# First Quarter 2023 Tier 5 Evaluation

## Georgetown Site

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# List of Acronyms

| Acronym | Explanation |
|---|---|
| 1,1-DCE | 1,1-Dichloroethylene |
| 1,2-DCA | 1,2-Dichloroethane |
| 1Q23 | First Quarter 2023 |
| 1Q24 | First Quarter 2024 |
| 3Q21 | Third Quarter 2021 |
| 3Q23 | Third Quarter 2024 |
| BE | Burlington Environmental LLC |
| CEF | Cancer Exceedance Factor |
| CCEF | Cumulative Cancer Exceedance Factor |
| cis-1,2-DCE | cis-1,2-Dichloroethylene |
| CNCEF | Cumulative Noncancer Exceedance Factor |
| Ecology | Washington Department of Ecology |
| Foster Wheeler | Foster Wheeler Environmental Corporation |
| GIVF | Groundwater-to-Indoor Air Volatilization Factor |
| IRIS | Integrated Risk Information System |
| MTCA | Model Toxics Control Act |
| NCEF | Noncancer Exceedance Factor |
| PIONEER | PIONEER Technologies Corporation |
| PSC | PSC Environmental Services, LLC |
| RCRA | Resource Conservation and Recovery Act |
| RSL | Regional Screening Level |
| SDAJ | Stone-Drew / Ashe & Jones |
| Site | BE Georgetown Site |
| Stericycle | Stericycle Environmental Solutions, Inc. |
| TCE | Trichloroethylene |
| trans-1,2-DCE | trans-1,2-Dichloroethylene |
| USEPA | United States Environmental Protection Agency |
| VI | Vapor Intrusion |
| VIAM | Vapor Intrusion Assessment and Mitigation |
| VIRL | Vapor Intrusion Remediation Level |
| VOC | Volatile Organic Compound |

# SECTION 1: INTRODUCTION

A Tier 5 evaluation was conducted for the Burlington Environmental, LLC (BE) Georgetown facility (site) in Seattle, Washington.[1] The Tier 5 evaluation was conducted to determine if any of the 12 vapor intrusion (VI) mitigation systems installed at the site can be shut down and removed (see Figure 1).[2] The 12 systems were installed as part of corrective action activities being conducted per the requirements in Resource Conservation and Recovery Act (RCRA) dangerous waste permit number WAD 00081 2909. Tier 5 is part of the Vapor Intrusion Assessment and Mitigation (VIAM) remedial component established as part of the Model Toxics Control Act (MTCA) Site cleanup in the Cleanup Action Plan and Engineering Design Report.

The purpose of this report is to summarize the Tier 5 process, document the results of the Tier 5 evaluation based on data from third quarter 2021 (3Q21) through first quarter 2023 (1Q23), and provide a path forward based on the results of the evaluation.

## 1.1 Five-Tiered VI Evaluation Process

A five-tiered process is used to determine whether buildings proximate to the Georgetown facility warrant investigation, require mitigation through an interim measure, or meet the decision criteria for shutting down existing mitigation systems (Appendix A; Appendix B). Site-specific groundwater and air vapor intrusion remediation levels (VIRLs) are used to evaluate sampling results from the five-tiered process (PIONEER Technologies Corporation [PIONEER] 2017b). The VIRLs were calculated using toxicity values from the Integrated Risk Information System (IRIS), the United States Environmental Protection Agency's (USEPA's) Regional Screening Level (RSL) table, and site-specific groundwater-to-indoor air volatilization factors (GIVFs).[3]

The groundwater and air VIRLs are used to calculate cancer and noncancer exceedance factors (CEFs and NCEFs, respectively), which are used to determine if mitigation systems are needed. Chemical concentrations are divided by cancer and noncancer VIRLs to calculate chemical-specific CEFs and NCEFs. Chemical-specific CEFs are summed to calculate the cumulative CEF (CCEF) and chemical-specific NCEFs are summed to calculate the cumulative NCEF (CNCEF). The CCEF and CNCEF are compared to benchmark levels. The benchmark level for Tiers 1-4 is 10 (excess cancer risk of 1E-05 or hazard index of 1). The benchmark levels for Tier 5 are 1 for CCEFs (excess cancer risk of 1E-06) and 10 for CNCEFs (hazard index of 1).

[1] BE is the legal owner of the facility, and is a wholly-owned subsidiary of PSC Environmental Services, LLC (PSC) which is a wholly-owned indirect subsidiary of Enviri/Clean Earth.

[2] Systems were installed in 15 buildings; however, three of the buildings were demolished during first quarter 2019 (404, 406, and 412 S Orcas St.; see Figure 1).

[3] The GIVFs were presented in the *2003 Revised Inhalation Pathway Interim Measure Technical Memorandum I* (Foster Wheeler, PIONEER, and PSC 2003; Appendix B).

The activities conducted in the five tiers are presented in the *2011 VIAM Plan* and are summarized below (PIONEER 2011b):

- **Tiers 1 & 2**: Groundwater data are compared to groundwater VIRLs to determine if there is a potential VI concern in residential (Tier 1) or commercial (Tier 2) buildings.[4]
- **Tier 3**: Building-specific sampling is conducted to determine whether or not a VI mitigation system (Tier 4) is warranted.
- **Tier 4**: A VI mitigation system is installed and operated to mitigate the VI pathway. Tier 4 activities have been performed since 2003 (i.e., systems were installed in 15 buildings between 2003 and 2005). Tier 4 activities include building-specific confirmation groundwater, indoor (or crawlspace) air, and ambient air sampling, system inspections, and negative-pressure measurements to ensure the systems are operating as intended.
- **Tier 5**: Groundwater data from the four most recent sampling events during the last two years are compared to VIRLs on a well-by-well basis. Buildings proximate to wells with CCEFs less than or equal to 1 and CNCEFs less than or equal to 10 will be identified as candidates for VI mitigation system shutdown.

## 1.2 Tier 5 Evaluation Process

The Tier 5 process is used to determine when a VI mitigation system is a candidate for shutdown and removal, and is only applicable at a building where groundwater is the source of volatile organic compounds (VOCs) in indoor air. The five steps of a Tier 5 evaluation are described in the *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)* May 3, 2011 memo from Chris Waldron of PIONEER to Ed Jones of Washington Department of Ecology (Ecology; PIONEER 2011a) which is included as Appendix C of this report and summarized below.

- **Step 1**: Identify candidate buildings for VI mitigation system shutdown based on reduction in groundwater concentrations.
- **Step 2**: Perform building-specific confirmation groundwater sampling on candidate buildings, if necessary. Buildings will proceed to Step 3 if soil gas, crawlspace, and/or indoor air samples were used as the basis for installing the VI mitigation system. Buildings will usually proceed directly to Step 4 if only groundwater samples were used as the basis for installing the VI mitigation system (i.e., soil gas, crawlspace, and/or indoor air samples were not used as the basis for installing systems in these buildings).
- **Step 3**: Perform building-specific confirmation air sampling, if necessary. A building can proceed from Step 2 to Step 4 (skip Step 3) if the mitigation system was installed based solely on the *potential for VI from groundwater* (i.e., based on the Tier 1/Tier 2 evaluation), not building-specific sampling (from a Tier 3 evaluation).
- **Step 4**: Shut down VI mitigation system (optional, the building owner may opt to run the system) and monitor groundwater for two years. Groundwater monitoring will be performed for two years after criteria for shutdown is met to verify that groundwater concentrations are consistent or decreasing.

[4] VIRLs were presented in the *Updated Air and Groundwater IPIMALs/VIRLs for Residential and Commercial Scenarios for the Georgetown Site* memo from Chris Waldron of PIONEER to Ed Jones of Ecology dated December 31, 2015 (PIONEER 2011a; Appendix C).

- **Step 5**: Remove VI mitigation system.

## 1.3 Results of Previous Evaluations

Three Tier 5 evaluations were conducted for the Georgetown site in 2015, 2017, and 2021 (PIONEER 2015, 2017a; Clean Earth and PIONEER 2021a).[5] The results of the 2015 evaluation indicated that none of the VI mitigation systems in Georgetown were candidates for shutdown and removal (i.e., none advanced to Step 2 of the Tier 5 process). Additional groundwater data were needed to show decreasing trends in concentrations, fill data gaps, and provide shallow groundwater data appropriate for evaluating VI.

The results of the 2017 Tier 5 evaluation indicated that one location (710 South Lucile Street [Mitigation Group 4]) qualified to proceed to Step 3 of the Tier 5 process based on the decision criteria; however, in a December 19, 2017 letter from Ed Jones of Ecology to Bill Beck of Stericycle Environmental Solutions, Inc. (Stericycle; Ecology 2017; see Appendix D) it was stated that "Ecology does not consider this building a Tier 5 candidate. In the future perhaps we will. A future Tier 5 evaluation should include soil gas sampling; groundwater data alone will be insufficient for the building at this location." Soil gas samples were subsequently collected during first quarter 2021. To fill data gaps, four Tier 5 water table wells were installed in 2019 (VIT5-01-WT through VIT5-04-WT) proximate to the buildings with VI mitigation systems (see Figure 2; PIONEER 2018a, 2018b; Ecology 2018).[6] The wells were installed to support Step 2 of the Tier 5 process (i.e., perform building-specific confirmation groundwater sampling on candidate buildings). Per the Tier 5 process, the wells were installed within 100 feet of buildings with VI mitigation systems and screened across the water table. Nine quarters of groundwater data have been collected from these wells to date.

The results of the 2021 Tier 5 evaluation indicated the following buildings met criteria to proceed to steps 3 and 4:

- Proceed to Step 3 (building-specific confirmation air sampling)
  - Mitigation Group 4: 710 South Lucile Street (SDAJ) building
  - Mitigation Group 5: 707 South Lucile Street (Western Trailer) building
- Proceed to Step 4 (VI mitigation system shutdown):
  - Mitigation Group 1: 402, 406, 412, and 416 South Lucile Street buildings
  - Mitigation Group 2: 601/605, 611/613, and 615 South Brandon and 5403 Maynard Avenue South buildings

Mitigation Group 3 (674 South Lucile Street) did not meet the criteria to proceed to Steps 3 of the Tier 5 process and would continue to be evaluated per Step 2. Approval for the buildings to proceed to Step 3

[5] References are included in Section 4 of this report.

[6] In an August 13, 2018 email from Ed Jones of Ecology to Barb Roloff of PIONEER, Mr. Jones stated, "I agree that no new WT well need be installed just east of DP location 402L." The direct push sample 402L had been collected in the driveway, south of the 402 South Lucile Street building (Stericycle and PIONEER 2018a).

of Tier 5 (Mitigation Groups 4 and 5) and Step 4 of Tier 5 (Mitigation Groups 1 and 2) was given by Erin Hobbs of Ecology in an email to Tasya Gray of Dalton, Olmsted & Fuglevand, July 25, 2022.[7]

## 1.4 Report Organization

The remainder of this report is organized as follows:

- Section 2 includes the Tier 5 evaluations for the 12 buildings with VI mitigation systems, which were evaluated as five VI mitigation groups (i.e., the buildings located proximate to one another were evaluated collectively). This approach was first introduced in the 2011 VIAM Plan and was used in the December 19, 2017 letter from Ed Jones of Ecology to Bill Beck of Stericycle to identify Tier 5 candidates (PIONEER 2011a; Appendix D). The buildings in the five VI mitigation groups and the Tier 5 Step they are being evaluated at are listed below and presented on Figure 2:
    - Tier 5 Step 2: Perform building-specific confirmation groundwater sampling
        - VI Mitigation Group 3: 674 South Lucile Street
    - Tier 5 Step 3: Perform building-specific confirmation air sampling
        - VI Mitigation Group 4: 710 South Lucile Street
        - VI Mitigation Group 5: 707 South Lucile Street
    - Tier 5 Step 4: Vapor Intrusion Mitigation System Shutdown
        - VI Mitigation Group 1: 402, 406, 412, and 416 South Lucile Street
        - VI Mitigation Group 2: 601, 605, 611/613, and 615 South Brandon Street and 5403 Maynard Avenue South
- Section 3 includes the conclusions and path forward for each VI mitigation group.
- Section 4 includes the references for the documents used to support the Tier 5 evaluations and conclusions.

[7] In a July 25, 2022 email from Erin Hobbs of Ecology to Tasya Gray of DOF, Ms. Hobbs stated, "… Tier 5 [can] proceed with the next steps (assuming there were Q3 2021 and Q1 2022 sampling data that did not contradict any of the conclusions based on the four most recent sampling events included in the Tier 5 evaluation which went through Q1 2021)". The data from Q3 2021 and Q1 2022 did not contradict conclusions made in the 2021 Tier 5 Evaluation. Therefore, the Tier 5 buildings proceeded to the next steps. The email is included as Appendix E.

# SECTION 2: TIER 5 EVALUATIONS

Buildings with VI mitigation systems were assigned to a VI mitigation group based on their location (i.e., buildings proximate to one another were evaluated collectively; see Figure 2). This approach was first introduced in the *2011 VIAM Plan* and was used in the December 19, 2017 letter from Ed Jones of Ecology to Bill Beck of Stericycle to identify Tier 5 candidates (PIONEER 2011a; Appendix D). A Tier 5 evaluation was conducted for each VI mitigation group and the results are summarized in this section.

## 2.1 Tier 5 Step 2 Evaluation – Perform Building-Specific Confirmation Groundwater Sampling

Only Mitigation Group 3 (674 South Lucile Street) was evaluated at Step 2. Since air samples were used as the basis for installing the VI mitigation system, the building must proceed to Step 3 (building-specific air sampling) before Step 4 (system shutdown), as opposed to buildings where only groundwater samples were used as the basis and can proceed directly to Step 4. To determine whether or not the building can proceed to Step 3 of the Tier 5 process, groundwater concentrations collected from Tier 5 monitoring wells installed in late-2018 and existing monitoring wells located proximate to building were evaluated as described in Step 2.[8] In accordance with the Tier 5 evaluation process, the samples included in the evaluation were collected during the four most recent quarters of the last two years (i.e., 3Q21 through 1Q23). Groundwater sampling results were compared to VIRLs to calculate CNCEFs and CCEFs. The residential and commercial CNCEFs and CCEFs are presented on Tables 1 and 2, respectively. The constituent concentrations for the residential and commercial CNCEFs and CCEFs are presented on Tables 3 and 4, respectively. The water table wells sampled for the Tier 5 evaluation are presented on Figure 2. Time series plots supporting groundwater trend analysis are included in Appendix F.

[8] In accordance with the *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)* May 3, 2011 memo from Chris Waldron of PIONEER to Ed Jones of Ecology, proximate is defined as within a 250-foot upgradient and downgradient and 100-foot cross-gradient radius (PIONEER 2011a; see Appendix C).

### 2.1.1 Tier 5 VI Mitigation Group 3

**Tier 5 VI Mitigation Group 3:**
674 S. Lucile St.









Evaluated as a residential building but currently used for commercial purposes. Basement is used for storage and a server room.

| | Tier 5 Criteria Met: 3Q21 – 1Q23 | | | |
|---|---|---|---|---|
| | Residential CNCEFs ≤ 10 (Table 1) | Residential CCEFs ≤ 1 (Table 1) | Groundwater Concentrations ≤ VIRLs (Table 3) | Groundwater Concentrations Consistent or Decreasing (Table 3 and App. F) |
| CG-118-WT | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |
| CG-124-WT | ☒ Yes ☐ No | ☐ Yes ☒ No | ☐ Yes ☒ No | ☒ Yes ☐ No |
| CG-112-S1 | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |

#### 2.1.1.1 Discussion

A mitigation system was installed circa 2004 in 674 South Lucile Street (Mitigation Group 3) based on elevated groundwater concentrations and building-specific indoor air concentrations in 2004 (Appendix A; Appendix B; PIONEER and ART 2004g). The 674 South Lucile Street building included a basement apartment (672 South Lucile Street) at the time the mitigation system was installed. Manufactured Housing Community Preservationists purchased the building in 2016 and redeveloped it as a commercial office, which now occupies the entire building. The basement was renovated into a storage area with a server room and the main floor includes two offices, a conference room, bathroom, and kitchenette. Although the building is used for commercial purposes, it was evaluated as a residential property because it could be used as a residential property in the future.[9]

[9] Prior to Manufactured Housing Community Preservationists purchasing the property, the basement was an approximately 660 square-foot apartment with eight-foot ceilings throughout. It included two bedrooms, a bathroom, laundry room, living room, small dining area, and kitchen. The flooring in the kitchen was linoleum and the rest of the apartment was carpeted.

Mitigation Group 3 was evaluated using groundwater data from three long-term monitoring wells located upgradient and cross-gradient of 674 South Lucile Street: CG-118-WT, CG-124-WT, and CG-112-S1 (see inset picture above). The constituent concentrations from upgradient wells CG-118-WT and CG-112-S1 have been consistently low[10] and TCE concentrations have been below 1 ug/L for more than four consecutive quarters (see Tables 1 and 3). The majority of constituent concentrations in cross-gradient monitoring well CG-124-WT have been consistently low;[11] however, the TCE concentrations during third quarter 2021 resulted in CCEFs slightly greater than the benchmark of 1 (see Tables 1 and 3).

If 674 South Lucile Street was evaluated based on its current use (i.e., as a commercial property), the commercial CNCEFs and CCEFs for CG-124-WT would be below benchmark levels (CNCEFs would range from 0.27 to 0.99 and the CCEFs would range from 0.084 to 0.28).

#### 2.1.1.2 Conclusion

This mitigation group does not meet the criteria to proceed to Step 3 of the Tier 5 shutdown process (i.e., building-specific air sampling) based on the evaluation performed assuming residential use. Groundwater-based residential CNCEFs were less than equal to the benchmark level of 10 in the last four consecutive quarters; however, the groundwater-based residential CCEFs slightly exceeded the benchmark level of 1 in one of the four quarters. Trichloroethylene was responsible for the exceedance during third quarter 2021; TCE was one of the primary risk drivers responsible for installing the VI Mitigation System at this location (Appendix A).

This location will be evaluated again in third quarter 2023 (3Q23), after biannual groundwater sampling is completed. This building is sampled triennially for indoor and ambient air as part of Tier 4 monitoring activities (see Section 1.1). The next Tier 4 monitoring event is scheduled for first quarter 2024 (1Q24). If the building qualifies and is approved to proceed to Step 3 (building-specific confirmation air sampling) after the 3Q23 groundwater sampling event, it will be sampled per Tier 5 Step 3 in 1Q24 instead of Tier 4; the Tier 5 event will include sampling soil gas, indoor air, and ambient air. Air samples should be collected during or close to (within a couple weeks of) the 1Q24 biannual groundwater sampling event, while the VI mitigation system is off.

## 2.2 Tier 5 Step 3 Evaluation – Perform Building-Specific Confirmation Air Sampling

Mitigation Group 4 (710 South Lucile Street) and Mitigation Group 5 (707 South Lucile) were evaluated at Step 3 because air samples were used as the basis for installing the VI mitigation systems. Step 3 of the Tier 5 Process is summarized below:

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[10, 11] During third quarter 2021, a lab discrepancy caused results from monitoring wells CG-112-S1 (1,1-dichloroethylene [1,1-DCE], 1,2-dichloroethane [1,2-DCA], and vinyl chloride) and CG-124-WT (1,2-DCA) to be unreportable (i.e., rejected by the data validator). However, concentrations from prior quarters showed that constituents were consistently non-detect, and the quarters after continued the trend. These results have minimal impact on the evaluation.

*Step 3: Perform Building-Specific Confirmation Air Sampling*[12]

- The VI mitigation system will be temporarily shut down and sub-slab soil gas, crawl space, and/or indoor air and ambient air samples will be collected approximately 4 weeks later.
- Samples should be collected during the heating season (i.e., late fall, winter, early spring) so they are representative of reasonable "worst-case" samples.
- CCEFs and CNCEFs will be calculated based on the building-specific indoor air data per the approach presented in Tier 3 of the Inhalation Pathway Interim Measures (IPIM) process (Appendix A).
- Results of historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling will be evaluated to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and are representative of a stable or decreasing trend.

*Decision Criteria*

1. Indoor air-based CCEFs and CNCEFs are less than or equal to 10.
2. Historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend.

Buildings that do not proceed to Step 4 will be eligible for additional confirmation air sampling (i.e., repeat Step 3) after one year.

[12] In accordance with the *Final Vapor Intrusion System Shutdown and Removal Process (Tier 5) Memo* from Chris Waldron of PIONEER to Jones of Ecology (Appendix C).

### 2.2.2 *Tier 5 VI Mitigation Group 4*

The Tier 5 evaluation for 710 S. Lucile is documented in a separate report and is included as Appendix G. The purpose of the report was to 1) document the results of the 2023 building-specific confirmation sampling, 2) present CCEFs and CNCEFs calculated using building-specific air data and VIRLs, 3) evaluate pre-VI mitigation and post-VI mitigation building-specific vapor-phase sampling results to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and are representative of a stable or decreasing trend, and 4) determine if the building can proceed to the next step (Step 4) of the Tier 5 process. The results of the evaluation are summarized below.

**Tier 5 VI Mitigation Group 4:**

710 S. Lucile St.







Commercial

Tier 5 Criteria Met

| Commercial Indoor Air CNCEFs ≤ 10 (App. G, Table 2) | Commercial Indoor Air CCEFs ≤ 10 (App. G, Table 2) | 2019 – 2023 Groundwater Concentrations Stable or Decreasing (App. G, Table 3) | Pre- and Post-VI Mitigation System Air Results Stable or Decreasing? (App G, Table 4) | Pre- and Post-VI Mitigation System Results Consistent with Groundwater Results? (App. G Table 3 and 4) |
|---|---|---|---|---|
| ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |

#### 2.2.2.1 Discussion

A mitigation system was installed circa 2004 in 710 South Lucile Street (also referred to as the Stone-Drew / Ashe & Jones [SDAJ] building) based on elevated groundwater concentrations and building-specific indoor air concentrations (Appendix A; Appendix B; Foster Wheeler Environmental Corporation [Foster Wheeler] 2004b; PIONEER and ART 2004h; Weston Solutions, Inc. [WESTON] 2001).

The 710 South Lucile Street building was evaluated using 1) groundwater data from CG-149-WT, from biannual sampling spanning January 2019 to February 2023, and 2) soil gas and indoor air results pre-mitigation system installation (August 2002) and post-mitigation system installation (February 2023).

The risk evaluation conducted using the 2023 sampling event results confirmed that indoor air-based CCEFs and CNCEFs are less than or equal to 10 (see Appendix G, Table 2). Groundwater trends indicate

that constituents all have stabilizing or decreasing trends (see Appendix G, Table 3). Pre- and post-VI mitigation groundwater, soil gas, and indoor air changes in constituent concentrations (between the two events) were compared to determine if results were consistent across all media. Both pre- and post-VI mitigation results for each constituent decreased or stabilized across all media (Appendix G, Tables 3 and 4).

#### 2.2.2.2 Conclusion

The results of the 2023 Tier 5 evaluation indicate that 710 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., system shutdown). The results of the 2023 groundwater, soil gas, indoor air, and ambient air sampling event show that indoor air concentrations associated with volatilization from groundwater are below Ecology's noncancer and cancer health risk thresholds (i.e., CNCEF of 10 and CCEF of 10), and constituents in groundwater have stable or decreasing trends. Pre- and post-VI mitigation system soil gas and indoor air results are consistent with stable/decreasing trends in groundwater and results for each constituent have decreased or stabilized across all media between the two events.

Step 4 involves shutting down the VI mitigation system (optional, the building owner may opt to run the system) and groundwater monitoring will be performed for two years after criteria for shutdown is met to verify that groundwater concentrations are consistent or decreasing. After the monitoring period, the groundwater data will be evaluated to determine if the system can be proposed for removal (i.e., Step 5 of the Tier 5 process).

### 2.2.3 *Tier 5 VI Mitigation Group 5*

The Tier 5 evaluation for 707 S. Lucile is documented in a separate report and included as Appendix H. The purpose of the report was to 1) document the results of the 2023 building-specific confirmation sampling, 2) present CCEFs and CNCEFs calculated using building-specific air data and VIRLs, 3) evaluate pre-VI mitigation and post-VI mitigation building-specific vapor-phase sampling results to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and representative of a stable or decreasing trend, and 4) determine if the building can proceed to the next step (Step 4) of the Tier 5 process. The results of the evaluation are summarized below.

**Tier 5 VI Mitigation Group 5:**

707 S. Lucile St.







Commercial

Tier 5 Criteria Met

| Commercial Indoor Air CNCEFs ≤ 10 (App. H, Table 2) | Commercial Indoor Air CCEFs ≤ 10 (App. H, Table 2) | 2019 – 2023 Groundwater Concentrations Stable or Decreasing (App. H, Table 3) | Pre- and Post-VI Mitigation System Air Results Stable or Decreasing? (App H, Table 4) | Pre- and Post-VI Mitigation System Results Consistent with Groundwater Results? (App. H Table 3 and 4) |
|---|---|---|---|---|
| ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |

#### 2.2.3.1 Discussion

A mitigation system was installed circa 2005 in 707 South Lucile Street (also referred to as the Western Trailer building) based on elevated groundwater concentrations and building-specific indoor air concentrations (Appendix A; Appendix B; PIONEER and ART 2005).

The 707 South Lucile Street building was evaluated using 1) groundwater data from VIT5-04-WT, sampled biannually since January 2019, and 2) soil gas and indoor results from pre-mitigation system installation in August 2003 and post-mitigation system installation in February 2023. The risk evaluation conducted using the 2023 sampling event results confirmed that indoor air-based CCEFs and CNCEFs are less than or equal to 10 (see Appendix H, Table 2). Groundwater trends indicate that constituents all have stabilizing or decreasing trends (see Appendix H, Table 3). Pre- and post-VI mitigation groundwater, soil gas, and indoor air changes in constituent concentrations (between the two events) were compared

to determine if results were consistent across all media. Both pre- and post-VI mitigation results for each constituent decreased or stabilized across all media (Appendix H, Tables 3 and 4).

#### 2.2.3.2 Conclusion

The results of the 2023 Tier 5 evaluation indicate that 707 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., system shutdown). The results of the 2023 groundwater, soil gas, indoor air, and ambient air sampling event show that indoor air concentrations associated with volatilization from groundwater are below Ecology's noncancer and cancer health risk thresholds (i.e., CNCEF of 10 and CCEF of 10), and constituents in groundwater have stable or decreasing trends. Pre- and post-VI mitigation system soil gas and indoor air results are consistent with stable/decreasing trends in groundwater and results for each constituent have decreased or stabilized across all media between the two events.

Step 4 involves shutting down the VI mitigation system (optional, the building owner may opt to run the system) and groundwater monitoring will be performed for two years after criteria for shutdown is met to verify that groundwater concentrations are consistent or decreasing. After the monitoring period, the groundwater data will be evaluated to determine if the system can be proposed for removal (i.e., Step 5 of the Tier 5 process).

## 2.3 Tier 5 Step 5 Evaluation - VI Mitigation System Removal

Mitigation Group 1 (402, 406, 412, and 416 South Lucile Street buildings) and Mitigation Group 2 (601/605, 611/613, and 615 South Brandon and 5403 Maynard Avenue South buildings) were evaluated for System Removal (Step 5). Groundwater monitoring has been conducted biannually for two years since the mitigation groups met the criteria for shutdown in first quarter 2021. Evaluation of Mitigation Group 1 was previously summarized for Ecology as part of the First Quarter 2023 Progress Report submitted May 15, 2023.

Step 5 of the Tier 5 Process is summarized below:

*Step 5: Vapor Intrusion Mitigation System Removal*[13]

- To ensure that VOC concentrations are low and will remain low, and thereby ensure that mitigation will not be needed in the future, groundwater monitoring will be conducted for two years after criteria for shutdown is met before determining if the system's hardware can be removed.

*Decision Criteria*

1. The VOC concentrations in groundwater remain below Ecology's health risk benchmarks (i.e., CCEF less than or equal to 1 for groundwater and NCCEF less than or equal to 10 for groundwater), and
2. the VOC concentrations are consistent with a stable or decreasing trend.

Time series charts supporting groundwater trend analysis are included in Appendix F.

[13] In accordance with the *Final Vapor Intrusion System Shutdown and Removal Process (Tier 5) Memo* from Chris Waldron of PIONEER to Jones of Ecology; (Appendix C).

### 2.3.4 Tier 5 VI Mitigation Group 1

**Tier 5 VI Mitigation Group 1:**
402, 406, 412, 416 S. Lucile Street







Commercial




Residential




Residential




Residential

| | Tier 5 Criteria Met: 3Q21 – 1Q23 | | | |
|---|---|---|---|---|
| | Residential CNCEFs ≤ 10 (Table 1) | Residential CCEFs ≤ 1 (Table 1) | Groundwater Concentrations ≤ VIRLs (Table 3) | Groundwater Concentrations Consistent or Decreasing (Table 3 and App. F) |
| VIT5-03-WT | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |

#### 2.3.4.1 Discussion

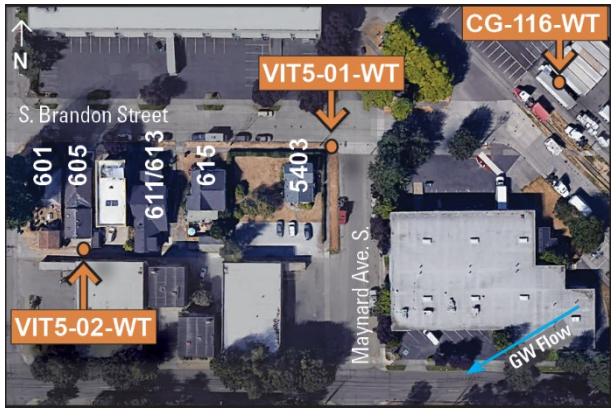
VI mitigation systems were installed circa 2004 in buildings located at 402, 406, 412, & 416 South Lucile Street due to possible exposures to elevated VOC concentrations in groundwater (Appendix A; Appendix B; PIONEER and ART 2004a, 2004b, 2004c, 2004d). Mitigation Group 1 was evaluated using groundwater data from upgradient well VIT5-03-WT (see inset picture above). The samples collected from this well confirmed what has been has been observed in Tier 4 evaluations and the 2021 Tier 5 evaluation—constituent concentrations in groundwater have been consistently low in this area (see Tables 1 and 3; Clean Earth and PIONEER 2021a, 2021b).

#### 2.3.4.2 Conclusion

This mitigation group meets the criteria to proceed to Step 5 of the Tier 5 shutdown process (i.e., system removal). During the two-year monitoring period, groundwater-based CNCEFs and CCEFs have been below benchmark levels for four or more consecutive quarters and groundwater constituent concentrations are consistent. In addition, only groundwater samples were collected and used as the basis for installing the VI mitigation system systems in these buildings; therefore, groundwater concentrations can be used as the basis for shutdown and removal.

### 2.3.5 Tier 5 VI Mitigation Group 2

**Tier 5 VI Mitigation Group 2:**
601, 605, 611/613, 615 S. Brandon + 5403 Maynard Ave S.






Residential



Residential



Residential

| | Tier 5 Criteria Met: 3Q19 – 1Q21 | | | |
|---|---|---|---|---|
| | Residential CNCEFs ≤ 10 (Table 1) | Residential CCEFs ≤ 1 (Table 1) | Groundwater Concentrations ≤ VIRLs (Table 3) | Groundwater Concentrations Consistent or Decreasing (Table 3 and App. F) |
| VIT5-01-WT | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |
| VIT5-02-WT | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |
| CG-116-WT | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No | ☒ Yes ☐ No |

#### 2.3.5.1 Discussion

VI mitigation systems were installed between 2003 and 2004 in buildings located at 601, 605, 611/613, South Brandon Street and 5403 Maynard Avenue South due to possible exposures to elevated VOC concentrations in groundwater (Appendix A; Appendix B; PIONEER and ART 2003a, 2003b, 2003c, 2004e, 2004f). Mitigation Group 2 was evaluated using data from upgradient wells VIT5-01-WT and CG-116-WT and downgradient well VIT5-02-WT (see inset picture above).[14] The samples collected from these wells confirmed what has been observed in Tier 4 evaluations and the 2021 Tier 5 evaluation—constituent concentrations in groundwater have been consistently low in this area (see Tables 1 and 3; Clean Earth and PIONEER 2021a, 2021c). The highest historical TCE concentration in a Tier 4 evaluation was 0.12

[14] Groundwater flow is generally west-southwest from the former facility toward the Duwamish Waterway (Ecology 2010).

ug/L in 2006 (see Table 5; Clean Earth and PIONEER 2021c). In addition, TCE has not been detected at VIT5-01-WT or VIT5-02-WT in any sample collected since sampling began in 2019 (see Tables 1 and 3).

#### 2.3.5.2 Conclusion

This mitigation group meets the criteria to proceed to Step 5 of the Tier 5 shutdown process (i.e., system removal). During the two-year monitoring period, groundwater-based CNCEFs and CCEFs have been below benchmark levels for four or more consecutive quarters and groundwater constituent concentrations are consistent.

# SECTION 3: CONCLUSIONS AND PATH FORWARD

## 3.1 Conclusions

Three of the five Tier 5 mitigation groups meet the criteria to proceed to their next Step in the Tier 5 process. Buildings with mitigation systems installed based on groundwater and air data (i.e., the results of Tiers 1/2 and Tier 3 evaluations) proceed to Step 3 (building-specific sampling). Buildings with mitigation systems installed based on Tiers 1/2 groundwater concentrations proceed to Step 4 (system shutdown). The buildings that meet the criteria to proceed to their next step are as follows:

- **Proceed to Step 4 - VI Mitigation System Shutdown:**
  - Mitigation Group 4: 710 South Lucile Street (SDAJ) building
  - Mitigation Group 5: 707 South Lucile Street (Western Trailer) building
- **Proceed to Step 5 - VI Mitigation System Removal:**
  - Mitigation Group 1: 402, 406, 412, and 416 South Lucile Street buildings
  - Mitigation Group 2: 601/605, 611/613, and 615 South Brandon and 5403 Maynard Avenue South buildings

One mitigation group did not meet criteria to proceed to the next step:

- **Remain at Step 2 - Building-Specific Confirmation Groundwater Sampling:**
  - Mitigation Group 3 (674 South Lucile Street).
    - Groundwater-based residential CCEFs slightly exceeded the benchmark level of 1 in one of the four quarters.

Mitigation Group 3 will continue to be evaluated per Step 2 of the Tier 5 process.

## 3.2 Path Forward

The recommendations are presented below for each mitigation group.

### *3.2.1 Mitigation Group 1 (402, 406, 412, 416 South Lucile Street)*

This mitigation group qualifies to proceed to Step 5 - VI Mitigation System Removal of the Tier 5 process. Once Ecology approves the request to remove the VI mitigation system from the buildings, an approval letter will be sent by Ecology to Clean Earth and the building owners. Clean Earth will perform the following tasks upon Ecology approval:

- Inform the owner (and tenants, if applicable) that the VI mitigation system is no longer needed (Ecology will be CC'd).
- Explain to the owners that they may elect to continue to operate the VI mitigation system but it will be solely at their own expense (i.e., Clean Earth will no longer service or maintain the system and all future costs will be the responsibility of the owner).

- Request access to the building to remove the system if removal is agreed to by the building owner.[15]

The Tier 5 Groundwater monitoring well associated with Mitigation group 1 (VIT5-03-WT) can be decommissioned as it is no longer necessary for the VIAM program.

### 3.2.2 Mitigation Group 2 (601, 605, 611/613, 615 South Brandon and 5403 Maynard Avenue South)

This mitigation group qualifies to proceed to Step 5- VI Mitigation System Removal of the Tier 5 process. Once Ecology approves the request to remove the VI mitigation system from the buildings, an approval letter will be sent by Ecology to Clean Earth and the building owners. Clean Earth will perform the following tasks upon Ecology approval:

- Inform the owner (and tenants, if applicable) that the VI mitigation system is no longer needed (Ecology will be CC'd).
- Explain to the owners that they may elect to continue to operate the VI mitigation system but it will be solely at their own expense (i.e., Clean Earth will no longer service or maintain the system and all future costs will be the responsibility of the owner).
- Request access to the building to remove the system if removal is agreed to the building owner.

The Tier 5 groundwater monitoring wells associated with Mitigation group 2 (VIT5-01-WT and VIT5-02-WT) can be decommissioned as they are no longer necessary for the VIAM program.

### 3.2.3 Mitigation Group 3 (674 South Lucile)

This mitigation group does not qualify to proceed to Step 3 - Building-Specific Air Sampling of the Tier 5 process. This building will continue to be evaluated at Step 2 of the Tier 5 process. Groundwater-based CCEFs must be less than or equal to 1 and NCCEFs must less than or equal to 10 will proceed to Step 3. This building is sampled triennially for indoor and ambient air as part of Tier 4 monitoring activities (see Section 1.1). The next Tier 4 monitoring event is scheduled for first quarter 2024 (1Q24). If the building qualifies and is approved to proceed to Step 3 (building-specific confirmation air sampling) after the 3Q23 groundwater sampling event, it will be sampled per Tier 5 Step 3 in 1Q24 instead of Tier 4; the Tier 5 event will include sampling soil gas, indoor air, and ambient air. Air samples should be collected during or close to (within a couple weeks of) the 1Q24 biannual groundwater sampling event, while the VI mitigation system is off.

### 3.2.4 Mitigation Group 4 (710 South Lucile)

This mitigation group qualifies to proceed to Step 4 –VI Mitigation System Shutdown of the Tier 5 process. Clean Earth will perform the following tasks after Ecology approval:

- Inspect the buildings to confirm the absence of any building feature that could serve as a significant preferential pathway for soil gas entry (Ecology 2018).

[15] Mitigation group 1 buildings have been purchased by a developer and are expected to be demolished in 2024. Based on previous conversations with the developer, it is not expected that system removal would occur prior to demolition.

- Tell building owners that the VI mitigation systems may be turned off but that the systems will be left in place for two years before removal and groundwater will be monitored.
- Explain that the owners may run the system but Clean Earth will not service or maintain the system during the 2-year period.
- Set up an appointment to turn off the system.
- Monitor groundwater biannually for two years to verify that VOC concentrations are stable or decreasing.

### *3.2.5 Mitigation Group 5 (707 South Lucile)*

This mitigation group qualifies to proceed to Step 4 - VI Mitigation System Shutdown of the Tier 5 process. Clean Earth will perform the following tasks after Ecology approval:

- Inspect the buildings to confirm the absence of any building feature that could serve as a significant preferential pathway for soil gas entry (Ecology 2018).
- Tell building owners that the VI mitigation systems may be turned off but that the systems will be left in place for two years before removal and groundwater will be monitored.
- Explain that the owners may run the system but Clean Earth will not service or maintain the system during the 2-year period.
- Set up an appointment to turn off the system.
- Monitor groundwater biannually for two years to verify that VOC concentrations are stable or decreasing.

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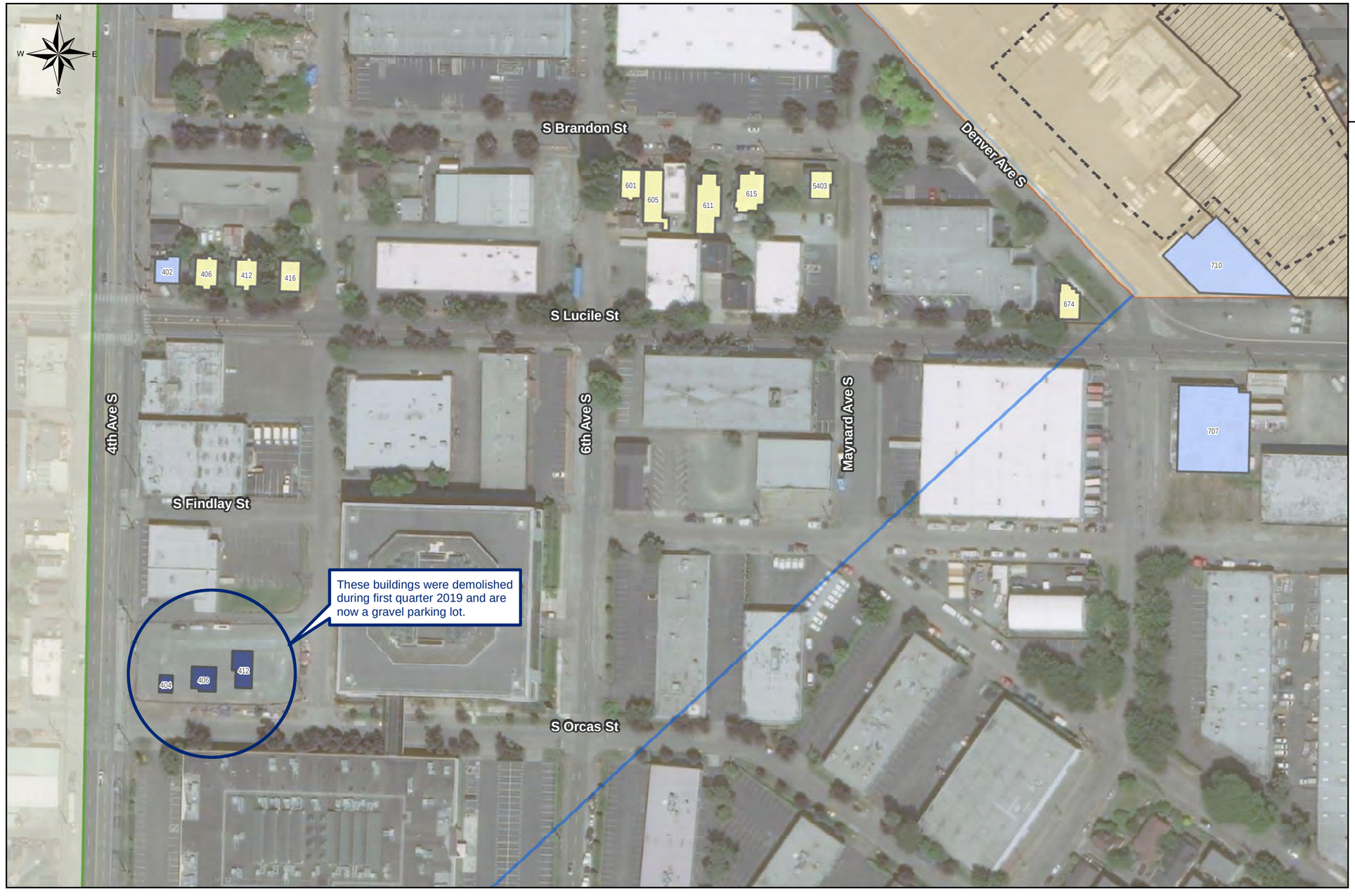
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# Figures







**Legend**

- Former Georgetown Facility
- HCIM Wall
- Areas 1 and 2
- Area 3
- Commingled Plume Area***

**VIAM Building**

- Commercial
- Residential
- Demolished

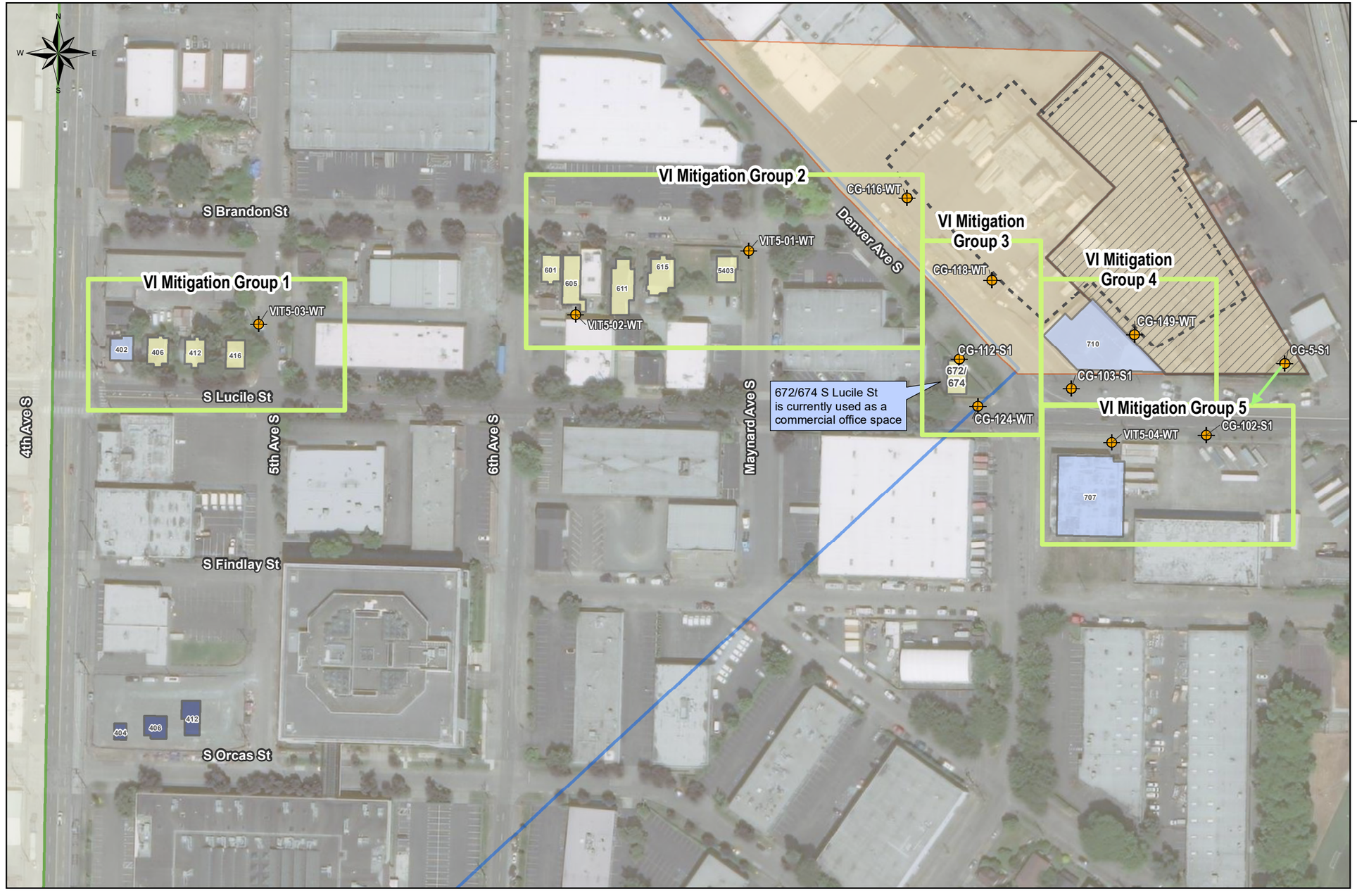
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PIONEER TECHNOLOGIES CORPORATION

# Vapor Intrusion Assessment and Mitigation Buildings
# Burlington Environmental LLC Georgetown Site

Figure 1

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**Legend**

- Tier 5 Well
- Former Georgetown Facility
- HCIM Wall
- Areas 1 and 2
- Area 3
- Commingled Plume Area

**VIAM Building Land Use**

- Commercial
- Residential
- Former VIAM Bldg - Demolished in 2019

0 360 Feet

PIONEER TECHNOLOGIES CORPORATION

# Tier 5 Sample Locations and VI Mitigation Groups
# Burlington Environmental LLC Georgetown Site

Figure 2

Document Path: G:\Projects\PSC\GIS\Source\Maps\Maps 2021\Tier 5\Fig2-T5-SampLocs_MitGroups.mxd; Author: ; Date Saved: 6/8/2021

# Tables

## Table 1: Tier 5 Groundwater Exceedance Factors for Residential Properties

| Well ID | Residential CNCEFs (3Q21 - 1Q23) Detected Data Only | | | | Residential CCEFs (3Q21 - 1Q23) Detected Data Only | | | |
|---|---|---|---|---|---|---|---|---|
| | 3Q21 | 1Q22 | 3Q22 | 1Q23 | 3Q21 | 1Q22 | 3Q22 | 1Q23 |
| **402 S. Lucile St. (commercial building) and 406, 412, and 416 S. Lucile St. (residential buildings)** | | | | | | | | |
| VIT5-03-WT | 0.71 | 0.41 | 0.39 | 0.53 | 0.19 | 0.11 | 0.12 | 0.14 |
| **601, 605, 611/613, and 615 S. Brandon St. & 5403 Maynard Ave. S. (residential buildings)** | | | | | | | | |
| VIT5-01-WT | NE | NE | ns | 0.00088 | NE | 0.0047 | ns | 0.0023 |
| VIT5-02-WT | NE | NE | 0.00050 | 0.0030 | NE | 0.0072 | 0.0069 | 0.028 |
| CG-116-WT | NE | 0.000015 | 0.0010 | 0.0047 | NE | 0.0056 | 0.014 | 0.040 |
| **674 S. Lucile St. (residential building)** | | | | | | | | |
| CG-118-WT | 0.53 | 0.44 | 0.44 | 0.40 | 0.13 | 0.18 | 0.20 | 0.17 |
| CG-124-WT | 4.2 | 1.2 | 1.6 | 1.9 | 1.1 | 0.31 | 0.39 | 0.47 |
| CG-112-S1 | 0.10 | NE | 0.000037 | 0.0019 | 0.025 | NE | NE | 0.0013 |

**Notes:**

NE: No exceedance

ns: Not sampled

Only wells located proximate to VI Mitigation Groups and sampled within the last two years (3rd Quarter 2021 through 1st Quarter 2023) are presented in this table. Buffers are approximately 250 feet upgradient and downgradient and 100 feet crossgradient.

CCEF less than 1 or CNCEF less than 10 – meets the Tier 5 Step 1 criterion

CCEF greater than 1 or CNCEF greater than 10 – does not meet the Tier 5 Step 1 criterion

## Table 2: Tier 5 Groundwater Exceedance Factors for Commercial Properties

| Well ID | Commercial CNCEFs (3Q21 - 1Q23) Detected Data Only | | | | Commercial CCEFs (3Q21 - 1Q23) Detected Data Only | | | |
|---|---|---|---|---|---|---|---|---|
| | 3Q21 | 1Q22 | 3Q22 | 1Q23 | 3Q21 | 1Q22 | 3Q22 | 1Q23 |
| **710 S. Lucile (commercial building)** | | | | | | | | |
| CG-149-WT | 0.16 | 0.40 | 0.28 | 0.30 | 0.12 | 0.61 | 0.32 | 0.91 |
| CG-103-S1 | 0.81 | 0.69 | 0.71 | 0.75 | 0.25 | 0.21 | 0.22 | 0.22 |
| **707 S. Lucile (commercial building** | | | | | | | | |
| CG-102-S1 | NE | 0.023 | 0.024 | 0.030 | NE | 0.018 | 0.030 | 0.030 |
| VIT5-04-WT | 0.20 | 0.19 | ns | 0.20 | 0.061 | 0.062 | ns | 0.076 |
| CG-5-S1 | 0.00011 | 0.15 | 0.20 | 0.11 | NE | 0.042 | 0.060 | 0.030 |

**Notes:**

NE: No exceedance

ns: Not sampled

Only wells located proximate to VI Mitigation Groups and sampled within the last two years (3rd Quarter 2021 through 1st Quarter 2023) are presented in this table. Buffers are approximately 250 feet upgradient and downgradient and 100 feet crossgradient.

CCEF less than 1 or CNCEF less than 10 – meets the Tier 5 Step 1 criterion

CCEF greater than 1 or CNCEF greater than 10 – does not meet the Tier 5 Step 1 criterion

## Table 3. Groundwater Constituent Concentrations for Residential Mitigation Groups

| Well ID | Constituent | Residential GW VIRLs | | Pre-VI Mitigation System Detected Results (ug/L) | 3rd Quarter 2021 | | 1st Quarter 2022 | | 3rd Quarter 2022 | | 1st Quarter 2023 | | Trend[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noncancer (ug/L) | Cancer (ug/L) | | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | |
| **Mitigation Group 1 (402, 406, 412, & 416 S Lucile St)** | | | | | | | | | | | | | |
| VIT5-03-WT | 1,1,1-Trichloroethane | 2,433 | -- | ns[2] | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | 1,1-Dichloroethane | -- | 51 | ns[2] | 0.70 | J | 0.33 | | 0.47 | | 0.21 | | NE |
| VIT5-03-WT | 1,1-Dichloroethylene | 53 | -- | ns[2] | 0.13 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-03-WT | 1,2,4-Trimethylbenzene | 15 | -- | ns[2] | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | 1,2-Dichloroethane | 43 | 13 | ns[2] | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | ns[2] | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | 2-Hexanone | 1,044 | -- | ns[2] | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| VIT5-03-WT | Benzene | 41 | 9.6 | ns[2] | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | Chloroethane | 5,437 | -- | ns[2] | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | Chloroform | 169 | 4.1 | ns[2] | 0.035 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | cis-1,2-Dichloroethylene | -- | -- | ns[2] | 2.2 | | 1.5 | | 2.1 | | 1.1 | | Stable |
| VIT5-03-WT | Ethylbenzene | 1,262 | 28 | ns[2] | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | Naphthalene | 59 | 32 | ns[2] | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| VIT5-03-WT | Propylbenzene | 779 | -- | ns[2] | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | Tetrachloroethylene | 21 | 116 | ns[2] | 0.075 | U | 0.10 | U | 0.020 | U | 0.020 | U | Stable |
| VIT5-03-WT | Toluene | 6,078 | -- | ns[2] | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | p-Isopropyltoluene | -- | -- | ns[2] | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | sec-Butylbenzene | -- | -- | ns[2] | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-03-WT | trans-1,2-Dichloroethylene | -- | -- | ns[2] | 0.075 | U | 0.080 | J | 0.15 | J | 0.080 | J | Stable |
| VIT5-03-WT | Trichloroethylene | 1.7 | 6.8 | ns[2] | 1.2 | | 0.69 | | 0.66 | | 0.89 | | Stable |
| VIT5-03-WT | Vinyl Chloride | 21 | 2.6 | ns[2] | 0.075 | U | 0.10 | U | 0.044 | | 0.014 | J | Stable |
| **Mitigation Group 2 (601, 605, 611/613, 615 S Brandon & 5403 Maynard Ave S)** | | | | | | | | | | | | | |
| VIT5-01-WT | 1,1,1-Trichloroethane | 2,433 | -- | -- | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | 1,1-Dichloroethane | -- | 51 | -- | 0.075 | U | 0.24 | | 0.10 | J | 0.11 | J | NE |
| VIT5-01-WT | 1,1-Dichloroethylene | 53 | -- | -- | 0.13 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-01-WT | 1,2,4-Trimethylbenzene | 15 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | 1,2-Dichloroethane | 43 | 13 | -- | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | 2-Hexanone | 1,044 | -- | -- | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| VIT5-01-WT | Benzene | 41 | 9.6 | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | Chloroethane | 5,437 | -- | -- | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |

## Table 3. Groundwater Constituent Concentrations for Residential Mitigation Groups

| Well ID | Constituent | Residential GW VIRLs | | Pre-VI Mitigation System Detected Results (ug/L) | 3rd Quarter 2021 | | 1st Quarter 2022 | | 3rd Quarter 2022 | | 1st Quarter 2023 | | Trend[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noncancer (ug/L) | Cancer (ug/L) | | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | |
| VIT5-01-WT | Chloroform | 169 | 4.1 | -- | 0.035 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | cis-1,2-Dichloroethylene | -- | -- | 3.2 | 0.44 | J | 0.27 | | 0.17 | J | 0.16 | J | Stable |
| VIT5-01-WT | Ethylbenzene | 1,262 | 28 | -- | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | Naphthalene | 59 | 32 | -- | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| VIT5-01-WT | Propylbenzene | 779 | -- | -- | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | Tetrachloroethylene | 21 | 116 | -- | 0.075 | U | 0.10 | U | 0.020 | [U] | 0.019 | J | Stable |
| VIT5-01-WT | Toluene | 6,078 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | p-Isopropyltoluene | -- | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | sec-Butylbenzene | -- | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-01-WT | trans-1,2-Dichloroethylene | -- | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-01-WT | Trichloroethylene | 1.7 | 6.8 | 0.032 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-01-WT | Vinyl Chloride | 21 | 2.6 | 0.972 | 0.075 | U | 0.10 | U | 0.046 | | 0.020 | U | Stable |
| VIT5-02-WT | 1,1,1-Trichloroethane | 2,433 | -- | -- | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | 1,1-Dichloroethane | -- | 51 | -- | 0.075 | U | 0.37 | | 0.15 | J | 0.64 | | NE |
| VIT5-02-WT | 1,1-Dichloroethylene | 53 | -- | -- | 0.13 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-02-WT | 1,2,4-Trimethylbenzene | 15 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | 1,2-Dichloroethane | 43 | 13 | -- | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | 2-Hexanone | 1,044 | -- | -- | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| VIT5-02-WT | Benzene | 41 | 9.6 | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | Chloroethane | 5,437 | -- | -- | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | Chloroform | 169 | 4.1 | -- | 0.035 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | cis-1,2-Dichloroethylene | -- | -- | 3.2 | 0.075 | U | 0.30 | | 0.13 | J | 0.47 | | Stable |
| VIT5-02-WT | Ethylbenzene | 1,262 | 28 | -- | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | Naphthalene | 59 | 32 | -- | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| VIT5-02-WT | Propylbenzene | 779 | -- | -- | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | Tetrachloroethylene | 21 | 116 | -- | 0.075 | U | 0.10 | U | 0.025 | [U] | 0.023 | | Stable |
| VIT5-02-WT | Toluene | 6,078 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | p-Isopropyltoluene | -- | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | sec-Butylbenzene | -- | -- | -- | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| VIT5-02-WT | trans-1,2-Dichloroethylene | -- | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-02-WT | Trichloroethylene | 1.7 | 6.8 | 0.032 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| VIT5-02-WT | Vinyl Chloride | 21 | 2.6 | 0.972 | 0.075 | U | 0.10 | U | 0.010 | J | 0.039 | M[JN] | Stable |

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## Table 3. Groundwater Constituent Concentrations for Residential Mitigation Groups

| Well ID | Constituent | Residential GW VIRLs | | Pre-VI Mitigation System Detected Results (ug/L) | 3rd Quarter 2021 | | 1st Quarter 2022 | | 3rd Quarter 2022 | | 1st Quarter 2023 | | Trend[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noncancer (ug/L) | Cancer (ug/L) | | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | |
| CG-116-WT | 1,1,1-Trichloroethane | 2,433 | -- | -- | 0.070 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | 1,1-Dichloroethane | -- | 51 | -- | 0.075 | U[UJ] | 0.29 | | 0.28 | | 0.34 | | NE |
| CG-116-WT | 1,1-Dichloroethylene | 53 | -- | -- | 0.13 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-116-WT | 1,2,4-Trimethylbenzene | 15 | -- | -- | 0.075 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | 1,2-Dichloroethane | 43 | 13 | -- | 0.070 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | -- | 0.060 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | 2-Hexanone | 1,044 | -- | -- | 0.46 | U[UJ] | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| CG-116-WT | Benzene | 41 | 9.6 | -- | 0.075 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | Chloroethane | 5,437 | -- | -- | 0.11 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | Chloroform | 169 | 4.1 | -- | 0.035 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | cis-1,2-Dichloroethylene | -- | -- | 3.2 | 0.075 | U[UJ] | 0.11 | J | 0.16 | J | 0.19 | J | Stable |
| CG-116-WT | Ethylbenzene | 1,262 | 28 | -- | 0.12 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | Naphthalene | 59 | 32 | -- | 0.13 | U[UJ] | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| CG-116-WT | Propylbenzene | 779 | -- | -- | 0.11 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | Tetrachloroethylene | 21 | 116 | -- | 0.075 | U[UJ] | 0.10 | U | 0.020 | J[U] | 0.011 | J | Stable |
| CG-116-WT | Toluene | 6,078 | -- | -- | 0.075 | U[UJ] | 0.090 | J | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | p-Isopropyltoluene | -- | -- | -- | 0.060 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | sec-Butylbenzene | -- | -- | -- | 0.060 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-116-WT | trans-1,2-Dichloroethylene | -- | -- | -- | 0.075 | U[UJ] | 0.10 | U | 0.20 | U | 0.090 | J | Stable |
| CG-116-WT | Trichloroethylene | 1.7 | 6.8 | 0.032 | 0.075 | U[UJ] | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-116-WT | Vinyl Chloride | 21 | 2.6 | 0.972 | 0.075 | U[UJ] | 0.10 | U | 0.021 | | 0.087 | | Stable |
| **Mitigation Group 3 (674 S Lucile St)** | | | | | | | | | | | | | |
| CG-118-WT | 1,1,1-Trichloroethane | 2,433 | -- | 82.4 | 0.070 | U | 0.24 | | 0.22 | | 0.20 | | Stable |
| CG-118-WT | 1,1-Dichloroethane | -- | 51 | 132 | 0.075 | U | 1.4 | | 1.5 | | 0.88 | | Stable |
| CG-118-WT | 1,1-Dichloroethylene | 53 | -- | -- | 0.13 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-118-WT | 1,2,4-Trimethylbenzene | 15 | -- | 29.2 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | 1,2-Dichloroethane | 43 | 13 | -- | 0.070 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | 2.51 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | 2-Hexanone | 1,044 | -- | -- | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| CG-118-WT | Benzene | 41 | 9.6 | 1.05 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | Chloroethane | 5,437 | -- | 119 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | Chloroform | 169 | 4.1 | -- | 0.035 | U | 0.10 | U | 0.20 | J[U] | 0.20 | U | NE |

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## Table 3. Groundwater Constituent Concentrations for Residential Mitigation Groups

| Well ID | Constituent | Residential GW VIRLs | | Pre-VI Mitigation System Detected Results (ug/L) | 3rd Quarter 2021 | | 1st Quarter 2022 | | 3rd Quarter 2022 | | 1st Quarter 2023 | | Trend[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noncancer (ug/L) | Cancer (ug/L) | | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | |
| CG-118-WT | cis-1,2-Dichloroethylene | -- | -- | 28.4 | 0.075 | U | 0.73 | | 0.64 | | 0.69 | | Stable |
| CG-118-WT | Ethylbenzene | 1,262 | 28 | 40.9 | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | Naphthalene | 59 | 32 | 20.8 | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| CG-118-WT | Propylbenzene | 779 | -- | 5.76 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | Tetrachloroethylene | 21 | 116 | -- | 0.075 | U | 0.62 | | 0.60 | | 0.51 | | Stable |
| CG-118-WT | Toluene | 6,078 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | p-Isopropyltoluene | -- | -- | 1.92 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-118-WT | sec-Butylbenzene | -- | -- | 2.48 | 0.060 | U | 0.17 | J | 0.21 | | 0.26 | [U] | NE |
| CG-118-WT | trans-1,2-Dichloroethylene | -- | -- | 1.57 | 0.075 | U | 0.090 | J | 0.10 | J | 0.070 | J | Stable |
| CG-118-WT | Trichloroethylene | 1.7 | 6.8 | 1.37 | 0.90 | J | 0.68 | | 0.68 | | 0.62 | | Stable |
| CG-118-WT | Vinyl Chloride | 21 | 2.6 | 6.12 | 0.075 | U | 0.12 | | 0.17 | | 0.16 | | Stable |
| CG-124-WT | 1,1,1-Trichloroethane | 2,433 | -- | 82.4 | 0.070 | U | 0.36 | | 0.39 | | 0.32 | | Stable |
| CG-124-WT | 1,1-Dichloroethane | -- | 51 | 132 | 0.075 | U | 0.16 | J | 0.14 | J | 0.12 | J | Stable |
| CG-124-WT | 1,1-Dichloroethylene | 53 | -- | -- | 0.085 | [JN] | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-124-WT | 1,2,4-Trimethylbenzene | 15 | -- | 29.2 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | 1,2-Dichloroethane | 43 | 13 | -- | nr | nr | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | 1,3,5-Trimethylbenzene | 8.2 | -- | 2.51 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | 2-Hexanone | 1,044 | -- | -- | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| CG-124-WT | Benzene | 41 | 9.6 | 1.05 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | Chloroethane | 5,437 | -- | 119 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | Chloroform | 169 | 4.1 | -- | 0.035 | U | 0.060 | J | 0.20 | J[U] | 0.20 | U | NE |
| CG-124-WT | cis-1,2-Dichloroethylene | -- | -- | 28.4 | 0.075 | U | 0.30 | | 0.31 | | 0.34 | | Stable |
| CG-124-WT | Ethylbenzene | 1,262 | 28 | 40.9 | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | Naphthalene | 59 | 32 | 20.8 | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| CG-124-WT | Propylbenzene | 779 | -- | 5.76 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | Tetrachloroethylene | 21 | 116 | -- | 1.2 | | 0.56 | | 0.79 | | 0.85 | | Stable |
| CG-124-WT | Toluene | 6,078 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | p-Isopropyltoluene | -- | -- | 1.92 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | sec-Butylbenzene | -- | -- | 2.48 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-124-WT | trans-1,2-Dichloroethylene | -- | -- | 1.57 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-124-WT | Trichloroethylene | 1.7 | 6.8 | 1.37 | 7.0 | | 1.9 | | 2.6 | | 3.1 | | Stable |
| CG-124-WT | Vinyl Chloride | 21 | 2.6 | 6.12 | 0.071 | [JN] | 0.022 | | 0.0059 | J | 0.0087 | J | Stable |
| CG-112-S1 | 1,1,1-Trichloroethane | 2,433 | -- | 82.4 | 0.070 | U | 0.10 | U | 0.090 | J | 0.080 | J | Stable |

## Table 3. Groundwater Constituent Concentrations for Residential Mitigation Groups

| Well ID | Constituent | Residential GW VIRLs | | Pre-VI Mitigation System Detected Results (ug/L) | 3rd Quarter 2021 | | 1st Quarter 2022 | | 3rd Quarter 2022 | | 1st Quarter 2023 | | Trend[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noncancer (ug/L) | Cancer (ug/L) | | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | Result (ug/L) | Q | |
| CG-112-S1 | 1,1-Dichloroethane | -- | 51 | 132 | 0.075 | U | 0.10 | U | 0.20 | U | 0.050 | J | Stable |
| CG-112-S1 | 1,1-Dichloroethylene | 53 | -- | -- | nr | nr | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-112-S1 | 1,2,4-Trimethylbenzene | 15 | -- | 29.2 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | 1,2-Dichloroethane | 43 | 13 | -- | nr | nr | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | 1,3,5-Trimethylbenzene | 8.2 | -- | 2.51 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | 2-Hexanone | 1,044 | -- | -- | 0.46 | U | 2.5 | U | 5.0 | U | 5.0 | U | NE |
| CG-112-S1 | Benzene | 41 | 9.6 | 1.05 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | Chloroethane | 5,437 | -- | 119 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | Chloroform | 169 | 4.1 | -- | 0.035 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | cis-1,2-Dichloroethylene | -- | -- | 28.4 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-112-S1 | Ethylbenzene | 1,262 | 28 | 40.9 | 0.12 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | Naphthalene | 59 | 32 | 20.8 | 0.13 | U | 0.25 | U | 0.50 | U | 0.50 | U | NE |
| CG-112-S1 | Propylbenzene | 779 | -- | 5.76 | 0.11 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | Tetrachloroethylene | 21 | 116 | -- | 0.075 | U | 0.10 | U | 0.036 | [U] | 0.039 | | Stable |
| CG-112-S1 | Toluene | 6,078 | -- | -- | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | p-Isopropyltoluene | -- | -- | 1.92 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | sec-Butylbenzene | -- | -- | 2.48 | 0.060 | U | 0.10 | U | 0.20 | U | 0.20 | U | NE |
| CG-112-S1 | trans-1,2-Dichloroethylene | -- | -- | 1.57 | 0.075 | U | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-112-S1 | Trichloroethylene | 1.7 | 6.8 | 1.37 | 0.17 | [JN] | 0.10 | U | 0.20 | U | 0.20 | U | Stable |
| CG-112-S1 | Vinyl Chloride | 21 | 2.6 | 6.12 | nr | nr | 0.10 | U | 0.020 | U | 0.020 | U | Stable |

**Notes:**

ns: Not sampled; nr: Not reported, result rejected during data validation due to lab discrepancy; NE: Constituent was not detected during both Pre-and post-VI samples, no trend analysis conducted; Q: qualifier; ug/L: micrograms per liter.

'--: No value. The constituent was not detected or no toxicity information was available to calculate a VIRL; Q: Qualifiers

The data qualifiers presented in this table are:

J: The result is an estimated value.

U: The constituent was not detected (the reporting limit is presented).

Data-validator-assigned qualifiers are presented in [ ].

Non-detected results are presented in light gray.

Concentration(s) in one (or more) sampling event(s) exceeded the VIRL.

[1] Supporting time series plots are presented in Appendix C. Trend analyses were conducted for groundwater constituents detected in both pre-and post-VI Installation samples, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-DCE, PCE, trans-DCE, TCE, and VC).

[2] No samples were collected at 402 South Lucile Street prior to the installation of the VI-mitigation system, a comparison is not possible

# Appendix A

August 12, 2002

Mr. Ed Jones
Department of Ecology, NWRO
3190 160th Ave., SE
Bellevue, WA 98008-5452

Re: Burlington Environmental Inc., a wholly-owned subsidiary of Philip Services Corporation (PSC), Part B Permit No.: WAD000812909 for the Georgetown Facility, Seattle, Washington.

Dear Mr. Jones:

Enclosed, please two hard copies of the complete revised *Inhalation Pathway Interim Measures Work Plan* for the PSC Georgetown Facility. This revision incorporates Ecology's comments on the work plan, sampling and analysis plan (SAP) and quality assurance project plan (QAPP) that were provided in a letter dated July 3, 2002 and were received by PSC on July 8, 2002.

Ecology requested that PSC revise the SAP, which was Appendix A of the work plan, within 14 days of receipt of the July 3, 2002 letter. Ecology also requested that the main text of the work plan and QAPP, which was Appendix B of the work plan, be revised within 30 days of receipt of the letter. On July 17, 2002, PSC requested a one-week extension on both documents and Ecology approved the request via email on July 18, 2002.

An electronic version of the SAP was submitted to Ecology on July 29, 2002. PSC hereby submits the entire revised work plan in hard copy form for your review. As you know, PSC plans to begin the GIVF Study on August 19, 2002. PSC has already begun mobilizing for this study by making arrangements with subcontractors, ordering sampling equipment for this study, and is working on gaining access to the buildings that are proposed for sampling.

If you have questions or comments, please feel free to contact me at (425) 227-6121 or at cmayer@contactpsc.com.

Sincerely,

Carolyn Mayer
Corrective Actions Manager
Regulatory Affairs Department

Enclosures

Cc: Mr. Mike Kuntz, WDOE-SWRO
Mr. Galen Tritt, WDOE-NWRO

Mr. Howard Orlean, EPA
Ms. Marcia Bailey, EPA
Ms. Kim Prestbo, Foster-Wheeler
Mr. Chris Waldron, Pioneer Technologies Corporation
Mr. James McAteer, Exponent
Mr. David Baylon, Ecotope
Public Repository

# FINAL INHALATION PATHWAY INTERIM MEASURES WORK PLAN

## Georgetown Facility

## Seattle, Washington

Prepared for

**Philip Services Corporation**
**955 Powell Avenue SW**
**Renton, Washington**

Prepared by

FOSTER WHEELER
FOSTER WHEELER ENVIRONMENTAL CORPORATION

August 12, 2002

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**Figure 1-1** Site Location—Aerial View

**Figure 1-2** Site Plan

**Figure 2-1** GIVF Study Area

**Figure 2-1A** IPIM Study Area West of Denver Avenue

**Figure 2-1B** IPIM Study Area East of Denver Avenue

**Figure 2-1C** Soil Classification for Areas 2 and 3

**Figure 2-2** Soil Gas and/or Indoor Air Sampling Locations

**Figure 2-3** Depth to Groundwater Below Ground Surface

**Figure 2-4** Groundwater Elevations (April 2002)

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 1,1-DCA | 1,1-dichloroethane |
| 1,1-DCE | 1,1-dichloroethene |
| 1,1,1-TCA | trans-1,2-dichloroethene |
| µg/L | micrograms per liter |
| AF | adjustment factor |
| AOI | area of impact |
| bgs | below ground surface |
| CEF | cumulative exceedance factor |
| cis-1,2-DCE | cis-1,2-dichloroethene |
| COPC | chemicals of potential concern |
| CR | cancer risk |
| DNAPL | dense nonaqueous phase liquid |
| DQO | data quality objective |
| Ecology | Washington State Department of Ecology |
| EF | exceedance factor |
| EPA | U.S. Environmental Protection Agency |
| EQM | Environmental Quality Management |
| FS | Feasibility Study |
| GIVF | indoor air volatilization factor |
| HHERA | Human Health and Ecological Risk Assessment |
| HI | hazard index |
| HVAC | heating, ventilation, and air conditioning |
| IM | interim measure |
| IPIM | inhalation pathway interim measure |
| IPIMAL | inhalation pathway interim measure action level |
| JEM | Johnson-Ettinger Model |
| MADEP | Massachusetts Department of Environmental Protection |
| MTCA | Model Toxics Control Act |
| PCAMP | Pre-corrective Action Monitoring Program |
| PRAL | preliminary remedial action level |
| PSC | Philip Services Corporation |
| QAPP | Quality Assurance Project Plan |
| RCRA | Resource Conservation and Recovery Act |

## ACRONYMS AND ABBREVIATIONS (continued)

| | |
|---|---|
| RFI | RCRA Facility Investigation |
| SAP | Sampling and Analysis Plan |
| SDAJ | Stone, Drew/Ashe & Jones |
| SVE | soil vapor extraction |
| TC | target compound |
| TCE | trichloroethene |
| UCL | upper confidence limit |
| USCS | United States Conservation Service |
| VC | vinyl chloride |
| VOC | volatile organic compound |
| WAC | Washington Administrative Code |
| WDOH | Washington State Department of Health |

# 1. INTRODUCTION

Philip Services Corporation (PSC) owns and operates a Resource Conservation and Recovery Act (RCRA) permitted waste management facility on 734 S. Lucile St. in the Georgetown community of Seattle, Washington. Figure 1-1 shows an aerial view of the facility and the surrounding area (the site) and Figure 1-2 presents a facility map. PSC is conducting corrective action at its Georgetown facility per requirements contained in its RCRA hazardous/dangerous waste permit (WAD 00081 2909).

This Inhalation Pathway Interim Measure (IPIM) Work Plan (herein after referred to as Work Plan) was prepared in response to a letter from the Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) dated June 28, 2001, and the modified corrective action permit for the facility, which required that groundwater interim measures be implemented at the facility. Vapor intrusion is evaluated under the Washington State Model Toxics Control Act (MTCA), pursuant to WAC 173-340-745(5)(b)(iii)(C) and 745(5)(c)(iv).

## 1.1 PURPOSE

The purpose of this Work Plan is to determine whether or not residents and workers in the vicinity of the facility are being exposed to concentrations of chemicals in indoor air, associated with releases from the facility to groundwater, that are above levels of concern. This Work Plan presents an efficient and flexible process (i.e., the IPIM Decision Tree) that facilitates rapid evaluation and response, if necessary. The IPIM Decision Tree is a tiered approach for evaluating specific locations in the affected area on a quarterly basis at least until a final remedy for the site is implemented.

In response to comments received from Ecology and EPA, PSC has developed a site-specific approach for determining the relationship between the concentrations of volatile organic compounds (VOCs) in groundwater and in indoor air through a groundwater to indoor air volatilization factor (GIVF). Two study areas (presented in Section 3.1) are identified in this Work Plan for implementing this approach.

- **Study Area 1** – GIVFs will be developed in this area which is located west and south of the facility in an area known to be impacted by VOCs in the shallow aquifer emanating from the PSC facility (see Figure 2-1). Additional evaluation is needed in this study area to better understand the relationship between groundwater chemical of potential concern (COPC) concentrations and concentrations of indoor air COPCs

caused by vapor intrusion. A contingency area is also shown on this map in case PSC is unable to obtain access to all the buildings in the initial Study Area.

- **Study Area 2** – After the GIVF Study, groundwater data from this area will be evaluated to determine if interim measures (IMs) are warranted (see Figure 2-1A and 2-1B). Information obtained from the GIVF evaluation will be applied to groundwater data collected throughout the monitoring well network within Study Area 2 via the Pre-Corrective Action Monitoring Program (PCAMP).

To meet the purpose of this Work Plan, PSC is implementing the following program, as outlined below and discussed in Section 3:

1. Implement an initial IPIM investigation in Study Area 1 to determine whether, and to what degree, vapor migration from groundwater to indoor air is occurring in areas of significant VOC concentrations in the groundwater directly downgradient of the facility. This will be accomplished by collecting co-located indoor air, groundwater, and ambient air samples at selected locations. The sampling data from this investigation will be evaluated and PSC will calculate GIVFs, which can be used to derive inhalation pathway interim measure action levels (IPIMALs) for each constituent of concern in groundwater throughout the affected area.

2. Collect additional groundwater data in Study Area 2 via the revised 2002 PCAMP, which is designed to monitor groundwater in order to help delineate the nature and extent of the groundwater plume and to provide data for assessing subsequent risks from VOCs migrating to indoor air in affected areas downgradient of the facility.

3. Compare these groundwater IPIMALs on a quarterly basis with groundwater concentrations for each well location in Study Area 2, to determine if the resulting cumulative inhalation risk (from vapor intrusion) exceeds 1E-05 or a hazard index (HI) of 1[1]. PSC will then use the IPIM Decision Tree (see Figure 3-1) to determine the need for further evaluation or interim measures at individual buildings. Groundwater IPIMALs will also be compared with groundwater concentrations already obtained from well and hydropunch samples downgradient of the facility.

[1] Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients by target organ/critical effect (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

This Work Plan will develop groundwater action, or target levels (IPIMALs) for determining the need to implement an IM. There are uncertainties related to the use of both empirical data and modeling; therefore, PSC will use conservative approaches to ensure that risks are not underestimated. Data quality objectives designed to ensure a conservative approach and the potential limitations and uncertainties associated with this approach are discussed in Section 4.

## 1.2 BACKGROUND

The Georgetown facility has a history of chemical use and storage dating back at least fifty years. In 1988, the EPA (lead regulatory agency) prepared a RCRA Facility Assessment (or a Solid Waste Management Unit Report), to determine if there had been any releases to the environment. Remedial investigation activities (groundwater, soil, and soil gas investigations) have been ongoing at the facility since 1988. The facility received a RCRA permit from EPA in August 1991, which contained corrective action requirements, including conducting a Remedial Facility Investigation (RFI) to determine the nature and extent of contamination.

PSC submitted a Draft Comprehensive RFI report on June 29, 2001. As part of the Draft RFI, a Draft Human Health and Ecological Risk Assessment (HHERA) was submitted on August 10, 2001 (PSC, 2001) that characterized the risk and provided preliminary pathway-specific remedial action levels for the areas potentially affected by the facility.

In January 2002, EPA provided comments to PSC on these RFI documents and requested additional work prior to resubmitting the documents. In response to EPA's and Ecology's comments, PSC submitted work plans to address the data gaps identified in the RFI and HHERA. Most of the field activities related to fulfillment of the data gaps will be completed during the summer of 2002; however, PSC has proposed to sample more than 80 monitoring wells, including more than 55 new wells, for four quarters prior to resubmitting these two reports.

As of March 2002, Ecology has assumed the status of lead agency and will enforce the permit's corrective action and site cleanup requirements per regulations in the Washington Administrative Code and the Model Toxics Control Act (MTCA). Following approval of the Final Remedial Investigation (RI) Report (which will include a final HHERA) by Ecology, the cleanup phase of the corrective action process will begin with the Feasibility Study (FS). In the FS, PSC will evaluate the options available as final remedies for the site's specific characteristics, and will propose one alternative as a preferred remedy. Final selection of the cleanup remedy requires agency and public approval.

During the RI process, if it is determined by Ecology or the Permittee (PSC) that there is a threat to human health or the environment, then an IM or an expedited cleanup may be necessary. This IM may not satisfy the requirements of a final remedy, but it should be consistent with the anticipated final remedy.

On June 28, 2001, EPA and Ecology issued a letter requesting that PSC design and implement immediate interim measures to provide hydraulic control of the impacted groundwater emanating from the facility and to control human exposures to impacted groundwater in any area where exposure may be occurring. A draft work plan for the groundwater IM was submitted on September 1, 2001. In response to EPA comments on the draft work plan and Georgetown Facility Permit Modification GTMOD 46-1, each interim measure has been detailed in a separate work plan. This Work Plan was developed in response to the June 28 letter and numerous subsequent meetings with EPA and Ecology regarding the approach for evaluating and addressing the inhalation pathway.

## 1.3 REPORT ORGANIZATION

This document is organized into the following sections:

- Section 1 presents the purpose of the Work Plan, and a brief background leading up to the development of the Work Plan.
- Section 2 introduces the inhalation pathway and the processes through which VOCs can potentially migrate from groundwater into buildings. Section 2 also provides a summary of current conditions at the facility and downgradient areas.
- Section 3 presents the procedures for implementing the Work Plan.
- Section 4 includes Data Quality Objectives and identifies potential limitations on the study's utility as well as approaches for evaluating uncertainties.
- Section 5 presents the schedule and staff organization.

The Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) are presented in Appendix A and Appendix B, respectively. Appendix C presents a letter from Rosa Environmental and Geotechnical Laboratory presenting the results of independent soil classifications provided by the laboratory. Appendix D presents a sample notification letter for use in requesting access to properties for sample collection. Appendix E presents the Health and Safety Plan (HASP) for the IPIM work.

# 2. SUBSURFACE VAPOR INTRUSION INTO BUILDINGS

This section introduces the factors that influence migration of VOCs in groundwater to soil gas and indoor air. It also presents a summary of the investigations that have been performed to date that provide the basis for the additional evaluation proposed in Section 3.

## 2.1 MIGRATION OF SOIL GAS FROM GROUNDWATER TO INDOOR AIR

Groundwater in the shallow aquifer in the area of the Georgetown facility is primarily migrating in a westerly direction. Under some conditions, VOCs dissolved in the groundwater may migrate through the soil into nearby basements, buildings, and other enclosed spaces[2]. The basic factors that influence the amount of VOCs that migrate from groundwater into indoor air include the following:

- Volatilization from groundwater to soil gas at the water table (i.e., at the groundwater/soil interface).
- Migration of the soil gas via diffusion upward toward buildings and ground surface through the partially saturated soils directly above the water table and through the unsaturated zone.
- Migration of soil gas vertically across the building foundation via diffusion and advection through cracks or other openings that may serve as entry points for soil gas. The degree of migration across the foundation depends on many factors, including building construction type (e.g., basement, slab-on-grade), structural integrity of the building, and pressure gradients associated with seasonal effects, the building ventilation system, and the operation of household appliances. Advection is made possible by continuous airflow paths associated with open or incompletely sealed doors and windows, chimneys and other intake/exhaust ports.
- Mixing inside the enclosed space with indoor air and outdoor air that is drawn into the building. The degree of mixing depends on the amount of mechanical or forced ventilation, natural ventilation, and infiltration from ambient air.

[2] Humans may also be exposed to contaminated soil gases when excavating soils in areas where the groundwater is contaminated with VOCs.

## 2.2 HISTORY OF INVESTIGATIONS

Numerous investigations have been conducted in the area of concern hydraulically downgradient of the facility to better understand the migration of VOCs in groundwater and the potential for these VOCs to migrate into indoor air. The facility and areas downgradient of the facility were divided into three exposure areas in the Draft HHERA and these are included in the study area (Study Area 2) for future interim measures (Figure 2-1A). Area 1 consists of the PSC Georgetown Facility property, which is entirely industrial. Area 2 consists of the private property downgradient (to the west) of the facility, which includes industrial/commercial properties 710 South Lucile Street and 5400 Denver Avenue South. Area 3 consists of a mixed zone neighborhood with residential, commercial, and industrial properties downgradient of the east side of Denver Avenue South to the Duwamish Waterway and from Dawson Street South to South Michigan Street.

### 2.2.1 Source Area Investigation East of Denver Avenue (Area 2)

The source area investigation was part of the Supplemental Off-Site Characterization Work Plan (PSC, 2000c). A purpose of the source area investigation was to define the south/west extent of the presumed dense-non-aqueous phase liquid (DNAPL) source area. Monitoring well data from this area had showed evidence of DNAPL. Dissolved groundwater concentrations of trichloroethene (TCE) were near the solubility limit for that compound. The goal of the investigation was accomplished by identifying the western and southern edges of groundwater contaminant concentrations near the solubility limits of the components of DNAPL. Samples of groundwater were collected at 25 locations horizontally across the study area at 10-foot intervals vertically at each sample location from ground surface to the top of the confining unit, approximately 90 feet below ground surface (bgs). Numerous chemical concentration maps show the horizontal and vertical extent of the source area in the Draft RFI Report (PSC, 2001). In general, the source area exists on the facility and on the downgradient neighbor's property (5400 Denver Avenue South). The chemical concentrations in groundwater in the source area (often in the tens of thousands of parts per billion [ppb] range) decrease rapidly and are orders of magnitude lower (concentrations ranging from non-detect to the hundreds of ppb) within a few hundred feet horizontal distance.

PSC assumes that any residual NAPL in the vadose zone is located primarily under the facility, or on properties very close to the facility boundary. Though PSC acknowledges that such NAPL, depending on its composition, could be a source of vapor intrusion, especially

in the future, the area is currently capped with high-density concrete or (off-facility) blacktop.

### 2.2.2 Nature and Extent Characterization of VOCs in Groundwater

PSC has conducted direct push groundwater sampling investigative activities since 1998 to determine the nature and extent of the VOCs in groundwater emanating from the facility.

Summaries of these findings are presented in the Draft RFI Report (PSC, 2001). Figures from that Report are included as Figures 2-5 through 2-14. Data collected from these nature and extent investigations have been used to select and install a network of monitoring wells downgradient of the facility that are included in the revised Pre-Corrective Action Monitoring Plan (PSC, 2002). These figures do not include data obtained recently from new shallow wells in the study area. Depth to groundwater below ground surface (bgs) is approximately six to ten feet bgs (Figure 2-3). Depth to groundwater fluctuates seasonally and groundwater is expected to drop approximately five feet bgs during the dry season. Groundwater elevation and general flow direction (west, southwest) are shown on Figure 2-4.

The contamination appears to be confined to the shallow and intermediate aquifers, typically in the water table to 60-foot bgs intervals, with contamination being confined to more shallow depths in the areas more downgradient of the facility. At this time, however, it is difficult to fully determine the extent of the groundwater contamination that is emanating from the facility, because there is the possibility of commingled plumes downgradient of the facility[3]. Therefore, PSC will be analyzing the direct-push and new well data in 2002 to determine whether there is sufficient evidence of commingled plumes or entirely other sources of contamination for facility related chemicals of potential concern (COPCs). A report will be prepared and submitted to Ecology in August 2002, presenting the decision framework for identifying other non-PSC sources of contamination.

[3] For example, the benzene plume at the water table interval appears to dissipate in the westward direction near 4th Avenue South. The chlorinated solvent plumes (TCE, vinyl chloride (VC), and cis-1,2-dichloroethene (cis-1,2-DCE)) tend to dissipate in the same area, but there may be separate plumes immediately downgradient of the plume originating from the facility. Some examples include chlorinated solvent plumes near 5th Avenue South and South Orcas Street, near 2nd Avenue South and South Fidalgo Street, and west of East Marginal Way South on South Findlay Street.

### 2.2.3 Draft Human Health and Ecological Risk Assessment

As part of the Comprehensive RFI Report, a Draft Human Health and Ecological Risk Assessment (HHERA) was prepared by PSC in 2001 in order to conservatively estimate the risks and hazards to human health and ecological receptors from exposure to soil contamination at the facility and groundwater contamination emanating from the facility (PSC, 2001a). The purpose of the draft risk assessment was to determine current and future risks to receptors at the site and to create Preliminary Remedial Action Levels (PRALs) for facility-related COPCs.

On January 3, 2002, Ecology and EPA provided written comments on the HHERA that identified data gaps that need to be filled and modifications that need to be made before the final risk assessment is submitted. Ecology and EPA also concurred with many portions of the document. For example, the assessment identified the inhalation pathway (migration of vapors from groundwater to indoor air) as the primary exposure pathway of concern in all exposure areas (Areas 1, 2, and 3 (Figure 2-1A). The risk assessment also identified four groundwater COPCs (i.e., 1,1-dichloroethene [1,1-DCE], chloroethane, VC, and TCE) as the primary risk drivers. Preliminary data evaluated in the Draft HHERA identified some areas of concern and areas where additional data and analysis are needed. Based on the results of the preliminary evaluation, an IM was proposed for the Stone-Drew/Ashe & Jones (SDAJ) Building and new PCAMP monitoring data will be evaluated to better characterize risk in Areas 2 and 3. Due to the lack of monitoring or modeling information, the groundwater-to-surface water (Duwamish Waterway) pathway was only evaluated using a screening level approach.

### 2.2.4 Concurrent Soil Gas, Indoor Air, and Groundwater Sampling Events

Several soil gas, groundwater, and indoor sampling events have been performed to better understand the groundwater-to-indoor air pathway and to determine whether immediate health risks exist associated with releases from the facility. Empirical data collected in these investigations are summarized, for key risk driving compounds only, in Table 2-1[4]. Sample locations are shown on Figure 2-2.

#### 2.2.4.1 October 1999 Soil Gas Investigation

In October 1999 (PSC, 2000b), PSC implemented a soil gas sampling study to determine whether the indoor inhalation pathway was complete as a result of high concentrations of

[4] Table 2-1 summarizes data for the inhalation pathway COPCs only, and does not include all of the chemicals analyzed during these sampling events.

VOCs detected in groundwater downgradient of the facility. The study was designed to collect soil and soil gas samples in the affected area in the vicinity of the homes with basements where known groundwater VOC concentrations were highest.

The data gathered were modeled using the Johnson-Ettinger Model (EQM, 2000) to estimate vapor concentrations in the basements. The results of the October 1999 soil gas investigation and subsequent modeling indicated that there was no off-facility soil contamination in the study area and the risks associated with the soil gas pathway were below levels of concern established by EPA and Ecology. Soil gas concentrations were found to be so low that it appeared that there may not be a complete pathway between VOCs in groundwater and indoor air.

#### 2.2.4.2 PSC and EPA/WDOH Indoor Air, Soil Gas, Groundwater Sampling Events

Due to the limited nature of the 1999 sampling, the potential for the sample concentrations to under-represent actual soil gas levels, the results of independent modeling by EPA, concerns expressed by the Georgetown residents, and the uncertainties regarding the assessment of the groundwater to indoor air pathway, PSC and EPA agreed that indoor air sampling was warranted. Two residences with basements immediately downgradient of the facility were initially selected. Both buildings were located near where the October 1999 soil gas samples were collected. PSC sampled indoor air, soil gas, and groundwater at or near these residences in August 2000 as part of a project to correlate concentrations of contaminants in groundwater and soil gas with indoor air and to determine if: a) there were immediate health concerns associated with the soil gas pathway, and b) whether the groundwater-to-indoor air pathway was likely to constitute a complete exposure pathway (PSC, 2000a, 2000b). Ambient air was collected to determine if ambient anthropogenic sources of contamination were entering homes and contributing to indoor air contamination or if ambient sources were contributing to soil gas contamination.

The Washington State Department of Health (WDOH) and EPA simultaneously conducted indoor air sampling a week after PSC at the same two homes. They also sampled one other residence with a basement one block from Denver Avenue (at the intersection of Maynard and Brandon) and two commercial buildings on the same block as PSC.

In May 2001, the WDOH issued a Public Health Consultation (2001) summarizing the August 2000 sampling events and concluded: “levels of contaminants found in indoor air near the Philip Services site pose no immediate health hazard.” EPA’s assessment of the data concluded that a complete pathway between groundwater VOCs and indoor air

appeared to exist (EPA, 2001). Both EPA and WDOH expressed concerns about long-term exposures to indoor air that was significantly impacted by vapor intrusion[5].

In March 2001, the WDOH (in cooperation with PSC and EPA) sampled indoor air in the same two residences on Denver to determine if there were seasonal changes of indoor air concentrations related to the soil gas pathway (PSC, 2001b). Additionally, they sampled a commercial building on the same block as the PSC facility, and four other residential buildings west of Denver Avenue South. PSC collected simultaneous soil gas, groundwater, and ambient air samples at these locations. Results of these comparisons, summarized in the Draft RFI Report (PSC, 2001a), indicated that concentrations of some chemicals exceeded MTCA B indoor air levels and there was some correlation (most obvious closer to the facility) between indoor air, soil gas, and groundwater concentrations. However, many of the chemicals were measured indoors at concentrations within the ranges that are typically found in residential buildings and ambient air in the Georgetown neighborhood, and the indoor concentrations attributable to groundwater contamination were not quantified.

### 2.2.5 Geotechnical Sampling

The physical characteristics of subsurface soil, above the shallow aquifer through which vapor migration occurs, are important factors in determining how readily contaminants can migrate through the vadose zone. Subsurface properties that most influence vapor migration into buildings include permeability (inferred from soil type), porosity, and moisture content. Increased permeability (associated with clean sands) increases vapor migration. PSC has collected a number of geotechnical samples of the vadose zone soils throughout the downgradient area in Study Area 2Area to characterize subsurface conditions downgradient of the facility. Soil classifications, based on grain-size analysis on these data, were determined by Rosa Environmental and Geotechnical Laboratory (Appendix C). These soil classifications, detailed on Table 2-2, are posted by location and depth on Figure 2-1C. Other geotechnical results are summarized on Table 2-3. The lithology of subsurface conditions can also be inferred by reviewing boring logs and cross-sections that are included and summarized in Section 3.5 of the RFI (PSC, 2001).

Boring logs and preliminary data and information presented in the draft RFI (PSC, 2001), indicate that a shallow sand unit (including fill material) is correlated with the shallow aquifer and varies in thickness from 21 feet to 44 feet. The RFI states that the upper portion

[5] WDOH's consultation stated that: "An indeterminate public health hazard exists with respect to risks associated with long-term exposure to VOCs that have migrated into indoor air from groundwater."

consists of fill that was emplaced during the industrial development of the area. The lower portion is comprised of Duwamish River deposits (alluvium). At some locations collected adjacent to roadways, the upper 1 to 2 feet consists of crushed rock, apparently emplaced as sub-base for surface pavement beneath roadways. The shallow sand and gravel unit consists of poorly graded, fine to medium sand with fine gravel. Organic matter is commonly present, at levels varying from trace to abundant (PSC, 2001).

Recent geotechnical data collected in Study Area 2 has provided a more site-specific characterization of the vadose zone downgradient of the facility. As shown on Table 2-2 and presented in Figure 2-1C, soil classification, based on the United States Conservation Service (USCS) Soil Classification system (EQM, 2000) ranges from silt to loamy sand to sand. Most locations show some vertical heterogeneity. For example, in locations where sand is identified, more silty or loamy intervals are also observed.

Total porosity in site soils ranges from 0.33 to 0.59 $m^3$-pores/$m^3$-soil with an average of 0.47 $m^3$-pores/$m^3$-soil. This range is representative of a mixture of finer grained sands, silts, and clays (Carsel and Parrish, 1988). Moisture content throughout the site is the most variable site parameter that influences vapor migration. Residual moisture saturations for typical drained vadose zone soil types are 0.05 to 0.10 percent for coarse-grained materials like sands and gravels and 0.10 to 0.30 percent for finer-grained mixtures of sands, silts, and clays (Carsel and Parrish, 1988). The range of water-filled porosity displayed in Table 2-3 (0.05 to 1 with and average of 0.61 percent) trends toward finer sands and silts, with potential perched water zones or near-surface soils with greater moisture saturations (reflecting high infiltration or recharge) exhibited by some samples with water-filled porosity greater than 90 percent.

# 3. PROCEDURES FOR EVALUATING THE INHALATION PATHWAY AND THE NEED FOR INTERIM MEASURES

This Work Plan presents an integrated approach for evaluating groundwater and indoor air data to determine – through the use of the IPIM Decision Tree (see Figure 3-1) – if IMs are warranted. The IPIM Decision Tree is organized into four tiers to allow progressive evaluation of groundwater data and incorporation of site-specific information. The IPIM Decision Tree is also intended to be flexible so that at any time a decision can be made to proceed directly to consult with Ecology regarding the need to implement an IM. A key component of the IPIM Decision tree is the development of IPIMALs. These groundwater IPIMALs are protective of human health and are used in the decision tree to determine if a building warrants further investigation or action based on current groundwater data.

IPIMALs will be developed for groundwater in a step-wise fashion, following the procedures outlined in Figure 3-2. The IPIMALs for groundwater will be calculated based on the relationship between the chemical concentration in groundwater and the concentration in indoor air (i.e., volatilization of chemicals in groundwater to air). Groundwater IPIMALs will be calculated using conservative risk-based indoor air action levels and a groundwater-to-indoor air volatilization factor (GIVF). The processes for defining the IPIMALs, collecting data, and determining the need for further investigation or interim measures are described in Section 3 below.

The results of the GIVF study will be presented in a technical memorandum (Tech Memo) to Ecology following receipt and evaluation of the validated data. The schedule and content of the Tech Memo are discussed in Section 5. Evaluations of quarterly monitoring data using the IPIM Decision Tree will be included in Technical Memorandums for the IPIM, which will be submitted to Ecology according to the schedule in Table 5-1.

## 3.1 STUDY AREA/TIME FRAME

There are two study areas identified in this Work Plan:

1. **Study Area 1** – The area where the GIVFs will be developed (see Figure 2-1).
2. **Study Area 2** – The area where groundwater data will be evaluated to determine if IMs are warranted (see Figure 2-1A and Figure 2-1B).

### 3.1.1 Study Area for Developing GIVFs – Study Area 1

The study area selected for calculating empirically derived GIVFs (Study Area 1) is presented in Figure 2-1. This figure identifies the main study area for the GIVF evaluation and a contingency area. This area is located within the mixed residential/industrial neighborhood that is hydraulically downgradient of the PSC Georgetown facility and most likely impacted by facility-related COPCs. As shown in Figures 2-5 through 2-14, the highest concentrations of the four risk-driving chemicals (1,1-DCE, chloroethane, TCE, and VC) were found within this area[6]. Consequently, this area is also where groundwater contamination is most likely to present a potential risk to human health via vapor intrusion. All buildings selected for evaluation in Study Area 1 will also undergo indoor air sampling and will be evaluated under Tier 3 of the Decision Tree to determine risks associated with inhalation. Groundwater samples will also be collected close to these buildings to determine the relationship between the concentrations of selected (target) COPCs in groundwater and indoor air. Ambient air samples will additionally accompany the indoor air samples, so that the indoor COPC levels may be "adjusted" for ambient air intrusion.

Figure 2-1 presents the areas that, based on previous modeling and on the results of 2000 and 2001 indoor air sampling studies, appear to have the possibility of the greatest vapor intrusion risks. The locations proposed for collecting samples as part of the GIVF evaluation are presented in Table 3-1 and were selected using the following guidelines:

- Located over/near areas with high concentrations in the groundwater plume for 1,1-dichloroethene, chloroethane, trichloroethene, and vinyl chloride.
- Residential buildings within the area with a construction type that is most likely to result in VOCs migrating from groundwater and becoming elevated in indoor air. Features of buildings and surrounding grounds that influence how contaminants may enter and be distributed through a building include the following: building size, construction type (crawl-space or basement versus slab-on-grade), and obvious cracks in the floors or walls in contact with the soil (MADEP, 2002).
- Locations least likely to be impacted by other sources of chemicals in indoor air, such as buildings not located next to a gasoline station or industry from which fugitive emissions could emanate.

[6] Figures 2-2 through 2-11 were provided directly from the Draft RFI and do not represent the latest data collected from new shallow wells in the affected area downgradient of the site. They also contain examples of standard cleanup criteria in the legend that are not applicable to this Work Plan.

- Locations that have been previously sampled and shown detections of risk-drivers in groundwater or indoor air.

In order to collect samples from the buildings presented in Table 1-1, PSC must be granted access from the building owner. A letter requesting access for GIVF sampling, which is presented in Appendix D, will be submitted to each property owner/resident presented in Table 3-1. In the event that PSC cannot gain access to all of the buildings presented in Table 3-1, PSC will extend the study area to include 4th Avenue South (which would include the building located at 412 Orcas). A sampling location will be selected from this "contingency" area that has the same building foundation type, if possible, as the location initially proposed for sampling[7].

*Note: The SDAJ building is currently being evaluated under a separate IPIM Work Plan and will not be included in the GIVF study due to the uncertainties associated with representing volatilization into large commercial buildings. Furthermore, the building is not a residential building and does not meet the criteria for maximum exposure to receptors.*

There are locations outside of Study Area 1 that are located over groundwater "hot spots" that may pose a concern to human health via the vapor intrusion pathway. These locations are:

- Third Avenue South and South Mead Street.
- South Fidalgo Street and East Marginal Way South

These locations are not included in the GIVF Study and will likely not be included in the tiered process described in this Work Plan. PSC intends to submit a separate plan that will define the process for identifying additional sources of groundwater contamination in the area west of 4th Avenue. One of the objectives of the plan is to determine how much of the contamination found at these locations is attributable to releases from the facility. It is possible that the indoor air contamination found last year in a home on Mead Street S., and the elevated groundwater concentrations of chlorinated VOCs in the area of Fidalgo Street S., Orcas Street S., 3rd Avenue South and 2nd Avenue South, might be primarily contributed from a source other than PSC. Building owners and occupants in this area will be notified of the potential risks, but the buildings themselves will not undergo the "tiered" analysis

described in this Work Plan until Ecology has determined that the PSC Georgetown Facility has contributed significantly to the contamination measured at this location.

