
Lead	6010C	**ND**	5.0
Mercury	7471B	**ND**	0.25
Selenium	6010C	**ND**	10
Silver	6010C	**ND**	1.0

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

TOTAL METALS
EPA 6010C/7471B
DUPLICATE QUALITY CONTROL

Date Extracted: 11-6-14
Date Analyzed: 11-6-14

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 10-257-01,02,03,04,05,06,07,08 Comp.

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Arsenic	**ND**	**ND**	NA	10	
Barium	**41.5**	**38.8**	7	2.5	
Cadmium	**ND**	**ND**	NA	0.50	
Chromium	**29.8**	**24.5**	20	0.50	
Lead	**ND**	**ND**	NA	5.0	
Mercury	**ND**	**ND**	NA	0.25	
Selenium	**ND**	**ND**	NA	10	
Silver	**ND**	**ND**	NA	1.0	

Date of Report: November 11, 2014
Samples Submitted: October 22, 2014
Laboratory Reference: 1410-257B
Project: 0183-099-00

TOTAL METALS
EPA 6010C/7471B
MS/MSD QUALITY CONTROL

Date Extracted: 11-6-14
Date Analyzed: 11-6-14

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 10-257-01,02,03,04,05,06,07,08 Comp.

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Arsenic	100	**89.5**	89	**91.4**	91	2	
Barium	100	**136**	95	**136**	94	0	
Cadmium	50.0	**45.2**	90	**45.0**	90	0	
Chromium	100	**113**	83	**111**	82	1	
Lead	250	**231**	93	**231**	93	0	
Mercury	0.500	**0.496**	99	**0.466**	93	6	
Selenium	100	**92.6**	93	**91.9**	92	1	
Silver	25.0	**19.7**	79	**19.9**	79	1	

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

Chain of Custody

Page 1 of _____

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: GeoEngineers
Project Number: UWT USC
Project Name: 0183-099-00
Project Manager: Tricia DeOme
Sampled by: Paul Robinette

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☐ Standard (7 Days) (TPH analysis 5 Days)
☒ 4-day turnaround (other)

Laboratory Number: 10-257

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	No. of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260B	Halogenated Volatiles 8260B	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082	Organochlorine Pesticides 8081A	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664	% Moisture
1	USC-MW1D-10-11.5	10/20	1310	S	4					X								A				
2	USC-MW1D-11.5-13		1315		4					X								A				
3	USC-MW1D-16.5-18		1330		4					X								A				
4	USC-MW1D-20-21.5		1340		4					X								A				
5	USC-MW1D-21.5-22		1355		4					X								A				
6	USC-MW1D-27.5-28		1510		4					X								A				
7	USC-MW1D-40-40.5	10/21	1155		4					X								A				
8	USC-MW1D-51-52	10/21	1340		4					X								A				

	Signature	Company	Date	Time
Relinquished		GeoEngineers	10/22/14	1:23 PM
Received		Speedy	10/22/14	1:24PM
Relinquished		Speedy	10/22/14	3:03pm
Received		ORE	10/22/14	1503
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

A-COMPOSITE. REQUESTED 11/5/14. DB (5 DAY TAT)

Chromatograms with final report ☐

Data Package: Level III ☐ Level IV ☐ Electronic Data Deliverables (EDDs) ☐ _____

Data Validation Report

1101 Fawcett Avenue, Suite 200, Tacoma, Washington 98402, Telephone: 253.383.4940, Fax: 253.383.4923 www.geoengineers.com

Project: University of Washington – Tacoma, Urban Solutions Center
October 2014 Air Samples

GEI File No: 00183-099-00

Date: December 16, 2014

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of soil vapor samples collected as part of the October 2014 sampling event, and the associated laboratory quality control (QC) samples. The samples were obtained from the Urban Solutions Center Site located at 1735 Jefferson Avenue on the University of Washington – Tacoma (UWT) campus located in Tacoma, Washington.