### 3.1.2 Study Area for Determining if Interim Measures are Warranted – Study Area 2

The study area for determining if IMs are warranted (Study Area 2) is presented in Figure 2-1A and 2-1B. Once GIVFs have been derived for all COPCs based on the results of the co-located sampling in Study Area 1, those GIVFs will be used to calculate groundwater IPIMALs. These groundwater IPIMALs will be compared with groundwater data collected from the PCAMP monitoring wells in Study Area 2 (see Figure 2-1A and 2-1B) starting with the 2nd Quarter 2002 sampling period (available at the end of August 2002). They will also be used for comparison to previous direct push groundwater sample results, taken from the water table.

## 3.2 DATA-DRIVEN DECISIONS

The data collected pursuant to the SAP presented in Appendix A will be used directly to assess the potential risks associated with indoor air concentrations at several downgradient buildings within Study Area 1. It will also be used to develop a mathematical relationship between measured levels of indoor air COPCs (adjusted so that the levels represent only the contribution from groundwater) and the levels of those COPCs in underlying groundwater.

In addition, from the empirically-derived groundwater/indoor air relationships, groundwater IPIMALs will be calculated that will be protective of receptors exposed via the vapor intrusion pathway. From comparison of the IPIMALs to groundwater COPC concentrations in Study Area 2, PSC will be able to identify buildings that currently: (1) need interim measures, (2) need more study, or (3) do not appear to need intervention (based on air quality impacts from vapor intrusion).

PSC will use the data collected pursuant to the SAP to refine the process for evaluating quarterly groundwater data to determine if a building-specific IM is warranted. The data will be used to assess the individual buildings where the co-located samples are collected, and to calculate GIVFs and IPIMALs for use when evaluating buildings where no indoor air samples have been taken, or when the data from such sampling have high levels of uncertainty associated with them. The following decision rules will be applied to the data resulting from the GIVF Evaluation:

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[7] It is possible the study area would be expanded under a second contingency in the event that data collected from the original study area is found to be inadequate. Under this contingency, PSC would expand the

A. Once the data have been validated, PSC will inspect the groundwater/indoor air data pairs. Detected concentrations of target compounds[8] (TCs) in groundwater will be paired with detected or non-detected results in indoor air to calculate GIVFs. For locations with non-detected results in indoor air, it will be assumed that the indoor air concentration is equivalent to the full reporting limit[9]. For example, if a target compound is not detected in the groundwater at a particular building, PSC will not develop a GIVF for that building and target compound (although GIVFs will be developed for this target compound at other buildings where the compound was detected in the groundwater).

B. For those buildings where indoor air samples have been collected to support the GIVF evaluation, the resulting, "adjusted" COPC levels (adjusted by subtracting the higher of the potential contributions from indoor air sources and ambient air sources) will be compared to indoor air IPIMALs calculated assuming residential exposure. In most cases, if the cumulative cancer risk is greater than 1E-5 or a hazard index (i.e., sum of the individual hazard quotients) is greater than 1.0, the building will be proposed for Tier 4 evaluation (i.e., implementation of IMs).

C. Once GIVFs have been derived for all COPCs, those GIVFs will be used to calculate groundwater IPIMALs. These IPIMALs will be compared to 2nd quarter water table groundwater monitoring data (available at the end of August 2002) and quarterly water table groundwater monitoring well data collected thereafter. They will also be used for comparison to previous hydropunch results, taken from the water table. Residential buildings where nearby groundwater exceeds the IPIMALs will be further evaluated in Tier 3 or Tier 4. Commercial buildings where nearby groundwater exceeds the IPIMALs will be further evaluated in Tier 2.

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sampling area in a separate round of sampling.

[8] Target compounds are a subset of the indoor air COPCs, which will be used by PSC to derive GIVFs (see section 3.3.1).

[9] PSC will evaluate the detection limits of the groundwater and indoor air pairs for the non-detected indoor air results to determine if they are appropriate for developing GIVFs. If the detection limits for target compounds are 1-2 orders of magnitude or higher than the method detection limit presented in the QAPP, then, upon consultation with the Ecology, an alternate method for evaluating the potential impacts to indoor air will be used. If the groundwater and indoor air data are appropriate for developing GIVFs, then GIVFs will be calculated, per building and per constituent, for all instances where the paired data includes a detected groundwater concentration.

D. Those buildings where indoor sampling shows acceptable risks/hazards, or where groundwater concentrations in the wells associated with those buildings indicate that risks/hazards via vapor intrusion should be acceptable, will be further evaluated (under Tier 1) each quarter as new groundwater data become available. The buildings will also be included in the assessment of site risks and hazards contained in the revised RI Report.

E. The results from geotechnical sampling will be used as part of the overall quality assurance effort to increase confidence in the assumption that buildings selected for deriving GIVFs properly represent the vadose zone below other buildings throughout Study Area 2.

F. The results of the soil gas sampling will be used qualitatively to assist in evaluating the completeness of the groundwater to indoor air vapor intrusion pathway.

The analytical data collected during the Tier 3 Evaluations will be used to assess the potential risks to human health at the buildings where the samples were collected. The following decision rules will be applied to the data resulting from the Tier 3 Evaluations:

A. A. Once the data have been validated, PSC will inspect the groundwater/indoor air data pairs. Detected concentrations of COPCs in groundwater will be paired with detected or non-detected results in indoor to evaluate potential risks associated with exposure to indoor air. For locations with non-detected results in indoor air, it will be assumed that the indoor air concentration is equivalent to the 1/2 reporting limit. For example, if a compound is not detected in the groundwater at a particular building, PSC will not include that chemical in the calculation of risk because it indicates that the vapor intrusion from groundwater pathway (although risks will be calculated for this compound at other buildings where the compound was detected in the groundwater). For those buildings where indoor air samples have been collected to support the GIVF evaluation, the resultant, “adjusted” COPC levels (adjusted by subtracting the higher of the potential contributions from indoor air sources and ambient air sources) will be compared to indoor air IPIMALs calculated assuming residential exposure. In most cases, if the cumulative cancer risk is greater than 1E-5 or a hazard index

(i.e., sum of the individual hazard quotients) is greater than 1.0, the building will be proposed for Tier 4 evaluation (i.e., implementation of IMs).

There are number of sources of error/uncertainty associated with the study and evaluation process. These are discussed in Section 4 and in Section 2.6 of the SAP (Appendix A).

## 3.3 DEVELOPMENT OF IPIMALS

The chemicals that will be evaluated using the IPIM Decision Tree are the inhalation pathway COPCs identified in the Draft HHERA (PSC, 2001a). In order to develop groundwater IPIMALs for these chemicals that can be used to determine if an IM is warranted, chemical specific GIVFs will be determined by measuring groundwater and indoor air concentrations from a number of co-located and co-collected groundwater, and air samples. This integrated approach will be used to derive an upper bound chemical-specific GIVF. Chemicals targeted for calculation of building-specific GIVFs are presented in Section 3.3.1. The area of focus for the co-located sampling program is discussed in Section 3.3.2. Development of the GIVFs from the data set is presented in Section 3.3.3. The approach for calculating the IPIMAL is presented in Section 3.3.4.

The methodology may be difficult to implement with confidence depending on the data collected/available. If the methodology proves inadequate to the task of conservatively predicting indoor air concentrations, PSC will propose alternative assessment techniques to Ecology.

### 3.3.1 Identification of Target Compounds for Development of GIVFs

The COPCs selected for focused evaluation of GIVFs, target compounds [TCs], are a subset of the inhalation pathway COPCs identified in the Draft HHERA. The inhalation pathway COPCs selected as TCs to derive a site-specific upper bound GIVF for the remaining COPCs have been selected based on the following criteria:

- Directly associated with historical use and/or releases from the facility. Or, they are breakdown products associated with source compounds.
- Consistently detected downgradient of the site.
- Detected in both groundwater and indoor air in previous groundwater and indoor air studies conducted downgradient of the PSC Georgetown facility.

- Less likely to reflect urban background concentrations in indoor air[10].

Chemical-specific data for the COPCs subject to this IPIM are presented in Table 3-2. The COPCs selected as TCs are highlighted in bold.

### 3.3.2 Selection of Sample Locations for Development of GIVFs

Indoor air and groundwater samples will be collected from the buildings presented in Table 3-1 (see Section 3.1.l) in accordance with the SAP presented in Appendix A. Ambient air, soil gas, and geotechnical soil samples will also be collected from select locations as described in the SAP presented in Appendix A. All analytical data will undergo quality assurance and quality control procedures described in the QAPP (Appendix B) prior to use in the following steps.

### 3.3.3 Development of GIVFs

GIVFs will be developed using sets of data collected from the selected locations (see Section 3.1.1).

Since the project will strive for collecting data representative of the entire downgradient area, data pairs will be collected from multiple locations. The information obtained will be evaluated and GIVFs derived from analysis of all the data. Building-specific GIVFs will be developed using the following approach:

1. Co-located and co-collected groundwater, indoor air, and ambient air data from each location sampled will be paired as follows:

    A. Only locations where TCs were detected in groundwater will be included in the GIVF evaluation. The detected concentrations in groundwater will be paired with detected or non-detected results in indoor air. For data sets with non-detected results in indoor air, it will be assumed that the concentration is equivalent to the full reporting limit.

    B. Data points with elevated detections limits will be evaluated to determine if they should be included or excluded from the analysis based on overall data quality, ability to meet the DQOs defined in Section 6 and the QAPP, and

[10] Due to the uncertainties associated with both TCE and BTEX as indoor air sources, GIVFs will not be calculated from chemical-specific data pairs for these compounds. PSC assumes that the GIVFs ultimately used for determining IPIMALs for these constituents – and especially the aromatics – will be conservative. Vapor phase BTEX is expected to undergo significant biodegradation before reaching groundsurface.

potential uncertainties associated with utilizing these ascribed data points to develop GIVFs.

*Note: Soil gas and geotechnical soil samples will be collected from some locations to assist in characterizing the groundwater to indoor air vapor intrusion pathway.*

2. Indoor air sampling results will be adjusted for contributions from background using the maximum concentration represented from the following sources:

   A. Chemical concentrations detected in the ambient air, likely to have infiltrated the building.

   B. Chemical concentrations from background indoor air sources[11]. PSC will use peer-reviewed literature values obtained from U.S. homes. Table 3-3 provides a range of scientific literature values for the chemicals. PSC intends to use a value per COPC that represents either the mean of the data between the 25$^{th}$ and 75$^{th}$ percentiles, or the median, whichever is lower. The value selected for correction will be finalized in the Tech Memo.

3. The results of the building evaluation conducted prior to sampling (see the Appendix A SAP) will be examined to determine if any sources of chlorinated solvents exist or existed in the building that might skew indoor air sample collection data (if so, and if PSC believes that the resulting impact on indoor air may not be accounted for through the "adjustment" mechanism explained in 2 above, PSC may request Ecology's approval to exclude some of the data points from the calculation of the GIVFs).

4. At each location, chemical-specific GIVFs for the TCs will be calculated using the following relationship:

$$GIVF_{TC}\ \frac{(mg/m^3)}{(mg/L)} = \frac{Indoor\ Air\ Concentration\ (mg/m^3)}{Groundwater\ Concentration\ (mg/L)}$$

5. The 95 percent UCL on the mean GIVF and the maximum GIVF will be calculated for each TC. The 95 percent UCL GIVF (or the maximum GIVF, when the 95%

[11] PSC will use indoor air data from typical urban buildings. Preferably, the data will represent only indoor sources of indoor air contamination. If the data combines the effects of indoor air sources and ambient intrusion, PSC will either attempt to subtract the ambient component, or – if the ambient component is similar to Georgetown ambient air quality – use the data, but not subtract out the ambient air concentration determined in 2.A.

UCL is greater than the maximum value) will be used to derive the groundwater IPIMALs for each TC.

In calculating the 95% UCL on the mean PSC will use procedures in Section 5.2.1 of the 1992 Washington State Department of Ecology Toxics Cleanup Program's *Statistical Guidance for Ecology Site Managers*. The methodology used for establishing the value and the assumed distribution will be documented in the post-sampling Tech Memo.

6. For those COPCs for which building-specific GIVFs were not calculated, the most protective (highest) representative GIVF for the TCs ($GIVF_{TC_max}$) will be used to derive a GIVF for each remaining COPC ($GIVF_{COPC}$) based on the relationship of the physical/chemical properties of the protective TC to the COPC. The relationship will be expressed in the form of a chemical-specific Adjustment Factor (AF) that is determined by using the Johnson and Ettinger model (JEM)[12] for estimating subsurface vapor migration into buildings (EQM, 2000). The model will be applied using a conservative set of site-specific parameters (presented in Table 3-4) to predict the indoor air concentration (JE_INDOOR) for a given groundwater concentration (i.e., 1 µg/L) of the COPC and the TC with the most protective GIVF ($GIVF_{TC_max}$). The $GIVF_{COPC}$ will be calculated using the following relationships:

$$GIVF_{COPC}\,\frac{(mg/m^3)}{(mg/L)} = GIVF_{TC}\,\frac{(mg/m^3)}{(mg/L)} * AF$$

### 3.3.4 Development of Inhalation Pathway Interim Measure Action Levels for Indoor Air and for Groundwater

Groundwater IPIMALs will be used in the IPIM Decision Tree to determine if IMs are necessary at a particular building. The IPIMALs are based on the action levels for indoor air developed in the Draft HHERA (PSC, 2001a). The action levels for indoor air were developed such that the maximum indoor air concentrations of each constituent are health protective action levels based on a chemical-specific carcinogenic risk goal of 1E-06 and a

[12] The JEM, as it has evolved since its original development (Johnson and Ettinger, 1991), is a widely used analytical tool for modeling contaminant partitioning and subsurface vapor transport into buildings based on chemical-specific and site-specific properties. The JEM is available on the EPA Web site for Risk Assessment (www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm).

hazard quotient of 1.0 for non-carcinogens for both residential and commercial/industrial workers. Table 3-5 presents the indoor air action levels for residential and commercial receptors and the specific exposure assumptions on which these action levels are based. As shown in Figure 3-2, IPIMALs for groundwater will be calculated using the action levels for indoor air and the GIVFs using the following relationship:

$$IPIMAL\ Groundwater\ \ (mg/L) = \frac{IPIMAL\ IndoorAir\ \ (mg/m^3)}{GIVF\ \frac{(mg/m^3)}{(mg/L)}}$$

## 3.4 COLLECTION OF GROUNDWATER DATA FOR IPIM EVALUATIONS

Groundwater data will be collected from a network of monitoring wells (located on Figure 2-1A and Figure 2-1B) for quarterly evaluation to determine if IMs are warranted. The PCAMP has been implemented by PSC since 1993 and, with the expansion and addition of more than 55 new monitoring wells downgradient of the facility; this program is an integral part of assessing the need for IPIMs. The screened interval of each water table monitoring well extends from 7 feet below to 3 feet above the estimated high water level at that location. Thirty-one monitoring wells are screened across the water table. Samples from each well will be submitted for analysis on a quarterly basis. The analyte list includes the inhalation pathway COPCs. Samples will be collected and analyzed in accordance with the approved PCAMP.

PSC will develop a method based (at least in part) on contouring or geostatistics for associating individual wells and/or COPC concentrations with individual buildings. This method will be presented, as applied to the 2$^{nd}$ Quarter 2002 groundwater data, in the Technical Memo.

## 3.5 APPLICATION OF THE IPIM DECISION TREE

The IPIM Decision Tree (Figure 3-1) is organized into four tiers and is an integrated approach for evaluating groundwater and indoor air data to determine if IMs are warranted. However, the IPIM Decision Tree is also intended to be flexible, so that at any time a decision can be made to proceed directly to consult with Ecology regarding the need to implement an IM. Each Tier of the IPIM Decision Tree is discussed below.

### 3.5.1 Tier 1 – Comparison of Residential-Based IPIMALs with Quarterly Groundwater Monitoring Data

The first Tier in the IPIM Decision Tree is to compare groundwater monitoring data from the wells presented on Figure 2-1 with residential-based IPIMALs on a well-by-well basis. Cumulative Exceedance Factors (CEFs) for both carcinogenic and non-carcinogenic effects will be calculated.

Chemical-specific exceedance factors (EFs) will be calculated for each location as follows:

$$EF = \frac{C_{groundwater}}{\text{Residential}_{IPIMAL}}$$

Where;

| Parameter | Description |
|---|---|
| $C_{groundwater}$ | Concentration in each groundwater well (µg/L). |
| $\text{Residential}_{IPIMAL}$ | Residential-based IPIMAL for groundwater (µg/L), based on a carcinogenic risk of 1E-06 and HI of 0.1. |

The CEFs for each location will be calculated by summing the EFs for individual carcinogenic and non-carcinogenic COPCs. A CEF of 1 indicates exposure to indoor air concentrations from groundwater near that well should correlate to a potential cumulative cancer risk of 1E-06 or a HI of 0.1. A CEF of 10 indicates that exposure to indoor air concentrations near the well could potentially lead to a cumulative risk of 1E-05 or a HI of 1[13].

The area of impact (AOI) associated with each monitoring well will define the building(s) of concern for all tiers. The AOI will be delineated by contouring the CEFs. Other geostatistical techniques, such as kriging, may also be applied, if PSC and/or Ecology feel that such techniques will significantly improve the confidence associated with each AOI's assumption of concentration homogeneity[14]. In addition, PSC/Ecology may choose to

[13] Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients by target organ/critical effect (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

[14] PSC will propose the methodology for locating buildings with groundwater concentrations that exceed a CEF of 10 in the technical memorandum due to Ecology 60 days after receiving validated data from the study described in the Appendix A SAP.

collect co-located and co-collected samples from buildings within the AOI (to the extent practical) to minimize uncertainty associated with spatial and temporal differences in concentrations.

The results of Tier 1 will be evaluated as follows to determine the appropriate course of action for each location:

1. Residential locations with CEFs exceeding 10 will proceed directly to Tier 3 or Tier 4[15].

2. Commercial/Industrial locations with a CEF exceeding 10 will be further evaluated in Tier 2 or proceed directly to Tier 3 or Tier 4, depending on site-specific information.

3. Locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

Note: All locations and chemicals will be retained for further evaluation in the Final Risk Assessment for the facility.

Using this approach, PSC will take further actions on individual buildings where the cumulative inhalation risk due to vapor intrusion is 1E-5 or greater (or greater than HI = 1[16]). If the potential cumulative risk at a residential building is estimated to be less than 1E-5, but individual COPCs may pose risks greater than 1E-6, PSC intends to wait until the revised RI and FS to consider remedial actions.

### 3.5.2 Tier 2 – Determination of Impacts to Commercial Buildings

Commercial/industrial locations that exceeded a CEF of 10 in Tier 1 will be further evaluated in Tier 2. Commercial/industrial buildings identified within these areas will be evaluated using commercial-based IPIMALs. The approach for developing commercial-based IPIMALs is identical to the approach used to develop the residential-based IPIMALs except that commercial intake exposure assumptions (PSC, 2001a) will be used instead of

[15] If it is determined that more investigation is unlikely to result in a conclusion that risks are acceptable, PSC will step directly to Tier 4. Likewise, if the cost of sampling and analysis is such that implementation of an interim measure could be viewed as cost-effective, PSC may opt to move directly to Tier 4.

[16] Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients by target organ/critical effect (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

residential intake assumptions. Table 3-5 presents the indoor air action levels and exposure assumptions for commercial receptors on which these action levels are based. The results of Tier 2 will be evaluated as follows to determine the appropriate course of action for each location:

1. Commercial/industrial locations with CEFs exceeding 10 will be further evaluated in Tier 3 or proceed directly to Tier 4 depending on site-specific information.
2. Locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

Note: All locations and chemicals will be retained for further evaluation in the Final Risk Assessment for the facility.

### 3.5.3 Tier 3 – Empirical Data Collection

Residential and commercial/industrial locations identified in Tier 1 or Tier 2 for review under Tier 3 will be evaluated to determine if site-specific data collection is warranted or if the location should move directly to Tier 4. Each location will be evaluated independently. If site-specific data collection is warranted, then the following data may be collected at the locations of concern:

1. Indoor air samples.
2. Groundwater samples.
3. Ambient air samples.
4. Soil gas samples.
5. Geotechnical samples.

All sampling and analysis performed during the initial Tier 3 investigation/evaluation[17] will be conducted in accordance with the enclosed SAP and QAPP (see Appendices A and B). Any Tier 3 investigations conducted after the GIVF calculations have been made will follow procedures contained in an addendum to the SAPs/QAPPs prepared specifically for the buildings being evaluated. The analytical results obtained during Tier 3 will be evaluated as follows to determine if the location should proceed to Tier 4:

[17] Following the collection of the sampling data, per the SAP, Tier 3 evaluations will be performed on selected locations. In the future, as new groundwater information becomes available, any Tier 3 evaluations requiring sampling will be proposed by PSC in Supplemental SAPs.

1. Groundwater, indoor air, ambient air, and any soil gas data from each location sampled will be examined to determine if a complete groundwater to indoor air pathway is present at the location:

   A. Locations where COPCs were not detected in groundwater or soil gas will not be further evaluated under Tier 3, but monitoring well data will be reviewed again after the next quarterly monitoring event.

   B. Only locations where COPCs were detected in either groundwater or soil gas will be retained for further evaluation. PSC will assume that the other locations do not have a complete groundwater to indoor air pathway[18].

2. The indoor air results for those COPCs detected in groundwater or soil gas will be adjusted for contributions from background using the process described to develop the GIVFs (Section 3.3.3):

3. Indoor air concentrations at the locations retained for evaluation will be compared with residential-based or commercial-based action levels (as appropriate; see Table 3-5) to determine if an IM is warranted. The results of this comparison will be evaluated as follows to determine the appropriate course of action for each location:

   A. Residential or commercial/industrial locations with CEFs exceeding 10 will proceed to Tier 4, or will be evaluated further in Step 4 of Tier 3.

   B. Locations with CEFs less than 10 will be reviewed again after the next quarterly monitoring event.

4. At locations where CEFs compared to indoor air action levels exceed 10, groundwater, soil gas, indoor air, and ambient air data may be further evaluated to determine if the concentrations in indoor air represent concentrations likely to have migrated from the groundwater source. For example, the $GIVF_{TC \text{ or } COPC}$ (used for Tier 1 screening) may be applied to the chemical(s) of interest in groundwater and predicted concentrations compared with measured indoor air concentrations. If indoor air concentrations were found to be significantly higher (an order of magnitude) than would be expected from the GIVF, then the site would be further evaluated to consider alternative sources of the chemical from indoor air or preferential pathways that may influence expected concentrations from the source

[18] I.e., PSC will assume that the contamination detected indoors is a result of sources *other than* vapor intrusion.

area. Ecology will be consulted prior to using other approaches for evaluating the vapor intrusion pathway.

Following this evaluation, a proposal will be made to Ecology as to whether to proceed to Tier 4, or re-evaluate the location again after the next quarterly monitoring event.

Note: All locations and chemicals will be retained for further evaluation in the Final Risk Assessment for the facility.

### 3.5.4 Tier 4 – Considering the Implementation of Interim Measures

Technical memorandums will present the groundwater data used in the evaluations, buildings that have been selected for IMs, and buildings that do not require IMs – but will be evaluated again when the next quarterly groundwater data becomes available. PSC will design and implement IPIMs at the former locations upon the property owner's and Ecology's concurrence with the respective design document.

The first step in proposing an IPIM will be to gain access to the building requiring the IPIM. Then PSC will proceed with reviewing the IPIM technology options by conducting a building evaluation. Following the building evaluation, a design document will be prepared. The technology options for the IM remedy must be considered in the context of the actual buildings that are to be addressed. One of these solutions may be possible in any of the buildings and a combination of these strategies may be appropriate in some cases. Only a thorough review of the individual structures would make it possible to specify a particular design strategy, which is why it is necessary to conduct the building evaluation prior to selecting the remedy for the building.

For individual buildings requiring further action, a technology will be chosen and a *Supplemental Groundwater Interim Measures Design* document submitted to Ecology for approval. The schedule will proceed as outlined in Section 5, pending contractors' availability and access issues.

# 4. MEETING DATA QUALITY OBJECTIVES

PSC will strive to meet the following data quality objectives (DQOs) when implementing the Work Plan:

1. Achieve detection limits for groundwater, indoor air, ambient air, and soil gas samples that are at or below constituent-specific health-based action level concentrations (cancer risk=1E-6; HQ=0.1).

2. Use and evaluate quality control tests, calculate and evaluate values for data quality indicators, and validate data to ensure that risk-based decisions are based on quality data.

3. Collect groundwater data representative of actual current conditions in the upper portion of the shallow aquifer (and particularly, at the water table).

4. Take actions to ensure that the indoor air sampling data is representative of actual conditions in the building being sampled that day (and particularly, in those portions of the building where exposures would be highest).

5. Maximize the ability to obtain indoor air data that is representative of that day's indoor air quality, as caused by vapor intrusion.

Methods designed to meet these data quality objectives are presented in this Work Plan's appendices (the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP)). PSC anticipates that the data quality objectives for this project will be met by adhering to these documents. While there are a number of sources of error/uncertainty associated with the GIVF study and evaluation process (see below), PSC has attempted to ensure that the total error/uncertainty will result in decision-making that is biased towards taking interim measures where such measures may not be necessary (as opposed to not taking measures when they should be taken). For example, PSC intends to:

- Collect duplicate co-located indoor air samples in each building to measure precision for each indoor air location.

- Use conservative site-specific assumptions when using models or performing calculations.

- Use procedures for collecting samples that were developed to ensure that samples are collected from areas that will be reasonable maximum estimates of the actual concentrations of indoor air to which individuals may be exposed. This will be done

by ensuring that samples are collected from the presumed highest exposed areas, using EPA and Ecology-approved sampling methodologies. For example, indoor air samples will be collected from the basement and/or the highest use area of a building to ensure that the area of maximum exposure is sampled.

- Use the most conservative TC GIVF to calculate the GIVFs for constituents that are not TCs.
- Assign the detection limit value to all indoor air contaminants that are not detected in deriving GIVFs.[19];
- Achieve detection limits for groundwater, indoor air, ambient air, and soil gas samples that are at or below constituent-specific health based action level concentrations.
- Only subtract contributions from ambient and indoor air contaminant sources that are measured (for ambient air) or representative of the average household (for indoor air sources).
- Not exclude any COPCs measured in indoor air, or target compounds, from the data set without the concurrence of Ecology.
- Use groundwater data as inputs into the JE model (EQM, 2000) using a range of site-specific inputs to evaluate the uncertainty of the empirical predictions of indoor air quality made through use of the *volatilization factor* methodology in the form of error bars or "bounding values".
- When modeling, or using calculations as part of the development of IPIMALs or as part of the IM process, PSC will use Ecology-approved, site-specific conservative input values to ensure that the results will be applicable to all of the affected population.

PSC will only use data deemed useable by the QAPP, and all data will be validated prior to use. These steps will help eliminate uncertainties related to sample analytical problems and quality control problems. The data validator may reject some data for use in the development of IPIMALs or for review of the IPIM on a quarterly basis if the data do not meet the standards outlined in the QAPP.

As with any study of indoor air quality, the evaluation process has a number of sources of uncertainty. These include:

[19] For indoor air analysis sampled for Tier 3, a non-detect will not be evaluated further.

A. The possibility that the indoor air samples, per COPC, will overestimate or underestimate the RME concentrations in the building over time.

*The error associated with using a one-time indoor air-sampling event will not be estimated during this study.*

B. The possibility that groundwater samples taken nearby the building may not represent groundwater below the building at the time of sampling, or shortly thereafter. This could lead to an overestimation or underestimation of risks.

*The error associated with this source of uncertainty will not be estimated during this study. However, groundwater samples collected for purposes of the GIVF evaluation will be co-located as close as feasibly possible to the indoor air samples.*

C. The possibility that the calculated ratio of groundwater-to-indoor air concentrations (assuming only vapor intrusion as the source) will not remain constant over time.

*The error associated with this source of uncertainty will not be estimated during this study.*

D. The possibility that some buildings will have less or more indoor air contamination from indoor sources than the *average* building reported from the literature. This could lead to an overestimation or underestimation of risks.

*Indoor air typical of the Georgetown area is not available. However, studies from the literature will be evaluated to select values that most represent building and sample conditions in the study area and an attempt will be made to identify a value that most represents a midpoint within the 25$^{th}$ to 75$^{th}$ percentile. Nevertheless, it is unclear how much lower or higher one building's indoor air contaminant levels could be with respect to the "average", so the error associated with this source of uncertainty will not be estimated during the study.*

E. The possibility that the choice of the most conservative target compound GIVF to "represent" all non-target compound GIVFs may result in using GIVFs that are too high or too low for certain COPCs. This is especially a concern for TCE, one of the primary risk drivers for this site and exposure pathway.

*The error associated with this source of uncertainty will not be estimated during this study. However, the use of the JE model (EQM, 2000) in calculating*

*adjustment factors (AFs) will provide an estimated GIVF that is chemical-specific to TCE and other non-target compounds and these uncertainties are expected to be minor.*

F. The possibility that GIVFs, calculated between the facility and Fourth Avenue, may overestimate or underestimate the GIVFs that would be calculated from paired sampling downgradient of Fourth. PSC cannot be certain that the buildings or site-specific subsurface conditions selected for the GIVF study represent worst case, or even average, susceptibility to vapor intrusion. This could lead to an overestimation or underestimation of risks. However, PSC chose this study area be area based on the fact that this is the area immediately downgradient of the facility. The highest groundwater COPC concentrations and the most susceptible buildings (i.e., homes) are located in this area. PSC is also sampling at the best time of year (summer) when groundwater concentrations should be highest and volatilization factors should be highest.

   *PSC has collected geotechnical samples from within Study Area 1 and further downgradient in Study Area 2 and will collect additional samples pursuant to the GIVF study that will adequately represent the vadose zone areas in Study Area 2. From this information PSC will discuss (in the Tech Memo) the likelihood that vadose zone areas included, as part of the GIVF study, may not represent vadose zone geology in other areas of the study area. Furthermore, PSC will include a comparison of the empirically-derived attenuation factors (GIVFs adjusted for Henry's Law) with estimated attenuation factors given by the JE model using reasonable ranges of Georgetown site-specific inputs to provide error bars or bounding values for the empirically-derived GIVFs.*

G. There may be "error" (or at least uncertainty with respect to representativeness) in the chosen GIVF value if the max value is used instead of the 95% UCL on the mean – when the latter is higher.

   *The error associated with this source of uncertainty will not be estimated during this study, but in any situation where the 95% UCL is higher than the maximum value, the former value will be provided (in the Tech Memo) for comparison purposes.*

H. The possibility that the calculated groundwater IPIMAL may be lower than achievable DLs.

*This source of uncertainty relates primarily to the ability of PSC and Ecology to make decisions related to IM implementation, and the confidence associated with assigned groundwater concentration values. Following the calculation of IPIMALs PSC will know, however, which COPCs will have this problem. in which case, the lowest possible reporting limit or PQL will be run by the laboratory.*

I. It may not be possible to collect the samples under optimal weather conditions, as sampling will be scheduled to occur during short time frames to collect, analyze, and interpret data in a timely manner. This could lead to an overestimation or underestimation of risks.

*Similar to the uncertainty mentioned in "A" above, the error associated with using a one-time indoor air sampling event – that is not scheduled to occur during worst-case meteorological conditions – will not be estimated during this study.*

J. Few field quality control samples will be collected for air samples. Groundwater samples will have a field duplicate, Matrix Spike/Matrix Spike Duplicate, a field blank, and a trip blank. Duplicate (co-located) indoor air samples will be collected at each building. Matrix spikes will not be collected and analyzed for air samples because the samples are not possible to spike in Summa canisters using analytical method TO-14/TO-15. No field quality control samples will be collected for ambient air samples, nor will matrix spikes will be collected and analyzed.

*Indoor air COPC precision will be calculated using co-located indoor air sample results. No such samples will be collected for ambient air, so no study-specific estimation of precision will be reported. No study-specific estimation of accuracy will be reported, either, for both ambient air and indoor air data.*

K. The Work Plan's methodology is only applicable for current assessments of risk via the vapor intrusion pathway.

*The ability of the "Decision-Tree" to identify buildings which will need IMs in the future will not be assessed since this is not a goal of the study or process.*

L. While geological conditions in the vicinity of the facility are fairly consistent in soil type and total porosity (although vertical heterogeneity is apparent), it is not known if this consistency holds for downgradient areas, especially at the micro

scale (between small distances). Heterogeneities may be present locally in both unsaturated and saturated zones. Moisture content throughout the area varies vertically and horizontally (which may be related to high recharge areas or perched water zones). Significant differences in groundwater concentrations have been observed over short distances.

*As noted in "F" above, PSC has collected geotechnical samples from throughout Study Area 2 (downgradient of the facility) and will collect additional samples pursuant to the GIVF study. From this information PSC will discuss (in the Tech Memo) the likelihood that vadose zone areas included as part of the GIVF study may not represent vadose zone geology in other areas of Study Area 2. Additionally, the JE model will be used to evaluate the uncertainty of the GIVF calculations, as discussed in "F" above. However, the error associated with discounting spatial and temporal variability in groundwater concentrations, as noted in "B" above, will not be estimated during this study.*

For many of these sources of uncertainty, an estimation of their potential magnitude, and effect on decision-making, will not be developed until the preparation of the revised RI Report. Additional sampling and analysis in the interim, however, should aide the estimation process.

# 5. SCHEDULE AND STAFF ORGANIZATION

## 5.1 SCHEDULE

PSC will collect, analyze, and interpret data in a timely manner in order to make expeditious decisions regarding interim measures. After receiving approval on the Sampling and Analysis Plan from Ecology (8/1/02), PSC has begun the process of obtaining access to buildings and mobilizing for the GIVF Study to collect and analyze co-located and co-collected groundwater, ambient air, and indoor air samples. Each sampling event will begin with building evaluations. After completing the building evaluation, the sample locations will be finalized with Ecology representatives and sampling will commence. Upon validation and evaluation of the data, chemical-specific GIVFs and groundwater IPIMALs will be developed and submitted to Ecology in a technical memorandum (Tech Memo) within 60 days of receiving the validated data and no later than November 27, 2002. The Tech Memo will contain the following information:

a) all the validated data from sampling and analysis during the GIVF evaluation;

b) geotechnical information and maps and/or cross-sections, as appropriate, documenting the geology of the vadose zone in the study areas;

c) the derivation of GIVFs and associated IPIMALs for each IPIM COPC;

d) a discussion of all obvious and significant factors that could have resulted in deriving GIVFs that are lower than "true GIVFs" for some buildings/conditions in Study Area 2;

e) a proposal for associating individual buildings in Study Area 2 with current groundwater COPC concentrations, specific to those locations.

f) typical indoor air concentrations of COPCs (revised table).

In order to expedite the IM process, PSC will include in the Tech Memo an evaluation of groundwater data from permanent monitoring wells upon receipt of validated second quarter 2002 data from the new PCAMP network. PSC will evaluate the data according to this Work Plan and include a comparison of the quarterly monitoring data to the proposed

IPIMALs[20]. Due to the requirements of collecting additional empirical data to derive the IPIMAL and associated sampling constraints, the second quarter IPIM evaluation will be submitted within 60 days of receipt of validated data from the GIVF Study, but no later than November 27, 2002.

Subsequent, tier 1, 2, 3, or 4 IPIM proposals will be made to Ecology after the receipt of validated groundwater data from quarterly groundwater sampling events in the form of Technical Memoradums for the IPIM. These Technical Memorandums will be submitted in accordance with the schedule provided in Table 5-1 of the IPIMWP. These proposals will include a schedule for implementation of the work proposed. This process will be repeated each quarter until a final remedy for the site has been approved and implemented. A summary of the IPIM schedule is presented in Table 5-1. Progress memorandums on each IPIM installed will be included in the March 15 IM Annual Progress Memorandum.

## 5.2 STAFF ORGANIZATION

The PSC Project Manager is Carolyn Mayer. Ms. Mayer will coordinate all contractors and PSC employees that will assist with implementation of this project. PSC has contractors assisting with the development of the work plans and technology selection, as well as IPIM implementation. Ms. Mayer will also coordinate with Ecology's Project Manager, Ed Jones, and all property owners.

[20] For the first quarterly monitoring evaluation (2Q02), PSC will include the HHERA (PSC, 2001) Area 3 direct push data in the evaluation.

# 6. REFERENCES


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**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | | 5409 Denver | | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| | Depth of Soil Gas Sample (feet bgs) | | | 2 | 4 | 2 | 4 | 2 | 4 | angled below basement | angled below basement | 7.5 | 7.5 | 7.5 | 5 | 8 | 2 | 4 | 1.5 below basement floor | angled below basement | 7.5 | 7.5 | 5 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 8 |
| | **Compound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **1,1,1-Trichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 5.6 | 44 | 0.81 | 460 | 160 | 380 | | | | | | | | 5.7 | 5.44 | | | | | | 1.5 | 0.48 | 2.3 | 5.9 | 0.66 | 0.66 | 0.54 | 0.65 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.3 | | | | | | | | | | | | | 0.3 | | | | | | | 0.3 | | | | 0.3 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **1,1-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.12 | 3.2 | 0.17 | 13 | 0.7 | 0.59 | | | | | | | | <0.12 | <0.13 | | | | | | <0.13 | <0.12 | <0.12 | <0.13 | NA | 1.9 | NA | 0.24 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.12 | | | | | | | | | | | | | <0.12 | | | | | | | <0.12 | | | | <0.12 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **1,1-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.12 | 0.22 | <0.12 | <0.25 | <0.13 | <0.21 | | | | | | | | <0.12 | <0.12 | | | | | | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 | <0.12 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.12 | | | | | | | | | | | | | <0.12 | | | | | | | <0.12 | | | | <0.12 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **1,2-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.12 | 1.1 | 0.59 | <0.26 | <0.13 | <0.22 | | | | | | | | 0.44 | <0.13 | | | | | | <0.13 | <0.12 | <0.12 | 0.34 | <0.13 | <0.12 | 0.31 | <0.12 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.12 | | | | | | | | | | | | | <0.12 | | | | | | | <0.12 | | | | <0.12 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Benzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 1.8 | 2.2 | <0.24 | 2.3 | 2.4 | 2.4 | | | | | | | | 1.6 | 1.3 | | | | | | 4.3 | 0.94 | 3.6 | 1 | 3.3 | 1.2 | 2.8 | 2.4 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 2.5 | | | | | | | | | | | | | 2.5 | | | | | | | 2.5 | | | | 2.5 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Benzene, 1,2,4-trimethyl** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 3.4 | 7.4 | 2.5 | 56 | 16 | 3.9 | | | | | | | | 2.6 | 1.7 | | | | | | 1.8 | <0.37 | 7 | 6.9 | 2.4 | <0.37 | 6.4 | 6.4 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.37 | | | | | | | | | | | | | <0.37 | | | | | | | <0.37 | | | | <0.37 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | | | | |
| | **Benzene, 1,3,5-trimethyl-** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 0.85 | 1.6 | <0.37 | 8.7 | 1.2 | 3 | | | | | | | | 0.71 | 0.45 | | | | | | 0.65 | <0.37 | 1.8 | 1.7 | 0.8 | <0.37 | 1.6 | 1.5 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.37 | | | | | | | | | | | | | <0.37 | | | | | | | <0.37 | | | | <0.37 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Carbon tetrachloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 0.62 | 0.72 | 1.5 | 0.58 | 0.55 | 0.42 | | | | | | | | 0.41 | 0.34 | | | | | | 0.44 | <0.19 | 0.44 | 0.33 | 0.66 | 0.47 | 0.59 | 0.46 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 1.4 | | | | | | | | | | | | | 1.4 | | | | | | | 1.4 | | | | 1.4 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Chloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 0.13 | 0.29 | <0.08 | 0.28 | <0.088 | <0.14 | | | | | | | | 0.11 | <0.083 | | | | | | <0.083 | <0.08 | <0.08 | 0.13 | 0.36 | <0.08 | <0.083 | <0.08 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.13 | | | | | | | | | | | | | 0.13 | | | | | | | 0.13 | | | | 0.13 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Chloroform** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 150 | 210 | 75 | 180 | 170 | 76 | | | | | | | | 150 | 95 | | | | | | 150 | 25 | 100 | 47 | 1.4 | 95 | 140 | 210 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.93 | | | | | | | | | | | | | 0.93 | | | | | | | 0.93 | | | | 0.93 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **cis-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.12 | 1.4 | <0.12 | <0.25 | <0.13 | <0.21 | | | | | | | | 0.48 | <0.12 | | | | | | 2.4 | <0.12 | 0.25 | 0.45 | 0.34 | 11 | 0.66 | 0.32 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.3 | | | | | | | | | | | | | 0.3 | | | | | | | 0.3 | | | | 0.3 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Ethylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 2.0 | 2 | 0.77 | 9.7 | 1 | 2.9 | | | | | | | | 1.4 | 0.81 | | | | | | 1.8 | 1.2 | 9.6 | 3.6 | 2.2 | <0.13 | 3.7 | 3.1 | | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.13 | | | | | | | | | | | | | <0.13 | | | | | | | <0.13 | | | | <0.13 | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Naphthalene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | NA | NA | NA | NA | NA | NA | | | | | | | | NA | NA | | | | | | NA | NA | NA | NA | NA | NA | NA | NA | | | | | | | | |

**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | | 5409 Denver | | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | NA | | | | | | | NA | | | | NA | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **n-Propylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | NA | NA | NA | NA | NA | NA | | | | | | | | NA | NA | | | | | | NA | NA | NA | NA | NA | NA | NA | NA | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | NA | | | | | | | NA | | | | NA | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **p-Isopropyltoluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | NA | NA | NA | NA | NA | NA | | | | | | | | NA | NA | | | | | | NA | NA | NA | NA | NA | NA | NA | NA | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | NA | | | | | | | NA | | | | NA | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **sec-Butylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | NA | NA | NA | NA | NA | NA | | | | | | | | NA | NA | | | | | | NA | NA | NA | NA | NA | NA | NA | NA | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | | NA | | | | | | | NA | | | | NA | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Tetrachloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 1.5 | 16 | 1.6 | 4.5 | 4.7 | 12 | | | | | | | | 7.9 | 8.7 | | | | | | 0.86 | 0.28 | 1.8 | 4.9 | 0.85 | 0.3 | 1.1 | 1.6 | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | NA | | NA | | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.31 | | | | | | | | | | | | | 0.31 | | | | | | | 0.31 | | | | 0.31 | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Toluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 17 | 18 | 4.3 | 5.9 | 4 | 24 | | | | | | | | 7.2 | 4.1 | | | | | | 8.3 | 3.7 | 81 | 38 | 10 | 0.72 | 26 | 26 | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 2.6 | | | | | | | | | | | | | 2.6 | | | | | | | 2.6 | | | | 2.6 | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **trans-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.61 | <0.62 | <0.6 | <1.2 | <0.65 | <1 | | | | | | | | <0.6 | <0.62 | | | | | | <0.62 | <0.6 | <0.6 | <0.62 | <0.62 | <0.6 | <0.62 | <0.6 | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.6 | | | | | | | | | | | | | <0.6 | | | | | | | <0.6 | | | | <0.6 | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Trichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | <0.17 | 4.2 | <0.16 | 2.3 | 0.44 | 0.33 | | | | | | | | 0.25 | 0.18 | | | | | | <0.17 | <0.16 | 0.22 | <0.17 | 0.34 | 0.17 | 0.21 | <0.16 | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | 0.28 | | | | | | | | | | | | | 0.28 | | | | | | | 0.28 | | | | 0.28 | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Vinyl chloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | 0.044 | 0.084 | <0.039 | <0.08 | <0.042 | <0.068 | | | | | | | | 0.06 | <0.04 | | | | | | 0.053 | <0.039 | <0.039 | <0.04 | <0.04 | <0.039 | <0.04 | <0.039 | | | | | | | |
| Oct-99 | Ground Water | ug/l | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ambient Air | ug/m^3 | PSC | <0.039 | | | | | | | | | | | | | <0.039 | | | | | | | <0.039 | | | | <0.039 | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | **1,1,1-Trichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 450 | 2400 | 910 | 990 | 340 | | | | | 19 | 50 | 110 | 54 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 379 | 174 | 144 | 264 | 3.98 | | | | | NA | <1 | 3.56 | 1.02 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | 2.4 | | | | | | | | | | | | | 2.4 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | 3 | | | | | | | | | | | | | 2.1 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | NA | | | | | | | | | | | | | | | NA | | | | | | |
| | Indoor Air | ug/m^3 | DOH | <1.48 | | | | | | | | | | | | | <1.48 | | | | | | | | | | | 4.42 | | | | | | | | | <1.48 | |
| | **1,1-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 6.3 | 330 | 100 | 0.49 | 3.6 | | | | | <0.48 | <0.13 | 2.1 | <0.12 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 815 | 64.1 | 226 | 465 | 26.8 | | | | | NA | <1 | 10.8 | 3.43 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | <0.12 | | | | | | | | | | | | | <0.12 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | <0.11 | | | | | | | | | | | | | <0.28 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | 59.96 | | | | | | | | | | | | | | | 45.12 | | | | | | |
| | Indoor Air | ug/m^3 | DOH | <1.34 | | | | | | | | | | | | | <1.34 | | | | | | | | | | | <1.34 | | | | | | | | | <1.34 | |
| | **1,1-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | <0.082 | <0.61 | 3 | <0.24 | <0.16 | | | | | <0.24 | <0.062 | <0.065 | <0.06 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 6.88 | 7.27 | 4.57 | 4.72 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | <0.058 | | | | | | | | | | | | | <0.058 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | <0.055 | | | | | | | | | | | | | <0.14 | | | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | 0.71 | | | | | | | | | | | | | | | 0.87 | | | | | | |
| | Indoor Air | ug/m^3 | DOH | <2.06 | | | | | | | | | | | | | <2.06 | | | | | | | | | | | <2.06 | | | | | | | | | <2.06 | |
| | **1,2-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | <0.17 | <1.2 | <0.61 | <0.49 | <0.33 | | | | | <0.48 | <0.13 | <0.13 | <0.12 | | | | | | | | | | | | | | | | | |

**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | 5409 Denver | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| | Ground Water | ug/l | PSC | | | | | | | 3.69 | <1 | 3.5 | 2.45 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 0.18 | | | | | | | | | | 0.18 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 0.2 | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 0.81 | | | | | | | | | | | | 0.69 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <2.84 | | | | | | | | | | 5.91 | | | | | | | | | <2.84 | | | | | | | | | <1.48 | |
| | **Benzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 1.9 | 2.8 | 4.4 | 4.2 | 4.1 | | | | | 2.2 | 2.4 | 2.9 | 2.2 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 5.4 | | | | | | | | | | 5.4 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 3.9 | | | | | | | | | | 1.6 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 29.95 | | | | | | | | | | | | 6.39 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <1.3 | | | | | | | | | | <1.3 | | | | | | | | | 0.65 | | | | | | | | | 1.5 | |
| | **Benzene, 1,2,4-trimethyl** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | NA | | | | | | | | | NA | |
| | **Benzene, 1,3,5-trimethyl-** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | <0.37 | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | <0.12 | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | NA | | | | | | | | | NA | |
| | **Carbon tetrachloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 61 | 320 | 120 | <0.76 | <0.51 | | | | | <0.75 | 6.9 | <0.2 | <0.19 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 0.8 | | | | | | | | | | 0.8 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 1 | | | | | | | | | | 0.67 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 0.69 | | | | | | | | | | | | 1.7 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <1.12 | | | | | | | | | | <1.12 | | | | | | | | | <1.12 | | | | | | | | | <1.12 | |
| | **Chloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 22.7 | <1 | 2.63 | 3.94 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | NA | | | | | | | | | NA | |
| | **Chloroform** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 160 | 14 | 5.7 | 5.6 | 3.6 | | | | | <0.58 | <0.15 | 0.3 | 0.26 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | 3.3 (J) | 1.15(J) | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 0.27 | | | | | | | | | | 0.27 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 0.83 | | | | | | | | | | 0.37 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 3.32 | | | | | | | | | | | | 0.98 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | 2.2 | | | | | | | | | | <1.7 | | | | | | | | | <1.7 | | | | | | | | | <1.7 | |
| | **cis-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | <0.16 | 160 | 39 | <0.48 | <0.32 | | | | | <0.47 | <0.12 | <0.13 | <0.12 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 618 | 144 | 217 | 428 | 3.81 | | | | | NA | <1 | 12.9 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | <0.12 | | | | | | | | | | <0.12 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | <0.11 | | | | | | | | | | <0.27 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 10.82 | | | | | | | | | | | | 16.49 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <1.14 | | | | | | | | | | <1.14 | | | | | | | | | <1.14 | | | | | | | | | <1.14 | |
| | **Ethylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 54 | 29 | 84 | 4.5 | 10 | | | | | <0.52 | 32 | 9.7 | 23 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 0.68 | | | | | | | | | | 0.68 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 1.9 | | | | | | | | | | 0.8 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 2.55 | | | | | | | | | | | | 7.79 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <2.7 | | | | | | | | | | <2.7 | | | | | | | | | <2.7 | | | | | | | | | 8.25 | |
| | **Naphthalene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |

**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | 5409 Denver | | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | NA | | | | | | | | | | NA | |
| | **n-Propylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | NA | | | | | | | | | | NA | |
| | **p-Isopropyltoluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | NA | | | | | | | | | | NA | |
| | **sec-Butylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | NA | NA | NA | NA | NA | | | | | NA | NA | NA | NA | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | NA | | | | | | | | | | NA | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | NA | | | | | | | | | | NA | | | | | | | | NA | | | | | | | | | | NA | |
| | **Tetrachloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 33 | 10 | 5.3 | 39 | 61 | | | | | 21 | 75 | 63 | 61 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 2.7 | | | | | | | | | | 2.7 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 2.3 | | | | | | | | | | 1.4 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 25.22 | | | | | | | | | | | | 10.17 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <2.64 | | | | | | | | | | <2.98 | | | | | | | | <2.98 | | | | | | | | | | 6.44 | |
| | **Toluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 7.2 | 6.5 | 7.6 | 4.1 | 6.2 | | | | | 1.5 | 6.7 | 4.1 | 5.3 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | <1 | <1 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 8.3 | | | | | | | | | | 8.3 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 23 | | | | | | | | | | 13 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 349.98 | | | | | | | | | | | | 23.81 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | 9.42 | | | | | | | | | | 21.1 | | | | | | | | 22.98 | | | | | | | | | | 33.9 | |
| | **trans-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | <0.16 | 2.8 | 1.9 | <0.48 | <0.32 | | | | | <0.47 | <0.12 | <0.13 | <0.12 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 2.18 | <1 | 2.2 | 1.44 | <1 | | | | | NA | <1 | <1 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | <0.12 | | | | | | | | | | <0.12 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | <0.11 | | | | | | | | | | <0.27 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | NA | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <2.54 | | | | | | | | | | <2.54 | | | | | | | | <2.54 | | | | | | | | | | <2.54 | |
| | **Trichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | 8.9 | 3.9 | 22 | 3.8 | <0.44 | | | | | 2.7 | 0.5 | 1.1 | 0.29 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | <1 | <1 | 16.5 | <1 | <1 | | | | | NA | <1 | 1.16 | <1 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | 6.7 | | | | | | | | | | 6.7 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 3.3 | | | | | | | | | | 4.4 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 3.06 | | | | | | | | | | | | 12.52 | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <2.84 | | | | | | | | | | <2.84 | | | | | | | | 17.19 | | | | | | | | | | 1.42 | |
| | **Vinyl chloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | <0.053 | <0.39 | <0.19 | <0.16 | <0.1 | | | | | <0.15 | <0.04 | <0.042 | <0.039 | | | | | | | | | | | | | | | | | |
| | Ground Water | ug/l | PSC | | | | | | | 97.3 | <1 | 8.88 | 18 | <1 | | | | | NA | <1 | <1 | 7.21 | | | | | | | | | | | | | | | | | |
| Aug-00 | Ambient Air | ug/m^3 | PSC | | | | | | | <0.037 | | | | | | | | | | <0.037 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | PSC | | | | | | | 0.15 | | | | | | | | | | <0.087 | | | | | | | | | | | | | | | | | | | |
| | Indoor Air | ug/m^3 | EPA | | | | | | | | | | | | | | | | | 1.05 | | | | | | | | | | | | NA | | | | | | | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | <1.48 | | | | | | | | | | <1.48 | | | | | | | | <1.48 | | | | | | | | | | <1.48 | |
| | **1,1,1-Trichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 1800 | 1600 | | | | | | | 65 | | | | | | | | | 27000 | 3300 | 0.35 | <17 | <16 | <17 | 1000 | 1100 |
| Mar-01 | Ground Water | ug/l | PSC | | | | | | | 39.8 | | | | | | | | | | 34.0 | | | | | | | | | | | | 123 | 4.10 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | | | | | | | 0.39 | | | | | | | | | | 0.39 | | | | | | | | | | | | 0.39 | | 0.25 | 0.25 | 0.25 | 0.25 | 0.39 | |
| | Indoor Air | ug/m^3 | DOH | | | | | | | 4.94 | | | | | | | | | | 3.49 | | | | | | | | | | | | 122.02 | | <5.55 | <5.55 | <5.55 | <5.55 | <1.48 | |
| | **1,1-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 480 | 520 | | | | | | | <0.26 | | | | | | | | | 4700 | 260 | <0.12 | <13 | <12 | <12 | 4200 | 4600 |
| Mar-01 | Ground Water | ug/l | PSC | | | | | | | 95.7 | | | | | | | | | | 169 | | | | | | | | | | | | 177 | 6.32 | 1.99 | <1 | <1 | 58.4 | | |

**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | 5409 Denver | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| | Ambient Air | ug/m^3 | PSC | <0.14 | | | | | | | | | | | | <0.14 | | | | | | | | | | | | | | <0.14 | | <0.12 | <0.12 | <0.12 | <0.12 | <0.14 | |
| | Indoor Air | ug/m^3 | DOH | <4.11 | | | | | | | | | | | | <4.11 | | | | | | | | | | | | | | 23.45 | | <4.11 | <4.11 | <4.11 | <4.11 | <1.34 | |
| | **1,1-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <0.38 | <0.3 | | | | | | | <0.12 | | | | | | | | | <6.9 | <6.2 | <0.059 | <6.2 | <5.9 | <6.1 | <1.2 | <1.3 |
| Mar-01 | Ground Water | ug/l | PSC | <1 | | | | | | | | | | | | <1 | | | | | | | | | | | | | | 5.96 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | <0.068 | | | | | | | | | | | | <0.068 | | | | | | | | | | | | | | <0.068 | | <0.06 | <0.06 | <0.06 | <0.06 | <0.068 | |
| | Indoor Air | ug/m^3 | DOH | <4.03 | | | | | | | | | | | | <4.03 | | | | | | | | | | | | | | 1.45 | | <4.03 | <4.03 | <4.03 | <4.03 | <2.06 | |
| | **1,2-Dichloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <0.77 | <0.61 | | | | | | | <0.26 | | | | | | | | | <14 | <13 | <0.12 | <13 | <12 | <12 | <2.4 | <2.6 |
| Mar-01 | Ground Water | ug/l | PSC | <1 | | | | | | | | | | | | <1 | | | | | | | | | | | | | | <1 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | <0.14 | | | | | | | | | | | | <0.14 | | | | | | | | | | | | | | <0.14 | | <0.12 | <0.12 | <0.12 | <0.12 | <0.14 | |
| | Indoor Air | ug/m^3 | DOH | <4.11 | | | | | | | | | | | | <4.11 | | | | | | | | | | | | | | <4.11 | | <4.11 | <4.11 | <4.11 | <4.11 | <1.48 | |
| | **Benzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 1.0 | 0.69 | | | | | | | 0.32 | | | | | | | | | 19 | 11 | 2.7 | 15 | 14 | <9.9 | <1.9 | <2 |
| Mar-01 | Ground Water | ug/l | PSC | 2.73 | | | | | | | | | | | | 38.2 | | | | | | | | | | | | | | <1 | <1 | <1 | 2.08 | <1 | 9.48 | | |
| | Ambient Air | ug/m^3 | PSC | 3.1 | | | | | | | | | | | | 3.1 | | | | | | | | | | | | | | 3.1 | | 2.2 | 2.2 | 2.2 | 2.2 | 6.39 | |
| | Indoor Air | ug/m^3 | DOH | 1.88 | | | | | | | | | | | | 1.53 | | | | | | | | | | | | | | 1.49 | | 6.17 | 9.74 | 3.9 | 1.79 | 1.5 | |
| | **Benzene, 1,2,4-trimethyl** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <0.93 | <0.74 | | | | | | | <0.31 | | | | | | | | | <17 | <15 | 0.84 | <15 | <14 | <15 | <3 | <3.2 |
| Mar-01 | Ground Water | ug/l | PSC | 106 | | | | | | | | | | | | 184 | | | | | | | | | | | | | | <1 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | 1.8 | | | | | | | | | | | | 1.8 | | | | | | | | | | | | | | 1.8 | | 1.2 | 1.2 | 1.2 | 1.2 | 1.8 | |
| | Indoor Air | ug/m^3 | DOH | 1.55 | | | | | | | | | | | | <5 | | | | | | | | | | | | | | 1.9 | | 3.5 | 2.5 | 2.1 | <5 | NA | |
| | **Benzene, 1,3,5-trimethyl-** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | Indoor Air | ug/m^3 | DOH | <5 | | | | | | | | | | | | <5 | | | | | | | | | | | | | | <5 | | <5 | <5 | <5 | <5 | NA | |
| | **Carbon tetrachloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <1.2 | <0.95 | | | | | | | <0.4 | | | | | | | | | <22 | <20 | 0.55 | <20 | <19 | <19 | <3.8 | <4 |
| Mar-01 | Ground Water | ug/l | PSC | <1 | | | | | | | | | | | | <1 | | | | | | | | | | | | | | <1 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | 0.54 | | | | | | | | | | | | 0.54 | | | | | | | | | | | | | | 0.54 | | 0.56 | 0.56 | 0.56 | 0.56 | 0.54 | |
| | Indoor Air | ug/m^3 | DOH | <6.4 | | | | | | | | | | | | <6.4 | | | | | | | | | | | | | | <6.4 | | <6.4 | <6.4 | <6.4 | <6.4 | <1.12 | |
| | **Chloroethane** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | 352 | | | | | | | | | | | | 401 | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | Indoor Air | ug/m^3 | DOH | <2.68 | | | | | | | | | | | | <2.68 | | | | | | | | | | | | | | <2.68 | | <2.68 | <2.68 | <2.68 | <2.68 | NA | |
| | **Chloroform** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 18 | 14 | | | | | | | 2.6 | | | | | | | | | 77 | 38 | 0.3 | <15 | <14 | <15 | 16 | 15 |
| Mar-01 | Ground Water | ug/l | PSC | <1 | | | | | | | | | | | | 1.13 | | | | | | | | | | | | | | 3.69 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | <0.17 | | | | | | | | | | | | <0.17 | | | | | | | | | | | | | | <0.17 | | <0.15 | <0.15 | <0.15 | <0.15 | <0.17 | |
| | Indoor Air | ug/m^3 | DOH | <4.96 | | | | | | | | | | | | <4.96 | | | | | | | | | | | | | | <4.96 | | <4.96 | 1.84 | <4.96 | <4.96 | <1.7 | |
| | **cis-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 64 | 74 | | | | | | | <0.25 | | | | | | | | | 1900 | 41 | <0.12 | <12 | <12 | <12 | 52 | 80 |
| Mar-01 | Ground Water | ug/l | PSC | 51.3 | | | | | | | | | | | | 21.9 | | | | | | | | | | | | | | 246 | 2.19 | <1 | 5.69 | 1.46 | 81.9 | | |
| | Ambient Air | ug/m^3 | PSC | <0.14 | | | | | | | | | | | | <0.14 | | | | | | | | | | | | | | <0.14 | | <0.12 | <0.12 | <0.12 | <0.12 | <0.14 | |
| | Indoor Air | ug/m^3 | DOH | <4.03 | | | | | | | | | | | | <4.03 | | | | | | | | | | | | | | 16.93 | | <4.03 | <4.03 | <4.03 | <4.03 | <1.14 | |
| | **Ethylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <0.82 | <0.66 | | | | | | | <0.27 | | | | | | | | | 100 | <14 | 0.92 | <14 | <13 | <13 | <2.6 | <2.8 |
| Mar-01 | Ground Water | ug/l | PSC | 130 | | | | | | | | | | | | 6950 | | | | | | | | | | | | | | <1 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | 1.3 | | | | | | | | | | | | 1.3 | | | | | | | | | | | | | | 1.3 | | 1 | 1 | 1 | 1 | 1.3 | |
| | Indoor Air | ug/m^3 | DOH | 1.32 | | | | | | | | | | | | <4.41 | | | | | | | | | | | | | | 6.18 | | 2.74 | 3.22 | 2.12 | <4.41 | 8.25 | |
| | **Naphthalene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | 58.6 | | | | | | | | | | | | 20.5 | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | Indoor Air | ug/m^3 | DOH | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | **n-Propylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | Indoor Air | ug/m^3 | DOH | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | **p-Isopropyltoluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |

**Table 2-1**
Empirical Data from Co-located Groundwater, Soil Gas, and Indoor Air Samples

| | | | | 672 Lucile | | | | | | | | | | | | 5409 Denver | | | | | | | between 5409 & 5327 Denver | | | | 5327 Denver | | | | 710 Lucile (SDAJ) | | 303 Brandon | 134 Mead | 125 Findlay | 412 Orcas | 5400 Denver (WSS) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sample Location | units | Sampled By | SG-6 | SG-6 | SG-7 | SG-7 | SG-8 | SG-8 | 672L-1 | 672L-2 | 672L-3 | 672L-4 | 672L-5 | CG-3 SG | CG-4-SG | SG-5 | SG-5 | ISG-5409-1 | 5409D-1 | 5409D-2 | 5409D-3 | CG-2-SG | SG-3 | SG-3 | SG-4 | SG-4 | SG-1 | SG-1 | SG-2 | SG-2 | SG-9 | SG-14 | SG-10 | SG-12 | SG-13 | SG-15 | CG-5-SG | CG-6-SG |
| | Indoor Air | ug/m^3 | DOH | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | **sec-Butylbenzene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | NA | NA | | | | | | | NA | | | | | | | | | NA | NA | NA | NA | NA | NA | NA | NA |
| Mar-01 | Ground Water | ug/l | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | | NA | NA | NA | NA | NA | NA | | |
| | Ambient Air | ug/m^3 | PSC | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | Indoor Air | ug/m^3 | DOH | NA | | | | | | | | | | | | NA | | | | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | |
| | **Tetrachloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 15 | 17 | | | | | | | 30 | | | | | | | | | 44 | 550 | 0.39 | <21 | 30 | <21 | 330 | 380 |
| Mar-01 | Ground Water | ug/l | PSC | 1.36 | | | | | | | | | | | | 2.56 | | | | | | | | | | | | | | | 13.2 | 3.02 | <1 | <1 | 7.37 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | 0.33 | | | | | | | | | | | | 0.33 | | | | | | | | | | | | | | | 0.33 | | 0.26 | 0.26 | 0.26 | 0.26 | 0.33 | |
| | Indoor Air | ug/m^3 | DOH | <6.89 | | | | | | | | | | | | 2.48 | | | | | | | | | | | | | | | 2.14 | | <6.89 | <6.89 | <6.89 | <6.89 | 6.44 | |
| | **Toluene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 4.5 | 2.8 | | | | | | | 0.56 | | | | | | | | | 1200 | 13 | 6.2 | 150 | 13 | <12 | <2.3 | <2.4 |
| Mar-01 | Ground Water | ug/l | PSC | 3.48 | | | | | | | | | | | | 2240 | | | | | | | | | | | | | | | <1 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | 7.3 | | | | | | | | | | | | 7.3 | | | | | | | | | | | | | | | 7.3 | | 5.6 | 5.6 | 5.6 | 5.6 | 7.3 | |
| | Indoor Air | ug/m^3 | DOH | 11.87 | | | | | | | | | | | | 9.19 | | | | | | | | | | | | | | | 12.64 | | 20.68 | 34.47 | 24.51 | 6.51 | 33.9 | |
| | **trans-1,2-Dichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <3.8 | 2.9 | | | | | | | <1.2 | | | | | | | | | <69 | <62 | <0.59 | <62 | <59 | <61 | <12 | <13 |
| Mar-01 | Ground Water | ug/l | PSC | 5.89 | | | | | | | | | | | | 3.95 | | | | | | | | | | | | | | | 5.82 | <1 | <1 | <1 | <1 | <1 | | |
| | Ambient Air | ug/m^3 | PSC | <0.68 | | | | | | | | | | | | <0.68 | | | | | | | | | | | | | | | <0.68 | | <0.6 | <0.6 | <0.6 | <0.6 | <0.68 | |
| | Indoor Air | ug/m^3 | DOH | <4.03 | | | | | | | | | | | | <4.03 | | | | | | | | | | | | | | | <4.03 | | <4.03 | <4.03 | <4.03 | <4.03 | <2.54 | |
| | **Trichloroethylene** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | 6.7 | 6.8 | | | | | | | <0.34 | | | | | | | | | 1300 | 2900 | 0.18 | <17 | <16 | <17 | 71 | 89 |
| Mar-01 | Ground Water | ug/l | PSC | 1.3 | | | | | | | | | | | | 2.22 | | | | | | | | | | | | | | | 71.2 | 8.83 | <1 | <1 | 5.93 | 1.69 | | |
| | Ambient Air | ug/m^3 | PSC | <0.18 | | | | | | | | | | | | <0.18 | | | | | | | | | | | | | | | <0.18 | | <0.16 | <0.16 | <0.16 | <0.16 | <0.18 | |
| | Indoor Air | ug/m^3 | DOH | <5.46 | | | | | | | | | | | | 2.46 | | | | | | | | | | | | | | | 11.47 | | <5.46 | 5.24 | <5.46 | 8.74 | 1.42 | |
| | **Vinyl chloride** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Soil Gas | ug/m^3 | PSC | | | | | | | | | | | | <0.24 | <0.19 | | | | | | | <0.08 | | | | | | | | | 5.4 | <4 | <0.038 | <4 | <3.8 | <3.9 | <0.77 | <0.82 |
| Mar-01 | Ground Water | ug/l | PSC | 4.98 | | | | | | | | | | | | 48.7 | | | | | | | | | | | | | | | 73.1 | <1 | <1 | 3.39 | <1 | 93.9 | | |
| | Ambient Air | ug/m^3 | PSC | <0.044 | | | | | | | | | | | | <0.044 | | | | | | | | | | | | | | | <0.044 | | <0.039 | <0.039 | <0.039 | <0.039 | <0.044 | |
| | Indoor Air | ug/m^3 | DOH | <2.6 | | | | | | | | | | | | <2.6 | | | | | | | | | | | | | | | <2.6 | | <2.6 | <2.6 | <2.6 | <2.6 | <1.48 | |

Notes: A blank cell indicates that no sample was collected.
NA indicates that a sample was collected for this matrtix, but not analyzed for this compound.
< indicates the reporting limit for a compound not detected in a sample.
All air data collected via Summa canisters.
All groundwater data collected approximately at the water table.

For 2001 groundwater samples for 672 Lucile and 5409 Denver are from permanent wells CG-112-S1 and CG-113-S1 respectively.
Ambient air data was usually applied to more than one building near the location of the ambient air sample.
Ambient air sample summary:
1999: One sample was collected near 672 Lucile
2000: One sample was collected near 672 Lucile
2001: One sample was collected near 710 Lucile and one was collected near 125 Findlay.

**Table 2-2**
USCS Soil Classification based on Grain-Size Analysis
for Vadose Zone Soil Samples

| | Sample | H14 | H14 | H14 | S15 | S15 | S15 | K10 | K10 | K10 | K21 | K21 | K21 | M29 | M29 | M29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (ft bgs) | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 |
| | Sample Date | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 | 2/20/2002 |
| | Percent Passing through Sieve | | | | | | | | | | | | | | | |
| Sieve Size | 2" | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 1" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/4" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 1/2" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | #4 (4750um) | 100 | 100 | 100 | 99.6 | 100 | 100 | 100 | 99.6 | 100 | 99.7 | 100 | 99.9 | 97.8 | 100 | 99 |
| | #10 (2000um) | 100 | 100 | 100 | 98.7 | 100 | 100 | 100 | 99.3 | 100 | 99.3 | 99.8 | 99.7 | 96.2 | 99.8 | 98.2 |
| | #18 (1000um) | 99.7 | 99.1 | 99.8 | 97.7 | 99.9 | 99.9 | 99.2 | 98.4 | 99.9 | 98.4 | 99.5 | 99.2 | 93.8 | 99.4 | 96.1 |
| | #35 (500um) | 98.6 | 98.1 | 98.6 | 92 | 99 | 99 | 98 | 96.7 | 97.8 | 96.7 | 98.3 | 95.9 | 81.6 | 86.2 | 82.9 |
| | #60 (250um) | 91.8 | 95.8 | 90.8 | 49.2 | 90.6 | 91.8 | 96.7 | 95.3 | 88.3 | 90.9 | 93.8 | 80.3 | 47.6 | 18 | 6.3 |
| | #120 (125um) | 76.8 | 84.9 | 71.2 | 11.2 | 73.4 | 79.4 | 92.8 | 91.8 | 77 | 73.5 | 88.7 | 60.3 | 26.3 | 5.3 | 29.8 |
| | #230 (63um) | 68.2 | 60 | 47.5 | 6.4 | 61.9 | 70.5 | 68.4 | 74.8 | 64.3 | 59.9 | 82 | 52.6 | 18.9 | 3 | 25.3 |
| | 32um | 54.7 | 31.8 | 26.7 | 6.2 | 44.4 | 50.3 | 39.5 | 42.5 | 35.7 | 40.3 | 57.1 | 37.3 | 19 | 1.7 | 26.7 |
| | 22um | 45.4 | 21.9 | 20.9 | 5 | 30.7 | 38.9 | 30.1 | 28.9 | 25 | 38.5 | 38.6 | 25.4 | 16.1 | 1.7 | 23.4 |
| | 13um | 26.6 | 13.6 | 13.4 | 4.4 | 20.5 | 25.9 | 20.7 | 20.4 | 16 | 28 | 25.2 | 17.9 | 10.4 | 1.7 | 14.5 |
| | 9um | 20.3 | 12.1 | 10 | 3.7 | 15.4 | 19.5 | 16 | 11.9 | 12.5 | 21 | 20.1 | 14.9 | 8.5 | 1.7 | 12.3 |
| | 7um | 15.6 | 10.6 | 8.4 | 3.7 | 11.9 | 13.8 | 13.2 | 10.2 | 8.9 | 15.8 | 1.8 | 11.9 | 7.6 | 1.7 | 9.5 |
| | 3.2um | 7.8 | 7.6 | 5 | 2.5 | 8.5 | 13 | 7.5 | 8.5 | 5.3 | 12.3 | 13.4 | 6.7 | 4.3 | 0.8 | 5.6 |
| | 1.3um | 3.9 | 4.5 | 3.3 | 1.2 | 3.4 | 8.1 | 5.6 | 6.8 | 3.6 | 7 | 6.7 | 6 | 2.4 | 0.8 | 2.8 |
| | | | | | | | | | | | | | | | | |
| Coarse sand | 4750-2000um | 0 | 0 | 0 | 1.7 | 0 | 0 | 0 | 1.1 | 0 | 1 | 0.2 | 0.4 | 6 | 0.2 | 2.8 |
| Medium sand | 2000-500um | 1.4 | 1.9 | 1.4 | 6.3 | 1 | 1 | 2 | 2.2 | 2.2 | 2.3 | 1.5 | 3.7 | 12.4 | 13.6 | 14.3 |
| Fine sand | 500-63um | 30.4 | 38.1 | 51.1 | 85.6 | 37.1 | 28.5 | 29.6 | 21.9 | 33.5 | 36.8 | 16.3 | 43.3 | 62.7 | 83.2 | 57.6 |
| *Total Sand* | | 31.8 | 40 | 52.5 | 93.6 | 38.1 | 29.5 | 31.6 | 25.2 | 35.7 | 40.1 | 18 | 47.4 | 81.1 | 97 | 74.7 |
| Silt | 63-3um | 60.4 | 52.4 | 42.5 | 3.9 | 53.4 | 57.5 | 60.9 | 66.3 | 59 | 47.6 | 68.6 | 45.9 | 14.6 | 2.2 | 19.7 |
| Clay | <3um | 7.8 | 7.6 | 5 | 2.5 | 8.5 | 13 | 7.5 | 8.5 | 5.3 | 12.3 | 13.4 | 6.7 | 4.3 | 0.8 | 5.6 |
| | USDA | silt loam | silt loam | sandy loam | sand | silt loam | silt loam | silt loam | silt loam | silt loam | loam | silt loam | sandy loam | loamy sand | sand | sandy loam |
| Classification[1] | ASTM | sandy silt | sandy silt | silty sand | poorly-graded sand | sandy silt | silt with sand | sandy silt | silt with sand | sandy silt | sandy silt | silt with sand | silty sand | silty sand | poorly graded sand | silty sand |

**Notes:**

--- = no data available

um = microns

References

[1] Classifications provided by Rosa Environmental and Geotechnical Laboratory, July 15, 2002 (See Appendix C).

USDA - Unified Soil Classification System Chart from User's Guide for the Johnson and Ettinger (1991) Model (EQM, 2000).

ASTM - ATSM D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System).

**Table 2-2**
USCS Soil Classification based on Grain-Size Analysis
for Vadose Zone Soil Samples (continued)

| | Sample | D25 | D25 | D25 | CG-112 | CG-112 | CG-113 | CG-113 | 672L-4 | 5409D-3 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (ft bgs)<br>Sample Date | 4-6<br>2/22/2001 | 8-10<br>2/22/2001 | 14-16<br>2/22/2001 | 0-3<br>1/30/2001 | 3-6<br>1/30/2001 | 0-3<br>1/30/2001 | 3-6<br>1/30/2001 | 5.5-7.5<br>8/5/2000 | 5.5-7.5<br>8/5/2000 |
| | Percent Passing through Sieve | | | | | | | | | |
| Sieve Size | 2" | 100 | 100 | 100 | --- | --- | --- | --- | 100 | 100 |
| | 1" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/4" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 1/2" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8" | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | #4 (4750um) | 99.6 | 98.7 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | #10 (2000um) | 98.6 | 97.9 | 99.8 | 99.9 | 100 | 100 | 99.8 | 100 | 99.9 |
| | #20 (850um) | 97.4 | 96.6 | 95.7 | 99.8 | 99.7 | 99.9 | 99.4 | 99.5 | 98.2 |
| | #40 (425um) | 90.7 | 89.4 | 71.4 | 99.5 | 94.7 | 99.8 | 92.9 | 93.7 | 87.6 |
| | #60 (250um) | 70.7 | 48.3 | 26.2 | 97.8 | 77.3 | 99.4 | 64.9 | 76.9 | 50.6 |
| | #100 (150um) | 32.4 | 25.4 | 7.6 | 90.9 | 45.7 | 98.8 | 27.2 | 44.9 | 18.1 |
| | #200 (75um) | 9.5 | 10.7 | 1.7 | 77.7 | 25.4 | 94.7 | 8.1 | 15.1 | 6.7 |
| | 32um | --- | --- | --- | 48.4 | 16.3 | 57.1 | 2.8 | --- | --- |
| | 22um | --- | --- | --- | 36.8 | 15.5 | 41.1 | 2.8 | --- | --- |
| | 13um | --- | --- | --- | 25.1 | 13.8 | 25 | 2.8 | --- | --- |
| | 9um | --- | --- | --- | 19.7 | 13 | 20.5 | 2.8 | --- | --- |
| | 7um | --- | --- | --- | 15.2 | 10.6 | 14.3 | 2.1 | --- | --- |
| | 3.2um | --- | --- | --- | 8.1 | 5.7 | 8 | 1.4 | --- | --- |
| | 1.3um | --- | --- | --- | 4.5 | 4.9 | 4.5 | 0.7 | --- | --- |
| | | | | | | | | | | |
| Coarse sand | >4750um | 0.4 | 1.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Medium sand | 2000-425um | 8.9 | 9.3 | 28.6 | 0.5 | 5.3 | 0.2 | 7.1 | 6.3 | 12.4 |
| Fine sand | 425-75um | 81.2 | 78.7 | 69.7 | 21.8 | 69.3 | 5.1 | 84.8 | 78.6 | 80.9 |
| *Total Sand* | | *90.5* | *89.3* | *98.3* | *22.3* | *74.6* | *5.3* | *91.9* | 84.9 | 93.3 |
| Silt | 75-3um | 9.5 | 10.7 | 1.7 | 69.6 | 19.7 | 86.7 | 6.7 | 15.1 | 6.7 |
| Clay | <3um | --- | --- | --- | 8.1 | 5.7 | 8 | 1.4 | -- | --- |
| | USDA | sand | loamy-sand | sand | silt loam | sandy loam | silt | sand | loamy-sand | sand |
| Classification[1] | ASTM | poorly graded sand with silt | silty sand | | silt with sand | silty sand | silt | poorly graded sand with silt | silty sand | poorly graded sand with silt |

**Notes:**

--- = no data available

um = microns

References:

[1] Classifications provided by Rosa Environmental and Geotechnical Laboratory, July 15, 2002 (See Appendix C).

USDA - Unified Soil Classification System Chart from User's Guide for the Johnson and Ettinger (1991) Model (EQM, 2000).

ASTM - ATSM D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System).

**Table 2-3**
Summary of Geotechnical Results for Vadose Zone Soils

| Sample | Depth (ft bgs) | Sample Date | Moisture Content (%) | Water-filled Porosity | Dry Bulk Density ($lb/ft^3$) | Dry Bulk Density ($g/cm^3$) | Specific Gravity | Total Porosity | Permeability ($cm^2$) | Hydraulic Conductivity (cm/s)[1] | Total Organic Carbon (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-4 | 0-2 | 11/30/1999 | 16.2 | --- | 67.8 | 1.09 | 2.67 | 0.59 | 2.80E-10 | --- | 0.63 |
| SS-4 | 2-4 | 11/30/1999 | 12.8 | --- | 87.8 | 1.41 | 2.67 | 0.47 | 4.50E-10 | --- | 0.41 |
| SS-6 | 0-2 | 11/30/1999 | 11.7 | --- | 70.5 | 1.13 | 2.7 | 0.58 | 5.00E-10 | --- | 1.3 |
| SS-6 | 2-4 | 11/30/1999 | 9.5 | --- | 84.4 | 1.35 | 2.73 | 0.51 | 4.10E-10 | --- | 0.098 |
| D25 | 4-6 | 2/22/2001 | 1.4 | --- | 89.2 | 1.43 | 2.72 | --- | *1.37E-06* | 1.20E-02 | --- |
| D25 | 8-10 | 2/22/2001 | 5.8 | --- | 88.3 | 1.41 | 2.86 | --- | *9.05E-07* | 7.90E-03 | --- |
| CG-112 | 0-3 | 1/30/2001 | 18.1 | --- | 81.9 | 1.31 | 2.66 | 0.51 | --- | --- | 0.64 |
| CG-112 | 3-6 | 1/30/2001 | 7.2 | --- | 83.3 | 1.33 | 2.72 | 0.51 | --- | --- | 1.1 |
| CG-113 | 0-3 | 1/30/2001 | 27.1 | --- | 69.7 | 1.12 | 2.67 | 0.58 | --- | --- | 0.42 |
| CG-113 | 3-6 | 1/30/2001 | 10.1 | --- | 82.3 | 1.32 | 2.74 | 0.52 | --- | --- | 0.048 |
| H14 | 0-2 | 2/20/2002 | 30.2 | 0.83 | 83.9 | 1.34 | --- | 0.49 | *4.08E-09* | 3.56E-05 | --- |
| H14 | 2-4 | 2/20/2002 | 23.9 | 0.78 | 92.7 | 1.48 | --- | 0.45 | *4.85E-06* | 4.23E-02 | --- |
| H14 | 4-6 | 2/20/2002 | 21.6 | 0.71 | 91.5 | 1.47 | --- | 0.45 | *5.28E-07* | 4.61E-03 | --- |
| S15 | 0-2 | 2/20/2002 | 5.3 | 0.19 | 97.8 | 1.57 | --- | 0.43 | *2.57E-07* | 2.24E-03 | --- |
| S15 | 2-4 | 2/20/2002 | 21.2 | 0.96 | 104 | 1.67 | --- | 0.37 | *2.35E-09* | 2.05E-05 | --- |
| S15 | 4-6 | 2/20/2002 | 24.5 | 0.99 | 99.5 | 1.59 | --- | 0.39 | *9.56E-11* | 8.34E-07 | --- |
| K10 | 0-2 | 2/20/2002 | 22.1 | 0.57 | 82 | 1.31 | --- | 0.51 | *8.47E-10* | 7.39E-06 | --- |
| K10 | 2-4 | 2/20/2002 | 30.7 | 0.56 | 67.1 | 1.07 | --- | 0.59 | *1.62E-10* | 1.41E-06 | --- |
| K10 | 4-6 | 2/20/2002 | 24.5 | 0.82 | 93 | 1.49 | --- | 0.44 | *3.23E-09* | 2.82E-05 | --- |
| K21 | 0-2 | 2/20/2002 | 20.4 | 0.37 | 68.3 | 1.09 | --- | 0.59 | *3.19E-09* | 2.78E-05 | --- |
| K21 | 2-4 | 2/20/2002 | 22.5 | 0.84 | 94.6 | 1.52 | --- | 0.41 | *8.01E-11* | 6.99E-07 | --- |
| K21 | 4-6 | 2/20/2002 | 19.1 | 1 | 111.6 | 1.79 | --- | 0.33 | *2.03E-10* | 1.77E-06 | --- |
| M29 | 0-2 | 2/20/2002 | 7.9 | 0.36 | 106.3 | 1.70 | --- | 0.37 | *1.95E-06* | 1.70E-02 | --- |
| M29 | 2-4 | 2/20/2002 | 1.8 | 0.06 | 89.5 | 1.43 | --- | 0.47 | *3.95E-05* | 3.45E-01 | --- |
| M29 | 4-6 | 2/20/2002 | 12.3 | 0.28 | 77.3 | 1.24 | --- | 0.5 | *6.60E-06* | 5.76E-02 | --- |

Notes:
--- Data not available
[1] Hydraulic conductivity data were not collected for purposes of IPIM evaluation and are not reliable for estimating soil type. The measurement was made from samples collected using 1-1/4" acetate tubing rather than the brass Shelby tube (2-5/8") routinely used for this methodology. In some cases, the same sample was not used for both grain-size analysis and hydraulic conductivity.

**Table 3-1.** Proposed Sampling Locations for the GIVF Evaluation

| Address | Building Foundation Type |
|---|---|
| 601 South Brandon Street | Residence – with unknown foundation |
| 605 South Brandon Street | Residence – with unknown foundation |
| 611/613 South Brandon Street | Residence – with crawl space |
| 615 South Brandon Street | Residence – with crawl space |
| 5403 Maynard Avenue South | Residence – with basement |
| 5409 Denver Avenue South | Residence – with basement |
| 672 South Lucile Street | Residence – with basement |
| 616 South Lucile Street | Residence – with basement |
| 612 South Lucile Street | Residence – with basement |

**Table 3-2**
Chemical-Specific Data and Target Compounds Selected for GIVF Evaluation

| CAS # | Chemical of Potential Concern (COPC) | Groundwater Sample Count in Area 3 [6] | Frequency of Detect in Groundwater | Min Detect (ug/l) | Max Detect (ug/l) | Min NonDetect (ug/l) | Max NonDetect (ug/l) | Henry's Law Constant at 15°C (atm-m$^3$/mol) [1,4] | Diffusivity in Air (cm$^2$/s) [1,5] | Diffusivity in Water (cm$^2$/s) [1,5] | Soil Biodegradation Half Life [2] | Atmospheric Degradation Half Life [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **71556** | **1,1,1-Trichloroethane [3]** | **89** | **28%** | **1.2** | **220** | **0.166** | **20** | **1.09E-02** | **7.80E-02** | **8.80E-06** | **20 wks - 39 wks** | **225 days - 6.2 yrs** |
| **75343** | **1,1-Dichloroethane** | **89** | **45%** | **1.21** | **379** | **0.037** | **20** | **3.64E-03** | **7.42E-02** | **1.05E-05** | **32 days - 22 wks** | **10.3 days - 103 days** |
| **75354** | **1,1-Dichloroethylene** | **90** | **11%** | **0.33 J** | **9.9** | **0.059** | **20** | **1.80E-02** | **9.00E-02** | **1.04E-05** | **4 wks - 6 months** | **9.9 hrs - 4.1 days** |
| 95636 | 1,2,4-trimethylbenzene | 11 | **55%** | 52.1 | 405 | 1 | 1 | 2.48E-03 | 7.50E-02 | 7.10E-06 | 7 days - 4 wks | 1.6 hrs - 16 hrs |
| **107062** | **1,2-Dichloroethane** | **90** | **8%** | **0.754** | **9.95** | **0.033** | **20** | **5.96E-04** | **1.04E-01** | **9.90E-06** | **100 days - 6 months** | **12.2 days - 122 days** |
| 108678 | 1,3,5-Trimethylbenzene | 2 | 0% | - | - | 1 | 1 | 3.34E-03 | 7.50E-02 | 7.10E-06 | 7 days - 4 wks[a] | 1.6 hrs - 16 hrs[a] |
| 591786 | 2-Hexanone (MIBK as surrogate) | 53 | 0% | - | - | 1.02 | 100 | 7.88E-05 | 7.50E-02 | 7.80E-06 | 1 day - 7 days | 4.6 hrs - 1.9 days |
| 71432 | Benzene | 90 | 17% | 1.19 | 38.2 | 0.041 | 60 | 3.47E-03 | 8.80E-02 | 9.80E-06 | 5 days - 16 days | 2.09 days - 20.9 days |
| **75003** | **Chloroethane** | **53** | **23%** | **1.1** | **789** | **0.291** | **2** | **7.81E-03** | **1.04E-01** | **1.15E-06** | **7 days - 4 wks** | **6.67 days - 66.8 days** |
| 67663 | Chloroform | 53 | 11% | 0.666 J | 5.4 | 0.168 | 10 | 2.36E-03 | 1.04E-01 | 1.00E-05 | 4 wks - 6 months | 26 days - 260 days |
| **156592** | **cis-1,2-Dichloroethylene** | **90** | **34%** | **1.04** | **349** | **0.04** | **65** | **2.59E-03** | **7.36E-02** | **1.13E-05** | **4 wks - 6 months** | **1.1 days - 11.9 days** |
| 100414 | Ethylbenzene | 52 | 17% | 1.09 | 15700 | 0.142 | 15 | 4.36E-03 | 7.50E-02 | 7.80E-06 | 3 days - 10 days | 8.56 hrs - 3.57 days |
| 91203 | Napthalene | 35 | 23% | 11.3 | 58.6 | 0.1 | 10 | 2.27E-04 | 5.90E-02 | 7.50E-06 | 16.6 days - 48 days | 2.96 hrs - 29.6 hrs |
| 103651 | n-Propylbenzene | 2 | 0% | - | - | 1 | 1 | 7.25E-03 | 7.50E-02 | 7.80E-06 | - | - |
| 99876 | p-Isopropyltoluene[c] | 2 | 0% | - | - | 1 | 1 | 1.10E-02 | - | - | - | - |
| 135988 | sec-Butylbenzene | 2 | 0% | - | - | 1 | 1 | 8.44E-03 | 7.50E-02 | 7.80E-06 | - | - |
| **127184** | **Tetrachloroethylene** | **90** | **10%** | **0.596** | **3.14** | **0.06** | **20** | **1.05E-02** | **7.20E-02** | **8.20E-06** | **6 months - 1 yr** | **16 days - 160 days** |
| 108883 | Toluene | 53 | 15% | 2.61 | 4060 | 0.149 | 63 | 3.89E-03 | 8.70E-02 | 8.60E-06 | 4 days - 22 days | 10 hrs - 4.3 days |
| 79016 | Trichloroethylene | 90 | 39% | 0.582 J | 147 | 0.051 | 20 | 6.26E-03 | 7.90E-02 | 9.10E-06 | 6 months - 1 year | 1.1 days - 11.3 days |
| **156605** | **trans-1,2-Dichloroethylene** | **90** | **13%** | **1.25** | **9.97** | **0.048** | **375** | **6.20E-03** | **7.07E-02** | **1.19E-05** | **4 wks - 6 months[b]** | **1.1 days - 11.9 days[b]** |
| **75014** | **Vinyl chloride** | **90** | **16%** | **2** | **2500** | **0.102** | **20** | **2.03E-02** | **1.06E-01** | **1.23E-06** | **4 wks - 6 months** | **9.7 hrs - 97 hrs** |

**Notes and References**

1. Vlookup table from Johnson and Ettinger Model (EQM, 2000)

2. Howard et. al., 1991. Handbook of Environmental Degradation Rates, Lewis Publishers Inc., Chelsea, MI

3. Chemicals designated in bold are selected as target compounds for GIVF evaluation. Depending on the nature of the data collected, additional chemicals (i.e., some of the chemicals not bolded in the current table) may be treated as target compounds for purposes of calculating chemical-specific GIVFs.

4. Henry's Law Constant (atm-m$^3$/mol) - determines the amount of constituent in the vapor phase relative to the dissolved phase under equilibrium conditions. Increasing values indicate increased volatilization from groundwater to soil gas. Values obtained from JE Intercalcs page.

5. Diffusivity in Air/Water - Diffusion of soil vapors can be a major component, depending on porosity and moisture content. Increased diffusivity in air indicates higher mobility as a function of porosity and moisture content)

6. Data include direct push and monitoring well data from Area 3, shallow aquifer (to 15 feet bgs), collected through second quarter 2001.

[a] Assumed to be same range as 1,2,4-trimethylbenzene

[b] Not distinguished in literature from cis form

**Table 3-3 (Draft)**
Typical Indoor Air Concentrations and Average Urban Ambient Air Concentrations of COPCs

| CAS Number | Analyte Name | Typical Indoor Air Concentrations in Residences (µg/m$^3$) | Reference(s) | Average Urban Ambient Air Concentrations[a,b] (µg/m$^3$) |
|---|---|---|---|---|
| 71-55-6 | 1,1,1-Trichloroethane | 14-24, 21-22.1, 271, 5-20 | 1, 2, 3, 5 | 2.20 |
| 75-34-3 | 1,1-Dichloroethane | 8, 0.6-1.1 | 2, 6 | 0.05 |
| 75-35-4 | 1,1-Dichloroethylene | <0.2, 79.26 | 1, 3 | 0.00 |
| 95-63-6 | 1,2,4-trimethylbenzene | 2.87, 2.87, 5-20 | 3, 4, 5 | 5.00 |
| 107-06-2 | 1,2-Dichloroethane | <0.8, 0.39 | 1, 3 | 0.05 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 4.57, 4.57, 2-5 | 3, 4, 5 | 1.00 |
| 108-10-1 | 2-Hexanone (MIBK as surrogate) | - | - | - |
| 71-43-2 | Benzene | 0.28-16.4, 11.5-18.7, 16.76, 10-20, 20 | 1, 2, 3, 5, 6 | 5.88 |
| 75-00-3 | Chloroethane | - | - | 0.28 |
| 67-66-3 | Chloroform | 4.13, 4.1, 3-15 | 3, 4, 5 | 0.30 |
| 156-59-2 | cis-1,2-Dichloroethylene | 41 | 6 | 0.20 |
| 100-41-4 | Ethylbenzene | 5.02-6.64, 8.3-11.1, 12.74, 10-20, 4.4 | 1, 2, 3, 5, 6 | 2.72 |
| 91-20-3 | Naphthalene | 2-5 | 5 | - |
| 103-65-1 | n-Propylbenzene | 0.649, 2-6 | 3, 5 | 0.83 |
| 99-87-6 | p-Isopropyltoluene | - | - | - |
| 135-98-8 | sec-Butylbenzene | - | - | 0.27 |
| 127-18-4 | Tetrachloroethylene | 2.27-6.72, 6.6, 21.07, 5-20, 10 | 1, 2, 3, 5, 6 | 2.55 |
| 108-88-3 | Toluene | 2.67, 28.3, 65-150, 27-62 | 3, 4, 5, 6 | 11.04 |
| 79-01-6 | Trichloroethylene | 0.63-3.97, 5-20 | 1, 5 | - |
| 156-60-5 | trans-1,2-Dichloroethylene | 7.358, 41 | 3, 6 | 1.12 |
| 75-01-4 | Vinyl chloride | <40 | 1 | 0.00 |

References:


[1] California Air Resources Board. Toxic Contaminant Fact Sheets. Available URL: www.arb.ca.gov/toxics/tac

[2] Guerin M.R., R.A. Jenkins , and B.A. Tompkins. *The Chemistry of Environmental Tobacco Smoke: Composition and Measurement* . CRC Press. p. 385-4

[3] Shah, Jitendra J. and Emily K. Heyerdahl. *National Ambient Volatile Organic Compounds (VOCs) Data Base Update* . EPA/600/3-38/010a. March 1988.

[4] Shah, Jitendra J. and Hanwant B. Singh. *Distribution of Volatile Organic Chemicals in Outdoor and Indoor Air* . Environmental Science Technology,

[5] Travis, Curtis (Editor-in-Chief). *Risk Analysis* , Vol 10, No 1. March 1990.[f]

[6] United States Environmental Protection Agency (EPA). *Report to Congress on Indoor Air Quality, Volume II: Assessment and Control of Indoor Air Pollu* August 1989.


Notes:

This table is preliminary, and these are not the screening values that will be used. This table will be replaced with a new table that will be presented to Ecology in Tech Memo 1.

'-' symbol corresponds to chemical concentrations that were not found in readily-available literature

[a] Concentration values from Shah and Heyerdahl, 1988

[b] Concentration values are for ambient (outdoor) air in urban areas

[c] Concentration values are for diesel exhaust; range is for office buildings to industrial plants and inside vehicles (average of enclosed environments is 2.1 µg/

[d] Concentration value range is derived from median in-vehicle values for individual components of gasoline vapors, including isopentane, n-butane, n-pentane 1,2,4-trimethylbenzene, 1,3-butadiene, and benzene

[e] Concentration values include average daily indoor concentration for all site types (i.e., urban, rural, remote, etc.)

[f] Range of values includes concentrations from the 50th to 90th percentiles

**Table 3-4**
Conservative JEM Input Parameters for Calculating Adjustment Factor

| JE Model Input Parameters | Values Selected for JEM Parameters | Units | Range of Input Values |
|---|---|---|---|
| Soil Temperature | 15 | C | site-specific |
| Depth below grade to Bottom of Floor | 100 | cm | 15-200 |
| Depth below grade to water table | 305 | cm | site-specific |
| Thickness of Soil Stratum A | 305 | cm | site-specific |
| Thickness of Soil Stratum B | 0 | cm | site-specific |
| SCS soil type above water table (Strata B) | Not Used | | NA |
| SCS soil type Strata A | Loamy Sand[1] | | site-specific |
| Soil dry bulk density of Stratum A | 1.32 | $gm/cm^3$ | 1.25-1.75 |
| Soil Total Porosity of Stratum A | 0.39 | $cm^3/cm^3$ | 0.34 - 0.53 |
| Soil Water-filled Porosity of Stratum A | 0.076 | $cm^3/cm^3$ | 0.02-0.43 |
| Soil Dry bulk density of Stratum B | Not Used | $gm/cm^3$ | NA |
| Total soil porosity of Stratum B | Not Used | $cm^3/cm^3$ | NA |
| Soil Water-filled porosity of Stratum B | Not Used | $cm^3/cm^3$ | NA |
| Enclosed space floor thickness | 15 | cm | site-specific |
| Crack radius | 0.1 | cm | 0.05 - 1 |
| Soil-bldg Pressure Differential | 40 | $g/cm\text{-}s^2$ | 0-200 |
| Building length | 961 | cm | site-specific |
| Building width | 961 | cm | site-specific |
| Enclosed space height | 244 | cm | site-specific |
| Building Air Exchange Rate | 0.45 | $h^{-1}$ | 0.18-1.26 |

Note - Parameters selected for input to Johnson and Ettinger Model for Vapor Transport into Buildings (EQM 2000).

[1]Identification of the entire affected area as best represented by loamy sand may need to

**Table 3-5**

Inhalation Pathway Interim Measure Action Levels (IPIMALs) for Indoor Air

| | | Indoor Air | |
|---|---|---|---|
| **CAS #** | **Analyte** | **IPIMAL[a] Residential ($\mu g/m^3$)** | **IPIMAL[a] Commercial ($\mu g/m^3$)** |
| 71-55-6 | 1,1,1-Trichloroethane | 460 | 1,950 |
| 75-34-3 | 1,1-Dichloroethane | 230 | 973 |
| 75-35-4 | 1,1-Dichloroethylene | 0.04 | 0.12 |
| 95-63-6 | 1,2,4-trimethylbenzene | 2.7 | 12 |
| 107-06-2 | 1,2-Dichloroethane | 0.07 | 0.22 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 2.7 | 12 |
| 591-78-6 | 2-Hexanone | 8 | 34 |
| 71-43-2 | Benzene | 0.26 | 0.75 |
| 75-00-3 | Chloroethane | 2.4 | 7 |
| 67-66-3 | Chloroform | 0.08 | 0.25 |
| 156-59-2 | cis-1,2-Dichloroethylene | 16 | 68 |
| 100-41-4 | Ethylbenzene | 460 | 1,950 |
| 91-20-3 | Naphthalene | 1.4 | 5.8 |
| 103-65-1 | n-Propylbenzene | 16 | 68 |
| 99-87-6 | p-Isopropyltoluene | 180 | 780 |
| 135-98-8 | sec-Butylbenzene | 16 | 68 |
| 127-18-4 | Tetrachloroethylene | 3.5 | 10 |
| 108-88-3 | Toluene | 180 | 780 |
| 79-01-6 | Trichloroethylene | 0.02 | 0.05 |
| 156-60-5 | trans-1,2-Dichloroethylene | 32 | 140 |
| 75-01-4 | Vinyl chloride | 0.23 | 0.66 |

[a]Note: The IPIMALs presented in this table are provided for purposes of this interim measure and are based on a chemical-specific carcinogenic risk goal of 1E-06, a hazard quotient of 1 for non-carcinogens, and the exposure assumptions for volatile inhalation from vapor intrusion for both residential and commercial workers. Specific exposure assumptions are noted below:

| Units | Exposure Assumption | Child-resident | Adult-resident | Commercial Worker |
|---|---|---|---|---|
| $m^3/hr$ | Air inhalation intake rate | 0.417 | 0.833 | 1.5 |
| hr/day | Exposure time | 24 | 24 | 10 |
| day/yr | Exposure frequency | 365 | 365 | 250 |
| yr | Exposure duration | 6 | 24 | 25 |
| kg | Body weight | 16 | 70 | 70 |

**Table 5-1.** Schedule for Implementation of IPIM Work Plan

| Task | Schedule |
|---|---|
| **Development of GIVFs and IPIMALs** | |
| Building Evaluation and Sample Collection | • Complete within 15 days of gaining access to the property. |
| Develop GIVFs and prepare IPIMAL Tech Memo | • Submit within 60 days of receipt of validated data, but no later than November 27, 2002. |
| **Tier 1 & 2: IPIM Decision Tree** | |
| Technical Memorandum IPIM2 | • Submit within 30 days after submittal of Technical Memorandum IPIM1 or 60 days of receipt of validated groundwater Third Quarter 2002 groundwater data whichever is later. |
| Technical Memorandum IPIM3 | • Submit within 30 days after submittal of Technical Memorandum IPIM2 or 60 days of receipt of validated groundwater Fourth Quarter 2002 groundwater data whichever is later. No later than March 31, 2003. |
| Technical Memorandum IPIM4 | • Submit within 30 days after submittal of Technical Memorandum IPIM3 or 60 days of receipt of validated groundwater First Quarter 2003 groundwater data whichever is later. No later than June 30, 2003. |
| **Tier 3: Indoor Air Sampling** | |
| Building Evaluation | • Begin work within 15 days of gaining access to the property and approval of the building locations identified for Tier 3 evaluations in the Tech Memo. |
| Develop Tier 3 Work Plan | • Within 30 days of completing the building evaluation. |
| Sample Collection | • Begin work within 15 days of receiving approval of the Tier 3 Work Plan. |
| Prepare Tier 3 Tech Memo | • Submit Tech Memo within 30 days of receipt of validated data. |
| **Tier 4: Interim Measures** | |
| Building Evaluation | • Begin work within 15 days of gaining access to the property and approval of the building |

**Table 5-1.** Schedule for Implementation of IPIM Work Plan

| Task | Schedule |
|---|---|
| Develop Tier 4 Work Plan | locations identified for Tier 4 evaluations in the Tech Memo<br>• Within 30 days of completing the building evaluation. |
| Installation of Remedy | • Mobilize within 15 days of receiving approval of the Tier 4 Work Plan. |
| Verification Sampling | • Per the schedule presented in the Tier 4 Work Plan. |
| Progress Report on Interim Measures | • Included in March 15 Interim Measure Progress Reports. |
| No Further Action | • One year of groundwater concentrations below PRALs. |




*Note: The image was photographed on 10 Jul 1990 by the National Aerial Photography Program and digitized by the USGS DOQ Program on 26 Apr 1996*

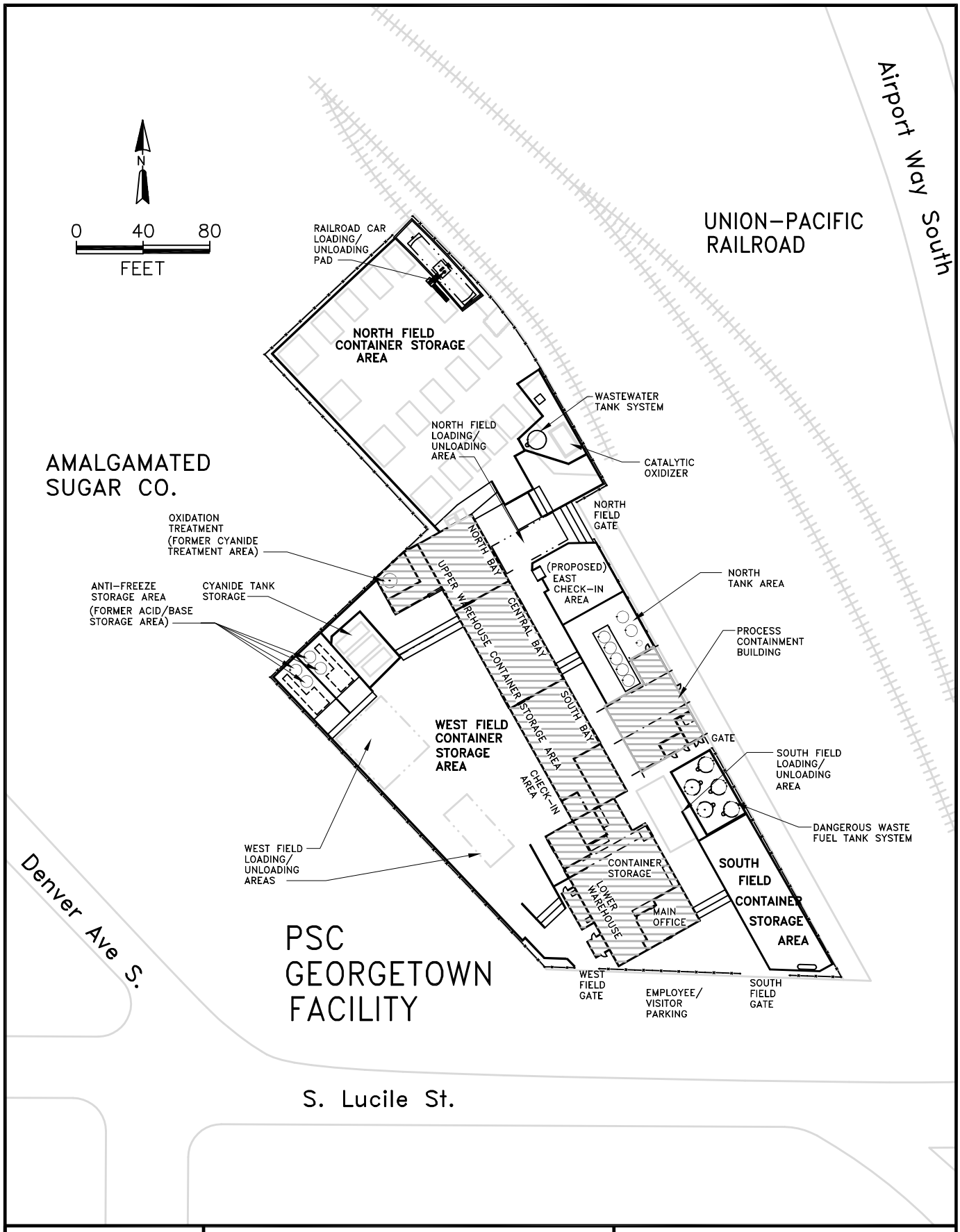
0 125 250 500 750 1,000
Feet

Site Location-Aerial View
PSC Georgetown Facility
Seattle, Washington

Figure 1-1

5/02

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Date: May 2002



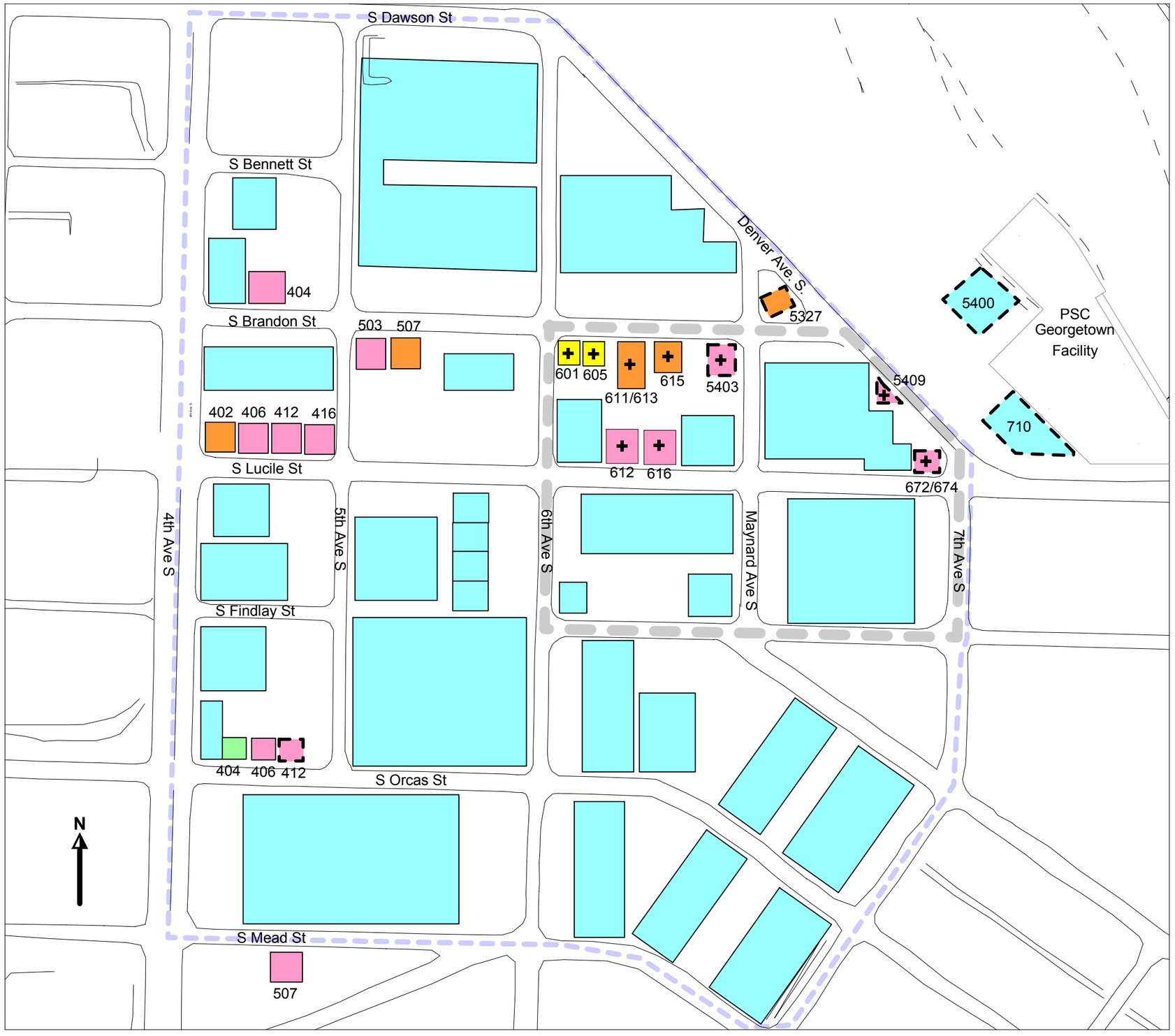

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PHILIP SERVICES CORP

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

Figure 1–2
Site Plan
Georgetown Facility

# Figure 2-1
## GIVF Study Area




Commercial Building

Residence Type Building with Basement

Residence Type Building on Slab

Residence Type Building with Crawl Space

Residence Type Building with unknown foundation

Previous Indoor Air Sampling Location

Proposed GIVF Co-located Sample Location

Area for GIVF Evaluation

Contingency Area for GIVF Evaluation

Figure not to scale

# Figure 2-1A
# IPIM Study Area
# West of Denver Avenue

E Marginal Way
Utah Ave S
1st Ave S
2nd Ave S
3rd Ave S
4th Ave S
5th Ave S
6th Ave S
S Dawson St
S Bennett St
S Brandon St
S Lucile St
S Findlay St
S Orcas St
S Mead St
S Fidalgo St
S Fidalgo St

**Area 3**
**Area 2**
**Area 1**
PSC Georgetown Facility

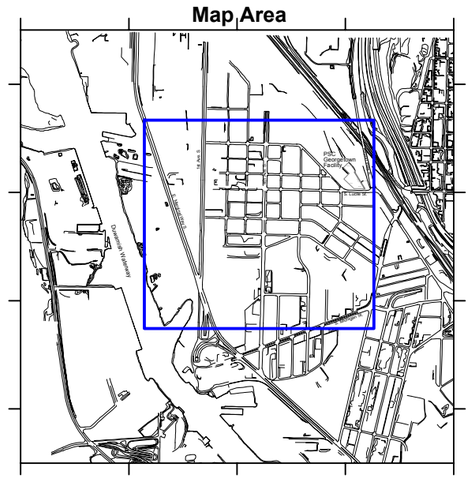
CG-129-WT
CG-113-S1
CG-112-S1
CG-143-WT
CG-130-WT
CG-128-WT
CG-124-WT
CG-122-WT
CG-138-WT
CG-126-WT
CG-127-WT
CG-142-WT
CG-131-WT
CG-134-WT
CG-136-WT
CG-132-WT
CG-141-WT
CG-137-WT
CG-140-WT

Duwamish River

N

0 1000 2000 3000 4000

Map Area



Water Table Monitoring Wells
Area 1
Area 2
Area 3
Study Area for Future IPIMs

# Figure 2-1B
# IPIM Study Area
# East of Denver Avenue

Area 2

Area 1

Area 3

CG-11-S1

CG-1-S1

CG-105-S1

CG-115-WT

CG-10-S1

CG-116-WT

CG-117-WT

CG-9-S1

CG-104-S1

CG-2-S1

CG-103-S1

CG-102-S1

CG-101-S1

CG-106-WT

CG-107-WT

S. Brandon St.

Denver Ave. S.

Airport Way S.

S.Lucile St.

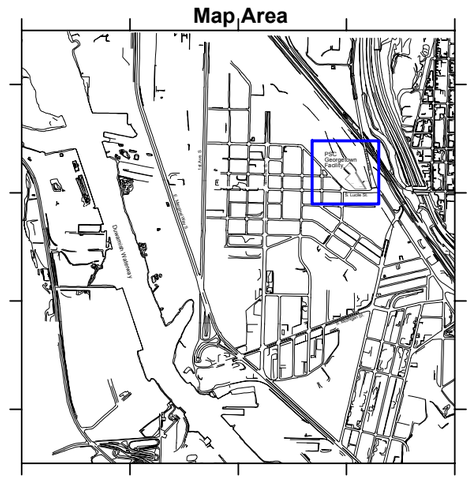
7th Ave. S.

PSC Georgetown Facility

N

0 200 400 600 800 feet

Map Area



Water Table Monitoring Wells

Proposed Water Table Monitoring Wells

Area 1

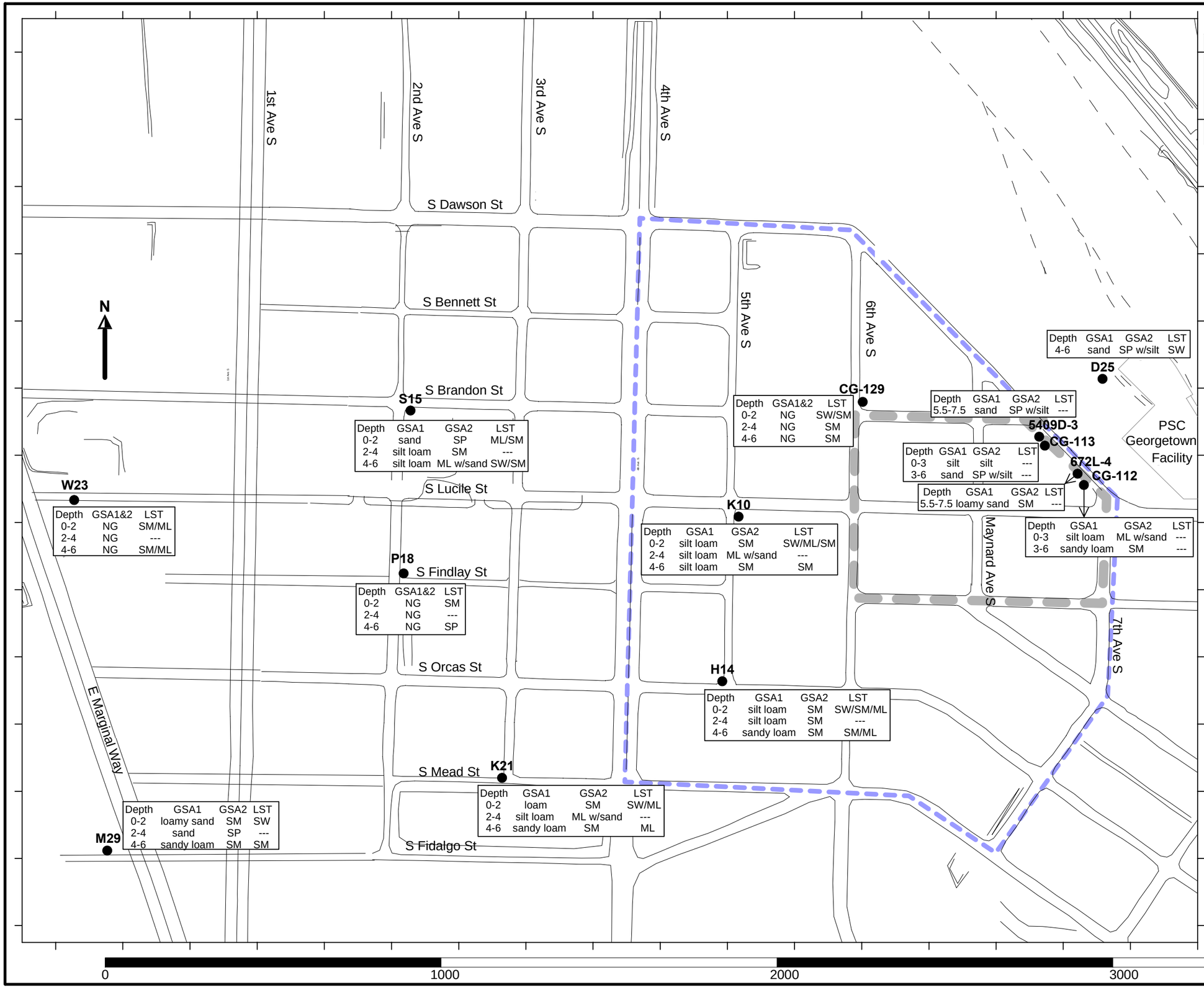
Area 2

Area 3

Study Area for Future IPIMs

# Figure 2-1C

## Soil Classification for Areas 2 and 3




## Legend

Depths are in feet below ground surface

GSA1 Grain Size Analysis (US Department of Agriculture, SCS)

GSA2 Grain Size Analysis (ASTM Unified Soil Classification)

LST In-Field Logged Soil Type

--- Sample Not Logged

NG No Geotechnical Sample Collected

Area for GIVF Evaluation

Contingency Area for GIVF Evaluation

## Definitions

SW: well-graded sand

SP: poorly-graded sand

SM: silty-sand, sand-silt

ML: inorganic silts & very fine sands

Sand: 25% or more very coarse, coarse, & medium sand & less than 50% either fine sand or very fine sand

Loamy Sand: 25% or more very coarse, coarse, & medium sand & less than 50% either fine sand or very fine sand

Sandy Loam: 30% or more very coarse, coarse, & medium sand & less than 30% either fine sand or very fine sand

Loam: 7-27% clay, 28-50% silt, and less than 52% sand

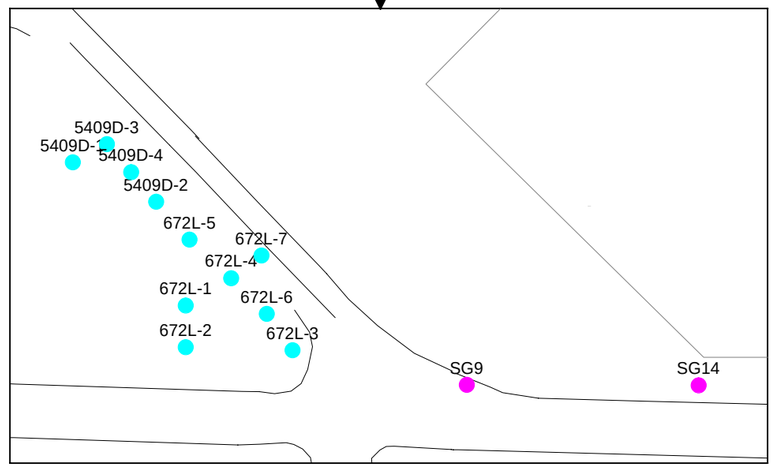
Silt Loam: 50% or more silt and 12-27% clay; or 50-80% silt & less than 12% clay

NOTES:

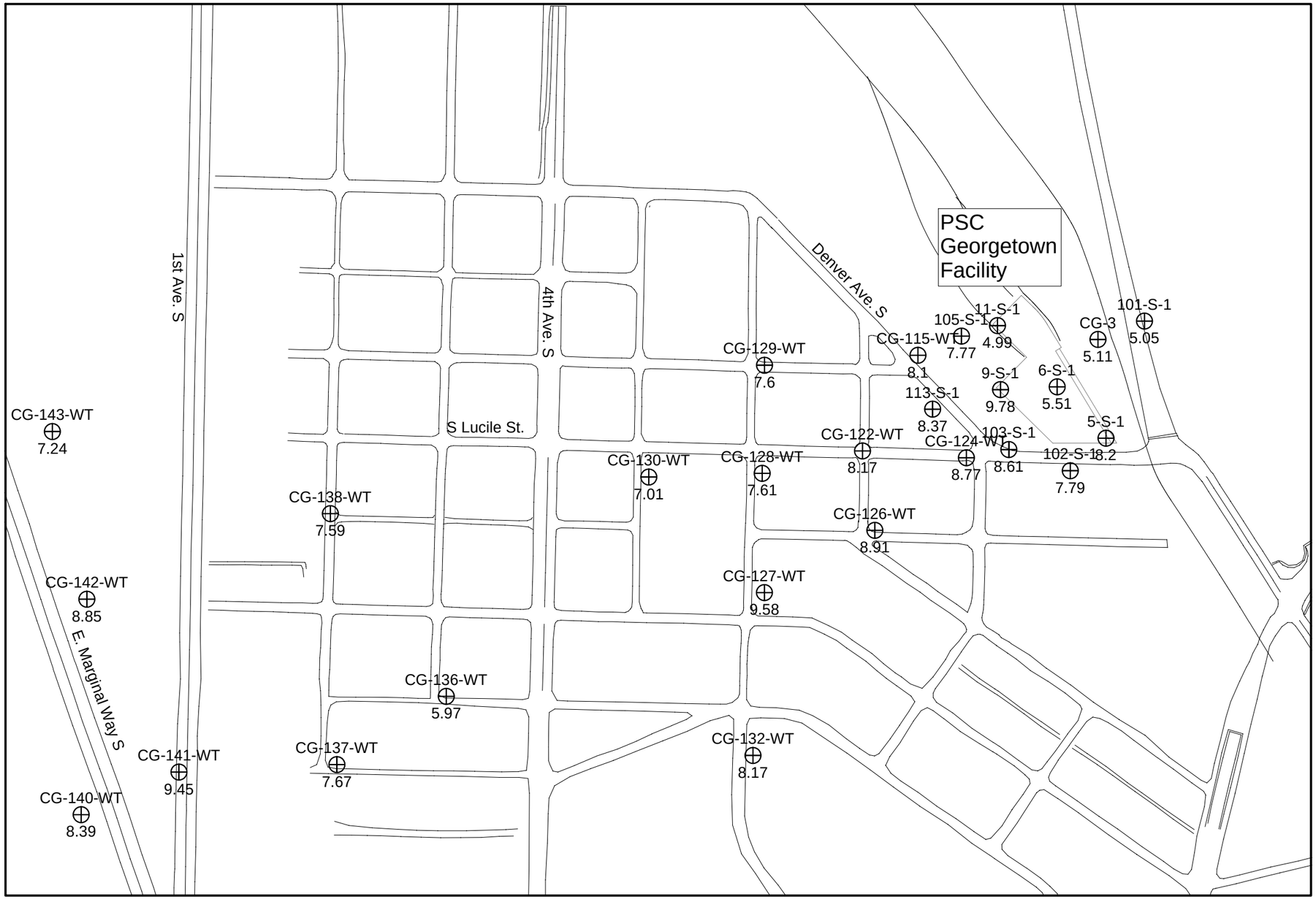
- Multiple soil types listed when multiple soil types were observed in a 2-foot interval.
- GSA1 and GSA2 results provided by Harold Benny, Laboratory Manager, Rosa Environmental &Geotechnical Laboratory, LLC.

# Figure 2-2
## Soil Gas and/or Indoor Air Sampling Locations




- 2000 Direct Push Soil Gas Sample Locations
- 2001 Direct Push Soil Gas Sample Locations



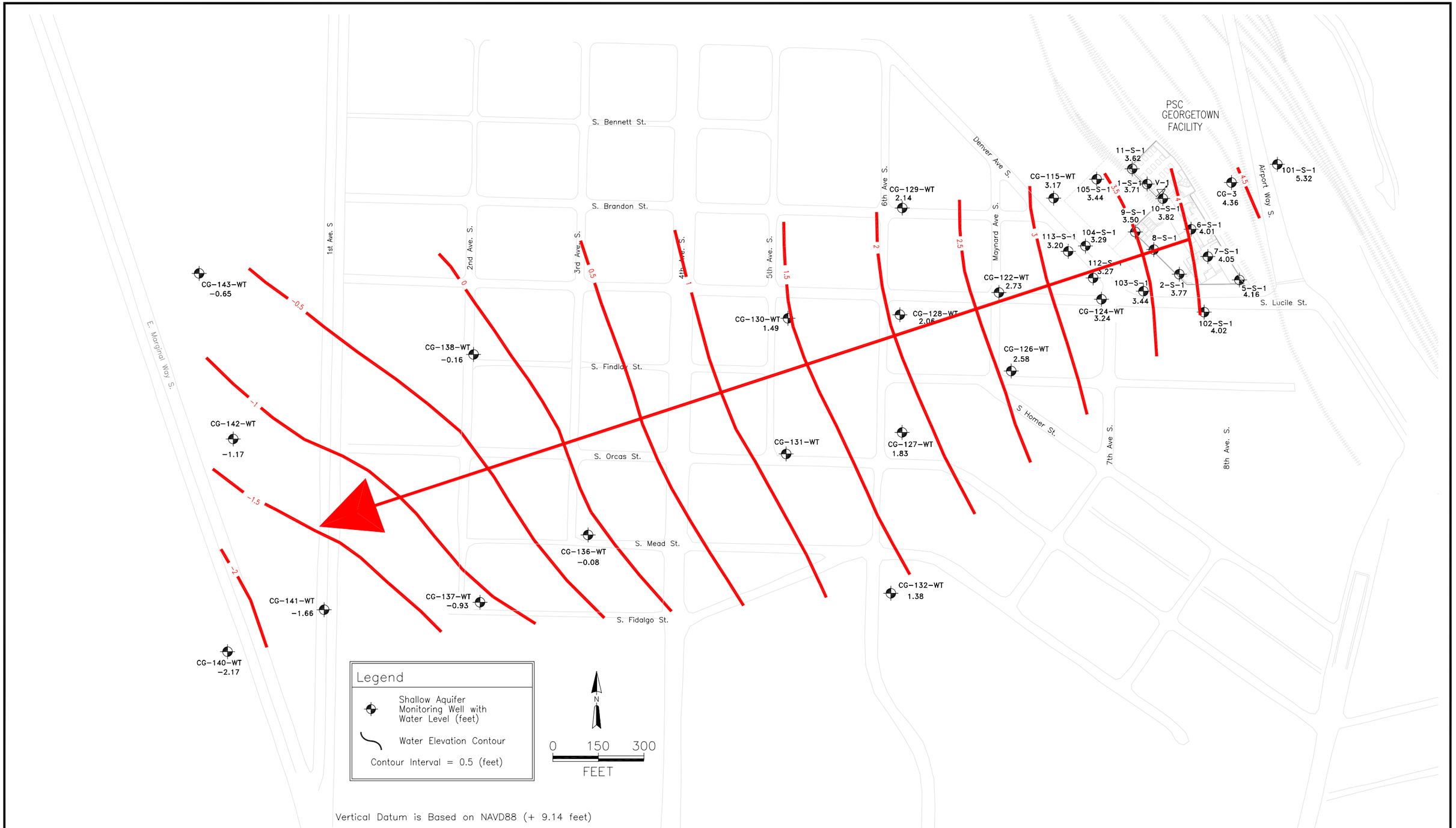

N

## Legend

⊕ Shallow Aquifer/ Water Table Monitoring Wells

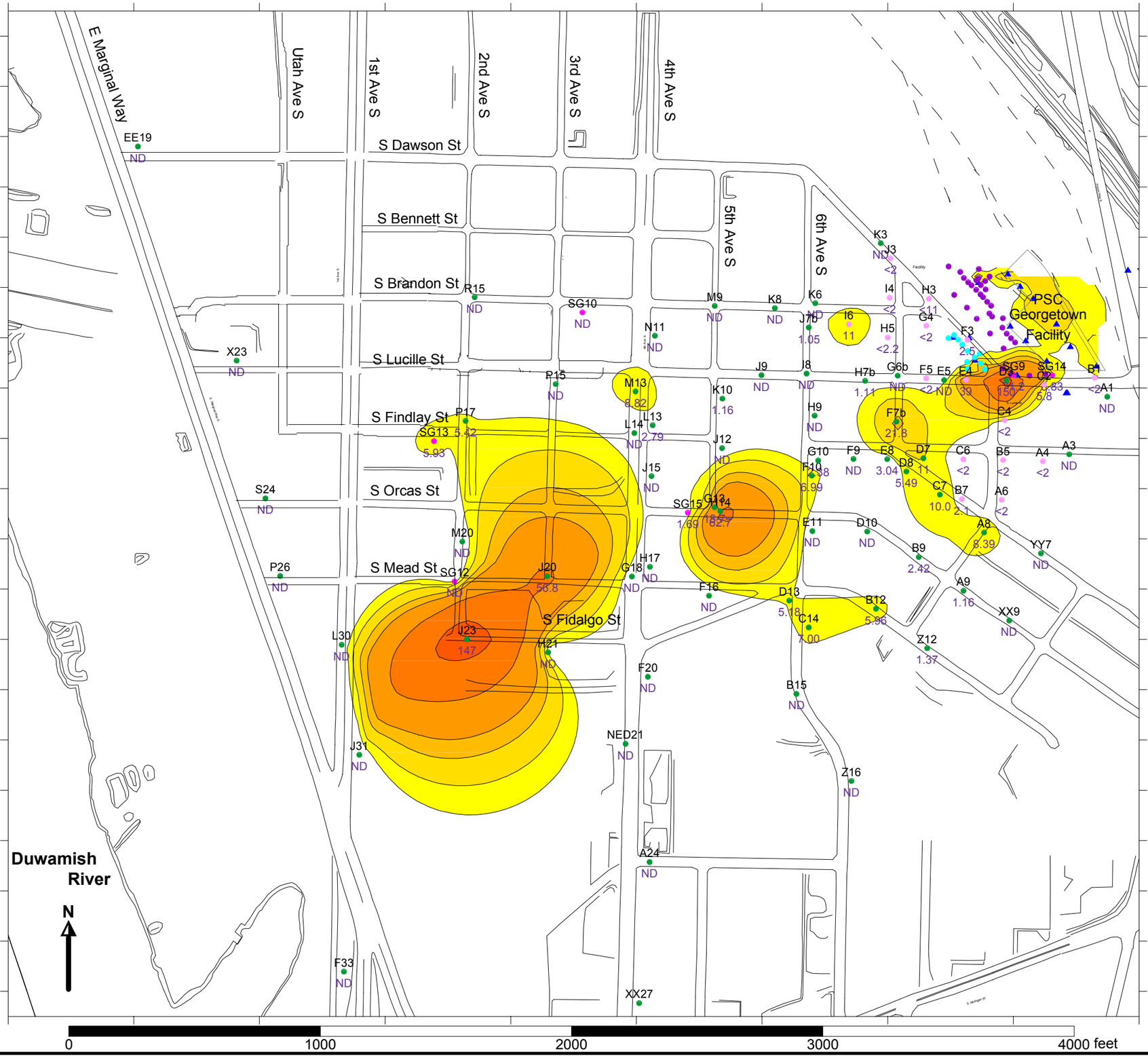
Depth to Groundwater from Below Ground Surface (feet bgs)
April 2, 2002
Georgetown Facility

IPIMWP May 2002
Figure 2-3




| | | | | |
|---|---|---|---|---|
| PSC | TITLE: Groundwater Elevations, April 2, 2002<br>Shallow Aquifer (Wells screened through the water table)<br>Georgetown Facility | DWN: dtb | DES.: | PROJECT NO.: IPIMWP May 2002 |
| | | CHKD: cjm | APPD: | FIGURE NO.: 2-4 |
| | | DATE: 5/23/02 | REV.: | |

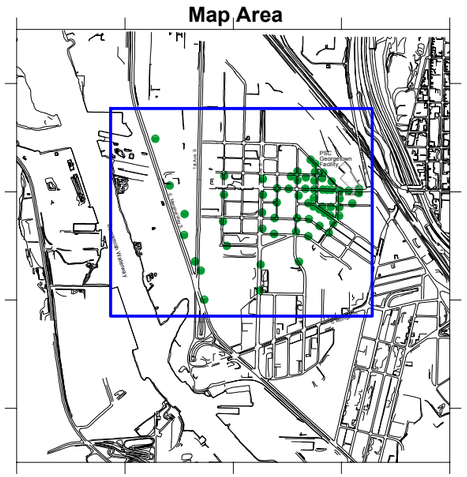
# Figure 2-5
## On-Site and Off-Site Groundwater Concentrations
## Trichloroethene: 10-20 feet bgs




**Concentrations in ug/L**

140
100
50
25
17.5
10
5

**Map Area**



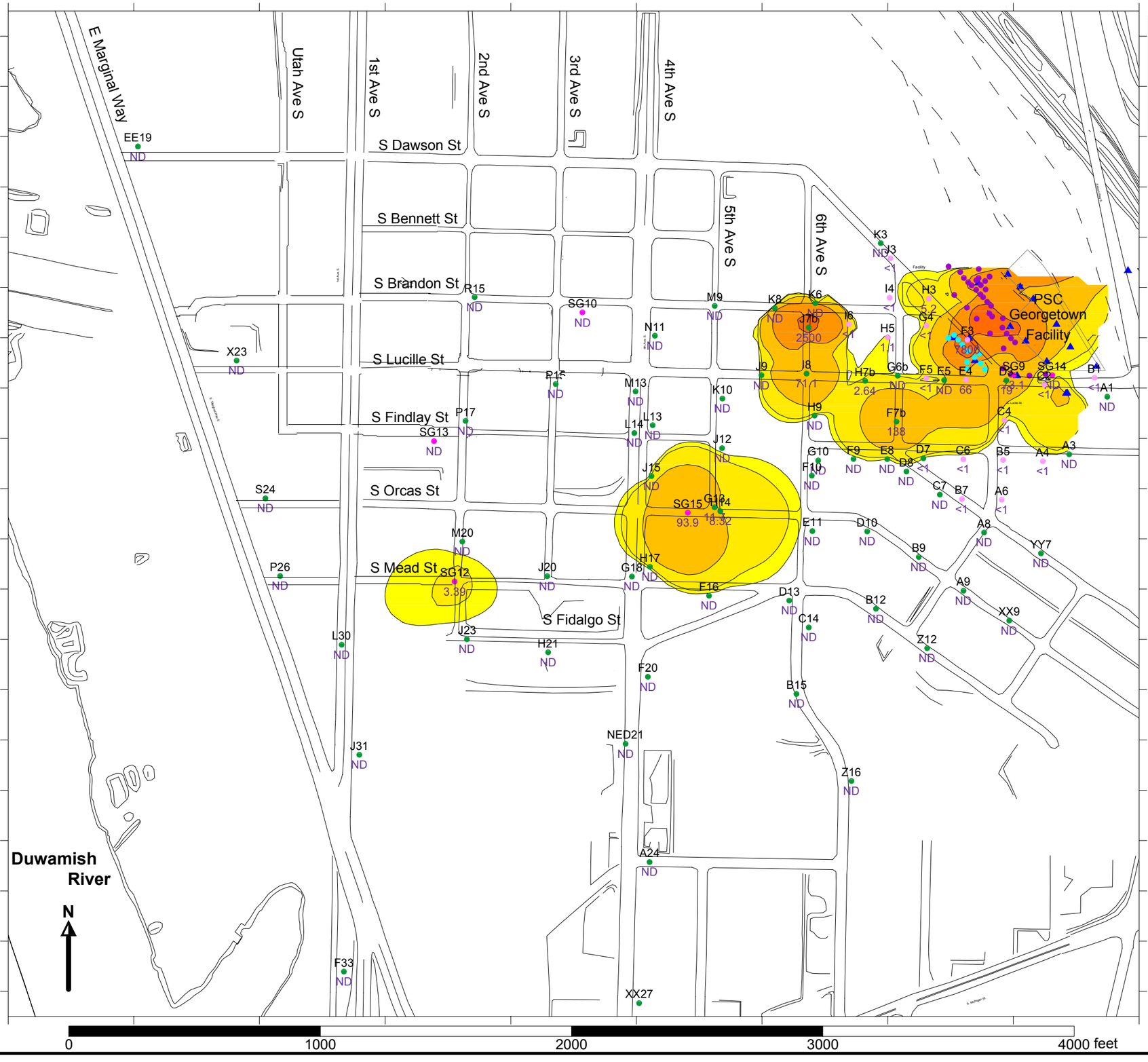
**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

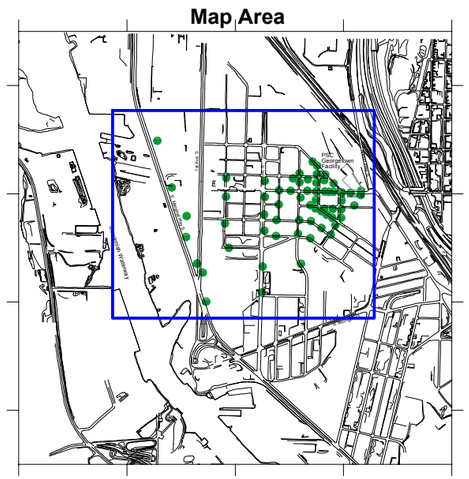
# Figure 2-6
## On-Site and Off-Site Groundwater Concentrations
## Vinyl Chloride: 10-20 feet bgs




**Concentrations in ug/L**

- 5500
- 1000
- 100
- 10
- 2
- 1

**Map Area**



**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

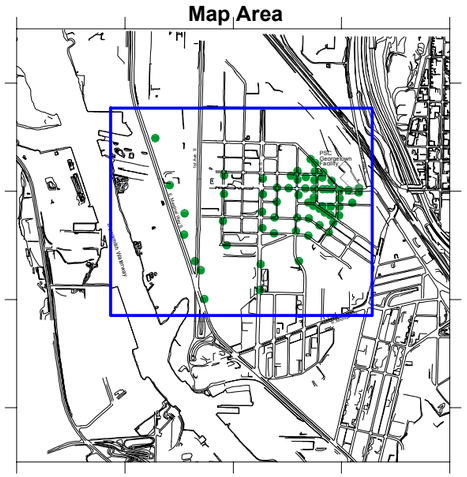
Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

# Figure 2-7
## On-Site and Off-Site Groundwater Concentrations
## 1,1-DCE: 10-20 feet bgs

**Concentrations in ug/L**

37
33
29
25
21
17
13
9
5
1

**Map Area**



**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

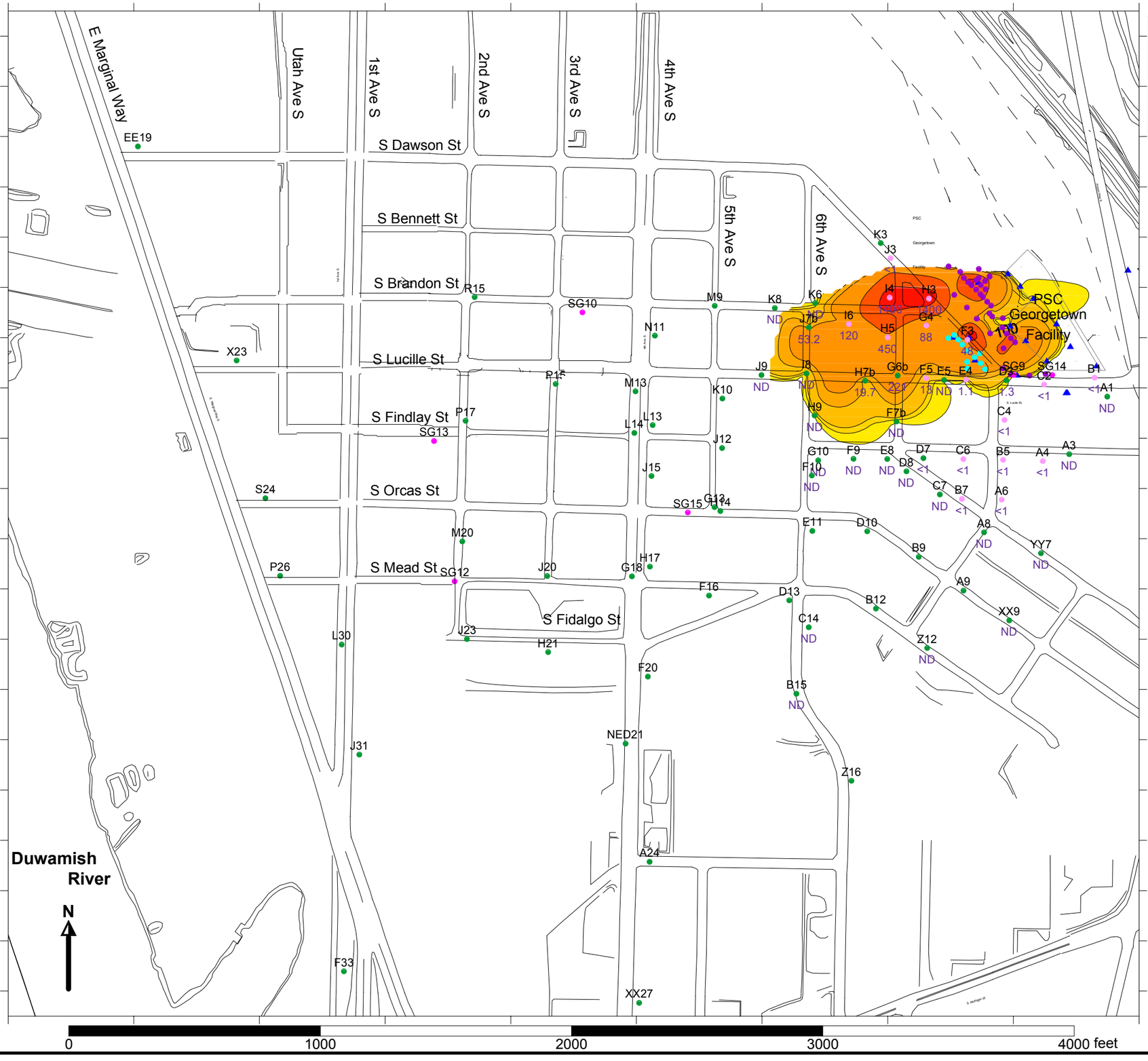
**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

N

0 250 500 750 1000 feet

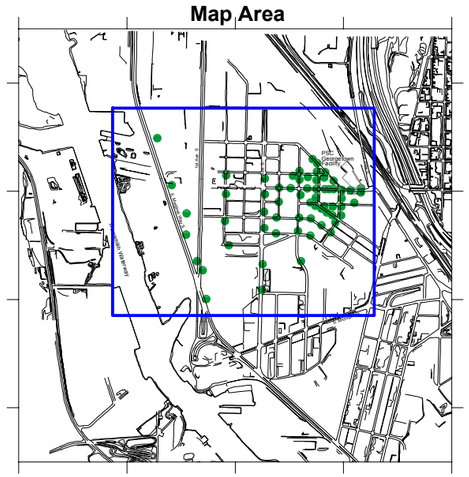
# Figure 2-8
## On-Site and Off-Site Groundwater Concentrations
## Chloroethane: 10-20 feet bgs




**Concentrations in ug/L**

1000
500
100
50
10
5
1

**Map Area**



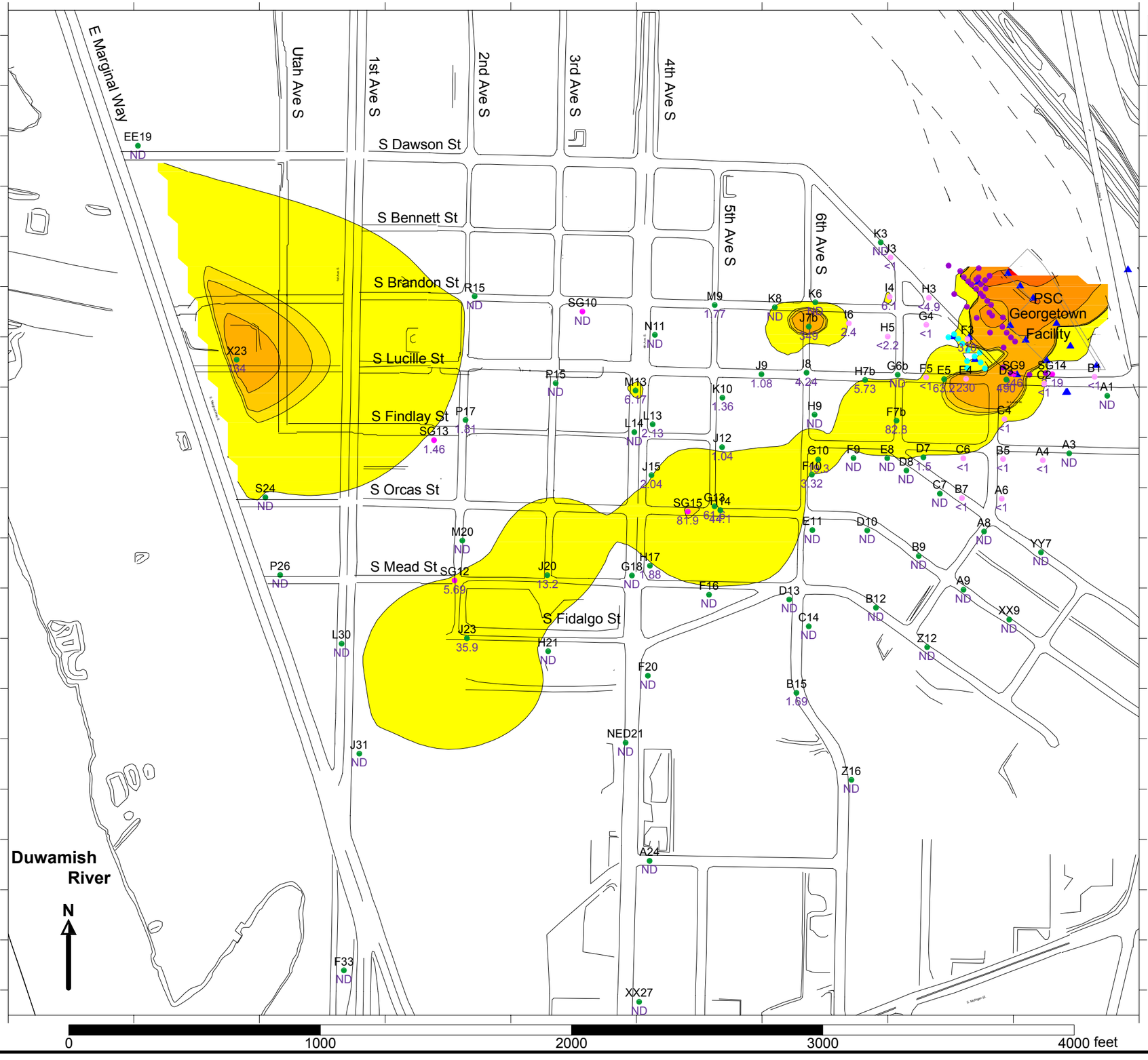
**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

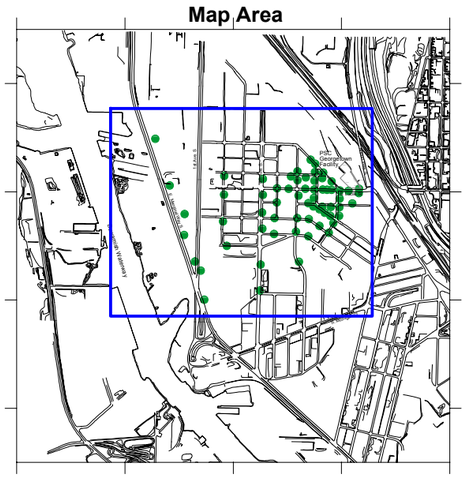
# Figure 2-9
## On-Site and Off-Site Groundwater Concentrations
## cis-1,2-Dichloroethene:10-20 feet bgs




Concentrations in ug/L

9000
5000
1000
100
80
70
5

Map Area



### Groundwater Sampling Locations:

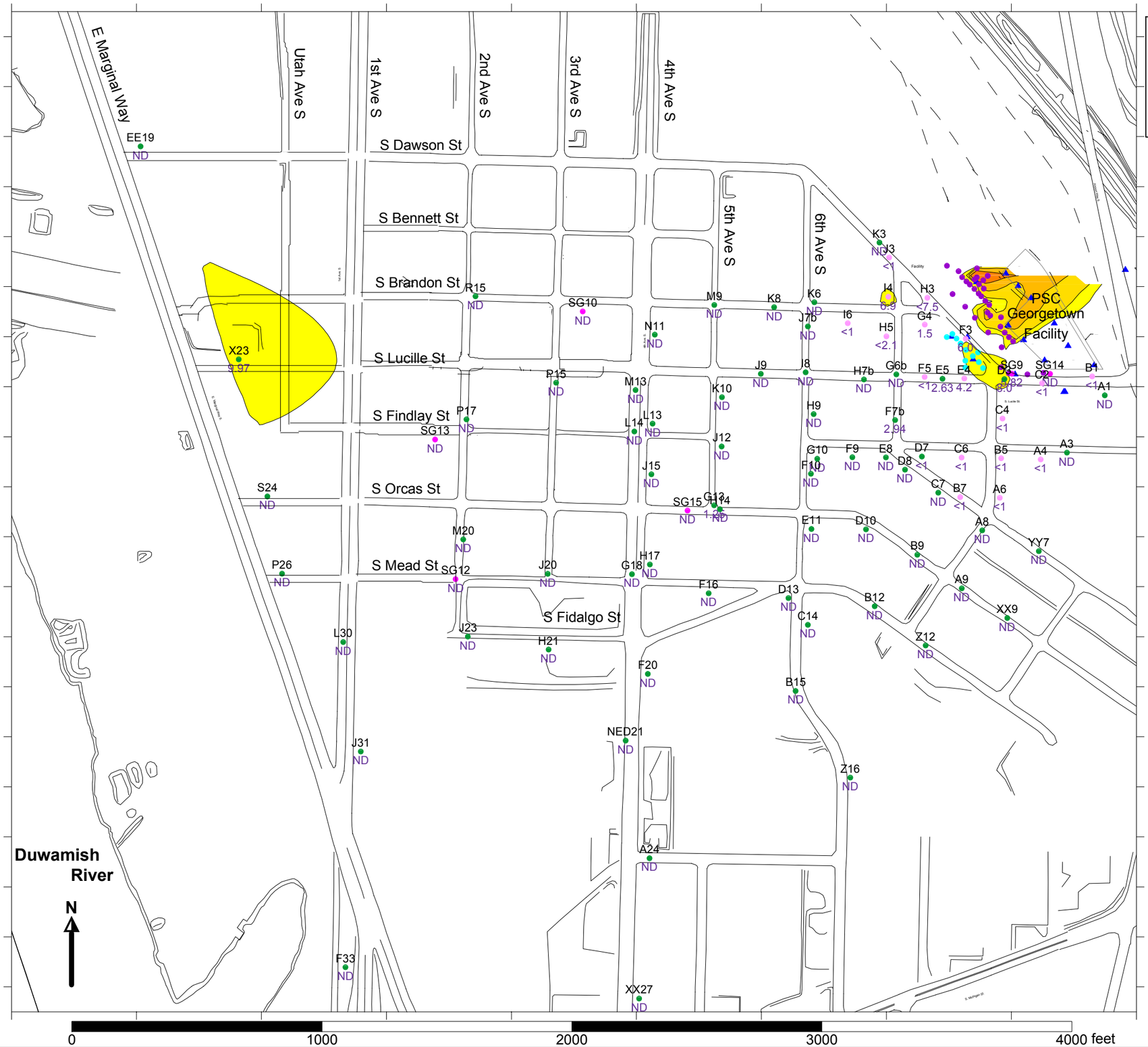
- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

# Figure 2-10
## On-Site and Off-Site Groundwater Concentrations
## trans1,2-Dichloroethene: 10-20 feet bgs

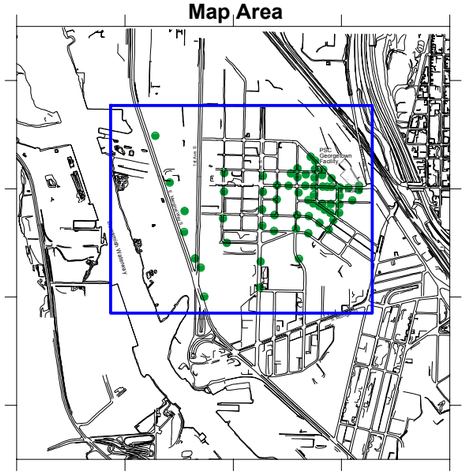
**Concentrations in ug/L**







**Map Area**



### Groundwater Sampling Locations:

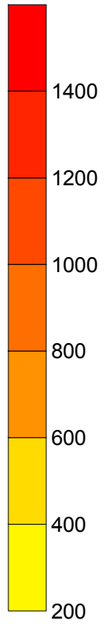
- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

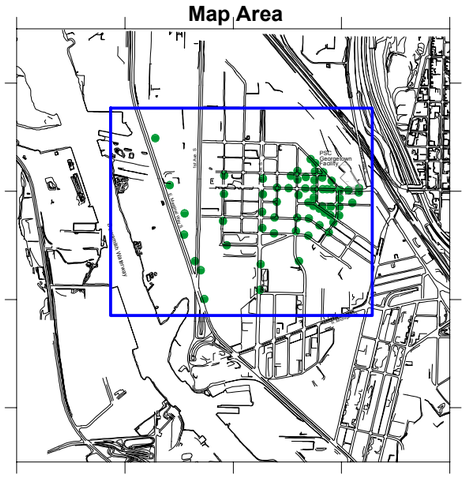
Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

# Figure 2-11
## On-Site and Off-Site Groundwater Concentrations
## 1,1,1-TCA: 10-20 feet bgs

**Concentrations in ug/L**




**Map Area**



EE19 ND
X23 ND
S24 ND
P26 ND
L30 ND
J31 ND
F33 ND
R15 ND
SG10 ND
M9 ND
K8 ND
K6 ND
N11 ND
P15 ND
M13 ND
K10 ND
P17 ND
SG13 ND
L14 ND
L13 ND
J12 ND
J15 ND
J9 ND
J8 ND
H9 ND
G10 ND
F9 ND
E8 ND
D8 1.3
F10 1.84
D7 ND
C6 3.0
C7 ND
B7 ND
A6 <1
B5 <1
A4 <1
A3 ND
A8 ND
YY7 ND
B9 ND
A9 ND
XX9 ND
Z12 ND
C14 ND
D13 ND
B12 ND
B15 ND
Z16 ND
A24 ND
XX27
NED21 ND
F20 ND
F16 ND
H21 ND
J23 ND
SG12 ND
M20 ND
J20 ND
G18 ND
H17 ND
SG15 ND
G13 ND
E11 ND
D10 ND
K3 ND
J3 <1
I4 <1
H3 <1
G4 <1
I6 <1
J7b ND
H5 <1
F3 120
H7b ND
G6b ND
F5 <1
E5 99.9
E4 220
D3 270
SG9 23
SG14 10
C2 1.3
B1 40
A1 ND
C4 1.2
F7b 3.91

0 250 500 750 1000 feet

N

### Groundwater Sampling Locations:

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

### Note:

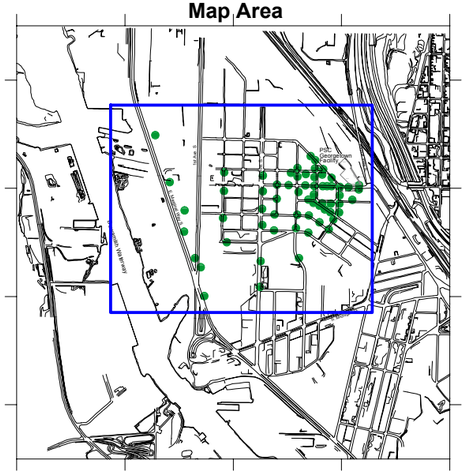
Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

# Figure 2-12
## On-Site and Off-Site Groundwater Concentrations
## 1,1-DCA: 10-20 feet bgs

**Concentrations in ug/L**

1000
800
600
400
200
100
50
25
10
5

**Map Area**



**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

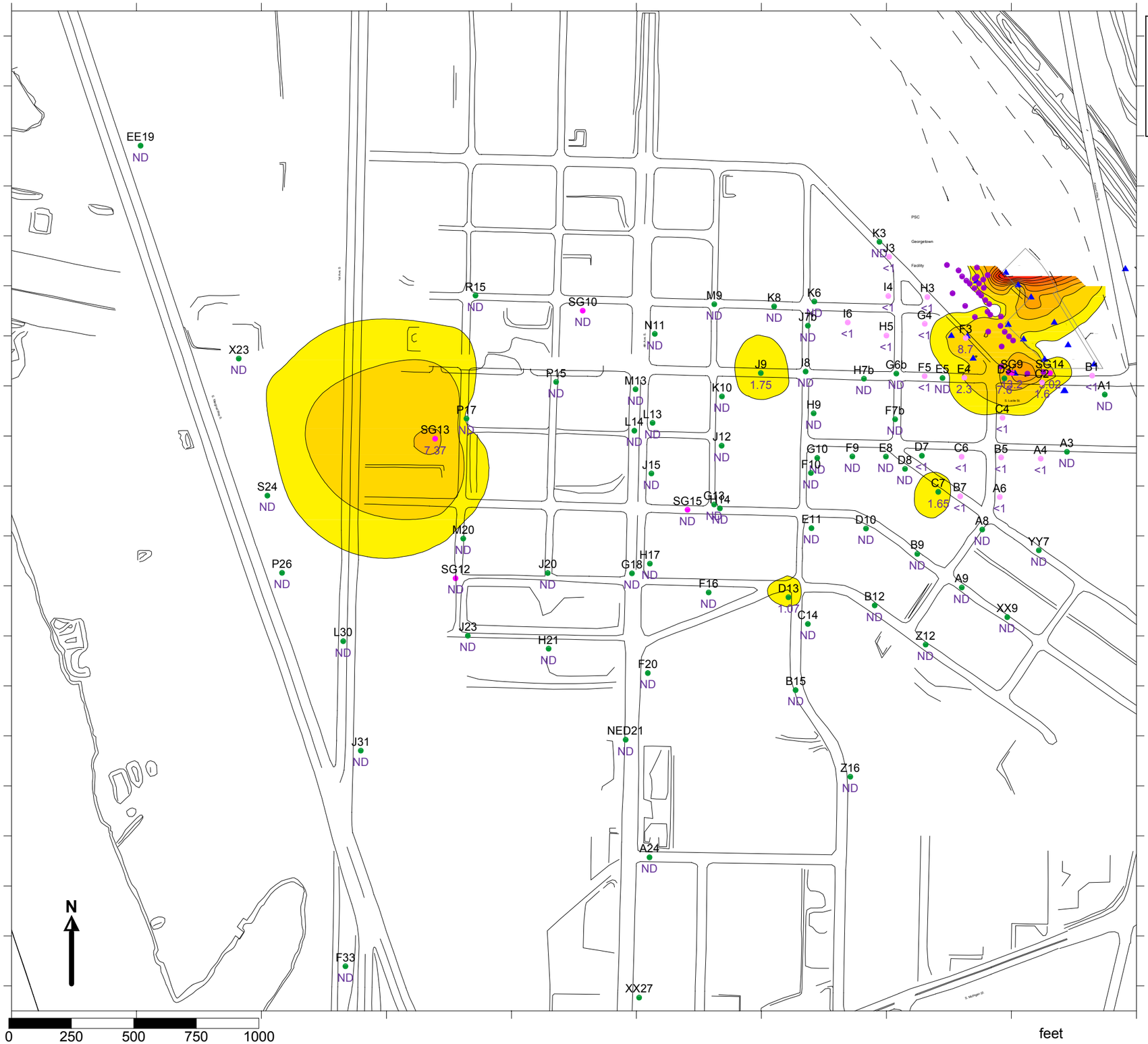
Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

N

0 250 500 750 1000 feet

# Figure 2-13
## On-Site and Off-Site Groundwater Concentrations
## PCE: 10-20 feet bgs

**Concentrations in ug/L**



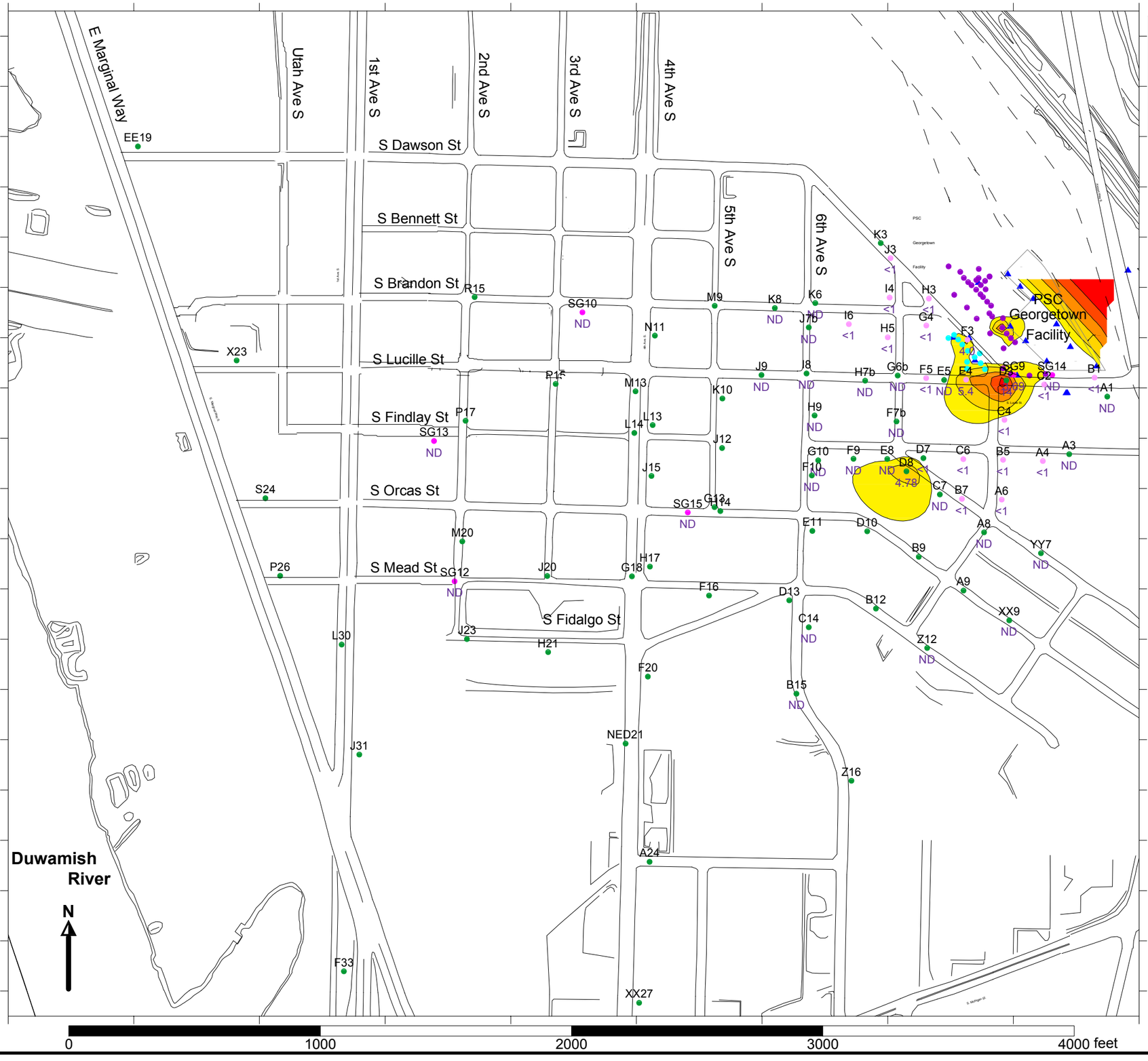

### Groundwater Sampling Locations:

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

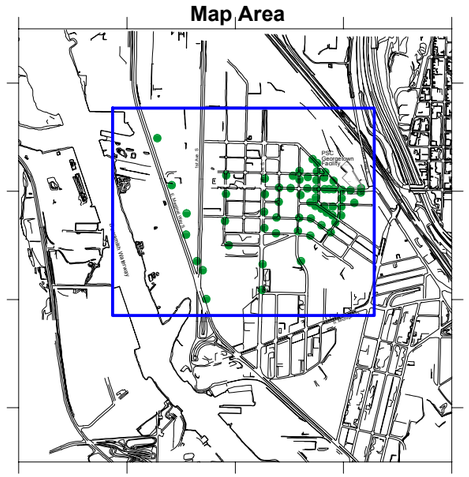
# Figure 2-14
## On-Site and Off-Site Groundwater Concentrations
## Chloroform: 10-20 feet bgs




**Concentrations in ug/L**

10
7.5
5
2.5
1

**Map Area**



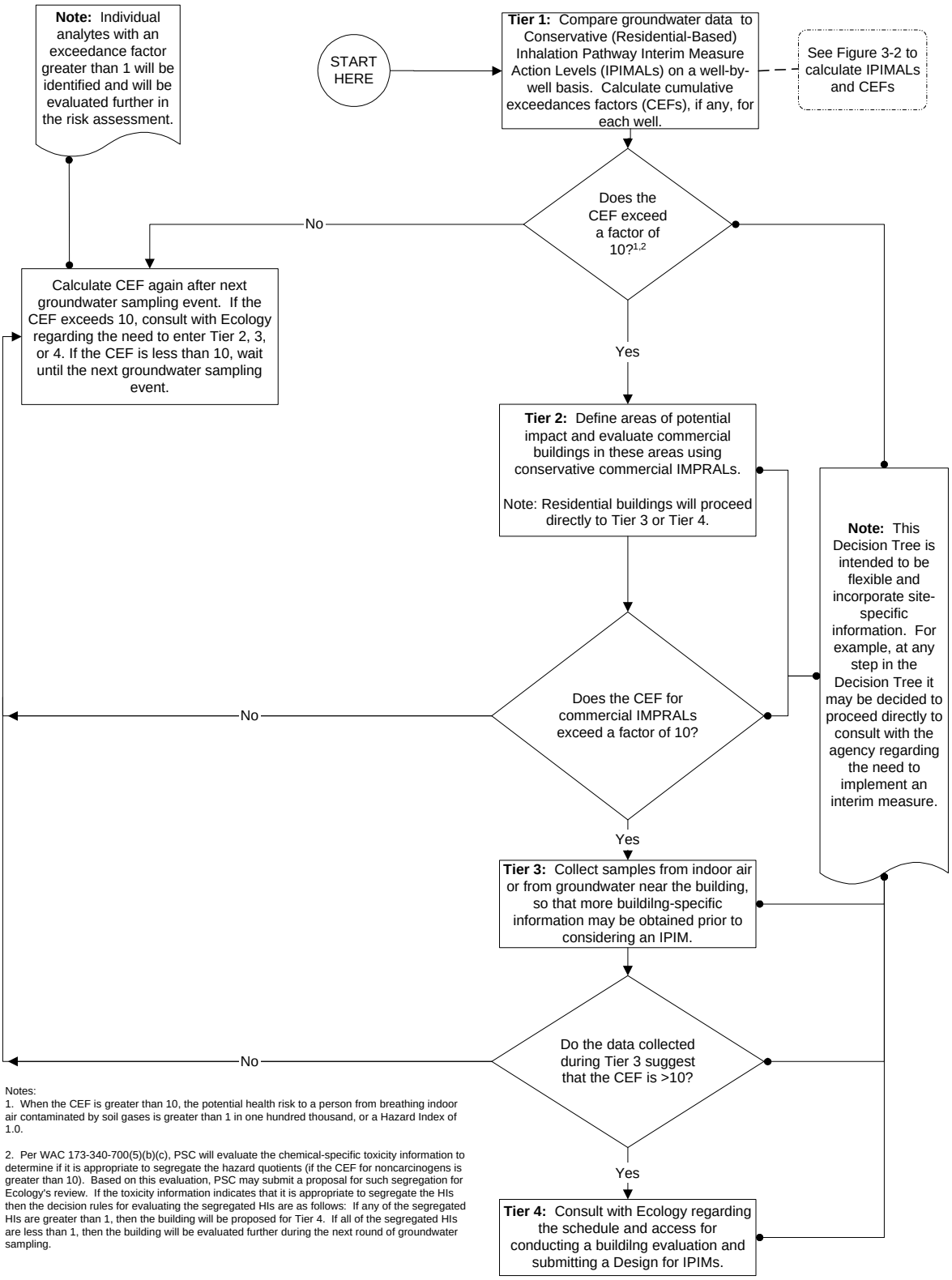
**Groundwater Sampling Locations:**

- Monitoring Wells, 1st Quarter 2001 Sampling Event
- Direct Push, 1998 Hydropunch Investigation
- Direct Push, 2000 Soil Gas Investigation
- Direct Push, 2000 Source Area Investigation
- Direct Push, 2000-2001 Nature and Extent Investigation
- Direct Push, 2001 Soil Gas Investigation

**Note:**

Data for monitoring well and Source Area samples is included in the contours but is not posted on the map due to space constraints

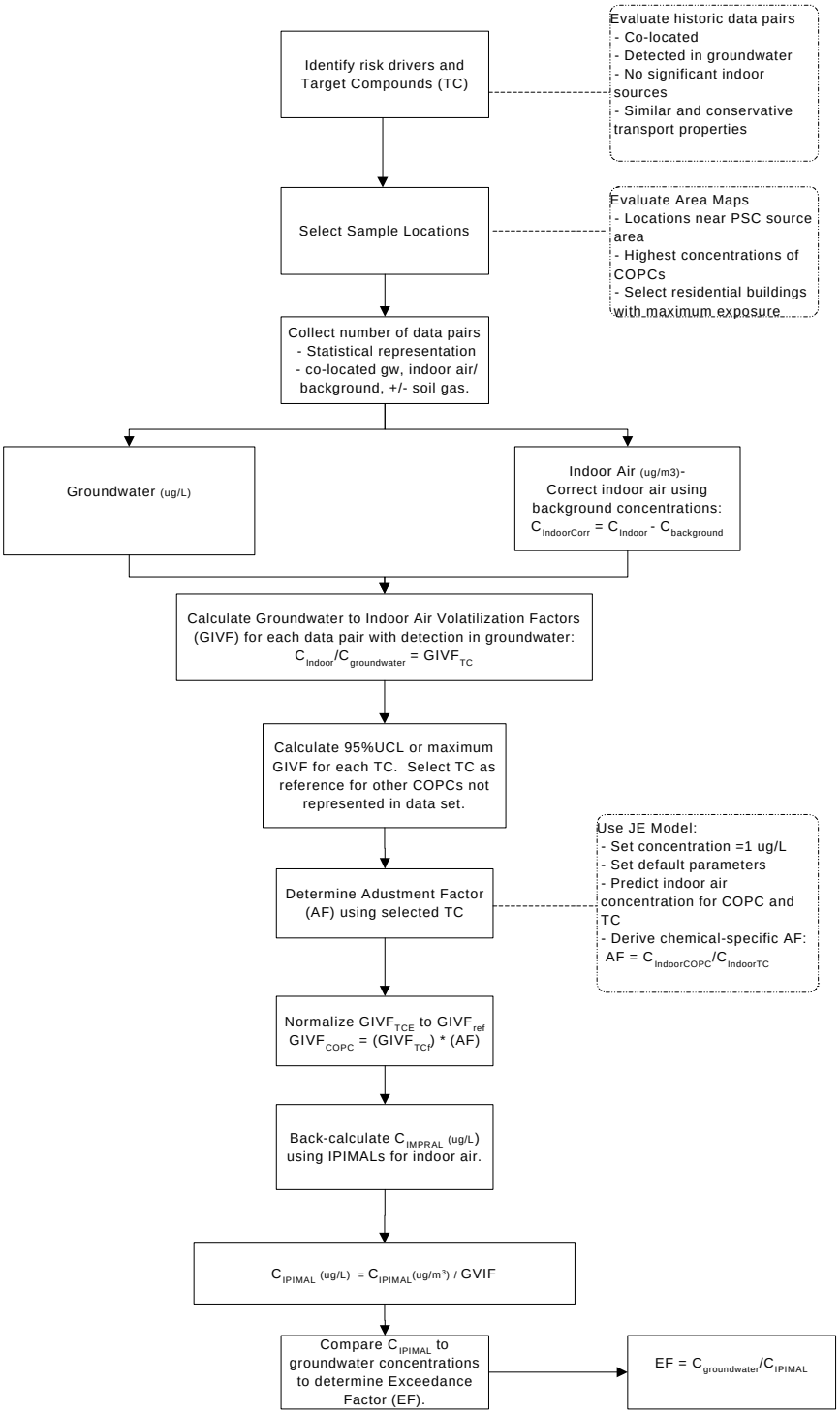
**Figure 3-1**
**IPIM Decision Tree**




Notes:
1. When the CEF is greater than 10, the potential health risk to a person from breathing indoor air contaminated by soil gases is greater than 1 in one hundred thousand, or a Hazard Index of 1.0.

2. Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). Based on this evaluation, PSC may submit a proposal for such segregation for Ecology's review. If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

**Figure 3-2**
**Approach for Developing IPIMALs**



# APPENDIX A

# SAMPLING AND ANALYSIS PLAN

August 2002

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## ATTACHMENTS

Attachment A PSC Standard Operating Procedures
Attachment B Direct Push Sampling Tool Information
Attachment C Building Evaluation Form

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| COPC | compounds of potential concern |
| DL | detection limits |
| DQO | Data Quality Objective |
| Ecology | Washington State Department of Ecology |
| EPA | United States Environmental Protection Agency |
| GIVF | Groundwater to Indoor Air Volatilization Factor |
| Hg | Mercury |
| HHERA | Human Health and Ecological Risk Assessment |
| IM | Interim Measures |
| IPIM | Inhalation Pathway Interim Measures |
| IPIMAL | Inhalation Pathway Interim Measure Actions Levels |
| IPIMWP | Inhalation Pathway Interim Measures Work Plan |
| JE | Johnson and Ettinger Model |
| L | liter |
| MADEP | Massachusetts Department of Environmental Protection |
| MTCA | Model Toxics Control Act |
| PCAMP | Pre-Corrective Action Monitoring Plan |
| ppbv | parts per billion by volume |
| PSC | Philip Services Corporation |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| RCRA | Resource Conservation Recovery Act |
| RFI | RCRA Facility Investigation |
| RI | Remedial Investigation |
| SAP | Sampling and Analysis Plan |
| SIM | Selective Ion Mode |
| THC | total hydrocarbons |
| VOC | volatile organic compound |

# 1. INTRODUCTION

This Sampling and Analysis Plan (SAP), part of the Inhalation Pathway Interim Measure Work Plan (IPIMWP) (PSC, 2002a), provides the rationale and methodology for collecting and analyzing samples of the following media:

1. Indoor air
2. Ambient air
3. Groundwater (via direct push method)
4. Soil (for geotechnical analysis)
5. Soil gas

These samples will be collected to:

1. Derive groundwater to indoor air volatilization factors (GIVFs), which will be used to calculate Inhalation Pathway Interim Measure Action Levels (IPIMALs) for groundwater based on the empirical relationship between groundwater and indoor air concentrations.
2. Evaluate potential impacts to human health resulting from groundwater vapor intrusion into indoor air of buildings located over the groundwater contaminant plume migrating from the Philip Services Corporation (PSC) Georgetown facility (i.e., Tier 3 of the Decision Tree[1]).

This SAP was prepared following recommendations from the Massachusetts Department of Environmental Protection's (MADEP) Indoor Air Sampling and Evaluation Guide (MADEP, 2002) recommended for use by the United States Environmental Protection Agency's (EPAs) Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (EPA, 2001).

## 1.1 DOCUMENT ORGANIZATION

The purpose of this SAP is to present the general rationale and methodology for collecting and analyzing samples collected as part of the IPIMWP and future field activities undertaken as part of Interim Measures (IMs). Supplemental IPIM SAPs will be developed for future field activities undertaken to implement the Decision Tree. These Supplemental IPIM SAPs will

[1] The Decision Tree is defined in the Inhalation Pathway Interim Measures (IPIM) Work Plan (Section 3.3). It presents a tiered approach for evaluating groundwater and indoor air data to determine if IMs are warranted.

incorporate this SAP by reference and will focus on site-specific characteristics of the field activities being implemented. At a minimum, the Supplemental IPIM SAPs will include:

- **Building-Specific Sampling and Analysis Plan**—This will include the number of samples that will be collected and figures identifying the specific locations within the building where the samples will be collected. The analytical methods that will be used to evaluate the samples will also be presented.
- **Building-Specific Data Quality Objectives (DQOs)**—This section, if necessary, will identify any site-specific DQOs. It is anticipated that the DQOs presented in Section 2 of this SAP will apply directly to the Supplemental IPIM SAPs and can be incorporated by reference. However, additional information on DQOs will be provided if needed.
- **Building-Specific Schedule**—This section will present the schedule for the field activities and analytics.

The sections of this SAP that will be included by reference in the Supplemental IPIM SAPs are Sampling Methodology (Section 4) and Sample Documentation (Section 5).

# 2. DATA QUALITY OBJECTIVES

## 2.1 PURPOSE OF SAMPLING

The potential risks to human health associated with the vapor intrusion pathway (i.e., the volatilization of compounds from groundwater and subsequent migration to indoor air) are being evaluated as part of the PSC Georgetown Facility Remedial Investigation (RI). An initial assessment of risk was included in the draft Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) Report, Part II (draft Human Health and Ecological Risk Assessment [HHERA]) (PSC, 2001). EPA's comments on the HHERA stated that the approach for evaluating the vapor intrusion pathway in the RFI needed to be modified before the Draft Final RI Report was submitted. The comments also identified data gaps in characterizing the potential indoor air risks. In response to EPA's comments, PSC has developed a site-specific approach, which is presented in the IPIMWP, for determining the relationship between the concentrations of volatile organic compounds (VOCs) in groundwater and in indoor air (i.e., GIVFs). The data collected as specified in this SAP, and future Supplemental IPIM SAPs, will fulfill the needs of this evaluation, and will be used to determine if IMs are warranted at buildings located hydraulically down gradient of the PSC Georgetown facility.

Vapor intrusion can affect the indoor air quality in homes and commercial/industrial buildings. Receptors may be residents or workers. These receptors are also exposed to air quality impacted by ambient air intrusion and indoor air sources, such as from consumer products, furnishings, and building materials.

Prior data collection and analysis efforts have indicated the following:

- Groundwater that is located down gradient of the PSC Georgetown facility contains concentrations of VOCs in some locations that may potentially exceed Model Toxics Control Act (MTCA) indoor air cleanup levels due to vapor intrusion.
- Indoor air samples obtained from some buildings in the area down gradient of the PSC facility had VOC concentrations exceeding Washington State cleanup levels.
- Soil gas samples, collected in various down gradient locations, contained VOCs associated with groundwater contamination originating from the PSC facility.
- Ambient air in the area down gradient of the PSC facility contains a number of the VOCs also detected in the groundwater, but are also from other sources of contamination.

Preliminary evaluations of groundwater data using EPA's Johnson and Ettinger (JE) vapor intrusion model (Johnson and Ettinger, 1991 and EQM, 2000) have indicated that some buildings

located down gradient of the PSC facility may contain concentrations of VOCs that could result in unacceptable health risks, due solely to the vapor intrusion pathway.

## 2.2 STUDY AREA/TIME FRAME

There are two study areas identified in the IPIM Work Plan:

1.) **Study Area 1** – The area where the GIVFs will be developed (see Figure 2-1 - GIVF Study Area).

2.) **Study Area 2** – The area where groundwater data will be evaluated to if IMs are warranted (see Figure 2-2a and Figure 2-2b - IPIM Study Area). Note: Figures 2-2a and 2-2b present the study area for the IPIM Evaluation (i.e., Study Area 2). They also identify Area 1, Area 2, and Area 3 that were evaluated in the draft HHERA (PSC, 2001).

### 2.2.1 Study Area 1 – Study Area for Developing GIVFs

The study area for developing the GIVFs is presented in Figure 2-1. This figure identifies the main study area for the GIVF evaluation and a contingency area. This area is located within the mixed residential/industrial neighborhood that is hydraulically down gradient of the PSC Georgetown facility and most likely impacted by source-related COPCs. As presented in Section 2.2 of the IPIM Work Plan, the maximum concentrations of the four risk-driving chemicals (i.e., 1,1-dichloroethene, chloroethane, trichloroethene, and vinyl chloride) were found within several blocks down gradient of Denver Avenue South. The proposed locations for collecting samples as part of the GIVF evaluation are presented in Table 1-1 and Figure 2-1. These locations were selected using the following guidelines:

- Located over/near areas with high concentrations in the groundwater plume for 1,1-dichloroethene, chloroethane, trichloroethene, and vinyl chloride.
- Residential buildings within the area with a construction type that is most likely to result in VOCs migrating from groundwater and becoming elevated in indoor air. Features of buildings and surrounding grounds that influence how contaminants may enter and be distributed through a building include the following: building size, construction type (crawl-space or basement versus slab-on-grade), and obvious cracks in the floors or walls in contact with the soil (MADEP, 2002).
- Locations least likely to be impacted by other sources of chemicals in indoor air, such as buildings not located next to a gasoline station or industry from which fugitive emissions could emanate.

- Locations that have been previously sampled and shown detections of risk-drivers in groundwater or indoor air.

In order to collect samples from the buildings presented in Table 1-1, PSC must be granted access from the building owner. A letter requesting access for GIVF sampling, which is presented in Appendix C, will be submitted to each property owner/resident presented in Table 1-1. In the event that PSC cannot gain access to all of the buildings presented in Table 1-1, PSC will extend the study area to include 4th Avenue South (which would include the building located at 412 Orcas). A sampling location will be selected from this "contingency" area that has the same building foundation type, if possible, as the location initially proposed for sampling.

Once PSC has been granted access to the buildings, PSC will coordinate with the building owner, residents, and the Washington State Department of Ecology (Ecology) to perform a building evaluation (see Section 4 of this SAP). The main purpose of the building evaluation is to identify building construction characteristics, occupants and occupations, heating and ventilation systems, and sources of possible chemical contaminants that may influence the results of indoor sampling at each location. Potential sources of VOCs in the home will be identified by visual observation and by using a photo ionization detector to screen the house/building. If possible, any chemicals found will either be sealed properly or removed from the house/building during the test. If source materials need to be removed from the building, sampling will not commence for a minimum of 24 hours. During the evaluation, outdoor sources of contamination and weather conditions that could influence indoor air concentrations will also be documented.

After the building evaluation has been performed, a Supplemental IPIM SAP will be prepared and will contain:

- **Building-Specific Sampling and Analysis Plan**—This will include the number of samples that will be collected and figures identifying the specific locations within the building where the samples will be collected. The analytical methods that will be used to evaluate the samples will also be presented.
- **Building-Specific Data Quality Objectives (DQOs)**—This section, if necessary, will identify any site-specific DQOs. It is anticipated that the DQOs presented in Section 2 of this SAP will apply directly to the Supplemental IPIM SAPs and can be incorporated by reference. However, additional information on DQOs will be provided if needed.
- **Building-Specific Schedule**—This section will present the schedule for the field activities and analytics.

The Supplemental IPIM SAP will also include the Sampling Methodology (Section 4) and Sample Documentation (Section 5) of this SAP by reference.

Indoor air samples will be collected from areas in the buildings representative of reasonable maximum exposure (e.g., basements, bedrooms, etc.). Groundwater samples will also be collected close to these buildings to determine the relationship between indoor air levels and groundwater levels of selected (*target*) compounds of potential concern (COPCs). Ambient air samples will additionally accompany the indoor air samples so that the indoor COPC levels may be adjusted for ambient intrusion. Soil gas and geotechnical samples may also be collected at locations to assist in qualitatively characterizing the vapor intrusion pathway.

After the samples have been collected as part of the GIVF evaluation, Inhalation Pathway Interim Measure Actions Levels (IPIMALs) for groundwater will be developed based on protection of indoor air associated with the groundwater vapor intrusion pathway. The calculation of GIVFs will be based on one-time, co-located sampling of groundwater and indoor air from multiple locations and they will not be re-collected. Once the GIVFs are calculated, groundwater will be monitored quarterly and compared to groundwater action levels (IPIMALs), established to be protective of the vapor intrusion pathway, as the data become available. The groundwater IPIMALs will be used to assist in determining if IMs are warranted.

### 2.2.2 Study Area 2 – Study Area for Determining if Interim Measures are Warranted

The study area for determining if IMs are warranted is presented in Figure 2-2a and Figure 2-2b. Groundwater data will be collected from this network of monitoring wells on a quarterly basis to determine if IMs are needed to protect human health. The Pre-Corrective Action Monitoring Plan (PCAMP) (PSC, 2002b) has been implemented by PSC since 1993 and, with the expansion and addition of more than 55 new monitoring wells down gradient of the facility, this program is an integral part of the IPIM. The screened interval of each water table monitoring well extends from 7 feet below to 3 feet above the estimated high water level at that location. Twenty-seven monitoring wells are screened across the water table within the IPIM Study Area and two more are proposed to be installed as soon as access is granted. Samples from each well will be submitted for analysis on a quarterly basis for the inhalation pathway COPCs. If a well contains compounds that exceed the IPIMALs and a Tier 3 or Tier 4 decision is made in relation to the Decision Tree presented in the IPIMWP, indoor air sampling may be conducted to verify whether the estimated risks to human health are accurate. Additional media may also be sampled to verify the human health risks associated with the inhalation pathway. In the event that additional media sampling is proposed as part of Tier 3, PSC will develop a Supplemental IPIM SAP for this effort.

## 2.3 DATA-DRIVEN DECISIONS

The data collected pursuant to this SAP will be used directly to:

1.) Develop empirically-derived GIVFs for groundwater COPCs associated with the indoor air pathway.

2.) Assess the potential risks associated with indoor air concentrations at buildings located hydraulically down gradient of the PSC Georgetown facility.

Note: The data collected pursuant to the Supplemental IPIM SAPs will only be used directly to assess the potential risks associated with indoor air concentrations at buildings located hydraulically down gradient of the PSC Georgetown facility. GIVFs will not be recalculated after they have been developed as described in the IPIM Work Plan and this SAP.

From comparison of the IPIMALs to groundwater COPC concentrations, PSC will be able to identify buildings that: (1) need interim measures, (2) need more study, or (3) do not appear to need intervention (based on air quality impacts from vapor intrusion). PSC will use the data to refine the process, included in the IPIM Work Plan, for evaluating buildings with groundwater data as it becomes available each quarter.

As noted in the IPIM Work Plan, there are a number of data quality objectives for the evaluation of vapor intrusion and for the sampling being conducted pursuant to this SAP. Four are related to data collection activities, as described below:

- Collect groundwater data representative of actual conditions in the upper portion of the shallow aquifer (and particularly, at the water table).
- Collect indoor air data representative of actual conditions in the building being sampled that day (and particularly, in those portions of the building where exposures would be highest).
- Collect indoor air data representative of actual conditions in the building being sampled that day, caused by vapor intrusion from groundwater.
- Achieve detection limits for both groundwater, ambient, and indoor air samples that are at or below constituent-specific health-based action level concentrations (cancer risk = 1E-6; hazard quotient = 0.1).

An explanation of how the SAP will meet these data quality objectives is provided in Section 3 below and in the Quality Assurance Project Plan (QAPP).

## 2.4 IDENTIFICATION OF DATA NEEDS

Table 2-1 presents an example of the type of information that will be detailed in the Supplemental IPIM SAPs.

## 2.5 DECISION RULES AND USE OF THE DATA

Analytical data will be collected as part of the GIVF Evaluation and, as needed, to support Tier 3 of the Decision Tree. The analytical data collected during the GIVF Evaluation will ultimately be used to assess the potential risks to human health at buildings within the study area. Ultimate uses of the data collected in carrying out this SAP will be described in the approved IPIM Work Plan. The six "rules" noted below should, therefore, be considered preliminary, and may be superceded by methods and procedures contained in the Work Plan. It is not anticipated, however, that changes to these rules will result in new data gaps (i.e., it is not expected that changes to the rules will affect the adequacy of the SAP).:

A. Once the data have been validated, PSC will inspect the groundwater/indoor air data pairs. The detected groundwater concentrations will be paired with the detected or non-detected results in indoor air to calculate GIVFs. For locations with non-detected results in indoor air, it will be assumed that the indoor air concentration is equivalent to the full reporting limit[2]. For example, if a target compound is not detected in the groundwater at a particular building, PSC will not develop a GIVF for that building and target compound (although GIVFs will be developed for this target compound at other buildings where the compound was detected in the groundwater).

B. For those buildings where indoor air samples have been collected to support the GIVF evaluation, the resultant, “adjusted” COPC levels will be compared to indoor air IPIMALs calculated assuming residential exposure. In most cases, if the cumulative cancer risk is greater than 1E-5 or a hazard index (i.e., sum of the individual hazard quotients) is greater than 1.0[3], the building will be proposed for Tier 4 evaluation (i.e., implementation of IMs).

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[2] PSC will evaluate the detection limits of the groundwater and indoor air pairs for the non-detected indoor air results to determine if they are appropriate for developing GIVFs. If the detection limits for target compounds are 1-2 orders of magnitude or higher than the method detection limit presented in the QAPP, then, upon consultation with the Washington State Department of Ecology (Ecology), an alternate method for evaluating the potential impacts to indoor air will be used. If the groundwater and indoor air data are appropriate for developing GIVFs, then GIVFs will be calculated, per building and per constituent, for all instances where the paired data includes a detected groundwater concentration.

[3] Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). Based on this evaluation, PSC may submit a proposal for such segregation for Ecology's review. If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater

C. Once GIVFs have been derived for all COPCs, those GIVFs will be used to calculate groundwater IPIMALs. These IPIMALs will be compared to 2nd quarter water table groundwater monitoring data (available at the end of August 2002) and quarterly water table groundwater monitoring well data collected thereafter. They will also be used for comparison to previous hydropunch results taken from the water table. Residential buildings where nearby groundwater exceeds the IPIMALs will be further evaluated in Tier 3 or Tier 4. Commercial buildings where nearby groundwater exceeds the IPIMALs will be further evaluated in Tier 2.

D. Those buildings where indoor sampling shows acceptable risks/hazards, or where groundwater concentrations in the wells associated with those buildings indicate that risks/hazards via vapor intrusion should be acceptable, will be further evaluated (under Tier 1) each quarter as new groundwater data become available. The buildings will also be included in the assessment of site risks and hazards contained in the revised RI Report.

E. The results from geotechnical sampling will be used as part of the overall quality assurance effort to increase confidence in the assumption that buildings selected for deriving GIVFs properly represent the vadose zone below other buildings throughout Area 3.

F. The results of the soil gas sampling will be used qualitatively to assist in evaluating the completeness of the groundwater to indoor air vapor intrusion pathway.

The analytical data collected during the Tier 3 Evaluations will be used to assess the potential risks to human health at the buildings where the samples were collected. The following decision rule will be applied to the data resulting from the Tier 3 Evaluations:

A. For those buildings where indoor air samples have been collected to support the GIVF evaluation, the resultant, "adjusted" COPC levels (adjusted by subtracting the higher of the potential contributions from indoor air sources and ambient air sources), will be compared to indoor air IPIMALs calculated assuming residential exposure. In most cases, if the cumulative cancer risk is greater than 1E-5 or a hazard index (i.e., sum of the individual hazard quotients) is greater than 1.0[4], the building will be proposed for Tier 4 evaluation (i.e., implementation of IMs).

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than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

[4] Per WAC 173-340-700(5)(b)(c), PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). Based on this evaluation, PSC may submit a proposal for such segregation for Ecology's review. If the toxicity information indicates that it is appropriate to

## 2.6 ALLOWABLE ERROR

There are a number of sources of error/uncertainty associated with the study and evaluation process (see the IPIM Work Plan). This SAP has been designed to ensure that the total error/uncertainty will result in decision-making that is biased towards implementing IMs where such measures may not be necessary (as opposed to not taking measures when they should be taken). For example, the procedures for collecting samples were developed to ensure that samples are collected from areas that will be reasonable maximum estimates of the actual concentrations of indoor air to which individuals may be exposed. This will be done by ensuring that samples are collected from areas expected to have the highest concentrations, using EPA and Ecology-approved sampling methodologies. Indoor air samples will be collected from the basement and/or the highest use area of a building to ensure that the area of maximum exposure is sampled.

In addition, PSC has instructed the laboratories to attempt to achieve the detection limit goals by analyzing samples by the regular method first to minimize the potential for matrix interferences that can be caused by samples with elevated concentrations being run undiluted on the column of a low-level instrument. If the sample does not have matrix interferences and has not reached the reporting limit goals, the lab will rerun the samples by a low-level method. If the lowest detection limit falls between the reporting limit and the method detection limit, the lab will report the detection limit as estimated rather than reporting the higher reporting limit. This data will be qualified as "J," estimated by the laboratory, but should still be useable in risk management decisions and in the risk assessment as long as no major quality assurance problems exist with the data set (EPA, 1989).

PSC will only use data deemed useable by the QAPP, and all data will be validated prior to use. These steps will help eliminate uncertainties related to sample analytical problems and quality control problems. The data validator may reject some data for use in the development of IPIMALs or for review of the IPIM on a quarterly basis if the data do not meet the standards outlined in the QAPP.

Nevertheless, the study design is limited, and the sources of uncertainty include those identified in the IPIM Work Plan.

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segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will be evaluated further during the next round of groundwater sampling.

# 3. SCHEDULE

Following Ecology's review and approval of this SAP, PSC will mobilize to collect and analyze co-located and concurrently collected groundwater, ambient, and indoor air samples within 15 days of obtaining access to each sampling location. Each sampling event will begin with a building evaluation. Then a Supplemental IPIM SAP will be developed and samples will be collected and submitted to the laboratory for analyses. Upon validation and evaluation of the data, chemical-specific GIVFs and groundwater IPIMALs will be developed and submitted to Ecology in a technical memorandum within 60 days of receiving the validated data. The schedule for future field activities under taken as part of the Decision Tree will be documented in the Supplemental IPIM SAPs.

PSC has made arrangements with the laboratories to work on a rapid turnaround time (i.e., 5-day turnaround time) for samples collected for this SAP and future Supplemental IPIM SAPs to ensure that samples are analyzed quickly. The data validation contractor will have the same turnaround time requirement to complete its validation tasks upon receipt of the final data package from the laboratory. PSC will expedite the analysis of the data so that the IPIM Decision Tree can be implemented and the data and proposed IPIM decisions can be reported to Ecology promptly.

# 4. SAMPLE COLLECTION AND ANALYSIS

## 4.1 INDOOR AIR SAMPLING METHODOLOGY

### 4.1.1 Time of Sampling

The optimal time to collect indoor air samples varies depending upon local conditions. However, it is generally agreed that best monitoring conditions exist when the indoor temperature is at least 10° F higher than outside air and wind speeds are steady and exceed about 5 miles per hour (EPA, 1992). Under these conditions, reasonable building air exchange rates and under-pressurization of the building develops. EPA recommends that sampling be avoided if significant precipitation or barometric pressure fluctuations have occurred in the preceding 12 hours (EPA, 1992). However, a more recent indoor air sampling guide (MADEP, 2002) suggests that when sampling is conducted during a rain event, VOCs are diverted from the wet soil around the building to drier soil underneath the building as soil pores become occupied with water. Other factors that can impact the degree of vapor intrusion from soil gas include the height of the water table and temperature of the soil and groundwater. For the purposes of this SAP, scheduling will attempt to replicate the prior indoor air sampling event taken during the summer (i.e., sampling will not be conducted on rainy days). Temperature, wind speed, and barometric pressure will be measured or recorded from nearby weather stations.

### 4.1.2 Preparation of Buildings for Sampling

Prior to sampling each building identified in Figure 2-1, a building evaluation will be performed. A building evaluation form is included as Attachment C. The main purpose of the building evaluation is to identify building construction characteristics, occupants and occupations, heating and ventilation systems, and sources[5] of possible chemical contaminants that may influence the

[5]There are many sources of indoor air contamination from the use of everyday cleaning products, beauty products, and home maintenance materials. Carpets and wood may contain volatile chemicals such as formaldehyde, xylenes, and acetone. Paints and paint thinners contain chemicals such as acetone and toluene. Refrigerators can leak Freon. Sinks and drains may be linked to sewer systems, and gases, such as methane, may back up through the sewer pipes into the home. Chemicals stored in the home may emit volatile compounds into the air such as cleaning products (oven cleaners, degreasers, ammonia, and chlorine) and beauty products (spray deodorants, hair spray, and perfumes). Other items that may also cause volatile emissions include animal feces in litter boxes, degrading food products, dry-cleaning chemicals from clothing, and fuel in furnaces. Table 3-2 in the Work Plan shows the list of compounds being evaluated and the ranges at which they have been detected in indoor air during recent studies.

results of indoor sampling at each location. Potential sources of VOCs in the home will be identified by visual observation and by using a photo ionization detector to screen the house/building. If possible, any chemicals found will either be sealed properly or removed from the house/building during the test. If source materials need to be removed from the building, sampling will not commence for a minimum of 24 hours. During the evaluation, outdoor sources of contamination and weather conditions that could influence indoor air concentrations will also be documented. Residents will be informed of things that they should and should not do in preparation and during sampling. They will also be asked if they have done any of these things post sampling.

### 4.1.3 Indoor Air Sampling Locations

The IPIM Work Plan describes the process for identifying buildings to be sampled. The building locations for the present study are identified on Figure 2-1. Each building evaluation will contain an approximate floor plan showing the indoor sampling locations and other co-located sample locations. One to two indoor air samples (as explained below) will be collected from each selected building in the primary breathing zones within the building. If the building has a basement, a minimum of one sample will be collected in the basement and, if possible, one sample will be collected on the main floor of the building. If the building is a residence, one sample will typically be collected at pillow level in the primary sleeping area and/or in the sitting area. If the building is a business, a sample will be collected in the basement, if present, and in the office area or an area where workers spend most of their time. These are areas where exposure would be expected to be highest.

### 4.1.4 Indoor Air Sampling Methodology

Indoor air concentrations can vary throughout the day as a result of a number of factors, including temperature changes and household activities. Indoor air samples will be collected using a time-integrated method over a 24-hour period to account for these fluctuations and to capture the daily average indoor air concentration to which an individual may be exposed. Time-integrated indoor air samples will be collected using 6 Liter (L) Summa canisters prepared under negative pressure and certified clean for the compounds of interest for the site. The Summa canisters will be equipped with dedicated flow regulators. The flow rate into the canisters will be set at a fill rate for a 24-hour period.

To begin sampling, the valve on the flow regulator will be opened, and the pressure of the canister and the time of sampling will be recorded on the sample identification tag for that canister and in the field notes. After sampling begins and the canister is verified to be operating correctly and filling at the correct speed, the canister will be left to fill. The sampling team will

return after approximately 20 hours to check the canisters to ensure that they are operating properly. It is necessary to check the canister prior to the 24-hour period because the accuracy of the flow regulators can vary slightly, causing the canisters to fill faster than expected. The valve on the canisters will then be closed when the pressure on the canisters reaches approximately -5 to -6 inches mercury (Hg), or 24 hours have elapsed, whichever occurs first. The exact pressure of the canister and time at the end of sampling will be recorded on the sample identification tag for that canister and in the field notes.

### 4.1.5 Quality Control for Indoor Air Sampling

One field quality control sample (i.e., a co-located canister sample) will be collected for each building. Matrix spikes will not be collected and analyzed for air samples because it is not possible to spike the Summa canisters for analysis using the combined analytical methods TO-14/TO-15

The Summa canisters will be cleaned individually and certified to 0.02 parts per billion-volume (ppbv) total hydrocarbons (THC) by the contract laboratory. Therefore, this certification qualifies as the equipment blank that is traditionally collected in the field for other types of sampling.

### 4.1.6 Decontamination Procedures

The equipment used for air sampling will not require decontamination in the field. The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC for the project-specific analyte list by the contract laboratory prior to shipment.

### 4.1.7 Sample Handling

All sample containers will be labeled with the following information: sample identification, date and time sample was collected, the starting and ending sample time and canister pressure, the site name, and the company name. All this information will also be included in the field book, and pertinent information will be transferred to the chain-of-custody record. All Summa canisters will be packed in the original shipping containers, sealed with a custody seal, and sent within 2 days to Air Toxics Laboratory in Folsom, California, for analysis.

### 4.1.8 Sample Analysis

Each Summa canister will hold 6 L of air, which will allow for sufficient volume to reach the method detection limit goals listed in the QAPP. The indoor air samples will be analyzed using combined EPA Methods TO-14/TO-15, and when necessary/possible, low-level analysis or

Selective Ion Mode (SIM) analysis will be used to obtain the lowest achievable detection and reporting limits. The air samples collected in the Summa canisters have a 30-day holding time. The QAPP in Appendix B of the IPIM Work Plan includes the laboratory's Quality Assurance Plans.

## 4.2 AMBIENT AIR SAMPLING METHODOLOGY

### 4.2.1 Time of Sampling

The ambient air samples will be taken concurrently with indoor samples.

### 4.2.2 Ambient Air Sampling Locations

Ambient air samples will be collected near the buildings where indoor sampling is occurring. The Summa canisters will be placed at 3 meters (m) or more above ground surface[6], upwind of the building. To minimize interferences and confounding influences, the project team will follow the PAMS siting guidelines presented in Appendix E of 40 CFR Part 58.

### 4.2.3 Ambient Air Sampling Methodology

Similarly to indoor air samples, ambient samples will be collected using a time-integrated method over a 24-hour period to account for concentration fluctuations and to capture the average air concentrations that could infiltrate into the building's indoor air space. Time-integrated air samples will be collected using 6 L Summa canisters prepared under negative pressure and certified clean for the compounds of interest for the site. The Summa canisters will be equipped with dedicated flow regulators. The flow rate into the canisters will be set at a fill rate for a 24-hour period.

Like indoor sampling, to begin ambient sampling the valve on the flow regulator will be opened, and the pressure of the canister and the time of sampling will be recorded on the sample identification tag for that canister and in the field notes. After sampling begins and the canister is verified to be operating correctly and filling at the correct speed, the canister will be left to fill. The sampling team will return after approximately 20 hours to check the canisters to ensure that they are operating properly. The valve on the canisters will then be closed when the pressure on the canisters reaches approximately -5 to -6 inches mercury (Hg), or 24 hours have elapsed, whichever occurs first. The exact pressure of the canister and time at the end of sampling will be recorded on the sample identification tag for that canister and in the field notes.

[6] No canister inlet should be below 2 m. If the summa canister is not located above at least 3 m, a notation will be made in the Record, and the Tech Memo (report) will explain which locations were unable to be sampled air at this height.

It is expected that a single canister sample will be collected per building. However, if in the judgment of the project manager in the field, a single ambient collection station may serve two buildings, only one sample of ambient air will be collected for the two buildings. In addition, if in the judgment of the project manager in the field, a second ambient air sampler should be added to a location where only one ambient sampler is being used (and there is not a second ambient canister for one block or more), a second sampling station will be established.