Objective and Quality Control Elements

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with Sampling and Analysis Plan and Quality Assurance Project Plan (GeoEngineers, 2014), the laboratory data was reviewed for the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Canister Vacuum/Pressure
- Surrogate Recoveries
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Miscellaneous

Validated Sample Delivery Groups

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
1410462A	USC-SV1-141024, USC-SV2-141024, USC-SV3-141024, USC-SV4-141024, USC-SV5-141028
1410462C	

Chemical Analysis Performed

Eurofins Air Toxics, Incorporated, located in Folsom, California, performed laboratory analysis on the soil vapor samples using the following methods:

- Volatile Organic Compounds (VOCs) by Method TO-15-SIM; and
- Helium by Method ASTM-D1946

Data Validation Summary

The results for each of the QC elements are summarized below.

Data Package Completeness

Eurofins Air Toxics provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab, with the following exception:

The laboratory noted that the sample collection date was incomplete on the COC for Samples USC-SV1-141024, USC-SV2-141024, USC-SV3-141024, USC-SV4-141024, and USC SV5-141028; therefore, the sample collection date from the sample canister tag was used.

Holding Times and Canister Vacuum/Pressure

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

As stated in the Sampling and Analysis Plan and Quality Assurance Project Plan (GeoEngineers, 2014), the sample canisters are prepared at the laboratory with approximately 30 inches of mercury (inHg) vacuum. In the field, the sample canisters are filled with soil vapor for approximately 30 minutes or until a vacuum equivalent of approximately 5 inHg remains in the sample canister, whichever comes first.

There are two reasons for this:

- The more sample volume collected within the sample canister, the less inert nitrogen air that is added by the laboratory to create a necessary positive pressure within the sample canister (5 pounds per square inch), resulting in less dilution of the sample.
- Allows for determination of leakage (loss of sample volume) from the sample canister between the field and receipt at the laboratory.

The final canister vacuum is recorded in the field and by the laboratory upon receipt. In the field, the final vacuum on the sample canisters were generally between 4 and 5.5 inHg. At the lab, the final vacuum on the sample canisters were generally between 4.5 and 7 inHg. The final canister vacuums between the field and laboratory readings were acceptable within + or – 5 inHg and no anomalies were identified.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates

The laboratory did not perform any MS/MSD sample sets because the air sampling method USEPA TO-15 does not require an internal accuracy and precision test sample aside from the LCS/LCSD.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Miscellaneous

SDG 1410462A: For Samples USC-SV1-141024, USC-SV2-141024, USC-SV3-141024, USC-SV4-141024, and USC SV5-141028, dilution of the sample was required due to high concentration of target analytes within the sample. Additionally, Samples USC-SV1-141024 (tetrachloroethene only) and USC-SV3-141024

were analyzed using Method TO-15 full scan, instead of the requested Method TO-15-SIM, due to high concentrations of target analytes within samples, requiring a higher reporting limit.

SDG 1410462C: Helium was utilized as a tracer gas while collecting the soil vapor samples. During sample collection, a surface shroud was installed over the sample train and filled with helium gas. The purpose of the helium-filled shroud is to evaluate potential dilution of the soil vapor sample from surface air that could enter from breaches in the sampling train. Helium was analyzed for in each soil vapor sample submitted for analysis. Concentrations of helium greater than 5 percent in the soil vapor sample may indicate introduction of surface air into the sample.

Concentrations of helium in the soil vapor samples collected during this sampling event were within the control limit for the sampling method, with the exception of Sample USC-SV5-141028. The helium concentration in Sample USC-SV5-141028 was 7.3 percent. For this reason, the positive result for tetrachloroethene and reporting limits for 1,1-Dichloroethene, cis-1,2-Dichloroethene, trans-1,2-Dichloroethene, trichloroethene, and vinyl chloride were qualified as estimated (J/UJ) in this sample.

Overall Assessment

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD RPD values.

All data are acceptable for the intended use, with the following qualifications listed below in Table 2.

TABLE 2: SUMMARY OF QUALIFIED SAMPLES

Sample ID	Analyte	Qualifier
USC-SV5-141028	1,1-Dichloroethene	UJ
	cis-1,2-Dichloroethene	UJ
	Tetrachloroethene	J
	trans-1,2-Dichloroethene	UJ
	Trichloroethene	UJ
	Vinyl chloride	UJ

References

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

GeoEngineers, Inc. "Sampling and Analysis Plan and Quality Assurance Project Plan," prepared for University of Washington, GEI File No. 0183-099-00. October 17, 2014.