### 4.2.4 Quality Control for Ambient Air Sampling

No field quality control samples will be collected for ambient air samples. Matrix spikes will not be collected and analyzed for air samples because it is not possible to spike the Summa canisters for analysis using the combined analytical methods TO-14/TO-15.

The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory. Therefore, this qualifies as the equipment blank that is traditionally collected in the field for other types of sampling.

### 4.2.5 Decontamination Procedures

The equipment used for air sampling will not require decontamination in the field. The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory prior to shipment.

### 4.2.6 Sample Handling

All sample containers will be labeled with the following information: sample identification, date and time sample was collected, the starting and ending sample time and canister pressure, the site name, and the company name. All this information will also be included in the field book and pertinent information will be transferred to the chain-of-custody record. All Summa canisters will be packed in the original shipping containers and sent within 2 days to Air Toxics Laboratory in Folsom, California, for analysis.

### 4.2.7 Sample Analysis

Each Summa canister will hold 6 L of air, which will allow for sufficient volume to reach the method detection limit goals. The ambient air samples will be analyzed using the combined EPA Methods TO-14/TO-15, and when necessary/possible, low-level analysis or Selective Ion Mode (SIM) analysis will be used to obtain the lowest achievable detection and reporting limits. The ambient air samples have a 30-day holding time and must be stored in a clean environment. The QAPP (Appendix B of the IPIM Work Plan) includes the laboratory's Quality Assurance Plans.

## 4.3 GROUNDWATER SAMPLING METHODOLOGY

For collecting groundwater information during the paired (groundwater and indoor air) sampling, direct push groundwater sampling will be employed if a permanent monitoring well screened at the water table is not situated close enough to the building. Direct-push groundwater samples will be taken from the water table interval. A vertical, temporary installation will be made near the building, reaching below the depth of the basement or foundation of the building.

### 4.3.1 Time of Sampling

PSC will attempt to collect the direct push samples as soon as the indoor air sampling is completed and in no case longer than 48 hours after indoor air sampling ends.

### 4.3.2 Direct Push Groundwater Sampling Locations

The sampling locations per building will be determined in the field, but will be chosen to be as close to the building where indoor air sampling was conducted as possible. The samples will be collected using a direct push drill rig that will install a vertical boring. The 4-foot screen will be placed across the water table.

### 4.3.3 Groundwater Sampling Methodology

As noted above, groundwater samples will be collected from permanent monitoring wells screened at the water table when possible. The monitoring wells will be sampled using the approved low-flow groundwater sampling SOP PSC-124, as provided in Attachment A.

If a permanent monitoring well is not close enough to the building, a groundwater sample will be collected using direct push sampling tools equipped with a 4-foot screen. A single sample will be taken from each location. Information concerning the sampling tools is provided in Attachment B. The procedures used to collect and analyze samples will be discussed in this section. Standard Operating Procedures for routine field activities are provided in Attachment A. Additional information concerning sampling procedures is provided in the IPIM Work Plan's QAPP (Appendix B).

The sampling protocol used for collecting groundwater samples will be:

1. Prior to beginning, the location will be cleared for utilities, making sure that all needed access agreements are in place, and the appropriate permits[7] obtained.
2. Sampling locations will be identified as specified in the IPIM Work Plan and SAP.

[7] PSC expects that sampling of groundwater at the building(s) may require a street use permit from the City of Seattle and a start card from the Washington Department of Ecology.

3. A decontaminated direct push water sampling tool will be attached to the end of the drive rods.
4. The lower tip of the sampling tool will be advanced to the lower depth of the interval to be sampled. The field team will note any changes in behavior (e.g., sound, resistance) as the tool is advanced.
5. The inner rods will be inserted into the drive rods with the male threads pointing down.
6. The inner threaded end of the inner rod will be engaged into the retaining plug located at the top of the water sampling tool. The reverse threaded plug that opens the sampling tool will be removed.
7. The drive rods will be retracted 4 feet, allowing the groundwater sample screen to be exposed to the subsurface.
8. The inner rods will be removed. Dedicated Teflon®-lined tubing will be placed down the drive rods to the depth of the screen.
9. The top of the tubing will be attached to the peristaltic pump and approximately 1 gallon of water removed to purge the tubing and to assure that sampled water is from the specified depth.
10. A water quality reading (pH, temperature, dissolved oxygen, specific conductivity, redox, and turbidity) will be collected from the purge tubing.
11. The pump will be stopped and the tubing removed from the borehole to collect the groundwater sample from the bottom of the tubing.
12. Two or three 40-milliliter vials will be filled, leaving no headspace.
13. If there is insufficient sample in the tubing to fill one sampling vial, the tubing will be re-inserted into the rod and the pump will be re-started. If there is insufficient sample on the second attempt, the sample will be collected through the pump.
14. The tubing will be discarded after all samples have been collected.
15. The sampling device will be retracted, and the sample tool and drive rods decontaminated using a non-phosphate detergent and a potable water rinse. The sample tool will be further rinsed with deionized water followed by a hexane rinse and air drying (If it is not being used immediately thereafter, it will be wrapped in aluminum foil).
16. Equipment rinsate blank collection will be completed as appropriate (e.g., on the direct push screen).
17. The decontaminated sample tool will be attached to the decontaminated drive rods so that the procedure may be repeated at the next sampling depth.
18. The boring will be abandoned.

### 4.3.4 Quality Control for Groundwater Sampling

Groundwater samples will have the following quality control samples collected in association with the regular samples: trip blank, field duplicate, field blank, equipment blank (for direct push samples), and matrix spike/matrix spike duplicate. Additional information regarding the use of the QC data collected is provided in the QAPP (Appendix B of the IPIM Work Plan).

#### 4.3.4.1 Field Duplicate Samples

Field duplicates will be prepared by collecting two aliquots of sample from the same sampling location using the same sampling equipment and technique. The samples will then be submitted for analysis as separate samples. The frequency of collection of field duplicate samples will be 1 per 20 samples collected (or 1 per sampling round if less that 20 samples are collected).

#### 4.3.4.2 Equipment Rinsate Blanks

Equipment rinsate blanks will be collected whenever non-dedicated or non-disposable sampling equipment will be used. Equipment rinsate blanks will be used to identify possible contamination from the sampling environment or from sampling equipment. These blanks will be collected by pouring deionized and distilled water over (or through) the decontaminated sampling equipment and into a sample jar. One equipment rinsate blank will be collected for each type of sampling equipment used during the sampling event.

#### 4.3.4.3 Field Blanks

Field blanks will be collected by sampling personnel in the field and submitted to the laboratory as natural samples. Field blanks will be used to identify possible contamination occurring from the sampling environment (e.g., airborne contamination). These blanks will consist of deionized and distilled water from the analytical laboratory in clean and preserved sampling containers. In the field, this water will be transferred to an empty sampling container at a specified sampling location. The sample will be preserved for the applicable analysis to be completed. The frequency of collection will be 1 per 20 samples collected and the field blanks will be analyzed for VOCs samples only.

#### 4.3.4.4 Trip Blanks

Trip blanks will be carried with sample coolers when sampling for VOCs and will be used to assess possible contamination during sample transport. Trip blanks will be prepared at the laboratory by adding distilled deionized water and preservative to clean volatile organic analysis

vials. Trip blanks will be included in each cooler used for transporting VOC and gasoline-range organic samples and will remain sealed during sample collection and transport.

### 4.3.5 Sample Handling

All sample containers will be labeled with the following information: sample identification, date and time sample was collected, the site name, and the company name. All this information will also be included in the field book and pertinent information will be transferred to the chain-of custody record. All sample containers will be packed in ice filled coolers for shipment to North Creek Analytical (NCA) in Bothell, Washington. The cooler will be secured and sealed with a chain-of-custody seal. Samples will be delivered to NCA within 1 day of their collection.

### 4.3.6 Groundwater Sample Analysis

Each groundwater sample will be analyzed for selected VOCs, listed in Table 1, by EPA Method SW846-8260B. If necessary, the sample will be run by either 25-mL purge or SIM analyses to achieve the reporting limit goals listed in the QAPP.

## 4.4 GEOTECHNICAL SOIL SAMPLING

More information will be gathered regarding soils in the area where indoor air samples are being taken. The information will include grain-size, moisture content, wet and dry bulk density, and total porosity. This data will be useful in estimating indoor air concentrations from groundwater or soil gas, and will help PSC determine the representativeness of the sampling-area vadose zone.

### 4.4.1 Time of Sampling

PSC will attempt to collect the samples within 72 hours of the indoor air sampling.

### 4.4.2 Direct Push Geotechnical Soil Sampling Locations

Figure 4-1 presents the proposed geotechnical soil sampling locations. These samples will be collected using a direct push drill rig that will install vertical borings. PSC will log the soil to the top of the water table to determine if there are variations in the soil lithology. Geotechnical soil sample intervals can then be determined. If there are differences in the lithology (i.e., A and B soil horizons exist), two geotechnical samples will be collected, one from each horizon.

### 4.4.3 Geotechnical Soil Sampling Methodology

Geotechnical soil samples will be collected in 2-foot-long by 1-inch-wide acetate liners that are driven to the desired depth using a direct push rig. The sampling protocol used for collecting soil samples for lithologic logging and collecting geotechnical soil samples will be:

1. Locate boring location as specified in IPIM Work Plan and by the project leader.
2. Attach direct push soil sampling tool with liner to the end of the drive rods.
3. Advance the sampling tool into the soil.
4. Engage the inner threaded end of inner rod into the retaining plug located at the top of the soil sampling tool, and remove the reverse threaded plug that opens the sampling tool.
5. Remove the drive rods and sampling tool.
6. Remove the inner liner of the sampling tool from the drive rods.
7. If a geotechnical analysis is needed, plug both ends of the liner and seal with tape, then label the sample top and bottom and affix a sample identification label.
8. Abandon the boring.

### 4.4.4 Quality Control for Geotechnical Soil Sampling

Quality control samples will not be collected for soil lithology or geotechnical samples.

### 4.4.5 Sample Handling

All geotechnical sample containers will be labeled with the following information: top and bottom of sample, sample interval in feet below ground surface, sample identification, date and time sample was collected, the site name, and the company name. All this information will also be included in the field book and pertinent information will be transferred to the chain-of-custody record. All geotechnical samples will be stored upright and delivered to Rosa in Seattle, Washington, as soon as possible, to reduce the chance of disturbing the sample.

### 4.4.6 Geotechnical Soil Sample Analysis

The analytical methods for geotechnical soil samples include grain-size by ASTM D422, moisture content by ASTM D2216, wet and dry bulk density by ASTM D2937, and total porosity by ASTM D854.

## 4.5 SOIL GAS SAMPLING METHODOLOGY

Soil gas samples will be collected, where feasible, to determine whether chemicals detected in the indoor air are associated with a complete pathway of migration from groundwater. Detection

of COPCs in soil gas within the vadose zone beneath or adjacent to the building will provide further indication that a complete pathway exists. If groundwater COPCs are not detected in soil gas, the potential for indoor air associated with other potential sources will be further examined. Soil gas data will not be evaluated quantitatively

### 4.5.1 Time of Sampling

The optimal time to collect soil gas samples varies depending upon local conditions. EPA recommends that sampling be avoided if significant precipitation or barometric pressure fluctuations have occurred in the preceding 12 hours (EPA, 1992). However, a more recent indoor air sampling guide (MADEP, 2002) suggests that when sampling is conducted during a rain event, VOCs are diverted from the wet soil around the building to drier soil underneath the building as soil pores become occupied with water. Other factors that can impact the degree of vapor intrusion from soil gas include the height of the water table and temperature of the soil and groundwater. However, it may not be possible to collect the samples under optimal weather conditions, as sampling will be scheduled in short time frames to collect, analyze, and interpret data in a timely manner due to potential public health concerns. PSC will sample soil gas within 72 hours of collecting indoor air samples. In the past, EPA has requested that subsurface sampling not occur simultaneously with indoor air sampling to prevent disturbing the subsurface conditions during the indoor air sampling process. Temperature, wind speed, and barometric pressure will be measured or recorded from nearby weather stations.

### 4.5.2 Soil Gas Sampling Locations

The sampling locations will be determined on a case-by-case basis. The options for sample collection include:

- Install a shallow boring through the floor of the building foundation near the indoor air samples.
- Install diagonal borings on the side of the building reaching just below the basement or foundation of the building.
- Install a vertical boring near the building, reaching below the depth of the basement or foundation of the building.

Soil gas will be sampled from the 4-foot interval above the capillary fringe, which will be estimated to be 1 foot above the current depth to the water table. Sampling to this depth will be very difficult using the first method of drilling through a building foundation, as this is a manual method of drilling.

### 4.5.3 Soil Gas Sampling Methodology

Soil gas samples will be collected from a direct push stainless-steel screen (typically between 1 and 4 feet long and approximately 1 inch in diameter) under one of three scenarios.

- In the first scenario, an approximately 2- to 3-inch diameter hole will be drilled in the foundation of the building and a 1- to 2-foot-long stainless-steel screen with a drive point will be driven into the hole, leaving the screen exposed to soil gas in the vadose zone.
- In the second scenario, a direct push drill rig will push the screen and drive point diagonally approximately 1 to 4 feet beneath the foundation of the building, leaving the screen exposed to soil gas in the vadose zone.
- In the third scenario, a direct push drill rig will push the screen and drive point vertically approximately 1 to 4 feet adjacent to and beneath the depth of the foundation of the building, leaving the screen exposed to soil gas in the vadose zone.
    1. Prior to beginning, have the location cleared for utilities, make sure access agreements are in place, and the appropriate permits have been obtained.
    2. Locate sampling location as specified in IPIM Work Plan.
    3. Attach the decontaminated direct push water sampling tool to the end of the drive rods.
    4. Advance lower tip of the sampling tool to lower depth of the interval to be sampled.
    5. Insert the inner rods into the drive rods with the male threads pointing down.
    6. Engage the inner threaded end of inner rod into the retaining plug located at the top of the water sampling tool and remove the reverse threaded plug that opens the sampling tool.
    7. Retract the drive rods 4 feet, allowing the groundwater sample screen to be exposed to the subsurface.
    8. Remove inner rods.
    9. During sampling, place a hydrated bentonite seal above the screen near ground surface to minimize surface air intrusion.
    10. Attach the sampling port at the top of the rods. The port will consist of a silicone stopper with a barbed brass fitting with a piece of Teflon®-lined tubing attached to each end of the barbed brass fitting. The tubing on the outside of the rod will be attached to the purging pump or sampling canister.

11. Prior to sampling, purge each soil vapor port for 3 minutes at 300 mL/min using an air pump to ensure that the soil gas sample is representative of subsurface conditions.[8]
12. After purging, set to fill the Summa canister over a 24-hour period. To begin sampling, open the valve on the flow regulator and the pressure of the canister and record the time of sampling on the sample identification tag for that canister and in the field notes. After sampling begins and the canister is verified to be operating correctly and filling at the correct speed, leave the canister to fill. The sampling team will return after approximately 20 hours to check the canisters to ensure that they are operating properly. It is necessary to check the canister prior to the 24-hour period because the accuracy of the flow regulators can vary slightly, causing the canisters to fill faster than expected. The valve on the canisters will then be closed when the pressure on the canisters reaches approximately -5 to -6 inches Hg. The exact pressure of the canister and time at the end of sampling will be recorded on the sample identification tag for that canister and in the field.
13. Discard the tubing after all samples have been collected.
14. If a groundwater sample is not planned for this location, retract the sampling device and decontaminate the sample tool and drive rods using a non-phosphate detergent and a potable water rinse. Further rinse the sample tool with deionized water followed by a hexane rinse and air drying. If sample tool is not being used immediately, wrap in aluminum foil.
15. If a groundwater sample is planned for this location, see the procedures outlined in Section 4.3.3.
16. Complete equipment rinsate blanks as appropriate (e.g., on the direct push screen).
17. Abandon the boring unless the same boring will be used for groundwater sampling.

### 4.5.4 Quality Control for Soil Gas Sampling

No field quality control samples will be collected for soil gas samples. Duplicate samples will not be collected for the project because there is no adequate method to collect a duplicate sample using Summa canisters. Matrix spikes will not be collected and analyzed for air samples because it is not possible to spike the Summa canisters for analysis using the combined analytical methods TO-14/TO-15.

[8] This purge rate was calculated according to the procedures outlined in the Soil Gas Sampling and Analysis Plan (PSC, 2001) in order to determine when concentrations in soil gas stabilize and are therefore most representative of subsurface conditions.

The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory. Therefore, this qualifies as the equipment blank that is traditionally collected in the field for other types of sampling.

The equipment used for air sampling will not require decontamination in the field. The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory prior to shipment. However, the direct push tooling will be decontaminated according to the PSC SOP-400 decontamination procedures, which is provided in Attachment A. Equipment rinsate blanks will be collected whenever non-dedicated or non-disposable sampling equipment will be used. Equipment rinsate blanks will be used to identify possible contamination from the sampling environment or from sampling equipment. These blanks will be collected by pouring deionized and distilled water over (or through) the decontaminated sampling equipment and into a sample jar. One equipment rinsate blank will be collected for each type of sampling equipment used during the sampling event and will be analyzed for all analytes except conventional analytes. The frequency of collection will be 1 per 20 samples collected. Additional information regarding this use of this data is provided in the QAPP in Appendix B of the IPIM Work Plan.

### 4.5.5 Sample Handling

All sample containers will be labeled with the following information: sample identification, date and time sample was collected, the starting and ending sample time and canister pressure, the site name, and the company name. All this information will also be included in the field book and pertinent information will be transferred to the chain-of-custody record. All Summa canisters will be packed in the original shipping containers and sent within 2 days to Air Toxics Laboratory in Folsom, California, for analysis.

### 4.5.6 Soil Gas Sample Analysis

Each Summa canister will hold 6 L of soil gas, which will allow for sufficient volume to reach the method detection limit goals. The indoor air samples will be analyzed using the combined EPA Methods TO-14/TO-15 and, when possible, low-level analysis or SIM analysis will be used to obtain the lowest achievable detection and reporting limits. The reporting limits for soil gas samples are provided in the QAPP. The soil gas samples have a 30-day holding time and must be stored in a clean environment. The QAPP is presented in Appendix B of the IPIM Work Plan and includes the laboratory's Quality Assurance Plans.

# 5. SAMPLE DOCUMENTATION

All incidents during a sampling event, including the names of all personnel on site involved in the sampling event, a description of each persons responsibilities, the weather conditions, the major events that occurred during the day, any concerns regarding sources of contamination or cross contamination, and details about samples collected or problems that occurred, will be kept in a site sampling log. All sample location descriptions, sample identifications, and analyses will also be recorded in the field log. The standard operating procedure for documentation procedures is provided in Attachment A.

At the end of each day of sampling, a chain-of-custody record will be generated using the field log. The chain-of-custody record is the document that correlates sample identifications, locations, sample times, and the analyses required for each sample. This is the only document shared by the sample generator and the laboratory; therefore, accuracy is extremely important. The sampler will also keep a copy of the chain-of-custody record for record keeping purposes.

## 5.1 SAMPLE IDENTIFICATION

Sample identification will consist of the sample location (address number of building followed by the first letter of the street name), type of sample, and the sample number, followed by the sample date. An abbreviation of the building address will begin the sample identification number. An example of an indoor air sample collected from 5409 Denver Avenue would be 5409D. The sample location will be followed by the media type and a sample number. All indoor air sample locations will be identified with an IA#, all ambient air sample locations will be labeled with an A#, any soil gas sample locations will be labeled SG-#, all direct push groundwater sample locations will be labeled GW-#, and all geotechnical soil samples will be labeled GS-#. The sample media code will be followed by a four digit code for the month and year of sampling, such as 0802 for August 2002. All duplicate samples have a “9” before the media code/sample number. A duplicate for a groundwater sample from 5409 Denver Avenue would be labeled: 5409D-9-GW1-0802. An MS/MSD for a groundwater sample will not be labeled differently, but the sampler will write in the notes section of the chain-of-custody form that extra sample volume was provided so the laboratory can use the sample for the MS/MSD. A trip blank for a water sample is referred to as a “trip blank” or “TB.” Field blanks will be called “FB.”

# 6. REFERENCES


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EPA (U.S. Environmental Protection Agency). 1989. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part A) – Interim Final Report. EPA 540/I-89/002. U.S. EPA, Office of Emergency and Remedial Response, Washington, D.C.

EPA (U.S. Environmental Protection Agency). 2001. Supplemental Guidance for Evaluating the Vapor Intrusion Pathway to Indoor Air Pathway. October 23, 2001.

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Environmental Quality Management (EQM). 2000. User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings (Revised). December 2000.

Johnson, P.C., and A. Ettinger. 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings, *Environ. Sci. Technol*., Vol. 25, 1445-1452. August 1991.

MADEP (Massachusetts Department of Environmental Protection). 2002. Indoor Air Sampling and Evaluation Guide, WSC Policy #02-430, Office of Research and Standards. April 2002.

PSC. 2001. Draft Comprehensive RCRA Facility Investigation Report, Part I (Draft Comprehensive RFI Report) and Part II (Draft Human Health and Ecological Risk Assessment). June and August 2001.

PSC (Phillips Services Corporation). 2002a. Draft Inhalation Pathway Interim Measure Work Plan. May 2002.

PSC (Phillips Services Corporation). 2002b. Revised Pre-Corrective Action Monitoring Plan. March 2002.

# APPENDIX A SAP—TABLES

**Table 1-1**
**Proposed Sampling Locations for the GIVF Evaluation**

| Address | Building Foundation Type |
|---|---|
| 601 South Brandon Street | Residence – with unknown foundation |
| 605 South Brandon Street | Residence – with unknown foundation |
| 611/613 South Brandon Street | Residence – with crawl space |
| 615 South Brandon Street | Residence – with crawl space |
| 5403 Maynard Avenue South | Residence – with basement |
| 5409 Denver Avenue South | Residence – with basement |
| 672 South Lucile Street | Residence – with basement |
| 616 South Lucile Street | Residence – with basement |
| 612 South Lucile Street | Residence – with basement |

**Table 2-1**
**Example of Data Needs that will be Presented in the Supplemental IPIM SAPs**

| Medium | Number of Samples[1] | Collection Method | Analytical Methods | Use of the Data | Notes on Detection Limits |
|---|---|---|---|---|---|
| Groundwater | The number and locations of samples will be presented in the Supplemental IPIM SAP. | Presented in Section 4.0 of the IPIMWP SAP. | EPA method SW846 8260B and 25-ml Purge or Selective Ion Mode (SIM) analysis, as needed. | The groundwater results will be used to:<br>1. Develop the GIVFs.<br>2. Determine if IMs are warranted at buildings evaluated in Tier 1 and Tier 2 of the Decision Tree. | Detection Limits (DL) will be as low as groundwater IPIMALs (Note: these IPIMALs have not been established yet, so initially, DLs will need to be as low as feasibly possible). |
| Indoor air | The number and locations of samples will be presented in the Supplemental IPIM SAP. | Presented in Section 4.0 of the IPIMWP SAP. | Combined TO-14/TO-15 (VOCs) | The indoor air results will be used to:<br>1. Develop the GIVFs.<br>2. Determine if IMs are warranted at buildings evaluated in Tier 3 of the Decision Tree. | Detection Limits (DL) will be as low as groundwater IPIMALs (Note: these IPIMALs have not been established yet, so initially, DLs will need to be as low as feasibly possible). |
| Ambient air | The number and locations of samples will be presented in the Supplemental IPIM SAP. | Presented in Section 4.0 of the IPIMWP SAP. | Combined TO-14/TO-15 (VOCs) | The indoor air results will be used to:<br>1. Develop the GIVFs.<br>2. Determine the contribution of ambient air to indoor air in the buildings evaluated in Tier 3 of the Decision Tree. | DLs will be as close as feasibly possible to indoor air IPIMALs, which are based on an individual analyte cancer risk of 1E-6 risk and an individual analyte hazard quotient of 0.1. |
| Soil gas | The number and locations of samples | Presented in Section 4.0 of the | Combined TO-14/TO-15 (VOCs) | The soil gas data will be used qualitatively to | DLs will be as close as feasibly possible to indoor |

**Table 2-1**

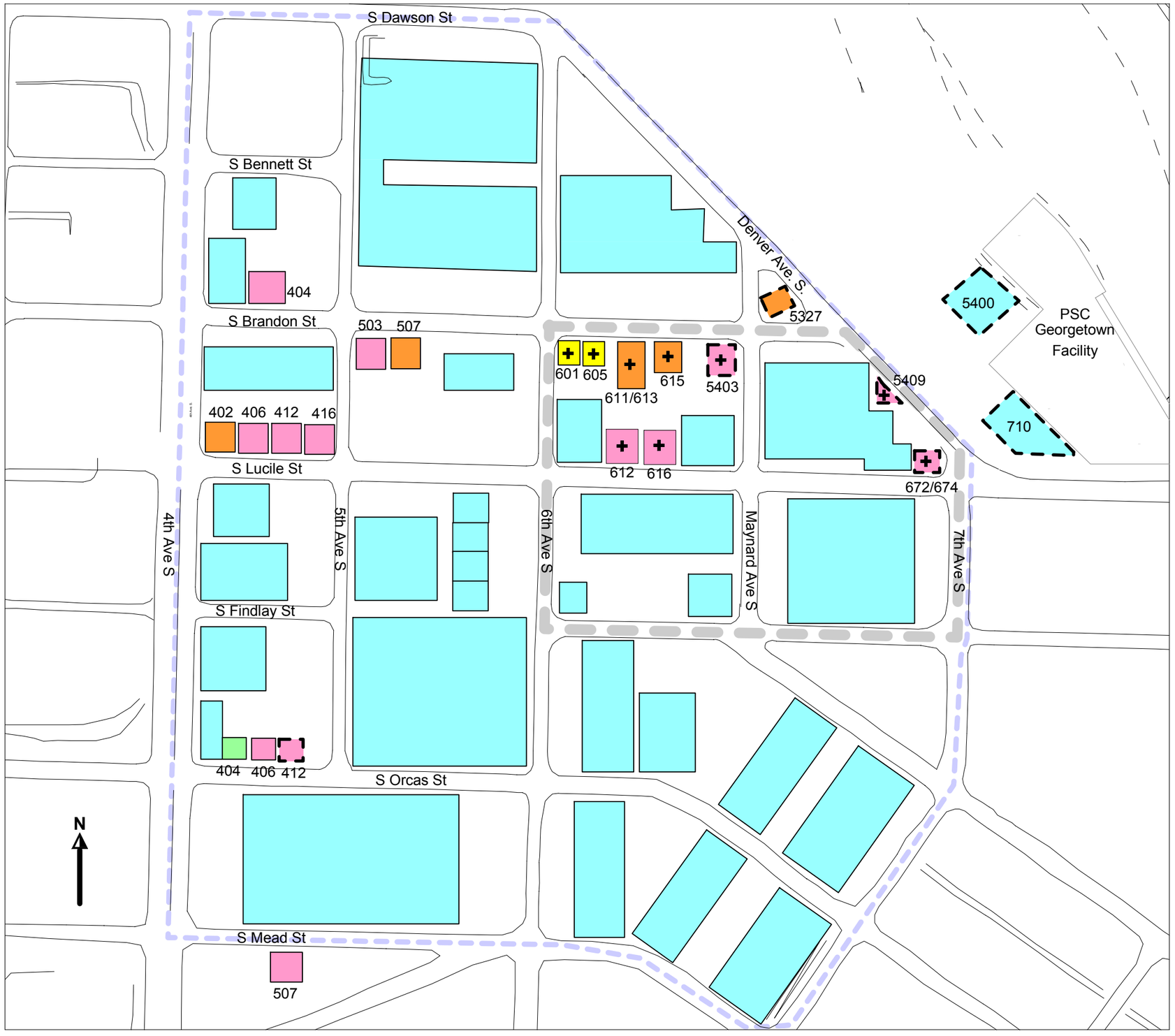
**Example of Data Needs that will be Presented in the Supplemental IPIM SAPs**

| Medium | Number of Samples[1] | Collection Method | Analytical Methods | Use of the Data | Notes on Detection Limits |
|---|---|---|---|---|---|
| | will be presented in the Supplemental IPIM SAP. | IPIMWP SAP. | | assist in determining if the groundwater to indoor air vapor intrusion pathway is complete. | air IPIMALs, which are based on an individual analyte cancer risk of 1E-6 risk and an individual analyte hazard quotient of 0.1. |
| Geotechnical Soil Samples | The number and locations of samples will be presented in the Supplemental IPIM SAP. | Presented in Section 4.0 of the IPIMWP SAP. | ASTM D422, D2216, D2937, and D854. | To assist in characterizing the physical characteristics of the surface and subsurface soil in the study area. | Not Applicable. |

[1]The sample locations will be presented in figures included in the Supplemental IPIM SAP.

# APPENDIX A SAP—FIGURES

# Figure 2-1
## GIVF Study Area




Commercial Building

Residence Type Building with Basement

Residence Type Building on Slab

Residence Type Building with Crawl Space

Residence Type Building with unknown foundation

Previous Indoor Air Sampling Location

Proposed GIVF Co-located Sample Location

Area for GIVF Evaluation

Contingency Area for GIVF Evaluation

Figure not to scale

# Figure 2-2A
# IPIM Study Area
# West of Denver Avenue

E Marginal Way
Utah Ave S
1st Ave S
2nd Ave S
3rd Ave S
4th Ave S
5th Ave S
6th Ave S
S Dawson St
S Bennett St
S Brandon St
S Lucile St
S Findlay St
S Orcas St
S Mead St
S Fidalgo St
S Fidalgo St

**Area 3**
**Area 2**
**Area 1**
PSC Georgetown Facility

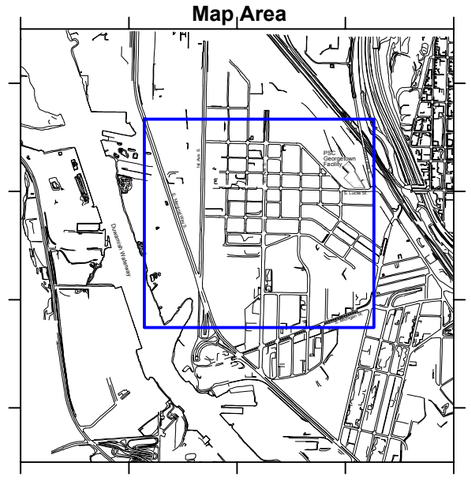
CG-129-WT
CG-113-S1
CG-112-S1
CG-143-WT
CG-130-WT
CG-128-WT
CG-124-WT
CG-122-WT
CG-138-WT
CG-126-WT
CG-127-WT
CG-142-WT
CG-131-WT
CG-134-WT
CG-136-WT
CG-132-WT
CG-141-WT
CG-137-WT
CG-140-WT

Duwamish River

N

0 1000 2000 3000 4000 feet

Map Area



Water Table Monitoring Wells
Area 1
Area 2
Area 3
Study Area for Future IPIMs

# Figure 2-2B
# IPIM Study Area
# East of Denver Avenue

Area 2

Area 1

Area 3

CG-11-S1

CG-1-S1

CG-105-S1

CG-115-WT

CG-10-S1

CG-116-WT

CG-117-WT

CG-9-S1

CG-104-S1

CG-2-S1

CG-103-S1

CG-102-S1

CG-101-S1

CG-106-WT

CG-107-WT

S. Brandon St.

Denver Ave. S.

Airport Way S.

S.Lucile St.

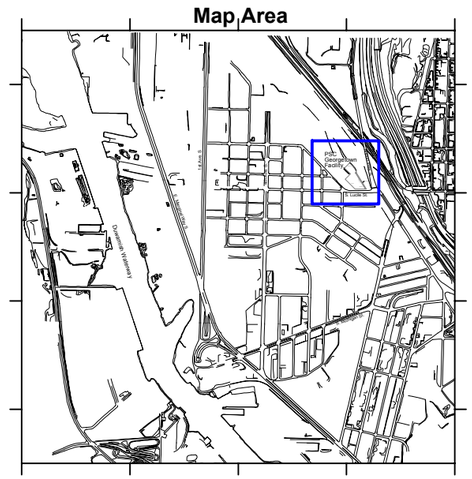
7th Ave. S.

PSC Georgetown Facility

N

0 200 400 600 800 feet

Map Area



Water Table Monitoring Wells

Proposed Water Table Monitoring Wells

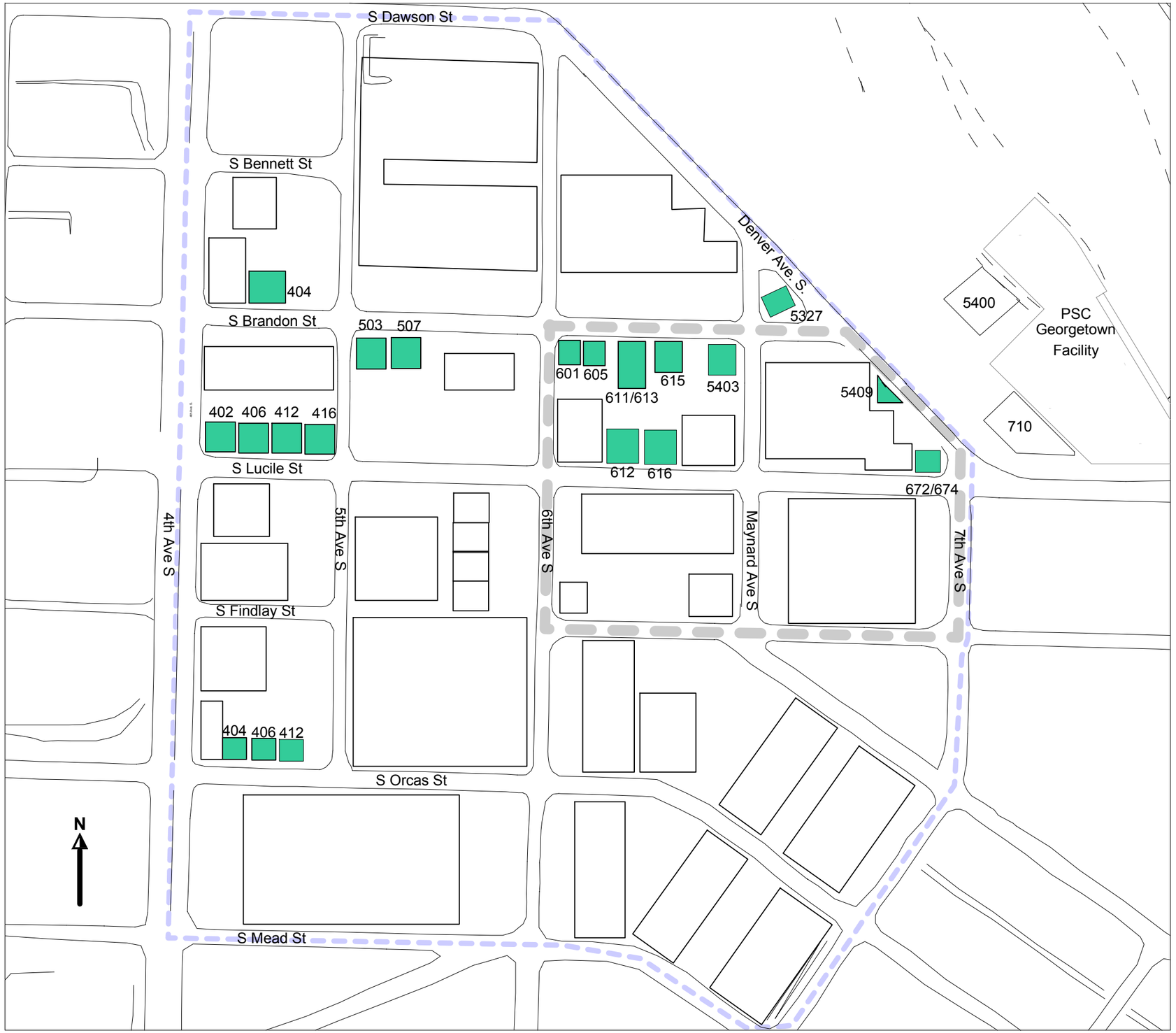
Area 1

Area 2

Area 3

Study Area for Future IPIMs

# Figure 4-1
## GIVF Preliminary Proposed Sample Locations




Proposed Building For GIVF Sampling

Area for GIVF Evaluation

Contingency Area for GIVF Evaluation

Figure not to scale

# APPENDIX A SAP—ATTACHMENT A – SOPS

**Equipment Decontamination Procedure**
**SOP No. PSC - 200**
Origination Date: 10/28/99
Revision Date:
Revision No.0


| Written By: | Approved By: | Date: | QA Concurrence: | Date: |
|---|---|---|---|---|
| Tasya Gray | Carolyn Mayer | 10/28/99 | Carolyn Mayer | 10/28/99 |

This SOP contains eight sections:


1.0 Purpose
2.0 Application
3.0 References
4.0 Associated SOPs
5.0 Equipment
6.0 General Decontamination Procedures
  6.1 Water Level Indicator Decontamination Procedure
  6.2 Oil/Water Interface Probe Decontamination Procedure
7.0 Specific Decontamination Procedures
  7.1 Grundfos EZ-Reel Portable Pump Decontamination Procedure
8.0 Documentation
9.0 Measure of Proficiency


## 1.0 Purpose

The purpose of this SOP is to provide field personnel with an outline of the procedure and frequency of decontaminating equipment that has come into contact with monitoring well water.

## 2.0 Application

This SOP provides a step-by-step guideline to be followed by the field sampling crew to prevent cross-contamination between monitoring wells and preserve well integrity.

## 3.0 References

RCRA Groundwater Draft Technical Guidance (EPA, 1992)

### 6.2 Decontamination When Inorganic Constituents Are of Interest

- Wash the equipment with a solution of nonphosphate detergent (Alconox) and water.
- Rinse the equipment with tap water.
- Rinse the equipment with 10% Nitric Acid solution.
- Rinse the equipment with DI water.

## 7.0 Specific Decontamination Procedures

### 7.1 Non-Dedicated Submersible Pump Decontamination Procedure

After sampling or developing a well using a non-dedicated submersible pump, decontaminate the pump as follows:

- Use hose to spray off EZ-Reel with tap water.
- Place pump into the PVC pipe.
- Fill the PVC pipe with tap water and Alconox.
- Run the pump until the pipe is empty, refilling it with tap water 3 times, running the discharge decontamination water into a 55-gallon drum.
- Remove the pump and wash out the pipe using tap water from the hose.
- Place the pump in the pipe again and fill with tap water.
- Repeat the process, running the pump until the pipe empties 3 times, then fill the pipe with 1L of Hexane.
- Repeat the process, running the pump until the pipe empties, then remove the pump and rinse out the pipe with tap water.
- Place the pump back in the pipe and fill with tap water.
- Run the pump until the pipe empties 3 times, then fill the pipe with 1L of 10% Nitric Acid.
- Run the pump until it empties, then rinse it with di-ionized water and refill the pipe with di-ionized water.
- Run the pump until the pipe empties three times with the di-ionized water.

## 8.0 Documentation

Documentation of all decontamination procedures associated with monitoring well activities including all field forms and the maintenance of a detailed field notebook as described in PSC-400.

**Photo-ionization Detector Calibration and Operation**
**SOP No. PSC - 300**
Origination Date: 5/14/98
Revision Date: 6/29/98
Revision No. 1


| Written By: | Approved By: | Date: | QA Concurrence: | Date: |
|---|---|---|---|---|
| Laurel Muselwhite | Carolyn Mayer | 5/14/98 | Carolyn Mayer | 7/1/98 |

This SOP contains nine sections:


1.0 Purpose
2.0 Application
3.0 References
4.0 Associated SOPs
5.0 Equipment
6.0 PID Calibration
7.0 PID Operation
8.0 Documentation
9.0 Measure of Proficiency


## 1.0 Purpose

The purpose of this SOP is to provide field personnel with step-by-step instructions on the proper use, operation, and handling of the PE Photovac MicroTIP Hand Held Air Monitor/Photoionization Detector, Model 2020 and Model IS-3000.

## 2.0 Application

This Photovac MicroTIP is used as a field screening instrument for detection of total volatile organic (TVO) concentrations in air. Typical uses include air monitoring of the breathing zone for Health and Safety purposes, and ground water and soil screening for TVO emissions.

The Photovac MicroTIP is a highly sensitive instrument with an operating range of 0.1 to 2000 ppm isobutylene equivalent. Its detection limit is 0.1 ppm isobutylene and its response time is less than 3 seconds.

## 3.0 References

PE Photovac, 2020 Photo-ionization Air Monitor Instruction Manual (Sept. 1997)

## 4.0 Associated SOPs

PSC-120 PSC-124 PSC-200 PSC-201 PSC-202

## 5.0 Equipment

The following equipment is necessary to calibrate the PID:

- If an increased meter reading is indicated, slowly sample the interface where leakage is indicated until the maximum meter reading is obtained and leave the probe inlet in that position for approximately six seconds.

- If the maximum reading is $\geq$ 10,000 ppm, a "leak" has been identified. A maximum reading of less than 10,000 ppm does not indicate a "leak".

## 8.0 Documentation

All PID measurements for all monitoring events will be documented on field forms and in a detailed field notebook . Observations of varying weather conditions such as temperature and humidity fluctuations will also be recorded. Standard Operating Procedure PSC-400 describes documentation procedures and provides examples of approved field forms.

## 9.0 Measure of Proficiency

Field staff will demonstrate proficiency of this SOP by successfully completing sections 6.0, 7.0, and 8.0 a minimum of twice under the direct supervision of the Corrective Actions Manager or her/his designee.

## 3.0 References

YSI 6-Series Environmental Monitoring Systems Operations Manual

## 4.0 Associated SOPs

PSC-124 PSC-125 PSC-200 PSC-400

## 5.0 Equipment

The following equipment is necessary to calibrate and use the YSI 600XL in correlation with the YSI 610-DM:

- pH buffer standard calibration solutions for pH of 4, 7, and 10, Conductivity calibration standard 718 uS solution, and ORP calibration solution.
- 3 clean, dry or pre-rinsed calibration cups.
- Di-ionized water with spray bottle and paper towels.
- Two 5 gallon buckets, a stand to hold YSI 600XL and flow through cell stationary, and rubber tubing to attach to the YSI flow through cell.

## 6.0 YSI Calibration

The YSI must be calibrated for Dissolved Oxygen daily. Weekly calibration is required for pH, Conductivity, and ORP (redox potential). Temperature is factory calibrated and does not require field calibration.
To operate the YSI start by doing the following:

- Connect the YSI 610-DM to the YSI 600XL (sonde) using the field cable.
- Remove probe from storage cup.
- Turn the YSI 610-DM on by pressing **Power**.

- Observe the readings under "pH" and when they show no significant change for approximately 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with di-ionized water.
- Press **Esc** 3 times to return to the Main Menu. At this point the YSI is calibrated for pH and is now ready for use.

### 6.3 Calibration for Conductivity

Before operating the YSI to monitor for pH, the following calibration procedures must be followed:

- From the Main Menu on the YSI 610-DM select "Calibration Mode" and press **Enter**.
- Select "Conductivity" and press **Enter**.
- Select "Cond" and press **Enter**.
- Fill one calibration cup with Conductivity Standard 718 uS solution.
- Carefully immerse the probe in the solution.
- Enter the calibration solution concentration in mS/cm (.718) and press **Enter**.
- Observe the readings under conductivity and when they show no significant change for 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with di-ionized water.
- Press **Esc** 3 times to return to the Main Menu. At this point the YSI is calibrated for Conductivity and is now ready for use.

### 6.4 Calibration for ORP (Redox Potential)

Before operating the YSI to monitor for ORP, the following calibration procedures must be followed:

- From the Main Menu on the YSI 610-DM select "Calibration Mode" and press **Enter**.
- Select "ISE2 Orp" and press **Enter**.
- Fill one calibration cup with Zobel 231 mV calibration solution.
- Carefully immerse the probe in the solution.
- Enter the concentration of calibration solution in mV and press **Enter**.
- Observe the readings under ORP and when they show no significant change for 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with di-ionized water.

- Connect the YSI 610-DM to the YSI 600XL (sonde) using the field cable.
- Remove probe from storage cup and screw on protective shield.
- Place the YSI 600XL in the flow through cell and secure it using the stand.
- Place the stand on top of an overturned 5-gallon bucket, placing the other 5-gallon bucket in front of it between the YSI and the monitoring well.
- Attach a 1' length of rigid 3/16" ID tubing to the top nozzle of the flow through cell and a 3' length of rigid 1/4" ID tubing to the bottom nozzle of the flow through cell. Point the upper tube into the bucket to collect wastewater.
- Attach the sample tubing to the 3' length of 1/4" ID tubing.
- Turn the YSI 610-DM on by pressing **Power** and pressing **Esc** to get to the Main Menu.
- Select "Run" from the Main Menu and press **Enter**.
- Data will be displayed continually.
- Press **Power** to end readings and turn off YSI.

## 8.0 Documentation

All YSI logging can be downloaded using the YSI software after fieldwork is completed (see manual listed in References for an explanation of how to download data). Monitoring events will be documented on field forms as well and in a detailed field notebook. Standard Operating Procedure PSC-400 describes documentation procedures.

## 9.0 Measure of Proficiency

Field staff will demonstrate proficiency of this SOP by successfully completing sections 6.1, 6.2, 7.0, and 8.0 a minimum of twice under the direct supervision of the Corrective Actions Manager or her/his designee.

## 3.0 References

HORIBA U-20 Series Multi-Parameter Water Quality Monitoring System Operational Manual

## 4.0 Associated SOPs

PSC-124 – Micropurge Groundwater Sampling Procedure
PSC-200 – Equipment Decontamination Procedure
PSC-400 – Documentation Procedures

## 5.0 Equipment

The following equipment is necessary to calibrate and operate the HORIBA U-22 Sensor probe and meter:

- HORIBA U-22 Sensor probe and meter
- HORIBA flow through cell.
- An alkaline battery 6LR61 (Manganese battery 6F22 [006P]) for the U-22 meter, and three alkaline batteries LR03 [AAA] (Manganese battery [R03]) for the U-22 Sensor probe.
- Auto Calibration Solution.
- Level 2 Calibration Solution.
- A labeled bottle for waste calibration solution.
- De-ionized water with spray bottle.
- One waste water receptacle.
- A stand to hold the HORIBA Sensor probe and flow through cell stationary.
- A stable elevated surface.
- Tubing to attach to the HORIBA flow through cell.
- Field Log Calibration book to record calibration information, or Field Log book if Field Log Calibration book is unavailable.

## 6.0 HORIBA Calibration

The HORIBA calibration procedures outlined here have been excerpted from the HORIBA Standard Operation Manual. For more information and troubleshooting tips, refer to the manual. The HORIBA Sensor probe should be calibrated daily for

# 8.0 HORIBA Operation

## 8.1 HORIBA Operation for Collecting Data Using the Flow Through Cell

The following procedures should be applied when using the HORIBA U-22 to monitor groundwater parameters using the flow through cell:

- Connect the HORIBA Sensor probes to the HORIBA meter using the field cable.
- Remove probes from the calibration cup, making sure the protective shield is secure on the HORIBA Sensor probe.
- Place the HORIBA Sensor probe in the flow through cell and secure it using the stand.
- Place the stand on top of an elevated stable surface, placing the waste water receptical in front of the stand between the HORIBA and the monitoring well.
- Attach a 2-3 inch piece of disposable tubing to the top nozzle of the flow through cell and another piece of disposable tubing to the bottom nozzle of the flow through cell. Direct the upper tube into the waste water receptacle.
- Attach the sample tubing to the disposable tubing on the bottom nozzle.
- Turn the HORIBA meter on by pressing **POWER.**
- Water quality parameters can be viewed by pressing **MEAS** to select each parameter. Water quality parameters should be recorded every 3 minutes using the clock on the HORIBA meter. Press **POWER** to turn off the HORIBA and end logging when sampling commences.

## *8.2 HORIBA Operation for Collecting Data without the Flow Through Cell*

The following procedures should be applied when using the HORIBA U-22 to monitor groundwater parameters without using the flow through cell:

- Connect the HORIBA Sensor probes to the HORIBA meter using the field cable.
- Remove probes from the calibration cup, making sure the protective shield is secure on the HORIBA Sensor probe.
- Collect groundwater sample directly from the tubing into the calibration cup. Fill the calibration cup with the proper volume of sample, as indicated by a black line on the calibration cup.
- Secure the calibration cup to the HORIBA Sensor probe by gently pressing the calibration cup up onto the HORIBA Sensor probe. Typically, there will be a slight snap when the calibration cup is secured.

## 10.0 Documentation

Monitoring events will be documented on field forms and in a detailed field notebook. Standard Operating Procedure PSC-400 describes documentation procedures.

## 11.0 Measure of Proficiency

Field staff will demonstrate proficiency of this SOP by successfully completing sections 6.0, 7.0, 8.1 and 8.2 a minimum of twice under the direct supervision of the Corrective Actions Manager or her/his designee.

Each field book is to be maintained as follows:

- Label the outside front cover with the following information: Burlington Environmental dba Philip Services Corporation, Facility Name, Dates Included, and Book Number. The inside cover should include: Burlington Environmental d.b.a. Philip Services Corporation, Project Manager's Name, 955 Powell Avenue, Renton, WA 98155, (206) 227-XXXX, Dates Included, and Book Number.

- Inside the cover, list the full names and initials of each person working on the project that will be referred to in the field book.

- Maintain all field notes directly in the field books (i.e. notes are not to be taken then transferred to the field books at a later time).

- Record all field notes in permanent ink (sharpie markers).

- Initial, date, and number each page upon completion.

- Correction of mistakes are made with a single line and initialing the correction.

- Avoid blank spaces within the notes. Unavoidable blank spaces are to be struck with a single line.

Examples of information required in the field book include:

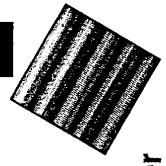
- The date of entry
- Time of entry for specific events (in military time)
- A meteorological description of daily changes
- Personnel present including arrival and departure times and affiliations
- Make, model and condition of equipment used
- The time interval and reasons for delays including a detailed description of corrective actions taken by the field crew.
- A detailed description and rationale for any deviations for the Work Plan, Sampling Plan, or Health and Safety Plan.

## 6.0 Field Forms

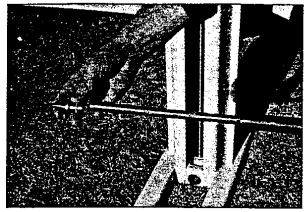
The field forms have been designed to detail all steps, actions, and readings associated with specific field procedures. These forms are to be completed in full. No sections are to be left blank, if a section is "not applicable", it is to be indicated as such. All forms, including location diagrams, are to be completed in the field with permanent ink. Refer to Table 1 to see which forms are required for specific field procedures. Examples of each form are also attached.

## 7.0 Measure of Proficiency

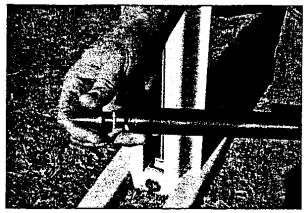
Proficiency assessment for documentation is associated with specific procedural proficiency, therefore, no separate proficiency measures for documentation are needed.



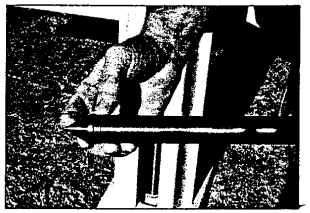




An Expendable Drive Point, Screen Insert, and Screen Sleeve are inserted into Sampler Sheath . . .

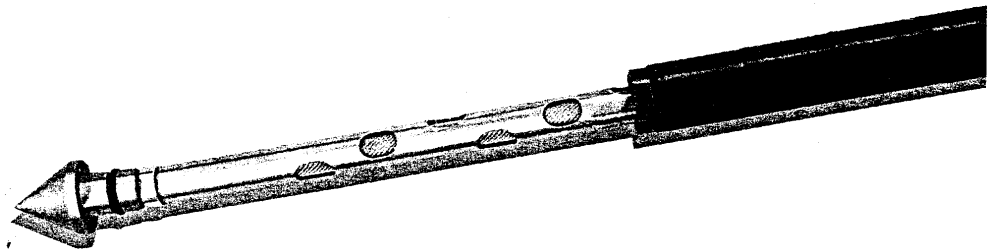


. . . the Screen Insert and Sleeve are inserted just far enough for the Expendable Drive Point to be inserted . . .



. . . and the assembled Screen Point Sampler is ready to be driven to depth.

# Screen Point Groundwater SAMPLER



***Collect relatively clean water samples in a short time period with the Screen Point Groundwater Sampler and a Tubing Check Valve System.***

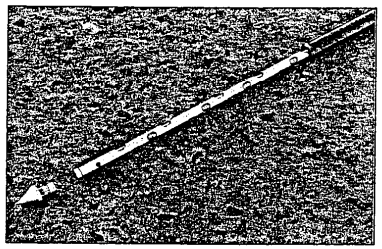
- Sampler remains sealed while driven to depth
- Stainless steel screen filters out sediment
- For sampling or piezometric measurements
- Also used in aquifers with low transmissivity

# Geoprobe's "First" Screen Point Sampler

The assembled Screen Point Groundwater Sampler threads onto the leading end of a Geoprobe probe rod and is driven into the subsurface with a soil probing machine. Additional probe rods are connected in succession to advance the sampler to depth. While the Screen Point Sampler is being driven to the desired sampling depth, it is kept sealed by O-ring connections placed at critical locations on the assembly.

Groundwater samples are recovered by pumping or bailing the water collected in the open probe rods. Alternately, tubing from the surface may be connected directly to the sampler screen using a Geoprobe PRT (post-run tubing) fitting, and samples recovered using a peristaltic pump or vacuum source. The pore size of the sampler screen is .0057 in. (0,145 mm). This sampler will allow the user to collect relatively clean water samples in a short time period due to its relatively large surface area.

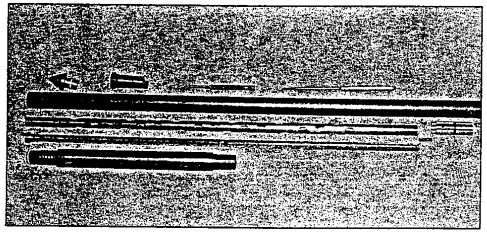
The assembled Screen Point Sampler has a 1.0-inch (25 mm) OD, is 36-inches (914 mm) long, and threads onto the leading probe rod. The device is also useful for measurement of piezometric levels.



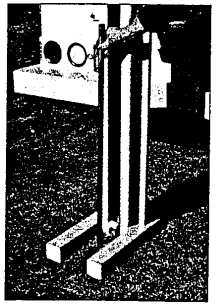
Screen Point Sampler (GW440K) in open position.

## Screen Point Features:

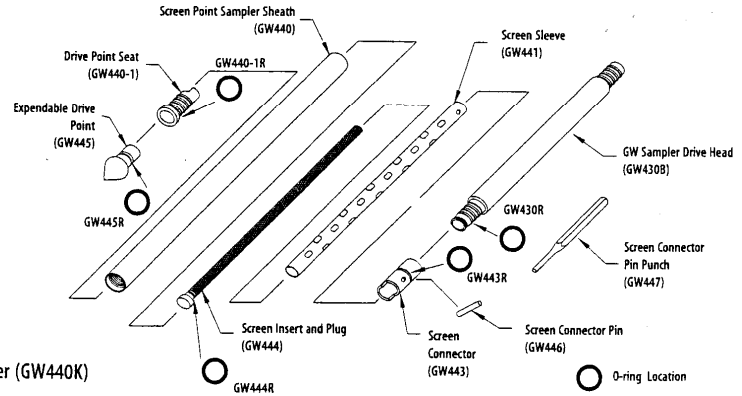
- Stainless steel inner core and screen.
- .0057-inch (.145 mm) pore-size screen filters out sediment.
- Simple design disassembles easily for cleaning.
- Remains sealed while being driven to depth.
- Used for piezometric measurements.
- Used for screening of contaminants.
- Sample at discrete depths within formations.
- Allows the pumping of multi-liter sample volumes.



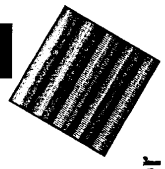
Screen Point Groundwater Sampler Kit (GW440K).



Place a drive cap on the assembled sampler and drive it into the subsurface.




Screen Point Sampler (GW440K)





# Assembly and Sampling

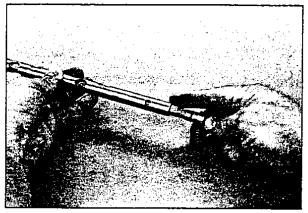
While the Screen Point Sampler is being driven to the desired sampling depth, it is kept sealed by O-ring connections placed at critical locations on the assembly. When the desired sampling depth is reached, the sampler is pulled up about 2 feet (1 m) which disengages the expendable drive point and creates an open probe hole from which to sample. The inner core, which consists of a stainless steel wire screen inside of a perforated stainless steel sleeve, is then pushed out into the borehole and water is allowed to enter the sampler. A groundwater sample can then be collected.

NOTE: These parts must be assembled so as to allow free movement of the screen assembly inside the Sampler Sheath. There should be no internal binding. The assembled sampler is now ready to be driven into the subsurface. Wetting the O-rings with a small amount of distilled water will aid in free movement of the parts.

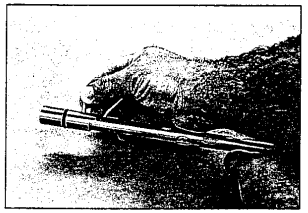
free SOP standard operating procedure

Screen Point Groundwater Sampler
Technical Bulletin 94-440

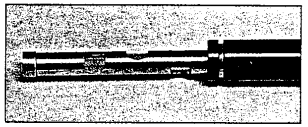




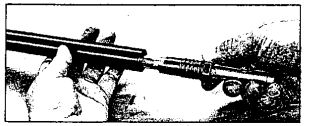
1. Push the Screen Insert and Plug into Screen Sleeve.



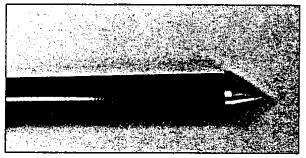
2. Push the Screen Connector Pin into place.



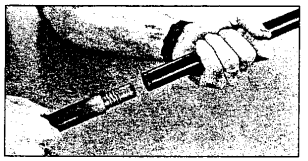
3. Insert Screen Sleeve halfway into Screen Point Sampler Sheath.



4. Slide Drive Point Seat over end of Screen Sleeve and screw into Sampler Sheath.



5. Insert Expendable Drive Point into Drive Point Seat.

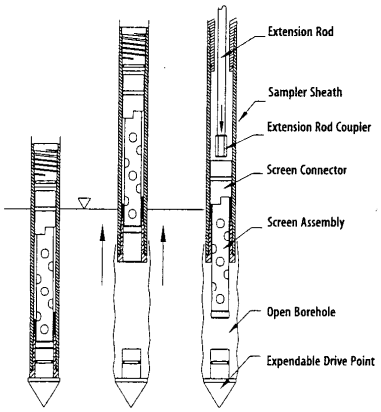


6. Screw O-ring end of Drive Head into top of Sampler Sheath.

## Exposing the Screen

In stable formations, the screen assembly may be pushed out into the open borehole by lowering 3/8-in. tubing affixed with a PRT Adapter (TB-25L and PR-25S) to the top end of the screen assembly. The threads on the PRT adapter are engaged with the threads on the Screen Connector by pushing gently downward on the tubing and rotating it counterclockwise. When properly connected, the screen assembly can be pushed out of the Sampler Sheath by pushing down on the tubing. A water sample can be drawn through the tubing.

In unstable formations, the screen assembly may have to be pushed out of the Sampler Sheath by means of extension rods coupled together and inserted down the inside of the probe rods. The leading end of the extension rods should be equipped with an extension rod coupler to protect the threads on the Screen Connector. A steady push is sufficient. Excessive hammering on the rods should be avoided. After pushing the screen into the formation, the extension rods need to be removed in order to begin sampling.




Continue driving (Figure A) by adding probe rods until the sampler tip has been driven about one foot (1225 mm) below the target sampling depth. Once depth has been reached (Figure B), disengage the expendable drive point by replacing the drive cap with a pull cap and pulling the rods back a distance of about 2 ft. (1 m). In unstable formations, push the screen assembly out of the sampler sheath (Figure C) using extension rods inserted down the inside of the probe rods.

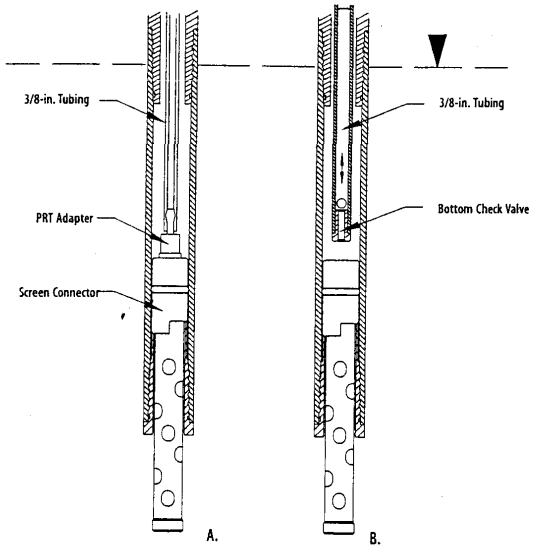
## Sampling

Water sampling may be accomplished by using 3/8-inch tubing and a stainless steel PRT adapter as previously described (TB25L and PR25S). Once the PRT adapter has made connection with the Screen Connector, a vacuum may be applied to the top of the tubing (Sampling Options A). This may be done with a peristaltic pump or by using a vacuum pump with an in-line trap.

If the PRT system is not used, the same tubing equipped with a Tubing Bottom Check Valve (GW42) may be used. The tubing is oscillated up and down and the water sample is pushed upward into the tubing as the ball repeatedly lifts and seats (Sampling Options B). The tubing will begin to feel heavier as it fills with several feet of water. It can then be lifted out of the probe rods, cut, and the water poured into a vial for analysis. This same tubing/check valve arrangement has been used to pump multi-liter samples from the probe rod.

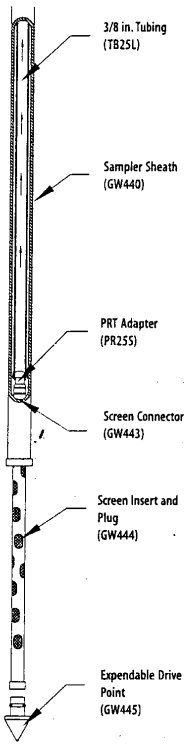
## Removal

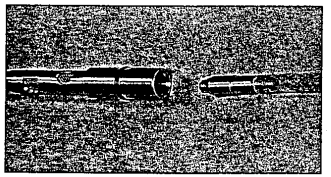
When the sampling procedure is finished, the probe rods and sampler may be extracted. If the PRT system is used, remove the tubing by pulling up firmly on it until it disconnects from the PRT adapter down-hole. The PRT adapter will remain attached to the Screen Connector.



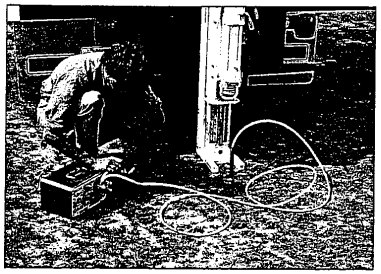

Sampling Options

Cross Section of Assembled Screen Point Sampler (GW440K)

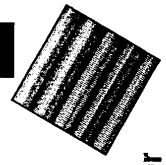


PRT-Adapter (PR25S) inserted in tubing (TB25L) prior to connection downhole with Screen Connector.



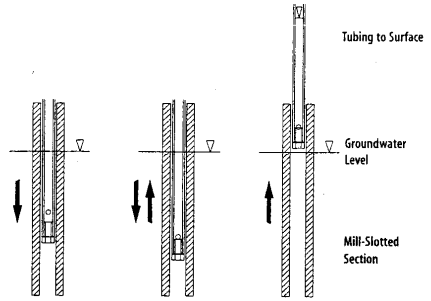
Using a peristaltic pump to collect a groundwater sample using the Screen Point Sampler.





# Tubing Bottom Check Valve. How well does it work?

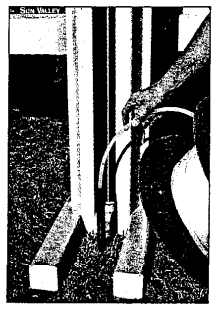
Tubing bottom check valves allow tubing to be used as a bailer. In higher yielding formations, this tubing and check valve arrangement can be used to pump water to ground surface. Tests in a sandy aquifer recovered 0.5 liters of water per minute from a depth of 25 feet (8 m) using 1/4-in. (6 mm) tubing and the bottom check valve (GW42) with the Screen Point Ground Water Sampler (GW440K). A peristaltic pump under the same conditions recovered only 0.1 liters of water per minute.




Groundwater Sampling With Tubing Bottom Check Valve

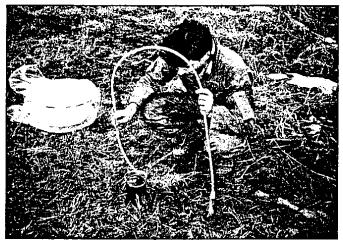


Tubing Bottom Check Valve and Check Ball are installed onto Tubing ...

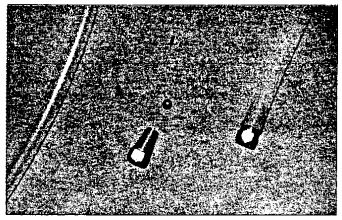


. . . . and are then fed through the diameter of the probe rods to retrieve the water sample.

Geoprobe® Systems



Using Tubing (TB25L) and Bottom Check Valve (GW42) to collect a water sample.



GW 42 ... Tubing Bottom Check Valve
TB25L ... Polyethylene Tubing

## Tubing Bottom Check Valve

### GW42

Fits 1/4-in. (6,4 mm) and 5/16-in. (7,9 mm) ID. tubing. Converts standard tubing into a mini-bailer. Oscillating motion pumps water column up into tubing. Can pump water to the surface in some formations. Tubing can recover 9.65 mL per foot.

## Check Balls

### GW42-1

Replacement check balls for tubing bottom check valve (GW42). Pkg. of 25.

## Polyethylene Tubing

### TB25L

3/8-in. OD x 1/4-in. ID (9,5 mm x 6,4 mm) with .060-in. (1,5 mm) wall tubing. For water sampling with the Tubing Bottom Check Valve (GW42). Discard tubing after each sample. 500 ft. (152 m) roll.

# Basic Parts and Components

### GW Sampler Drive Head
**GW430B**

Geoprobe brand alloy steel. 8.5 in. x 1.0 in. ID (216 mm x 25 mm), 0.5 in. ID (13 mm). equires O-ring (GW430R).

### O-rings for Drive Head
**GW430R**

Fits on to lower end of drive head. Replace after every sampling event. Pkg. of 25.

### GW Sampler Sheath
**GW440**

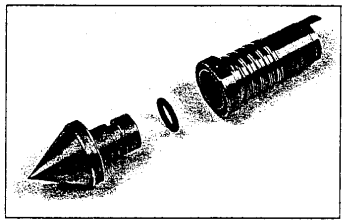
Geoprobe brand alloy steel. 27 in. x 1.0 in. OD (686 mm x 25 mm), 0.76 in. ID (19 mm).

### GW Drive Point Seat
**GW440-1**

Fits end of sampler sheath to hold expendable drive point in place. Requires O-ring (GW440-1R).

### O-rings for Drive Point Seat
**GW440-1R**

Fits on lower end of drive point seat. Replace after every sampling event. Pkg. of 25.



New O-rings should be used at each O-ring location prior to each sampling event. Shown here is the Expendable Drive Point (GW445), O-ring (GW445R), and Drive Point Seat (GW4401).

### GW Screen Sleeve
**GW441**

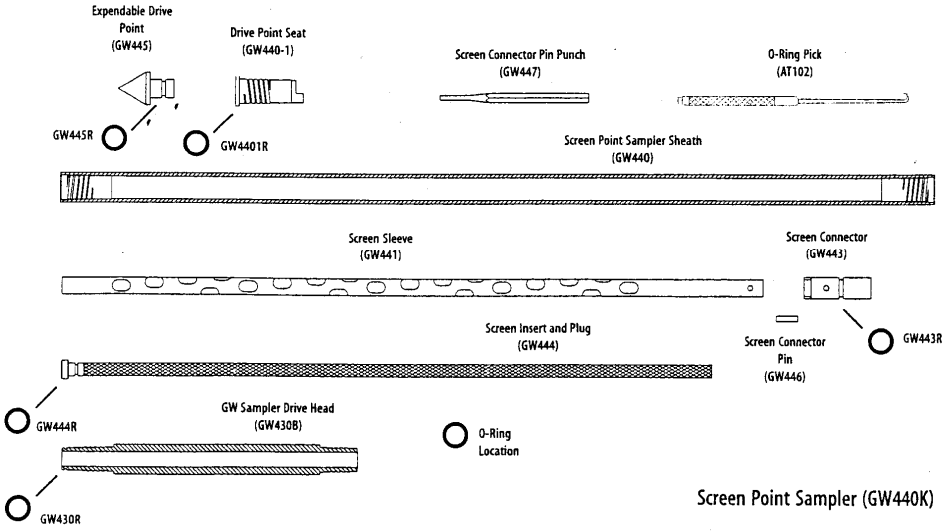
Stainless Steel. 22.7 in. x 0.56 in. OD (577 mm x 14 mm), 0.44 in. ID (11 mm).

### GW Screen Connector
**GW443**

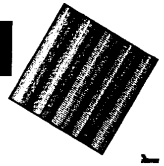
Stainless Steel. Top end has left-hand threaded PRT fitting. Requires O-ring.

### O-rings for Screen Connector
**GW443R**

Fits in to groove on screen connector. Replace after every sampling event. Pkg. of 25.




Screen Point Sampler (GW440K)





## GW Screen Insert and Plug
### GW444

Stainless Steel. 22.25 in. (565 mm) length. 0.145 mm pore size, 0.375 in. OD (9,5 mm). Requires O-ring.

## O-ring for Screen Insert
### GW444R

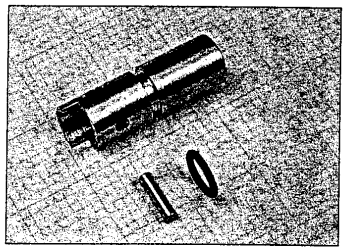
Fits on to lower end of screen insert. Replace after every sampling event. Pkg. of 25.

## Expendable Drive Point
### GW445

Geoprobe brand alloy steel. 1.1 in. (28 mm) maximum OD, 0.625 in. (16 mm) OD shaft.

## O-ring for Expendable Drive Point
### GW445R

Fits in groove in expendable drive point. Replace after every sampling event. Pkg. of 25.



Screen Connector (GW443), O-ring (GW443R), and Screen Connector Pin (GW446).

## Screen Connector Pin
### GW446

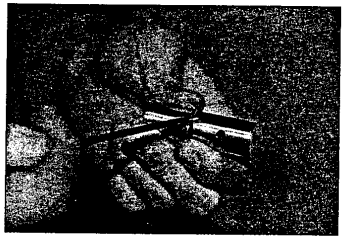
Stainless Steel. Hold screen connector in place.

## Screen Connector Pin Punch
### GW447

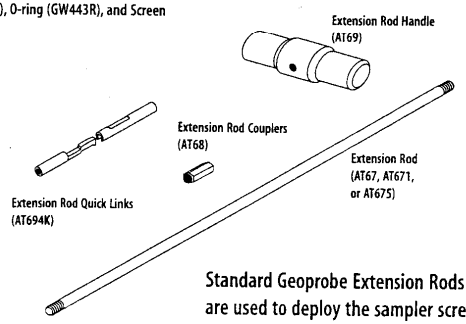
Used for installation and removal of screen connector pin.

## O-ring Pick
### AT102

Handy, dandy tool to help remove O-rings for tools. Included in each O-ring Service Kit.



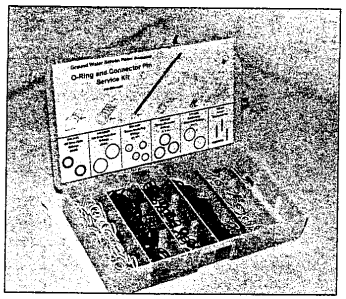
Another handy tool! The O-Ring Pick (AT102) helps to remove O-rings from tools. One is included in each Screen Point Sampler Kit (GW440K).



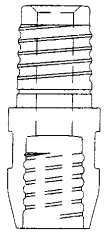

Standard Geoprobe Extension Rods and Couplers are used to deploy the sampler screen.

## O-ring Service Kit
### GW448K

Be organized in the field! No more hunting for missing O-rings. Assembled in one handy carrier. All the O-rings needed for use with the Geoprobe Screen Point Ground Water Sampler. 100 each of five different O-rings: GW430R, GW440-1R, GW443R, GW444R, and GW445R and 10 Screen Connector Pins. A great savings over items when purchased separately.



GW Screen Point O-Ring Service Kit (GW448K) includes 500 O-rings and 10 screen connector pins plus placement guide for O-rings.



AT1226 ... Adapter

## Adapter
### AT1226

1.25 in. pin x 1.0 in. box. Enables field operator to use Screen Point Groundwater Sampler with 1.25-in. probe rod system.

## Screen Point Sampler Parts for 1.0 in. rods

85.00 GW430B ..... GW Sampler Drive Head
5.00 GW430R ..... O-Rings for Sampler Drive Head (Pkg. of 25)
82.00 GW440 ..... Screen Point Sampler Sheath
55.00 GW440-1 ..... Drive Point Seat
5.00 GW440-1R ..... O-Rings for Drive Point Seat (Pkg. of 25)
200.00 GW441 ..... Screen Sleeve
100.00 GW443 ..... Screen Connector
5.00 GW443R ..... O-Rings for Screen Connector (Pkg. of 25)
38.00 GW444 ..... Screen Insert and Plug
5.00 GW444R ..... O-Rings for Screen Plug (Pkg. of 25)
5.00 GW445 ..... Expendable Drive Point — 119. 1-1-25.
3.00 GW445R ..... O-Rings for Drive Point (Pkg. of 25)
10.00 GW446 ..... Screen Connector Pin
5.00 GW447 ..... Screen Connector Pin Punch

## GW440K Screen Point Groundwater Sampler Kit

GW-430B ..... (1) ..... GW Sampler Drive Head
GW-430R ..... (25) ..... O-Rings for Drive Head
GW-440 ..... (1) ..... GW Sampler Sheath
GW-440-1 ..... (1) ..... GW Drive Point Seat
GW-440-1R ..... (25) ..... O-Rings for Drive Point Seat
GW-441 ..... (1) ..... Screen Sleeve
GW-443 ..... (1) ..... Screen Connector
GW-443R ..... (25) ..... O-Rings for Screen Connector
GW-444 ..... (1) ..... Screen Insert and Plug
GW-444R ..... (25) ..... O-Rings for Screen Plug
GW-445 ..... (25) ..... GW Expendable Drive Points
GW-445R ..... (25) ..... O-Rings for Drive Points
GW-446 ..... (1) ..... Screen Connector Pin
GW-447 ..... (1) ..... Screen Connector Pin Punch
AT102 ..... (1) ..... O-Ring Pick

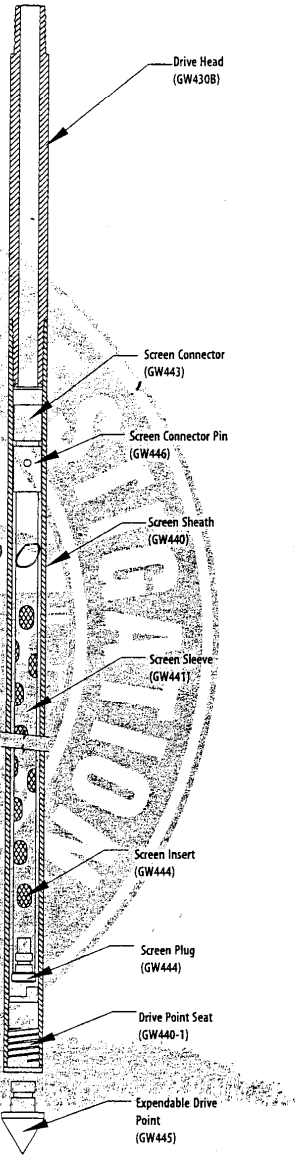
## Sampler Accessories

Variable ..... Probe Rods, 1-in. OD
AT106B ..... Probe Rod (1 ft.)
AT1100 ..... Drive Cap
AT12B ..... Pull Cap
Variable ..... Extension Rod
AT68 ..... Extension Rod Coupler
AT694K ..... Extension Rod Quick Links
AT69 ..... Extension Rod Handle

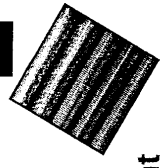
## Optional

AT1226 ..... Adapter, 1.25 in. pin x 1.0 in. box
GW41 ..... Stainless Steel Mini-Bailer
GW42 ..... Tubing Bottom Check Valve
GW42-1 ..... Check Balls for Check Valve
TB25L ..... Polyethylene Tubing, 1/4 in. I.D.
AT102 ..... O-Ring Pick
AT122 ..... Probe Rod Pull Plate
PR25S ..... PRT Fitting

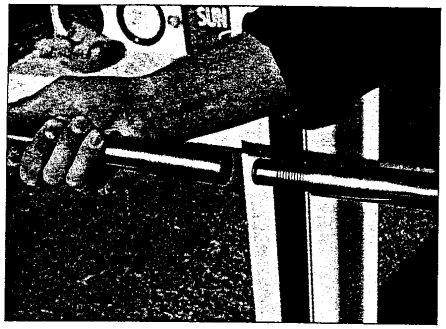
735.00




Cross Section of Assembled Screen Point Sampler (GW440K)

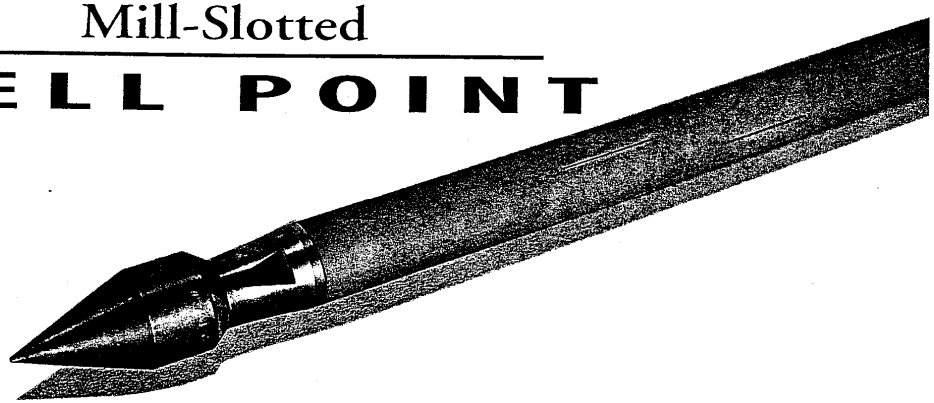






Mill-Slotted Drive Head (GW1512) screws into Mill-Slotted Rod Section (GW4412).

# Mill-Slotted WELL POINT



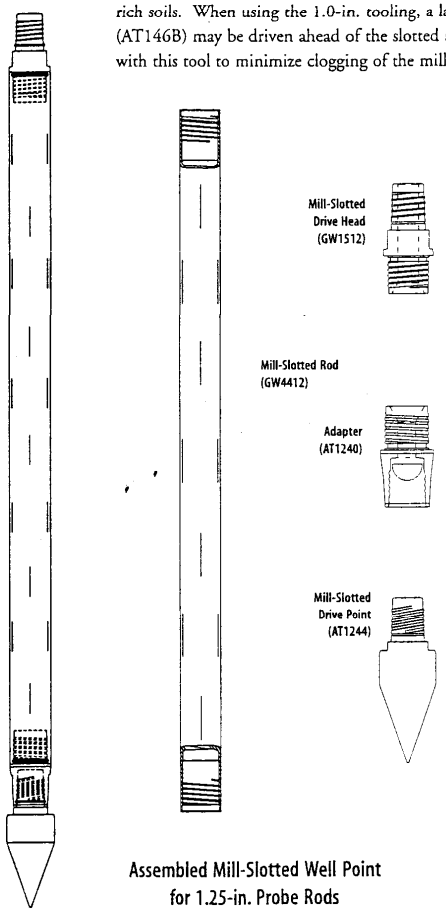
***Geoprobe's first groundwater sampler remains fast and inexpensive to use.***

- Collect non-discrete groundwater samples from unconsolidated formations
- Large Sample Capacity
- Inexpensive ... few parts to buy or use
- Ideal for collecting non-discrete samples from coarse sand formations
- No Cuttings ... Minimal Surface Disturbance
- Easy to Use ... Just Push Into the Formation

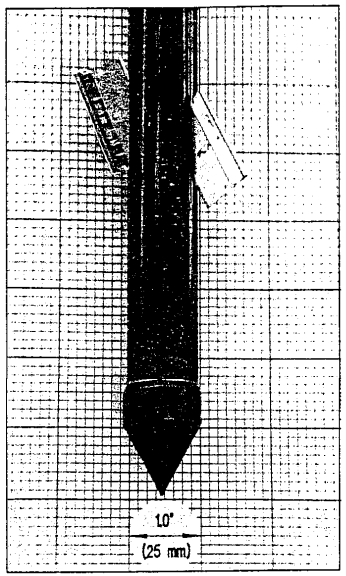
# Mill-Slotted Well Point

For non-discreet groundwater sampling. Now in two sizes: 1.25-in. and 1.0 in. sampling systems. This open-slotted tool is driven from the ground surface into the water table. An inner tubing or smaller diameter bailer is inserted down the inside diameter of the probe rods to collect a water sample. Threads into leading Geoprobe probe rod. The 1.0-in. slotted rod sections are 24-in. long x .76-in. (610 mm x 19 mm) ID, and have 15 mill-cut slots, each 1.5-in. long x 0.020-in. wide (38 mm x 0,51 mm). The 1.25-in. slotted rod sections are 24 in. long x 1.2 in. (610 mm x 30.5 mm) ID, and have 28 mill-cut slots, each 1.5 in. long x 0.020-in. wide (38 mm x 0,51 mm).

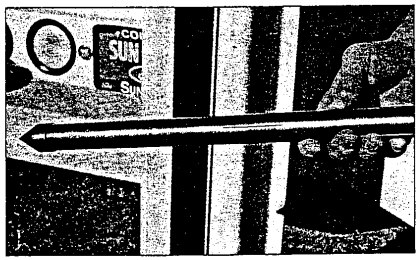
The slotted sections may be threaded together to increase the sampler length. For the 1.0-in. rod system, slotted rod sections are coupled together with Mill-Slotted Rod Couplers (GW45) This tool works best in sandy aquifers. Not recommended for use in silty, clay-rich soils. When using the 1.0-in. tooling, a larger diameter pre-probe (AT146B) may be driven ahead of the slotted section and is often used with this tool to minimize clogging of the mill slots.



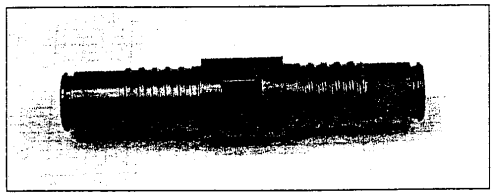

Assembled Mill-Slotted Well Point for 1.25-in. Probe Rods



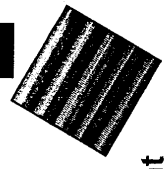

0.020-in. mill cut slots in Mill-Slotted Well Point (GW43K) for 1.0-in. probe rod system.



Assembled Mill-Slotted Well Point (GW43K) for 1.0 in. probe rod system.

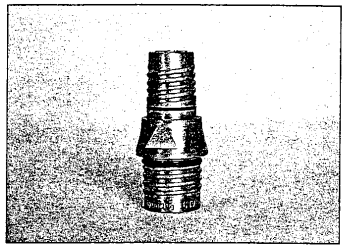


Mill-Slotted Rod Coupler (GW45) for the 1.0-in. sampling system is used to couple two Mill-Slotted Rod Sections (GW44).

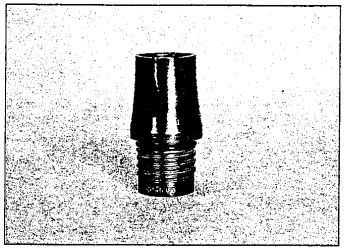




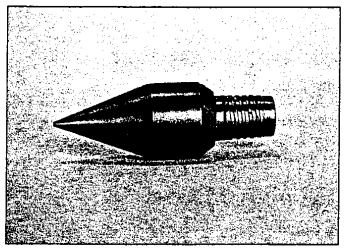
# Mill-Slotted Well Point 1.25-in. sampler



GW1512 ... Mill-Slotted Drive Head
AT1250R ... O-ring (top)
GW1520R ... O-ring



AT1240 ... Adapter
GW1520R... O-ring



AT1244 ... Solid Drive Point
AT1250R O-ring

## Mill-Slotted Drive Head
### GW1512 ... for 1.25 in. sampler

Geoprobe brand alloy steel. 1.25-in. (31.75 mm) OD. 0.625-in. ID (16 mm). Requires two sets of O-rings (AT1250R and GW1520R).

## Adapter
### AT1240

Alloy steel. LB thread pin x 1.25 in. box. Requires O-rings (GW1520R).

## Solid Drive Point
### AT1244

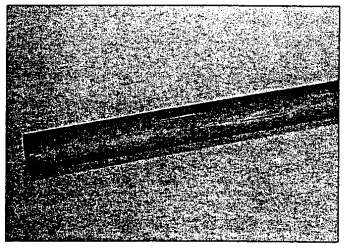
Hardened steel. 1.75 in. OD. 1.25 in. pin. Threads into end of mill-slotted rod section. Requires O-rings (AT1250R).

## O-rings
### GW1520R ... for 1.25 in. sampler

Fits on 1.25-in. drive head (GW1512) and Adapter (AT1240). Replace after each sampling event. Pkg. of 25.

## O-rings
### AT1250R

Fits on 1.25-in. pin of drive head (GW1512) and on solid drive point (AT1244). Replace after each sampling event. Pkg. of 25.



*GW4412 ... Mill-Slotted Rod*

## Mill-Slotted Rod Section
### GW4412 ... for 1.25 in. sampler

Alloy steel. 24-in. long x 1.5-in. OD (610 mm x 38 mm). 1.2 in. ID (30 mm) with twenty-eight 1.5-in. x .020-in. (51 mm x 0,5 mm) mill cut slots.

### Mill-Slotted Well Point (for 1.25-in. rods)

GW4412 ..... Mill-Slotted Rod
GW1512 ..... SP15 Drive Head
GW1520R ..... O-rings for Drive Head (GW1512) and Adapter (AT1240), Pkg. of 25
AT1240 ..... Adapter, LB Thread Pin x 1.25-in. box
AT1250R ..... O-rings for Drive Head (GW1512) and Drive Point (AT1244)
AT1244 ..... Solid Drive Point, 1.75 in. OD x 1.25-in. pin

### GW4412K Mill-Slotted Well Point Kit (for 1.25-in. rods)

GW4412 ..... (1) .... Mill-Slotted Rod
GW1512 ..... (1) .... SP15 Drive Head
GW1520R ... (1) .... O-rings for Drive Head (GW1512) and Adapter (AT1240), Pkg. of 25
AT1240 ..... (1) .... Adapter, LB Thread Pin x 1.25-in. box
AT1250R ..... (1) .... O-rings for Drive Head (GW1512) and Drive Point (AT1244)
AT1244 ..... (1) .... Solid Drive Point, 1.75 in. OD x 1.25-in. pin

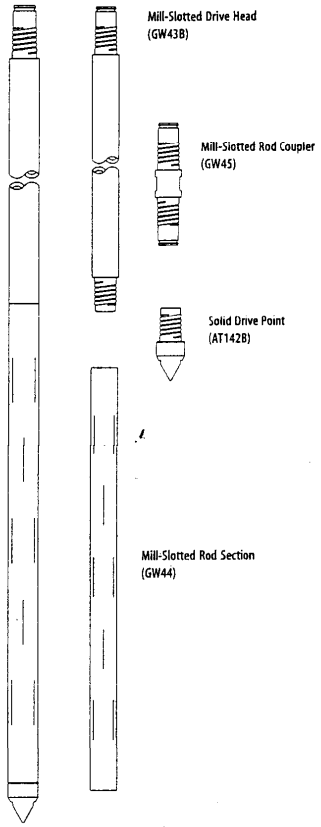
# Mill-Slotted Well Point 1.0-in. sampler

## Mill-Slotted Drive Head
### GW43B
Geoprobe brand alloy steel. 12-in. long x 1.0-in. OD (305 mm x 25 mm). 0.5-in. ID (13 mm). Male B threaded on both ends.

## Mill-Slotted Rod Section
### GW44
Geoprobe brand alloy steel. 24-in. long x 1.0-in. OD (610 mm x 25 mm). 0.76-in. ID (19,3 mm) with fifteen 2.0-in. x .020-in. (51 mm x 0,5 mm) mill cut slots. Female B threaded on both ends.

## Mill-Slotted Rod Coupler
### GW45
Used for joining mill-slotted rod sections together. Alloy steel with flats for attaching a 7/8-in. wrench.

## Solid Drive Point
### AT142B
Hardened steel. Threads into end of mill-slotted rod section.



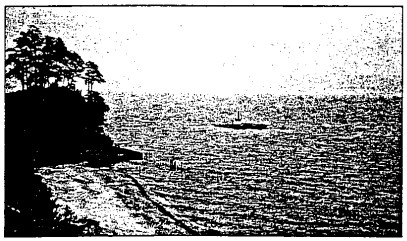

Assembled Mill-Slotted Well Point (GW-43K)

MILL-SLOTTED WELL POINT (FOR 1.0-IN. RODS)

GW43B ..... Mill-Slotted Drive Head
GW44 ..... Mill-Slotted Rod Section
GW45 ..... Mill-Slotted Rod Coupler
AT142B ..... Solid Drive Point

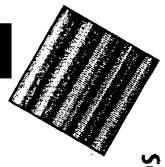
GW43K MILL-SLOTTED WELL POINT KIT (FOR 1.0-IN. RODS)

GW44B ..... (1) ..... Mill-Slotted Drive Head
GW44 ..... (1) ..... Mill-Slotted Rod Section
AT142B ..... (1) ..... Solid Drive Point



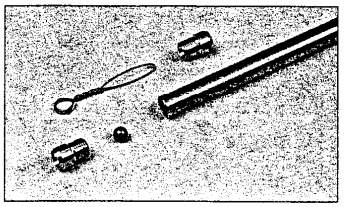
Dr. Michael Barcelona, with the University of Michigan, led a "fishing expedition" that took a Geoprobe unit onto Lake Michigan. Using a screen well point, the expedition identified high levels of chloride and reducing groundwater in a confined sand layer through a plume was discharging into the lake. The well point was advanced to depths of 21 feet or greater into beach sand and silt layers in 15 to 20 feet of water. The Geoprobe unit checked out sea-worthy, but future amphibious probing will depend on wave conditions ... nothing greater than three to four feet!



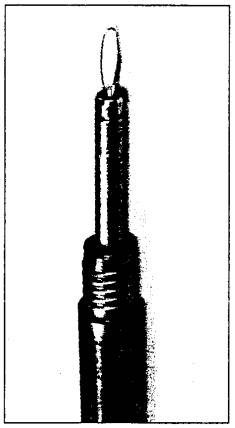




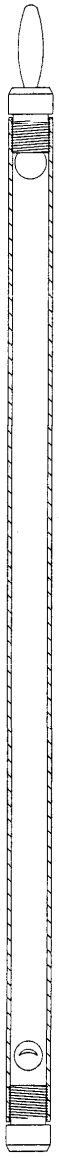
# Geoprobe Mini-Bailer



Well Mini-Bailer (GW41) Parts.



Mini-Bailer (GW41) fits down ID of Geoprobe probe rods.



Well Mini-Bailer (GW41)

## Well Mini-Bailer

### GW41

Stainless steel. 20-in. long x 7/16-in. OD (508 mm x 11 mm). Fits down I.D. of Geoprobe probe rods. Recovers up to 20 mL of sample.

## Mini-Bailer Check Ball

### GW411

Replacement check ball for Mini-Bailer. Pkg. of 5.

### GW-41 Stainless Steel Mini-Bailer Kit

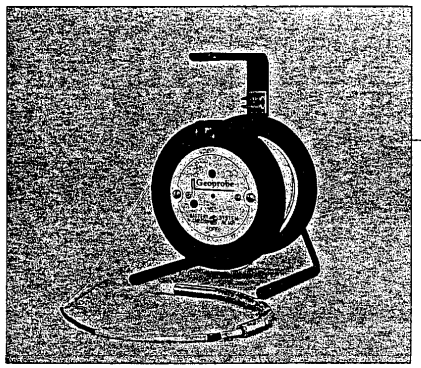
GW411 ..... (1) .... Mini-Bailer Check Balls, Pkg. of 5
GW412 ..... (2) .... Mini-Bailer End
GW413 ..... (1) .... Mini-Bailer Wire Hook
GW414 ..... (1) .... Mini-Bailer Tube



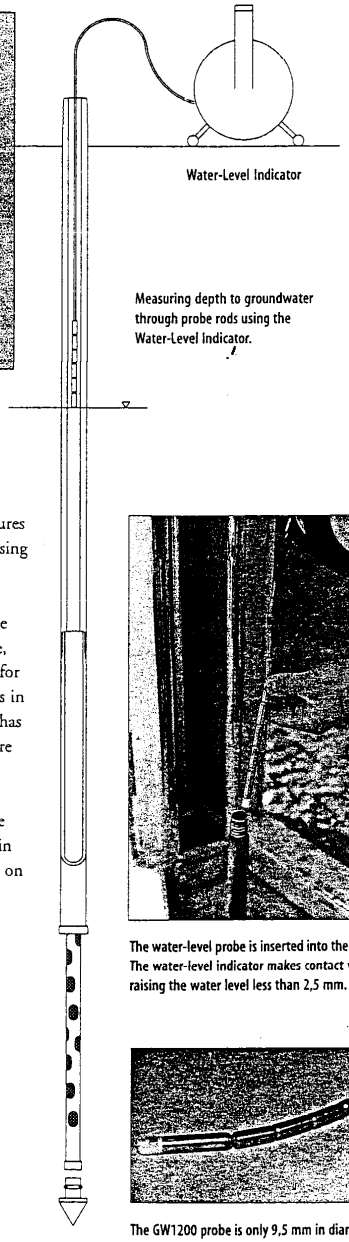
If you've got questions about how to use any of our samplers, logging systems, or other tools chances are excellent that we have the answers for you. Tool and equipment demonstrations are available to you just by calling us. Two Geoprobe units came to the rescue of this request for assistance!

# Water Level Indicator – Specifically for Probing Tools

Probing tools differ from monitoring wells in that they have a small inside diameter. Consequently, the displacement of a water level probe as it immerses to make electrical contact with the free surface of the water can create a significant increase in the measured water level. Many water level sounders require several inches of probe immersion before making electrical contact. This problem is magnified when making measurements in fine-grained formations which have a slow response time to the increased water level caused by probe insertion. To increase accuracy, you need a probe that requires little or no immersion before making its electrical contact with the water.



The Geoprobe Water-Level Indicator (GW1200). Water-level sensing designed for use in small diameter probing tools.



Water-Level Indicator

Measuring depth to groundwater through probe rods using the Water-Level Indicator.

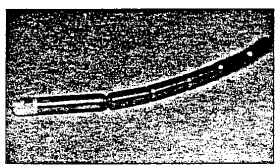
Geoprobe offers a solution to the probe interference problem. The Water-Level Indicator features a water-level probe that makes contact with the water level and emits a sensing signal while raising the water level less than .008 inches (0,3 mm) in a standard probe rod (0.5-in. [13 mm] ID).

The Water-Level Indicator is a self-contained unit for measuring water levels in wells and probe holes. Each unit consists of a hand-held wire spool with an indicator module, measuring cable, and probe. The spool, constructed of ABS plastic and steel, is equipped with a brake and clip for probe storage. It features a segmented probe that is able to snake around tight joints and bends in probe rods. The indicator module has both audible and visual indicators to show when water has been detected. A standard 9-volt transistor battery is the only power source required. The wire used is high-strength, hard drawn, copper-coated steel for stretch resistance.

The wetted probe end is constructed of stainless steel and Teflon® for environmentally sensitive testing. The sounder tape, 3/8 inch (9,5 mm) in diameter, is very flexible and clearly marked in 1-foot increments (a metric model is available). The markings are permanently heat embossed on the cable.



The water-level probe is inserted into the rod bore. The water-level indicator makes contact while raising the water level less than 2,5 mm.



The GW1200 probe is only 9,5 mm in diameter and segmented for insertion in probe rods.

### Water-Level Indicator

GW1200 ..... Water Level Indicator, 100-ft. cable, 3/8-in. probe

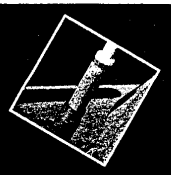
GW1201 ..... Cable/Probe Replacement Assembly, 100-ft. cable, 3/8-in. probe

GW1205 ..... Water Level Indicator, 30 m cable, 3/8-in. probe

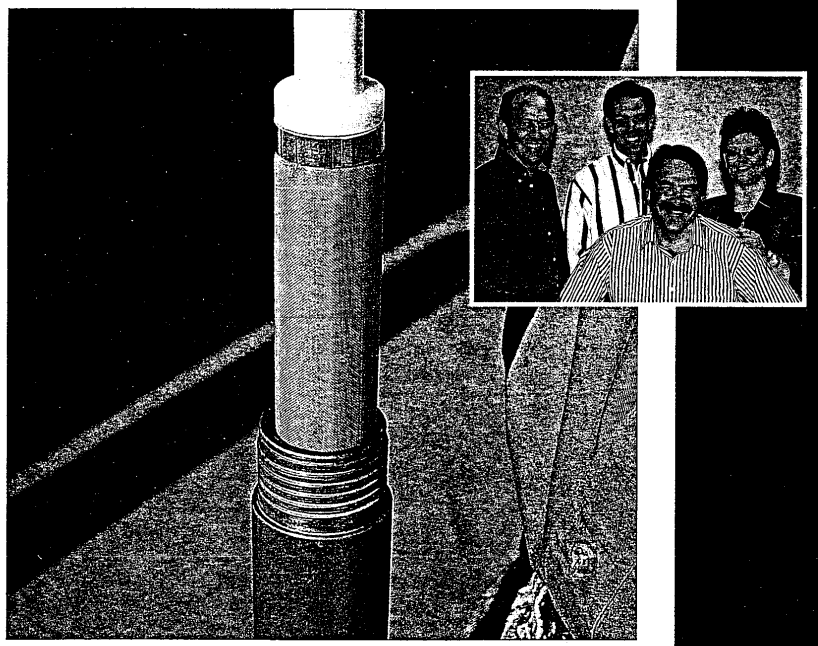
GW1206 ..... Cable/Probe Replacement Assembly, 30 m cable, 3/8-in. probe

GW1220 ..... Water Level Indicator, 200-ft. cable, 3/8-in. probe

# Groundwater Monitoring



BARBARA FARMER, FINANCIAL SERVICES
BREAD BAKIN' $$$ SPENDER
(right)



RANDY HAYES, SHIPPING
BBQ BUM
(left)

MARK ABKER, RESEARCH & DEVELOPMENT
OWNER, ABKER'S AUTOMART
(center back)

PAUL DRUMMOND, RESEARCH & DEVELOPMENT
FRIENDLY FARMER
(front)

# GROUNDWATER MONITORING

*penned by Wes McCall*

At many facilities where contamination is observed, state and federal regulations require the installation of permanent groundwater monitoring wells. The most common method for installing these monitoring wells in unconsolidated formations has been by conventional hollow stem auger drilling methods. That is, up until now!

After several years in development, Geoprobe Systems offers an alternative to large diameter, permament monitoring wells. Geoprobe welcomes Prepacked Screen Monitoring Wells to its inventory of direct push sampling tools and eqiupment.

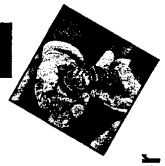
The prepacked screens can be used to install permanent, small diameter groundwater monitoring wells that can be used to collect water quality samples, conduct hydrologic and pressure measurements, or perform almost any other type of sampling that does not require large amounts of water at any given time. Depending on the formation yield, the prepacked screen monitoring wells can produce a gallon of water in approximately 7 to 10 minutes, exceeding requirements for environmental sampling objectives.

Use of the Direct Image Soil Conductivity Logging System with targeted Large Bore sampling can allow for quick and accurate definition of subsurface geology prior to well installation. The conductivity system generates a continuous log of the litology. Based on the logs, field operators can recognize pertinent information, such as sand and clay layers, aquitards, and aquifers. From this information, the project manager or site geologist can determine the appropriate screen intervals for setting monitoring wells. Use of the conductivity system helps eliminate setting a well screen across a confining layer which could allow contaminants to migrate into a previously uncontaminated aquifer.

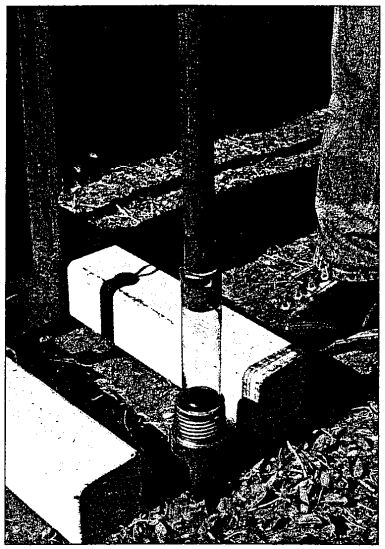
Depending on the depth, site specific conditions, and experience of the operators, the time required for installation and grouting one of these wells varies from approximately one to four hours. Geoprobe's Prepacked Screen Monitoring Wells have been installed in various types of soil compositions including alluvial sediments consisting of clays, silts, and sands with fine to medium gravels at depths exceeding 60 feet (18 m).

These direct push wells are designed for installation in unconsolidated soils and sediments. As with other direct push tools manufactured by Geoprobe Systems, this equipment is not designed to penetrate consolidated bedrock. Sediments with abundant coarse gravels, cobbles, or boulders may hinder or prevent penetration to the desired depths. Field operators should also be aware that recharge from very fine grained formations (clays and silty clays) may be minimal if smearing of clays occurs.

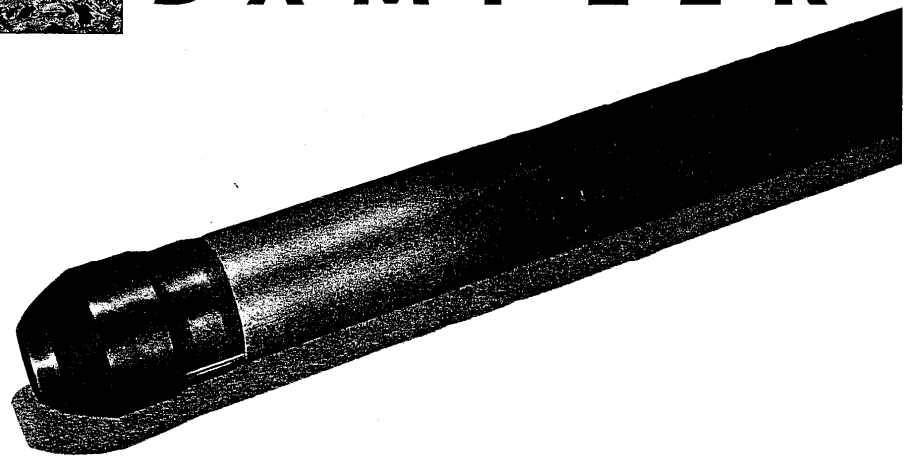
Geoprobe's Prepacked Screen Monitoring Wells have been installed in various types of soil compositions including alluvial sediments consisting of clays, silts, and sands with fine to medium gravels at depths exceeding 60 feet. The time required for installation and grouting one of these wells varies from approximately one to four hours depending on the depth, site specific conditions, and experience of the operators.





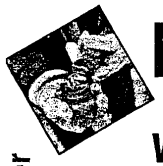


# Dual Tube Soil SAMPLER



***Geoprobe's efficient method of collecting continuous soil cores with the added benefit of a cased hole ... the Dual Tube 21 System.***

- Continuous Soil Coring
- Sample both Saturated and Unsaturated Zones
- Set Monitoring Wells
- Bottom-up Grouting Through Primary Tool String



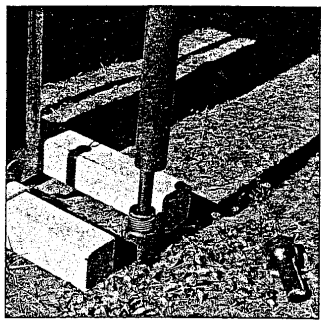




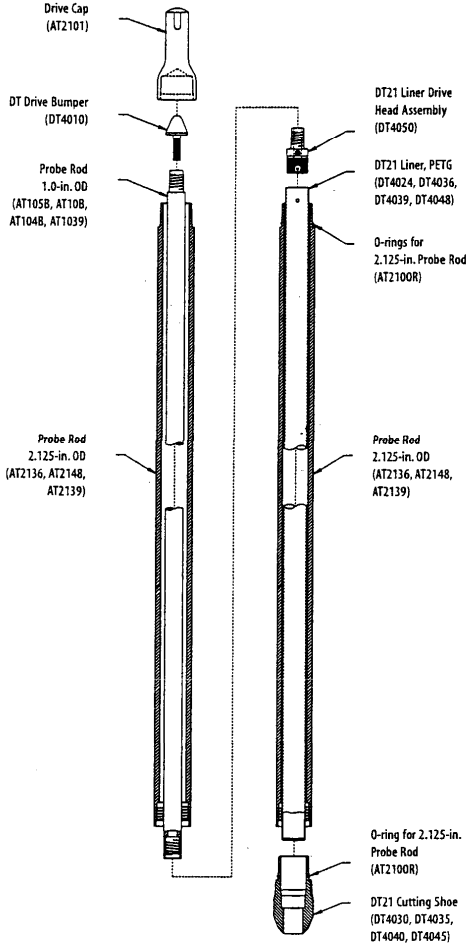
# What Is Dual Tube Sampling?

The direct push method of continuous soil coring has historically involved repeatedly driving and retrieving a solid barrel sampler in and out of the same probe hole. While the use of a sealed sampler has proven to yield representative samples, a considerable time investment is required when coring depths exceeding 20 feet. Geoprobe's DT21 Dual Tube Soil Sampling System offers an efficient method of collecting continuous soil cores with the added benefit of a cased hole.

Dual tube sampling gets its name from the fact that two sets of probe rods are used to collect continuous soil cores. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The second, smaller set of rods are placed inside the outer casing. The smaller rods hold a sample liner in place as the outer casing is driven one sampling interval. The small rods are then retracted to retrieve the filled liner.



When sampling with the DT21 system, the smaller OD probe rods are placed inside the outer casing and hold a sample liner in place as the outer casing is driven one sampling interval.




Dual Tube Soil Sampler Components

# Why Dual Tube Sampling?

- Continuous coring in both saturated and unsaturated zones
- Cased hole eliminates cross contamination when sampling through perched water tables
- No special sample tube required
- Retrieves 1.125-in. OD soil cores
- Replaceable cutting shoes available
- Optional solid drive tip seals system for driving to top of sampling interval
- Perform bottom-up grouting while retracting outer casing
- Set monitoring wells through outer casing after collection of soil cores



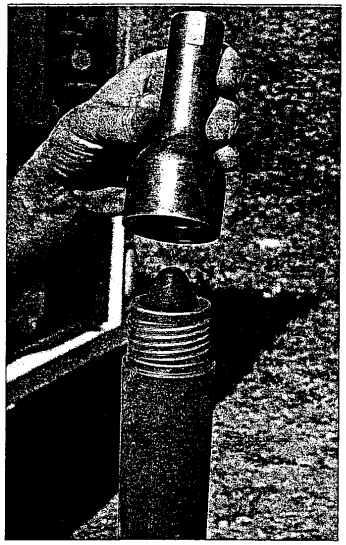


# DTSS -- Designed for Continuous Soil Coring

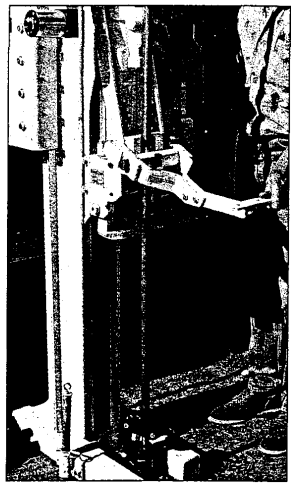
The DT21 system uses Geoprobe 2.125-in. OD probe rods as an outer casing. A cutting shoe is threaded into the leading end of the rod string. When driven into the subsurface, the cutting shoe shears a 1.125-in. OD soil core which is collected inside the casing in a clear PETG liner.

A second set of probe rods (standard Geoprobe 1.0-in. OD) are inserted into the casing with a liner attached. The 1.0-in. rods hold the liner in place while collecting the soil core, and also provide a means of retrieving the liner once the sample is collected. The 2.125-in. probe rods provide a cased hole through which to sample.

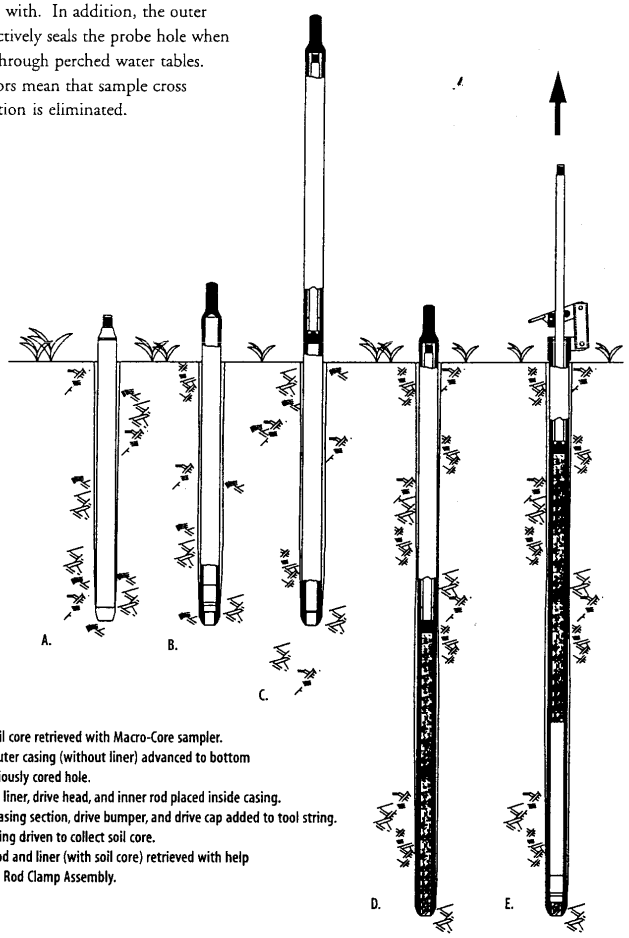
The main advantage of sampling through a cased hole is that there is no side slough to contend with. In addition, the outer casing effectively seals the probe hole when sampling through perched water tables. These factors mean that sample cross contamination is eliminated.



The DT21 System features a drive bumper (DT4010K) which is placed on the top of the 1.0-in. probe rod. This bumper prevents the dynamic hammering forces from being transmitted to the sample liner, thus helping to preserve the liner during the sampling process.



Only the smaller diameter probe rods are retracted when retrieving the filled liner. The outer casing prevents the threat of cross contamination.




A. First soil core retrieved with Macro-Core sampler.
B. DT21 outer casing (without liner) advanced to bottom of previously cored hole.
C. Sample liner, drive head, and inner rod placed inside casing. Outer casing section, drive bumper, and drive cap added to tool string.
D. Tool string driven to collect soil core.
E. Inner rod and liner (with soil core) retrieved with help of DT21 Rod Clamp Assembly.

Driving and Sampling with the Dual Tube Soil Sampler

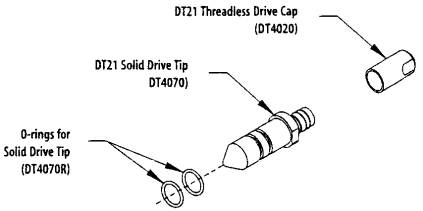




# Continuous Coring with the Dual Tube Soil Sampling System

The DTSS is similar to the Macro-Core sampler in that it is capable of easily obtaining continuous soil samples. But it's also akin to the classic Large Bore discrete sampler because of its ability to drive through undisturbed soil before actually sampling. With the DTSS exclusive expendable cutting shoe, the Dual Tube Soil Sampler is also well suited for installing monitoring wells after sampling to a predetermined depth.

Since it is not always desirable to start continuous coring from the ground surface, Geoprobe's DTSS has a solid drive tip (DT4070) available which allows the operator to advance the DT21 tool string directly through undisturbed soil to the top of the sampling interval. The drive tip is installed on the leading end of the 1.0-in. probe rod string in place of the sample liner. When placed within the 2.125-in. probe rods, the drive tip fits firmly inside the cutting shoe. The solid drive tip plugs the cutting shoe and effectively seals the tool string as the outer casing is driven to depth. Once to depth, the sampler can be treated as a continous sampler by removing the 1.0-in. probe rod and solid drive point and installing a sample liner.



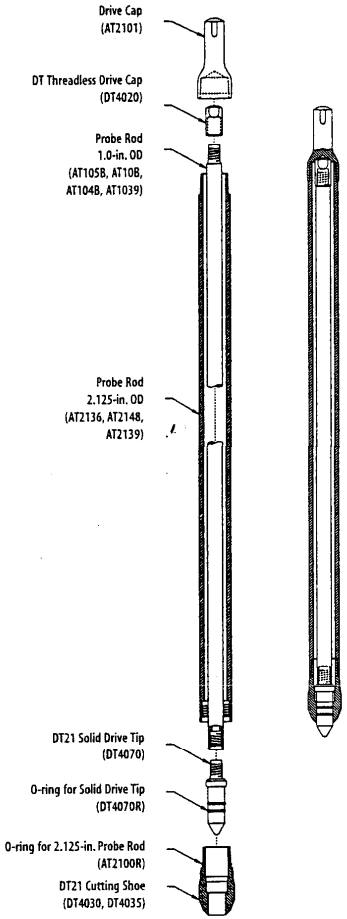

**The use of a removable 1.0-in. solid drive tip inside the cutting shoe closes the open end of the sampler making it possible to drive the sampler through undisturbed soil to the top of the sampling interval.**

# Bottom-Up Grouting

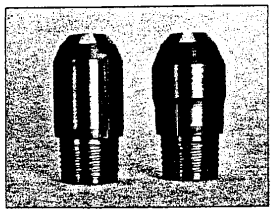
The DT21 system is the only soil sampler that allows bottom-up grouting through the primary tool string. This means that the sample hole can be sealed by pumping grout from the bottom of the tool string as the outer casing is withdrawn. All other soil samplers require driving a secondary set of tools to deliver grout to the bottom of the core hole.

# Different Probing Jobs Require Different Cutting Shoes

Field operators can select which cutting shoe to use depending on the sample process desired. The D21 Large Cutting Shoe (DT4030) and DT21 Small Cutting Shoe (DT4035) thread into the leading end of the 2.125-in. probe rods and are recovered after sampling. The Large Cutting Shoes have a 1.125-in. ID and 2.375 in. OD. The Small Cutting Shoe has an ID of 1.125 in. but the OD is only 2.205 in. To reduce side friction and make driving easier, the Large Cutting Shoe (DT4030) is oversized to provide a small annulus between the outer casing and soil. By contrast, the Small Cutting Shoe (DT4035) is for use in soil conditions where an annulus is undesirable.



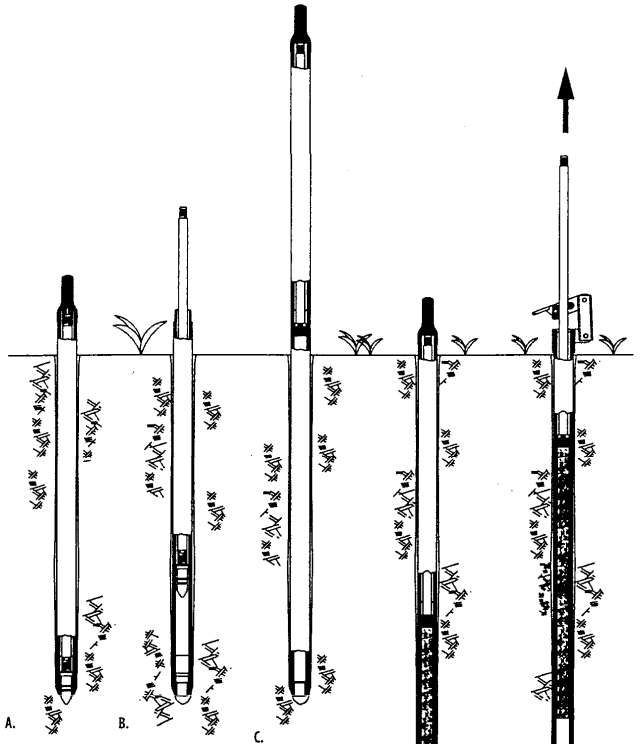

**Dual Tube Soil Sampler Solid Drive Tip Assembly**



**Use the DT21 Small Cutting Shoe (DT4035, left) when probing through aquifers when an annulus is undesirable. Use the DT21 Large Cutting Shoe (DT4030) when minimal side friction with the probe rod and the formation is desired.**

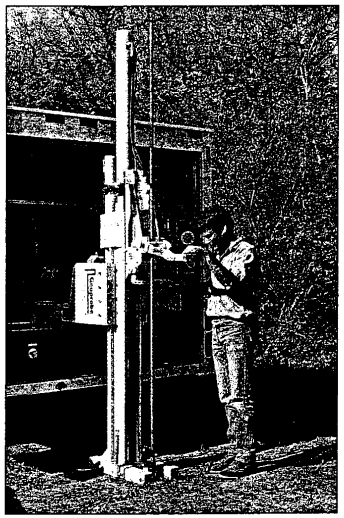







A. Outer casing advanced through undisturbed soil to top of sampling interval. Solid drive tip, inner rod, and threadless drive cap seal casing as it is advanced.
B. Solid drive tip and inner rod string removed from outer casing.
C. Sample liner, drive head, and inner rod placed inside casing. Outer casing section, drive bumper, and drive cap added to tool string.
D. Tool string driven to collect soil core.
E. Inner rod and liner (with soil core) retrieved with help of DT21 Rod Clamp Assembly.

**Driving and Sampling with the Dual Tube Soil Sampler**
(Solid Drive Tip Process)

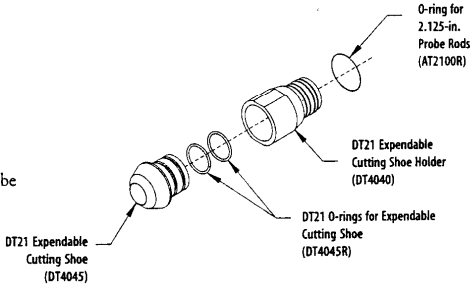


To reduce "threading" time, we suggest coupling probe rods in 8- to 12-foot sections as you recover and install sample liners. Be sure to watch out for overhead utility lines!

Geoprobe® Systems

# Monitoring Well Installation

An Expendable Cutting Shoe (DT4045) allows the field operator to install a Geoprobe Prepacked Screen Monitoring Well after soil sampling is completed. An expendable cutting shoe is inserted into an expendable cutting shoe holder (DT4040) which is threaded into the leading end of the outer casing. When the last soil sample is retrieved the outer casing is withdrawn slightly. The expendable cutting shoe pulls out of the expendable cutting shoe holder and is left in the ground. The field operator then installs the monitoring well by placing prepacked screens with PVC risers in the 2.125-in. casing, grouting while pulling back the casing, and then developing the well.




**Dual Tube Soil Sampler**
**Expendable Cutting Shoe Assembly**

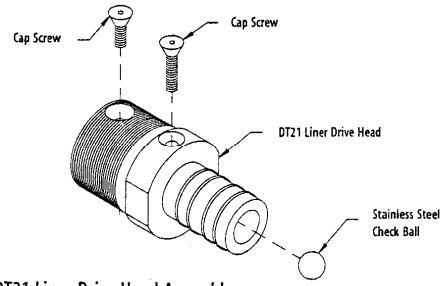




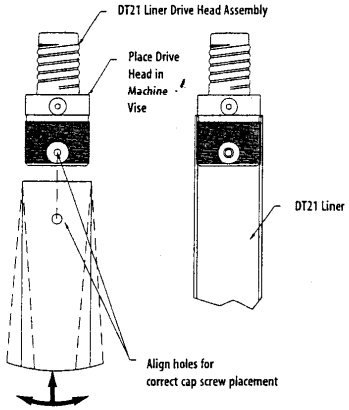
# Continuous Coring in Both Saturated and Unsaturated Zones

Sampling in saturated sands has become quite a challenge with any sampling system, especially when the end of the sampler is left open. This creates the potential for formation heave into the 2.125-in. probe rods when it is not desired (i.e., when sample liners are being removed or installed). A common method for dealing with formation heave is equalizing the formation pressure by adding a column of water insde the 2.125-in. casing. The head pressure created by the column of water will sometimes prevent formation heave.

The Geoprobe Dual Tube Soil Sampler has a unique feature to help deal with the presence of water inside the 2.125-in. probe rods. The liner drive head is designed with an internal check valve that is normally closed. The check valve will allow water and/or air to pass up through the liner drive head while sampling (acting like a vent), but will not allow the water to re-enter back down through the liner drive head. If water is present inside the 2.125-in. casing, it will normally create a certain amount of head pressure on the soil core. If this head pressure is great enough, it may force the soil sample out of the liner, thus decreasing the amount of recovery.



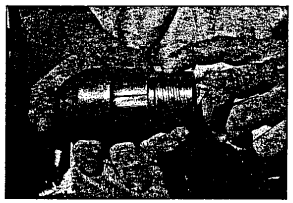

DT21 Liner Drive Head Assembly (DT4050)



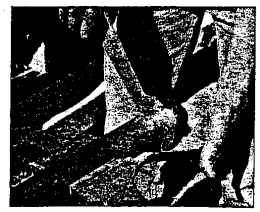

DT21 liner securely attaches to drive head with cap screw.

# Sampling with the DTSS

Thoroughly clean the sampler before assembly to insure correct operation and to remove contaminants. When sampling from the ground surface to 4 feet, we suggest using the Macro-Core Soil Sampler for the best sample recovery at this depth. The field operator should therefore start the following procedure with an open hole that is as deep as the first 2.125-in. probe rod (dual tube outer casing).



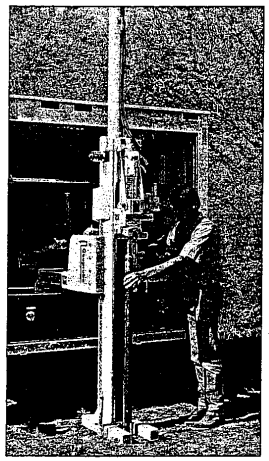
1. Install O-ring in groove of cutting shoe.



2. Thread cutting shoe into female end of 2.125-in. probe rod. Place rod in vise and tighten cutting shoe with MC wrench.



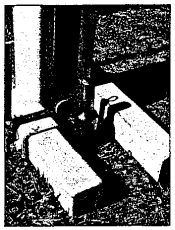
3. Thread drive cap onto male end of 2.125-in. probe rod.



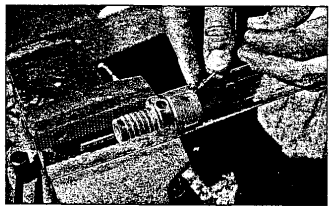
4. Place the probe rod in driving position, parallel to the probe derrick axis.



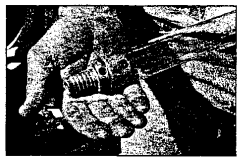




5. Advance the rod string to the bottom of the previously sampled hole. Remove the drive cap from the probe rod and install an O-ring at the base of the male threads.



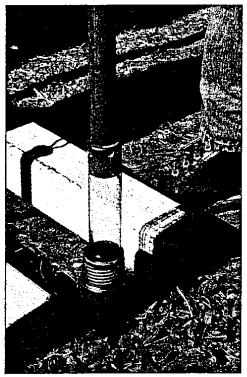
6. Place the liner drive head assembly in a machine vise and remove the cap screw from the lower end of the drive head. Place the open end of the clear liner over the end of the drive head and align the hole in the liner with the threaded cap screw hole in the drive head.



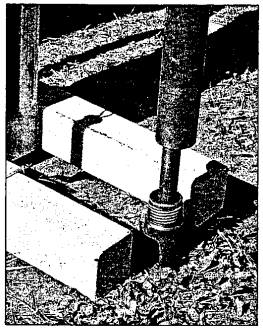
7. After the liner is in place, replace the cap screw and tighten with a hex wrench. The liner is now securely attached to the drive head.



8. Thread the liner/drive head assembly into the female end of a 1.0 in. probe rod.



9. Insert the "rolled" end of the liner into the 2.125-in. probe rod which is now the outer casing. Lower liner and probe rod until liner seats firmly within the cutting shoe.



10. Place a 2.125-in. probe rod over the 1.0 in. rod and thread it onto the outer casing. Tighten outer casing with a pipe wrench.

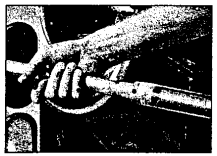


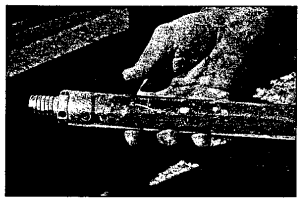
11. Insert a drive bumper in the top of the 1.0 in. probe rod. A portion of the drive bumper will protrude slightly from top of outer casing. Thread a drive cap onto the male end of the probe rod and tighten with a pipe wrench.



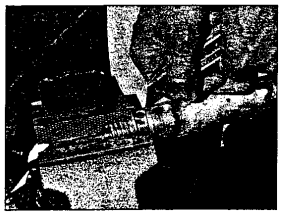
12. Drive the DT21 tool string one sampling interval, then remove the drive cap and bumper. Back the probe assembly away from the the tool string and thread another 1.0 in. probe rod onto the 1.0 in. rod in the outer casing. Raise the 1.0 in. rod to retrieve the filled liner.



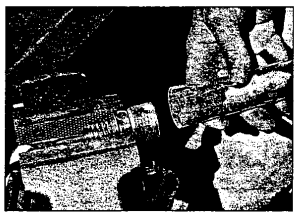


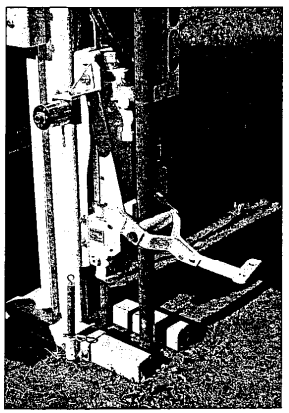


13. Unthread the 1.0 in. probe rod from the liner drive head (left). The drive head remains attached to the liner (right).



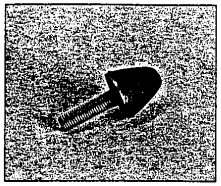
14. Place liner drive head in machine vise (left). Remove set screw holding liner in place. Cut from top of liner to end of drive head with a utility knife. Move lower end of liner back and forth while pulling away from drive head. The liner end will split and release from the drive head (right).





15. The outer casing of 2.125 in. probe rods is easily recovered with Geoprobe's rod grip pull system.

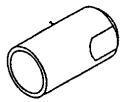
# Dual Tube System Parts and Components



DT4010K ... DT21 Drive Bumpers

## DT21 Drive Bumpers
### DT4010K

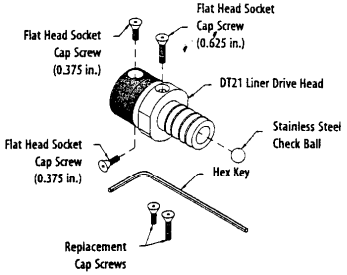
Placed on top of 1.0 in. probe rods while sampling. Absorbs shock of hammer to protect liner. Pkg. of 5.



DT4020 ... Threadless Drive Cap

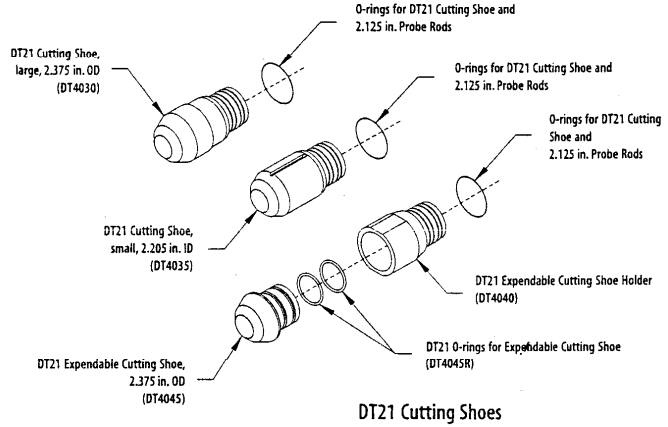
## DT21 Threadless Drive Cap
### ADT4020

Protects threads of top 1.0-in. probe rod while driving sampler with solid drive tip (DT4070). Threadless for quick attachment/removal.




## DT21 Liner Drive Head Assembly
### DT4050

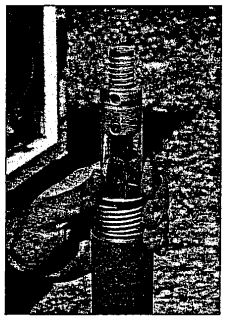
For 1.0 in. probe rods. Assembly includes 1 drive head, 5 screws, 1 check ball, and 1 hex wrench.




DT21 Cutting Shoes

## DT Cutting Shoes
### DT4030 ... Large, 2.375 in. OD
### DT4035 ... Small, 2.205 in. OD
### DT4045 ... Expendable, 2.375 in. OD

Geoprobe brand alloy steel. Cutting shoes attach to leading end of outer casing. Shear a 1.125-in. OD core when sampler is driven.



DT21 Liner Drive Head (DT4050) attaches to the liner and is held securely in place.

## DT21 Rebuild Kit for Liner Drive Head
### DT4051

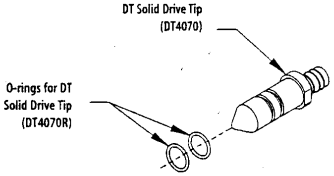
For 1.0 in. probe rods. Kit includes 4 flat head socket cap screws (0.375 in.), 1 stainless steel check ball, 3 flat head socket cap screws (0.625 in.), and 1 hex key (0.09375 in.).

## O-rings for Expendable Cutting Shoe
### DT4045R

O-rings fit groove on expendable cutting shoe (DT4045). Not required for DT4030 or DT4035 cutting shoes. Pkg. of 50.

## DT21 Expendable Cutting Shoe Holder
### DT4040

Threads into leading end of outer casing. Holds expendable cutting shoe in place as sampler is driven to depth.




## DT21 Solid Drive Tip
### DT4070

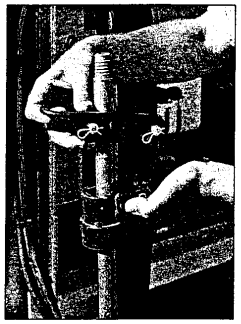
For 1.0 in. probe rods. Fits inside cutting shoes to seal sampler as it is driven through undisturbed soil to top of sampling interval.

## DT21 O-rings for Solid Drive Tip
### DT4070R

O-rings for Solid Drive Tip. Pkg. of 25.

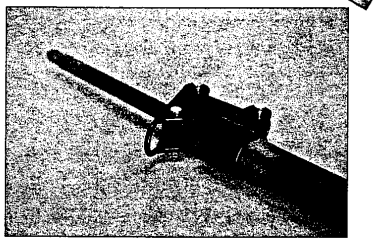




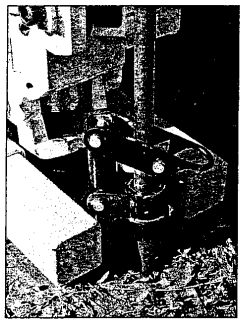


## DT21 Rod Clamp Assembly
### DT4060

The inner (1.0 in.) probe rod string can get heavy and hard to hold by hand when sampling past 15 or 20 feet (4,5 to 6 m). Use Geoprobe's Rod Grip Pull System (GH3000K) to raise and lower the rods, and a DT21 Rod Clamp Assembly to hold them in place while removing or adding rods to the string. Probe rods not included!



DT4060 ... DT21 Rod Clamp Assembly



The DT21 Rod Clamp Assembly slides over the 1.0 in. rods and rests on top of the outer casing (upper left). The 1.0 in. rods slide through the rod clamp when raised (left), but are held in place when released. This ensures that the rods do not fall downhole when adding or removing rods from the tool string.




DT Liners, PETG, 24 in. 36 in., 48 in.

## DT21 Liners
### DT4024K ... 24 in. length
### DT4036K ... 36 in. length
### DT4039K ... 1 m. length
### DT4048 ... 48 in. length

All liners made of PETG. 1.375 in. OD. Box of 50. Cap screw hole in one end to attach to liner drive head assembly. Opposite end is rolled to increase structural integrity of liner and help keep sample in liner during retrieval. 36-in. liners are used with 36-in. probe rods, 48-in. liners are used with 48-in. probe rods, 1-m. liners are used with 1-m. probe rods. 24-in. liners are used with 48-in. probe rods but also require a 24-in. probe rod and are used for hard to sample materials such as expanding clays and heaving sands. Refer to page 5.16 for a composition description of PETG.



**Do You Need**

## Technical Support?

**Darren Stanley is just one of our fleet of Technical Service Representatives ready to assist you with any probing problems or questions you may have. His first priority is to answer your questions, offer probing or tooling suggestions, and assist you in selecting the right tool for the job. As part of the Tech Services Team in Salina, Darren will be taking your tools orders and making sure your Geoprobe machine is equipped with the best possible probing tools. If he's not here to answer the phone, he's probably out hunting or fishing!**

## DT21 Vinyl End Caps
### DT4026

Box of 50 pair: 50 black and 50 red.





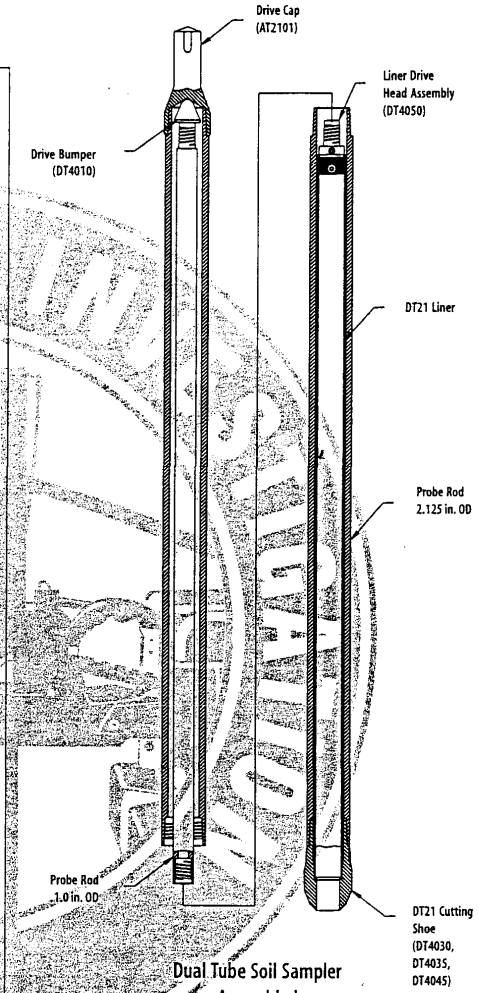
## Dual Tube Soil Sampling System Parts

DT4010K ..... DT21 Drive Bumper, Pkg. of 5 (1.0-inch rods)
DT4020 ..... DT21 Threadless Drive Cap (1.0-inch rods)
DT4030 ..... DT21 Cutting Shoe, Large, 2.375-in. OD
DT4035 ..... DT21 Cutting Shoe, Small, 2.205 in. OD
DT4040 ..... DT21 Expendable Cutting Shoe Holder
DT4045 ..... DT21 Expendable Cutting Shoe, 2.375 in. OD
DT4045R ..... DT21 O-Rings for Expendable Cutting Shoe, Pkg. of 50
DT4024K ..... DT21 Liner, PETG, 24 in., Box of 50
DT4026 ..... DT21 Vinyl End Caps, 50 Pair
DT4036K ..... DT21 Liner, PETG, 36 in., Box of 50
DT4039K ..... DT21 Liner, PETG, 39 in., Box of 50
DT4048K ..... DT21 Liner, PETG, 48 in, Box of 50
DT4050 ..... DT21 Liner Drive Head Assembly, 1.0-in. rods
DT4051 ..... DT21 Rebuild Kit for Liner Drive Head, 1.0-in. rods
DT4060 ..... DT21 Rod Clamp Assembly, 1.0-in. rods
DT4070 ..... DT21 Solid Drive Tip, 1.0-in. rods
DT4070R ..... O-Rings for Solid Drive Tip, 1.0-in. rods

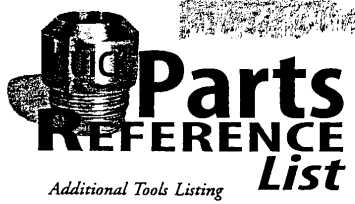
## Additional Required Parts

AT2101 ..... Drive Cap, for 2.125-in. probe rods
AT2148 ..... Probe Rod, 2.125 in. OD x 48 in.
AT2136 ..... Probe Rod, 2.125 in. OD x 36 in.
AT2139 ..... Probe Rod, 2.125 in. OD x 1 m
AT2100R ..... O-rings for 2.125-in. probe rods, Pkg. of 25
AT2104 ..... Pull Cap, 2.125-in. probe rods (or Rod Grip Pull System)
AT104B ..... Probe Rod, 1.0 in. OD x 48 in.
AT10B ..... Probe Rod, 1.0 in. OD x 36 in.
AT1039 ..... Probe Rod, 1.0 in. OD x 39 in.
AT105B ..... Probe Rod, 1.0 in. OD x 24 in. (for 24 in. liners)
GH3000K ..... Rod Grip Pull System
AT8590 ..... MC Combination Wrench

Macro-Core Soil Sampler (see pg. 5.3)




Dual Tube Soil Sampler Assembled




*Additional Tools Listing*
*Section 17*



# APPENDIX A SAP—ATTACHMENT C – BUILDING EVALUATION FORM

**Attachment C**

# Building Evaluation Form

Address _____ Date_____

Occupant Name _____ Phone _____

Owner's Name _____ Phone _____

Owner's Address _____

Point of Contact _____ Phone_____

Contact Information _____

Conducted By_____ Company_____

## A. General Building Information

Building Age _____

Building Type: Residential / Office / Commercial / Industrial /
Government / School / Warehouse

Building Occupants: Adults ____ Children under 6 ____ Children 6-15_____

Building Use _____

Square Footage _____

Ceiling Height _____

General Description of Building Construction Materials: _____

_____

_____

Foundation Type: Basement / Crawl Space / Slab

Foundation Materials: Poured Concrete / Cinder Blocks / Earthen / Wood Pilings /

Other (Specify_____)

Foundation Wall Material: Poured Concrete / Cinder Blocks / Earthen / Wood / Stone

**Attachment C**

Floor Plan:

If there is a basement, please answer questions in Section B.
If there is not a basement, skip to Section C.

**B. Basement Information:**

Is the basement finished? Y / N

Does anyone live in the basement as a primary residence or use the basement daily?Y / N

Is the basement generally: wet / dry / damp ?

Is there a sump in the basement? Y / N If yes, please describe the size, the construction, where it is and whether or not there is a sump and how it is activated:

_____

_____

_____

What was the PID or FID or CGI reading on the air above the sump grate? _____

Does basement have:

cracks Y / N If yes, PID/FID/CGI reading _____

_____

Does basement have (cont):

drainage point in floor Y / N If yes, PID/FID/CGI reading _____

_____

sump or sump pump Y / N If yes, PID/FID/CGI reading _____

_____

pipes or utility conduits through floor or outside walls Y / N If yes, PID/FID/CGI reading _____

_____

Is the basement painted? Y / N

If yes, when_____ and with: latex / oil-based paint / stain ?

Does the basement have flooring over the foundation? Y / N

If yes, what type: tile / carpet / wood / pergo / other, specify _____

Was glue used for installing the flooring?

Is there new furniture in the basement? Y / N If yes, describe type and date received

_____

Are there odors in the basement? If yes, describe _____

**C. First Floor Information**

What are the walls constructed of? Cinder block / sheet rock / paneling / other, specify _____.

Are the walls painted? Y / N

If yes, when_____ and with: latex / oil-based paint / stain ?

Is there flooring in the first floor? Y / N

If yes, what type tile / carpet / wood / pergo / other, specify _____

Was glue used for installing the flooring?

Is there new furniture on the first floor? Y / N If yes, describe type and date received

_____

Are there pipes or utility conduits through the outside walls or floor? Y / N If yes, PID/FID/CGI reading _____

Are there odors on the first floor? If yes, describe _____

**D. Second Floor Information (if applicable)**

What are the walls constructed of? Cinder block / sheet rock / paneling / other, specify _____.

Are the walls painted? Y / N

If yes, when_____ and with: latex / oil-based paint / stain ?

Is there flooring in the second floor? Y / N

If yes, what type: tile / carpet / wood / pergo / other, specify _____

Was glue used for installing the flooring?

Is there new furniture on the second floor? Y / N If yes, describe type and date received _____

Are there pipes or utility conduits through the outside walls or floor? Y / N If yes, PID/FID/CGI reading _____

Are there odors on the second floor? If yes, describe_____

**E. Heating and Ventilation Systems:**

What type of heating system(s) are used in the building? (check all that apply)

___Heat Pump/Furnace ___Hot Air Radiation

___Steam Radiation ___Unvented Kerosene Heater

___Wood Stove ___Electric Baseboard

___Other, specify: _____

What type of fuel(s) are used in the building? (check all that apply)

___Natural Gas ___Electric

___Fuel Oil ___Wood

___Coal ___Solar

___Other, specify _____

**Attachment C**

What type of mechanical ventilation systems are present and/or currently operating in the building? (check all that apply)

___Mechanical Fans ___Open Windows

___Individual Air Conditioning Units ___Kitchen Range Hood

___Bathroom Ventilation Fan ___Air-toAir Heat Exchanger

___Other, specify _____

**F. Roof construction**

Is the roof pitched or flat? _____

Is there an attic? Y / N

If so, is it accessible? Y / N

If so, what is the height of the attic? _____

What is the roof comprised of? Tar shingles / metal / rolled tar material / asphalt coating / other, specify _____

Description of roof support system (trusses, beams, construction materials, etc…) :

_____

_____

**Diagram of Roof and Roof Supports**

| |
|---|
| |

**G. Potential Sources of Indoor Chemical Contaminants:**

Which of these items are present in the building? (Check all that apply)

| Potential VOC Source | Location of Source | Removed 48 hours prior to sampling (Yes/No/NA) |
|---|---|---|
| Paints | | |
| Gas-powered equipment | | |

**Attachment C**

| | | |
|---|---|---|
| Gasoline storage cans | | |
| Cleaning solvents (thinner) | | |
| Air fresheners | | |
| Oven cleaners | | |
| Carpet/upholstery cleaners | | |
| Hairspray | | |
| Nail polish/polish remover | | |
| Bathroom cleaner | | |
| Appliance cleaner | | |
| Furniture/floor polish | | |
| Moth balls | | |
| Fuel tank | | |
| Wood stove | | |
| Fireplace | | |
| Perfume/colognes | | |
| Hobby supplies (e.g., solvents, paints, lacquers, glues, photographic darkroom chemicals) | | |
| Scented trees, wreaths, potpourri, etc. | | |
| Polish / wax | | |
| Insecticide / pesticide | | |
| kerosene | | |
| Other | | |
| Other | | |

**H. Building Use:**

Is there standing water in the building (historic or current)? Y / N

Is there water damage in the building (historic or current)? Y / N

Is there fire damage to the building? Y / N If yes, date_____

**Attachment C**

Are there pest control applications to the building? Y / N If yes, date_____

Is there a septic system? Y / N……..If yes, date of system_____

Do one or more smokers occupy this building on a regular basis? Y / N

Has anybody smoked in the building in the last 48 hours? Y / N

Does the building have an attached garage? Y / N

If so, is a car usually parked in the garage? Y / N

Do the occupants of the building frequently have their clothes dry-cleaned? Y / N

Was there any recent remodeling or painting done in the building? Y / N

Are there any pressed wood products in the building (e.g., hardwood plywood wall paneling, particleboard, fiberboard)? Y / N

Are there any new upholstery, drapes or other textiles in the building? Y / N

Has the building been treated with any insecticides/pesticides? Y / N
If so, what chemicals are used and how often are they applied?

_____
_____
_____

Do any of the occupants apply pesticides/herbicides in the yard or garden? Y / N
If so, what chemicals are used and how often are they applied?

_____
_____
_____

Type of ground cover (e.g., grass, pavement, etc.) outside the building:

_____
_____

Is there a well on the property? If so, what is it used for and where is it screened?

_____

Is there any other information about the structural features of this building, the habits of its occupants or potential sources of chemical contaminants to the indoor air that may be of importance in facilitating the evaluation of the indoor air quality of the building?

_____
_____
_____

**Attachment C**

## I. Other Potential Sources of Indoor or Outdoor Air Contamination

Outside Sources of Contamination (check all that apply):

___Garbage Dumpsters ___Heavy Motor Traffic
___Loading Dock in Use ___Construction Activities
___Airport flight path ___ Railyard/ railcar traffic
___Nearby Industries, specify _____
___UST/AST (gasoline / heating fuel / other, specify _____)

Is there a known spill or release outside or inside the building? If yes, was it:

___ oil ___ natural gas
___ kerosene ___ heating oil
___ used vehicle oil ___ solvents
___ pesticide/insecticide ___ other, describe_____

Describe any additional information about the release (amount, when it occurred, action taken to clean up, etc…) _____
_____
_____
_____

## J. Building Screening Results (PID/FID/CGI)

| | FID (ppm) | PID (ppm) | CGI (%) |
|---|---|---|---|
| Basement | | | |
| First Floor | | | |
| Second Floor | | | |
| Other - | | | |
| Other - | | | |
| Other - | | | |

**Attachment C**

**Instructions for Inhabitants of Building Prior to Sampling Event**
**(to be followed starting at least 48 hours prior to and during the sampling event)**

- Do not open windows, fireplace openings or vents.
- Do not keep doors open.
- Do not operate ventilation fans or air conditioning.
- Do not use air fresheners or odor eliminators.
- Do not smoke in the house.
- Do not use wood stoves, fireplace or auxiliary heating equipment (e.g., kerosene heater).
- Do not use paints or varnishes.
- Do not use cleaning products (e.g., bathroom cleaners, furniture polish, appliance cleaners, all-purpose cleaners, floor cleaners).
- Do not use cosmetics, including hair spray, nail polish, nail polish remover, perfume, etc.
- Do not partake in indoor hobbies that use solvents.
- Do not apply pesticides.
- Do not store containers of gasoline, oil or petroleum–based or other solvents within the house or attached garage (except for fuel oil tanks).
- Do not operate or store automobiles in an attached garage.

# APPENDIX B

# QUALITY ASSURANCE PROJECT PLAN

# Quality Assurance Project Plan

# Inhalation Pathway Interim Measures Georgetown Facility, Seattle, Washington

Prepared for

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Regulatory Affairs Department
955 Powell Avenue SW
Renton, Washington 98055

Prepared by

Exponent
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August 2002

Doc. No. 8601793.001 0101 0502 JM23

# Quality Assurance Project Plan

Prepared by: Exponent
August 2002

Prepared for: Philip Services Corporation, Regulatory Affairs Department

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A copy of this QAPP will also be provided to all contractors hired by Philip Services Corporation to complete this investigation, including field sampling crews and testing laboratories.

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Attachment 2 - North Creek Analytical, Inc. Quality Assurance Manual

Attachment 3 - Rosa Environmental and Geotechnical Laboratory Quality Assurance Manual

Attachment 4 - Standard Operating Procedure: TO-14/TO-15 – Volatile Organic Compounds from Air Toxics, Ltd. Methods Manual

Attachment 5 - North Creek Analytical, Inc. Standard Operating Procedure: Measurement of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (EPA 8260B)

Attachment 6 - Rosa Environmental and Geotechnical Laboratory Standard Operating Procedure: Particle Size Distribution of Soils

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# Acronyms and Abbreviations

| | |
|---|---|
| ATL | Air Toxics, Ltd. |
| COC/SAR | chain-of-custody/sample analysis request |
| COPC | chemical of potential concern |
| DQI | data quality indicator |
| DQO | data quality objective |
| Ecology | Washington State Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| GC/MS | gas chromatography/mass spectrometry |
| GIVF | groundwater to indoor air volatilization factor |
| IPIM | inhalation pathway interim measures |
| IPIMAL | inhalation pathway interim measure action level |
| IPIMWP | *Draft Inhalation Pathway Interim Measures Work Plan* |
| LCS | laboratory control sample |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| NCA | North Creek Analytical, Inc. |
| NIST | National Institute for Standards and Technology |
| OSHA | Occupational Safety and Health Administration |
| PID | photoionization detector |
| PSC | Philip Services Corporation |
| QA/QC | quality assurance and quality control |
| QAM | quality assurance manual |
| QAPP | quality assurance project plan |
| REG | Rosa Environmental and Geotechnical Laboratory |
| RPD | relative percent difference |
| SAP | sampling and analysis plan |
| SDG | sample delivery group |
| SMC | system monitoring compound |
| SOP | standard operating procedures |
| THC | total hydrocarbon |
| TSA | technical systems audit |
| VOC | volatile organic compound |

# Introduction

This quality assurance project plan (QAPP) describes the quality assurance and quality control (QA/QC) procedures used to support the analytical data generated as part of the inhalation pathway interim measures (IPIM) investigation that will be conducted for evaluating the potential for risk to human health resulting from groundwater vapor intrusion into indoor air of buildings located over the groundwater contaminant plume migrating from the Philip Services Corporation (PSC) Georgetown dangerous waste management facility located in Seattle, Washington. These QA/QC procedures are designed to ensure the data generated are representative of actual field conditions and meet the project's data quality objectives (DQOs). This QAPP was developed using guidance provided by the U.S. Environmental Protection Agency (EPA) (U.S. EPA 1998, 2000, 2001).

The rationale for this study and sampling and analysis procedures are provided in the *Inhalation Pathway Interim Measures Work Plan* (IPIMWP) (PSC 2002).

This QAPP contains the following sections:

- Section 1. Project Management
- Section 2. Data Acquisition
- Section 3. Assessment and Oversight
- Section 4. Data Verification, Validation, and Usability
- Section 5. References.

Various elements of the field and laboratory procedures are addressed in each section, as applicable.

# 1 Project Management

Well-defined project management procedures, QA/QC procedures, and quality assessment checkpoints are instrumental in the execution of a successful field effort and the generation of well-documented, high-quality data. This section of the QAPP includes descriptions of the project structure and management procedures that relate to project QA.

## 1.1 Project Organization

The project organization is depicted in Figure 1. The individuals responsible for planning and implementing field and laboratory operations and QA/QC procedures for this project are identified in Table 1, along with a summary of each individual's tasks for project management and QA procedures, and contact information.

### 1.1.1 Management Responsibilities

Project management responsibilities are described in Table 1. Management and QA responsibilities of laboratory personnel are described in the laboratory QA manuals (QAMs) (Attachments 1, 2, and 3).

### 1.1.2 Quality Assurance Responsibilities

The personnel responsible for review and approval of the QAPP and for data verification, validation, and data quality assessment are described in Table 1.

No routine system audits are planned for the field or laboratory activities for this study. The QA/QC coordinator will conduct performance and system audits if required by a nonconformance issue, as described in Section 3.1.

### 1.1.3 Field Responsibilities

Responsibilities of the field team leader are described in Table 1. Field responsibilities for collection of the samples are provided in the sampling and analysis plan (SAP) contained in Appendix A of the IPIMWP (PSC 2002).

### 1.1.4 Laboratory Responsibilities

Air Toxics, Ltd. (ATL), North Creek Analytical, Inc. (NCA), and Rosa Environmental and Geotechnical Laboratory (REG) will provide analytical services for the IPIM

investigation. Laboratory project chemists and QA managers, as described in Table 1, will ensure that appropriate procedures are followed during sample analysis and preparation of the data packages and electronic deliverables. The laboratory project chemists and QA managers are identified in the organization chart (Figure 1).

ATL, NCA, and REG provided their QAMs and applicable analytical standard operating procedures (SOPs) for review and approval by the PSC project manager and the QA/QC coordinator. The QAMs and analytical SOPs include descriptions of the laboratory organization, personnel, and responsibilities; facilities and equipment; analytical methods and QA/QC protocols; and routine procedures for sample custody and data handling. The QAMs for each laboratory completing chemical analyses are provided in Attachment 1 (ATL), Attachment 2 (NCA), and Attachment 3 (REG), respectively. Analytical laboratory SOPs for the analytical methods that will be used are provided in Attachments 4–7.

### 1.1.5 Special Training Requirements/Certification

Procedures to be completed for this study are, for the most part, routine. Standard procedures will be used to collect the indoor air, ambient air, soil gas, groundwater, and soil samples and to complete laboratory analyses. All field personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response training with annual refresher courses as required by the Occupational Safety and Health Administration (OSHA). Complete details of the health and safety procedures to be followed during the investigations are described in the *PSC Site Health and Safety Plan, Corrective Actions Group, Corrective Actions Activities, Western Region*, prepared by Phoenix Health and Safety (PHS 2001). The field team leader will be responsible for ensuring that all field personnel who take part in sample collection have completed the required training and refresher courses.

## 1.2 Problem Definition and Background

The Georgetown dangerous waste management facility is located at 734 Lucile Street, Seattle, King County, Washington. The location of the facility and a facility map are presented in Figures 1-1 and 1-2 in the IPIMWP. The IPIMWP presents the methodology for evaluating the need for, and if necessary, implementation of an IPIM using a tiered approach. A brief description of the problem and background information is provided below. A more detailed discussion is presented in the IPIMWP.

### 1.2.1 Problem Definition and Background

The IPIMWP presents a tiered process for evaluating the potential for risk to human health resulting from groundwater vapor intrusion into indoor air of buildings located over the groundwater contaminant plume migrating from the PSC Georgetown Facility.

The tiered process is implemented using a decision tree, one of the branches of which calls for collecting additional empirical data from areas that show a potential human health risk via the inhalation pathway. Empirical data can be in the form of direct push groundwater, soil gas, or geotechnical soil data closer to a particular building of concern, indoor air samples, and ambient air samples.

The objective of the IPIM investigation is to determine whether a current exposure to residents and workers in the vicinity of the facility exists and, if so, to prevent exposure of these residents and workers to contaminated indoor air resulting from facility-related groundwater contamination. Some of the objectives of the IPIM investigation are as follows:

- Develop empirically-derived groundwater to indoor air volatilization factors (GIVFs) for chemicals of potential concern (COPCs) associated with the indoor air pathway
- Assess the potential risks that may be associated with indoor air concentrations in buildings that are located hydraulically downgradient of the facility
- Achieve detection limits at or below constituent-specific health-based action level concentrations
- Maximize the ability to obtain indoor air data that are representative of the day's indoor air quality as may be caused by vapor intrusion.

Detailed descriptions and a summary of how each of the DQOs listed above will be met are included in the IPIMWP.

## 1.3 Project Description and Schedule

The investigation will consist of indoor air sampling, ambient air sampling, soil gas sampling, direct push groundwater sampling, and geotechnical soil sampling. The purpose of this work is to evaluate the need for, and if necessary, implement an IPIM.

A brief description of the types of sampling activities that will be completed to meet the objectives of the IPIM investigation is provided below. More complete descriptions of the scope of work and field sampling procedures, including station locations and a tentative sampling schedule, are provided in the SAP (Appendix A of the IPIMWP). A summary of the target analytes is provided in Table 2.

### 1.3.1 Indoor Air Sampling

Indoor air samples will be analyzed for volatile organic compounds (VOCs) and will be collected using 6-L Summa® canisters prepared under negative pressure and certified

clean for the compounds of interest. The Summa® canisters will be individually cleaned and certified to 0.02 ppbv total hydrocarbon (THC) by the contract laboratory. Any other equipment used for indoor air sampling will not require decontamination in the field. The procedures for indoor air sample collection are discussed in the SAP.

The Summa® canisters will be equipped with dedicated flow regulators and the flow rate into the canisters will be set at a fill rate for a 24-hour period. The indoor air samples will be collected using a time-integrated sampling method over a 24-hour period to account for such fluctuations as temperature changes and household activities. The 24-hour sampling period should be representative of the average indoor air concentration to which an individual may be exposed.

No field QC samples will be collected for ambient air samples; however, a collocated Summa® canister will be collected for each building in which samples will be collected. Matrix spikes (MSs) will not be collected and analyzed for air samples, as the samples are not possible to spike in Summa® canisters.

### 1.3.2 Ambient Air Sampling

Ambient air samples will be analyzed for VOCs and will be collected using 6-L Summa® canisters prepared under negative pressure and certified clean for the compounds of interest. The Summa ® canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory. Other equipment used for ambient air sampling will not require decontamination in the field. The procedures for ambient air sample collection are discussed in the SAP.

The Summa® canisters will be equipped with dedicated flow regulators. The flow rate into the canisters will be set at a fill rate for a 24-hour period. No field QC samples will be collected for ambient air samples. Duplicate samples will not be collected for the project, because there is no adequate method to collect a duplicate sample using Summa® canisters. MSs will not be collected and analyzed for air samples, as the samples are not possible to spike in Summa® canisters.

### 1.3.3 Soil Gas Sampling

Soil gas samples will be collected, where feasible, to determine whether chemicals detected in the indoor air emanated from the soil gas (the medium between groundwater and indoor air) are associated with other potential sources of contamination within the building or ambient air. The procedures for soil gas sample collection are discussed in the SAP.

Soil gas samples will be collected from a direct push stainless-steel screen using 6-L Summa® canisters attached by Teflon®-lined tubing to a sampling port. The Summa® canisters will be prepared under negative pressure and certified clean for the compounds

of interest. The Summa® canisters will be individually cleaned and certified to 0.02 ppbv THC by the contract laboratory. The direct push tooling will be decontaminated according to PSC SOP-400, contained in the SAP. Prior to sampling, each soil vapor port will be purged for 3 minutes at 300 mL/minute using an air pump to ensure that the soil gas sample is representative of subsurface conditions. After purging, the Summa® canisters will be set to fill over a 24-hour period.

No field QC samples will be collected for ambient air samples. Duplicate samples will not be collected for the project, because there is no adequate method to collect a duplicate sample using Summa® canisters. MSs will not be collected and analyzed for air samples, as the samples are not possible to spike in Summa® canisters.

### 1.3.4 Groundwater Sampling

There may be cases where a permanent monitoring well does not exist close enough to a building being investigated for interim measures; in such cases, direct push groundwater sampling may be employed. When groundwater samples are collected for the IPIM, analyses will be completed for VOCs. The sampling locations will be determined on a case-by-case basis. In some cases, a permanent well may be adequate to use and in other cases a direct push groundwater sample will be necessary. The procedures and options for groundwater sample collection are discussed in the SAP.

The field QC samples associated with the groundwater samples will include a trip blank, a field duplicate, a field blank, an equipment blank, and a matrix spike/matrix spike duplicate (MS/MSD). An explanation of how to collect each of these QC samples is provided in the SAP.

### 1.3.5 Geotechnical Soil Sampling

It may be necessary in some circumstances to gather more information about site-specific soil, including grain size distribution, moisture content, wet and dry bulk density, and total porosity. The sampling locations will be determined on a case-by-case basis. Soil samples will be collected using a direct push drill rig that will install a vertical borehole near the building being sampled for indoor air. The procedures that will be used for soil sample collection are provided in the SAP.

### 1.3.6 Laboratory and Field Testing Measurements

Testing for this study will include laboratory analyses and field measurements. All air and groundwater samples collected will be analyzed for the VOCs listed in Table 2 of this QAPP using the laboratory modified version of EPA Methods TO-14A and TO-15 (U.S. EPA 1999a) and U.S. EPA SW-846 Method 8260B (U.S. EPA 1997), respectively.

Geotechnical analyses will be conducted on soil samples collected and analyzed for grain size distribution using ASTM Method D422-63 (ASTM 1998); moisture content using ASTM Method 2216-98 (ASTM 1998); wet and dry bulk density by ASTM D2937-00; and total porosity by ASTM D854-00 (ASTM 2000). Groundwater and soil samples will be field screened using a photoionization detector (PID) to measure the concentration of VOCs during sampling activities.

Details regarding laboratory methods, field measurements, and related QA/QC requirements are provided in Section 2 of this QAPP.

### 1.3.7 Special Personnel and Equipment Requirements

Personnel and equipment required to complete this investigation may include a registered driller, utility locators, and field geologists/engineers for logging soils.

### 1.3.8 Project Assessment Techniques

Various types of assessment activities will be implemented during the course of the investigation to determine compliance with the planning documents and ensure efficiency in completing the project tasks. Details regarding the types of assessments that will be completed are presented in Section 3.1 of this QAPP.

### 1.3.9 Project Schedule

Mobilization for field activities will begin as soon as this IPIMWP is approved by Washington State Department of Ecology (Ecology) and the property access agreements are finalized. A building evaluation with the property owner will be completed prior to sample collection. The building evaluation will provide data necessary to design a remedy for the building. Upon validation and evaluation of the data, chemical-specific groundwater-to-indoor-air volatilization factors and groundwater inhalation pathway interim measure action levels (IPIMALs) will be developed and submitted to Ecology in a brief technical memorandum within 30 days of receiving the validated data and no later than November 27, 2002.

Groundwater data from permanent monitoring wells will be reevaluated after receipt of second quarter 2002 data from the new pre-corrective action monitoring plan network. The data will be evaluated according to the IPIMWP and a review of the quarterly monitoring data compared to IPIMALs. Due to the requirements of collecting additional empirical data to derive the IPIMALs and associated sampling constraints, the second quarter IPIM evaluation will be submitted within 60 days of receipt of the validated data from the GIVF study and no later than November 27, 2002.

Subsequent tier 1, 2, 3, or 4 IPIM proposals will be submitted to Ecology after the receipt of validated groundwater data from quarterly groundwater sampling events in the form of

technical memoranda for the IPIM. These technical memoranda will be submitted in accordance with the schedule provided in Table 5-1 of the IPIMWP. These proposals will include a schedule for implementation of the work proposed. Progress reports on each IPIM installed will be included in the March 15 interim measure annual progress reports. This process will be repeated each quarter until a final remedy for the site has been approved and implemented. A summary of the IPIM schedule is presented in Table 5-1 in the IPIMWP.

Air, groundwater, and soil samples will be submitted to the appropriate laboratories for analysis. Quick turnaround times (e.g., 5 days) are anticipated for the data. The chemical and geotechnical data will be validated as discussed in Section 4 of this QAPP.

### 1.3.10 Required Data Records and Reports

Procedures, observations, and test results will be documented for all sample collection, laboratory analysis and reporting, and data validation activities. In addition to data reports provided by the laboratories, reports that address data quality and usability and that provide tabulated laboratory and field data will be prepared. Internal and external reporting procedures for this study are described in this section.

The required records and reports for this investigation include the following:

- A field notebook for recording daily sampling activities, field conditions, field measurements, and any deviations from sampling procedures specified in the IPIMWP, the SAP, this QAPP, and any other field observations
- A field form that will be used to document information such as station locations and sample collection and geological information
- Laboratory data reports that will include complete documentation of all analytical results, analytical methods, detection limits, results of QA/QC measurements, and any problems that arise during analysis
- Electronic data deliverables provided by the laboratories for direct entry into the project database
- QA reports that detail the results of the data review and validation of the analytical results from the laboratories.

More detailed descriptions of the records and reports described above are provided in the IPIMWP and Section 1.5 of this QAPP.

## 1.4 Quality Objectives and Criteria for Measurement Data

Quality objectives for this investigation primarily include obtaining data that are of acceptable quality, are representative of the conditions at the site, and are sufficient to support the end uses of the data.

To meet the overall quality objectives of a project, the production of valid and acceptable data begins with the seven-step DQO process, as described in EPA QA/G-4 (U.S. EPA 2000), prior to the collection of field samples and measurement data. As outlined in guidance for preparing QAPPs (U.S. EPA 1998, 2001) and specified by the seven-step DQO process (U.S. EPA 2000), the specific quality objectives and criteria for measurement data for this investigation are discussed below.

Measurement performance criteria for data quality indicators (DQIs) have been established for this project to ensure that chemical data are of known and sufficiently high quality to support the project objectives. Quantitative DQIs for field QC samples and laboratory analyses include indicators for precision, accuracy, completeness, and sensitivity. The measurement performance criterion for completeness is 95% for all analyses for this project. Measurement performance criteria for the quantitative DQIs for laboratory analyses are provided in Table 3 for surrogate compound recoveries, Table 4 for MS and laboratory control sample (LCS) recoveries, and Table 5 for duplicate sample or MSD sample analyses. Field duplicate samples will be collected to determine overall precision. Laboratory duplicates or MSDs will be analyzed to check for analytical precision. MS samples will be used to determine analytical accuracy. Field equipment blanks and laboratory method blanks will serve as an additional check on accuracy. Method-specific detection limits or method reporting limits will be determined as required by U.S. EPA (1997) to quantify sensitivity of the system.

The qualitative goals of representativeness and comparability of the data will be met by the careful collection of samples according to protocols established in the IPIMWP and the use of standard methodology for laboratory testing and analyses. These procedures are described or referenced in Section 3 of this QAPP.

### 1.4.1 Intended Data Uses

The purpose of the IPIM is to complete a tiered process for evaluating the potential for risk to human health resulting from groundwater vapor intrusion into indoor air of buildings located over the groundwater contaminant plume migrating from the PSC Georgetown Facility. The objective of the groundwater IPIM investigation is to determine whether a current exposure to residents and workers in the vicinity of the facility exists and, if so, to prevent exposure of these residents and workers to contaminated indoor air resulting from facility-related groundwater contamination. The IPIM investigation will use empirical data and some modeling to develop action levels for determining risk. Further details regarding the intended data uses are provided in the IPIMWP.

## 1.4.2 Data Type

To meet the objectives of this project, air, groundwater, and soil samples will be collected. The samples will be analyzed for VOCs and geotechnical parameters, as discussed below. In addition, field screening analyses will also be completed.

The data collected from all field and laboratory analyses will be used to gather sufficient information necessary to meet the project objectives, as discussed in the IPIMWP.

### 1.4.2.1 Laboratory Analyses

Testing for the IPIM investigation will include laboratory analyses and field measurements. The number and type of samples that are planned for each investigation are specified in the IPIMWP. Samples will be analyzed for the parameters listed in Table 2. VOC analyses will be performed using the laboratory modified version of EPA Methods TO-14A and TO-15 (U.S. EPA 1999a) for air samples and EPA Method SW-846 8260B (U.S. EPA 1997) for groundwater samples. Geotechnical analyses will be performed using methods described in ASTM (ASTM 1998, 2000). Details regarding laboratory methods, field measurements, and related QA/QC requirements are provided in Section 2 of this QAPP.

### 1.4.2.2 Field Screening Analyses

Groundwater and soil samples will be field screened using a PID to measure the concentration of VOCs during sampling activities. The SOP for the completion of the PID testing is presented in SAP (Appendix A of the IPIMWP). Details regarding field measurements are provided in Section 2 of this QAPP and the IPIMWP.

## 1.4.3 Acceptable Level of Confidence in Data

The study design was optimized for this project to limit the uncertainty in the data set, based on analysis of existing data and professional judgment of the PSC project manager.

## 1.4.4 Measurement Performance Criteria

Measurement performance criteria (also referred to as DQIs) are used to document and evaluate the quality of the data generated by the laboratories (U.S. EPA 1998). DQIs for measurement data are usually expressed in terms of accuracy (bias and precision), completeness, representativeness, and comparability. These characteristics are defined as follows:

- **Bias—**The degree of conformity of a measurement, X, with respect to an accepted reference value, T, expressed as a percentage: $X/T \times 100$. Bias is quantified by the analysis of MS samples and reference

materials (e.g., LCSs). Bias is one component of the accuracy of measurements.

- **Precision—**A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is expressed in terms of the relative standard deviation for three or more measurements or relative percent difference (RPD) for two measurements. Precision is calculated from laboratory and field duplicate measurements. Precision is the second component of the accuracy of measurements.

- **Completeness—**The ratio of the number of valid measurements compared to the number of expected measurements, expressed as a percentage. Field and analytical data may be specified at different completeness levels.

- **Representativeness—**The degree to which data accurately and precisely represent the true value of a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness of field and laboratory data is attained through the use of consistent methods of data collection, including field methods, sampling procedures, sample preservation and handling, calibration of field and laboratory instruments, and analytical procedures.

- **Comparability—**The confidence with which one data set can be compared with another. All data for this site investigation will be obtained using consistent analytical methods to ensure comparability of the results within the study, and every reasonable effort will be made to maintain comparability with other studies completed at the site. Comparability of data is attained by following established protocols for sample collection and analysis and recording field and laboratory data in consistent units.

Measurement targets for the quantitative DQIs, including method reporting limits (sensitivity), bias, precision, and completeness for laboratory analyses are presented in Tables 2 through 5. Attainment of these targets will ensure that the data are of appropriate quality for their intended purpose. Data that do not meet these measurement targets will be qualified during data validation, and their limitations will be noted in the laboratory or QA/QC report for the project, as discussed in Section 1.5 of this QAPP.

To confirm that measurement targets for precision and accuracy are achieved, analytical results for both field and laboratory QC samples will be evaluated, as discussed in Section 4.2 of this QAPP. The equations used to assess precision, accuracy, and completeness, as well as the techniques used to determine sensitivity (i.e., the reported instrument detection limits for each method), are listed in Section 4.2.3 of this QAPP.

## 1.5 Documentation and Records

Procedures, observations, and test results will be documented for all sample collection, laboratory analysis and reporting, and data validation activities. In addition to data reports provided by the laboratories, reports that address data quality and usability and that provide tabulated laboratory and field data will be prepared. Internal and external reporting procedures for this study are described in this section.

### 1.5.1 Field Records

Field records will be maintained during all stages of sample collection and preparation for shipment to the laboratories. Field records will include the following items:

- Field notebook to record daily sampling activities, conditions, and field measurements
- Building evaluation form
- Combined station/sample log to document station locations and date and time of collection
- Sample labels and sample tags
- Combined chain-of-custody/sample analysis request (COC/SAR) forms
- Custody seals to monitor cooler security during shipment
- Photographic documentation (if taken).

Detailed descriptions of the information that will be reported on each field record form are provided in SOP-400, contained in the SAP (Appendix A of the IPIMWP).

In addition to the standard field records, the following reports will be completed if a deviation from the SAP or QAPP is encountered or to document an audit:

- Corrective action reports documenting any problems encountered during field activities and corrective actions taken
- System and performance audit reports completed during the investigation
- A summary of any changes made to documented procedures and the rationale for the changes.

### 1.5.2 Laboratory Data Reports

The laboratories will perform data reduction as described in each test method for this project and will submit complete data packages with full documentation for all analyses or other determinations. The laboratory QA managers or their designees are responsible for reviewing their respective laboratory data packages, verifying that all method-specific QA/QC measurements were completed and are acceptable, and checking data reduction so that quality-assured data are reported prior to submittal to PSC. Any transcription or computation errors identified during this review will be corrected by the laboratory.

The analytical laboratories (excluding the laboratory completing geotechnical determination) will provide all information required to complete a 100-percent QA review (i.e., data validation) on 25 percent of the data that will be used to determine the GIVFs and 10 percent of the data reported for all other analyses completed. In addition, the analytical laboratories will provide all information required to complete an abbreviated QA review (i.e., a summary review) for the remaining 75 percent of the data that will be used to determine the GIVFs and 90 percent of all other data to be reported.

In order to complete a 100-percent QA review, the information to be reported (as applicable to the analytical method) will include, at a minimum, the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered
- A summary of analyte concentrations and method reporting limits
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Initial and continuing calibration data, including instrument printouts and quantification summaries for all analytes
- Results for method and calibration blanks
- Results for all QA/QC checks, including system monitoring compound (SMC) or surrogate compounds, MS samples, LCSs, MSD samples, and laboratory duplicate or triplicate samples
- Original data quantification reports for all analyses and samples.

All laboratory worksheets and standard preparation logs (data include final dilution volumes, sample sizes, and spiking and standard preparation procedures for all analyses).

To complete an abbreviated QA review, the information to be reported (as applicable to the analytical method) will include, at a minimum, the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered

- A summary of analyte concentrations and method reporting limits
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Results for method and calibration blanks
- Results for all QA/QC checks, including SMC or surrogate compounds, MS samples, LCSs, MSD samples, and laboratory duplicate or triplicate samples.

### 1.5.3 Data Quality and Usability Report

A data quality and usability report will be prepared in conjunction with a data report for major reports (e.g., annual interim measure progress report) used for decisionmaking. The data quality report will summarize the results of the data validation and data quality review and will describe any significant QA problems that were encountered. The data quality report for the chemical and geotechnical analyses will include all or a portion (depending on the type of data validation that will be completed) of the following items:

- Executive summary of overall data quality and recommendations for data use and limitations
- Description of sample collection and shipping, including COC and holding time documentation
- Description of analytical methods and detection limits
- Description of data reporting
- Description of completeness relative to QAPP objectives
- Description of any contamination in field and laboratory blanks and implications for bias of the data
- Description of accuracy relative to QAPP objectives, including results of SMC or surrogate, MSs, and LCS recoveries
- Description of precision relative to QAPP objectives, including results for field and laboratory replicate analyses
- Identification of cases where control limits or measurement performance criteria were not met and summary of the significance of these deviations
- Description of analyte identification and quantification.

All data and any qualifiers applied to the data as a result of the QA review will be reported in the final data report.

### 1.5.4 Location of Records and Reports

The records generated during sample collection and analysis document the validity and authenticity of the project data. These records will become part of the final evidence file, as described in Section 2.3.4. The evidence file will be retained at PSC's office located in Renton, Washington. The electronic database for this study will also be retained at PSC's Renton, Washington office in the custody of the project data manager. Project reports will be kept with the PSC project files for reference purposes. Records that are more than 3 years old may be archived at a data archiving subcontractor's site, but all data will be retrievable in a quick timeframe (normally 1–2 days).

# 2 Measurement/Data Acquisition

The purpose of this section is to provide sufficient detail to evaluate whether the methods used for this project have been verified and documented.

## 2.1 Experimental Design

The overall goal of the field sampling effort is to collect data that will support the intended uses of the data (as described in the IPIMWP).

The main objectives of the data collection effort are to obtain representative samples and to collect enough data to:

- Develop derived groundwater to indoor air volatilization factors (GIVFs) for COPCs associated with the indoor air pathway
- Assess the potential risks that may be associated with indoor air concentrations in buildings that are located hydraulically downgradient of the facility
- Achieve detection limits at or below the action level concentrations for all empirical data
- Maximize the ability to obtain indoor air data that are representative of the day's indoor air quality as may be caused by vapor intrusion.

More complete details regarding the main objectives of the project are provided in the IPIMWP.

## 2.2 Sampling Method Requirements

The sample types that will be collected for this investigation are indoor air, ambient air, soil gas, groundwater, and soil. Sample collection procedures are described in the IPIMWP.

Requirements for sample containers, preservation, and holding times, as well as the sample mass required by the laboratory for each analysis, are summarized in Table 6. Clean 6-L Summa® canisters with certificates of analysis will be provided by the analytical laboratory for the air and soil gas sampling. New I-Chem® 300 series or equivalent sample containers, with certificates of analysis, will be provided by the laboratories for the groundwater and soil samples. The originating laboratory will be responsible for checking the certificates of analysis to ensure that decontamination standards are met. Sample containers will be kept closed until used. Groundwater and

soil samples, as may be required, will be preserved as necessary immediately upon collection. All samples will be packed on ice in coolers as soon as possible after collection.

## 2.3 Sample Handling and Custody Requirements

A continuous record of the possession and proper handling of samples must be maintained so that sample custody and handling are traceable from the time of sample collection until the analytical data have been validated and accepted for use.

### 2.3.1 Field Sampling Operations

Sample custody documentation is initiated in the field as each sample is collected. The designated sampler assumes custody of the samples as soon as they are collected. A sample label is attached to each sample jar as it is filled in the field and assigned a sample identifier. The sample information is recorded by the field samplers onto the sample log forms at the time of collection.

During sample collection or at the end of each day and prior to shipping or storage, COC/SAR forms will be completed for all samples by a designated sample custodian. The information on the sample labels will be rechecked and verified against field logbook entries and the COC/SAR forms. Any necessary changes to COC/SAR forms, sample container labels, or the field logbook will be made by striking out the error with one line and reentering the correct information. The new entries will be initialed and dated.

Samples with extra volume for laboratory QC procedures (i.e., MS/MSD and laboratory duplicates) will be designated as such on the COC/SAR. The laboratory will decide how to batch samples within the constraint of a maximum of 20 samples per batch. Samples that arrive over a period of several days may be combined in a sample delivery group (SDG) provided the samples are processed together and holding times are not jeopardized. A separate LCS must be analyzed with each processing batch if the samples are not prepared together.

### 2.3.2 Shipping

All samples will be accompanied by COC/SAR forms during shipment. The custodial sampler provides the first signature on the COC/SAR form when relinquishing custody to another member of the field team for documentation or packing or to the shipping company, laboratory courier, or field sampling personnel.

When groundwater samples are shipped, the COC/SAR forms will be placed inside the shipping coolers, and the samples placed on ice. When air samples are shipped, the COC/SAR forms will be placed inside the shipping box. When geotechnical soil samples

are collected, they will be delivered by hand and the COC/SAR forms will be handed directly to laboratory personnel along with the associated samples. All details regarding shipping of samples are specified in SAP. The field personnel will be responsible for sample custody and appropriate sample storage prior to shipment, as well as for packing and shipping samples in a manner that allows the laboratory sufficient time to meet holding time requirements. The technical field personnel will also contact the laboratory project chemist and the project manager to notify them of the sample shipment.

The field personnel will be responsible for sample custody and appropriate sample storage prior to shipment, as well as for packing and shipping samples in a manner that allows the laboratory sufficient time to meet holding time requirements. The field personnel will also contact the laboratory project chemists and the project managers to notify them of the sample shipment.

### 2.3.3 Laboratory Operations

The laboratory project chemist for each laboratory will verify receipt of each sample shipment and will contact the sample manager to provide notification that all samples were received and to relay any concerns or observations regarding sample integrity or documentation. The laboratory project chemist will also be responsible for ensuring that laboratory COC/SAR forms and tracking records are completed upon receipt of the samples and maintained through all stages of laboratory analysis. Storage information must be maintained until disposal of the samples. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis for each analytical procedure. These records will be used to determine compliance with holding time requirements.

The laboratories will maintain daily temperature logs for all refrigerators and freezers that contain samples for this project. These logs will be stored at the laboratory and copies will be provided to the PSC project manager if requested. The laboratory project chemist will notify the project QA/QC coordinator if storage temperatures deviate from those specified in Table 6.

### 2.3.4 Evidence Files

Final evidence files will be assembled throughout the course of the project as material becomes available. The final evidence file will contain the following items:

- The planning documents (the IPIMWP, SAP, and QAPP) prepared for the project
- All field logbooks, sample log sheets, and any other written records generated during sample collection
- Photographs of the sampling procedures, if applicable

- Copies of all COC/SAR forms (the signed originals will be provided by the laboratory as part of the data packages)
- All original laboratory data
- Copies of electronic data provided by the laboratory (original disks or CDs will be stored if the data are provided in this manner)
- All records generated during verification of the database
- Copies of final project reports and any pivotal intermediate work products used in generating the final reports.

The evidence file will be secured and maintained in PSC's custody, unless specified otherwise. Records that are more than 3 years old may be archived at a data archiving subcontractor's site, but all data will be retrievable in a quick time frame (normally 1 or 2 days).

## 2.4 Analytical Method Requirements

VOC analyses of air samples and soil gas samples will be completed by the laboratory modified version of EPA Methods TO-14A and TO-15 (U.S. EPA 1999a). VOC analyses of groundwater samples will be completed by EPA SW-846 Method 8260B (U.S. EPA 1997). All analyses will include all associated QA/QC procedures recommended in each method. Geotechnical analyses will be completed according to methods described in ASTM (ASTM 1998, 2000). Descriptions of the analytical methods that will be used are described in greater detail in the laboratory SOPs contained in this QAPP (Attachments 4 through 7). Laboratory methods to be used during this investigation are referenced in Table 2. Field screening analyses will be completed according to methods and relevant SOPs described in the IPIMWP.

The project-specific target compounds and method reporting limits for the VOC and geotechnical analyses are provided in Table 2. The reporting limits reflect laboratory capabilities or represent reporting limits that can reasonably be expected from a competent laboratory. Analytical methods that yield reporting limits that are sufficiently low to support the objectives of this investigation were selected whenever possible. The actual reporting limits attained during this site investigation may be elevated with respect to theoretical reporting limits if interferences are encountered because of the sample matrices.

## 2.5 Quality Control Requirements

QC samples and procedures are used to obtain quantitative information regarding the execution of field and laboratory activities. QC results will be used to estimate the magnitude of bias and level of precision inherent in the test data. A variety of QC

samples will be collected in the field and initiated by the laboratories for every test. The sections presented below describe field and laboratory QC samples and procedures in more detail.

## 2.5.1 Field Quality Control

Field QC samples are used to assess sample collection techniques, possible sources of contamination, interferences that may be attributed to the sample matrix, and, to some degree, the bias and precision of the reported results. Field QC samples will not be collected for indoor air, ambient air, and soil gas samples. Duplicate samples will not be collected for any of the air samples, because there is no adequate method to collect a duplicate sample using Summa® canisters. MSs will not be collected and analyzed for air samples, as the samples are not possible to spike in Summa® canisters. The following section discusses the types of field QC samples that will be collected for the direct push groundwater samples.

### 2.5.1.1 Field Duplicate Samples

Field duplicate samples (groundwater samples only) will be collected to assess the homogeneity of the samples and the precision of the sampling process. Field duplicates will be prepared by collecting two aliquots of sample from the same sampling location using the same sampling equipment and technique, then submitting them for analysis as separate samples. Results from the analysis of field duplicates are used to evaluate the precision of the analysis by calculating the RPD between the results obtained. The frequency of collection will be 1 per 20 samples collected and analyzed for VOCs only.

### 2.5.1.2 Equipment Rinsate Blanks

Equipment rinsate blanks (groundwater samples only) will be collected whenever non-dedicated or non-disposable sampling equipment will be used. Equipment rinsate blanks will be used to identify possible contamination from the sampling environment or from sampling equipment. These blanks will be collected by pouring deionized and distilled water over (or through) the decontaminated sampling equipment and into a sample jar. One equipment rinsate blank will be collected for each type of sampling equipment used during the sampling event and will be analyzed for all applicable analytes. The frequency of collection will be 1 per 20 samples collected and analyzed for VOCs only.

### 2.5.1.3 Field Blanks

Field blanks (also referred to as environmental blanks) will be collected by sampling personnel in the field and submitted to the laboratory as natural samples. Field blanks will be used to identify possible contamination occurring from the sampling environment (e.g., airborne contamination). These blanks will consist of deionized and distilled water from the analytical laboratory in clean and preserved sampling containers. In the field,

this water will be transferred to an empty sampling container at a specified sampling location. The sample will be preserved for the applicable analysis to be completed. The frequency of collection will be 1 per 20 samples collected and analyzed for VOCs only.

#### 2.5.1.4 Trip Blanks

Trip blanks (groundwater samples only) will be carried with sample coolers when sampling for VOCs. Trip blanks will be used to assess possible contamination during sample transport. Trip blanks will be prepared at the laboratory by adding distilled deionized water and preservative to clean volatile organic analysis vials. Trip blanks will be included in each cooler used for transporting VOC samples and will remain sealed during sample collection and transport.

### 2.5.2 Laboratory Quality Control

Each analytical protocol used in this site investigation (Table 2) includes specific instructions for analysis of QC samples and completion of QC procedures during sample analysis. These QC procedures verify that the instrument is calibrated properly and remains in calibration throughout the analytical sequence and that the sample preparation procedures have been effective and have not introduced contaminants into the samples. Additional QC samples are used to identify and quantify positive or negative interference caused by the sample matrix.

The following laboratory QC procedures are required for most analytical procedures:

- **Holding Times—**Holding time constraints for each method will be met to ensure the validity of the results reported.
- **Instrument Tuning—**Instrument tuning for analyses by gas chromatography/mass spectrometry (GC/MS) will be completed to ensure that mass resolution, identification, and, to some degree, sensitivity of the analyses are acceptable. Instrument tuning will be completed each 12-hour period during which samples or standards are analyzed. In the event that an instrument tuning does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications. Any project samples analyzed while the instrument is out of calibration will be reanalyzed.
- **Initial Calibration and Continuing Calibration Verification—** Initial calibration of instruments, as applicable, will be performed at the start of the project and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibration verification will be performed as specified in the analytical methods to track

instrument performance. In the event that a continuing calibration does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications. Any project samples analyzed while the instrument was out of calibration will be reanalyzed.

- **Method Blanks—**Method blanks are used to assess possible laboratory contamination of samples during all stages of preparation and analysis. Blank corrections will not be applied by the laboratories to the original data. A minimum of 1 method blank will be analyzed for every sample preparation group or 1 for every 20 samples, whichever is more frequent.

- **Surrogate Spike Compounds—**Surrogate spike compounds (or SMCs for VOC analyses) will be added to all field and QC samples for applicable organic compound analyses prior to analysis or extraction to evaluate the recovery of analytes from each sample. Recoveries for these surrogate compounds will be reported by the laboratories; however, the laboratories will not correct sample results using these recoveries.

- **Matrix Spike Samples and Matrix Spike Duplicates—**MS samples are used to assess the effects of the sample matrix on the accuracy of analytical measurements. For organic analyses, MSD samples are used to assess both accuracy and precision. One MS and one MSD will be analyzed for every SDG or for every 20 samples, whichever is more frequent. Unspiked laboratory duplicates (described below) are used to assess the precision of data for inorganic analytes.

- **Laboratory Control Samples—**LCSs (reference material or spiked blanks) will be used as a check on overall method performance. An LCS will be analyzed for every SDG or for every 20 samples, whichever is more frequent.

- **Laboratory Duplicates—**Duplicate laboratory analyses (sample duplicate and/or MSD) are indicators of laboratory precision. One laboratory duplicate and/or one MSD will be analyzed for every SDG or for every 20 samples, whichever is more frequent.

- **Internal Standards—**Internal standards are added to all field and QC samples for analyses completed by GC/MS immediately prior to analysis. The internal standards are used for quantification of target compounds and to ensure that the instrument is stable and functioning as calibrated.

No special QC procedures will be required for this project. Laboratory QC samples and procedures are itemized and described in the laboratory SOPs (Attachments 4 through 7).

Laboratory-established control limits for surrogate/SMC, MS/MSD, and LCS recoveries and laboratory duplicate sample analyses, as applicable, are provided in Tables 3 through 5.

## 2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Preventive maintenance of field equipment and laboratory instruments is essential if project resources are to be used in a cost-effective manner. Preventive maintenance will take two forms: 1) a schedule of preventive maintenance activities to minimize downtime and ensure the accuracy of measurement systems, and 2) availability of critical spare parts and backup systems and equipment. The performance of these maintenance procedures will be documented in field and laboratory notebooks.

The field team leader will be responsible for ensuring that routine preventive maintenance is performed and documented for all field instrumentation and equipment. The laboratory QA managers will be responsible for ensuring that routine preventive maintenance is performed and documented for each analytical instrument and that spare parts or additional instruments are available in case of instrument breakdown or failure. Instrument QC procedures (e.g., initial and continuing calibration, LCSs, calibration blanks) will be used to verify the continuing acceptable performance of each instrument. Details are provided in the laboratory QAMs (Attachments 1, 2, and 3), the referenced analytical methods, the laboratory SOPs (Attachments 4 through 7), and the SOPs for field procedures in the SAP.

## 2.7 Instrument Calibration and Frequency

Initial and continuing calibration procedures for laboratory instruments will be completed in accordance with the cited analytical method for each analysis (Table 2) and the laboratory SOPs. The descriptions for each analysis specify acceptance criteria for initial and continuing calibration and state the conditions where recalibration is necessary.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute for Standards and Technology (NIST) or other documented, reliable, commercial sources. At the laboratories, standards are validated prior to use to verify their accuracy by comparison with an independent standard. Reagents are examined for purity by performing method blank analyses.

Field instruments that will be used will be calibrated prior to use each day. Calibration will be completed according to the manufacturer's instructions and the procedures specified in the SOPs contained in the SAP. If calibration is found to drift, the calibration will be checked and the probe recalibrated more frequently, as required. The PID that will be used to measure the concentration of VOCs will be calibrated according to the manufacturer's instructions and the procedures specified in the SOPs contained in the SAP.

## 2.8 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables are required for sample collection and laboratory activities. During sample collection, the most critical supplies affecting data quality are those used for decontamination of the sampling equipment. Solvents of appropriate, documented purity will be purchased from reputable vendors and used for decontamination. Acceptance for all supplies will require an intact seal upon receipt, maintenance at appropriate temperature, and use prior to the expiration date. Acceptance requirements will include a basic inspection of all containers received and rejection of unacceptable supplies.

Reagents of appropriate purity and suitably cleaned equipment must also be used for all stages of laboratory analyses. In addition, the laboratories must ensure that the concentrations of calibration and spiking standard are accurate and that instrumentation is functioning properly. The lot numbers of all standards are routinely tracked by the laboratories, from purchase of stock standards to preparation of secondary and working calibration standards. All calibration and spiking standards are checked against standards from another source. LCS results provide an additional check for accuracy. Details for acceptance requirements for supplies and consumables at the laboratories are provided in the laboratory QAMs (Attachments 1, 2, and 3) and the laboratory SOPs (Attachments 4 through 7).

## 2.9 Data Acquisition Requirements for Non-Direct Measurements

In addition to the direct site measurement data that will be collected, other data and information will be used in data assessment and evaluation. Although not specified at this time, additional analyses and data collection may be required to meet the objectives of the investigation. These data (if collected), which constitute non-direct measurements, will be carefully evaluated to determine quality and usability. Data characteristics that will be evaluated include the following:

- Technical basis
- Experimental bias
- Relevance to site conditions
- Natural variability
- Uncertainty
- Validation processes applied to the data (if applicable).

## 2.10 Data Management

Data management plays a critical supporting role in the achievement of the goals of the investigation. Sample collection, sample analysis, data validation, and data analysis must be carried out so as to eliminate or minimize errors resulting from lost, ambiguous, or incomplete data. SOPs and customized software tools will be will be used to prevent errors, omissions, and ambiguities in the data. In most cases, electronic data files can be imported directly from the laboratory to PSC's database, and in other cases, data collected will need to be manually entered into the database. Sampling location coordinates will be entered into the database to enable the generation of maps and figures using GISKey® and AutoCAD® software. Data management efforts will focus on the following:

- Collecting and organizing all of the information necessary to identify and characterize sampling location, samples, and analytical results
- Establishing a single authority (i.e., a computerized database) as a reference for any data used for analysis
- Controlling modifications to data in the database
- Ensuring that only data that have been validated are available for data analysis
- Providing reliable means of selecting, summarizing, and presenting data
- Backing up the computerized database on a regular schedule.

Computerization of data management functions allows data to be handled more rapidly and with fewer errors than manual techniques. The data management approach to be used takes maximum advantage of appropriate general- and special-purpose software tools. These tools include databases for the storage of environmental and experimental data, statistical software and spreadsheets for data analysis, and graphics software for the presentation of analytical results.

Computerized systems will be used to record, store, and sort the technical data that will be generated to support the study. As discussed above, automated data handling increases data integrity by reducing errors, omissions, and ambiguities that can be introduced by manual procedures. In addition, automated procedures will be used by the laboratories to capture and summarize analytical results. In this case, electronic data files can be imported directly from the laboratory to the project database, minimizing both data entry effort and opportunities for error. Sampling location coordinates will be entered into the database.

Field logbooks, station/sample forms, and COC/SAR forms are prepared by the field team while sample collection activities are in progress. Sample information from the field is entered manually into the database, as applicable. Each data record will include a

unique sample code, station ID, sample type (matrix), analyte, analyte concentration, and concentration units. Data from the laboratories are entered directly from the electronic disk deliverables. A small portion of the laboratory data may be entered manually if electronic data cannot be supplied. Electronic data summaries are produced to support data validation procedures. Data qualifiers are entered into the database when validation is completed and verified, and the data set is approved as final. All manual and electronic entries are verified by the data manager (data and information generated in the field) or validation personnel (chemical data and ancillary information).

Project data tables and reports are prepared using customized retrievals that filter and sort the data according to criteria specified by the user. The data are automatically formatted for direct use with statistics software packages and various GIS software. The maintenance of a single, authoritative database prevents the proliferation of multiple versions of data and the introduction and proliferation of errors.

# 3 Assessment/Oversight

The sections below describe the internal and external checks to ensure that all elements specified in this QAPP are correctly implemented as prescribed, the quality of the data generated is adequate to meet their intended purpose, and that corrective actions, if required, are implemented in timely manner and the effectiveness of such corrective actions is confirmed.

No changes in the QAPP procedures will be permitted without written justification and a detailed explanation of the intended change. All changes are subject to approval by the QA coordinator and the PSC project manager. A description of all changes, with justification, will be included in applicable QA or data reports generated for this project.

## 3.1 Assessment Activities

Various types of assessment activities will be implemented during the course of the investigation to determine compliance with the planning documents and ensure efficiency in completing the project tasks. Assessment activities for each sampling event will include readiness reviews prior to commencement of each phase of project work and surveillance while work is in progress. In addition, a technical systems audit (TSA) will be conducted if problems are encountered during sample collection or analysis.

Readiness reviews are completed to ensure that the components of a project are in place so that work can be completed efficiently. Two readiness reviews will be conducted: one prior to the initiation of fieldwork and the other prior to data interpretation activities for each sampling event. The project manager or designee will be responsible for conducting readiness reviews.

The field team leader will verify that the following conditions are met prior to field sampling:

- All required field equipment is ready and available, and shipment to the sampling site has been arranged
- The field sampling team has been scheduled, and transportation has been arranged
- Subcontractors (e.g., drillers and all laboratories) have been contracted and scheduled.

The data manager, at the project manager's direction, will finalize the project data after all results have been received from the laboratory, data validation has been completed, and data qualifiers have been entered into the database and verified. This process constitutes the readiness review for data use. The project manager will be responsible for

addressing any deficiencies in the readiness review. No report will be prepared in conjunction with the readiness reviews.

Project surveillance will be conducted periodically during the course of all project activities to ensure that every phase of work (fieldwork, laboratory analysis, data review/validation, data interpretation, and report preparation) follows the QA procedures outlined in this QAPP. The project manager will be responsible for conducting surveillance with the assistance of the field team leader, QA coordinator, laboratory QA managers, and lead technical personnel. Technical problems will be noted in the field sampling or data quality report if appropriate. Any noncompliance issues will be addressed as described below in Section 3.2.

TSAs will be conducted if problems are encountered during sampling or analysis operations. If completed, these audits will be conducted by the project QA/QC coordinator or designee or by the laboratory QA manager. These audits will consist of onsite reviews of field activities or laboratory analyses. TSAs will include, but are not limited to, the following components:

- Field and laboratory personnel, facilities, and equipment
- SOPs for field activities
- COC procedures and records
- Instrument calibration and maintenance procedures and records
- Standards preparation and verification procedures and records
- Documentation of analytical methods
- Sample storage conditions
- Data reduction, processing, and reporting procedures
- Documentation of control procedures.

All personnel engaged in sampling and analysis tasks will have appropriate training and required certifications. All laboratories are required to have written procedures addressing internal QA/QC; these procedures must be submitted to and will be reviewed by the project QA coordinator to ensure compliance with this QAPP. The QA coordinator will discuss any serious problems with the QA/QC Coordinator. The PSC project managers will be notified of the situation. Any problems identified during the course of the project that affect data quality will be discussed in the data quality and usability report.

## 3.2 Response Actions

While the entire QA program is designed and implemented to avoid problems, it also serves to identify unexpected or unavoidable problems that may be encountered during sample collection and analysis. An important part of any QA program is a well-defined policy that can effectively correct these problems after they have been identified to minimize the possibility of questionable data or documentation. The two types of response actions (short-term and long-term) are discussed below.

### 3.2.1 Short-Term Corrective Action

Short-term corrective actions fall into two categories: 1) handling analytical instrument or field equipment malfunctions, and 2) handling nonconformance or noncompliance with the QA requirements that have been established for the project.

During field operations and sampling procedures, the field team leader will be responsible for correcting equipment malfunctions. Acceptable equipment operating parameters and control limits are specified in the operating instructions and SOPs. If any piece of equipment fails to meet established QC criteria or cannot be properly repaired, it will be replaced. All equipment malfunctions and subsequent corrective measures will be documented in the field log.

The laboratory QA managers are responsible for ensuring that laboratory results comply with project, method, and laboratory QC requirements and that all analytical instruments and laboratory equipment are properly maintained. Acceptable instrument operating parameters, control limits for QC results, and required corrective actions are specified in the laboratory SOPs, method protocols, and manufacturers' instructions provided with laboratory instruments. Control limit specifications are designed to help analysts detect the need for corrective action. Often an analyst's experience will be most valuable in identifying suspicious data or malfunctioning equipment. Immediate corrective action must be taken by the laboratory if any phase of the sample preparation and analysis process is considered suspect. Any corrective actions will be noted in the laboratory notebooks and, if appropriate, discussed in the case narratives for all affected sample sets.

### 3.2.2 Long-Term Corrective Action

In addition to short-term corrective actions taken by field and laboratory personnel, a mechanism is required to address long-term, systemic corrective actions. The need for long-term corrective action will be identified by an overview of compliance with standard QC procedures, control charts, and performance or system audits. Any QC problem that cannot be solved by immediate corrective action falls into this long-term category. The long-term system will be used to ensure that the condition is reported to the person who is responsible for the corrective action and followup plan.

The required corrective actions will vary, depending on the nature of the problem; however, the essential steps in the closed-loop, long-term corrective action system are as follows:

- Identify the problem
- Assign responsibility for investigating the problem
- Investigate and determine the cause of the problem
- Determine a corrective action to eliminate the problem
- Establish responsibility for implementing the corrective action, and implement the corrective action
- Verify that the corrective action has eliminated the problem
- Document the complete process of establishing and implementing the corrective action in a project memorandum that specifies the problem areas requiring corrective action and how they were detected, the individual initiating corrective action, the samples concerned, the acceptable data range, the measures taken to correct the problems, and the individual approving the corrective action.

The QA/QC coordinator, who has the authority to enforce necessary corrective measures, will routinely review the documentation of corrective actions.

## 3.3 Reports to Management

Reports that may be submitted to project management during the course of the investigation include performance evaluations, TSAs, and corrective action reports. These reports will be prepared by the individual who conducted the audit, generally the QA/QC coordinator or designee, and provided to PSC project managers. Any significant problems identified in any of these reports will be discussed with the Ecology project manager.

Upon completion of the site investigation, a report that contains a discussion of QA/QC evaluations, summarizes the quality of the project data, and describes data usability for each activity of the project will be prepared. The objective of the QA/QC evaluations will be to ensure that the data are representative of site conditions and sufficient in quality and quantity to support the baseline risk assessments. The report will be prepared by or under the direction of the field activities manager (for QA procedures related to fieldwork) and the QA/QC coordinator (for data quality evaluation). The report will be approved by PSC and submitted to the Ecology project manager.

# 4 Data Review, Validation, Verification, and Usability

Data review, verification, and validation are conducted to establish the data quality and usability for the project. Data verification is the process of determining whether samples have been collected and analyzed according to procedures prescribed in the IPIMWP, the SAP, the field and laboratory SOPs, and this QAPP. Data verification includes checking for compliance of procedures with the project plan, correctness of protocols used in the field and at the laboratory, comparability of the data collection and analysis procedures, and completeness of the data set and supporting documentation. Data validation is the process of evaluating the technical quality of the verified data with respect to the project quality objectives.

Verification of sampling information and chemical data occurs at several levels throughout the course of sample collection and analysis. The project data are validated after the field activities are completed and the laboratory results are available and all data have been verified, and prior to use of the data for interpretive activities. The purpose of the verification and validation procedures is to assess whether the data conform to the project requirements and DQOs, and to identify data limitations when data do not conform to the project requirements and DQOs. Data review, verification and validation criteria, and procedures are described below. The responsible personnel that may complete data verification and validation are listed in Table 7.

## 4.1 Data Review, Validation, and Verification Requirements

Data verification is the process for determining whether data have been collected or generated according to the SAP and the respective SOPs or method descriptions. Data verification consists of the following categories: 1) verifying compliance with SOPs, QAPP, and contractual agreements; 2) verifying correctness to determine that the data collection plans and protocols were followed; and 3) verifying completeness to establish that all data necessary to meet project objectives have been collected.

Data validation is the process of evaluating the technical usability of the verified data with respect to the planned objectives of the project. Data validation consists of the following objectives: 1) verify that measurements (field and laboratory) meet the user's needs, 2) provide information to the data user regarding data quality by assignment of individual data qualifiers based on the associated degree of variability, and 3) determine whether DQOs were met.

### 4.1.1 Sampling Design and Sample Collection Procedures

The conformance of the field activities to specifications in the sampling plan will be evaluated on an ongoing basis while field activities are in progress. Additional verification will be provided through oversight of the field activities by the field activities manager and by contacts with the project manager. If a sample cannot be collected as planned, the project manager will be notified and an alternate location or sampling method may be selected if possible. The review process will include immediate evaluation of any change to the sampling plan so that an alternate field procedure may be established quickly, if necessary.