Data Validation Report

1101 Fawcett Avenue, Suite 200, Tacoma, Washington 98402, Telephone: 253.383.4940, Fax: 253.383.4923 www.geoengineers.com

Project: University of Washington – Tacoma, Urban Solutions Center
October 2014 Soil and Groundwater Samples

GEI File No: 00183-099-00

Date: November 5, 2014

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of soil and groundwater samples collected as part of the October 2014 sampling events, and the associated laboratory quality control (QC) samples. The samples were obtained from the Urban Solutions Center Site located at 1735 Jefferson Avenue on the University of Washington – Tacoma (UWT) campus located in Tacoma, Washington.

Objective and Quality Control Elements

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) and Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with Sampling and Analysis Plan and Quality Assurance Project Plan (GeoEngineers, 2014), the laboratory data was reviewed for the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Laboratory Duplicates

Validated Sample Delivery Groups

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
1410-257	USC-MW1D-10-11.5, USC-MW1D-11.5-13, USC-MW1D-16.5-18, USC-MW1D-20-21.5, USC-MW1D-21.5-22, USC-MW1D-27.5-28, USC-MW1D-40-40.5, USC-MW1D-51-52
1410-257B	USC-MW1D Comp. A
1410-328	USC-MW1S-141027, USC-MW1D-141027, JS-MW3-141027, JS-MW3S-141027

Chemical Analysis Performed

OnSite Environmental (OnSite), located in Redmond, Washington, performed laboratory analysis on the soil and groundwater samples using one or more of the following methods:

- Petroleum Hydrocarbons (NWTPH-Dx) by Method NWTPH-Dx;
- Volatile Organic Compounds (VOCs) by Method SW8260C; and
- Total Metals by Methods EPA6010C and EPA7471B

Data Validation Summary

The results for each of the QC elements are summarized below.

Data Package Completeness

OnSite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab.

Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The laboratory did not include the sample receipt forms; therefore, the sample cooler temperatures could not be verified that they were within the control limits upon arrival at the laboratory. The samples were stored at the laboratory at the appropriate temperatures of between two and six degrees Celsius.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The percent recovery control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element percent recoveries were outside the control limits in the matrix spike. The percent recovery control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Duplicates

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the sample analytes has a concentration less than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. For organic analyses, the RPD control limit is specified in the laboratory documents. For inorganic analyses, the RPD control limit 20 percent. The absolute difference control limit is the lowest reporting limit of the two samples. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

Overall Assessment

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and laboratory duplicate RPD values.

No analytical results were qualified. All data are acceptable for the intended use.

References

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review," EPA-540-R-10-011. January 2010.

GeoEngineers, Inc. "Sampling and Analysis Plan and Quality Assurance Project Plan," prepared for University of Washington, GEI File No. 0183-099-00. October 17, 2014.

APPENDIX E
Johnson and Ettinger Model

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (µg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	2.75E+03			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{0}C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	15	13	15	0	0	s		

Risk	8.2E-06
HI	0.01
alpha	0.0012
1/alpha (VAF)	8.2E+02
Indoor Air [ ]	3.37

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
s	1.66	0.375	0.054	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
7.6	40	3048	3048	487.68	1.25	0.5	46.5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

	feet	cm	
Slab	0.25	7.62	
Width	100	3048	Approximate width of USC
Length	100	3048	Approximate length of USC
Height	16	487.68	Approximate ceiling heigh of USC ground floor
	2200	67056	Approximate length of cracks in USC ground floor

Qsoil (calc)	7.74E+02 cm3/s	
	4.65E+01 L/m	Qsoil value used in calculations
Qsoil (NJ)	15.24	Qsoil calculated using New Jersey approach: (5L/min) x (building perimeter in cm/4,000 cm)
Qsoil(Cal)	46.45152	Qsoil calculated using Cal-EPA/DTSC approach: (5L/min) x (building area in cm^2/10,000 cm^2)