Additional verification procedures may be completed for information generated in the field. Field information recorded in the sample logs will be verified when these data are entered into the database and station location information will be verified when station coordinates are used to generate project maps. A final verification review of field activities will be made when the field effort is complete. The verification results will be included in the data quality report.

### 4.1.2 Sample Handling

Standard procedures for sample collection and shipping will be followed to ensure that samples are preserved and stored as required (Table 6). Any sample handling difficulties that are encountered in the field will be described in the field log. The field log will be reviewed and sample integrity verified as part of the data validation procedures.

Samples will be checked by laboratory personnel upon receipt and the cooler temperature will be determined. The temperature and condition of the samples will be recorded at the laboratory and any problems will be described in the case narrative for the data report. The field log and case narrative will be reviewed, and data will be flagged if the sample integrity was compromised. Data may be rejected as unusable if severe handling problems are encountered.

### 4.1.3 Analytical Procedures, Calibration, and Quality Control

Review and verification of testing procedures, including instrument calibration and analysis of all field samples and QC samples, will initially be completed at the laboratories during and after sample analyses. Each laboratory will complete QC procedures as specified in the method descriptions and in the laboratory's SOPs and QAMs (Attachments 1, 2, and 3). The laboratories will perform internal QA checks on the reported data to verify data quality prior to submitting the data packages to PSC. Any nonconformance issues identified during this QA check will be corrected and noted by the laboratory. Close contact will be maintained between the QA/QC coordinator and laboratory project chemist so that all quality issues can be resolved in a timely manner.

PSC and the QA/QC coordinator will complete additional data verification and validation when data are received from the laboratory. All data will be reviewed as described below in Section 4.2.2.

### 4.1.4 Data Reduction and Processing

Review procedures for laboratory data are described in the previous section and in Section 4.2.2. These procedures include the verification of correct transcription and reduction procedures at the laboratory. Data verification procedures also include verification of the field information and laboratory data in the project database, as described in Sections 4.2.1 and 4.2.2. Data integrity during data processing will be maintained through the exclusive use of electronic data transfer and manipulation.

## 4.2 Verification and Validation Methods

Verification procedures will be completed in the field during sample collection and in the laboratory during sample analysis and testing. In addition, verification and validation of all field and laboratory documentation and reports will be conducted after the analyses and tests are completed. The data will be released for interpretation only after quality-assured data have been released by the laboratory and/or after validation has been completed and all qualifiers have been correctly entered into the database.

### 4.2.1 Verification of Field Procedures

Field procedures will be followed as described in the SAP and this QAPP. All protocols related to sample collection, storage, shipping, and handling include requirements for QA procedures and documentation of activities. Any deviations from specified procedures should be documented in detail in the field logbook and fully justified. Specific requirements include, but are not limited to, the following:

- Sampling locations must be fully documented and correct. Errors in the sampling location may result in the rejection of data.
- Sample collection procedures must be completed as planned and fully documented. Difficulties encountered during sampling that may affect the representativeness of the sample should be minimized.
- Sample shipping and handling procedures must be completed as described in the SAP. Maintaining appropriate sample temperatures during field activities and shipping is particularly important.
- Results for field QC samples will be evaluated. Equipment rinsate blank contamination will result in the qualification of related data as described in the functional guidelines (U.S. EPA 1999b) for organic

compound analyses and in the context of method-specific QC requirements and laboratory-established control limits for geotechnical determinations.

Failure to meet these requirements will result in qualification or rejection of data during data validation (see Section 4.2).

### 4.2.2 Verification and Validation of Chemical Data

Verification of chemical data will be completed at the laboratories and by the QA/QC coordinator. The laboratory will be responsible for the review and verification of all bench sheets, manual entry or transcriptions of data, and any professional judgments made by a chemist during sample preparation, analysis, and calculation and reporting of the final concentrations. The laboratory will also be responsible for the review of QC results to determine whether data are of usable quality or reanalyses are required. Any nonconformance issues identified during the laboratory's QA checks will be corrected and noted by the laboratory. Close contact will be maintained between the project QA/QC coordinator and the laboratory project chemist so that any quality issues can be resolved in a timely manner. Any data quality deviations will be discussed in the laboratory case narrative, including the direction or magnitude of any bias to the data, if possible.

Data validation and verification will be completed by the QA/QC coordinator prior to finalization of the data and release of the data set for interpretation. All data will be verified and validated in accordance with *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA 1999b) for organic analyses, and in the context of method-specific QC requirements and laboratory-established control limits, as applicable to the methods being used. Data will be qualified when QC procedures are not completed as required by the referenced methods, or when measurement performance criteria established in the method (e.g., criteria for acceptable calibration) or in this QAPP (e.g., criteria for bias and precision) are not achieved.

External data verification and validation will include a 100-percent QA review (i.e., data validation) on 25 percent of the data that will be used to determine the GIVFs and 10 percent of the data reported for all other analyses completed. In addition, the analytical laboratories will provide all information required to complete an abbreviated QA review (i.e., a summary review) for the remaining 75 percent of the data that will be used to determine the GIVFs and 90 percent of all other data to be reported. The laboratory information that will be reviewed for each of these validation efforts is described below.

#### 4.2.2.1 100-percent QA Review

Completion of 100-percent QA review includes a review of all calibration and QA procedures and results, 10-percent checks of laboratory calculations and transcriptions, and evaluation of the results for applicable QC samples with respect to applicable control

limits. The following laboratory information will be reviewed, as applicable to each analysis:

- COC documentation to verify completeness of the data set
- Case narratives discussing analytical problems (if any) and procedures
- Sample preparation logs or laboratory summary result forms to verify analytical holding time constraints were met
- Instrument tuning, initial calibration, and continuing calibration results to assess instrument performance
- Method blank, trip blank, equipment rinsate blank, and other field blank results to determine whether an analyte reported as detected in any sample was the result of possible contamination at the laboratory, contamination during transport of samples, or contamination during field sampling, respectively
- SMC/surrogate compound recoveries to assess preparation and analyses
- MS and LCS recoveries to assess analytical accuracy
- Internal standards performance to ensure that instrument sensitivity and response are stable during the analysis of the samples
- Instrument-specific QC measurements associated with metals analyses (e.g., interference check sample analyses, serial dilutions) to assess instrument performance and matrix effects
- Laboratory duplicate sample or MSD results to assess analytical precision
- Instrument printouts (e.g., chromatograms, mass spectra, and quantification reports) to assess the validity of reported results and the validity of analyte identification as either detected or undetected
- Verification of quantification of sample results to assess the correctness of reported results
- Confirmation that reporting limits for all target analytes are acceptable and within method-specific or project-specific requirements.

Results for all applicable field QC samples will also be reviewed to provide additional information in support of the QA review.

#### 4.2.2.2 Abbreviated QA Review

Completion of an abbreviated QA review (i.e., a summary review) assumes that all results reported by the laboratory are correct. For this level of effort, summaries of applicable calibration and QA measurement results are reviewed. Calculations and transcriptions are not verified or confirmed, and original instrument printouts are not reviewed. The following laboratory information will be reviewed, as applicable to each analysis:

- COC documentation to verify completeness of the data set
- Case narratives discussing analytical problems (if any) and procedures
- Sample preparation logs or laboratory summary result forms to verify analytical holding times constraints were met
- Method blank, trip blank, equipment rinsate blank, and other field blank results to determine whether an analyte reported as detected in any sample was the result of possible contamination at the laboratory, contamination during transport of samples, or contamination during field sampling, respectively
- Surrogate/SMC recoveries to assess preparation and analyses
- MS and LCS recoveries to assess analytical accuracy
- Laboratory duplicate sample or MSD results to assess analytical precision.

Results for all applicable field QC samples will also reviewed to provide additional information in support of the QA review.

### 4.2.3 Algorithms to Assess Quality Control Results

Data verification includes checking that QC procedures were included at the required frequencies and that the QC results meet control limits defined in the method descriptions or by the project DQOs. The equations that will be used to determine whether measurement performance criteria for project DQIs were met for each QC procedure are summarized below.

#### 4.2.3.1 Duplicate Analyses

Precision for duplicate chemical analyses will be calculated as the RPD between the duplicate samples. The formula that will be used to assess precision for both laboratory and field duplicate samples is as follows:

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

where:

$D_1$ = sample value

$D_2$ = duplicate sample value.

#### 4.2.3.2 Matrix Spikes and Surrogate Recoveries

Spiked samples provide an indication of the bias of the analysis system. The recovery of MSs and surrogate spikes will be calculated as the ratio of the recovered spike concentration to the known spiked quantity:

$$\%R = \frac{A - B}{C} \times 100$$

where:

A = the analyte concentration determined experimentally from the spiked sample

B = the background level determined by a separate analysis of the unspiked sample

C = the amount of the spike added.

#### 4.2.3.3 Completeness

Completeness will be calculated for each sample type by dividing the number of valid measurements (all measurements except rejected data) actually obtained by the number of valid measurements that were planned:

$$\%\text{Completene ss} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

To be considered complete, the data sets must also contain all QC check analyses that verify the precision and accuracy of the results.

#### 4.2.3.4 Sensitivity

The detection limit of the sample preparation and analysis process is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte is greater than zero" (40 CFR 136B). This procedure defines the point at which qualitative, not quantitative, identification can be made. In practice, the limit of detection is defined as 3 times the standard deviation of the blank or background response, adjusted for the amount of sample that was extracted and the final extract volume and any dilutions made prior to analysis.

Best professional judgment is used to adjust the limit of detection upward in cases where high instrument precision (i.e., low variability) results in a calculated limit of detection and equivalent instrument response less than the absolute sensitivity of the analytical instrument. The actual reporting limit for environmental samples is generally higher than the instrument detection limit because the sample matrix tends to contribute to fluctuations in the instrument's background signal. Laboratory personnel will determine reporting limits based on their experience with samples of similar matrix to those collected for this study and on the response of each instrument to samples for this study. The method detection limits and/or method reporting limits will be verified during data validation.

### 4.2.4 Data Management

In most instances, data will be entered electronically from the laboratories' electronic data deliverables to the project database. This task will be completed by data validation personnel in conjunction with data verification for each data package. Any discrepancies will be resolved with the laboratory project manager. This check serves to verify the integrity of the project database and the accuracy of data handling at the laboratory. All data qualifier entries will also be checked by data validation personnel to ensure correct data entry.

## 4.3 Reconciliation with Data Quality Objectives

The goal of data validation is to determine the quality of each data point and to identify data points that do not meet measurement performance criteria and other project DQOs. Nonconforming data will be qualified as estimated (*J*), restated as undetected (*U*), or rejected (*R*) as unusable during data validation if criteria for data quality are not met. Rejected data will not be used for any purpose. An explanation of the rejected data will be included in the data quality report. If the rejected data are needed to make a decision, then it may be necessary to resample. Any decision to resample will be based on discussions among the project management team.

Data qualified as estimated (*J*) will be appropriately qualified in the final project database. Although estimated data are less precise or less accurate than unqualified data, estimated results will still be used to evaluate and interpret site conditions provided that consideration of these data does not compromise the project objectives. The data quality report will include all available pertinent information regarding the direction or magnitude of bias or the degree of imprecision for qualified data to facilitate the assessment of data usability.

The effect of estimated sample results on interpretation of site conditions depends on several factors such as the following:

- The nature and magnitude of the data quality problem; for example, a small positive bias in a sample concentration near a screening level may result in a conservative conclusion but a large negative bias may render the screening-level comparison meaningless
- The nature and location of the affected sample(s); for example, a data deficiency in a result for a reference area may have a much greater impact on data interpretation than a similar deficiency in one of many results for a study site
- The context of the sample result within the data set; for example, a questionable result for an analyte that is detected at high concentrations and important for site interpretation is likely to have a much greater impact on data interpretation than a questionable result for an analyte that is present at only low concentrations.

The assessment of any data deficiencies on interpretive activities will be completed on a case-by-case basis. The QA/QC coordinator, risk assessors, and other data users are responsible for assessing the effect of the inaccuracy or imprecision of the qualified data on comparisons to screening criteria, statistical procedures, risk assessments, and other data uses. The effect of any data deficiencies on risk assessment and other interpretive activities and conclusions will be described in the final report.

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**Table 1. Project personnel and responsibilities**

| Personnel | Responsibilities | Contact Information |
|---|---|---|
| Edward Jones<br>Washington Department of Ecology<br>Project Manager | Oversee all program activities to ensure compliance; perform technical oversight and consultation on major quality assurance problems; provide final approval of all necessary actions and adjustments for activities to accomplish project objectives. Provide final approval of the work plan and QAPP. | Department of Ecology, NWRO<br>3190 160th Avenue SE<br>Bellevue, WA 98008-5452<br>(425) 649-4449 |
| Carolyn Mayer<br>Philip Services Corporation<br>Project Manager | Overall responsibility for PSC activities. Oversee all program activities to ensure compliance; provide technical oversight and consultation on major quality assurance problems; implement final approval of all necessary actions and adjustments for activities to accomplish project objectives. | Philip Services Corporation<br>955 Powell Avenue SW<br>Renton, WA 98055-2908<br>(425) 227-6121 |
| Carolyn Mayer<br>Philip Services Corporation Team Leader | Oversee analysis progress and delivery of data to the data manager; inform QA/QC coordinator of any quality problems encountered by the laboratory. | Philip Services Corporation<br>955 Powell Avenue SW<br>Renton, WA 98055-2908<br>(425) 227-6121 |
| Tasya Gray<br>Philip Services Corporation Field Project Manager | Coordinate and supervise field activities; ensure field procedures are completed in accordance with work plan and QAPP; authorize and document minor adjustments to the sampling plan in response to field conditions, as necessary, notify project manager and QA/QC coordinator; oversee field sampling manager.<br><br>Ensure field procedures are completed in accordance with work plan and QAPP. Coordinate with project manager and project laboratories for bottle and equipment shipments to the site and sample shipments to the laboratories; track submittal and receipt of samples to the laboratory, and initiate COC/SAR forms. | Philip Services Corporation<br>955 Powell Avenue SW<br>Renton, WA 98055-2908<br>(425) 227-6149 |
| Duane Beery<br>Philip Services Corporation<br>Database Administrator | Organize and maintain project database. Ensure that the data are stored in accordance with the work plan and QAPP; supervise data management personnel. | Philip Services Corporation<br>955 Powell Avenue SW<br>Renton, WA 98055-2908<br>(425) 227-6128 |

**Table 1. (cont.)**

| Personnel | Responsibilities | Contact Information |
|---|---|---|
| James J. Mc Ateer, Jr.<br>Exponent QA/QC Coordinator | Provide technical quality assurance assistance; develop and review QAPP; oversee quality assurance activities to ensure compliance with QAPP; coordinate and supervise data validation and data quality report preparation; review and submit quality assurance reports. | Exponent<br>4000 Kruse Way Place<br>Building Two, Suite 285<br>Lake Oswego, OR 97305<br>(503) 534-3240 |
| Karen Burden, Kortland Orr, and Harold Benny<br><br>Air Toxics, Ltd., North Creek Analytical, Inc., and Rosa Environmental Geotechnical Laboratory<br>Laboratory Project Managers | Ensure that sample receipt and custody records are properly handled and data are reported within specified turnaround times: calibrate and maintain instruments as specified; perform internal quality control measures and analytical methods as required; take appropriate corrective action as necessary; notify the QA/QC coordinator when problems occur; report data and supporting quality assurance information as specified in this QAPP. | Air Toxics, Ltd.<br>180 Blue Ravine Road, Suite B<br>Folsom, CA 95630<br>(916) 985-1000<br><br>North Creek Analytical, Inc.<br>18939 120th Avenue NE, Suite 101<br>Bothell, WA 98011-9508<br>(425) 420-9200<br><br>Rosa Environmental & Geotechnical Laboratory<br>1001 SW Klickitat Way, Suite 107<br>Seattle, WA 98134<br>(206) 287-9122 |

**Note:** COC - chain of custody
PSC - Philip Services Corporation
QAPP - quality assurance project plan
QA/QC - quality assurance and quality control
SAR - sampling analysis and request

## Table 2. Target analytes

| Analysis | Method Reference | Units | MDL[a] | MRL[b] | MRL[c] | SIM MRL |
|---|---|---|---|---|---|---|
| **Volatile Organic Compounds (Air Samples)** | | | | | | |
| 1,2,4-Trimethylbenzene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| 1,3,5-Trimethylbenzene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| 1,1,1-Trichloroethane | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| 1,1-Dichloroethane | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| 1,1-Dichloroethene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.01 |
| 1,2-Dichloroethane | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| 2-Hexanone | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.5 |
| Benzene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.05 |
| Chloroethane | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.05 |
| Chloroform | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| *cis* -1,2-Dichloroethene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| Ethylbenzene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| Naphthalene | EPA Method TO-14A | ppbv | NA | 10 | NA | NA |
| *n* -Propylbenzene | EPA Method TO-14A | ppbv | NA | 5 | NA | NA |
| *p* -Isopropyltoluene | EPA Method TO-14A | ppbv | NA | 5 | NA | NA |
| *sec* -Butylbenzene | EPA Method TO-14A | ppbv | NA | 5 | NA | NA |
| Tetrachloroethene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| Toluene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| Trichloroethene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.02 |
| *trans* -1,2-Dichloroethene | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.1 |
| Vinyl chloride | EPA Method TO-14A | ppbv | NA | 0.5 | NA | 0.01 |
| **Volatile Organic Compounds (Groundwater Samples)** | | | | | | |
| 1,2,4-Trimethylbenzene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.20 | NA |
| 1,3,5-Trimethylbenzene | EPA SW-846 Method 8260B | µg/L | 0.10 | 1.0 | 0.50 | NA |
| 1,1,1-Trichloroethane | EPA SW-846 Method 8260B | µg/L | 0.17 | 1.0 | 0.20 | NA |
| 1,1,2,2-Tetrachloroethane | EPA SW-846 Method 8260B | µg/L | 0.13 | 1.0 | NA | NA |
| 1,1-Dichloroethane | EPA SW-846 Method 8260B | µg/L | 0.43 | 1.0 | 0.20 | NA |
| 1,1-Dichloroethene | EPA SW-846 Method 8260B | µg/L | 0.15 | 1.0 | 0.20 | 0.05 |
| 1,2-Dichloroethane | EPA SW-846 Method 8260B | µg/L | 0.23 | 1.0 | 0.20 | NA |
| 2-Hexanone | EPA SW-846 Method 8260B | µg/L | 1.0 | 10 | 2.0 | NA |
| Benzene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.20 | NA |
| Chloroform | EPA SW-846 Method 8260B | µg/L | 0.17 | 1.0 | 0.20 | NA |
| *cis* -1,2-Dichloroethene | EPA SW-846 Method 8260B | µg/L | 0.18 | 1.0 | 0.20 | NA |
| Ethylbenzene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.20 | NA |
| Naphthalene | EPA SW-846 Method 8260B | µg/L | 0.33 | 1.0 | 0.50 | NA |
| *n* -Propylbenzene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.50 | NA |

**Table 2. (cont.)**

| Analysis | Method Reference | Units | MDL[a] | MRL[b] | MRL[c] | SIM MRL |
|---|---|---|---|---|---|---|
| *p*-Isopropyltoluene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.20 | NA |
| *sec*-Butylbenzene | EPA SW-846 Method 8260B | µg/L | 0.14 | 1.0 | 0.20 | NA |
| Tetrachloroethene | EPA SW-846 Method 8260B | µg/L | 0.16 | 1.0 | 0.20 | NA |
| Toluene | EPA SW-846 Method 8260B | µg/L | 0.15 | 1.0 | 0.20 | NA |
| *trans*-1,2-Dichloroethene | EPA SW-846 Method 8260B | µg/L | 0.28 | 1.0 | 0.20 | NA |
| Trichloroethene | EPA SW-846 Method 8260B | µg/L | 0.11 | 1.0 | 0.20 | NA |
| Vinyl chloride | EPA SW-846 Method 8260B | µg/L | 0.30 | 1.0 | 0.20 | NA |
| **Geotechnical Analyses** | | | | | | |
| Grain size distribution | ASTM Method D422-63 | weight percent | NA | 0.1 | NA | NA |
| Percent moisture | ASTM Method 2216-18 | percent | NA | 0.1 | NA | NA |
| Bulk density | ASTM D2937-00 | g/cc | NA | 0.01 | NA | NA |
| Porosity | ASTM D854-00 | percent | NA | 0.01 | NA | NA |

**Note:** ASTM - American Society of Testing Materials
EPA - U.S. Environmental Protection Agency
K - coefficient of hydraulic conductivity
NA - not applicable
MDL - method detection limit
MRL - method reporting limit
SIM - selected ion monitoring
ppbv - parts per billion volume

[a]Method detection limits will be updated by the laboratories as they are established.

[b]Routine method reporting limit used by laboratories

[c]Method reporting limit based on optional 25 mL purge volume for VOCs to achieve lower reporting limits

## Table 3. Summary of data quality indicators for surrogate recovery

| Analysis | Surrogate Recovery[a] (percent) |
|---|---|
| **Volatile Organic Compounds** | |
| **Air Toxics, Ltd.** | |
| Toluene-d8 | 70–130 |
| 4-Bromofluorobenzene | 70–130 |
| 1,2-Dichloroethane-d4 | 70–130 |
| **North Creek Analytical, Inc.** | |
| Toluene-d8 | 75–124 |
| 4-Bromofluorobenzene | 77–120 |
| 1,2-Dichloroethane-d4 | 73–137 |

**Note:** [a]Control limits will be updated by the laboratories as they are established.

## Table 4. Summary of data quality indicators for matrix spike and laboratory control sample recoveries

| Analysis | Matrix Spike[a] Recovery (percent) | Laboratory Control[a] Sample Recovery (percent) |
|---|---|---|
| **Air Toxics, Ltd.** | | |
| 1,2,4-Trimethylbenzene | NA | 70–130 |
| 1,3,5-Trimethylbenzene | NA | 70–130 |
| 1,1,1-Trichloroethane | NA | 70–130 |
| 1,1-Dichloroethane | NA | 70–130 |
| 1,1-Dichloroethene | NA | 70–130 |
| 1,2-Dichloroethane | NA | 70–130 |
| 2-Hexanone | NA | 60–140 |
| Benzene | NA | 70–130 |
| Chloroethane | NA | 70–130 |
| Chloroform | NA | 70–130 |
| *cis* -1,2-Dichloroethene | NA | 70–130 |
| Ethylbenzene | NA | 70–130 |
| Naphthalene | NA | 60–140 |
| *n* -Propylbenzene | NA | 60–140 |
| *p* -Isopropyltoluene | NA | 60–140 |
| *sec* -Butylbenzene | NA | 60–140 |
| Tetrachloroethene | NA | 70–130 |
| Toluene | NA | 70–130 |
| Trichloroethene | NA | 70–130 |
| *trans* -1,2-Dichloroethene | NA | 60–140 |
| Vinyl chloride | NA | 70–130 |
| **North Creek Analytical, Inc.** | | |
| Benzene | 75–125 | 80–120 |
| Chlorobenzene | 75–125 | 77–120 |
| 1,1-Dichloroethene | 40–154 | 80–120 |
| Toluene | 72–125 | 80–120 |
| Trichloroethene | 73–131 | 80–120 |

**Note:** NA - not applicable

[a]Control limits will be updated by the laboratories as they are established.

**Table 5. Summary of data quality indicators for duplicate analyses**

| Analysis | Type of Duplicate | Duplicate Results (relative percent difference)[a] Air | Aqueous | Soil |
|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | |
| **Air Toxics, Ltd.** | | | | |
| 1,2,4-Trimethylbenzene | LD or LCS | 25 | NA | NA |
| 1,3,5-Trimethylbenzene | LD or LCS | 25 | NA | NA |
| 1,1,1-Trichloroethane | LD or LCS | 25 | NA | NA |
| 1,1-Dichloroethane | LD or LCS | 25 | NA | NA |
| 1,1-Dichloroethene | LD or LCS | 25 | NA | NA |
| 1,2-Dichloroethane | LD or LCS | 25 | NA | NA |
| 2-Hexanone | LD or LCS | 25 | NA | NA |
| Benzene | LD or LCS | 25 | NA | NA |
| Chloroethane | LD or LCS | 25 | NA | NA |
| Chloroform | LD or LCS | 25 | NA | NA |
| *cis* -1,2-Dichloroethene | LD or LCS | 25 | NA | NA |
| Ethylbenzene | LD or LCS | 25 | NA | NA |
| Naphthalene | LD or LCS | 25 | NA | NA |
| *n* -Propylbenzene | LD or LCS | 25 | NA | NA |
| *p* -Isopropyltoluene | LD or LCS | 25 | NA | NA |
| *sec* -Butylbenzene | LD or LCS | 25 | NA | NA |
| Tetrachloroethene | LD or LCS | 25 | NA | NA |
| Toluene | LD or LCS | 25 | NA | NA |
| Trichloroethene | LD or LCS | 25 | NA | NA |
| *trans* -1,2-Dichloroethene | LD or LCS | 25 | NA | NA |
| Vinyl chloride | LD or LCS | 25 | NA | NA |
| **North Creek Analytical, Inc.** | | | | |
| Benzene | MSD | NA | 20 | NA |
| Chlorobenzene | MSD | NA | 20 | NA |
| 1,1-Dichloroethene | MSD | NA | 20 | NA |
| Toluene | MSD | NA | 20 | NA |
| Trichloroethene | MSD | NA | 20 | NA |
| **Geotechnical Analyses** | | | | |
| Grain size distribution | LD | NA | NA | 25 |
| Percent moisture | LD | NA | NA | 25 |
| Bulk density | LD | NA | NA | 25 |
| Porosity | LD | NA | NA | 25 |

**Note:** LD - laboratory duplicate
LCS - laboratory control sample
MSD - matrix spike duplicate
NA - not applicable

[a]Control limits will be updated by the laboratories as they are established.

**Table 6. Sample preservation and holding time requirements**

| Analysis | Matrix | Approximate Laboratory Subsample | Container | Preservation and Handling | Maximum Holding Time (from date of collection) |
|---|---|---|---|---|---|
| **Organic Compounds** | | | | | |
| Volatile organic compounds | Air | ~400 mL | Summa® canister | NA | 30 days |
| | Aqueous | 40 mL | 40-mL glass vial with Teflon®-lined septum | HCl to pH <2; fill, no head space; keep in dark; cool (4 °C) | 14 days |
| **Geotechnical Analyses** | | | | | |
| Grain size distribution | Soil | 250–500 g | Shelby® tubes | NA, but 4 ±2 °C (do not freeze) is recommended | NA |
| Percent moisture | Soil | 10–50 g | Shelby® tubes | NA, but 4 ±2 °C (do not freeze) is recommended | NA |
| Bulk density | Soil | 100–1,000 g | Shelby® tubes | NA, but 4 ±2 °C (do not freeze) is recommended | NA |
| Porosity | Soil | 100–1,000 g | Shelby® tubes | NA, but 4 ±2 °C (do not freeze) is recommended | NA |

**Note:** NA - not applicable

**Table 7. Responsibilities for verification of data and sampling activities**

| Project Personnel | Verification Activity |
|---|---|
| Compliance | |
| PSC Project Manager | Assign appropriate staff to perform the work and ensure that all field personnel are familiar with field SOPs. |
| PSC Field Project Manager | Verify that the proper sampling protocols, including sample preservation, handling, and storage, are performed during fieldwork. |
| PSC Field Project Manager | Track the samples sent to the laboratories, verify that the chain-of-custody forms are filled out correctly and the samples were received in good condition at the appropriate laboratory. |
| PSC Field Project Manager | Verify that the proper number of field blanks and sample duplicates are collected. |
| Laboratory QA Personnel | Verify that the laboratory instruments are calibrated, quality control samples are analyzed (e.g., blanks, duplicates, MS/MSD, LCS). |
| QA/QC Coordinator | Verify that the laboratory conducted proper calibration and quality control sample procedures (i.e., the laboratory followed the contract SOW), conduct field data collection audit to ensure that the proper field procedures are followed, and confirm that the analytical data met specified detection limits in analytical SOPs. |
| Correctness | |
| PSC Field Project Manager | Inspect and ensure that the field and analytical equipment are calibrated and properly functioning in accordance with field instrument user manuals and laboratory QA manuals. |
| PSC Project Manager and Field Project Manager | Review data reduction process, examine the raw data to verify that the correct calculation of sample results were reported by laboratory or transferred from field logs, examine the raw data for any anomalies, and verify that there are no transcription or reduction errors. |
| Consistency (Comparability) | |
| PSC Field Project Manager and Field Personnel | Ensure that proper data handling procedures were followed (e.g., the SOP procedures and contract SOWs are followed consistently throughout the project); any handwritten data in field logs will be rechecked for any transcription errors. |
| QA/QC Coordinator and PSC Database Manager | Review the data transfer and procedure used to characterize transmittal error rates in order to minimize data problems. |
| Completeness | |
| PSC Field Project Manager and PSC Project Manager | Verify proper documentation of chain of custody and sampling handling/shipping procedures, ensure that the chain of custody seals were properly used, document any problems encountered during sample collection, identify any problems with damaged samples, and confirm with laboratory that all samples have been received. |
| PSC Field Personnel and Laboratory QA Personnel | Ensure that an accurate record was maintained during sample collection and analysis. |

**Table 7. (cont.)**

| Project Personnel | Verification Activity |
|---|---|
| Completeness (cont.) | |
| PSC Field Personnel, Laboratory Personnel, and QA/QC Coordinator | Document that general quality control measures were conducted (e.g., instrument calibration, routine monitoring of analytical performance, calibration verification). |
| QA/QC Coordinator or Data Validation Manager | Ensure that a unique identification number was assigned to each sample. |
| Laboratory QA Personnel | Document deviations from SOW (e.g., analytical procedures), document corrective actions taken if quality control check identifies any problems, ensure that the appropriate analytical method was used. |

**Note:** LCS - laboratory control sample
MS/MSD - matrix spike/matrix spike duplicate
PSC - Philip Services Corporation
QA/QC - quality assurance and quality control
SOP - standard operating procedure
SOW - statement of work

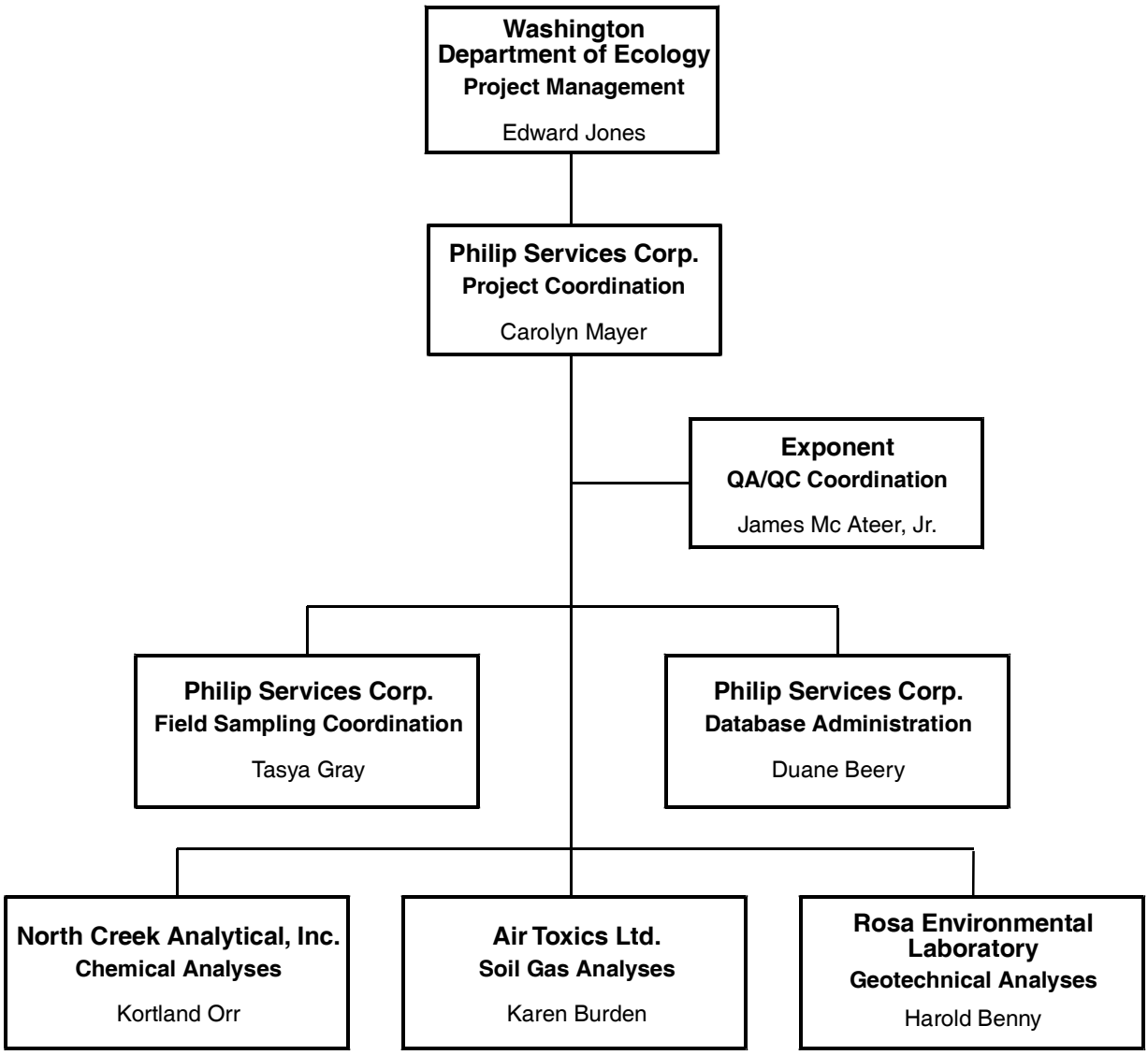



Figure 1. Project organization chart

## Attachment 1

## Air Toxics, Ltd. Quality Assurance Manual (Not Available in PDF Format)

## Attachment 2

# North Creek Analytical, Inc. Quality Assurance Manual (Not Available in PDF Format)

## Attachment 3

# Rosa Environmental and Geotechnical Laboratory Quality Assurance Manual (Not Available in PDF Format)

## Attachment 4

# Standard Operating Procedure: TO-14/ TO-15—Volatile Organic Compounds from Air Toxics, Ltd. Methods Manual (Not Available in PDF Format)

## Attachment 5

**North Creek Analytical, Inc. Standard Operating Procedure: Measurement of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (EPA 8260B) (Not Available in PDF Format)**

## Attachment 6

# Rosa Environmental and Geotechnical Laboratory Standard Operating Procedure: Particle Size Distribution of Soils (Not Available in PDF Format)

## Attachment 7

# Rosa Environmental and Geotechnical Laboratory Standard Operating Procedure: Moisture Content, Wet and Dry Density, and Total Porosity of Soils (Not Available in PDF Format)

# APPENDIX C

# SOIL CLASSIFICATIONS PROVIDED BY ROSA ENVIRONMENTAL AND GEOTECHNICAL LABORATORY

**Rosa Environmental & Geotechnical Laboratory, LLC**
1001 SW Klickitat Way, Suite 107
Seattle, WA 98134
206.287.9122 P
206.264.1995 F

July 15, 2002

Ms. Natasya Gray
Philip Services Corp.
955 Powell Ave S.W.
Renton, WA 98055

**Subject: RFI Well Installation, REGL Project No.: 1006-589**

Dear Ms. Gray,

We have added the soil classifications you requested to the bottom of the e-mail you sent to us. Both the USDA and ASTM (Unified Soil Classification) systems were employed.

Please call me to discuss any questions, or comments you may have on the data or its presentation.

Best Regards,
Rosa Environmental & Geotechnical Laboratory, LLC.

Harold Benny
Laboratory Manager

| | Sample | H14 | H14 | H14 | S15 | S15 | S15 |
|---|---|---|---|---|---|---|---|
| | Depth (ft bgs) | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 |
| | Sample Date | 2/20/02 | 2/20/02 | 2/20/02 | 2/20/02 | 2/20/02 | 2/20/02 |
| | | Percent Passing through Sieve | | | | | |
| Sieve Size | 2" | --- | --- | --- | --- | --- | --- |
| | 1" | 100 | 100 | 100 | 100 | 100 | 100 |
| | ¾" | 100 | 100 | 100 | 100 | 100 | 100 |
| | ½" | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8" | 100 | 100 | 100 | 100 | 100 | 100 |
| | #4 (4750um) | 100 | 100 | 100 | 99.6 | 100 | 100 |
| | #10 (2000um) | 100 | 100 | 100 | 98.7 | 100 | 100 |
| | #18 (1000um) | 99.7 | 99.1 | 99.8 | 97.7 | 99.9 | 99.9 |
| | #35 (500um) | 98.6 | 98.1 | 98.6 | 92 | 99 | 99 |
| | #60 (250um) | 91.8 | 95.8 | 90.8 | 49.2 | 90.6 | 91.8 |
| | #120 (125um) | 76.8 | 84.9 | 71.2 | 11.2 | 73.4 | 79.4 |
| | #230 (63um) | 68.2 | 60 | 47.5 | 6.4 | 61.9 | 70.5 |
| | 32um | 54.7 | 31.8 | 26.7 | 6.2 | 44.4 | 50.3 |
| | 22um | 45.4 | 21.9 | 20.9 | 5 | 30.7 | 38.9 |
| | 13um | 26.6 | 13.6 | 13.4 | 4.4 | 20.5 | 25.9 |
| | 9um | 20.3 | 12.1 | 10 | 3.7 | 15.4 | 19.5 |
| | 7um | 15.6 | 10.6 | 8.4 | 3.7 | 11.9 | 13.8 |
| | 3.2um | 7.8 | 7.6 | 5 | 2.5 | 8.5 | 13 |
| | 1.3um | 3.9 | 4.5 | 3.3 | 1.2 | 3.4 | 8.1 |
| Coarse sand | 4750-2000um | 0 | 0 | 0 | 1.7 | 0 | 0 |
| Medium sand | 2000-500um | 1.4 | 1.9 | 1.4 | 6.3 | 1 | 1 |
| Fine sand | 500-63um | 30.4 | 38.1 | 51.1 | 85.6 | 37.1 | 28.5 |
| Total Sand | | 31.8 | 40 | 52.5 | 93.6 | 38.1 | 29.5 |
| Silt | 63-3um | 60.4 | 52.4 | 42.5 | 3.9 | 53.4 | 57.5 |
| Clay | <3um | 7.8 | 7.6 | 5 | 2.5 | 8.5 | 13 |

--- = no data available
um = microns

Classifications

| USDA | silt loam | silt loam | sandy loam | sand | silt loam | silt loam |
|---|---|---|---|---|---|---|
| ASTM | sandy silt | sandy silt | silty sand | poorly-graded sand | sandy silt | silt with sand |

| K10 0-2 2/20/02 | K10 2-4 2/20/02 | K10 4-6 2/20/02 | K21 0-2 2/20/02 | K21 2-4 2/20/02 | K21 4-6 2/20/02 | M29 0-2 2/20/02 | M29 2-4 2/20/02 | M29 4-6 2/20/02 |
|---|---|---|---|---|---|---|---|---|
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 99.6 | 100 | 99.7 | 100 | 99.9 | 97.8 | 100 | 99 |
| 100 | 99.3 | 100 | 99.3 | 99.8 | 99.7 | 96.2 | 99.8 | 98.2 |
| 99.2 | 98.4 | 99.9 | 98.4 | 99.5 | 99.2 | 93.8 | 99.4 | 96.1 |
| 98 | 96.7 | 97.8 | 96.7 | 98.3 | 95.9 | 81.6 | 86.2 | 82.9 |
| 96.7 | 95.3 | 88.3 | 90.9 | 93.8 | 80.3 | 47.6 | 18 | 6.3 |
| 92.8 | 91.8 | 77 | 73.5 | 88.7 | 60.3 | 26.3 | 5.3 | 29.8 |
| 68.4 | 74.8 | 64.3 | 59.9 | 82 | 52.6 | 18.9 | 3 | 25.3 |
| 39.5 | 42.5 | 35.7 | 40.3 | 57.1 | 37.3 | 19 | 1.7 | 26.7 |
| 30.1 | 28.9 | 25 | 38.5 | 38.6 | 25.4 | 16.1 | 1.7 | 23.4 |
| 20.7 | 20.4 | 16 | 28 | 25.2 | 17.9 | 10.4 | 1.7 | 14.5 |
| 16 | 11.9 | 12.5 | 21 | 20.1 | 14.9 | 8.5 | 1.7 | 12.3 |
| 13.2 | 10.2 | 8.9 | 15.8 | 1.8 | 11.9 | 7.6 | 1.7 | 9.5 |
| 7.5 | 8.5 | 5.3 | 12.3 | 13.4 | 6.7 | 4.3 | 0.8 | 5.6 |
| 5.6 | 6.8 | 3.6 | 7 | 6.7 | 6 | 2.4 | 0.8 | 2.8 |
| | | | | | | | | |
| 0 | 1.1 | 0 | 1 | 0.2 | 0.4 | 6 | 0.2 | 2.8 |
| 2 | 2.2 | 2.2 | 2.3 | 1.5 | 3.7 | 12.4 | 13.6 | 14.3 |
| 29.6 | 21.9 | 33.5 | 36.8 | 16.3 | 43.3 | 62.7 | 83.2 | 57.6 |
| 31.6 | 25.2 | 35.7 | 40.1 | 18 | 47.4 | 81.1 | 97 | 74.7 |
| 60.9 | 66.3 | 59 | 47.6 | 68.6 | 45.9 | 14.6 | 2.2 | 19.7 |
| 7.5 | 8.5 | 5.3 | 12.3 | 13.4 | 6.7 | 4.3 | 0.8 | 5.6 |

| silt loam | silt loam | silt loam | loam | silt loam | sandy loam | loamy sand | sand | sandy loam |
|---|---|---|---|---|---|---|---|---|
| sandy silt | silt with sand | sandy silt | sandy silt | silt with sand | silty sand | silty sand | poorly-graded sand | silty sand |

| D25 | CG-112 | CG-112 | CG-113 | CG-113 | 672L-4 | 5409D-3 |
|---|---|---|---|---|---|---|
| 4-6 | 0-3 | 3-6 | 0-3 | 3-6 | 5.5-7.5 | 5.5-7.5 |
| 2/22/01 | 1/30/01 | 1/30/01 | 1/30/01 | 1/30/01 | 8/5/00 | 8/5/00 |
| | | | | | | |
| 100 | --- | --- | --- | --- | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 99.6 | 100 | 100 | 100 | 100 | 100 | 100 |
| 98.6 | 99.9 | 100 | 100 | 99.8 | 100 | 99.9 |
| 97.4 | 99.8 | 99.7 | 99.9 | 99.4 | 99.5 | 98.2 |
| 90.7 | 99.5 | 94.7 | 99.8 | 92.9 | 93.7 | 87.6 |
| 70.7 | 97.8 | 77.3 | 99.4 | 64.9 | 76.9 | 50.6 |
| 32.4 | 90.9 | 45.7 | 98.8 | 27.2 | 44.9 | 18.1 |
| 9.5 | 77.7 | 25.4 | 94.7 | 8.1 | 15.1 | 6.7 |
| --- | 48.4 | 16.3 | 57.1 | 2.8 | --- | --- |
| --- | 36.8 | 15.5 | 41.1 | 2.8 | --- | --- |
| --- | 25.1 | 13.8 | 25 | 2.8 | --- | --- |
| --- | 19.7 | 13 | 20.5 | 2.8 | --- | --- |
| --- | 15.2 | 10.6 | 14.3 | 2.1 | --- | --- |
| --- | 8.1 | 5.7 | 8 | 1.4 | --- | --- |
| --- | 4.5 | 4.9 | 4.5 | 0.7 | --- | --- |
| | | | | | | |
| 0.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.9 | 0.5 | 5.3 | 0.2 | 7.1 | 6.3 | 12.4 |
| 81.2 | 21.8 | 69.3 | 5.1 | 84.8 | 78.6 | 80.9 |
| 90.5 | 22.3 | 74.6 | 5.3 | 91.9 | 84.9 | 93.3 |
| 9.5 | 69.6 | 19.7 | 86.7 | 6.7 | 15.1 | 6.7 |
| --- | 8.1 | 5.7 | 8 | 1.4 | -- | --- |

| sand | silt loam | sandy loam | silt | sand | loamy sand | sand |
|---|---|---|---|---|---|---|
| poorly-graded sand with silt | silt with sand | silty sand | silt | poorly-graded sand with silt | silty sand | poorly-graded sand with silt |

# APPENDIX D

# REQUEST FOR ACCESS LETTER – GIVF SAMPLING

July 29, 2002

Address

Re: Notification of Potential Indoor Air Contamination and Request for Access to Conduct Indoor Air Sampling at 412 Orcas Street, Seattle, Washington

Dear Neighbor:

As you may know, historic business practices at the Philip Services Corporation (PSC) facility located at 734 South Lucile Street in Seattle caused contamination of groundwater in areas of Georgetown west and southwest of the PSC facility. In general, solvents and petroleum that were used for various practices, or simply stored, are the types of chemicals being found in the groundwater. These compounds are part of a group of chemicals called volatile organic compounds. Currently, PSC is studying the nature and extent of this contamination under supervision of the Washington State Department of Ecology (Ecology) and is moving forward to design a belowground containment wall around the facility to minimize further downgradient contamination of groundwater.

Elevated concentrations of volatile organic compounds have been detected in the groundwater near your property.[1] Although the groundwater in the Georgetown area of Seattle is not used for drinking water and residences and businesses are connected to city water; it is possible that vapors from the chemicals in the groundwater could enter your building through the underlying soil. These underground vapors are called "soil gas."

PSC, Ecology, the US Environmental Protection Agency (EPA), and the Washington State Department of Health (DOH) are now in the process of estimating the likelihood that contaminated soil gas could enter buildings in the affected area and cause indoor air concentrations that may exceed State cleanup levels. This estimation will be accomplished by using concentrations of volatile organic compounds measured in shallow groundwater close to your building and applying an *attenuation* or *volatilization* factor to the groundwater concentration to estimate an indoor air concentration. The levels of groundwater contaminants measured near your property suggest that it is possible that soil gas might be entering your building and producing indoor air concentrations that are higher than State cleanup levels. Accordingly, we want to further investigate this potential and, if need be, devise measures to reduce the levels.

[1] The area between the PSC facility and the Duwamish Waterway is home to a number of other commercial and industrial companies that, in some cases, use the same types of chemicals. Therefore, it is possible that other sources of contamination may be contributing to some of the groundwater contamination found during the investigation of the PSC facility.

Not everyone in the community has received this letter. No one who lives in an area where groundwater is not contaminated or not contaminated sufficiently to pose a potential threat to indoor air quality has been notified. To evaluate impacts from soil gas to indoor air, PSC will sample indoor air and groundwater at selected buildings near the facility. The selected buildings are residential-type structures located in areas where underlying groundwater contamination indicates a potential impact to indoor air.

At the selected buildings, PSC intends to sample indoor air, outdoor air, and groundwater at the same time to develop a relationship between groundwater contamination and indoor air quality. Indoor and outdoor air samples will be collected simultaneously to estimate the contribution of outdoor air contaminants to indoor air quality versus the contribution of groundwater contaminants to indoor air quality. Soil and soil gas sampling may also be conducted to provide additional information about the relationship between groundwater contamination and indoor air quality. Once the relationship between groundwater contamination and indoor air quality is established, indoor air in buildings throughout the area of contaminated groundwater can be evaluated by simply measuring groundwater concentrations.

To accomplish these goals, PSC would like to proceed as follows:

1. Obtain approval from the building owner and occupant(s) to allow PSC, and our contractors, to enter the property for a building evaluation. The purpose of the building evaluation will be to gather sufficient information to prepare a sampling and analysis plan for the collection of indoor air data and possibly groundwater, soil, soil gas, and ambient air data from the building.

2. Conduct a building evaluation which will consist of a walk-through the building – preferably with the building owner or tenant – to determine where to collect indoor air samples based on the building structure and building size. In addition, a survey will be conducted to determine whether there are other sources of indoor air contamination within the building caused by building materials or items used/stored there.

3. PSC will prepare a sampling and analysis plan for Ecology that proposes the types of samples that should be collected, the proposed locations for the samples, and the list of chemicals that will be analyzed for by a laboratory. The sampling and analysis plan will be approved by Ecology prior to implementation.

4. PSC or its contractors will conduct indoor air sampling in the building. The sampling is very simple. One or two metal canisters (1.5 gallons) will be placed in the building over a 24-hour period. During this time, the canister will constantly collect air. There are no motors or pumps; the canister is under vacuum and collects air silently and continuously. At the end of the 24 hours, PSC will pick up the canister and send it to a laboratory for analysis.

5. PSC or its contractors will sample air, groundwater, and possibly soil gas and soil, outside the building. The air sample will be collected in a metal canister over a 24-hour period. At the end of the 24 hours, PSC will pick up the canister and send it to a laboratory for analysis. Groundwater, soil gas, and soil samples will be collected from a small-truck mounted drill rig that will create a temporary boring approximately 10 feet below ground surface in an area close to your building. After samples are obtained, PSC will send the samples to the laboratory for analysis.

6. Once the samples have been analyzed, and the information is quality assured, a process that will take six to eight weeks, PSC and Ecology will inform you of the results of the sampling and any necessary actions that will be taken. If the analytical results from the indoor sampling show that contaminated groundwater is not impacting your air quality at levels that trigger regulatory and health concerns, then no further action would be required. If, on the other hand, the results indicate that State air cleanup levels in indoor air are being exceeded due to the volatilization of contaminated groundwater, then a likely next step may be to propose a system to vent (remove) soil gas before it enters your building. PSC would assume all costs related to such a measure.

PSC wants to quickly follow-up on concerns associated with indoor air contamination. We also want you to be aware that no acute (immediate) health risk is expected from the levels of indoor air contaminants in your building. If data collected during this investigation suggest such a risk, we will notify you immediately.

PSC has prepared a document that describes the history of the soil gas investigations conducted to date, the reasons for continuing the investigation, and how we intend to proceed in the future. This document is called the Inhalation Pathway Interim Measure Work Plan. It will be available following approval by Ecology, which is expected in August, and may be reviewed at:

| | | |
|---|---|---|
| USEPA Region 10<br>1200 Sixth Avenue<br>Seattle, WA 98101<br>(206) 553-8665<br>(800) 424-4372 | Department of Ecology<br>NW Regional Office<br>3190 160th Avenue S.E.<br>Bellevue, WA 98008<br>(425) 649-7239 | Georgetown Gospel Chapel<br>6606 Carleton Ave. S.<br>Seattle, Wa 98108<br>(206) 767-3207<br>Contact: Pastor Leroy Hedman |

Attached is a consent form acknowledging that you received this letter and agree to allow PSC to collect samples at your property. If you agree to allow PSC to sample at your property, please sign both copies and send COPY 2 back to PSC in the enclosed pre-stamped envelope by August 5, 2002.

If you have any questions, please feel free to contact:

| | | | |
|---|---|---|---|
| Carolyn Mayer<br>PSC<br>955 Powell Ave. SW<br>Renton, WA 98055<br>(425) 227-6121<br>(800) 228-7872 | Galen Tritt or Ed Jones<br>WA Dept. of Ecology<br>NW Regional Office<br>3190 160th Avenue SE<br>Bellevue, WA 98008<br>(425) 649-7239 | Marcia Bailey<br>USEPA Region 10<br>1200 Sixth Avenue<br>Seattle, WA 98101<br>(206) 553-0684<br>(800) 424-4372 | Barbara Trejo<br>WA Dept. of Health<br>PO Box 47846<br>Olympia, WA 98504<br>(360) 236-3373<br>(877) 485-7316 |

If you feel that it would be helpful for someone from PSC or someone from the agencies to visit you to answer questions or better explain this letter, please contact me, or one of the other contacts.

Sincerely,

Carolyn Mayer
Corrective Actions Manager
Regulatory Affairs Department
Philip Services Corporation

cc: Ed Jones, Ecology - Hazardous Waste and Toxics Reduction Program
Galen Tritt, Ecology - Hazardous Waste and Toxics Reduction Program
Marcia Bailey, EPA - Risk Assessment
Howard Orlean, EPA - RCRA Permits Team/Corrective Action
Barbara Trejo, WDOH - Office of Environmental Health Assessments
Public Repository (Georgetown Gospel Chapel)

**Consent Form**
**COPY 1 – For Owner/Tenant**

I acknowledge that I have received the July 29, 2002 letter from PSC regarding indoor air, groundwater, soil and soil gas sampling at my property. I understand the information provided to me and I agree to allow PSC to conduct this sampling.

| | |
|---|---|
| Name | |
| Owner or Tenant | |
| Address | |
| Address | |
| Phone Number | |
| Date | |

**Consent Form**
**COPY 2 – For PSC**

I acknowledge that I have received the July 29, 2002 letter from PSC regarding indoor air, groundwater, soil and soil gas sampling at my property. I understand the information provided to me and I agree to allow PSC to conduct this sampling.

| | |
|---|---|
| Name | |
| Owner or Tenant | |
| Address | |
| Address | |
| Phone Number | |
| Date | |

# APPENDIX E

# IPIM – HEALTH AND SAFETY PLAN



# PHILIP SERVICES CORPORATION
# HEALTH AND SAFETY PLAN

## Inhalation Pathway
## Interim Measure Construction
## Seattle, Washington

**955 Powell Avenue SW**
**Renton, WA 98055**
**Ph 425-227-0311  Fax 425-227-6171**

*"Helping Clients Attain a Competitive Advantage in a Global Market SM"*

# 1.0 PURPOSE

This Health and Safety Plan (HASP) outlines project personnel, individual responsibilities, anticipated hazards related to subsurface contamination and general work activities related to the construction of a subsurface depressurization system intended to mitigate indoor air. The plan includes appropriate personal protective equipment, steps to take in the event of an emergency, and other health and safety requirements necessary for the installation of an indoor air mitigation system to be completed safely and in compliance with applicable regulations and client requirements.

Project personnel should familiarize themselves with the contents of this HASP and sign the HASP compliance form in the appendix. Personnel will be expected to abide by this HASP and notify their supervisor or the H&S department if project conditions require additional procedures or changes to procedures described within this HASP. Subcontractors will abide by this HASP as well as any internal HASPs required by their own companies. The general contractor's HASP is attached.

# 2.0 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

PSC Regional Safety Manager or designee such as Regional Safety Coordinator:

- Oversee development and implementation of the site-specific health and safety plan;
- Audit the equipment, medical monitoring, air monitoring, and training of individuals on this project;
- Has "stop work" authority over Project Manager for all field work.

PSC Project Manager:

- Overall administration of the project for PSC;
- Project planning, budgeting, communications, regulatory compliance, site documentation, and operations coordination;
- Overall implementation of this HASP;
- Designate and supervise the Site Health and Safety Officer.

Site Health and Safety Officer:

- Verify compliance with this HASP;
- Perform site air monitoring to determine PPE levels and site perimeter locations;
- Implementation of procedures and programs to limit risk to site personnel;
- Ensure that health and safety meetings are conducted daily;
- Verify all site personnel understand this HASP;
- Document activities and information required by this HASP;
- Reports to Philip Project Manager directly and indirectly to Philip Regional Safety Manager.

Site Personnel

- Perform technical roles assigned;
- Review and understand the protocols presented in this HASP;
- Notify a supervisor or the H&S department if project conditions require additional procedures or changes to procedures described within this HASP.

## 3.0 APPROVALS

| | |
|---|---|
| Project Name and Number: | To be determined |
| Project Site Location: | To be determined |
| PSC Project Manager (PM): | Carolyn Mayer |
| PSC Site Safety Officer (SSO): | Corey Johnson |
| Contractor Site Supervisor: | To be determined |
| Date(s)/Duration of Field Work: | Start to be determined |
| PSC H&S Plan Preparer: | Lou La Rosa |
| Preparation Date: | August 1, 2002 |
| Expiration Date: | Whenever project is completed. |

APPROVED:

Mark Haller, PSC Health and Safety Manager

Carolyn Mayer, PSC Project Manager (PM)

Rent-02-045
Health and Safety Plan Approval Number

## 3.0 FIELD PERSONNEL

The field team will consist of the following persons:

| | |
|---|---|
| Project Manager: | Carolyn Mayer |
| Site Safety Officer(SSO): | Corey Johnson |
| Contractor Site Supervisor: | To be determined |
| Field Personnel: | To be determined at start of project.<br>(list below): |

_____

_____

_____

_____

_____

_____

### 3.1 FIELD PERSONNEL TRAINING/MEDICAL REQUIRMENTS

The PSC SSO will have the following training/medical records:

- HAZWOPER 40 Hour Initial Certificate;
- HAZWOPER 8 Hour Refresher Certificate (Current - i.e, within last 12 months);
- Medical Clearance Certificate (e.g., from last annual/biennial physical);

At least one on-site employee must possess the following training records:

- HAZWOPER 8 Hour Supervisor Certificate
- First Aid and CPR Certification (First Aid within 3 years, CPR within current year)

Personnel using respiratory protection must possess the following records:

- Respirator Fit Test Record less than 12 months old (applicable to Level C only);
- Medical Clearance to wear a respirator (this is normally noted on the Summary Profile for the annual physical)

PSC will provide a HASP orientation and site orientation to all subcontractors working on this project and will require subcontractors to complete the Subcontractor Statement of Compliance Form before site work begins, which is attached. The subcontractor will also abide by any HASP

required by their own company. The general contractor may have its own HASP that it will follow in addition to this one.

# 4.0 PROJECT DESCRIPTION

The inhalation pathway interim measure (IM) will consist of a subsurface depressurization system. The purpose of this system is to prevent volatile organic compounds in groundwater from volatilizing through the slab of the building into the indoor air. The subsurface ventilation system is designed to depressurize the ground immediately below the slab. The effort would be implemented by using as many as in-line fans installed in pipes that are placed in the subsurface of a building and routed through the top of the building's roof or the side of the building. The initial remedy will consist of at least one subsurface depressurization system consisting of a fan and sub-slab venting system.

## 4.1 LOCATION

The locations of the IM will be determined after the August 2002 indoor air sampling event and after quarter groundwater results are reviewed for second quarter 2002, third quarter 2002, fourth quarter 2002 and first quarter 2003. The area of concern is generally west and southwest of the PSC facility in the downgradient direction of the site.

## 4.2 SITE FEATURES

Each building identified for interim measures will have different characteristics. Buildings may include residential or commercial structures. Buildings may have basements, slab on grade, crawl spaces, or may be evaluated on fill material to support a loading dock. Some building will have HVAC systems and others will not. Therefore, the design of the IM will vary based on these building characteristics and therefore the HSP has to be flexible enough to accommodate these differences as well.

## 4.3 WORK TASKS

PSC or its contractors will secure all necessary permits for the construction of this system. The work will vary slightly depending on the building and the system chosen, but in general the work will consist of the following procedures:

1. Concrete coring.
2. Removal of subsurface soil to create a borehole about two to three feet deep.
3. Installation of PVC pipe/screen, filter sand, bentonite, and concrete into the borehole.
4. Grout the concrete slab with a similar composition to the original slab material.
5. Install a fan in the PVC riser
6. The roof or wall may need to be penetrated (possibly with a roof jack and sealed with asphalt-based roofing mastic and flashing) in order to install the fan and pipe.
7. Provide electrical connection to the fan in accordance with the National Electric Code.
8. Remove all debris.

# 5.0 HAZARD EVALUATION

A job hazard analysis (JHA) must be performed prior to beginning each new task. A documented hazard analysis form shows that you have considered each step of your task, the possible safety risks, and control or preventative measures. JHAs for some of the site tasks foreseen prior to project mobilization are included in the appendix of this HASP and may be evalable from the contractor's HASP. The best person to fill out a JHA is the person who is going to do the job.

## 5.1 WASTE EXPOSURES

It is the responsibility of the SSO to insure that the proper levels of personal protection and any other needed controls are instituted during the various tasks on these projects. The levels of personnel protection required will vary according to specific project tasks during the subsurface activities.

The primary potential for exposure during this project will be during and after the coring of the concrete slab. During this activity continuous air monitoring with direct reading instruments such as a PID, FID and CGI will be implemented. Further explanation of personal monitoring is provided in Section 5.2.3.

## 5.2 EXPOSURE PREVENTION

### 5.2.1 Site Control

The PSC SSO will enforce the following zones to keep unauthorized and unprotected individuals out of the work area.

*Exclusion Zone (EZ)* The exclusion zone encompasses the invasive remedial work area, including excavation and elevated work including work conducted on the roof or in a man lift. The construction area is demarcated with barrier tape or some other visual barrier. Only authorized personnel may enter this area wearing the specified level of protection.

*Support Zone (SZ)* The support zone is located beyond the CRZ and will include the remaining portions of the site. No specific project-related personal protective equipment (PPE) is required in this zone.

### 5.2.2 Personal Protective Equipment

Non-intrusive work will be performed in Level D PPE. The PSC SSO will dictate the appropriate level of protection for all other tasks base on information and conditions at the time.

Level A _____ Level B _____ Level C _____ Level D X

**Level D Protection - Protective Equipment Ensemble**

*Coveralls or work clothes, or*

When in contact with waste materials impermeable coveralls are required, consisting of:

- **PVC**, or
- **Polycoated Tyvek,** or
- **Tyvek (dust only)**

*Work gloves (as needed), or*

When in contact with waste materials impermeable gloves and inner gloves required, consisting of:

- **PVC** (inner)
- **Nitrile** (outer)

*Safety boots, leather, steel toe , or*

For incidental contact with waste materials, wear **Rubber (latex) overboots** to protect leather work boots; or

For extended contact with waste materials, wear **16 inch PVC boots** with steel toe and shank

*Safety glasses, or*

For incidental eye contact with liquid chemicals or contaminants **Splash goggles** are required.

*Hard hat (when working with heavy equipment or working in an elevated situation)*

*Hearing protection* (when in proximity to heavy equipment or other noise generating sources)

*Orange safety vest (near heavy equipment and open roadways)*

### 5.2.3 Personal Monitoring

The primary potential for exposure during this project will be during and after the coring of the concrete slab. The PSC SSO will conduct air monitoring within the exclusion zones as determined by the conditions of the task at hand.

During this activity continuous air monitoring with direct reading instruments such as a PID, FID and CGI will be implemented. In addition, testing of primary contaminants of concern with detector tubes will be conducted if the field screening instrument (e.g., PID) indicates the total volatile organic compound concentration exceeds background concentrations by 1 ppm during these activities. The primary contaminates of concern are vinyl chloride, trichloroethylene (TCE) and benzene.

## 5.3 FIRE AND EXPLOSION POTENTIAL

Fire and explosion potential for this project is low. Gasoline and LP gas are very flammable and, if used, must be handled safely. Hydrocarbon vapors are heavier than air and may accumulate in low-lying areas under certain conditions. Ignition sources such as heavy equipment will be present within the EZ.

Fire extinguishers as specified in section 7.2 of this HASP are mandatory.

## 5.4 GENERAL CONSTRUCTION HAZARDS

The hazards in sections 5.4.1 through 5.4.7 are ranked with section 5.4.1 the most hazardous for this project. In addition, the contractor's employees should refer to their company's safety manual.

### 5.4.1 Falls and Falling Objects

Falls are possible from while mounting/dismounting heavy equipment, while beside the excavations, and from getting tripped up by uneven terrain. At any time you must work above six feet, you will be provided with a full body harness and shock-absorbing lanyard. Portable extension ladders should be tied off at the top and have secure footing at the bottom, always make sure the ladder extends three feet past the top. Avoid the edge of excavations, if you must get within a couple feet, tying off is suggested. The edge of the excavation should always be marked by tape or other means set back from the actual edge so as to provide a warning before reaching the edge.

### 5.4.2 Physical Hazards

Accidents in manual handling of materials are primarily the result of unsafe working habits--improper lifting, carrying too heavy a load, incorrect gripping, or failing to wear personal protective equipment. These may be avoided by testing the weight of an object before attempting to lift and carry it. If it is too heavy, get help, and if possible, use mechanical lifting aids.

The proper method for lifting is:

- Get a good footing.
- Place feet about shoulder-width apart.
- Bend knees to pick up load. Never bend from waist.
- Keep back straight.
- Get a firm hold. Grasp opposite corners of the load, if possible.
- Keep the back as upright as possible.
- Lift gradually by straightening the legs--don't jerk the load.
- Keep the weight as close to the body as possible.
- When changing directions, turn the entire body, including the feet.
- Don't twist the body.

Workers can be struck by vehicles used at a site. While driving in reverse, the operator usually has a more limited field of view than while driving forward and must observe extra caution. Such vehicles must be equipped with a backup alarm to warn workers that the vehicles are moving in reverse.

### 5.4.3 Excavations

No one may enter an excavation deeper than four feet without first getting approval from the SSO or Contractor Site Supervisor. Personnel entry into excavations is not anticipated and is to be avoided. Edges of excavations must be marked to prevent people from walking over the edge. Stop logs, spotters, or markers of some type must be provided for truck drivers when they must get close to excavation edges.

### 5.4.4 Electrical Hazards

Utility clearance will be performed prior to any soil penetration. Any electrical power tools must be connected to GFCI (ground fault circuit interrupter) protected circuits. All power cords must be inspected for damage prior to use.

### 5.4.5 Heat &Cold Stress

Common sense precautions will be used primarily. If conditions are extreme, monitoring and other steps as indicated in the H&S heat and cold stress procedure will need to be performed. A heated break trailer should be provided. Workers should wear multiple layers of clothing and avoid getting wet.

### 5.4.6 Noise Hazards

Hearing protection is required for work performed adjacent to operating heavy equipment or other noise generating sources. Based on previous monitoring of heavy equipment sound levels in the range of 85-95 dBA will be common. Earplugs provided by PSC usually have a noise reduction rating of 29 that should be more than adequate as long as they are worn according to the directions provided with them. As a rule of thumb, noise levels that interfere with easy communication with someone next to you require hearing protection.

### 5.4.7 Other Hazards

PSC staff shall stay out of the operating range of any heavy equipment on site. The "operating range" is defined as the swing zone plus 25 feet. Entry into the operating range is allowed only after the operator's attention has been gained and all buckets or extensions have been grounded.

PSC employees will not enter permit-required confined spaces for the duration of this project.

PSC employees will be required to wear orange reflective safety vests when in close proximity to roadways and operating heavy equipment.

All employees on the jobsite have the responsibility to refuse to work with faulty equipment that may lead to accidents. Tag any faulty equipment and bring it to the attention to the site supervisor.

## 5.5 HAZARD COMMUNICATION

Any chemicals brought on site will be accompanied by an MSDS which should be reviewed by the SSO and discussed at the daily safety meeting. A copy of the MSDS must be included in the HASP. PSC subcontractors must have MSDSs for chemicals brought on site. The PSC SSO will review the MSDSs prior to use.

# 6.0 EMERGENCY INFORMATION

## 6.1 EMERGENCY CONTACTS

| Contact | Person or Agency | Telephone No. |
|---|---|---|
| Police | | 911 |
| Fire | | 911 |
| Hospital | Harborview Medical Center<br>325 9th Ave<br>Seattle, Washington 98101 | (206) 731-3000 |
| Hospital | Swedish Medical Center<br>747 Broadway<br>Seattle, Washington 98122 | (206) 386-6000 |
| PSC Project Manager | Carolyn Mayer | (425) 227-6121 - Office |
| PSC Environmental Health & Safety Manager | Mark Haller | (425) 227-6119 - Office<br>(253) 261-1019 - Cell |
| PSC Project Site Supervisor | Corey Johnson | (206) 715-4995 - Cell |

## 6.2 LOCATION OF SITE RESOURCES

Water Supply: Inside the building.
Telephone: Inside the building or cell phone.
Toilet: Inside the building.

## 6.3 EMERGENCY MEDICAL TREATMENT PROCEDURES AND BLOODBORNE PATHOGEN EXPOSURES

### 6.3.1 Emergency Medical Treatment

First aid should be administered while awaiting an ambulance or paramedics. First aid kits will have gloves and artificial airways to protect against bloodborne pathogens, and personnel who have come into contact with bodily fluids such as blood or saliva will immediately confer with the PSC Health & Safety Manager to determine whether inoculation or other action is necessary. All injuries and illnesses must be reported immediately to the Project Manager.

Personnel who are transported to a clinic or hospital for treatment should take with them information any chemical(s) they have been exposed to at the site. This information is included in Table 1, Exposure Limits and Recognition Qualities.

### 6.3.2 Bloodborne Pathogens

For purposes of this health and safety plan employees have jobs where required tasks normally do not but could involve exposure to blood, bodily fluids, or tissues--for example, in the event first aid or CPR is required. If exposure to blood, bodily fluids, or tissues occurs, Universal Precautions, such as described in the Appendix, should be followed to minimize the chance of contracting disease.

# 7.0 MISCELLANEOUS

## 7.1 REQUIRED SAFETY POSTINGS AND INFORMATION

Emergency Numbers
Route from the Georgetown area to Hospitals
Operators Manuals for heavy equipment or instrumentation
PSC Site Health and Safety Plan

## 7.2 ADDITIONAL REQUIRED EQUIPMENT TO BE TAKEN INTO FIELD

- First aid kit
- Fire extinguishers - 5lb ABC rated on/in heavy equipment, 10lb ABC rated in the EZ

## 7.3 WORKER TRAINING RECORDS

PSC employee documentation should be on site. Additional copies of documentation are located in the PSC office.

## 7.4 FIELD FORMS TO BE USED

Copies of the following forms will be completed in field:

- Plan Acceptance Form
- Site Safety Meeting Record
- Utilities and Structures Checklist

Copies of the following forms will be available with the HASP and used, if applicable:

- Bloodborne Pathogens Incident Evaluation Form
- Equipment Calibration and Air Monitoring Data Form
- Subcontractor Statement of Compliance Form
- Supervisor's Accident/Injury Investigation Report

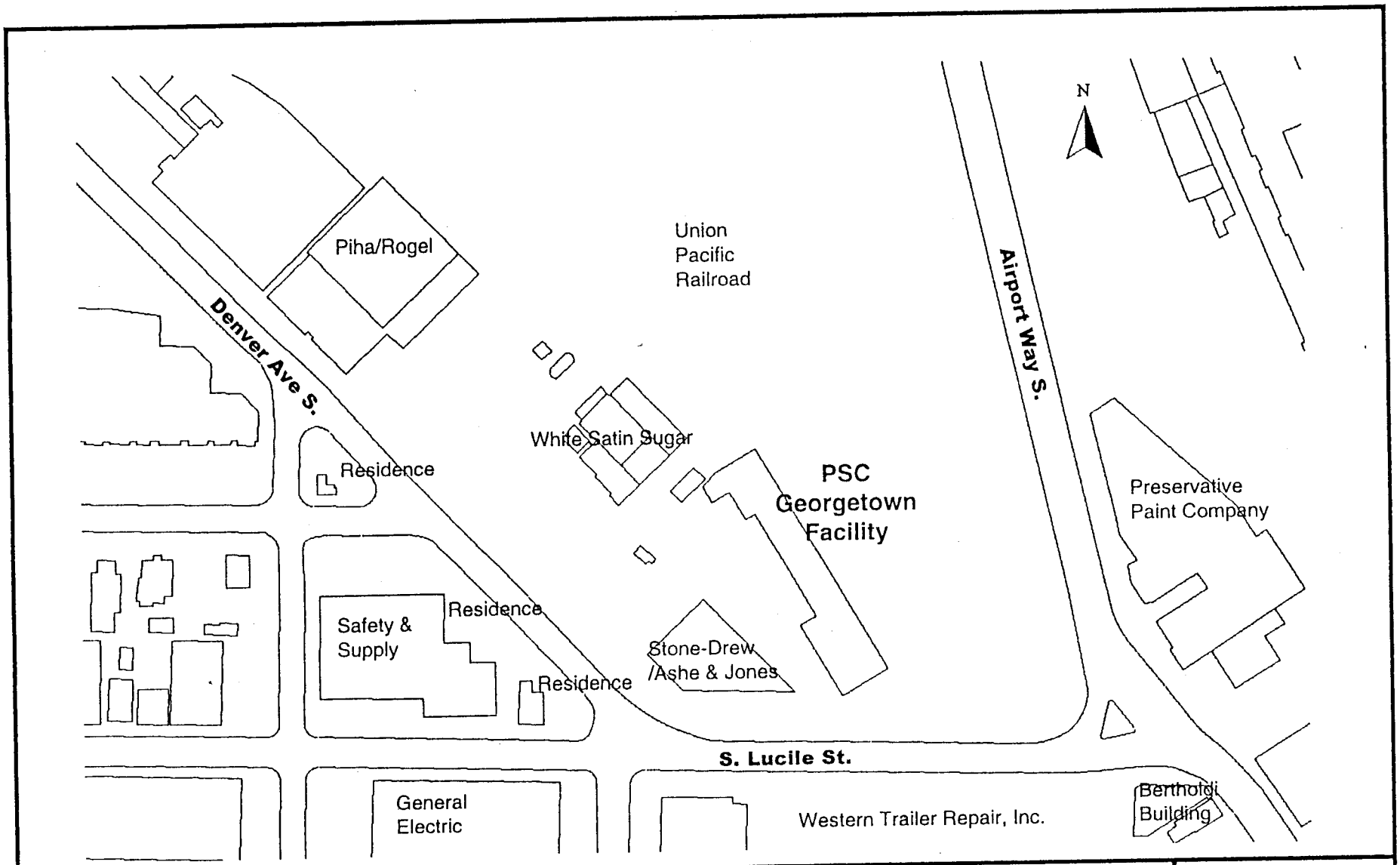
# TABLES

**TABLE 1**
**INHALATION PATHWAY INTERIM MEASURE ACTION LEVELS (IPIMALs)**

| COMPOUND | CAS # | EXPOSURE STANDARDS | | |
|---|---|---|---|---|
| | | TLV/PEL (ppm) | STEL (ppm) | IDLH (ppm) |
| 1,1,1-Trichloroethane | 71-55-6 | 350 | 450 | |
| 1,1-Dichloroethane | 75-34-3 | 100 | | |
| 1,1-Dichloroethylene | 75-35-4 | 100 | | |
| 1,2,4-Trimethylbenzene | 95-63-6 | 25 | | |
| 1,2-Dichloroethane | 107-06-2 | 1 | 2 | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 25 | | |
| 2-Hexanone | 591-78-6 | 100 | | 1600 |
| Benzene | 71-43-2 | 1 | 5 | |
| Chloroethane | 75-00-3 | NA | | |
| Chloroform | 67-66-3 | 2 | | |
| cis-1,2-Dichloroethylene | 156-59-2 | 200 | | |
| Ethylbenzene | 100-41-4 | 100 | 125 | |
| Naphthalene | 91-20-3 | 10 | 15 | |
| n-Propylbenzene | 103-65-1 | NA | | |
| p-Isopropyltoluene | 99-87-6 | NA | | |
| sec-Butylbenzene | 135-98-8 | NA | | |
| Tetrachloroethylene | 127-18-4 | 25 | | |
| Toluene | 108-88-3 | 100 | 150 | |
| trans-1,2-Dichloroethylene | 156-60-5 | NA | | |
| Trichloroethylene | 79-01-6 | 50 | 200 | |
| Vinyl chloride | 75-01-4 | 1 | 5 | |

TLV/PEL = The more stringent of either the American Conference of Governmental Industrial Hygienist' (ACGIH) threshold limit value or the Occupational Safety and Health Administration (OSHA) permissible exposure limit.
STEL = Short term exposure limit based on a 15 minute time weighted average.
IDLH = Immediately dangerous to life and health.
ppm = Parts per million
NA = None available. A search of the NIOSH Pocket Guide to Chemical Hazards and the Rapid Guide to Hazardous Chemicals in the Workplace yielded no established limits for this chemical.
* = Milligrams per cubic meter

# FIGURES



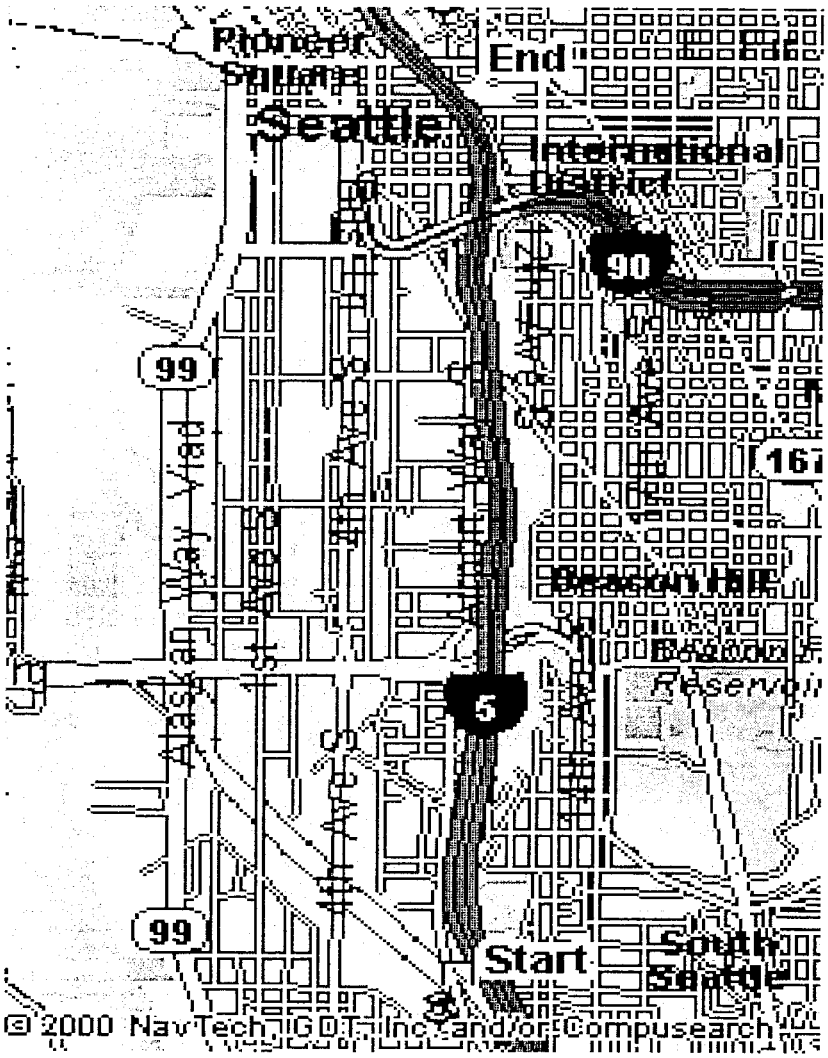

PSC

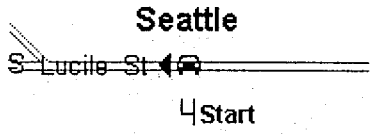
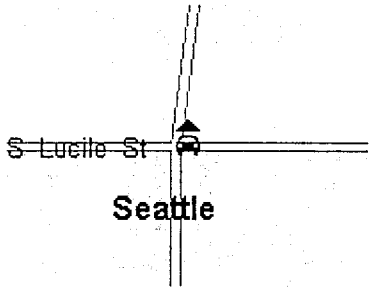
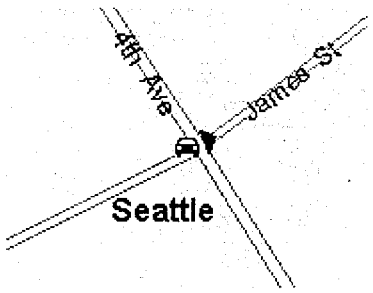
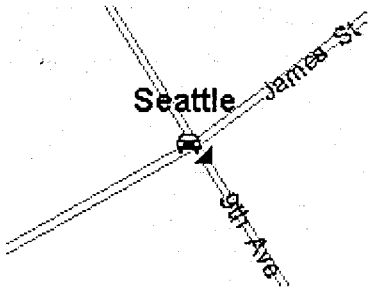
**Figure 1**
**Location of SDAJ Building**
**710 S. Lucile Street, Seattle, WA**

| | |
|---|---|
| dtb | |
| 6/14/01 | Figure 1 |

Figure 2 – Georgetown Site Hospital Map - Harborview

**Harborview Medical Center**
**325 9th Ave.**
**Seattle, Washington , 98101**
**(206) 731-3000**



| Detailed Map | Directions | Toward | Distance | Time |
|---|---|---|---|---|
|  | **Start: Depart** 734 S Lucile St, Seattle, WA, 98108 on **S Lucile St** (West) | | 0.3 | 0:02 |
|  | **1:** Turn **RIGHT** (North) onto **4th Ave (S)** | | 3.5 | 0:09 |
|  | **2:** Turn **RIGHT** (East) onto **James St** | | 0.3 | 0:01 |
|  | **3:** Bear **RIGHT** (South-East) onto **9th Ave** | | 0.2 | 0:01 |

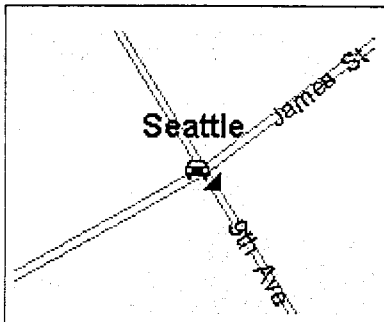
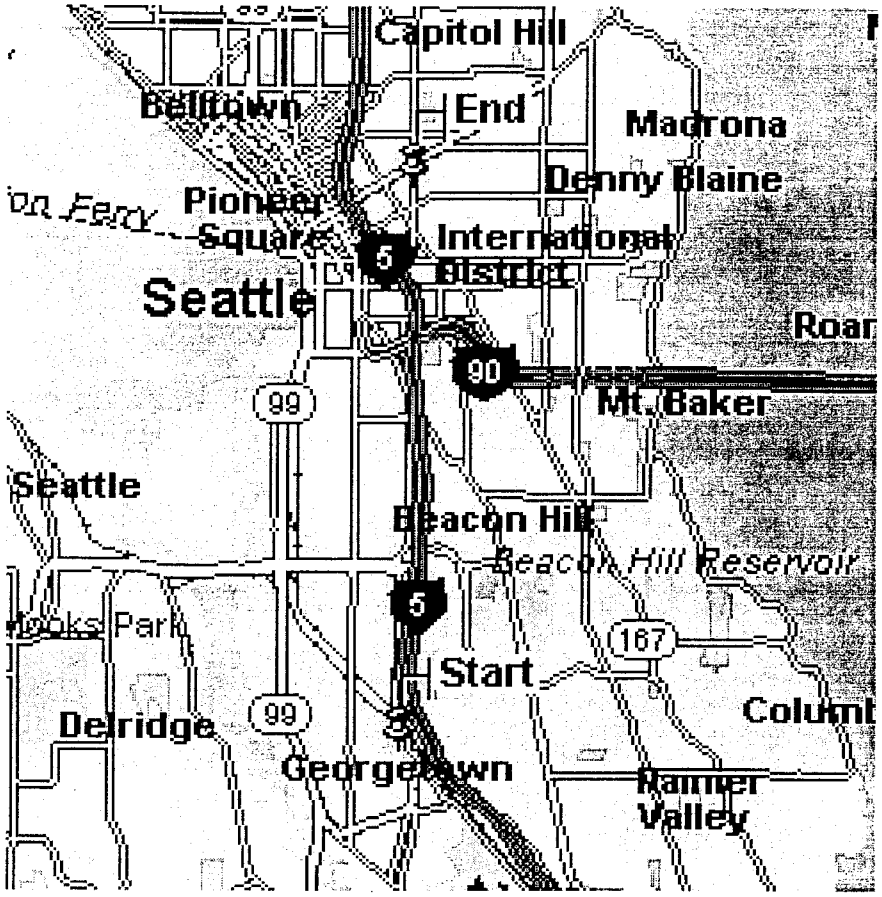
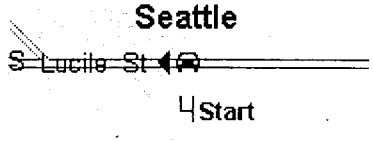
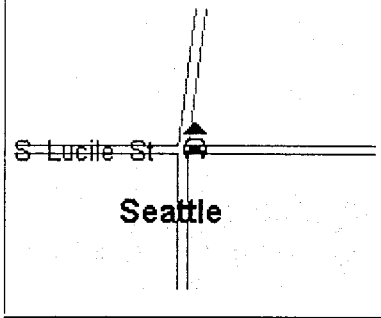
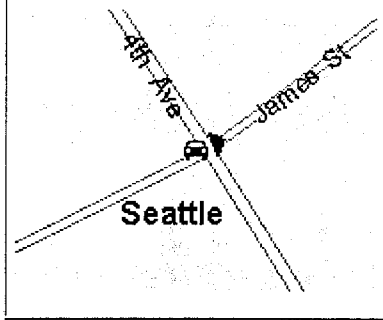
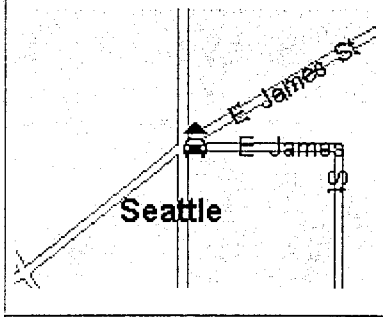
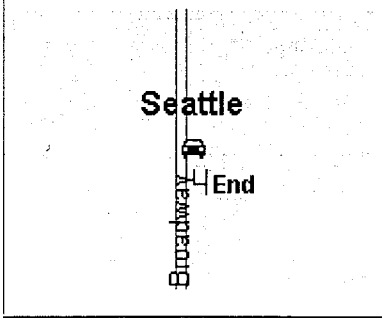
| | | | | |
|---|---|---|---|---|
|  | **End: Arrive** Harborview Medical Center, Seattle, Washington | | < 0.1 | < 1min |
| **Total Route** | | | **4.2 mi** | **13 mins** |

Figure 3 – Georgetown Site Hospital Map – Swedish

**Swedish Medical Center**
**747 Broadway**
**Seattle, Washington 98122**
**(206) 386-6000**




| Detailed Map | Directions | Toward | Distance | Time |
|---|---|---|---|---|
|   | **Start: Depart** 734 S Lucile St, Seattle, WA, 98108 on **S Lucile St** (West) | | 0.3 | 0:02 |

| | | | | |
|---|---|---|---|---|
|  | **1:** Turn **RIGHT** (North) onto **4th Ave (S)** | | 3.5 | 0:09 |
|  | **2:** Turn **RIGHT** (East) onto **James St** | | 0.5 | 0:02 |
|  | **3:** Bear **LEFT** (North) onto **Broadway** | | 0.1 | < 1min |
|  | **End: Arrive** Swedish Medical Center, Seattle, Washington | | < 0.1 | < 1min |
| **Total Route** | | | **4.4 mi** | **13 mins** |

# FORMS

**BLOODBORNE PATHOGENS INCIDENT EVALUATION FORM**

Employee Name: _____
Office/Location: _____
Date: _____ Time: _____ a.m./p.m.

Circumstances: Supervisor's Assessment of the Following Control Measures Used at the Time of the Exposure (see definition below):

Route of Exposure:
_____

_____

_____

Engineering:
_____

_____

_____

Work Practice:
_____

_____

_____

Personal Protective Equipment: _____
_____
_____

Reason for Failure of the Control Measures or Failure to Comply with Recommended Protective Measures:

_____
_____
_____
_____
_____
_____

Measures Taken to Minimize Reoccurrence of Incident:_____
_____
_____
_____
_____
_____

Supervisor's Signature: _____

Definitions:

Exposure Incident: a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that result from the performance of an employee's duties.

Engineering Controls: controls (e.g., sharps, disposal containers, self-sheathing needles) that isolate or remove the bloodborne pathogens hazard from the workplace.

Work Practice Controls: controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).

Personal Protective Equipment is specialized clothing or equipment worn by an employee for protection against a hazard. General work clothes not intended to function as protection against a hazard are <u>not</u> considered to be personal protective equipment.

# HEALTH AND SAFETY PLAN ACCEPTANCE FORM

**<u>INSTRUCTIONS</u>: This form is to be completed by each PSC employee to work on the subject project work site.**

Project Name: _____

Project Number: _____

I represent that I have read and understand the contents of the above Plan and agree to perform my work in accordance with it.

| **Name (print)** | **Signature** | **Date** |
|---|---|---|
| | | |
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**PHILIP SERVICES CORPORATION**

**SUPERVISOR'S ACCIDENT/INJURY INVESTIGATION REPORT**

ACCIDENT TYPE: INJURY _____ VEHICLE _____ PROPERTY _____ NEAR MISS _____

NAME OF INJURED PERSON:
_____

DEPARTMENT TO WHICH INJURED PERSON IS ASSIGNED:
_____

LENGTH OF EMPLOYMENT:
_____

LENGTH OF TIME ON JOB ON WHICH PERSON WAS INJURED:
_____

LOST TIME: YES: _____ NO: _____

DATE OF ACCIDENT:_____ DATE INJURY REPORTED:
_____

TIME OF ACCIDENT: _____ AM OR PM DAY OF WEEK:
_____

DOCTOR TREATED: _____ FIRST AID ONLY:
_____

NAME OF HOSPITAL OR CLINIC:
_____

EXACT LOCATION AT WHICH ACCIDENT OCCURRED:
_____

SUPERVISOR OF INJURED EMPLOYEE:
_____

WITNESS:
_____

WAS THE SCENE OF THE ACCIDENT INVESTIGATED BEFORE COMPLETING THIS REPORT?

YES: _____ NO: _____

EMPLOYEE'S DESCRIPTION OF ACCIDENT AND SUPERVISOR'S COMMENTS:

**Body Part Affected**

_____ Head, Face
_____ Eye(s) R L
_____ Neck, Shoulder
_____ Arms, Elbows R L
_____ Wrist, Hands R L
_____ Thumbs, Fingers R L
_____ Back
_____ Chest, Lower Trunk
_____ Ribs
_____ Hips
_____ Legs/Knee R L
_____ Foot/Toes R L

**Type of Injury**

_____ Burn
_____ Cut
_____ Strain, Sprain
_____ Fracture
_____ Amputation
_____ Bruise
_____ Foreign Body
_____ Abrasion
_____ Glass Cut
_____ Other

**DESCRIBE UNSAFE ACT OR UNSAFE CONDITION INVOLVED.** IDENTIFY BY CHECKING (8) APPROPRIATE LINES BELOW. **CHECK ALL UNSAFE ACTS INVOLVED (CHECK ONE OR MORE).**

_____ Working without Authority
_____ Assuming Hazardous Position
_____ Failure to Lock Out Equipment
_____ Making Safety Devices Inoperative
_____ Unsafe Piling of Materials
_____ Unsafe Material Handling
_____ Horseplay
_____ Using Improper Tools/Appliances
_____ Violation of Instructions
_____ Failure to use Personal Protective Equipment
_____ Failure to Follow Safety Rules
_____ Other

**CHECK ALL UNSAFE CONDITIONS INVOLVED (CHECK ONE OR MORE).**

_____ Improperly Guarded Equipment
_____ Improper Illumination
_____ Failure of Machinery, Equipment or Materials
_____ Equipment Not Locked Out
_____ Poor Housekeeping
_____ Other

**CHECK SPECIFIC INJURY CAUSES (ONE OR MORE).**

_____ Struck by Falling Objects
_____ Slipping, Tripping, Falling

_____ Struck by Splashing Material
_____ Struck Against Material
_____ Caught in Equipment
_____ Struck Against Stationary Object or Equipment
_____ Struck Against Moving Object or Equipment
_____ Caught Between Material
_____ Caught Between Equipment
_____ Caught Between Material & Equipment
_____ Exploding Container
_____ Struck by Tool or Equipment
_____ Struck by Flying Object
_____ Struck Against Tool
_____ Fire
_____ Caught Between Tool
_____ Caught Between Tool & Equip
_____ Other

_____
_____

**AS A SUPERVISOR, WHAT CORRECTIVE ACTION DO YOU RECOMMEND OR HAVE YOU TAKEN TO PREVENT A RECURRENCE OF THIS INJURY**?_____
_____
_____

DATE OF REPORT:
_____

SUPERVISOR:
_____

PLANT MANAGER:
_____

SAFETY DEPARTMENT:
_____

**PHILIP SERVICES CORPORATION**
**SAFETY MEETING RECORD**

## GENERAL INFORMATION

PERSON CONDUCTING MEETING _____

LOCATION/DEPARTMENT _____

DATE _____ TIME____TO____NUMBER ATTENDING _____

## MEETING CONTENT

WHAT WERE THE TOPICS? _____

WHY WERE THESE TOPICS CHOSEN? _____
_____
_____

WHAT VISUAL AIDS, IF ANY, WERE USED? _____
_____

WHAT SIGNIFICANT QUESTIONS OR CONCERNS WERE EXPRESSED?
_____
_____
_____
_____

FOLLOW UP RECOMMENDATIONS _____
_____
_____

## SAFETY MEETING ATTENDANCE RECORD

| PLEASE PRINT NAME | EMPLOYEE NUMBER |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

**SUBCONTRACTOR STATEMENT OF COMPLIANCE FORM**

This is to confirm that the employees listed below are qualified by virtue of training and experience to engage in field activities at _____ _____ located in _____, _____, in connection with the applicable Subcontract Agreement between Philip Services and _____ dated _____, 19____. Further, all said employees have been determined to be properly trained and medically fit to perform those activities prescribed by said subcontract and to use the respiratory protective equipment necessary to perform the job safely in accordance with 29 CFR 1910 and 1926 and any other Federal, State, or local requirements.

Employee Names

1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

4. _____ 9. _____

5. _____ 10. _____

_____

Name of Subcontractor

_____

Signature of Authorized Subcontractor Representative

_____

Printed Name of Authorized Subcontractor Representative

## UNIVERSAL PRECAUTIONS FOR BLOODBORNE PATHOGENS

"Universal Precautions" Universal Precautions is an approach to infection control in which all human blood and certain human body fluids are treated as if known to be infectious for human immunodeficiency virus (HIV), hepatitis B virus (HBV) and other bloodborne pathogens.

How is HIV Transmitted?

1. Sexual intercourse with an infected person.
2. Direct blood-to-blood transfer (e.g., sharing intravenous needles with an infected person, transfusion with infected blood or blood products).
3. Infected mother to unborn child.

**HIV and HBV ARE NOT TRANSMITTED THROUGH CASUAL CONTACT**.

What body fluids are important with Universal Precautions?

1. Blood and any body fluid that is visibly contaminated with blood.
2. Semen, vaginal secretions, cerobrospinal fluid (around brain and spinal column), synovial fluid (joints), pleural fluid (lungs), pericardial fluid (heart), peritoneal fluid (abdomen), amniotic fluid (fetus in womb), saliva in dental procedures.
3. Concentrated HIV or HBV (in the laboratory or research setting).

What are the principles of Universal Precautions?

1. "Barrier". Use appropriate barrier precautions to prevent skin and mucous membrane exposure to infectious body fluids. These may include: gloves (latex or vinyl), masks, goggles, gowns or aprons. Gloves should be worn for any contact with blood or infectious body fluids. Change gloves if they are torn. Do not reuse single-use gloves. Utility gloves may be disinfected and reused. Pocket masks for performing rescue breathing/CPR may be used. Some masks may be disinfected and reused.

2. "Wash Hands". Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids. Soap and water or antiseptic hand cleanser should be used. Wash hands immediately after removing gloves.

3. "Prevent Injuries". Put used needles and sharp instruments directly into puncture-resistant containers that are readily available. Never re-cap, bend or break a needle by hand.

4. **"Clean Up". Any surface or object that is contaminated with blood or infectious body fluids should be cleaned promptly. Decontaminate surfaces with an appropriate disinfectant. Household bleach mixed at a ratio of 1 part bleach to 100 parts water (one quarter cup bleach in one gallon water) is recommended. Thoroughly wash and disinfect reusable items or instruments. Dispose of infectious waste by placing in closable, leakproof containers. Infectious waste for disposal should be clearly labeled "BIOHAZARD". Disposal is according to applicable federal, state and local regulations.**

**UTILITIES AND STRUCTURES CHECKLIST**

Project: _____ Prepared by: _____
Location: _____ Date: _____

**Instructions**: This checklist has to be completed by a Philip Services staff member as a safety measure to ensure that all underground utility lines, other underground structures as well as above-ground power lines are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED**. Arrangements for underground utility markouts are best made at the time of the preliminary site visit to allow client and/or utility company sufficient time. Keep completed checklist and maps onsite; send copy to Project Manager.

Client Approval: Client is responsible for having underground utilities and structures located and marked. Preferably, the utilities themselves should mark out the lines.

Name:
_____
Signature:_____
__
Date:
_____

**Drilling or Excavation Sites**: Attach a map of the property showing the proposed drilling or excavation site (or if sites are widely separated, several maps) clearly indicating the area(s) checked for underground utilities or underground structures and the location of above-ground power lines.

**UTILITIES AND STRUCTURES**

| TYPE | NOT PRESENT | PRESENT | MARKED [1] |
|---|---|---|---|
| | | | |
| Petroleum product line | | | |
| Natural gas line | | | |
| Steam line | | | |
| Water line | | | |
| Sewer line | | | |
| Storm drain | | | |
| Telephone cable | | | |
| Electric power line | | | |
| Product tank | | | |
| Septic tank/drain field | | | |
| Overhead power line | | | |

[1] Flags, paint on pavement, wooden stakes, etc.

Name and affiliation of person who marked out underground lines or structures.

_____ _____
_____
**(Name)** **(Organization)** **(Phone)**

**Emergency Procedures**
Person at site or facility to contact in case of emergency:

1. _____ Phone:
_____

2. _____ Phone: _____

Fire Department Phone: _____ Ambulance Phone: _____

Utility Phone: _____ Utility Phone: _____

Directions to nearest hospital (describe on back or attach map).

**PHILIP SERVICES CORPORATION**
**AIR MONITORING DATA FORM**

PROJECT NAME: _____ INSTRUMENT USED: _____
PROJECT NUMBER: _____ SAMPLES BY: _____
DATE: _____ CALIBRATION DATE: _____

FIELD ACTIVITIES:
_____
____

BACKGROUND LEVEL: _____ LOCATION: _____

| SAMPLE NUMBER | TIME | DURATION (MINUTES) | LOCATION | READING (PPM) | COMMENTS |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

**PHILIP SERVICES CORPORATION**
**EQUIPMENT CALIBRATION LOG FORM**

PROJECT NAME: _____ INSTRUMENT: _____
PROJECT NUMBER: _____ SERIAL NUMBER: _____

| DATE | CALIBRATED BY | HOURS USED | CALIBRATION STANDARD * | INITIAL READING * | CORRECTED READING * | BATTERY CHECK (Y/N) | MAINTENANCE AND REPAIR |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

*Specify Units

# *ERRATA Document for the 08/12/02 Revised Inhalation Pathway Interim Measures Work Plan*

**Philip Services Corporation**
**Georgetown Facility**
**Seattle, Washington**

**September 17, 2002**

**Prepared by:**


**FOSTER WHEELER ENVIRONMENTAL CORPORATION**
**12100 NE 195th Street,**
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**PIONEER TECHNOLOGIES CORPORATION**
**2612 Yelm Hwy, SE – Suite B**
**Olympia, WA 98501**

**PHILIP SERVICES CORPORATION**
**955 Powell Avenue, SW**
**Renton, WA 98055**

RE: Errata Document for the
Philip Services Corporation – Georgetown Facility
Revised Inhalation Pathway Interim Measures Work Plan
Ecology/EPA ID#: WAD 00081 2909

The purpose of this Errata document is to respond/incorporate the Washington State Department of Ecology's (Ecology) comments (dated September 12, 2002) on the Revised Inhalation Pathway Interim Measures Work Plan (IPIMWP). As noted in the comment letter, the August 12, 2002 Revised IPIMWP was approved by Ecology with the changes and are presented first followed by PSC's response.

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| 1 | **Ecology's Comment/Condition:** Page 1-1. The last sentence of the second paragraph is replaced to read:<br><br>"Vapor intrusion is evaluated…(MTCA), pursuant to WAC 173-340-350, 173-340-720(1)(c), 173-340-720(1)(d)(iv), and 173-340-750."<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 1-1. The last sentence of the second paragraph is replaced to read:<br><br>"Vapor intrusion is evaluated…(MTCA), pursuant to WAC 173-340-350, 173-340-720(1)(c), 173-340-720(1)(d)(iv), and 173-340-750." |
| 2 | **Ecology's Comment/Condition:** Page 3-3. The "Note" discussing the Stone, Drew, Ashe, and Jones building is modified to:<br><br>"Note: The SDAJ building is currently being evaluated under a separate IPIM work plan and will not be included in the GIVF study."<br><br>*rationale: Ecology agrees that the SDAJ building has already been assessed and targeted for an IPIM. PSC's rationale for not including the building in the GIVF study, or tiered process, is unnecessary.*<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 3-3. The "Note" discussing the Stone, Drew, Ashe, and Jones building is modified to: |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | "Note: The SDAJ building is currently being evaluated under a separate IPIM work plan and will not be included in the GIVF study." |
| 3 | **Ecology's Comment/Condition:** Page 3-3. The paragraph beginning with "There are locations outside of Study Area 1…" is replaced to read:<br><br>"There are locations outside of Study Area 1 that are located over groundwater with elevated levels of volatile COPCs. Two such locations are:<br>"These locations are not included in the GIVF study, but will be included in the tiered process described in this Work Plan. Building owners and occupants at these locations will be notified if potential risks/hazards are found to be unacceptable. PSC intends, however, to submit a separate plan that will define the process for identifying additional (i.e., non-PSC) sources of groundwater contamination in certain downgradient areas west of 4th Avenue S. One of the objectives…from the facility. It is possible that…might be primarily contributed from a source other than PSC. If Ecology agrees that releases from the PSC facility are not the cause of unacceptable risks/hazards, or potentially unacceptable risks/hazards, associated with indoor air exposure at particular buildings, PSC does not intend to propose IPIMs.<br><br>*rationale: PSC included language here suggested by Ecology on 7/3/02. However, based on EPA and Washington State Department of Health comments (September 3, 2002; see enclosure), and re-consideration of the suggested language, Ecology concludes that all locations within the affected area should be processed through the decision tree's tiered approach. Based on our September 6, 2002,meeting, this was apparently PSC's intention in any case.*<br><br>**PSC's Response/Action:** Comment Accepted.<br><br>**Errata:** Page 3-3. The paragraph beginning with "There are locations outside of Study Area 1…" is replaced to read:<br><br>"There are locations outside of Study Area 1 that are located over groundwater with elevated levels of volatile COPCs. Two such locations are:<br>"These locations are not included in the GIVF study, but will be |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | included in the tiered process described in this Work Plan. Building owners and occupants at these locations will be notified if potential risks/hazards are found to be unacceptable. PSC intends, however, to submit a separate plan that will define the process for identifying additional (i.e., non-PSC) sources of groundwater contamination in certain downgradient areas west of 4th Avenue S. One of the objectives…from the facility. It is possible that…might be primarily contributed from a source other than PSC. If Ecology agrees that releases from the PSC facility are not the cause of unacceptable risks/hazards, or potentially unacceptable risks/hazards, associated with indoor air exposure at particular buildings, PSC does not intend to propose IPIMs. |
| 4 | **Ecology's Comment/Condition:** Page 3-5. Perhaps PSC's intent was for the Work Plan to imply that all GIVFs calculated using non-detected indoor air results would be *flagged* in some manner in the Technical Memorandum. In any case, this is Ecology's expectation.<br><br>**PSC's Response/Action:** Values in the data tables will be flagged with a footnote.<br><br>**Errata:** Values in the data tables in the Technical Memorandum will be flagged with a footnote. |
| 5 | **Ecology's Comment/Condition:** Page 3-6. The last paragraph (including all of "A" on this page and the next) is replaced to read:<br><br>"The analytical data collected…samples were collected. Steps 1 through 4 of Section 3.5.3 will be followed to determine if the location should proceed to Tier 4:"<br><br>*rationale: Section 3.5.3 describes how the Tier 3 evaluation will proceed. It is less confusing to the reader if he/she is directed to one explanation of the evaluation.*<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 3-6. The last paragraph (including all of "A" on this page and the next) is replaced to read: |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | "The analytical data collected…samples were collected. Steps 1 through 4 of Section 3.5.3 will be followed to determine if the location should proceed to Tier 4:" |
| 6 | **Ecology's Comment/Condition:** Page 3-9. PSC discusses a method for adjusting indoor air results here that has been previously discussed with Ecology, and which, in part at least, the agencies have concurred with. However, there are two concerns that must be emphasized in the Department's approval of this part of the Work Plan: (1) using an indicator of central tendency for selection of a background concentration of indoor air will likely result in assigning background levels at a number of Georgetown buildings that are higher than the actual concentrations. This source of uncertainty must be factored into decisions related to whether specific buildings should undergo further evaluation or be targeted for interim actions. It must also be considered during the Remedial Investigation Report as part of the determination of whether the interim measures conducted to date are sufficiently conservative to serve as final remedial measures; and, (2) the databases PSC uses for selecting background concentrations must be approved by Ecology. Our approval will be based primarily on how well the chosen background data represents background conditions likely to exist in Georgetown buildings in the affected area.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 3-9. PSC discusses a method for adjusting indoor air results here that has been previously discussed with Ecology, and which, in part at least, the agencies have concurred with. However, there are two concerns that must be emphasized in the Department's approval of this part of the Work Plan: (1) using an indicator of central tendency for selection of a background concentration of indoor air will likely result in assigning background levels at a number of Georgetown buildings that are higher than the actual concentrations. This source of uncertainty must be factored into decisions related to whether specific buildings should undergo further evaluation or be targeted for interim actions. It must also be considered during the Remedial Investigation Report as part of the determination of whether the interim measures conducted to date are sufficiently conservative to serve as final remedial measures; and, (2) the databases PSC uses for selecting background concentrations must be |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | approved by Ecology. Our approval will be based primarily on how well the chosen background data represents background conditions likely to exist in Georgetown buildings in the affected area. |
| 7 | **Ecology's Comment/Condition:** Perhaps PSC's intent was for the Work Plan to imply that based on the results of new geotech sampling and analysis, soil properties used in calculating GIVFs may differ from those provided in Table 3-4. In any case, this is Ecology's expectation.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** The results from the Geotech samples will be used to determine the most appropriate parameters for the JE Modal presented in Table 3-4. |
| 8 | **Ecology's Comment/Condition:** Footnotes 13 and 16 (to Pages 3-12 and 3-13). Based on EMAIL discussions between Marcia Bailey (EPA) and PSC's consultants, footnote 13 is replaced with the following:<br><br>"PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: if any of the segregated HIs are greater than 1, then the building will be proposed for Tier 3 or 4. If all of the segregated HIs are less than 1, then the building will not be evaluated further until the next round of groundwater sampling. Segregation of hazard quotients will be done only with the chemical-specific prior approval of Ecology."<br><br>Footnote 16 is replaced with:<br><br>"PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will not be evaluated further until the next round of groundwater sampling. |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | Segregation of hazard quotients will be done only with the chemical-specific prior approval of Ecology."<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Footnotes 13 and 16 (to Pages 3-12 and 3-13). Based on EMAIL discussions between Marcia Bailey (EPA) and PSC's consultants, footnote 13 is replaced with the following:<br><br>"PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: if any of the segregated HIs are greater than 1, then the building will be proposed for Tier 3 or 4. If all of the segregated HIs are less than 1, then the building will not be evaluated further until the next round of groundwater sampling. Segregation of hazard quotients will be done only with the chemical-specific prior approval of Ecology."<br><br>Footnote 16 is replaced with:<br><br>"PSC will evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HIs then the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, then the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, then the building will not be evaluated further until the next round of groundwater sampling. Segregation of hazard quotients will be done only with the chemical-specific prior approval of Ecology." |
| 9 | **Ecology's Comment/Condition:** Page 3-15. The sentence prior to Step 1. is footnoted (i.e., a new footnote is introduced) as follows:<br><br>"the following assumes that indoor air samples are taken as part of a Tier 3 Evaluation. If, in Tier 3, groundwater is sampled for the purpose of re-calculating CEFs for a particular location, procedures described in section 3.5.1 (*Tier 1*…) will be followed." |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | *rationale: the added language clarifies that the following steps assume that indoor air samples are collected in these Tier 3 evaluations.*<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 3-15. The sentence prior to Step 1. is footnoted (i.e., a new footnote is introduced) as follows:<br><br>"the following assumes that indoor air samples are taken as part of a Tier 3 Evaluation. If, in Tier 3, groundwater is sampled for the purpose of re-calculating CEFs for a particular location, procedures described in section 3.5.1 (*Tier 1*…) will be followed." |
| 10 | **Ecology's Comment/Condition:** Page 4-2. Footnote 19 is replaced by:<br><br>"For Tier 3 Evaluations where indoor air measurements are conducted, the concentrations of COPCs not detected at the reporting limit will be assigned the value of ½ the reporting level. These assigned concentrations will be used to calculate CEFs per location. However, while it is PSC's intention to use methods which will result in appropriately low detection limits, it is not PSC's plan at this time to propose locations for Tier 4 if the resulting CEF or HI exceeds 10 or 1, respectively, due to the contribution from non-detected constituents."<br><br>*rationale: non-detected **COPCs** should be assigned a value of DL/2. While Ecology does not expect PSC to design and implement IMs based on risks/hazards associated with NDs, it is not sufficiently conservative to state that NDs will "not be evaluated further."*<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 4-2. Footnote 19 is replaced by:<br><br>"For Tier 3 Evaluations where indoor air measurements are conducted, the concentrations of COPCs not detected at the reporting limit will be assigned the value of ½ the reporting level. These assigned concentrations will be used to calculate CEFs per location. However, while it is PSC's intention to use methods which will result in appropriately low detection limits, it is not PSC's plan at this time to |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | propose locations for Tier 4 if the resulting CEF or HI exceeds 10 or 1, respectively, due to the contribution from non-detected constituents." |
| 11 | **Ecology's Comment/Condition:** Page 4-4. The last two sentences of the first paragraph of F are replaced by:<br><br>"The highest groundwater COPC concentrations, clearly linked to releases from the facility, are located in this area. PSC is also sampling when the groundwater concentrations and volatilization factors should be highest."<br><br>*rationale: the new text is more accurate in the sense that some COPC concentrations outside the study area are actually higher than those within it. In addition, while we hope that "the most susceptible buildings" are being included in the study, there is little confidence in this assumption. It is perhaps more correct to assume that the most susceptible **types** of buildings are included in the GIVF study area.*<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** Page 4-4. The last two sentences of the first paragraph of F are replaced by:<br><br>"The highest groundwater COPC concentrations, clearly linked to releases from the facility, are located in this area. PSC is also sampling when the groundwater concentrations and volatilization factors should be highest." |
| 12 | **Ecology's Comment/Condition:** Page 4-6. The first sentence of the second paragraph under "L" is replaced to read:<br><br>"As noted in "F" above, PSC has previously collected geotechnical samples in the affected area, and will collect additional samples pursuant to the GIVF study."<br><br>*rationale: PSC included language suggested by Ecology on 7/3/02. However, based on a re-consideration of this particular sentence, Ecology believes the clarity of the Work Plan language will be improved by the modification.*<br><br>**PSC's Response/Action:** Agreed. |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | **Errata:** Page 4-6. The first sentence of the second paragraph under "L" is replaced to read:<br><br>"As noted in "F" above, PSC has previously collected geotechnical samples in the affected area, and will collect additional samples pursuant to the GIVF study." |
| 13 | **Ecology's Comment/Condition:** Pages 5-1 and 2. Perhaps it is implied in the text, but Ecology expects that Technical Memorandum 1 (submitted on/before November 27, 2002) will include PSC's proposals for those locations which should undergo Tier 3 assessment and those that appear to require Tier 4 measures.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** The Technical Memorandum (submitted on/before November 27, 2002) will include PSC's proposals for those locations which should undergo Tier 3 assessment and those that appear to require Tier 4 measures. |
| 14 | **Ecology's Comment/Condition:** Figure 2-1. This figure does not show the locations actually sampled. A new figure, representing the locations PSC sampled, should be prepared and submitted to Ecology.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** A revised Figure 2-1 is attached to this Errata document. |
| 15 | **Ecology's Comment/Condition:** Table 3-1. This table does not show the locations actually sampled. A new table, listing the locations PSC sampled, should be prepared and submitted to Ecology.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** A revised Table 3-1 is attached to this Errata document. |
| 16 | **Ecology's Comment/Condition:** Table 3-3. This table is qualified as "draft." A new table with complete footnotes (the August 12 table's |

**Table 1 – Ecology's Changes/Conditions Required for Ecology's Approval of the August 12, 2002 Revised Inhalation Pathway Interim Measures Work Plan**

| Ecology Comment Number | Ecology's Comment/Conditions with PSC's Response |
|---|---|
| | footnotes run off the page at the right margin), should be prepared and submitted to Ecology.<br><br>**PSC's Response/Action:** Agreed.<br><br>**Errata:** A revised Table 3-3 is attached to this Errata document. |

# Figure 2-1
## GIVF Study Area

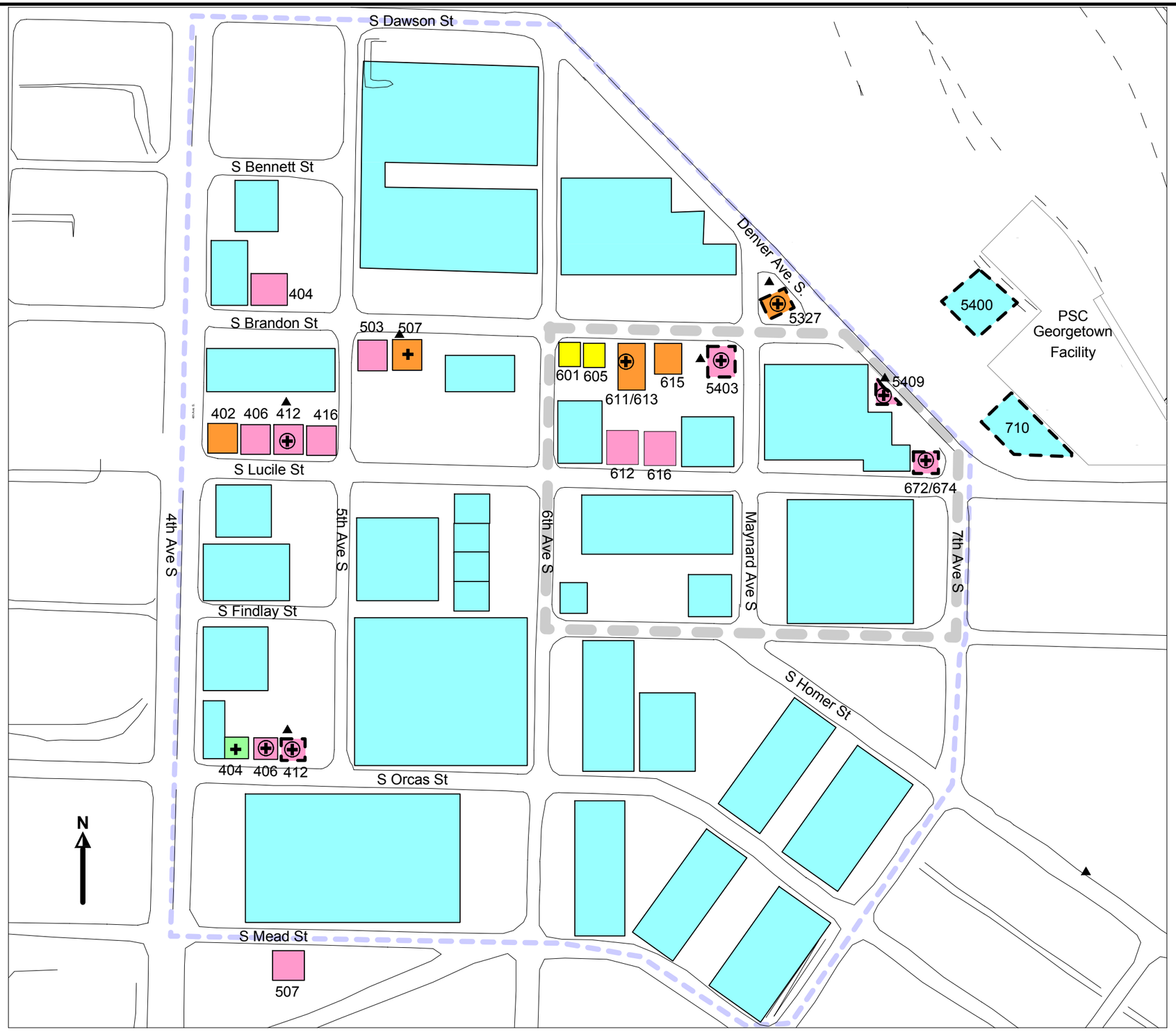



Figure not to scale

- Commercial Building
- Residence Type Building with Basement
- Residence Type Building on Slab
- Residence Type Building with Crawl Space
- Residence Type Building with unknown foundation
- Previous Indoor Air Sampling Location
- August 2002 GIVF Indoor Air Sample Location
- August 2002 GIVF Indoor Air and/or Basement/ Crawl Space Sample Location
- August 2002 GIVF Ambient Air Sample Location
- Area for GIVF Evaluation
- Contingency Area for GIVF Evaluation

**Table 3-1**
August 2002 GIVF Indoor Air Sampling Locations

| Location | Building Foundation Type |
|---|---|
| 507 S. Brandon | Residence - with crawl space |
| 613 S. Brandon (and 611 crawl space) | Residence - with crawl space |
| 5403 S. Maynard | Residence - with basement |
| 412 S. Lucile | Residence - with basement |
| 672 S. Lucile | Residence - with basement |
| 5409 Denver | Residence - with basement |
| 5327 Denver | Residence - with crawl space |
| 404 Orcas | Residence - on slab |
| 406 Orcas | Residence - with basement |
| 412 Orcas | Residence - with basement |

**Table 3-3**
Typical Indoor Air Concentrations and Average Urban Ambient Air Concentrations of COPCs

| CAS Number | Analyte Name | Typical Indoor Air Concentrations in Residences ($\mu g/m^3$) | Reference(s) | Average Urban Ambient Air Concentrations[a,b] ($\mu g/m^3$) |
|---|---|---|---|---|
| 71-55-6 | 1,1,1-Trichloroethane | 14-24, 21-22.1, 271, 5-20 | 1, 2, 3, 5 | 2.20 |
| 75-34-3 | 1,1-Dichloroethane | 8, 0.6-1.1 | 2, 6 | 0.05 |
| 75-35-4 | 1,1-Dichloroethylene | <0.2, 79.26 | 1, 3 | 0.00 |
| 95-63-6 | 1,2,4-trimethylbenzene | 2.87, 2.87, 5-20 | 3, 4, 5 | 5.00 |
| 107-06-2 | 1,2-Dichloroethane | <0.8, 0.39 | 1, 3 | 0.05 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 4.57, 4.57, 2-5 | 3, 4, 5 | 1.00 |
| 108-10-1 | 2-Hexanone (MIBK as surrogate) | - | - | - |
| 71-43-2 | Benzene | 0.28-16.4, 11.5-18.7, 16.76, 10-20, 20 | 1, 2, 3, 5, 6 | 5.88 |
| 75-00-3 | Chloroethane | - | - | 0.28 |
| 67-66-3 | Chloroform | 4.13, 4.1, 3-15 | 3, 4, 5 | 0.30 |
| 156-59-2 | cis-1,2-Dichloroethylene | 41 | 6 | 0.20 |
| 100-41-4 | Ethylbenzene | 5.02-6.64, 8.3-11.1, 12.74, 10-20, 4.4 | 1, 2, 3, 5, 6 | 2.72 |
| 91-20-3 | Naphthalene | 2-5 | 5 | - |
| 103-65-1 | n-Propylbenzene | 0.649, 2-6 | 3, 5 | 0.83 |
| 99-87-6 | p-Isopropyltoluene | - | - | - |
| 135-98-8 | sec-Butylbenzene | - | - | 0.27 |
| 127-18-4 | Tetrachloroethylene | 2.27-6.72, 6.6, 21.07, 5-20, 10 | 1, 2, 3, 5, 6 | 2.55 |
| 108-88-3 | Toluene | 2.67, 28.3, 65-150, 27-62 | 3, 4, 5, 6 | 11.04 |
| 79-01-6 | Trichloroethylene | 0.63-3.97, 5-20 | 1, 5 | - |
| 156-60-5 | trans-1,2-Dichloroethylene | 7.358, 41 | 3, 6 | 1.12 |
| 75-01-4 | Vinyl chloride | <40 | 1 | 0.00 |

References:


[1] California Air Resources Board. Toxic Contaminant Fact Sheets. Available URL: www.arb.ca.gov/toxics/tac

[2] Guerin M.R., R.A. Jenkins , and B.A. Tompkins. *The Chemistry of Environmental Tobacco Smoke: Composition and Measurement* . CRC Press. p. 385-415. 2000.

[3] Shah, Jitendra J. and Emily K. Heyerdahl. *National Ambient Volatile Organic Compounds (VOCs) Data Base Update* . EPA/600/3-38/010a. March 1988.[e]

[4] Shah, Jitendra J. and Hanwant B. Singh. *Distribution of Volatile Organic Chemicals in Outdoor and Indoor Air* . Environmental Science Technology, Vol 22, No 12. 1998.

[5] Travis, Curtis (Editor-in-Chief). *Risk Analysis* , Vol 10, No 1. March 1990.[f]

[6] United States Environmental Protection Agency (EPA). *Report to Congress on Indoor Air Quality, Volume II:* Assessment and Control of Indoor Air Pollution. EPA/400/1-89/001C. August 1989.


Notes:

This table is preliminary, and these are not the screening values that will be used. This table will be replaced with a new table that will be presented to Ecology in Tech Memo 1.

'-' symbol corresponds to chemical concentrations that were not found in readily-available literature

[a] Concentration values from Shah and Heyerdahl, 1988

[b] Concentration values are for ambient (outdoor) air in urban areas

[c] Concentration values are for diesel exhaust; range is for office buildings to industrial plants and inside vehicles (average of enclosed environments is 2.1 mg/m3)

[d] Concentration value range is derived from median in-vehicle values for individual components of gasoline vapors, including isopentane, n-butane, n-pentane, toluene, m-/p-xylene, 1,2,4-trimethylbenzene, 1,3-butadiene, and benzene

[e] Concentration values include average daily indoor concentration for all site types (i.e., urban, rural, remote, etc.)

[f] Range of values includes concentrations from the 50th to 90th percentiles

# Appendix B

# *Revised Inhalation Pathway Interim Measure*

# *Technical Memorandum I*

# *Development of GIVFs, Evaluation of Tier 3 Data from GIVF Study, and Evaluation of 2nd Quarter 2002 Groundwater Data*

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**February 2003**

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# REVISED INHALATION PATHWAY INTERIM MEASURE TECHNICAL MEMORANDUM I

# DEVELOPMENT OF GIVFs, EVALUATION OF TIER 3 DATA FROM GIVF STUDY, AND EVALUATION OF 2ND QUARTER 2002 GROUNDWATER DATA

## Georgetown Facility

## Seattle, Washington


Prepared by

FOSTER WHEELER

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&


February 2003

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 1,1-DCA | 1,1-dichloroethane |
| 1,1-DCE | 1,1-dichloroethene |
| 1,1,1-TCA | 1,1, trichloroethane |
| 1,2-DCA | 1,2-Dichloroethane |
| trans1,2-DCE | trans-1,2-dichloroethene |
| µg/L | micrograms per liter |
| AC | attenuation coefficient |
| AF | adjustment factor |
| AOI | area of impact |
| ASTM | American Society for Testing and Materials |
| bgs | below ground surface |
| CARB | California Air Resources Board |
| CCEF | cancer cumulative exceedance factor |
| CEF | cumulative exceedance factor |
| cis1,2-DCE | cis-1,2-dichloroethene |
| COPC | chemicals of potential concern |
| DQO | data quality objective |
| Ecology | Washington State Department of Ecology |
| EF | exceedance factor |
| EPA | U.S. Environmental Protection Agency |
| EQM | Environmental Quality Management |
| FS | Feasibility Study |
| GC/MS | gas chromatography/mass spectrometry |
| GIVF | groundwater –to-indoor air volatilization factor |
| GTMOD | Georgetown Facility Permit Modification |
| HHERA | Human Health and Ecological Risk Assessment |
| HI | hazard index |
| IDW | inverse distance weighting |
| IM | interim measure |
| IPIM | inhalation pathway interim measure |
| IPIMAL | inhalation pathway interim measure action level |
| JEM | Johnson-Ettinger Model |

## ACRONYMS AND ABBREVIATIONS (continued)

| | |
|---|---|
| MRL | method reporting limit |
| MQL | method quantitation limit |
| MTCA | Model Toxics Control Act |
| NCEF | non-cancer cumulative exceedance factor |
| NHEXUS | National Human Exposure Assessment Survey |
| PCAMP | Pre-corrective Action Monitoring Program |
| PID | photoionization detector |
| PSC | Philip Services Corporation |
| QAPP | Quality Assurance Project Plan |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RPD | Relative Percent Difference |
| RFI | RCRA Facility Investigation |
| SAP | Sampling and Analysis Plan |
| SIM | selected ion monitoring |
| TC | target compound |
| TCE | trichloroethene |
| UCL | upper confidence limit |
| USCS | United States Conservation Service |
| USDA | United States Department of Agriculture |
| VC | vinyl chloride |
| VOC | volatile organic compound |
| VVOC | very volatile organic compound |
| WAC | Washington Administrative Code |
| WDOH | Washington State Department of Health |

# ES–1 INTRODUCTION

This report presents the results of Inhalation Pathway Interim Measure (IPIM) Technical Memorandum #1 investigations conducted at the Philip Services Corporation (PSC) Georgetown facility, located at 734 South Lucile Street, Seattle, Washington. PSC is conducting corrective action at this facility per requirements contained in its Resource Conservation and Recovery Act (RCRA) hazardous/dangerous waste permit. The IPIM Work Plan investigations were conducted by PSC, Foster Wheeler Environmental Corporation and PIONEER Technologies Corporation, under contract to PSC.

## ES–1.1 PURPOSE

The purpose of this IPIM Technical Memorandum (Tech Memo) is to present the results of the program performed under the IPIM Work Plan, which was developed to determine whether or not residents and workers in the vicinity of the Georgetown facility are being exposed to concentrations of chemicals in indoor air, associated with releases from the facility to groundwater, that are above levels of concern. On June 28, 2001, the U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) issued a letter requesting that PSC design and implement immediate interim measures (IMs) to provide hydraulic control of the impacted groundwater emanating from the facility and to control human exposures to impacted groundwater in any area where exposure may be occurring. These IMs are focused primarily on addressing vapor intrusion to buildings from groundwater.

In response to the June 28 letter and numerous subsequent meetings with EPA and Ecology, PSC developed the IPIM Work Plan detailing the approach for evaluating and addressing the inhalation pathway. The approach consisted of two steps: 1) develop site-specific groundwater to indoor air volatilization factors (GIVFs) that represent the relationship of concentrations of volatile organic compounds (VOCs) in groundwater and concentrations in indoor air and 2) use the GIVFs and other data developed in Step 1 to determine, via the IPIM Decision Tree, if indoor air concentrations of VOCs would potentially be above levels of concern. The IPIM Decision Tree is a tiered approach for evaluating locations west-southwest of the Georgetown facility on a quarterly basis at least until a final remedy for the site is implemented (Figure ES-1).

## ES–1.2 DEVELOPMENT OF GIVFS AND IPIMALS

### ES–1.2.1 Sampling Overview

Two study areas were identified in the IPIM Work Plan: 1) Area 3, the area west of Denver Avenue that was defined in the Draft Human Health and Ecological Risk Assessment (HHERA) previously submitted by PSC and 2) a subset of Area 3 called the GIVF Study Area, which is located west and southwest of the facility and known to be impacted by VOCs in the shallow aquifer emanating from the facility (Figure ES-2). Co-located indoor air, ambient air, groundwater and soil gas samples were collected from 10 building locations in the GIVF Study Area (see Figure ES-3) and were analyzed for the chemicals of potential concern (COPCs) identified in the Draft HHERA. The results of these chemical analyses were used to develop GIVFs for target compounds (TCs), which are the subset of COPCs considered the most reliable tracers for representing volatilization from groundwater to indoor air.

### ES–1.2.2 Development of GIVFs

Prior to calculating TC-specific GIVFs, and in accordance with the IPIM Work Plan, indoor air sampling results for TCs were adjusted for contributions from background by subtracting the maximum of either: 1) the chemical concentration detected in ambient air, likely to have infiltrated the building or 2) the median or mean of the 25th and 75th percentiles from national background indoor air sources, compiled from peer-reviewed literature values. Review of the ambient air concentrations measured in the Georgetown neighborhood showed that in many cases, ambient air concentrations were higher than measured indoor air concentrations and were above levels of concern for human health. Locations at which this occurred were subsequently not used in the GIVF calculations.

TC-specific GIVFs were calculated by dividing the measured indoor air concentration by the co-located groundwater concentration for each TC and building location (Table ES-1). To help evaluate the uncertainty of these empirical predictions of indoor air quality, PSC also calculated GIVFs using the Johnson-Ettinger Model (JEM). Recommended for use by EPA and Ecology, the JEM is an analytical tool for modeling contaminant partitioning and subsurface vapor transport into buildings based on chemical- and site-specific properties. Because the physical characteristics of subsurface soil above the water table through which vapor migration occurs are important factors in determining how readily contaminants can migrate from groundwater to indoor air, the JEM model was applied using three different

subsurface conditions: (1) conservative parameters for maximum migration (Upper Boundary), (2) plausible site-specific parameters for less migration (Lower Boundary), and (3) plausible but more conservative site-specific parameters for more migration (Site-specific). The comparisons of the empirical GIVFs against the range of modeled GIVFs provided a strong weight of evidence that vapor migration to indoor air in the Georgetown area is occurring within the ranges shown by the Site-specific or Lower Boundary conditions predicted by the JEM (Figure ES-4).

### ES–1.2.3 Development of Groundwater IPIMALs

Following the development of the TC-specific GIVFs, the maximum GIVF was selected for use in developing groundwater inhalation pathway interim measure action levels (IPIMALs). This GIVF was then used to derive a GIVF for each remaining COPC based on the relationship of the physical/chemical properties of the protective TC to the COPC. IPIMALs for groundwater were subsequently calculated for each COPC and receptor (i.e., residential and commercial/industrial) by dividing conservative, risk-based indoor air IPIMALs by the COPC-specific GIVF. The indoor air IPIMALs were developed in the Draft HHERA such that the maximum indoor air concentrations of each COPC are health protection action levels based on a chemical-specific carcinogenic risk goal of 1E-06 and a hazard quotient of 0.1 for non-carcinogens for both residential and commercial/industrial workers. The groundwater and indoor air IPIMALs are summarized in Table ES-2.

## ES–1.3 RESULTS OF DECISION TREE EVALUATIONS

### ES–1.3.1 Tier 1

Under the first tier of the IPIM Decision Tree, groundwater data from 23 monitoring wells and 79 direct push groundwater sampling locations were compared with residential-based groundwater IPIMALs on a location-by-location basis. Chemical-specific exceedance factors (EFs) were calculated by dividing the measured groundwater concentration by its associated residential groundwater IPIMAL. EFs were then summed for each location for individual cancer and non-cancer COPCs to obtain cancer cumulative exceedance factors (CCEFs) and non-cancer cumulative exceedance factors (NCEFs).

The groundwater cumulative exceedance factor (CEF) data were plotted and contoured using a weighted-averaging interpolation method to determine the areas of potential impact associated with each data point. Residential locations that fell within the contours

representing CEFs exceeding 10 were proposed for further investigation/evaluation under Tier 3 (or proceeded directly to Tier 4) of the IPIM Decision Tree (Figure ES-5). Commercial/industrial locations that fell within these contours were further evaluated under Tier 2. Locations with commercial CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

### ES–1.3.2 Tier 2

Commercial/industrial locations that fell within the contours representing the groundwater CCEFs or NCEFs exceeding 10 in Tier 1 were evaluated under Tier 2 by comparing the monitoring well and direct push data to commercial-based groundwater IPIMALs. The resulting CEFs were plotted and contoured as described above. Commercial/industrial locations that fell within the contours representing CEFs exceeding 10 were proposed for further evaluation under Tier 3 of the IPIM Decision Tree (Figure ES-6). Locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

### ES–1.3.3 Tier 3

The purpose of the Tier 3 analysis is to collect additional site-specific data at locations exceeding a groundwater CEF of 10 in Tier 1 or Tier 2 to determine if an IM is warranted. PSC performed an accelerated Tier 3 analysis on the indoor air data collected for the GIVF study to immediately identify locations warranting IMs in areas of high groundwater concentrations nearest the PSC Georgetown facility. Indoor air COPCs were adjusted for contributions from background (as described in the GIVF Development process) and the resulting values compared to residential- and commercial/industrial-based indoor air IPIMALs. EFs were calculated by dividing the adjusted indoor air concentration by its associated residential or commercial indoor air IPIMAL. CCEFs and NCEFs were calculated following the same procedure as in Tier 1.

Five residential locations had indoor air CCEFs exceeding 10 and were thus proposed for evaluation of IMs under Tier 4: 404 South Orcas, 406 South Orcas, 412 South Orcas, 5409 Denver and 672 South Lucile Street (Figure ES-3).

### ES–1.3.4 Tier 4

Site-specific assessments (e.g., building evaluations to determine appropriate IM systems) will be conducted at the five locations identified for IM evaluations under Tier 4. PSC will

use the results from these evaluations to design and implement IPIMs at these locations upon the property owner's and Ecology's concurrence with the developed work plans.

## ES–1.4 UNCERTAINTIES

There are a number of sources of uncertainty associated with the GIVF study and IPIM Decision Tree process. However, PSC has attempted to minimize the total uncertainty so that decision making is biased toward implementing IMs where such measures may not be necessary (as opposed to not implementing measures when they should be implemented). Conservative estimates were used throughout the GIVF study, which typically resulted in overestimating GIVFs and subsequently biasing groundwater IPIMALs to more stringent values.

The major sources of uncertainty associated with the GIVF study included:

- Calculating GIVFs using non-detected indoor air data, which consistently resulted in overestimates of GIVFs, as indoor air concentrations are likely to be less than the full reporting limit.
- Overestimating GIVFs by using groundwater data points that were at or near detection limits, which was compounded when low-concentration groundwater data were related to non-detect indoor air data.
- The presence of most groundwater COPCs in ambient air samples at concentrations higher than indoor air values.
- The provisional cancer slope factor used for TCE for calculating IPIMALs is highly uncertain, resulting in a potential overestimation of risks due to the stringent IPIMALs calculated for this compound.

Key uncertainties associated with the IPIM Decision Tree process included:

- Not having access to the best locations (i.e., highest groundwater concentrations nearest the facility).
- Using direct push groundwater data in the Tier 1 and Tier 2 analyses, which relies on one data set that represents conditions at the time of sample collection, as opposed to exclusively using groundwater data from monitoring wells, which are sampled repeatedly to determine if there are any fluctuations in chemical concentrations. To minimize this uncertainty, only recent direct push data were included in the analyses.

The use of the direct push data also added to the confidence in the application of Tier 1 and Tier 2 of the decision tree by increasing the spatial coverage of samples in Area 3.

- Using a mapping interpolation method to determine the area of influence associated with each groundwater and direct push sample location in Tiers 1 and 2. This uncertainty was minimized by using an Inverse Distance Weighting (IDW) method. With IDW, areas closer to a data point are given greater weight than more distant areas. In addition, the preferred direction of groundwater flow can be incorporated into the interpolation, which further reduces the uncertainty associated with the contoured results.
- The presence of COPCs in ambient air at concentrations higher than indoor air concentrations. In some cases, the indoor air concentrations of TCs and non-TCs may reflect background ambient concentrations rather than concentrations resulting from vapor migration from groundwater to indoor air.
- The general difficulty in identifying and quantitatively accounting for possible site-specific indoor air sources of VOCs when evaluating indoor air data. This uncertainty was minimized in Tier 3 by performing building evaluations where potential indoor air sources of VOCs were identified and removed from the building.

## ES–1.5 IMPLEMENTATION OF TIER 3 AND TIER 4 EVALUATIONS

Residential and commercial locations identified for Tier 3 or Tier 4 evaluations are summarized in Tables ES-3 and ES-4, respectively. Following a review of these areas and approval by Ecology of the locations proposed for further evaluation under Tier 3 or Tier 4, PSC will send out a letter of notification and request for access to the property. Once access is granted, the Tier 3 and Tier 4 IPIM Decision Tree will be implemented. Properties selected for further evaluation and/or interim measures will be addressed in IM Groups, working with those properties closest to the facility first. PSC will evaluate properties for Tier 3 and/or Tier 4 one IM Group at a time.

**Table ES-1.** Summary of Target Compound GIVFs

| Cas_No | Target Compound | Minimum and Maximum Empirical GIVFs | | | |
|---|---|---|---|---|---|
| | | Minimum GIVF | Location of Minimum Value | Maximum GIVF | Location of Maximum Value |
| 71-55-6 | 1,1,1-Trichloroethane | 0.0165 | 5409 Denver Ave S | 0.0204 | 672 Lucile St |
| 75-34-3 | 1,1-Dichloroethane | 0.0008 | 5403 Maynard Ave S | 0.0778 | 412 S Lucile |
| 75-35-4 | 1,1-Dichloroethene | 0.0152 | 412 S Orcas | **0.1718** | **406 S Orcas**[1] |
| 107-06-2 | 1,2-Dichloroethane | 0.0144 | 412 S Orcas | 0.0144 | 412 S Orcas |
| 75-00-3 | Chloroethane | 0.0004 | 5409 Denvers Ave S | 0.0024 | 672 Lucile St |
| 156-59-2 | cis-1,2-Dichloroethene | 0.0006 | 5403 Maynard Ave S | 0.0502 | 611 S Brandon (CS) |
| 156-60-5 | trans-1,2-Dichloroethene | 0.1040 | 5403 Maynard Ave S | 0.1040 | 5403 Maynard Ave S |
| 75-01-4 | Vinyl Chloride | 0.0089 | 672 Lucile St (8/19/02) | 0.1549 | 412 South Lucile |

1. Location of target compound with maximum GIVF - Value used for calculating non-target compound GIVFs.

**Table ES-2.** Indoor Air IPIMALs and Estimated Groundwater IPIMALs for Residential and Commercial Scenarios

| CAS # | Analyte | Indoor Air | | Groundwater | | Basis[3] | RfD (mg/kg-day) or Slope Factor (mg/kg-day$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | IPIMAL[1] Residential | IPIMAL[1] Commercial | IPIMAL[2] Residential | IPIMAL[2] Commercial | | |
| | | (µg/m$^3$) | (µg/m$^3$) | (µg/L) | (µg/L) | | |
| 71-55-6 | 1,1,1-Trichloroethane | 46 | 195 | 500 | 2118 | NC | 0.286[a] |
| 75-34-3 | 1,1-Dichloroethane | 23 | 97.3 | 756 | 3199 | NC | 0.142857143[b] |
| 75-35-4 | 1,1-Dichloroethylene | 1.44 | 6.13 | 8.4 | 36 | NC | 0.009[c] |
| 95-63-6 | 1,2,4-trimethylbenzene | 0.27 | 1.2 | 81 | 359 | NC | 0.0017[a] |
| 107-06-2 | 1,2-Dichloroethane | 0.07 | 0.22 | 9.4 | 29 | CR | 0.091[f] |
| 108-67-8 | 1,3,5-Trimethylbenzene | 0.27 | 1.2 | 9.7 | 43 | NC | 0.0017[a] |
| 591-78-6 | 2-Hexanone | 0.8 | 3.4 | 609 | 2588 | NC | 0.005[d] |
| 71-43-2 | Benzene | 0.26 | 0.75 | 7.8 | 22 | CR | 0.0273[f] |
| 75-00-3 | Chloroethane | 2.4 | 7 | 29 | 83 | CR | 0.0029[h] |
| 67-66-3 | Chloroform | 0.08 | 0.25 | 3.0 | 9.4 | CR | 0.0805[f] |
| 156-59-2 | cis-1,2-Dichloroethylene | 1.6 | 6.8 | 73 | 309 | NC | 0.01[c] |
| 100-41-4 | Ethylbenzene | 46 | 195 | 1270 | 5385 | NC | 0.285714286[f] |
| 91-20-3 | Naphthalene | 0.14 | 1 | 60 | 250 | NC | 0.000857143[f] |
| 103-65-1 | n-Propylbenzene | 1.6 | 6.8 | 27 | 114 | NC | 0.01[c] |
| 99-87-6 | p-Isopropyltoluene | 18 | 78 | 73 | 320 | NC | 0.114285714[g] |
| 135-98-8 | sec-Butylbenzene | 1.6 | 6.8 | 23 | 98 | NC | 0.01[c] |
| 127-18-4 | Tetrachloroethylene | 3.5 | 10 | 42 | 120 | CR | 0.00203[a] |
| 108-88-3 | Toluene | 18 | 78 | 488 | 2116 | NC | 0.114285714[f] |
| 79-01-6 | Trichloroethylene | 0.02 | 0.05 | 0.4 | 0.9 | CR | 0.4[i] |
| 156-60-5 | trans-1,2-Dichloroethylene | 3.2 | 14 | 65 | 285 | NC | 0.02[c] |
| 75-01-4 | Vinyl chloride | 0.23 | 0.66 | 1.0 | 3.0 | CR | 0.0308[f] |

**Table ES-2.** Indoor Air IPIMALs and Estimated Groundwater IPIMALs for Residential and Commercial Scenarios (cont)

| CAS # | Analyte | Indoor Air | | Groundwater | | Basis[3] | RfD (mg/kg-day) or Slope Factor (mg/kg-day$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | IPIMAL[1] Residential | IPIMAL[1] Commercial | IPIMAL[2] Residential | IPIMAL[2] Commercial | | |
| | | (µg/m$^3$) | (µg/m$^3$) | (µg/L) | (µg/L) | | |
| 156-60-5 | trans-1,2-Dichloroethylene | 3.2 | 14 | 65 | 285 | NC | 0.02[c] |
| 75-01-4 | Vinyl chloride | 0.23 | 0.66 | 1.0 | 3.0 | CR | 0.0308[f] |

Notes:

The IPMALs presented in this table are based on the Preliminary Remedial Action Levels (PRALs) presented in the HHERA (PSC, 2001) and do not take into account multipathway or multiconstituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.

The HHERA PRALs were developed using the following target risk goals for individual COPCs:

Cancer Risk (CR) = 1E-06

Hazard Quotient (HQ) = 0.1

[1]IPIMAL – Inhalation Pathway Interim Measure Action Level.

[2]Calculated using Maximum GIVF for 1,1-DCE and AFs as per Section 2.3.

[3]CR = IPIMAL based on carcinogenic risk. NC = IPIMAL based on non-cancer hazard quotient.

[a]NCEA value from EPA Region 9 PRG list

[b]HEAST2 (Table 2), 1997

[c]EPA Region 9 PRG route extrapolation value

[d]NCEA provisional report (March 2000)

[e]Letter from EPA (Baily) to WA Ecology (Akana) (October 2000)

[f]IRIS (2nd Quarter), 2001

[g]1-methylbenzene toxicity value used as surrogate

[h]EPA Region 9 PRG value – withdrawn from IRIS

[i]NCEA value from August 2001 TCE Document

**Table ES-3**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Residential NCEF and/or CCEF Greater Than Ten

| Address | Follow Up Action |
|---|---|
| 612 S LUCILE ST | Tier 4 |
| 616 S LUCILE ST | Tier 4 |
| 674 S LUCILE ST | Tier 4 |
| 672 S LUCILE ST | Tier 4 |
| 611 S BRANDON ST | Tier 4 |
| 613 S BRANDON ST | Tier 4 |
| 615 S BRANDON ST | Tier 4 |
| 605 S BRANDON ST | Tier 4 |
| 123 S FINDLAY ST | Tier 4 |
| 122 S FINDLAY ST | Tier 4 |
| 121 S FINDLAY ST | Tier 4 |
| 118 S FINDLAY ST | Tier 4 |
| 125 S FINDLAY ST | Tier 4 |
| 5601 2ND AV S | Tier 4 |
| 5610 2ND AV S | Tier 4 |
| 5606 2ND AV S | Tier 4 |
| 215 S ORCAS ST | Tier 4 |
| 217 S ORCAS ST | Tier 4 |
| 214 S FINDLAY ST | Tier 4 |
| 317 S LUCILE ST | Tier 4 |
| 5403 MAYNARD AV S | Tier 4 |
| 5409 DENVER AV S | Tier 4 |
| 404 S ORCAS | Tier 4 |
| 5607 2ND AV S | Tier 4 |

**Table ES-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 612 S ORCAS ST | Commercial | Tier 3 |
| 620 S ORCAS ST | Commercial | Tier 3 |
| 5600 6TH AV S | Commercial | Tier 3 |
| 5602 6TH AV S | Commercial | Tier 3 |
| 5604 6TH AV S | Commercial | Tier 3 |
| 5606 6TH AV S | Commercial | Tier 3 |
| 5608 6TH AV S | Commercial | Tier 3 |
| 5612 6TH AV S | Commercial | Tier 3 |
| 5616 6TH AV S | Commercial | Tier 3 |
| 5620 6TH AV S | Commercial | Tier 3 |
| 5618 6TH AV S | Commercial | Tier 3 |
| 5506 6TH AV S | Commercial | Tier 3 |
| 637 S LUCILE ST | Commercial | Tier 3 |
| 624 S FINDLAY ST | Commercial | Tier 3 |
| 5412 6TH AV S | Commercial | Tier 3 |
| 5413 MAYNARD AV S | Commercial | Tier 3 |
| 5419 MAYNARD AV S | Commercial | Tier 3 |
| 665 S LUCILE ST | Commercial | Tier 3 |
| 667 S LUCILE ST | Commercial | Tier 3 |
| 701 S LUCILE ST | Commercial | Tier 3 |
| 707 S LUCILE ST | Commercial | Tier 3 |
| 710 S LUCILE ST | Commercial | Tier 3 |
| 650 S LUCILE ST | Commercial | Tier 3 |
| 652 S LUCILE ST | Commercial | Tier 3 |
| 654 S LUCILE ST | Commercial | Tier 3 |
| 656 S LUCILE ST | Commercial | Tier 3 |
| 658 S LUCILE ST | Commercial | Tier 3 |
| 660 S LUCILE ST | Commercial | Tier 3 |
| 662 S LUCILE ST | Commercial | Tier 3 |
| 664 S LUCILE ST | Commercial | Tier 3 |

**Table ES-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 666 S LUCILE ST | Commercial | Tier 3 |
| 668 S LUCILE ST | Commercial | Tier 3 |
| 670 S LUCILE ST | Commercial | Tier 3 |
| 672 S LUCILE ST | Commercial | Tier 3 |
| 519 S BRANDON ST | Commercial | Tier 3 |
| 521 S BRANDON ST | Commercial | Tier 3 |
| 5900 1ST AV S | Commercial | Tier 3 |
| 111 S MEAD ST | Commercial | Tier 3 |
| 5801 2ND AV S | Commercial | Tier 3 |
| 508 S MEAD ST | Commercial | Tier 3 |
| 5601 6TH AV S | Commercial | Tier 3 |
| 500 S FINDLAY ST | Commercial | Tier 3 |
| 502 S FINDLAY ST | Commercial | Tier 3 |
| 504 S FINDLAY ST | Commercial | Tier 3 |
| 506 S FINDLAY ST | Commercial | Tier 3 |
| 508 S FINDLAY ST | Commercial | Tier 3 |
| 510 S FINDLAY ST | Commercial | Tier 3 |
| 512 S FINDLAY ST | Commercial | Tier 3 |
| 514 S FINDLAY ST | Commercial | Tier 3 |
| 516 S FINDLAY ST | Commercial | Tier 3 |
| 518 S FINDLAY ST | Commercial | Tier 3 |
| 520 S FINDLAY ST | Commercial | Tier 3 |
| 5603 6TH AV S | Commercial | Tier 3 |
| 5605 6TH AV S | Commercial | Tier 3 |
| 5607 6TH AV S | Commercial | Tier 3 |
| 5609 6TH AV S | Commercial | Tier 3 |
| 5611 6TH AV S | Commercial | Tier 3 |
| 5613 6TH AV S | Commercial | Tier 3 |
| 5615 6TH AV S | Commercial | Tier 3 |
| 5617 6TH AV S | Commercial | Tier 3 |
| 5619 6TH AV S | Commercial | Tier 3 |

**Table ES-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 5620 5TH AV S | Commercial | Tier 3 |
| 5621 6TH AV S | Commercial | Tier 3 |
| 500 S LUCILE ST | Commercial | Tier 3 |
| 502 S LUCILE ST | Commercial | Tier 3 |
| 504 S LUCILE ST | Commercial | Tier 3 |
| 506 S LUCILE ST | Commercial | Tier 3 |
| 508 S LUCILE ST | Commercial | Tier 3 |
| 510 S LUCILE ST | Commercial | Tier 3 |
| 512 S LUCILE ST | Commercial | Tier 3 |
| 514 S LUCILE ST | Commercial | Tier 3 |
| 516 S LUCILE ST | Commercial | Tier 3 |
| 518 S LUCILE ST | Commercial | Tier 3 |
| 520 S LUCILE ST | Commercial | Tier 3 |
| 522 S LUCILE ST | Commercial | Tier 3 |
| 524 S LUCILE ST | Commercial | Tier 3 |
| 526 S LUCILE ST | Commercial | Tier 3 |
| 528 S LUCILE ST | Commercial | Tier 3 |
| 530 S LUCILE ST | Commercial | Tier 3 |
| 532 S LUCILE ST | Commercial | Tier 3 |
| 534 S LUCILE ST | Commercial | Tier 3 |
| 536 S LUCILE ST | Commercial | Tier 3 |
| 538 S LUCILE ST | Commercial | Tier 3 |
| 540 S LUCILE ST | Commercial | Tier 3 |
| 542 S LUCILE ST | Commercial | Tier 3 |
| 544 S LUCILE ST | Commercial | Tier 3 |
| 546 S LUCILE ST | Commercial | Tier 3 |
| 548 S LUCILE ST | Commercial | Tier 3 |
| 550 S LUCILE ST | Commercial | Tier 3 |
| 552 S LUCILE ST | Commercial | Tier 3 |
| 554 S LUCILE ST | Commercial | Tier 3 |
| 556 S LUCILE ST | Commercial | Tier 3 |

**Table ES-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

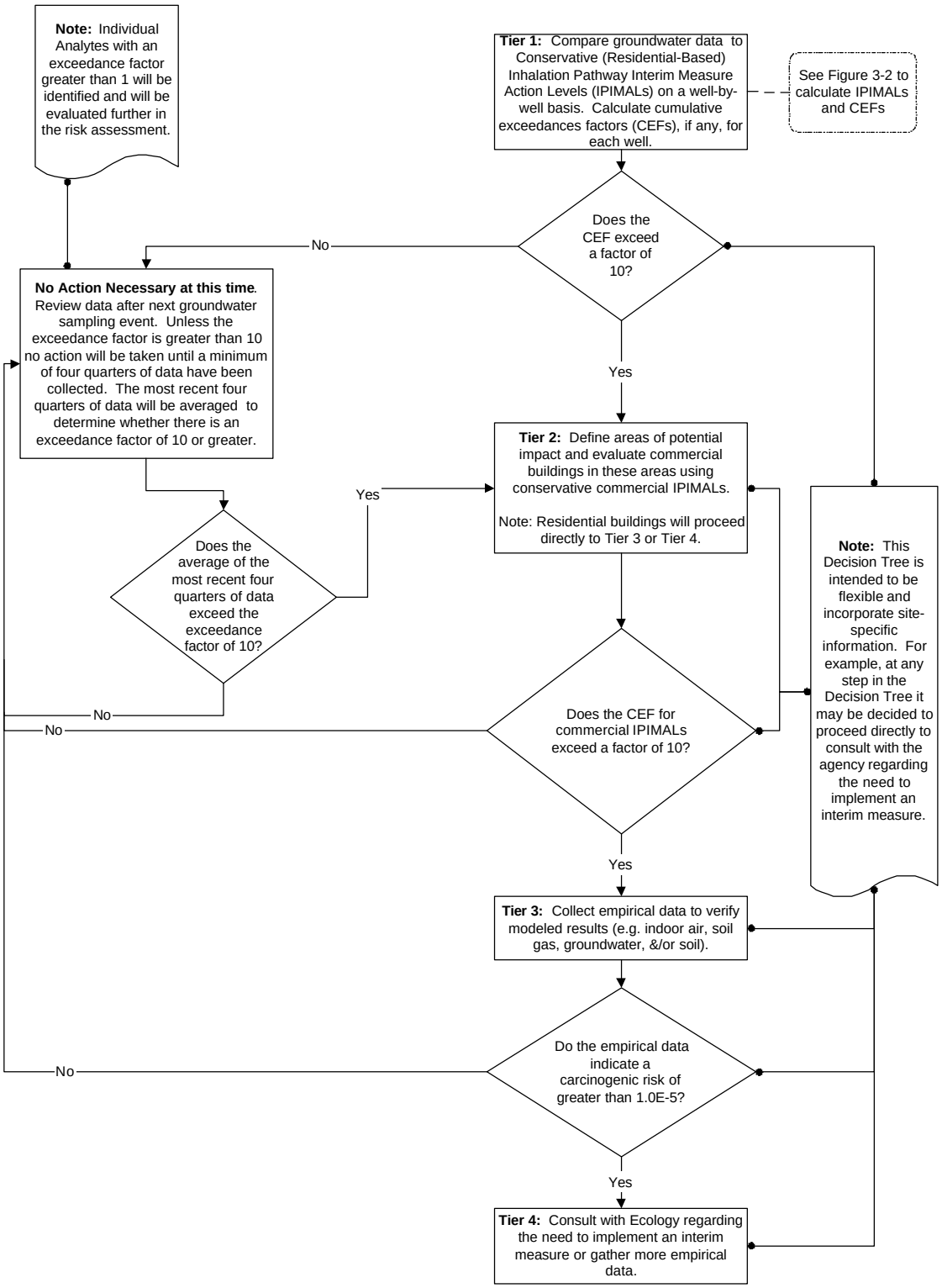
| Address | Building Type | Follow Up Action |
|---|---|---|
| 558 S LUCILE ST | Commercial | Tier 3 |
| 560 S LUCILE ST | Commercial | Tier 3 |
| 562 S LUCILE ST | Commercial | Tier 3 |
| 564 S LUCILE ST | Commercial | Tier 3 |
| 566 S LUCILE ST | Commercial | Tier 3 |
| 568 S LUCILE ST | Commercial | Tier 3 |
| 570 S LUCILE ST | Commercial | Tier 3 |
| 572 S LUCILE ST | Commercial | Tier 3 |
| 574 S LUCILE ST | Commercial | Tier 3 |
| 576 S LUCILE ST | Commercial | Tier 3 |
| 578 S LUCILE ST | Commercial | Tier 3 |
| 580 S LUCILE ST | Commercial | Tier 3 |
| 202 S MEAD ST | Commercial | Tier 3 |
| 204 S MEAD ST | Commercial | Tier 3 |
| 206 S MEAD ST | Commercial | Tier 3 |
| 208 S MEAD ST | Commercial | Tier 3 |
| 210 S MEAD ST | Commercial | Tier 3 |
| 212 S MEAD ST | Commercial | Tier 3 |
| 214 S MEAD ST | Commercial | Tier 3 |
| 218 S MEAD ST | Commercial | Tier 3 |
| 220 S MEAD ST | Commercial | Tier 3 |
| 222 S MEAD ST | Commercial | Tier 3 |
| 224 S MEAD ST | Commercial | Tier 3 |
| 228 S MEAD ST | Commercial | Tier 3 |
| 5706 2ND AV S | Commercial | Tier 3 |
| 200 S MEAD ST | Commercial | Tier 3 |
| 316 S FIDALGO ST | Commercial | Tier 3 |
| 320 S FIDALGO ST | Commercial | Tier 3 |
| 5700 3RD AV S | Commercial | Tier 3 |
| 309 S ORCAS ST | Commercial | Tier 3 |
| 227 S ORCAS ST | House[1] | Tier 4 |

**Table ES-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 412 S ORCAS ST | House[1] | Tier 4 |
| 601 S BRANDON ST | House[1] | Tier 4 |

[1]These are homes currently being used for commercial purposes.

**Figure ES-1.** IPIM Decision Tree






## Legend

- Roads
- GIVF Study Area
- Areas 1 and 2
- Area 3
- Buildings

## Notes

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

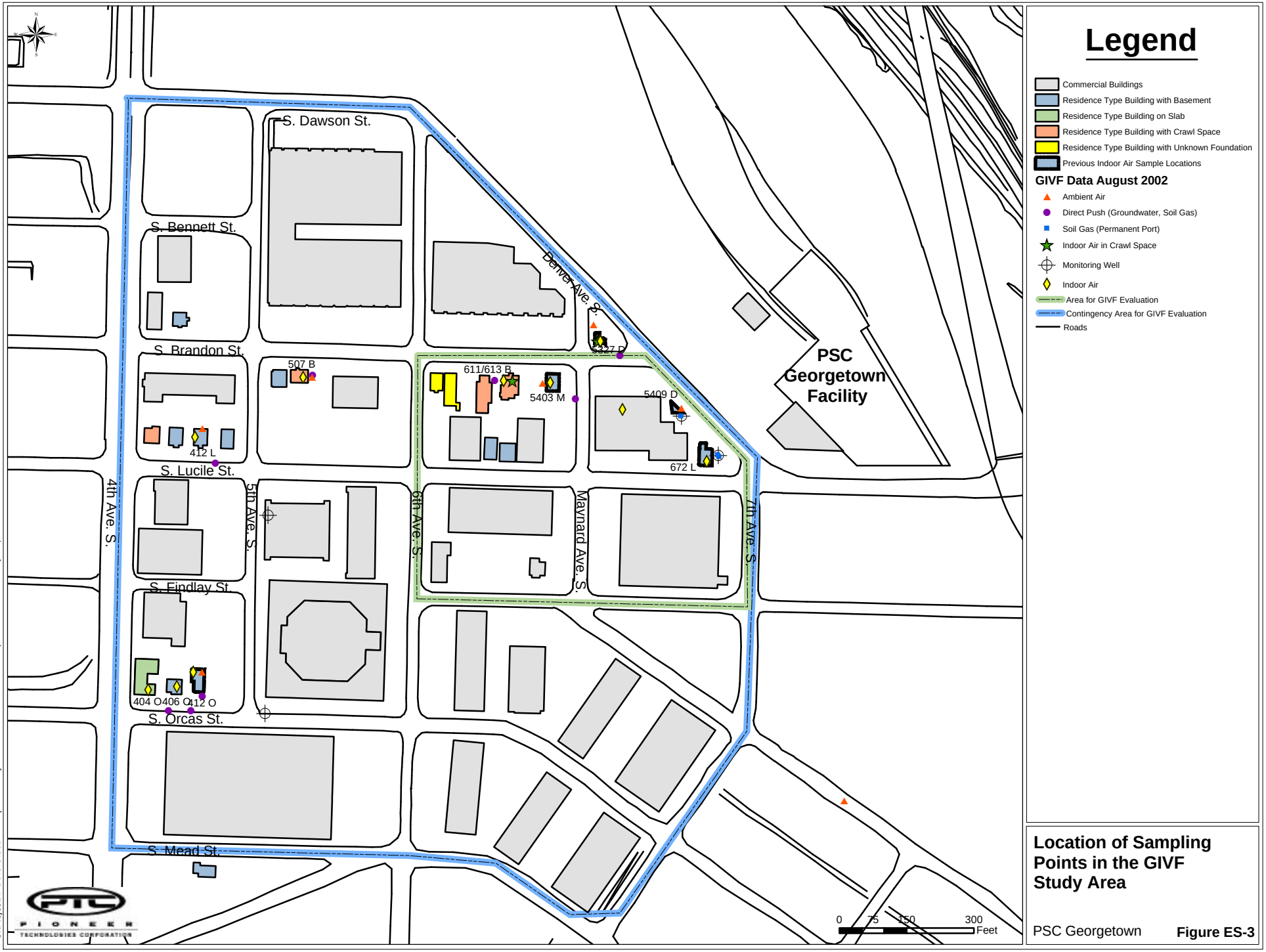
**Study Areas Identified in the IPIM Workplan**

PSC Georgetown

**Figure ES-2**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\SourceMaps\February 2003\Revised Tech Memo Maps\Executive Summary Maps




# Legend

- Commercial Buildings
- Residence Type Building with Basement
- Residence Type Building on Slab
- Residence Type Building with Crawl Space
- Residence Type Building with Unknown Foundation
- Previous Indoor Air Sample Locations

**GIVF Data August 2002**

- Ambient Air
- Direct Push (Groundwater, Soil Gas)
- Soil Gas (Permanent Port)
- Indoor Air in Crawl Space
- Monitoring Well
- Indoor Air
- Area for GIVF Evaluation
- Contingency Area for GIVF Evaluation
- Roads

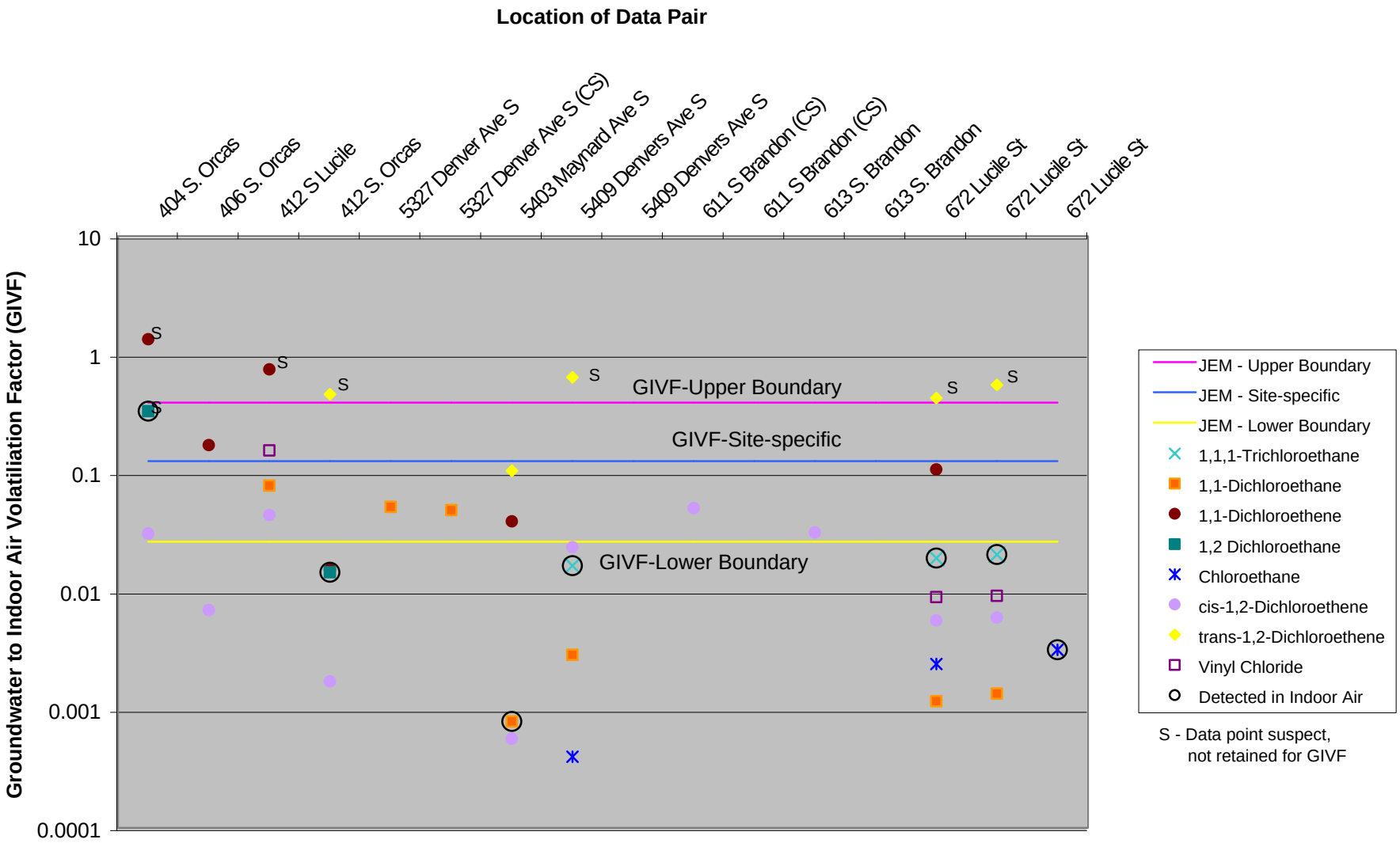
**Location of Sampling Points in the GIVF Study Area**

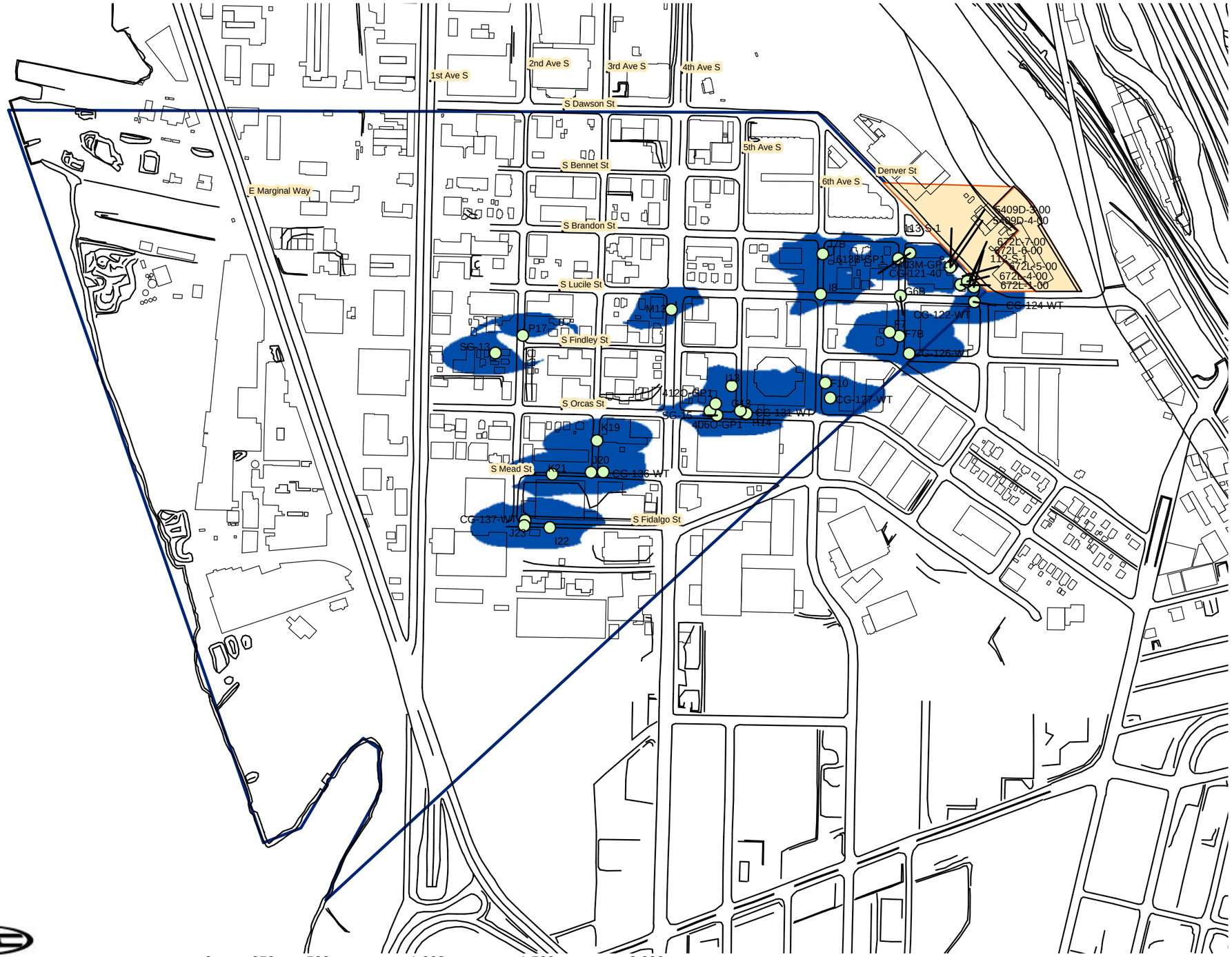
PSC Georgetown **Figure ES-3**

PIONEER TECHNOLOGIES CORPORATION

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Figure ES-4. Empirical GIVFs Plotted Against Maximum and Site-specific Boundary GIVFs Predicted by JEM






# Legend

**IPIM Residential CCEFs**

- >10 CCEF

**IDW of IPIM Residential CCEFs**

- >10 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

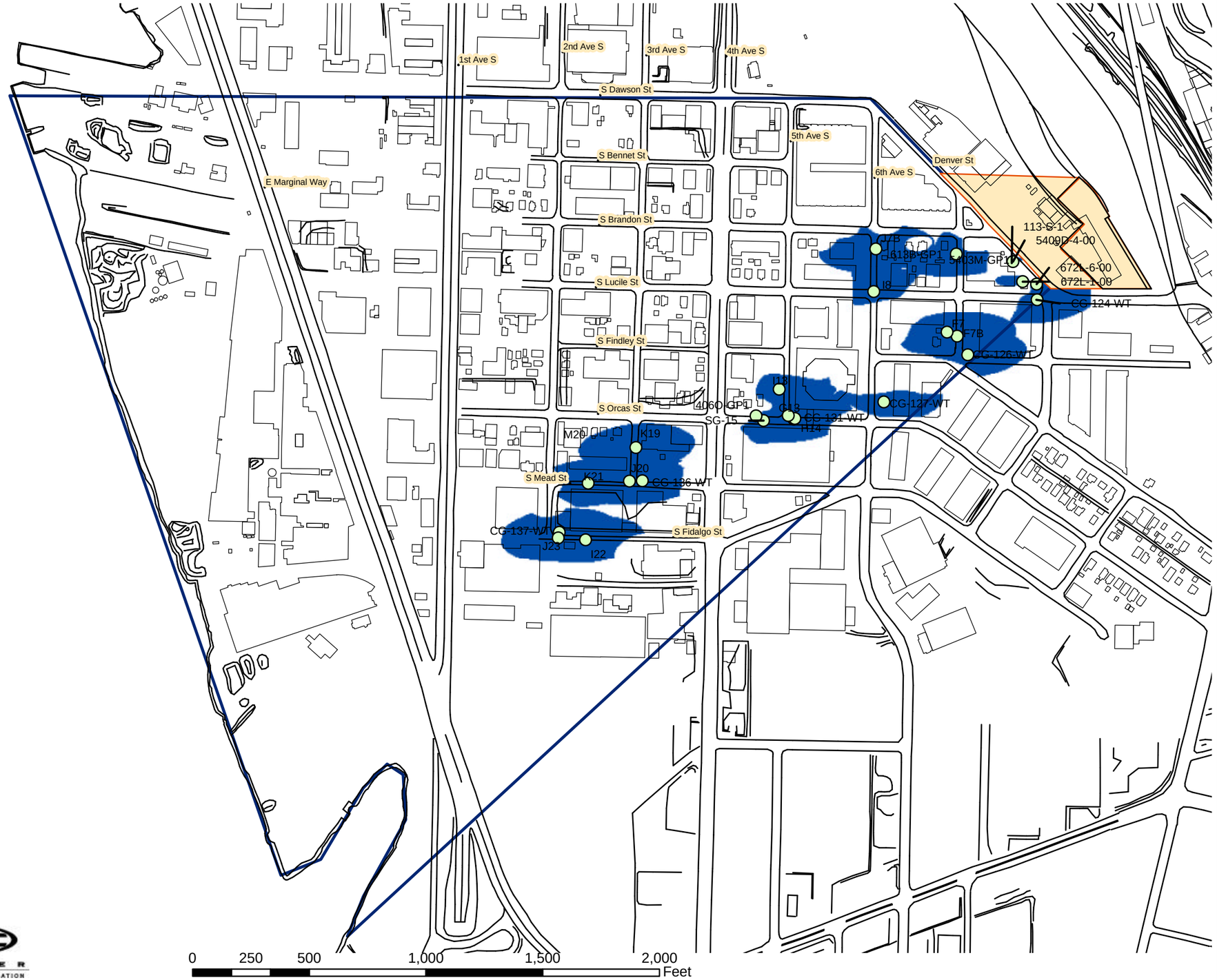
- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential CCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure ES-5**

PIONEER TECHNOLOGIES CORPORATION

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# Legend

**IPIM Commercial CCEFs**

>10 CCEF

**IDW of IPIM Commercial CCEFs**

>10 CCEF

Roads

Buildings

Areas 1 and 2

Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 2 Commercial CCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure ES-6**

PIONEER TECHNOLOGIES CORPORATION

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# 1. INTRODUCTION

Philip Services Corporation (PSC) owns and operates a Resource Conservation and Recovery Act (RCRA) permitted waste management facility on 734 South Lucile Street in the Georgetown community of Seattle, Washington. Figure 1-1 shows an aerial view of the facility and the surrounding area (the site) and Figure 1-2 presents a facility map. PSC is conducting a corrective action at its Georgetown facility per requirements contained in its RCRA hazardous/dangerous waste permit (WAD 00081 2909).

In August 2002, PSC submitted an Inhalation Pathway Interim Measure (IPIM) Work Plan (PSC, 2002a) (herein after referred to as IPIM Work Plan) in response to a letter from the Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) dated June 28, 2001, that modified the corrective action permit for the facility and required that groundwater interim measures be implemented at the facility. These interim measures are focused primarily on addressing vapor intrusion from groundwater, which is evaluated under the Washington State Model Toxics Control Act (MTCA), pursuant to Washington Administrative Code (WAC) 173-340-350, 173-340-720(1)(c), 173-340-720(1)(d)(iv), and 173-340-750.

The IPIM Work Plan (PSC, 2002a) presents the detailed approach for determining whether or not residents and workers in the vicinity of the PSC Georgetown facility are being exposed to concentrations of chemicals in indoor air, associated with releases from the facility to groundwater, that are above levels of concern. The volatile organic compounds (VOCs) considered inhalation pathway chemicals of potential concern (COPCs) for the Georgetown facility were identified in the Draft Human Health and Ecological Risk Assessment (HHERA) (PSC, 2001). The approach presented in the IPIM Work Plan consists of two steps: 1) develop site-specific groundwater to indoor air volatilization factors (GIVFs) that represent the relationship of concentrations of VOCs in groundwater and concentrations in indoor air and 2) use the GIVFs and other data developed in Step 1 to determine via the IPIM Decision Tree, if indoor air concentrations of VOCs would potentially be above levels of concern. The Decision Tree is a tiered approach for evaluating locations west-southwest of the Georgetown facility on a quarterly basis at least until a final remedy for the site is implemented. The four-tiered Decision Tree framework is outlined in Section 3 (Figure 3-1).

Two study areas were identified in the IPIM Work Plan for implementing the two steps. These study areas are shown in Figure 1-3 and introduced below:

- **GIVF Study Area** –The GIVF Study Area is the area located west and south of the PSC facility known to be impacted by VOCs in the shallow aquifer emanating from the facility. This area includes the original GIVF Study Area and the contingency study area presented in the IPIM Work Plan and Sample and Analysis Plan (SAP). Groundwater, soil gas, indoor air, and ambient air samples were collected from this area to develop GIVFs.

- **Area 3** – Area 3 is the area west of Denver Avenue and was defined in the Draft HHERA (PSC, 2001). GIVFs derived from the evaluation in the GIVF Study Area were applied to groundwater data collected from all sample locations in Area 3. Data from the Pre-Corrective Action Monitoring Program (PCAMP) (PSC, 2002b) were evaluated using the GIVFs to determine if further evaluation or interim measures (IMs) are warranted.

Note: The groundwater monitoring wells screened across the water table were evaluated using the GIVFs. The only exceptions were the following wells: CG-121-40, CG-135-40, CG-139-40, GP-144-35, and CG-145-35. These wells were also evaluated using GIVFs because they were screened in the shallow aquifer and because there was not a well screened across the water table in the immediate vicinity of the well. These wells were included in the evaluation for screening purposes only in order to provide an estimate of the concentration of VOCs that may occur at the water table at these locations.

## 1.1 PURPOSE

The purpose of this IPIM Technical Memorandum (herein after referred to as IPIM Tech Memo) is to present the results of the program performed under the IPIM Work Plan. In addition, at the request of Ecology, the IPIM Tech Memo will include the results of a Tier 3 Decision Tree evaluation of the indoor air collected to develop the GIVFs. A brief review of the steps that were used to implement the IPIM Work Plan are presented below:

1. PSC implemented an initial sampling program in the GIVF Study Area to determine whether, and to what degree, vapor migration from groundwater to indoor air is occurring in areas of significant VOC concentrations in the groundwater directly downgradient of the facility by collecting co-located indoor air, groundwater, and ambient air samples at selected locations. PSC evaluated the data and calculated

GIVFs, which were sufficiently conservative to be health-protective in their use to estimate "upper-bound" indoor air concentrations for each COPC detected in groundwater throughout the affected area. Results of the data collection and the process for calculating chemical-specific GIVFs are presented in Section 2. Supporting information is provided in Appendices A through D.

2. PSC applied the chemical-specific GIVFs derived from data in the GIVF Study Area to estimate groundwater inhalation pathway interim measure action levels (IPIMALs). These values were compared with the results of the 2nd Quarter 2002 groundwater data and historic temporary well (direct push) data collected after January 1, 2000 from Area 3 under Tier 1 and Tier 2 of the IPIM Decision Tree (Section 3, Figure 3-1) to determine if the resulting cumulative inhalation risk (from vapor intrusion) exceeds a cancer risk of 1E-05 or a hazard index (HI) of 1.[1]

3. Indoor air data collected from the GIVF Study Area during the GIVF survey were compared to indoor air IPIMALs under Tier 3 of the IPIM Decision Tree.

There are uncertainties related to the use of both empirical data and modeling. However, this uncertainty is minimized because the results of the empirical data collection/analysis were compared with the results of the modeling analysis to critically evaluate each other. For this analysis, both site-specific GIVFs and attenuation coefficients (ACs)[2] were calculated using empirical data and these were compared with modeled GIVFs and ACs predicted by using various site-specific and boundary conditions applied to the Johnson and Ettinger Model (JEM) (Johnson and Ettinger, 1991; Environmental Quality Management [EQM], 2000). A range of plausible conditions were modeled using the JEM to assist with data evaluation and the uncertainty analysis.

PSC has used conservative approaches with both model design and sample methodology in order to ensure that risks are not underestimated. Adherence to the data quality objectives

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[1] Per WAC 173-340-700(5)(b)(c), PSC may elect to evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (HQs) (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HQs, the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, the building will not be evaluated further until the next round of groundwater sampling. Segregation of HIs will be done with the chemical-specific prior approval of Ecology.

[2] The attenuation coefficient is simply the ratio between the indoor air concentration and the predicted soil gas concentration just above the water table that is derived assuming equilibrium conditions between soil gas and groundwater and a chemical-specific Henry's Law constant. The attenuation coefficient is another measure of the degree to which volatilization to indoor air occurs.

(DQOs) designed to ensure a conservative approach and the potential limitations and uncertainties associated with this approach are discussed in Section 4.

## 1.2 BACKGROUND

### 1.2.1 Regulatory Background

The Georgetown facility has a history of chemical use and storage dating back at least 50 years. In 1988, the EPA (lead regulatory agency) prepared a RCRA Facility Assessment and produced a Solid Waste Management Unit Report to evaluate whether there had been any releases to the environment. Remedial investigation activities (including groundwater, soil, and soil gas investigations) have been ongoing at the facility since 1988. The facility received a RCRA permit from EPA in August 1991, which contained corrective action requirements, including conducting a Remedial Facility Investigation (RFI) to determine the nature and extent of contamination.

PSC submitted a Draft Comprehensive RFI report on June 29, 2001. As part of the Draft RFI, a Draft Human Health and Ecological Risk Assessment (HHERA) was submitted on August 10, 2001 (PSC, 2001) that characterized the risk and provided preliminary pathway-specific remedial action levels for the areas potentially affected by the facility.

In January 2002, EPA provided comments to PSC on these RFI documents and requested additional work prior to resubmitting the documents. In response to EPA's and Ecology's comments, PSC submitted work plans to address the data gaps identified in the RFI and HHERA. Most of the field activities related to fulfillment of the data gaps were completed during the summer of 2002, including sampling a total of 79 monitoring wells, including 54 new off-site monitoring wells. Quarterly monitoring will continue into 2003 prior to resubmitting these two reports.

As of March 2002, Ecology has assumed the status of lead agency at the site and will enforce the permit's corrective action and site cleanup requirements per regulations in the WAC and MTCA. Following approval of the Final Remedial Investigation (RI) Report (which will include a final HHERA) by Ecology, the clean-up phase of the corrective action process will begin with the Feasibility Study (FS). In the FS, PSC will evaluate the options available as final remedies for the site's specific characteristics, and will propose one alternative as a preferred remedy. Final selection of the clean-up remedy requires agency and public approval.

During the RI process, if it is determined by Ecology or the Permittee (PSC) that there is a threat to human health or the environment, an IM or an expedited cleanup may be necessary. This IM may not satisfy the requirements of a final remedy, but it should be consistent with the anticipated final remedy.

On June 28, 2001, EPA and Ecology issued a letter requesting that PSC design and implement immediate interim measures to provide hydraulic control of the impacted groundwater emanating from the facility and to control human exposures to impacted groundwater in any area where exposure may be occurring. A draft work plan for the groundwater IM was submitted on September 1, 2001. In response to EPA comments on the draft work plan and Georgetown Facility Permit Modification GTMOD 46-1, each IM has been detailed in a separate work plan. The IPIM Work Plan was developed in response to the June 28 letter and numerous subsequent meetings with EPA and Ecology regarding the approach for evaluating and addressing the inhalation pathway.

### 1.2.2 Migration of Soil Gas from Groundwater to Indoor Air

Groundwater in the shallow aquifer in the area of the Georgetown facility is primarily migrating in a west-southwest direction. Under some conditions, VOCs dissolved in the groundwater may migrate through the soil into nearby basements, buildings, and other enclosed spaces.[3] The basic factors that influence the amount of VOCs that migrate from groundwater into indoor air include the following:

- Volatilization from groundwater to soil gas at the water table (i.e., at the groundwater/soil interface).
- Migration of the soil gas via diffusion upward toward buildings and ground surface through the partially saturated soils directly above the water table and through the unsaturated zone (vadose zone).
- Migration of soil gas vertically through the building foundation via diffusion and advection through cracks or other openings that may serve as entry points for soil gas. The degree of migration through the foundation depends on many factors, including soil type and moisture content directly beneath the structure, building construction type (e.g., basement, slab-on-grade), structural integrity of the building, pressure gradients associated with seasonal effects, the building ventilation system,

[3] People may also be exposed to contaminated soil gases if they are excavating soils in areas where the groundwater is contaminated with VOCs.

and the operation of household appliances. Advection is made possible by continuous airflow paths associated with open or incompletely sealed doors and windows, chimneys and other intake/exhaust ports.

- Mixing of indoor air inside the enclosed space with outdoor air that is drawn into the building. The degree of mixing depends on the amount of mechanical or forced ventilation, natural ventilation, and infiltration from ambient air.

## 1.3 REPORT ORGANIZATION

This document is organized into the following sections:

- Section 1 introduces the IPIM Tech Memo, outlines the approach of the IPIM Work Plan, and presents a brief discussion of the events and observations leading up to the Tech Memo.
- Section 2 presents the data collected for the GIVF evaluation and applies the data to develop chemical-specific GIVFs for each COPC.
- Section 3 applies Tier 1 through Tier 3 of the IPIM Decision Tree.
- Section 4 presents data quality objectives and uncertainty analysis.
- Section 5 presents a tentative schedule for Tier 3 and Tier 4 analyses.

Building Evaluation Forms and other field data collected during the GIVF survey are presented in Appendix A. Analytical results of the sampling performed in support of the GIVF study are presented in Appendix B. Geotechnical laboratory reports and a summary of the geotechnical data are presented in Appendix C. A summary of the database search and literature review performed to establish background indoor air values is presented in Appendix D.




*Note: The image was photographed on 10 Jul 1990 by the National Aerial Photography Program and digitized by the USGS DOQ Program on 26 Apr 1996*

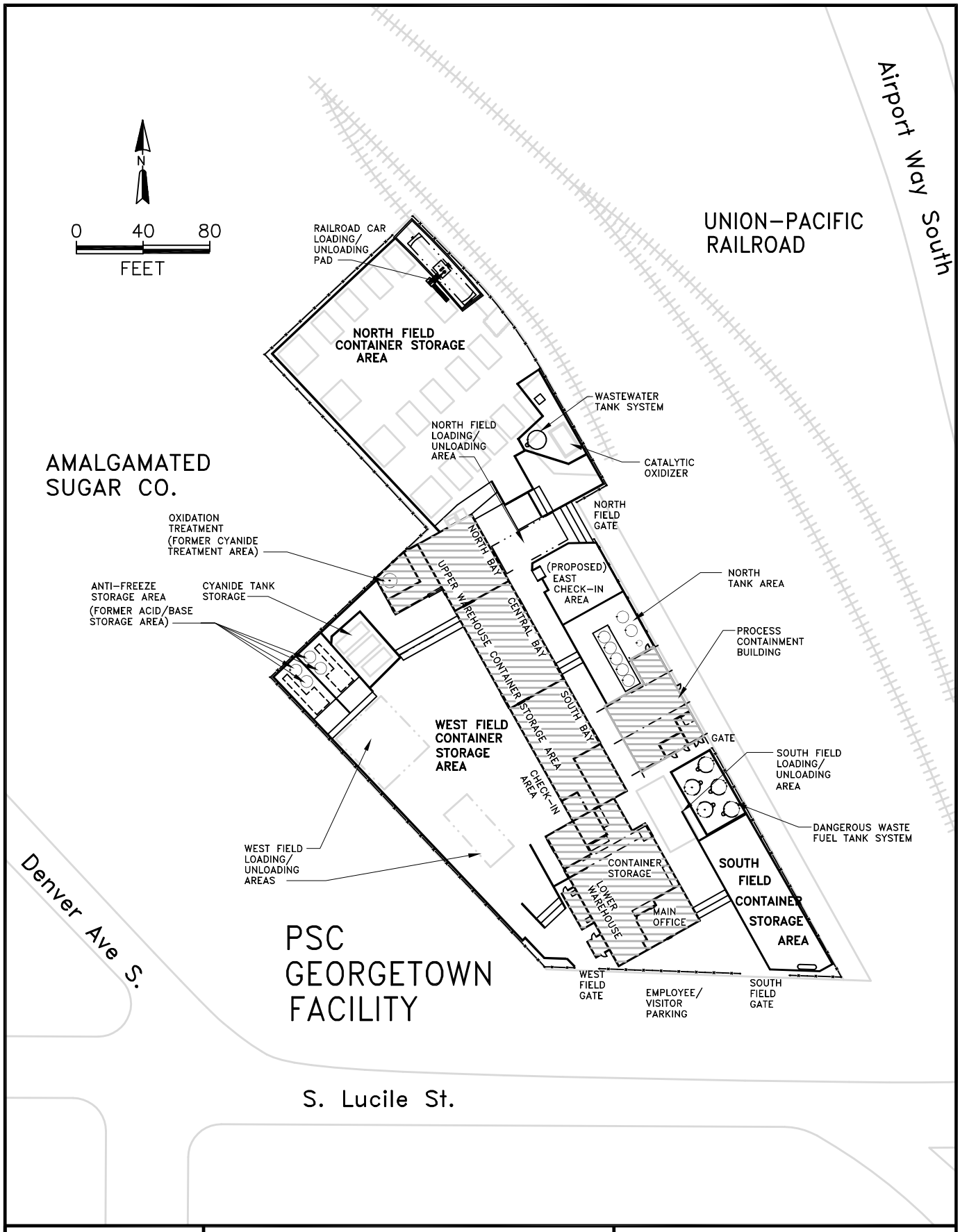
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Site Location-Aerial View
PSC Georgetown Facility
Seattle, Washington

Figure 1-1

5/02

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PHILIP SERVICES CORP

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

Figure 1–2
Site Plan
Georgetown Facility




## Legend

- Roads
- GIVF Study Area
- Areas 1 and 2
- Area 3
- Buildings

## Notes

- Areas 1, 2, and 3 Were Designated in the Draft Risk Assessment PSC 2002.

**Study Areas Identified in the IPIM Workplan**

PSC Georgetown

**Figure 1-3**

PIONEER TECHNOLOGIES CORPORATION

File:C:\PSC\Maps\November 2002\Tier 1 Maps

# 2. DEVELOPMENT OF GIVFS

This section presents the results of the GIVF Study and develops GIVFs for each COPC. Section 2.1 reviews the data collected during the field sampling program. The data are summarized in Appendices A, B, and C. Section 2.2 reviews the approach used to determine contributions to background indoor air. A more complete summary of this review is presented in Appendix D. Section 2.3 presents the technical basis for selecting the upper-bound GIVFs and applies these GIVFs to indoor air IPIMALs to calculate health-protective groundwater IPIMALs for use in Tier 1 and Tier 2 of the IPIM Decision Tree.

## 2.1 GIVF FIELD SAMPLING PROGRAM

During the week of August 19, 2002, PSC conducted a field sampling program at 10 building locations in the GIVF Study Area (Figure 2-1). The GIVF Study Area is located within the mixed residential/industrial neighborhood that is hydraulically downgradient of the PSC Georgetown facility and is most likely impacted by facility-related COPCs. The COPCs for the site were identified in the HHERA (PSC, 2001). Three locations (611 Brandon, 613 Brandon, and 672 South Lucile) were re-sampled for indoor air on August 26 and 27, 2002. The purpose was to collect data necessary for empirically deriving the GIVFs. Both characterization and geotechnical data were collected during this period. All sampling was performed in accordance with the IPIM Work Plan and Sampling and Analysis Plan (SAP)(PSC, 2002a).

Note: The indoor air samples that were collected to develop the GIVFs will be evaluated in Tier 3 (see Section 3.3) of the IPIM Decision Tree to determine if any of these buildings should be considered for Tier 4 evaluations.

### 2.1.1 Building Evaluations

Buildings sampled for development of GIVFs were selected based on the following criteria:

- Located over/near areas with high concentrations of COPCs (i.e., chloroethane, trichloroethene [TCE], and vinyl chloride) in the groundwater plume;
- Buildings with construction type likely to result in VOCs migrating from groundwater and becoming elevated in indoor air (e.g., residential buildings with basements);

- Locations least likely to be impacted by sources other than facility-related COPCs; and
- Locations that had been previously sampled for indoor air and where COPCs were detected.

Following the receipt of permission to access a building from the building owner, PSC performed a building evaluation for each location (provided in Appendix A) in order to identify building construction characteristics, occupants and occupations, heating and ventilation systems, and sources of possible chemical contaminants that might influence the results of the indoor sampling[4]. Potential sources were identified visually and by using a photo ionization detector (PID) screen. In some cases, materials likely to be confounding sources of volatile chemicals were removed from the premises prior to sampling. Field data associated with sample collection for groundwater, indoor and ambient air, soil gas, and geotechnical analysis are summarized in Appendix A (Tables A-1 through A-4).

### 2.1.2 Groundwater Sampling Results

Eighteen groundwater samples, including two duplicates, were collected over a two-day period using either in-situ, direct push methodology, or by sampling a nearby permanent monitoring well screened at the water table. All groundwater samples (located on Figure 2-1) were collected as close to the building as possible[5] and within 48 hours of the indoor air sample collection. Groundwater samples were analyzed for 49 target analytes using purge and trap with analysis by gas chromatography/mass spectrometry (GC/MS) and EPA Method SW846-8260B (EPA, 1997). Several analytes (including 1,2-dichloroethane [1,2-DCA], 1,1-dichloroethene [1,1-DCE], tetrachloroethene, TCE, and vinyl chloride) were analyzed using GC/MS operated in selected ion monitoring (SIM) mode to achieve lower reporting limits listed in the Quality Assurance Project Plan (QAPP) (PSC, 2002a).

All groundwater results were validated according to validation requirements presented in the QAPP. The results of the data collection for the inhalation pathway COPCs are presented in Table B-1 in Appendix B, along with the data validation report.

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[4] Photographs were also taken during the building evaluations; these are available as part of the field notes.

[5] In some cases, samples were not collected directly adjacent to the building due to logistics (i.e., the drill rig could not be operated any closer to the building) or as a result of selecting to sample existing monitoring wells that were as near as possible. Distances from the buildings generally ranged from directly adjacent to within 25 feet, with two exceptions: at 412 S. Lucile, the monitoring well selected for sampling was located

### 2.1.3 Air Sampling Results

#### 2.1.3.1 GIVF Sampling Event

Sixty-four air samples (including 15 field duplicates) were collected from indoor air, outdoor (ambient) air, and soil gas collection points during the GIVF sampling event. These sample locations are located on Figure 2-1.

- Forty-three indoor air samples (up to three samples from each selected building) were collected on the main floor in the primary breathing zones (bedroom and/or living room). If the building was a business, at least one sample was collected in the office area. For buildings with basements, at least one sample was collected from the basement area in areas where potential infiltration of soil gas was expected to be highest. To meet data quality objectives, at least one duplicate co-located indoor air sample was collected from each building.
- Six ambient air samples and one duplicate sample accompanied the indoor air samples to allow for indoor air COPC concentrations to be "adjusted" for ambient air intrusion. One ambient air sample (727H) was collected from outside the plume area. The remaining samples were collected from each block where indoor air samples were collected. To the extent possible, Summa canisters were placed at a sampling height of 3 meters (m) above the ground, upwind of the building.
- Fourteen soil gas samples were collected from vertical shallow borings near the buildings. Soil gas was sampled from approximately 4 to 8 feet below ground surface (bgs) (above the water table) using a direct push stainless-steel screen, in accordance with the SAP (PSC, 2002a). This depth is consistent with the depth of a basement foundation.

A 6-Liter (L) Summa canister, equipped with dedicated flow regulators, was set to collect air samples over a 24-hour period to account for fluctuations in concentrations that typically occur diurnally throughout the day.

VOCs in air samples were analyzed by GC/MS and/or GC/MS-SIM using the laboratory modified version of EPA methods TO-14A and TO-15 (EPA, 1999). All VOC air analyses were validated according to the validation requirements presented in the QAPP. The analytical results of the air analyses are presented in Appendix B. Field data associated with

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approximately 300 feet from the residence, and similarly, the monitoring well sampled for 412 S. Orcas was

collection of the air samples are presented in Table A-2 and A-3, respectively. Summary results for indoor air, ambient air, and soil gas, for the inhalation COPCs are presented in Tables B-2, B-3, and B-4, respectively.

#### 2.1.3.2 Previous Air Sampling Events

Two previous indoor air surveys were performed in the vicinity of the PSC Georgetown facility in August 2000 and March 2001. The data collected during these surveys were reviewed to determine if they could be used to augment the GIVF air data. As per discussions on December 13, 2002 with EPA, Ecology, and DOH, the review focused on those groundwater and indoor air data pairs where the chemical of interest was detected in both media. The surveys and specific samples were reviewed to determine if they met the DQOs defined in the IPIM Work Plan.

In August 2000, PSC collected indoor air samples from 672 Lucile and 5409 Denver over a 24-hour period using 6L Summa canisters equipped with dedicated flow regulators. One ambient sample was also collected from an upgradient area along Denver Ave. S. for the same 24-hour period. PSC also collected groundwater samples from each location two weeks after the air sampling event. Four days prior to the groundwater sampling activities, DOH and EPA collected indoor air samples. However, no ambient samples were collected in conjunction with the indoor air samples, and no details regarding sampling methodology were provided to PSC.

The review of the August 2000 data relative to the IPIM Work Plan DQOs indicated the following important differences:

- Prior to PSC sampling indoor air, residents were asked to leave the building for a 72-hour period. The building was evacuated of five volumes of air, then closed up and allowed to re-equilibrate for a 24-hour period prior to the 24-hour sampling period. This differed from the methodology used during the GIVF sampling event.
- The PSC and EPA/DOH indoor air samples were not analyzed using the same methods as the IPIM survey data
- The EPA/DOH data did not undergo rigorous data validation.
- The PSC groundwater data were not collected in conjunction with the indoor air and ambient air samples.

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located approximately 200 feet from the building.

- The method used to analyze the groundwater samples did not achieve low detection limits, thus limiting the number of groundwater detections and subsequent data pairs that could be reviewed for the GIVF analysis (i.e., only two PSC data pairs had detections in both groundwater and indoor air).
- Calculated GIVFs for 1,1,1-TCA and 1,2-DCA for the two available data pairs were two orders of magnitude lower than the maximum target compound GIVF identified using the GIVF sampling data.

In March 2001, PSC and DOH collaborated to collect co-located groundwater, soil gas, and ambient air samples from 6 residential locations (672 Lucile, 5409 Denver, 303 Brandon, 134 Mead, 125 Findlay, and 412 Orcas). The indoor air and groundwater samples were collected during the same 48-hour period, but the ambient air samples were represented only by two field blank samples collected in conjunction with soil gas sampling during a 30 minute period within the 24-hour sampling period.

The review of the March 2001 data relative to the IPIM Work Plan DQOs indicated the following important differences:

- The sampling event occurred during a different season than the GIVF survery (March vs. August).
- A 24-hour ambient air sample was not collected during the indoor air sampling period to adjust indoor air values for background. Given that the GIVF study has shown that ambient air has a significant influence on indoor air concentrations throughout the Georgetown area, the lack of certainty in identifying the ambient air component during the March 2001 sampling event is of critical concern.
- DOH collected indoor air samples using a different sampling methodology than PSC (passive vs. dedicated flow regulators).
- The DOH air samples were analyzed using a different method than used during the GIVF sampling event.
- The method used to analyze the groundwater samples did not achieve low detection limits, thus limiting the number of groundwater detections and subsequent data pairs that could be reviewed for the GIVF analysis (i.e., only three data pairs had detections in both groundwater and indoor air).

Overall, the August 2000 and March 2001 data present spatial and temporal inconsistencies that do not meet the requirements of the August 2002 DQOs. These inconsistencies, coupled with the differences in sampling and analytical protocols, pointed to potential problems in comparing these data side-by-side with the GIVF sampling data to make Tier-based decisions. These data were therefore excluded from further analysis in the Tech Memo.

### 2.1.4 Geotechnical Results

Six geotechnical samples were collected from ground surface to 6 or 8 feet bgs at locations shown on Figure 2-1. As per the SAP, these borings were advanced to a depth of one foot above the capillary fringe[6]. Locations were selected to provide consistent area-wide coverage of the GIVF Study Area. Soil classifications, based on grain-size analysis, were determined by Rosa Environmental and Geotechnical Laboratory (Appendix C). Soil classifications and geotechnical results for these samples and all previous samples collected from Area 3 to date are presented in Appendix C (Tables C-1 and C-2, respectively). Soil classifications for these samples are posted by location and depth on Figure 2-2 and associated classification definitions are provided in Tables 2-11 through 2-15 (for USC Classification), Figure 2-7 (USDA SCS Classification). Although the generalized basement floor slab elevation is considered to be 4 to 8 feet below ground surface, geotechnical data are also presented in Figure 2-2 for 0 to 4 feet below ground surface, as these shallower data are relevant for buildings without basements (e.g., buildings that are built slab-on-grade or with crawlspaces).

Grain-size testing was conducted on all samples according to American Society for Testing Materials (ASTM)-D-422 using both sieve and hydrometer portions of the analysis. Soils were then classified using United States Department of Agriculture (USDA) soil texture based on grain size[7]. All six locations sampled during this field event showed mixtures of soil types within a single boring (ranging from sandy silt to sand). To date, a total of 17

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[6] Not all historic samples extended to the water table.

[7] The field logging conducted by geologists and geotechnical engineers traditionally uses the Unified Soil Classification System per ASTM D2487-93, which does not use the term "loam." However, the JEM model requires the use of the United States Conservation Service Soil Classification System (USDA SCS), which uses the term "loam." Due to these differences, the geotechnical samples were classified by each system (as depicted in Figure 2-2). The USDA SCS defines the term "loam" as "a soil having a relatively even mixture of different grades of sand and silt and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the

geotechnical samples have been collected to characterize the vadose zone soils west and south of the facility. Fourteen of these samples are from the GIVF Study Area, as shown in Figure 2-2. Figure 2-3a shows the percentage of soil types observed in Area 3 samples. Sand is observed in the top 4 feet in less than 10 percent of the samples; silt loam is most commonly observed (52 percent). Sand is somewhat more prevalent in the lower 4 to 8 feet (35 percent), but all samples indicate interbeds of finer-grained materials between the groundwater interface (water table) and ground surface. Only two samples had sand classified in the upper 4 feet bgs (M29 and S15). These borings, located west of the GIVF Study Area also have layers of finer-grained material in the soil profile. There are no locations where sand is continuously observed.

Although there are fewer geotechnical samples outside of the GIVF Study Area, lithologic logs from previous borings in Area 3 further illustrate the presence of substantially silty fine sand associated commonly with silt interbeds and, in two instances, clay. Nine boring logs[8] from Area 3 (reviewed to a depth of 8 feet bgs) identify a heterogeneous distribution of silty sand and fine sand with fine-grained interbeds, as documented by either continuous or alternating 2-foot lithologic logging. Thin to medium beds of silt or clay were commonly observed disrupting the vertical continuity of silty sand and sand deposits. No silt or clay was logged in borehole B6, near the PSC facility, although it includes substantially silty fine sand. Considering the density of coverage in the GIVF Study Area, conditions are fairly consistent and best represented by a silt loam to sandy loam in the upper portion of the zone underlain by sandy loam to sand in the lower portions.

Volumetric moisture content[9] in the six geotechnical samples and previous samples is consistent with the soil types identified in these samples. Moisture content measured for all samples collected to date (where available) is presented in Figure 2-3b. Sand and loamy sand tend to have lower moisture content ranging from 0.03 to 0.2 (for one sample of loamy sand at 5403 Maynard). Less than 20 percent of the samples had a moisture content below 0.10. A complete summary of the geotechnical information collected to date and the

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moist soil can be handled quite freely without breaking. The text is not referring, in this application, to the description of loam associated with the organic content soil."