	Default Crack Length	Adjuste Crack Length (accounts for expansion joings)
crack length	12,192	67,056
area below grade	9.47E+06	9.47E+06
crack width	1.25E+00	1.25
crack area	1.52E+04	8.38E+04
crack ratio	1.61E-03	8.85E-03

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.244	0.244	0.003	9.98E-08	0.998	9.96E-08	67,056 0	2.75E+03	6.29E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.47E+06	8.85E-03	15	9,523	9.35E-03	3.98E-01	1.76E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.75E+03	1.25	7.74E+02	1.16E-02	8.38E+04	4.16E+02	1.22E-03	3.37E+00	5.9E-06	6.0E-01

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	2.75E+03			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	15	13	15	0	0	s		

Risk	8.2E-06
HI	0.01
alpha	0.0012
1/alpha (VAF)	8.2E+02
Indoor Air [ ]	3.37

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
s	1.66	0.375	0.054	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
7.6	40	381	304.8	487.68	1.25	0.5		0.6

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

	feet	cm	
Slab	0.25	7.62	
Width	10	304.8	Approximate width of USC
Length	12.5	381	Approximate length of USC
Height	16	487.68	Approximate ceiling heigh of USC ground floor
	27.5	838.2	Approximate length of cracks in USC ground floor

Qsoil (calc)	9.68E+00 cm3/s	
	5.81E-01 L/m	Qsoil value used in calculations
Qsoil (NJ)	1.7145	Qsoil calculated using New Jersey approach: (5L/min) x (building perimeter in cm/4,000 cm)
Qsoil(Cal)	0.580644	Qsoil calculated using Cal-EPA/DTSC approach: (5L/min) x (building area in cm^2/10,000 cm^2)
	Default Crack Length	Adjuste Crack Length (accounts for expansion joings)
crack length	1,372	838
area below grade	1.37E+05	1.37E+05
crack width	1.25E+00	1.25
crack area	1.71E+03	1.05E+03
crack ratio	1.25E-02	7.66E-03

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.244	0.244	0.003	9.98E-08	0.998	9.96E-08	838 0	2.75E+03	7.87E+03

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.37E+05	7.66E-03	15	9,523	9.35E-03	3.98E-01	9.72E-05	1.16E-02	0.00E+00	0.00E+00	1.16E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.75E+03	1.25	9.68E+00	1.16E-02	1.05E+03	4.16E+02	1.23E-03	3.37E+00	5.9E-06	6.0E-01

END

APPENDIX F
Report Limitations and Guidelines for Use

APPENDIX F
REPORT LIMITATIONS AND GUIDELINES FOR USE[2]

This appendix provides information to help you manage your risks with respect to the use of this report.

Environmental Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for use by University of Washington. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an environmental site assessment study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. No one except University of Washington should rely on this environmental report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

This Environmental Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the University of Washington Tacoma Urban Solutions Center located in Tacoma, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Reliance Conditions for Third Parties

If a lending agency or other parties intend to place legal reliance on the product of our services, we require that those parties indicate in writing their acknowledgement that the scope of services provided, and the general conditions under which the services were rendered including the limitation of professional liability, are understood and accepted by them. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

[2] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

Environmental Regulations are Always Evolving

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance, change or if more stringent environmental standards are developed in the future.

Subsurface Conditions can Change

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, by new releases of hazardous substances, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying this report to determine if it is still applicable.

Topsoil

For the purposes of this report, we consider topsoil to consist of generally fine-grained soil with an appreciable amount of organic matter based on visual examination, and to be unsuitable for direct support of the proposed improvements. However, the organic content and other mineralogical and gradational characteristics used to evaluate the suitability of soil for use in landscaping and agricultural purposes was not determined, nor considered in our analyses. Therefore, the information and recommendations in this report, and our logs and descriptions should not be used as a basis for estimating the volume of topsoil available for such purposes.

Most Environmental Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Do Not Redraw the Exploration Logs

Environmental scientists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in an environmental report should never be redrawn for inclusion in other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory “limitations” provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these “Report Limitations and Guidelines for Use” apply to your project or site.

Geotechnical, Geologic and Geoenvironmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, preventing, assessing, or abating Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

Have we delivered World Class Client Service?
Please let us know by visiting **www.geoengineers.com/feedback**.

GeoEngineers