[8] Boring logs: B4, B6, E7, B12, D7, D12, F9, K10, and H14 reviewed to a depth of 8 feet below ground surface. Boreholes K10 and H14 were recently completed as monitoring wells CG-130 and CG-131, respectively.

[9] Moisture content is represented here as water-filled porosity (e.g., volume of water/total volume in pore space). It is a function of the total porosity and the percent saturation of the soil. The moisture content data are provided for discussion purposes only, as it is recognized that episodic measurements of water-filled porosity may not accurately reflect long-term conditions.

laboratory report and soil classifications for the most recent sampling event provided by Rosa Environmental and Geotechnical Laboratory are presented in Appendix C.

## 2.2 CONTRIBUTIONS FROM BACKGROUND

In accordance with the IPIM Work Plan, indoor air sampling results for target compounds (TCs)[10] were adjusted for contributions from background using the maximum concentration represented from the following sources:

- Chemical concentrations detected in ambient air, likely to have infiltrated the building (Section 2.2.1), and
- Chemical concentrations from national background indoor air sources, compiled from peer-reviewed literature values (Section 2.2.2).

### 2.2.1 Ambient Air Results

The results of ambient air sampling are presented on Table B-3 in Appendix B and summarized for each chemical in Table 2-1. Maximum concentrations in ambient air were observed at sample location 6120[11] (412 South Orcas Street) for 1,1-dichloroethane [1,1-DCA] (0.42 ug/$m^3$) and TCE (4.1 ug/$m^3$). Maximum concentrations for chloroethane (0.56 ug/$m^3$) and vinyl chloride (0.63 ug/$m^3$), as well as, the only detected concentrations for cis-1,2-dichloroethene [cis1,2-DCE] (0.63 ug/$m^3$), trans-1,2-dichloroethene [trans1,2-DCE] (1.5 ug/$m^3$) and 1,2-DCA (17 ug/$m^3$) were detected outside of the groundwater plume area at sample location 727H (727 Homer). The maximum ambient concentration of tetrachloroethylene was detected in a duplicate sample at sample location 5327D (5327 Denver). At locations where tetrachloroethylene was detected in ambient air, it was not detected in groundwater.

Note: The ambient air concentrations measured in the Georgetown neighborhood were elevated with respect to the IPIMALs for indoor air. This should be considered when evaluating locations for possible Tier 4 IMs as in many cases it will not be possible to meet the indoor air IPIMALs because of contributions from ambient air sources.

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[10] Target compounds are compounds considered the most reliable tracers for representing volatilization of source COPCs from groundwater to indoor air. The basis for selection of these compounds is discussed in Section 3.3.1 of the IPIM Work Plan. Chemical-specific parameters that influence migration from groundwater to indoor air for TCs and other chemicals of interest are presented in Table 2-10.

[11] Sample 612O was collected at 412 S. Orcas Street, but was mis-labeled.

### 2.2.2 Background Indoor Air – Database and Literature Review

A comprehensive database and literature review was performed to compile available background indoor air data from surveys performed within the United States. As per the IPIM Work Plan, PSC identified data sets that could provide sufficient data to calculate or obtain the 25th and 75th percentiles of background indoor air values measured during the survey. The literature value selected for adjusting measured indoor air values (background indoor air value) was either the mean of the 25th and 75th percentiles, or the median, whichever was lower.

The following sources of information were reviewed and statistical information was either calculated (from the database) or extracted from reports summarizing the results.

- National Human Exposure Assessment Survey (NHEXAS) Region 5 Study Data Base. Quality Systems and Implementation Plan for Human Exposure Assessment (EPA, 1995) (Pellizzari et. al., 1995).
- California Air Resources Board (CARB) Data Base and Total Exposure Assessment Methodology (TEAM) studies (Clayton and Perritt, 1993).
- Assessment of Population Exposure and Carcinogenic Risk Posed by VOCs in Indoor Air (Stolwijk, 1989).
- National Ambient VOCs Data Base Update (Shah and Singh, 1988).

Relevant study information and sampling protocols from each study are presented in Appendix D, along with a table that summarizes the extracted information. As part of the literature review, the following data for each study were identified including:

- Year(s) samples were collected,
- Sample size (number of homes evaluated),
- Consistency and type of sampling protocol, and
- Sample population.

Background indoor air values selected for use in the GIVF study are presented in Table 2-1. The 25th and 75th percentile value was preferentially obtained from the NHEXAS Region 5 Study Data Base (EPA, 1995) or the CARB Data Base (Clayton and Perritt, 1993). Both the NHEXUS and CARB studies represent a large sample count and a well-documented and consistent sampling protocol.[12] The NHEXUS study is the most recent and was designed

[12] The only other 25th and 75th percentile data available were for 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, obtained from the National VOC Data Base (Shah and Singh, 1988). Sampling protocol,

with a population that closely represents the national profile. Compounds not found in the NHEXUS data base were selected from either the 1990 (first) or 1987 (second) CARB study (see Appendix C). The CARB data base is a consolidation of data from six California studies. Data from the final three studies, conducted in 1987 (two events) and 1990 were extracted for analysis. The 1990 study identified a subset of VOCs called very volatile organic compounds (VVOCs), which include the following chemicals: 1,1-DCE, cis 1,2-DCE, trans 1,2-DCE, and vinyl chloride. The VVOCs were collected in evacuated 6-L stainless-steel canisters and analyzed using GC/MS-SIM methodology, while the VOCs were collected on Tenax sorbent over a 24-hour period using very low flow pumps; the samples were analyzed by thermal desorption/GC/MS. This distinction had no effect on the GIVF calculation; vinyl chloride and 1,1-DCE were not adjusted for background indoor air (as they were not quantifiable in background studies). Neither vinyl chloride nor 1,1-DCE were detected above the method quantitation limit (MQL) (1.2 ug/$m^3$ and 0.7 ug/$m^3$, respectively) in the 1990 CARB study.

A summary of the available statistics from these databases and studies is presented in Table 2-1, along with the source of the data, the sample count for that chemical, and the frequency at which the chemical was detected above the MQL or Method Reporting Limit (MRL)[13]. Only compounds with 25th and 75th percentile statistical information were used for adjusting GIVF indoor air values. Other statistics, where available, are presented for information purposes in Appendix D. Chemicals for which 25th and 75th percentiles were not available (as indicated by a GIVF Value of "nd" or "na" in Table 2-1) were not adjusted unless the COPC was detected in ambient air at that location.

### 2.2.3 Application of Background Concentrations to GIVF Evaluation

In accordance with the IPIM Work Plan, indoor air concentrations of TCs were adjusted for background concentrations by subtracting the higher of the potential contributions from indoor air sources and ambient air sources, which are defined below:

- Background Indoor Air Value—the lower of the median or mean of the 25th and 75th percentiles for background indoor air obtained from the NHEXUS or CARB studies; and

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sampling period, and sample population were not documented for this study and the data are assumed to be highly variable and difficult to evaluate. Data from this study was not used to adjust indoor air concentrations in the GIVF analysis.

[13] The specific detection limit used was not always well documented in the databases.

- Ambient Air Value—measured ambient air value at each location.

Note: COPCs not detected in ambient air and not statistically represented in the NHEXUS or CARB databases (i.e., 1,1-DCE, chloroethane, cis1,2-DCE, and trans1,2-DCE) were not adjusted for background contributions.

## 2.3 DEVELOPMENT OF GIVFS AND GROUNDWATER IPIMALS

PSC developed groundwater IPIMALs for the inhalation pathway COPCs in a step-wise fashion, following the procedures outlined in the IPIM Work Plan and shown in Figure 2-4. The process for selecting an upper bound building and chemical-specific GIVF and calculating GIVFs for the remaining chemicals consists of the following steps:

1. Compile and evaluate indoor air, groundwater, soil gas, and ambient air data;
2. Calculate GIVFs and identify the upper bound or maximum GIVF;
3. Develop GIVFs for non-target compounds using the JEM model to determine adjustment factors; and
4. Develop groundwater IPIMALs based on chemical-specific GIVFs and indoor air IPIMALs.

### 2.3.1 Compile and Evaluate Data

Once the data were validated, PSC inspected and compiled groundwater, indoor air, soil gas, and ambient air data prior to calculating building-specific GIVFs. Detected concentrations of TCs in groundwater were paired with detected or non-detected results in indoor air to calculate the GIVFs. All field duplicate results were averaged using the following decision rules: 1) If both results were detected, average the results, 2) If both results were not detected, use the lower detection limit, 3) If one result was detected and the other was not detected, use the detected results. In the case of a duplicate with detected and non-detected results, the detected value was used in the initial evaluation. The effect of using averaged field duplicate data to calculate GIVFs is considered a minor uncertainty, as the relative percent difference between the detected values in duplicate samples was generally less than 20 percent. As a result, using the averaged data rather than one of the two duplicate results had little impact on the GIVF calculations.

In four of the data pairs, the results were J-qualified and considered by the data validators as biased low (Appendix B) (Exponent, 2002). There was little confidence in using these

estimates for the GIVF ratio because they would artificially overestimate the GIVF (for J-qualified groundwater data) and underestimate the GIVF (for J-qualified indoor air data); therefore, these four data points were not included in further analysis[14].

For locations with non-detected results in indoor air, it was assumed that the indoor air concentration was equivalent to the full reporting limit. All non-detected values are flagged in the tables with a "U" qualifier. At least two indoor air samples were collected from each building. The location with the maximum detected indoor air concentration was selected for developing the building-specific GIVFs. When a compound was not detected in indoor air at any location in the building (multiple non-detected results), the lowest reported detection limit was used for the data pair, as this represents the highest reasonable prediction of the indoor air concentration for that location[15]. The effect of using non-detect data and the full MRL to calculate the GIVF ratio is considered a significant uncertainty, which is discussed further in Section 2.3.2.3 and Section 4. However, this uncertainty systematically results in GIVFs that over predict the amount of soil gas migrating into air from a given groundwater concentration, which would result in more stringent estimated groundwater IPIMALs.

Table 2-2 shows how frequently TCs, TCE and benzene were detected in groundwater and, where detected in groundwater, how frequently the compound was detected in soil gas and indoor air. For each location where the TC (or TCE or benzene) was detected in groundwater, the compound is evaluated per building in Table 2-3. This information was used to qualitatively evaluate the data pairs. TCE is a risk-driving COPC, but it is commonly found in background indoor air and ambient air. Therefore it is not a TC but is included in Tables 2-2 and 2-3 for comparison purposes. Benzene is not a risk-driving COPC or TC, but it is also included in these tables at the request of Ecology. Also of note, none of these compounds were detected in groundwater collected at 507 S Brandon; therefore, this building is not included in the Table 2-3.

[14] Three of the excluded data points were based on J-qualified groundwater results for 1,2-dichloroethane, tetrachloroethane, and vinyl chloride (collected at 5409 Denver Ave S) and the remaining excluded data point was based on J-qualified indoor air results for vinyl chloride (collected at 5403 Maynard Ave S). In four of the data pairs, either the groundwater or indoor air result were J-qualified and considered by the data validators as biased low (Appendix B) (Exponent, 2002)

[15] When comparing two detection limits where one reported limit is higher than the other, it is reasonable to assume that if the chemical is present in the building, it would be present at a concentration lower than the lowest reported detection limit. If the chemical was present at a concentration lower than the higher reported detection limit, then it would have been detected in the sample with the lower detection limit.

The information presented in these tables indicates the following:

- Vinyl chloride was detected in 11 out of 12 groundwater samples (in concentrations ranging from 0.071 ug/L at 404 South Orcas to 176 ug/L at 5403 Maynard). One groundwater sample was J-qualified (5409 Denver). Soil gas was detected in 7 out of 11 samples where detected in groundwater. However, where detected in groundwater vinyl chloride was detected in only 5 indoor air samples. The indoor air sample from 5403 Maynard was J-qualified. The remaining four samples were collected at 613 Brandon during two sampling events. The groundwater concentration at 613 Brandon was relatively low (less than 1 ug/L in both samples), soil gas was low (0.5 $ug/m^3$ on 8/26/02 and non-detect on 8/19/02), and the nearby ambient air concentration was relatively high 0.68 $ug/m^3$. Since the ambient air concentration of vinyl chloride was nearly seven times higher than the measured indoor air concentration, it is likely that the indoor levels of the contaminant at 613 Brandon are more related to outdoor air than volatilization from groundwater.
- 1,1,1-TCA was detected in 3 out of 12 groundwater samples at 5409 Denver (5.47 ug/L) and twice at 672 South Lucile (72.4 ug/L and 82.4 ug/L). In each case, the compound was also detected in soil gas at the same relative concentration (i.e., a soil gas/groundwater ratio of 0.2). The compound was also detected in indoor air at these locations. Based on Henry's Law and diffusivity, 1,1,1-TCA is one of the more volatile compounds and the data pairs identified at 5409 Denver and 672 Lucile are considered indicative of the groundwater to indoor air pathway for this compound.
- Chloroethane was detected in 3 out of 12 groundwater samples at the same locations as the 1,1,1-TCA, however the maximum concentration (552 ug/L) was measured at 5409 Denver. Chloroethane was measured at 672 South Lucile during both sampling events (94.8 ug/L and 119 ug/L). Unlike 1,1,1-TCA, chloroethane was not detected in soil gas and was detected in only one indoor air sample (0.38 $ug/m^3$ at 672 South Lucile on 8/27/02). Chloroethane has a lower Henry's Law constant than 1,1,1-TCA (e.g., it moves less readily from groundwater to the soil gas phase), but once in the vadose zone, it has a higher diffusivity (e.g., moves more readily than 1,1,1-TCA as a function of porosity and moisture content). Non-detects in soil gas and only one indoor air detection indicate that potential for migration into indoor air at these locations is not as high as for 1,1,1-TCA.

- 1,1-DCE was detected in 6 out of 12 groundwater samples at low concentrations (ranging from 0.052 ug/L at 404 South Orcas to 4.46 ug/L at 412 South Orcas). The compound was detected in only one soil gas sample (672 South Lucile), which did not correlate with the maximum groundwater concentration. 1,1-DCE was not detected in any indoor air samples. 1,1,-DCE moves quickly into the gas phase (high Henry's Law coefficient) and diffuses readily through the vadose zone (as function of porosity and moisture content). However, the compound was not detected in soil gas or indoor air above detection limits, indicating that the concentration of 1,1-DCE observed in groundwater is not sufficient to result in migration to indoor air at these locations.

- trans1,2-DCE was detected in 5 out of 12 groundwater samples at concentrations ranging from 1.06 ug/L (5409 Denver) to 7.21 ug/L (5403 Maynard). The compound was not detected in soil gas or indoor air above detection limits. At these groundwater concentrations, there is not expected to be a complete pathway for trans1,2-DCE at these locations.

- 1,1-DCA was detected in 9 out of 12 groundwater samples, ranging in concentration from 1.8 ug/L at 412 South Lucile to 265 ug/L at 5403 Maynard. Where detected in groundwater, the compound was detected in 70 percent of the soil gas samples. While a consistent ratio between groundwater and soil gas was not observed (as in the case of 1,1,1-TCA), the maximum soil gas concentration correlated with the maximum groundwater concentration and the only detected indoor air result at 5403 Maynard. Based on the relatively low Henry's Law constant and diffusivity, 1,1-DCA is not among the more volatile TCs, but the data pair at 5403 Maynard is considered representative of the groundwater-to-indoor air pathway, given the higher concentrations in groundwater.

- Cis1,2-DCE was detected in 9 out of 12 groundwater samples at concentrations ranging from 3.18 ug/L at 412 South Lucile to 265 ug/L at 5403 Maynard. Where detected in groundwater, cis1,2-DCE was detected in only two soil gas samples, but there was a good correlation between the maximum detected soil gas (460 ug/$m^3$) and maximum groundwater at 5403 Maynard. Cis1,2-DCE was not detected in any indoor air sample. The data are consistent with the physical properties for cis1,2-DCE. It has a lower Henry's Law constant and diffusivity in air and water than 1,1-DCA, and is not expected to migrate as readily from groundwater into indoor air.

- 1,2-DCA was detected in 5 out of 12 groundwater samples in relatively low concentrations ranging from 0.172 ug/L at 404 South Orcas to 1.92 (J) ug/L at 5409 Denver and was not detected in soil gas. However, 1,2-DCA was detected in three indoor air locations at 404 South Orcas, 412 South Orcas, and 5409 Denver. 1,2-DCA has the lowest Henry's Law coefficient of the TCs and is not expected to readily move out of groundwater into the gas phase. This is consistent with the non-detects observed in soil gas. Therefore, given the low concentrations of groundwater, 1,2-DCA detected in indoor air at these locations may be associated with background indoor air and not related to a groundwater source.

- Tetrachloroethylene was detected in 5 out of 12 groundwater samples at very low concentrations ranging from 0.05 ug/L at 412 South Lucile to 1.76 (J) ug/L at 5409 Denver Street. Tetrachloroethylene was detected in soil gas at 4 out of 5 of these locations, but the elevated soil gas (280 ug/$m^3$) at 404 South Orcas did not correlate with the low groundwater concentration (0.1 ug/L) at this location, suggesting that the elevated soil gas concentration at 404 South Orcas is associated with another potential source (e.g., spill from a business in the area). Where detected in groundwater, tetrachloroethylene was detected in only three indoor air locations at low levels (404 South Orcas, 412 South Lucile, and 5409 Denver). The low concentrations measured in groundwater at 412 South Lucile and the lack of correlation with soil gas and indoor air detections make it more difficult to determine whether these results represent the groundwater to indoor air pathway at this location. However, the data pair at 5409 Denver may be representative of the groundwater-to-air pathway, given the presence of tetrachloroethylene in groundwater, soil gas, and indoor air.

- TCE was detected in 9 out of 12 groundwater samples at concentrations ranging from 0.032 ug/L at 611/613 South Brandon to 41.1 ug/L at 412 South Orcas.[16] Concentrations were less than 5 ug/L at all locations except for 412 South Orcas. TCE was detected in soil gas at 6 of these locations, but concentrations were low (0.89 to 7.5 ug/$m^3$). In contrast, TCE was detected in all indoor and ambient air locations, including 4 locations where it was not detected in groundwater. Both 404 and 406 South Orcas had the maximum concentrations in indoor air (7.4 ug/$m^3$ and 7.5 ug/$m^3$, respectively). The TCE concentration in ambient air at these locations was 4.1 ug/$m^3$. The ubiquitous presence of TCE in both indoor air and ambient air and

[16] The groundwater result from 5409 Denver was J-qualified.

the lack of correlation with results detected in either groundwater or soil gas validates the IPIM Work Plan approach – not to use TCE as a TC in the GIVF analysis.

- Benzene was detected in 6 out of 12 groundwater samples at concentrations ranging from 1.03 ug/L at 672 Lucile to 5.76 ug/L at 5409 Denver. Concentrations were less than 5 ug/L at all locations except for 5409 Denver. Benzene was detected in soil gas at 4 of these locations, but concentrations were low (0.51 ug/$m^3$ to 4 ug/$m^3$). In contrast, benzene was detected in all indoor and ambient air locations, including 5 locations where it was not detected in groundwater. Indoor air sample concentrations ranged from 0.93 ug/$m^3$ to 3.7 ug/$m^3$, with one higher concentration (11 ug/$m^3$) measured at 672 Lucile (8/27/02). Ambient air concentrations for benzene were similar, ranging from 0.95 ug/$m^3$ to 1.8 ug/$m^3$. The ubiquitous presence of benzene in both indoor air and ambient air and the lack of correlation with results detected in either groundwater or soil gas validates the IPIM Work Plan approach – not to use benzene as a TC in the GIVF analysis.

### 2.3.2 Calculate GIVFs and Identify Upper Bound or Maximum GIVF

#### 2.3.2.1 Calculate GIVFs and Attenuation Coefficients

Once the data set was compiled, both GIVFs and attenuation coefficients (ACs) were calculated for each TC and building location. Prior to calculating the GIVF for each TC, indoor air concentrations from each building were "adjusted" by subtracting the higher of the potential contributions from indoor air sources and site-specific ambient air sources, according to the rules outlined in Section 2.2.3. Locations where the ambient or background indoor air value was higher than the measured indoor air value were not used to calculate GIVFs. This occurred twice, for tetrachloroethene at 404 S. Orcas and at 412 S. Lucile. In both cases, tetrachloroethene was detected in indoor air samples at concentrations slightly lower than the background value of 2 ug/$m^3$.

In one case, indoor air concentrations were not adjusted according to the Work Plan. For 1,1,1-TCA, the indoor air concentration was adjusted using the ambient air value (0.22 ug/$m^3$ measured in the 5409D ambient air sample), which was lower then the National Indoor Air Background Value.[17] Data pairs detected in both groundwater and indoor air were limited. 1,1,1-TCA was the compound most consistently detected in both media (representing 3 out

[17] The national background indoor air value for 1,1,1-TCA was 3.1 ug/$m^3$ (see Table 2-1).

of 8 data pairs). Using the "national background air value" to adjust 1,1,1-TCA indoor air concentrations would have effectively removed these data pairs from the set (the national background value was greater than the measured indoor air value). Using the lower ambient air adjustment may result in a GIVF that is higher (more conservative) than a GIVF calculated using a larger background indoor air and allows the data pairs to be retained in the data set.

At each location, chemical-specific GIVFs for the TCs were calculated based on the following relationship:

$$GIVF_{TC}\,\frac{(mg/m^3)}{(mg/L)} = \frac{Indoor\ Air\ Concentration\ (mg/m^3)}{Groundwater\ Concentration\ (mg/L)}$$

As discussed in the data quality objectives, PSC applied the JEM (EQM, 2000) [18] to help evaluate the uncertainty of the empirical predictions of indoor air quality made through use of the GIVF methodology. To facilitate this evaluation, PSC also calculated GIVFs and ACs using the JEM to predict boundary conditions for maximum vapor migration and more plausible site-specific vapor migration. The AC for a given TC is the ratio between the indoor air concentration and the soil gas concentration at the source (groundwater/soil interface), as predicted by Henry's Law, and as shown by the relationships below:

(1)
$$AC_{TC}\,\frac{(mg/m^3)}{(mg/m^3)} = \frac{Indoor\ Air\ Concentration\ (mg/m^3)}{Soil\ Gas\ Concentration\ at\ Source\ (mg/m^3)}$$

Given a measured groundwater concentration, the JEM assumes equilibrium conditions between soil gas and groundwater and uses the Henry's Law constant to calculate a vapor-phase concentration according to the relationship below:

[18] The JEM, as it has evolved since its original development (Johnson and Ettinger, 1991), is a widely used analytical tool for modeling contaminant partitioning and subsurface vapor transport into buildings based on chemical-specific and site-specific properties. The JEM is available on the EPA Web site for Risk Assessment (www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm).

(2) $$Soil\ Gas\ Concentration\ at\ Source\ (mg/m^3) = H' \times Groundwater\ Concentration\ at\ Source\ (ug/L)\ \times 1000\ (L/m^3)$$

where:

H' = Henry's Law constant at the temperature of the groundwater (dimensionless, chemical-specific)

The Henry's Law constants used in the JEM for the TCs are summarized in Table 2-10.

#### 2.3.2.2 Compare Empirical Relationships to GIVFs and ACs Predicted by JEM

As discussed in the IPIM Work Plan, the physical characteristics of subsurface soil above the water table through which vapor migration occurs are important factors in determining how readily contaminants can migrate through the vadose zone. The effective permeability of soils in contact with a building greatly influences vapor migration into indoor air. Effective permeability is a function of soil type and moisture content (water-filled porosity). Increased permeability (associated with dry medium sands, for example) directly beneath a building increases vapor migration.

PSC applied the JEM to calculate modeled GIVFs for each TC for three different subsurface conditions:

- Conservative parameters for maximum migration – not specific to site (Upper Boundary).
- Plausible site-specific parameters for less migration (Lower Boundary).
- Plausible but more conservative site-specific parameters for more migration (Site-specific).

To facilitate the discussion, modeled ACs were also used for this comparison. Building parameters were set constant for all conditions to assume: 1) a depth to groundwater of 10 feet, 2) a basement configuration, 3) JEM default values for infiltration and pressure differential, and 4) a small enclosed space with an air exchange rate of 0.45/hr which reflects a low building ventilation rate. Specific parameters are shown on Table 2-4 and summarized below:

- For the Lower Boundary[19] conditions (lower range of vapor migration), loamy sand with a higher moisture content (0.3, selected based on JEM guidance and the presumption of likely some vertical or lateral infiltration of water), was assumed.
- For the Site-specific conditions (upper range vapor migration), two soil types were assumed (sand over loamy sand) with a low moisture content (based on ½-field capacity moisture characteristics of 0.054 and 0.076 for sand and loamy sand, respectively), which is the typical or mean value for sand (Hers, 2002). While generally more conservative than the conditions represented by the geotechnical samples collected in Area 3, these conditions were assumed to allow for the possibility of drier sandy soil directly beneath building foundations. These Site-specific conditions were applied to the JEM for calculating adjustment factors (AFs) for use in the GIVF calculations in accordance with the IPIM Work Plan (see Section 2.3.3).
- For the Upper Boundary conditions (maximum vapor migration), only one soil type (sand) was assumed to exist from surface to the water table with minimal moisture content (0.054, which is the typical or mean value for sand) (Hers, 2002). A user-defined soil vapor permeability of 1E-06 $cm^2$ was used to assume maximum predicted migration of soil gas to indoor air[20]. These conditions are significantly more permeable than any of the geotechnical samples collected from Area 3 indicate.

To establish the Upper, Lower, and Site-specific boundaries, GIVFs and ACs for each COPC were calculated using the three conditions described above and setting the groundwater concentration at unity. The results of these model runs (presented in Table 2-5) demonstrate that, for a given set of parameters and constant source concentration, there is little difference between chemicals in the vapor migration potential. The differences represent how readily each chemical volatilizes from groundwater and diffuses through the soil for a given porosity and moisture content.[21] The Upper, Lower, and Site-specific boundary GIVFs and ACs that were calculated by using the JEM are plotted on Figures 2-5a and 2-5b, respectively. Calculated GIVFs and ACs from the empirical data set are also

[19] Lower Boundary conditions selected for this study represent the moisture content and soil type (loamy sand) generally observed in several locations within the GIVF Study Area and are within the range of conditions measured and modeled in other studies (Johnson et. al., 2002).
[20] The user-defined soil vapor permeability for the Upper Boundary conditions was selected as the top of the typical range of vapor permeability for sands, as presented in the User's Guide for the JEM (EQM, 2000).
[21] The model does not account for biodegradation, which results in the most significant differences in vapor transport between chemicals. See Table 2-10 for information on the biodegradation rates of the COPCs.

plotted for each TC and building location. Each separate building sampling event is shown on the X-axis (i.e., 672 South Lucile and 613 Brandon were sampled twice). Data pairs detected in both groundwater and indoor air are circled.

Comparison of the empirical data to the range of modeled conditions on Figure 2-5a and Figure 2-5b provides a strong weight of evidence that vapor migration to indoor air in the Georgetown area is occurring within the ranges shown by the Site-specific conditions or Lower boundary condition predicted by the JEM.

- Out of 39 data pairs meeting the criteria for GIVF analysis established by the IPIM Work Plan, 77 percent have GIVFs and ACs that are at or below the Site-specific range predicted by the JEM.
- Where detected in both groundwater and indoor air, seven out of eight data points fall at or below the Site-specific range predicted by the JEM. For 1,1-DCA and 1,1,1-TCA, these detected data pairs show both elevated concentrations in groundwater and in soil gas, indicating that these pathways are likely representative of vapor transport from the groundwater source. 1,2-DCA, which generally had higher GIVFs and ACs in this group, did not have detections in soil gas, thus, indicating that these data pairs may be influenced by background indoor or ambient air sources.

#### 2.3.2.3 Identify Suspect Data Points and Remove Outliers

While the empirical data provide strong evidence for the degree of migration in the range of Site-specific Boundary conditions predicted by the JEM, there is a fairly wide range of GIVFs and ACs for each location, which is likely an artifact of background sources, and, more often, the combined effect of non-detected indoor air (reported at the MRL or higher) and low groundwater concentrations. The greatest range of chemical-specific ACs predicted by the JEM for each TC is shown with the error bars above and below the Upper Boundary line on Figure 2-5b, indicating that the range of ACs, given the same above ground and subsurface conditions, should be relatively small. The range is too small to distinguish on the plot for the Lower Boundary JEM Parameters[22]. Given the consistent conditions expected for each location, the variability shown by the empirical data on Figures 2-5a and 2-5b more likely reflects the effects of one or more of these artifacts.

[22] The variability between chemicals increases for the Upper Boundary conditions, as a function of total porosity and moisture content.

GIVFs and ACs that plotted near or above the Upper Boundary predicted by the JEM on Figures 2-5a and 2-5b were evaluated further because these ratios were not considered plausible for this area. Those considered suspect and removed from further application in the GIVF evaluation are designated with an "S" on Figures 2-5a and 2-5b. A total of seven empirical data pairs were considered suspect, as shown in Table 2-6. These suspect empirical data pairs fell into two categories:

- **Data pairs that were not detected in indoor air or soil gas.** Six data pairs were not detected in indoor air or soil gas and all groundwater concentrations were very low (at or near the MRL). Additionally, the reporting limit for the non-detects was up to two times the MRL for that chemical, further compounding the effect. The GIVFs and ACs were elevated as a consequence of the analytical results being reported near the limit of detection coupled with elevated detection limits for the indoor air results.
- **Data pairs that were detected in indoor air.** There was only one case in which a data pair detected in indoor air was considered suspect. The compound 1,2-DCA was detected in indoor air at 404 South Orcas in the primary sample but not the duplicate. Although not rejected for quality purposes by the validators (Exponent, 2002), there was little confidence in using this data point in the GIVF analysis because of the confounding effect of the uncertain indoor air concentration and the low groundwater concentration. The empirically calculated GIVF (0.331) for 1,2-DCA was an order of magnitude higher than the Upper Boundary value for that COPC predicted by the JEM (see Table 2-5), and the concentration in groundwater (0.172 ug/L) was below the MRL reported in the QAPP. The empirically calculated AC was 1.3E-02 compared to the Upper Boundary for 1,2-DCA of 1.9E-03. The compound was not detected in soil gas. The indoor air value predicted by the JEM (0.002 ug/$m^3$) using the Site-specific Boundary parameters was two orders of magnitude below what was measured in the primary sample (0.22 ug/$m^3$). Finally, conditions at 404 South Orcas (slab-on-grade over silt loam in the subsurface) do not indicate the potential for increased migration over other locations measured in the GIVF Study Area. The building evaluation (Appendix A) indicates the building was formerly used for solvent storage and printing supplies associated with a print shop, but the building is now vacant.

The effect of data pairs with low groundwater and non-detected indoor air values on the AC for these data pairs is demonstrated in Figure 2-6, which compares groundwater

concentration and ACs for cis1,2-DCE and 1,1-DCE. Both chemicals show varying concentrations in the groundwater (3.2 to 265 ug/L for cis1,2-DCE and 0.052 to 4.5 ug/L for 1,1-DCE) with the same reporting limit in indoor air. This results in a range of ACs that vary by almost two orders of magnitude for data pairs that all were reported at the MRL or higher in indoor air. A similar phenomenon is noted for trans1,2-DCE. Though rarely detected in groundwater (at very low concentrations) and not detected in soil gas, the GIVFs and ACs calculated using the trans1,2-DCE empirical data pairs result in some of the highest GIVFs and ACs in the data set.

This increased disparity between sampled and modeled results in locations with low groundwater concentrations and the subsequent uncertainties with these data has been recognized at other sites where similar studies have been performed to derive an empirical relationship between groundwater and indoor air (Mann, 2000 and Johnson et. al., 2002). Furthermore, the Colorado empirical study (Johnson et. al., 2002) had an extensive data set and the authors used only data pairs with detected concentrations in both groundwater and indoor air to eliminate the phenomenon of deriving relationships using non-detected concentrations. Due to sampling constraints and the subsequently small data set for this study, removal of non-detect indoor air data points was not an option and the full detection reporting limit was retained in accordance with the IPIM Work Plan. However, as shown in this study and others, the more reliable empirical data pairs are those with the highest concentrations in groundwater and detections in indoor air.

In summary, 7 out of 39 data pairs were considered outliers and removed from further analysis for the reasons outlined above. These are shown in Table 2-6 and designated with an S on Figures 2-5a and 2-5b.

#### 2.3.2.4 Selection of $GIVF_{TC}$

The IPIM Work Plan states that the 95 percent upper confidence limit (UCL) GIVF or maximum GIVF value should be used for the $GIVF_{TC}$. Due to the limited data set, maximum values were identified for each chemical. Table 2-7 presents the minimum and maximum GIVFs and attenuation coefficients for each TC.

The maximum GIVF selected for use in developing the groundwater IPIMALs was calculated from the data pair for 1,1-DCE (measured in groundwater but not detected in indoor air) at 406 South Orcas. This GIVF was selected in accordance with the IPIM Work

Plan and is considered the most conservative representation of the potential for vapor migration to indoor air for the following reasons.

- This is the maximum value of the calculated building and TC-specific GIVFs in the data set (after the outliers are removed).
- The ratio is based on detected values in groundwater but not indoor air and reflects the effects of using the full detection limit. This site-specific value is likely an overestimate because it is calculated using relatively low concentrations in groundwater and non-detect values reported at the full detection limit in indoor air.

Note: The maximum GIVF is not identical to the maximum AC. For example, the maximum AC shown on Table 2-7 is for 1,2-DCA (5.73E-04), not for 1,1-DCE. The AC reflects the application of the dimensionless Henry's Law coefficient, which represents the chemical-specific rate at which a chemical volatilizes from groundwater into the soil gas phase. This calculation incorporates assumptions about the temperature of the groundwater/subsurface that may or may not be the same as when the data for developing the GIVFs were collected. For calculating groundwater IPIMALs, the GIVF was used to eliminate this uncertainty.

### 2.3.3 Calculate GIVFs for Non-Target Compounds

PSC used the most stringent (highest) representative GIVF for the TCs identified above ($GIVF_{1,1\text{-DCE}}$) to derive a GIVF for each remaining COPC ($GIVF_{COPC}$) based on the relationship of the physical/chemical properties of the protective TC to the COPC. This relationship is expressed in the form of a chemical-specific AF that is determined by using the JEM to calculate a proportional ratio that is based on the chemical-specific difference in migration potential for each compound. The JEM was applied using the Site-specific set of parameters introduced in Section 2.3.2.2 to predict the indoor air concentration for a given groundwater concentration (i.e., 1 µg/L) of the COPC ($C_{Indoor_COPC}$)and the 1,1-DCE ($C_{Indoor_1,1\text{-DCE}}$) which is the target compound with the most protective GIVF ($GIVF_{1,1\text{-DCE}}$).

The $GIVF_{COPC}$ was calculated using the following relationship:

$$GIVF_{COPC}\frac{(mg/m^3)}{(mg/L)} = GIVF_{1,1DCE}\frac{(mg/m^3)}{(mg/L)} * \mathrm{AF}$$

in which:

$$AF = \left[ \frac{C_{Indoor_COPC}}{C_{Indoor_1,1DCE}} \right]$$

Using this approach, an AF (proportioned to 1,1-DCE) was calculated for all the remaining COPCs. The calculated GIVF for each COPC, based on these modeled AFs, is presented in Table 2-8.

### 2.3.4 Develop IPIMALs for Groundwater

The IPIMALs for groundwater were calculated based on the GIVF ratio (e.g., the ratio between groundwater and estimated indoor air concentration) using conservative risk-based indoor air action levels (IPIMALs) and the chemical-specific GIVF.

The IPIMALs are based on the action levels for indoor air developed in the Draft HHERA (PSC, 2001). These action levels were developed such that the maximum indoor air concentrations of each constituent are health protective action levels based on a chemical-specific carcinogenic risk goal of 1E-06 and a hazard quotient of 0.1 for non-carcinogens for both residential and commercial/industrial workers. Table 2-9 presents the indoor air action levels for residential and commercial receptors and the specific exposure assumptions on which these action levels are based. As shown in Figure 2-4, IPIMALs for groundwater were calculated using the action levels for indoor air and the GIVFs using the following relationship:

$$IPIMAL\,Groundwater\ (mg/L) = \frac{IPIMAL\,IndoorAir\ (mg/m^3)}{GIVF\,\frac{(mg/m^3)}{(mg/L)}}$$

Table 2-9 also shows the calculated residential and commercial groundwater IPIMALs for each COPC that will be used to evaluate quarterly groundwater monitoring results by applying the IPIM Decision Tree.

Note: The individual COPC cancer risk and non-cancer hazard goals for residents stipulated in MTCA are 1E-06 and an HQ of 1, respectively (WAC 173-340-705 (2)(C)). The cumulative cancer risk and non-cancer hazard goals were 1E-05 and an HI of 1, respectively (WAC 173-340-705 (4)).

The individual COPC cancer risk and non-cancer hazard goals for commercial/industrial workers stipulated in MTCA are 1E-05 and an HQ of 1 (WAC 173-340-706 (2)(C)). The cumulative cancer risk and non-cancer hazard goals are 1E-05 and an HI of 1, respectively (WAC 173-340-706(4)). For the purposes of this evaluation, the individual COPC cancer risk and non-cancer hazard goals were 1E-06 and an HQ of 0.1. The cumulative cancer risk and non-cancer hazard goals were 1E-05 and an HI of 1.

**Table 2-1.** Background Indoor Air Values and Ambient Air Values Used in GIVF Study

| | | | Ambient Air (ug/m$^3$) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Minimum Detect** | **Location of Minimum** | **Maximum Detect** | **Location of Maximum** | **Average of Detects** | **Number of Detects** |
| **CAS-No** | **Analyte** | **Units** | | | | | | |
| 71-55-6 | 1,1,1-Trichloroethane | ug/m3 | 0.18 | 5403M | 0.22 | 5409D | 0.2 | 4/7 |
| 75-34-3 | 1,1-Dichloroethane | ug/m3 | 0.26 | 727H | 0.42 | 6120 | 0.34 | 2/7 |
| 75-35-4 | 1,1-Dichloroethene | ug/m3 | | -nd- | | - nd - | | - nd- |
| 95-63-6 | 1,2,4-Trimethylbenzene | ug/m3 | 0.35 | 5409D | 2.1 | 5327D9 | 0.90875 | 7/7 |
| 107-06-2 | 1,2-Dichloroethane | ug/m3 | 17 | 727H | 17 | 727H | 17 | 1/7 |
| 108-67-8 | 1,3,5-Trimethylbenzene | ug/m3 | 0.18 | 507B | 0.73 | 6120 | 0.51 | 5/7 |
| 591-78-6 | 2-Hexanone | ug/m3 | 1.3 | 5403M | 3.2 | 6120 | 2.05 | 4/7 |
| 71-43-2 | Benzene | ug/m3 | 0.95 | 5409D | 1.8 | 5327D | 1.35625 | 7/7 |
| 75-00-3 | Chloroethane | ug/m3 | 0.55 | 507B | 0.56 | 727H | 0.555 | 2/7 |
| 67-66-3 | Chloroform | ug/m3 | 2.4 | 727H | 2.4 | 727H | 2.4 | 1/7 |
| 98-82-8 | Cumene | ug/m3 | | - nd - | | - nd - | | - nd - |
| 100-41-4 | Ethyl Benzene | ug/m3 | 0.49 | 507B | 1.1 | 5403M | 0.78375 | 7/7 |
| 91-20-3 | Naphthalene | ug/m3 | | - nd - | | - nd - | | - nd - |
| 103-65-1 | Propylbenzene | ug/m3 | | - nd - | | - nd - | | - nd - |
| 127-18-4 | Tetrachloroethene | ug/m3 | 0.24 | 727H | 0.41 | 5327D9 | 0.35 | 3/7 |
| 108-88-3 | Toluene | ug/m3 | 3.3 | 5409D | 9.1 | 5403M | 6.575 | 7/7 |
| 79-01-6 | Trichloroethene | ug/m3 | 0.41 | 5327D | 4.1 | 6120 | 1.47375 | 7/7 |
| 75-01-4 | Vinyl Chloride | ug/m3 | 0.19 | 5327D9 | 2 | 727H | 0.76 | 4/7 |
| 156-59-2 | cis-1,2-Dichloroethene | ug/m3 | 0.63 | 727H | 0.63 | 727H | 0.63 | 1/7 |
| 135-98-8 | sec-Butylbenzene | ug/m3 | | - nd - | | - nd- | | - nd- |
| 156-60-5 | trans-1,2-Dichloroethene | ug/m3 | 1.5 | 727H | 1.5 | 727H | 1.5 | 1/7 |

**Table 2-1.** Background Indoor Air Values and Ambient Air Values Used in GIVF Study (continued)

| | | | National Background Indoor Air Evaluation (ug/m$^3$) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Background Indoor Air Concentrations | | | Data Source | Sample Count | Percent Detected above MQL or MRL |
| **CAS-No** | **Analyte** | **Units** | **GIVF Value[1]** | **Minimum** | **Maximum** | | | |
| 71-55-6 | 1,1,1-Trichloroethane | ug/m3 | 3.1 | 0.09 | 816.5 | NHEXUS | 395 | 76 |
| 75-34-3 | 1,1-Dichloroethane | ug/m3 | -nd- | - nd- | - nd- | CARB | 41 | nd |
| 75-35-4 | 1,1-Dichloroethene | ug/m3 | - nd- | - nd- | - nd- | CARB | 55 | nd |
| 95-63-6 | 1,2,4-Trimethylbenzene | ug/m3 | 1.4 | 0.59 | 3.96 | Natl. VOC | 96 | na |
| 107-06-2 | 1,2-Dichloroethane | ug/m3 | 0.163 | 0.1 | 0.75 | CARB | 224 | 56 |
| 108-67-8 | 1,3,5-Trimethylbenzene | ug/m3 | - na- | 1.43 | 5.41 | Natl. VOC | 178 | na |
| 591-78-6 | 2-Hexanone | ug/m3 | - na- | -na- | - na- | -na- | | |
| 71-43-2 | Benzene | ug/m3 | 4.7 | 0.75 | 156.3 | NHEXUS | 401 | 99 |
| 75-00-3 | Chloroethane | ug/m3 | - na- | - na- | - na- | -na- | | |
| 67-66-3 | Chloroform | ug/m3 | 1.8 | | 34.02 | NHEXUS | 398 | 67 |
| 98-82-8 | Cumene | ug/m3 | -na- | - na- | - na- | -na- | | |
| 100-41-4 | Ethyl Benzene | ug/m3 | 3.253 | 0.63 | 24.12 | CARB | 247 | 100 |
| 91-20-3 | Naphthalene | ug/m3 | - na- | 2 | 5 | Stolwijk | 500 | na |
| 103-65-1 | Propylbenzene | ug/m3 | - na- | 2 | 6 | Stolwijk | 500 | na |
| 127-18-4 | Tetrachloroethene | ug/m3 | 2 | 0.03 | 659.6 | NHEXUS | 350 | 61 |
| 108-88-3 | Toluene | ug/m3 | 24 | 4.24 | 1885 | NHEXUS | 402 | 100 |
| 79-01-6 | Trichloroethene | ug/m3 | 0.59 | 0.001 | 720.4 | NHEXUS | 321 | 32 |
| 75-01-4 | Vinyl Chloride | ug/m3 | -nd- | - nd- | - nd- | CARB | 62 | nd |
| 156-59-2 | cis-1,2-Dichloroethene | ug/m3 | -nd- | - nd- | - nd- | CARB | 2661 | nd |
| 135-98-8 | sec-Butylbenzene | ug/m3 | -na- | 1 | 10 | Stolwijk | | |
| 156-60-5 | trans-1,2-Dichloroethene | ug/m3 | -na- | - na- | - na- | CARB | 41 | 2.4 |

Notes:
na – not available
nd – not detected above MRL or MQL
MRL – Method Reporting Limit; MQL – Method Quantitation Limit
1. GIVF value is the value selected for adjusting the measured indoor air value. Chemicals for which this value is not available (indicated by an "na" or "nd") were not adjusted unless the COPC was detected in ambient air at that location. The location-specific ambient air values used to correct indoor air values are provided in Table 2-3.

**Table 2-2.** Number of Detected Target Compounds and TCE Detected in Groundwater, Soil Gas, and Indoor Air

| Cas_No | Target Compound[1] | Groundwater | | Number of Detections In Media Where Detected in Groundwater | | | |
|---|---|---|---|---|---|---|---|
| | | | | Soil Gas | | Indoor Air | |
| | | Number of Data Points | Number of Detects | Number of Sample Locations | Number of Detects | Number of Sample Locations | Number of Detects |
| 71-55-6 | 1,1,1-Trichloroethane | 12 | 3 | 3 | 3 | 7 | 7 |
| 75-34-3 | 1,1-Dichloroethane | 12 | 9 | 9 | 6 | 20 | 1 |
| 75-35-4 | 1,1-Dichloroethene | 12 | 6 | 6 | 1 | 13 | 0 |
| 107-06-2 | 1,2-Dichloroethane | 12 | 5 | 5 | 0 | 10 | 5 |
| 71-43-2 | Benzene | 12 | 6 | 6 | 4 | 12 | 12 |
| 75-00-3 | Chloroethane | 12 | 3 | 3 | 0 | 7 | 1 |
| 156-59-2 | cis-1,2-Dichloroethene | 12 | 9 | 9 | 2 | 21 | 0 |
| 127-18-4 | Tetrachloroethene | 12 | 5 | 5 | 4 | 11 | 4 |
| 156-60-5 | trans-1,2-Dichloroethene | 12 | 5 | 5 | 0 | 11 | 0 |
| 79-01-6 | Trichloroethylene | 12 | 9 | 9 | 6 | 21 | 21 |
| 75-01-4 | Vinyl Chloride | 12 | 11 | 11 | 7 | 26 | 4 |

Notes:
1. Target Compounds (TCs) selected for GIVF analysis in IPIM Work Plan. TCE and benzene are not TCs, but are included for comparison purposes

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| **Building Location** | **Closest Geotech Sample** | | H14 |
|---|---|---|---|
| 404 S. Orcas | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | sandy loam |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 |
| Building Type | Residence type - on slab | | |

| | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1-Dichloroethane | 4.5 | 4.5 U | 0.14 U | 0.29 U | -- | 0.42 | -- | Yes - AA | Yes | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | 0.052 | 4.4 U | 0.07 U | 0.14 U | -- | 0.079 U | -- | -- | -- | 0.070 | 1.77E-03 | 1.3462 | 1.33E-02 | 0.0003 |
| 1,2-Dichloroethane | 0.172 | 4.5 U | 0.22 | 0.29 U | -- | 0.16 U | 0.163 | No | -- | 0.057 | 1.32E-02 | 0.3314 | 1.91E-03 | 0.0004 |
| cis-1,2-Dichloroethene | 4.57 | 4.4 U | 0.14 U | 0.29 U | -- | 0.16 U | -- | -- | -- | 0.14 | 2.79E-04 | 0.0306 | 1.50E-01 | 0.0003 |
| Tetrachloroethene | 0.097 | 280 | 0.31 | 0.49 U | -- | 0.27 U | 2 | Yes - BG | Yes | -- | -- | -- | -- | -- |
| Vinyl Chloride | 0.071 | 2.8 U | 0.045 U | 0.093 U | -- | 0.5 | -- | Yes - AA | Yes | 0.045 | 7.39E-04 | 0.6338 | 2.34E-02 | 0.0004 |
| Trichloroethylene[1] | 1.5 | 5.9 U | 5.35 | 7.4 | -- | 4.1 | 0.59 | No | -- | -- | -- | -- | -- | -- |

| **Building Location** | **Closest Geotech Sample** | | H14 |
|---|---|---|---|
| 406 S Orcas | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | sandy loam |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 |
| Building Type | Residence type - with basement | | |

| | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1-Dichloroethane | 31.7 | 0.68 | 0.15 U | 0.15 U | -- | 0.42 | -- | Yes - AA | yes | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | 0.419 | 0.085 U | 0.072 U | 0.072 U | -- | 0.079 U | -- | -- | -- | 0.072 | 2.26E-04 | 0.1718 | 1.07E-01 | 0.0003 |
| 1,2-Dichloroethane | 0.535 | 0.17 U | 0.15 U | 0.15 U | -- | 0.16 U | 0.163 | Yes - BG | no | -- | -- | -- | -- | -- |
| Tetrachloroethene | 0.06 | 8.2 | 0.25 U | 0.25 U | -- | 0.27 U | 2 | Yes - BG | yes | -- | -- | -- | -- | -- |
| Vinyl Chloride | 15.8 | 1.6 | 0.046 U | 0.046 U | -- | 0.5 | -- | Yes - AA | yes | 0.046 | 3.39E-06 | 0.0029 | 5.21E+00 | 0.0004 |
| cis-1,2-Dichloroethene | 20.2 | 0.17 U | 0.14 U | 0.14 U | -- | 0.16 U | -- | -- | -- | 0.14 | 6.32E-05 | 0.0069 | 6.62E-01 | 0.0003 |
| Trichloroethylene[1] | 4.38 | 3.4 | 7.25 | 7.5 | -- | 4.1 | 0.59 | No | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| **Building Location** | **Closest Geotech Sample** | | H14 |
|---|---|---|---|
| 412 S Orcas | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | sandy loam |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 |
| Building Type | Residence type - on slab | | |

| | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1-Dichloroethane | 38.8 D | 0.63 | 0.14 U | 0.15 U | -- | 0.42 | -- | Yes - AA | yes | -- | -- | -- | -- | -- |
| 1,1-Dichloroethene | 4.46 D | 0.081 U | 0.068 U | 0.072 U | -- | 0.079 U | -- | -- | -- | 0.068 | 2.00E-05 | 0.0152 | 1.14E+00 | 0.0003 |
| 1,2-Dichloroethane | 1.87 | 0.16 U | 0.14 | 0.19 | -- | 0.16 U | 0.163 | No | -- | 0.027 | 5.73E-04 | 0.0144 | 2.08E-02 | 0.0004 |
| Vinyl Chloride | 51.1 D | 0.49 | 0.044 U | 0.046 U | -- | 0.5 | -- | Yes - AA | Yes | 0.044 | 1.00E-06 | 0.0009 | 1.69E+01 | 0.0004 |
| cis-1,2-Dichloroethene | 80.9 D | 0.16 U | 0.14 U | 0.14 U | -- | 0.16 U | -- | -- | -- | 0.14 | 1.58E-05 | 0.0017 | 2.65E+00 | 0.0003 |
| trans-1,2-Dichloroethene | 1.47 D | 0.81 U | 0.68 U | 0.72 U | -- | 0.79 U | -- | -- | -- | 0.68 | 1.76E-03 | 0.4626 | 1.07E-01 | 0.0003 |
| Trichloroethylene[1] | 44.1 D | 7.5 | 3.9 | 4.6 | -- | 4.1 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| Benzene[1] | 3.46 D | 4 | 1.4 | 1.5 | -- | 1.2 | -- | -- | -- | -- | -- | -- | -- | -- |

| **Building Location** | **Closest Geotech Sample** | | K10 |
|---|---|---|---|
| 412 S Lucile | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | silt loam |
| Water-filled Porosity | 0.57 | 0.56 | 0.82 |
| Building Type | Residence type - with basement | | |

| | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1-Dichloroethane | 1.8 | 4.4 U | 0.14 U | 0.15 U | 0.14 U | 0.19 U | -- | -- | -- | 0.14 | 5.06E-04 | 0.0778 | 8.15E-02 | 0.0003 |
| 1,1-Dichloroethene | 0.091 | 4.3 U | 0.07 U | 0.074 U | 0.068 U | 0.19 U | -- | -- | -- | 0.068 | 9.83E-04 | 0.7473 | 2.33E-02 | 0.0003 |
| Tetrachloroethene | 0.052 | 7.3 U | 0.24 U | 0.25 U | 0.26 | 0.26 U | 2 | Yes-BG | yes | -- | -- | -- | -- | -- |
| Vinyl Chloride | 0.284 | 2.8 U | 0.045 U | 0.048 U | 0.044 U | 0.19 U | -- | -- | -- | 0.044 | 1.81E-04 | 0.1549 | 9.37E-02 | 0.0004 |
| cis-1,2-Dichloroethene | 3.18 | 4.3 U | 0.14 U | 0.15 U | 0.14 U | 0.15 U | -- | -- | -- | 0.14 | 4.01E-04 | 0.0440 | 1.04E-01 | 0.0003 |
| Trichloroethylene[1] | 1.54 | 5.8 U | 1.85 | 2.1 | 2.2 | 2.3 | 0.59 | Yes - AA | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| **Building Location** | **Closest Geotech Sample** | | 5403M | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5327 Denver Ave S | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | | | | | | | | | | | |
| Soil Type | silt loam | silt loam | loamy sand | | | | | | | | | | | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | | | | | | | | | | | |
| Building Type | Residence type with crawl space | | | | | | | | | | | | | |
| | | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | **JEM Modeled** | |
| **Target Compounds Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air (AA) ug/m3** | **National Background Value (BG) ug/m3** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| 1,1-Dichloroethane | 3.11 | 2.7 | 0.16 U | -- | -- | 0.14 U | -- | -- | -- | 0.16 | 3.34E-04 | 0.0514 | 1.41E-01 | 0.0003 |
| Vinyl Chloride | 0.209 | 0.23 | 0.051 U | -- | -- | 0.31 | -- | Yes - AA | Yes | 0.051 | 2.84E-04 | 0.2440 | 6.89E-02 | 0.0004 |
| Trichloroethylene[1] | 0.073 | 0.89 | 0.335 | -- | -- | 0.41 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| Benzene[1] | 1.32 | 2.9 | 1.75 | -- | -- | 1.8 | -- | -- | -- | -- | -- | -- | -- | -- |

| **Building Location** | **Closest Geotech Sample** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5327 Denver Ave S (CS) | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | | | | | | | | | | | |
| Soil Type | silt loam | silt loam | loamy sand | | | | | | | | | | | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | | | | | | | | | | | |
| Building Type | Residence type with crawl space | | | | | | | | | | | | | |
| | | | | | | | | **Adjustments to Indoor Air** | | | **Calculated Empirical** | | **JEM Modeled** | |
| **Target Compounds Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air (AA) ug/m3** | **National Background Value (BG) ug/m3** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| 1,1-Dichloroethane | 3.11 | 2.7 | 0.15 U | -- | -- | 0.14 U | -- | -- | -- | 0.15 | 3.14E-04 | 0.0482 | 1.41E-01 | 0.0003 |
| Vinyl Chloride | 0.209 | 0.23 | 0.046 U | -- | -- | 0.31 | -- | Yes - AA | yes | 0.046 | 2.57E-04 | 0.2201 | 6.89E-02 | 0.0004 |
| Trichloroethylene[1] | 0.073 | 0.89 | 0.35 | -- | -- | 0.41 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| Benzene[1] | 1.32 | 2.9 | 1.75 | -- | -- | 1.8 | -- | -- | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| **Building Location** | **Closest Geotech Sample** | | 5403M |
|---|---|---|---|
| 5403 Maynard Ave S | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | loamy sand |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 |
| Building Type | Residence type with basement | | |

| | | | | | | | **Adjustments to Indoor Air** | | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1-Dichloroethane | 265 D | 610 | 0.21 | 0.16 U | -- | 0.12 U | -- | -- | -- | 0.21 | 5.15E-06 | 0.0008 | 1.20E+01 | 0.0003 |
| 1,1-Dichloroethene | 1.93 D | 16 U | 0.075 U | 0.077 U | -- | 0.06 U | -- | -- | -- | 0.075 | 5.11E-05 | 0.0389 | 4.94E-01 | 0.0003 |
| cis-1,2-Dichloroethene | 265 D | 460 | 0.15 U | 0.15 U | -- | 0.12 U | -- | -- | -- | 0.15 | 5.16E-06 | 0.0006 | 8.68E+00 | 0.0003 |
| trans-1,2-Dichloroethene | 7.21 D | 65 U | 0.75 U | 0.77 U | -- | 0.6 U | -- | -- | -- | 0.75 | 3.97E-04 | 0.1040 | 5.26E-01 | 0.0003 |
| Vinyl Chloride | 176 D | 10 U | 0.048 U | 0.049 J | -- | 0.68 | -- | Yes - AA | Yes | -- | -- | -- | -- | -- |
| Benzene[1] | 2.48 D | 13 U | 1.2 | 1.3 | | 1.1 | -- | -- | -- | -- | -- | -- | -- | -- |

| **Building Location** | **Closest Geotech Sample** | | CG-113 |
|---|---|---|---|
| 5409 Denvers Ave S | 0-3' bgs | 3-6' bgs | |
| Soil Type | silt | sand | |
| Water-filled Porosity | na | na | |
| Building Type | | | |

| | | | | | | | **Adjustments to Indoor Air** | | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1,1-Trichloroethane | 5.47 | 27 | 0.295 | 0.31 | -- | 0.22 | 3.1 | No | -- | 0.090 | 3.58E-05 | 0.0165 | 7.49E-01 | 0.0003 |
| 1,1-Dichloroethane | 48.4 | 0.16 U | 0.14 U | 0.14 U | -- | 0.15 U | -- | -- | -- | 0.14 | 1.88E-05 | 0.0029 | 2.19E+00 | 0.0003 |
| 1,2-Dichloroethane | 1.92 J | 0.16 U | 2.15 | 0.87 | -- | 0.15 U | 0.163 | No | -- | -- | na | na | na | na |
| Chloroethane | 552 D | 0.26 U | 0.23 U | 0.22 U | -- | 0.25 U | -- | -- | -- | 0.22 | 5.60E-06 | 0.0004 | 6.91E+01 | 0.0004 |
| cis-1,2-Dichloroethene | 5.94 | 0.16 U | 0.14 U | 0.14 U | -- | 0.15 U | -- | -- | -- | 0.14 | 2.15E-04 | 0.0236 | 1.95E-01 | 0.0003 |
| Tetrachloroethene | 1.76 J | 40 | 0.25 | 0.68 | -- | 0.26 U | 2 | Yes - BG | Yes | -- | na | na | na | na |
| Trichloroethylene[1] | 0.943 J | 0.21 U | 0.495 | 0.83 | -- | 0.48 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| trans-1,2-Dichloroethene | 1.06 | 0.79 U | 0.69 U | 0.68 U | -- | 0.75 U | -- | -- | -- | 0.68 | 2.45E-03 | 0.6415 | 7.74E-02 | 0.0003 |
| Vinyl Chloride | 2.89 J | 3.9 | 0.044 U | 0.044 U | -- | 0.048 U | -- | -- | -- | -- | na | na | na | na |
| Benzene[1] | 5.76 | 0.51 | 0.955 | 1.2 | -- | 0.95 | -- | -- | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| Building Location | Closest Geotech Sample | | 5403M |
|---|---|---|---|
| 613 S Brandon | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | loamy sand |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 |
| Building Type | Residence Type with crawlspace | | |

| | | | | | | | | Adjustments to Indoor Air | | | Calculated Empirical | | JEM Modeled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Target Compounds Detected in Groundwater | Ground-water | Soil Gas | Indoor Air_1 | Indoor Air_2 | Indoor Air_3 | Ambient Air (AA) | National Background Value (BG) | BG or AA > Indoor Air? | By Factor of 2 or more? | Indoor Air Value Used in GIVF | Attenuation Coefficient | GIVF | Predicted Indoor Air ug/m3 | Predicted Attenuation Coefficient |
| | ug/L | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | | | | | | | |
| Vinyl Chloride - 8/19/02 | 0.194 | 2.4 U | 0.067 | 0.059 | -- | 0.68 | -- | Yes - AA | Yes | 0.067 | 4.03E-04 | 0.3454 | 6.40E-02 | 0.0004 |
| Vinyl Chloride - 8/26/02 | 0.972 | 0.5 | 0.098 | 0.074 | -- | 0.68 | -- | Yes - AA | Yes | 0.098 | 1.18E-04 | 0.1008 | 3.21E-01 | 0.0004 |
| cis-1,2-Dichloroethene - 8/26/0 | 3.19 | 0.16 U | 0.1 U | 0.16 U | -- | 0.12 U | -- | -- | -- | 0.1 | 2.86E-04 | 0.0313 | 1.04E-01 | 0.0003 |
| Trichloroethylene[1] | 0.032 | 1.5 | 0.47 | 0.72 | -- | 0.42 | 0.59 | No | -- | -- | -- | -- | -- | -- |

| Building Location | Closest Geotech Sample | | |
|---|---|---|---|
| 611 S Brandon (CS) | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | loamy sand |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 |
| Building Type | Residence Type with crawlspace | | |

| | | | | | | | | Adjustments to Indoor Air | | | Calculated Empirical | | JEM Modeled | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Target Compounds Detected in Groundwater | Ground-water | Soil Gas | Indoor Air_1 | Indoor Air_2 | Indoor Air_3 | Ambient Air (AA) | National Background Value (BG) | BG or AA > Indoor Air? | By Factor of 2 or more? | Indoor Air Value Used in GIVF | Attenuation Coefficient | GIVF | Predicted Indoor Air ug/m3 | Predicted Attenuation Coefficient |
| | ug/L | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | | | | | | | |
| Vinyl Chloride 8/19/02 | 0.194 | 2.4 U | 0.037 U | -- | -- | 0.68 | -- | Yes - AA | -- | 0.037 | 2.22E-04 | 0.1907 | 6.40E-02 | 0.0004 |
| Vinyl Chloride 8/26/02 | 0.972 | 0.5 | 0.051 U | -- | -- | 0.68 | -- | Yes - AA | -- | 0.051 | 6.12E-05 | 0.0525 | 3.21E-01 | 0.0004 |
| cis-1,2-Dichloroethene 8/26/02 | 3.19 | 0.16 U | 0.16 U | -- | -- | 0.12 U | -- | -- | -- | 0.16 | 4.57E-04 | 0.0502 | 1.04E-01 | 0.0003 |
| Trichloroethylene[1] | 0.032 | 1.5 | 0.23 | -- | -- | 0.42 | 0.59 | Yes - BG | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

| **Building Location** | **Closest Geotech Sample** | CG-112 and 672L |
|---|---|---|
| 672 Lucile St - 8/19/02 | 0-3' bgs | 3-6'bgs |
| Soil Type | silt loam | sandy loam/loamy sand |
| Water-filled Porosity | na | na |
| Building Type | residence with basement (basement apartment) | |

| | | | **Adjustments to Indoor Air** | | | | | | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1,1-Trichloroethane | 72.4 D | 340 | 1.5 | 1.6 | -- | 0.22 | 3.1 | No | -- | 1.380 | 4.15E-05 | 0.0191 | 9.92E+00 | 0.0003 |
| 1,1-Dichloroethane | 119 D | 11.9 | 0.14 U | 0.14 U | -- | 0.15 U | -- | -- | -- | 0.14 | 7.65E-06 | 0.0012 | 5.39E+00 | 0.0003 |
| 1,1-Dichloroethene | 0.645 | 0.44 | 0.069 U | 0.07 U | -- | 0.075 U | -- | -- | -- | 0.069 | 1.41E-04 | 0.1070 | 1.65E-01 | 0.0003 |
| 1,2-Dichloroethane | 0.357 | 0.31 U | 0 U | 0.14 U | -- | 0.15 U | 0.163 | Yes-BG | no | -- | -- | -- | -- | -- |
| Chloroethane | 94.8 D | 0.51 U | 0.23 U | 0.23 U | -- | 0.25 U | -- | -- | -- | 0.23 | 7.35E-06 | 0.0024 | 1.19E+01 | 0.0004 |
| Tetrachloroethene | 0.896 | 15.35 | 0.24 U | 0.24 U | -- | 0.26 U | 2 | Yes-BG | yes | -- | -- | -- | -- | -- |
| Trichloroethylene[1] | 1.64 | 3.65 | 0.55 | 0.52 | -- | 0.48 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| Vinyl Chloride | 4.94 | 2.9 | 0.044 U | 0.045 U | -- | 0.048 U | -- | -- | -- | 0.044 | 1.04E-05 | 0.0089 | 1.63E+00 | 0.0004 |
| cis-1,2-Dichloroethene | 24.7 | 0.63 | 0.14 U | 0.14 U | -- | 0.15 U | -- | -- | -- | 0.14 | 5.16E-05 | 0.0057 | 8.09E-01 | 0.0003 |
| trans-1,2-Dichloroethene | 1.61 | 1.5 U | 0.69 U | 0.7 U | -- | 0.75 U | -- | -- | -- | 0.69 | 1.63E-03 | 0.4286 | 1.17E-01 | 0.0003 |
| Benzene[1] | 1.03 | 0.62 U | 1.2 | 1.2 | -- | 0.95 | -- | -- | -- | -- | -- | -- | -- | -- |

| **Building Location** | **Closest Geotech Sample** | CG-112 and 672L |
|---|---|---|
| 672 Lucile St - 8/27/02 | 0-3' bgs | 3-6'bgs |
| Soil Type | silt loam | sandy loam/loamy sand |
| Water-filled Porosity | na | na |
| Building Type | residence with basement (basement apartment) | |

| | | | **Adjustments to Indoor Air** | | | | | | | | **Calculated Empirical** | | **JEM Modeled** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Target Compounds Detected in Groundwater** | **Ground-water** | **Soil Gas** | **Indoor Air_1** | **Indoor Air_2** | **Indoor Air_3** | **Ambient Air (AA)** | **National Background Value (BG)** | **BG or AA > Indoor Air?** | **By Factor of 2 or more?** | **Indoor Air Value Used in GIVF** | **Attenuation Coefficient** | **GIVF** | **Predicted Indoor Air ug/m3** | **Predicted Attenuation Coefficient** |
| | **ug/L** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | **ug/m3** | | | | | | | |
| 1,1,1-Trichloroethane | 82.4 D | 420 | 1.9 | 1.6 | 1.8 | 0.22 | 3.1 | No | -- | 1.680 | 4.43E-05 | 0.0204 | 1.13E+01 | 0.0003 |
| 1,1-Dichloroethane | 132 D | 14.5 | 0.18 U | 0.18 U | 0.2 U | 0.15 U | -- | -- | -- | 0.18 | 8.86E-06 | 0.0014 | 5.97E+00 | 0.0003 |
| Chloroethane | 119 D | 0.58 U | 0.38 | 0.3 U | 0.32 U | 0.25 U | -- | -- | -- | 0.38 | 9.67E-06 | 0.0032 | 1.49E+01 | 0.0004 |
| Trichloroethylene[1] | 1.37 | 4.6 | 1.25 | 1.4 | 1.2 | 0.48 | 0.59 | No | -- | -- | -- | -- | -- | -- |
| Vinyl Chloride | 6.12 | 2.35 | 0.056 U | 0.058 U | 0.062 U | 0.048 U | -- | -- | -- | 0.056 | 1.07E-05 | 0.0092 | 2.02E+00 | 0.0004 |
| cis-1,2-Dichloroethene | 28.4 | 0.35 U | 0.17 U | 0.18 U | 0.19 U | 0.15 U | -- | -- | -- | 0.17 | 5.45E-05 | 0.0060 | 9.30E-01 | 0.0003 |
| trans-1,2-Dichloroethene | 1.57 | 1.7 U | 0.87 U | 0.9 U | 0.96 U | 0.75 U | -- | -- | -- | 0.87 | 2.11E-03 | 0.5541 | 1.15E-01 | 0.0003 |
| Benzene[1] | 1.05 | 0.92 | 1.95 | 2 | 11 | 0.95 | -- | -- | -- | -- | -- | -- | -- | -- |

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

Table 2-3 - Building-specific Results for TCs and TCE Detected in Groundwater

**Building Location**

507 S Brandon

TCs, TCE, and benzene were not detected in groundwater at this location

na: J-qualified data pairs not used in GIVF analysis
D-qualified data means sample was diluted
[1]Non-TC; Included per request from Ecology

**Table 2-4.** Summary of Parameters Selected for JEM Boundary Conditions

| JEM Input Parameters | Conditions for Vapor Migration | | | Units | Basis for Selection |
|---|---|---|---|---|---|
| | Site-specific | Lower Boundary | Upper Boundary | | |
| Soil Temperature | 15 | 15 | 15 | °C | Average temperature measured in field |
| Depth below grade to Bottom of Floor | 100 | 100 | 100 | cm | Typical depth of daylight basement |
| Depth below grade to water table | 305 | 305 | 305 | cm | Depth to water table |
| Thickness of Soil Stratum A | 105 | 305 | 305 | cm | Selected to represent site-specific, lower and upper boundary[1] |
| Thickness of Soil Stratum B | 200 | 0 | 0 | cm | |
| SCS soil type above water table (Strata B) | Loamy Sand | Loamy Sand | Sand | | |
| SCS soil type Strata A (beneath building) | Sand | Loamy Sand | Sand | | |
| Soil dry bulk density of Stratum A | 1.66 | 1.5 | 1.66 | $gm/cm^3$ | Based on soil type[2] |
| Soil Total Porosity of Stratum A | 0.375 | 0.43 | 0.375 | $cm^3/cm^3$ | |
| Soil Water-filled Porosity of Stratum A | 0.054 | 0.3 | 0.054 | $cm^3/cm^3$ | |
| Soil Dry bulk density of Stratum B | 1.32 | --[4] | --[4] | $gm/cm^3$ | |
| Total soil porosity of Stratum B | 0.39 | -- | -- | $cm^3/cm^3$ | |
| Soil Water-filled porosity of Stratum B | 0.076 | -- | -- | $cm^3/cm^3$ | |
| Effective permeability of Stratum A | calculated | calculated | 1E-06 $cm^3$ | $cm^2$ | Based on soil type (calculated) or entered[3] |
| Enclosed space floor thickness | 15 | 15 | 15 | cm | Typical construction for basement |
| Crack radius | 0.1 | 0.1 | 0.1 | cm | Default value from JEM |
| Soil-bldg Pressure Differential | 40 | 40 | 40 | $g/cm\text{-}s^2$ | Default value from JEM |
| Building length | 961 | 961 | 961 | cm | Volume represents small daylight apartment room in basement. |
| Building width | 961 | 961 | 961 | cm | |
| Enclosed space height | 244 | 244 | 244 | cm | |
| Building Air Exchange Rate | 0.45 | 0.45 | 0.45 | $h^{-1}$ | Default value from JEM |

Notes
1. Basis for selection of soil types for upper, lower, and site-specific conditions is discussed in Section 2.2.3.2.
2. Soil total porosity and water-filled porosity were obtained for each soil type based on moisture characteristics predicted using VG Model, and Schaap and Leij model parameters (from Hers, 2002; Table 1). Lower Boundary values obtained from JEM default values.
3. Effective permeability is calculated by JEM based on soil type and water-filled porosity or value can be entered in DataEntry page.
4. Scenario assumes only one Stratum (A)

Table 2-5 - Chemical-specific GIVFs and ACs predicted by JEM Using Lower, Upper, and Site-specific Parameters

| Chemical | CAS | JEM Model Results[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | GIVF | | | Attenuation Coefficient (AC) | | |
| | | Lower Boundary | Site-specific | Upper Boundary | Lower Boundary | Site-specific | Upper Boundary |
| **1,1,1-trichloroethane**[1] | 71556 | 0.0298 | 0.1370 | 0.4208 | 6.47E-05 | 2.98E-04 | 1.38E-03 |
| **1,1-dichloroethane** | 75343 | 0.0097 | 0.0453 | 0.1349 | 6.32E-05 | 2.94E-04 | 1.33E-03 |
| **1,1-Dichloroethylene** | 75354 | 0.0535 | 0.2558 | 0.7981 | 7.03E-05 | 3.36E-04 | 1.58E-03 |
| 1,2,4-trichlorobenzene | 120821 | 0.0010 | 0.0050 | 0.0107 | 3.69E-05 | 1.79E-04 | 6.00E-04 |
| **1,2-dichloroethane** | 107062 | 0.0020 | 0.0111 | 0.0312 | 7.85E-05 | 4.41E-04 | 1.86E-03 |
| 1,3,5-trimethylbenzene | 108678 | 0.0090 | 0.0415 | 0.1249 | 6.34E-05 | 2.94E-04 | 1.34E-03 |
| 2-hexanone (mibk) | 108101 | 0.0003 | 0.0020 | 0.0036 | 7.95E-05 | 5.87E-04 | 1.67E-03 |
| benzene | 71432 | 0.0102 | 0.0497 | 0.1512 | 6.98E-05 | 3.39E-04 | 1.55E-03 |
| **Chloroethane** | 75003 | 0.0251 | 0.1251 | 0.3978 | 7.61E-05 | 3.79E-04 | 1.80E-03 |
| chloroform | 67663 | 0.0076 | 0.0394 | 0.1209 | 7.67E-05 | 3.95E-04 | 1.82E-03 |
| **1,2-dichloroethylene (cis)** | 156592 | 0.0069 | 0.0328 | 0.0958 | 6.32E-05 | 2.98E-04 | 1.32E-03 |
| **1,2-dichloroethylene (trans)** | 156605 | 0.0160 | 0.0730 | 0.2189 | 6.12E-05 | 2.78E-04 | 1.26E-03 |
| ethylbenzene | 100414 | 0.0117 | 0.0539 | 0.1629 | 6.34E-05 | 2.92E-04 | 1.34E-03 |
| Napthalene | 91203 | 0.0006 | 0.0035 | 0.0074 | 6.13E-05 | 3.59E-04 | 1.18E-03 |
| n-Propylbenzene | 103651 | 0.0194 | 0.0886 | 0.2704 | 6.32E-05 | 2.89E-04 | 1.33E-03 |
| p-Isopropyltoluene | 99876 | 0.0480 | 0.3633 | 0.6877 | 1.58E-04 | 1.20E-03 | 5.12E-03 |
| sec-butylbenzene | 135988 | 0.0225 | 0.1029 | 0.3145 | 6.32E-05 | 2.88E-04 | 1.33E-03 |
| **tetrachloroethylene** | 127184 | 0.0275 | 0.1239 | 0.3778 | 6.16E-05 | 2.78E-04 | 1.28E-03 |
| toluene | 108883 | 0.0114 | 0.0549 | 0.1677 | 6.92E-05 | 3.33E-04 | 1.54E-03 |
| trichloroethylene | 79016 | 0.0173 | 0.0805 | 0.2457 | 6.53E-05 | 3.04E-04 | 1.40E-03 |
| **vinyl chloride** | 75014 | 0.0659 | 0.3299 | 1.0516 | 7.68E-05 | 3.85E-04 | 1.83E-03 |
| **Average of TCs**[3] | | 0.0263 | 0.1260 | 0.3919 | 0.0001 | 0.0003 | 0.0015 |

Notes:

1. Target compounds shown in bold

2. JEM used to calculate attenuation coefficients (ACs) and groundwater to indoor air volatilization factors (GIVFs) by assuming 1 ug/L concentration of chemical in groundwater.

3. Average value used to plot boundary lines on Figures 2-5a and 2-5b. Error bars for Maximum AC Boundary selected from maximum and minimum chemical-specific value.

Table 2-6 - Suspect Data Pairs Removed from Final Analysis for GIVFs

| Chemical | ADDRESS | Sample Date | Groundwater Result | Soil Gas Result | Indoor Air Location 1 Result | Indoor Air Location 2 Result | Indoor Air Location 3 Result | Ambient Air Result | Background Indoor Air Values IPIM Value | Background Indoor Air Values Min | Background Indoor Air Values Max | Empirically Calculated Values Attenuation Coefficient | Empirically Calculated Values GIVF | Basis for Exclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ug/L | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | ug/m3 | | | |
| 1,1-Dichloroethene | 404 S Orcas | 8/19/2002 | 0.052 | 4.4 U[2] | 0.07 U | 0.14 U | -- | 0.079 U | na | na | na | 1.77E-03 | 3.36E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |
| 1,1-Dichloroethene | 412 S Lucile | 8/19/2002 | 0.091 | 4.3 U | 0.07 U | 0.074 U | 0.068 U | 0.19 U | na | na | na | 9.83E-04 | 3.36E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |
| 1,2-Dichloroethane | 404 S Orcas | 8/19/2002 | 0.172 | 4.5 U | 0.22[1] | 0.29 U | -- | 0.16 U | 0.163 | 0.1 | 0.75 | 1.32E-02 | 4.41E-04 | Not detected in soil gas. GW value at or near detection limit. Field duplicate inconsistent with primary sample (detect and non-detect). |
| trans-1,2-Dichloroethene | 412 S Orcas | 8/19/2002 | 1.47 D[3] | 0.81 U | 0.68 U | 0.72 U | -- | 0.79 U | na[4] | na | na | 1.76E-03 | 2.78E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |
| trans-1,2-Dichloroethene | 5409 Denvers Ave S | 8/19/2002 | 1.06 | 0.79 U | 0.69 U | 0.68 U | -- | 0.75 U | na | na | na | 2.45E-03 | 2.78E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |
| trans-1,2-Dichloroethene | 672 Lucile St | 8/19/2002 | 1.61 | 1.5 U | 0.69 U | 0.7 U | -- | 0.75 U | na | na | na | 1.63E-03 | 2.78E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |
| trans-1,2-Dichloroethene | 672 Lucile St | 8/27/2002 | 1.57 | 1.7 U | 0.87 U | 0.9 U | 0.96 U | 0.75 U | na | na | na | 2.11E-03 | 2.78E-04 | Not detected in IA or soil gas. GW value at or near detection limit. |

Note

[1] Field duplicate for this sample was non-detect (0.14U)

[2] U - non-detect

[3] D - Laboratory completed dilutions so that the quanitified results were either within the linear range of the instrument and/or to minimize matrix interferences to obtain the reportable results

[4] na - statistical value meeting the criteria established by IPIM Work Plan was not available.

-- No sample collected

**Table 2-7.** Summary of Target Compound GIVFs and ACs After Outliers Removed

| Cas_No | Target Compound | Minimum and Maximum Empirical GIVFs and Attenuation Coefficients | | | |
|---|---|---|---|---|---|
| | | **Minimum GIVF** | **Location of Minimum Value** | **Maximum GIVF** | **Location of Maximum Value** |
| | | **Minimum AC** | | **Maximum AC** | |
| 71-55-6 | 1,1,1-Trichloroethane | 0.0165 | 5409 Denver Ave S | 0.0204 | 672 Lucile St |
| | | 3.58E-05 | | 4.43E-05 | |
| 75-34-3 | 1,1-Dichloroethane | 0.0008 | 5403 Maynard Ave S | 0.0778 | 412 S Lucile |
| | | 5.15E-06 | | 5.06E-04 | |
| 75-35-4 | 1,1-Dichloroethene | 0.0152 | 412 S Orcas | **0.1718** | **406 S Orcas**[2] |
| | | 2.00E-05 | | 2.26E-04 | |
| 107-06-2 | 1,2-Dichloroethane | 0.0144 | 412 S Orcas | 0.0144 | 412 S Orcas |
| | | 5.73E-04 | | 5.73E-04 | |
| 75-00-3 | Chloroethane | **0.0004** | **5409 Denvers Ave S**[1] | 0.0024 | 672 Lucile St |
| | | 5.60E-06 | | 7.35E-06 | |
| 156-59-2 | cis-1,2-Dichloroethene | 0.0006 | 5403 Maynard Ave S | 0.0502 | 611 S Brandon (CS) |
| | | 5.16E-06 | | 4.57E-04 | |
| 156-60-5 | trans-1,2-Dichloroethene | 0.1040 | 5403 Maynard Ave S | 0.1040 | 5403 Maynard Ave S |
| | | 3.97E-04 | | 3.97E-04 | |
| 75-01-4 | Vinyl Chloride | 0.0089 | 672 Lucile St (8/19/02) | 0.1549 | 412 South Lucile |
| | | 1.04E-05 | | 1.81E-04 | |

Notes

The maximum GIVF may not be for the same data pair as the maximum AC. This is due to the difference in how the two ratios are calculated. The GIVF is a strict representation of the data. The AC reflects Henry's Law as predicted by the JEM. The GIVF reflects the actual ratio between the measured groundwater and indoor air concentration while the AC reflects the ratio between the soil gas at the source (predicted by the JEM) and indoor air concentration. The AC reflects the uncertainty associated with predicting the soil gas concentration (as a function of Henry's Law and temperature), which may be lower or higher than actual soil gas at the groundwater interface when the indoor air sample was collected.

1. Location of target compound with minimum GIVF
2. Location of target compound with maximum GIVF - Value used for calculating non-target compound GIVFs in Table 2-8.

**Table 2-8.** Calculated GIVF for Non-Target Compounds Based on Maximum Target Compound GIVF for 1,1-DCE

| Chemical | CAS | JEM Model Results[1] | | Adjustment Factor (AF)[2] | Calculated GIVF[3] |
|---|---|---|---|---|---|
| | | Concentration in Indoor Air $C_{Indoor}$ (ug/m$^3$) | Attenuation Coefficient | | |
| **Max TC – 1,1-DCE** | **75354** | 2.56E-01 | 3.36E-04 | **1.00E+00** | **1.72E-01**[4] |
| 1,1,1-Trichloroethane | 71556 | 1.37E-01 | 2.98E-04 | 5.36E-01 | 9.21E-02 |
| 1,1-Dichloroethane | 75343 | 4.53E-02 | 2.94E-04 | 1.77E-01 | 3.04E-02 |
| 1,1-Dichloroethylene | 75354 | 2.56E-01 | 3.36E-04 | 1.00E+00 | 1.72E-01 |
| 1,2,4-Trichlorobenzene | 120821 | 4.97E-03 | 1.79E-04 | 1.94E-02 | 3.34E-03 |
| 1,2-Dichloroethane | 107062 | 1.11E-02 | 4.41E-04 | 4.34E-02 | 7.46E-03 |
| 1,3,5-Trimethylbenzene | 108678 | 4.15E-02 | 2.94E-04 | 1.62E-01 | 2.79E-02 |
| 2-Hexanone (MIBK)[4] | 108101 | 1.96E-03 | 5.87E-04 | 7.64E-03 | 1.31E-03 |
| Benzene | 71432 | 4.97E-02 | 3.39E-04 | 1.94E-01 | 3.34E-02 |
| Chloroethane | 75003 | 1.25E-01 | 3.79E-04 | 4.89E-01 | 8.41E-02 |
| Chloroform | 67663 | 3.94E-02 | 3.95E-04 | 1.54E-01 | 2.65E-02 |
| 1,2-dichloroethylene (cis) | 156592 | 3.28E-02 | 2.98E-04 | 1.28E-01 | 2.20E-02 |
| 1,2-dichloroethylene (trans) | 156605 | 7.30E-02 | 2.78E-04 | 2.85E-01 | 4.90E-02 |
| Ethylbenzene | 100414 | 5.39E-02 | 2.92E-04 | 2.11E-01 | 3.62E-02 |
| Napthalene | 91203 | 3.45E-03 | 3.59E-04 | 1.35E-02 | 2.32E-03 |
| n-Propylbenzene | 103651 | 8.86E-02 | 2.89E-04 | 3.47E-01 | 5.96E-02 |
| p-Isopropyltoluene[5] | 98828 | 3.63E-01 | 1.20E-03 | 1.42E+00 | 2.44E-01 |
| sec-Butylbenzene | 135988 | 1.03E-01 | 2.88E-04 | 4.02E-01 | 6.91E-02 |
| Tetrachloroethylene | 127184 | 1.24E-01 | 2.78E-04 | 4.84E-01 | 8.32E-02 |
| Toluene | 108883 | 5.49E-02 | 3.33E-04 | 2.14E-01 | 3.69E-02 |
| Trichloroethylene | 79016 | 8.05E-02 | 3.04E-04 | 3.15E-01 | 5.41E-02 |
| Vinyl Chloride | 75014 | 3.30E-01 | 3.85E-04 | 1.29E+00 | 2.22E-01 |

Notes:

1. Concentration in indoor air and calculated AC predicted by JEM (AC taken from intercalcs page) assuming 1 ug/L chemical in groundwater and Site-specific condition.
2. AF is the ratio of predicted indoor air concentration for the COPC over the indoor air concentration predicted for 1,1-DCE
3. GIVF calculated by multiplying the GIVF for 1,1-DCE (1.72 E-01) times the AF for each chemical
4. JEM properties for 2-hexanone based on transport properties of methyl-isobutyl-ketone (MIBK)
5. JEM properties for p-Isopropyltoluene based on transport properties of cumene

**Table 2-9.** Indoor Air IPIMALs and Estimated Groundwater IPIMALs for Residential and Commercial Scenarios

| CAS # | Analyte | Indoor Air | | Groundwater | | Basis[3] | RfD (mg/kg-day) or Slope Factor (mg/kg-day$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | IPIMAL[1] Residential | IPIMAL[1] Commercial | IPIMAL[2] Residential | IPIMAL[2] Commercial | | |
| | | (µg/m$^3$) | (µg/m$^3$) | (µg/L) | (µg/L) | | |
| 71-55-6 | 1,1,1-Trichloroethane | 46 | 195 | 500 | 2118 | NC | 0.286[a] |
| 75-34-3 | 1,1-Dichloroethane | 23 | 97.3 | 756 | 3199 | NC | 0.142857143[b] |
| 75-35-4 | 1,1-Dichloroethylene | 1.44 | 6.13 | 8.4 | 36 | NC | 0.009[c] |
| 95-63-6 | 1,2,4-trimethylbenzene | 0.27 | 1.2 | 81 | 359 | NC | 0.0017[a] |
| 107-06-2 | 1,2-Dichloroethane | 0.07 | 0.22 | 9.4 | 29 | CR | 0.091[f] |
| 108-67-8 | 1,3,5-Trimethylbenzene | 0.27 | 1.2 | 9.7 | 43 | NC | 0.0017[a] |
| 591-78-6 | 2-Hexanone | 0.8 | 3.4 | 609 | 2588 | NC | 0.005[d] |
| 71-43-2 | Benzene | 0.26 | 0.75 | 7.8 | 22 | CR | 0.0273[f] |
| 75-00-3 | Chloroethane | 2.4 | 7 | 29 | 83 | CR | 0.0029[h] |
| 67-66-3 | Chloroform | 0.08 | 0.25 | 3.0 | 9.4 | CR | 0.0805[f] |
| 156-59-2 | cis-1,2-Dichloroethylene | 1.6 | 6.8 | 73 | 309 | NC | 0.01[c] |
| 100-41-4 | Ethylbenzene | 46 | 195 | 1270 | 5385 | NC | 0.285714286[f] |
| 91-20-3 | Naphthalene | 0.14 | 1 | 60 | 250 | NC | 0.000857143[f] |
| 103-65-1 | n-Propylbenzene | 1.6 | 6.8 | 27 | 114 | NC | 0.01[c] |
| 99-87-6 | p-Isopropyltoluene | 18 | 78 | 73 | 320 | NC | 0.114285714[g] |
| 135-98-8 | sec-Butylbenzene | 1.6 | 6.8 | 23 | 98 | NC | 0.01[c] |
| 127-18-4 | Tetrachloroethylene | 3.5 | 10 | 42 | 120 | CR | 0.00203[a] |
| 108-88-3 | Toluene | 18 | 78 | 488 | 2116 | NC | 0.114285714[f] |
| 79-01-6 | Trichloroethylene | 0.02 | 0.05 | 0.4 | 0.9 | CR | 0.4[i] |

**Table 2-9.** Indoor Air IPIMALs and Estimated Groundwater IPIMALs for Residential and Commercial Scenarios (cont)

| CAS # | Analyte | Indoor Air | | Groundwater | | Basis[3] | RfD (mg/kg-day) or Slope Factor (mg/kg-day$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | IPIMAL[1] Residential | IPIMAL[1] Commercial | IPIMAL[2] Residential | IPIMAL[2] Commercial | | |
| | | (µg/m$^3$) | (µg/m$^3$) | (µg/L) | (µg/L) | | |
| 156-60-5 | trans-1,2-Dichloroethylene | 3.2 | 14 | 65 | 285 | NC | 0.02[c] |
| 75-01-4 | Vinyl chloride | 0.23 | 0.66 | 1.0 | 3.0 | CR | 0.0308[f] |

Notes:
The IPMALs presented in this table are based on the Preliminary Remedial Action Levels (PRALs) presented in the HHERA (PSC, 2001) and do not take into account multipathway or multiconstituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.
The HHERA PRALs were developed using the following target risk goals for individual COPCs:
Cancer Risk (CR) = 1E-06
Hazard Quotient (HQ) = 0.1

[1]IPIMAL – Inhalation Pathway Interim Measure Action Level.
[2]Calculated using Maximum GIVF for 1,1-DCE and AFs as per Section 2.3.
[3]CR = IPIMAL based on carcinogenic risk. NC = IPIMAL based on non-cancer hazard quotient.
[a]NCEA value from EPA Region 9 PRG list
[b]HEAST2 (Table 2), 1997
[c]EPA Region 9 PRG route extrapolation value
[d]NCEA provisional report (March 2000)
[e]Letter from EPA (Baily) to WA Ecology (Akana) (October 2000)
[f]IRIS (2nd Quarter), 2001
[g]1-methylbenzene toxicity value used as surrogate
[h]EPA Region 9 PRG value – withdrawn from IRIS
[i]NCEA value from August 2001 TCE Document

**Table 2-10**. Chemical-Specific Data and Target Compounds Selected for GIVF Evaluation

| CAS # | Chemical of Potential Concern (COPC) | Groundwater Sample Count in Area 3[6] | Frequency of Detect in Groundwater | Min Detect (ug/l) | Max Detect (ug/l) | Min NonDetect (ug/l) | Max NonDetect (ug/l) | Henry's Law Constant at 15°C (atm-m$^3$/mol) [1,4] | Diffusivity in Air (cm$^2$/s) [1,5] | Diffusivity in Water (cm$^2$/s) [1,5] | Soil Biodegradation Half Life [2] | Atmospheric Degradation Half Life[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **71556** | **1,1,1-Trichloroethane [3]** | **89** | **28%** | **1.2** | **220** | **0.166** | **20** | **1.09E-02** | **7.80E-02** | **8.80E-06** | **20 wks - 39 wks** | **225 days - 6.2 yrs** |
| **75343** | **1,1-Dichloroethane** | **89** | **45%** | **1.21** | **379** | **0.037** | **20** | **3.64E-03** | **7.42E-02** | **1.05E-05** | **32 days - 22 wks** | **10.3 days - 103 days** |
| **75354** | **1,1-Dichloroethylene** | **90** | **11%** | **0.33 J** | **9.9** | **0.059** | **20** | **1.80E-02** | **9.00E-02** | **1.04E-05** | **4 wks - 6 months** | **9.9 hrs - 4.1 days** |
| 95636 | 1,2,4-trimethylbenzene | 11 | **55%** | 52.1 | 405 | 1 | 1 | 2.48E-03 | 7.50E-02 | 7.10E-06 | 7 days - 4 wks | 1.6 hrs - 16 hrs |
| **107062** | **1,2-Dichloroethane** | **90** | **8%** | **0.754** | **9.95** | **0.033** | **20** | **5.96E-04** | **1.04E-01** | **9.90E-06** | **100 days - 6 months** | **12.2 days - 122 days** |
| 108678 | 1,3,5-Trimethylbenzene | 2 | 0% | - | - | 1 | 1 | 3.34E-03 | 7.50E-02 | 7.10E-06 | 7 days - 4 wks[a] | 1.6 hrs - 16 hrs[a] |
| 591786 | 2-Hexanone (MIBK as surrogate) | 53 | 0% | - | - | 1.02 | 100 | 7.88E-05 | 7.50E-02 | 7.80E-06 | 1 day - 7 days | 4.6 hrs - 1.9 days |
| 71432 | Benzene | 90 | 17% | 1.19 | 38.2 | 0.041 | 60 | 3.47E-03 | 8.80E-02 | 9.80E-06 | 5 days - 16 days | 2.09 days - 20.9 days |
| **75003** | **Chloroethane** | **53** | **23%** | **1.1** | **789** | **0.291** | **2** | **7.81E-03** | **1.04E-01** | **1.15E-06** | **7 days - 4 wks** | **6.67 days - 66.8 days** |
| 67663 | Chloroform | 53 | 11% | 0.666 J | 5.4 | 0.168 | 10 | 2.36E-03 | 1.04E-01 | 1.00E-05 | 4 wks - 6 months | 26 days - 260 days |
| **156592** | **cis-1,2-Dichloroethylene** | **90** | **34%** | **1.04** | **349** | **0.04** | **65** | **2.59E-03** | **7.36E-02** | **1.13E-05** | **4 wks - 6 months** | **1.1 days - 11.9 days** |
| 100414 | Ethylbenzene | 52 | 17% | 1.09 | 15700 | 0.142 | 15 | 4.36E-03 | 7.50E-02 | 7.80E-06 | 3 days - 10 days | 8.56 hrs - 3.57 days |
| 91203 | Napthalene | 35 | 23% | 11.3 | 58.6 | 0.1 | 10 | 2.27E-04 | 5.90E-02 | 7.50E-06 | 16.6 days - 48 days | 2.96 hrs - 29.6 hrs |
| 103651 | n-Propylbenzene | 2 | 0% | - | - | 1 | 1 | 7.25E-03 | 7.50E-02 | 7.80E-06 | - | - |
| 99876 | p-Isopropyltoluene[c] | 2 | 0% | - | - | 1 | 1 | 1.10E-02 | - | - | - | - |
| 135988 | sec-Butylbenzene | 2 | 0% | - | - | 1 | 1 | 8.44E-03 | 7.50E-02 | 7.80E-06 | - | - |
| **127184** | **Tetrachloroethylene** | **90** | **10%** | **0.596** | **3.14** | **0.06** | **20** | **1.05E-02** | **7.20E-02** | **8.20E-06** | **6 months - 1 yr** | **16 days - 160 days** |
| 108883 | Toluene | 53 | 15% | 2.61 | 4060 | 0.149 | 63 | 3.89E-03 | 8.70E-02 | 8.60E-06 | 4 days - 22 days | 10 hrs - 4.3 days |
| 79016 | Trichloroethylene | 90 | 39% | 0.582 J | 147 | 0.051 | 20 | 6.26E-03 | 7.90E-02 | 9.10E-06 | 6 months - 1 year | 1.1 days - 11.3 days |
| **156605** | **trans-1,2-Dichloroethylene** | **90** | **13%** | **1.25** | **9.97** | **0.048** | **375** | **6.20E-03** | **7.07E-02** | **1.19E-05** | **4 wks - 6 months[b]** | **1.1 days - 11.9 days[b]** |
| **75014** | **Vinyl chloride** | **90** | **16%** | **2** | **2500** | **0.102** | **20** | **2.03E-02** | **1.06E-01** | **1.23E-06** | **4 wks - 6 months** | **9.7 hrs - 97 hrs** |

**Notes and References**

1. Vlookup table from Johnson and Ettinger Model (EQM, 2000)

2. Howard et. al., 1991. Handbook of Environmental Degradation Rates, Lewis Publishers Inc., Chelsea, MI

3. Chemicals designated in bold are selected as target compounds for GIVF evaluation. Depending on the nature of the data collected, additional chemicals (i.e., some of the chemicals not bolded in the current table) may be treated as target compounds for purposes of calculating chemical-specific GIVFs.

4. Henry's Law Constant (atm-m$^3$/mol) - determines the amount of constituent in the vapor phase relative to the dissolved phase under equilibrium conditions. Increasing values indicate increased volatilization from groundwater to soil gas. Values obtained from JE Intercalcs page.

5. Diffusivity in Air/Water - Diffusion of soil vapors can be a major component, depending on porosity and moisture content. Increased diffusivity in air indicates higher mobility as a function of porosity and moisture content)

6. Data include direct push and monitoring well data from Area 3, shallow aquifer (to 15 feet bgs), collected through second quarter 2001.

[a] Assumed to be same range as 1,2,4-trimethylbenzene

[b] Not distinguished in literature from cis form

[c] Henry's Law Constant for this chemical at 25°C

**Table 2-11.** Unified Soil Classification System (USCS) Flowchart for Identifying Coarse-Grained Soils (less than 50% fines)

| Major Category | % Fines | Grading | Fines | Group Symbol | % Minor Component | Group Name |
|---|---|---|---|---|---|---|
| **GRAVEL** % gravel >/= % sand | </= 5 | well | -- | **GW** | < 15% sand | well-graded gravel |
| | | | | | >/= 15% sand | well-graded gravel w/sand |
| | | poor | -- | **GP** | < 15% sand | poorly-graded gravel |
| | | | | | >/= 15% sand | poorly-graded gravel w/sand |
| | 10 | well | ML or MH | **GW-GM** | < 15% sand | well-graded gravel w/silt |
| | | | | | >/= 15% sand | well-graded gravel w/silt & sand |
| | | | CL or CH | **GW-GC** | < 15% sand | well-graded gravel w/clay |
| | | | | | >/= 15% sand | well-graded gravel w/clay and sand |
| | | poor | ML or MH | **GP-GM** | < 15% sand | poorly-graded gravel w/silt |
| | | | | | >/= 15% sand | poorly-graded gravel w/silt & sand |
| | | | CL or CH | **GP-GC** | < 15% sand | poorly-graded gravel w/clay |
| | | | | | >/= 15% sand | poorly-graded gravel w/clay & sand |
| | >/= 15 | -- | ML or MH | **GM** | < 15% sand | silty gravel |
| | | | | | >/= 15% sand | silty gravel w/sand |
| | | | CL or CH | **GC** | < 15% sand | clayey gravel |
| | | | | | >/= 15% sand | clayey gravel w/sand |
| **SAND** % sand >/= % gravel | </= 5 | well | -- | **SW** | < 15% gravel | well-graded sand |
| | | | | | >/= 15% gravel | well-graded sand w/gravel |
| | | poor | -- | **SP** | < 15% gravel | poorly-graded sand |
| | | | | | >/= 15% gravel | poorly-graded sand w/gravel |
| | 10 | well | ML or MH | **SW-SM** | < 15% gravel | well-graded sand w/silt |
| | | | | | >/= 15% gravel | well-graded sand w/silt & gravel |
| | | | CL or CH | **SW-SC** | < 15% gravel | well-graded sand w/clay |
| | | | | | >/= 15% gravel | well-graded sand w/clay & gravel |
| | | poor | ML or MH | **SP-SM** | < 15% gravel | poorly-graded sand w/silt |
| | | | | | >/= 15% gravel | poorly-graded sand w/silt & gravel |
| | | | CL or CH | **SP-SC** | < 15% gravel | poorly-graded sand w/clay |
| | | | | | >/= 15% gravel | poorly-graded sand w/clay & gravel |
| | >/= 15 | -- | ML or MH | **SM** | < 15% gravel | silty sand |
| | | | | | >/= 15% gravel | silty sand w/gravel |
| | | | CL or CH | **SC** | < 15% gravel | clayey sand |
| | | | | | >/= 15% gravel | clayey sand w/gravel |

**Table 2-12.** Unified Soil Classification System (USCS) Flowchart for Identifying Fine-Grained Soils (50% or more fines)

| Group Symbol | % Finer than No. 200 Sieve | | | Group Name |
|---|---|---|---|---|
| CL | < 30 | < 15% plus No. 200 | -- | lean clay |
| | | 15-25% plus No. 200 | % sand >/= % gravel | lean clay w/sand |
| | | | % sand < % gravel | lean clay w/gravel |
| | >/= 30 | % sand >/= % gravel | < 15% gravel | sandy lean clay |
| | | | >/= 15% gravel | sandy lean clay w/gravel |
| | | % sand < % gravel | < 15% sand | gravelly lean clay |
| | | | >/= 15% sand | gravelly lean clay w/sand |
| ML | < 30 | < 15% plus No. 200 | -- | silt |
| | | 15-25% plus No. 200 | % sand >/= % gravel | silt w/sand |
| | | | % sand < % gravel | silt w/gravel |
| | >/= 30 | % sand >/= % gravel | < 15% gravel | sandy silt |
| | | | >/= 15% gravel | sandy silt w/gravel |
| | | % sand < % gravel | < 15% sand | gravelly silt |
| | | | >/= 15% sand | gravelly silt w/sand |
| CH | < 30 | < 15% plus No. 200 | -- | fat clay |
| | | 15-25% plus No. 200 | % sand >/= % gravel | fat clay w/sand |
| | | | % sand < % gravel | fat clay w/gravel |
| | >/= 30 | % sand >/= % gravel | < 15% gravel | sandy fat clay |
| | | | >/= 15% gravel | sandy fat clay w/gravel |
| | | % sand < % gravel | < 15% sand | gravelly fat clay |
| | | | >/= 15% sand | gravelly fat clay w/sand |
| MH | < 30 | < 15% plus No. 200 | -- | elastic silt |
| | | 15-25% plus No. 200 | % sand >/= % gravel | elastic silt w/sand |
| | | | % sand < % gravel | elastic silt w/gravel |
| | >/= 30 | % sand >/= % gravel | < 15% gravel | elastic silt |
| | | | >/= 15% gravel | elastic silt w/gravel |
| | | % sand < % gravel | < 15% sand | elastic silt |
| | | | >/= 15% sand | elastic silt w/sand |
| OL/OH | < 30 | < 15% plus No. 200 | -- | organic soil |
| | | 15-25% plus No. 200 | % sand >/= % gravel | organic soil w/sand |
| | | | % sand < % gravel | organic soil w/gravel |
| | >/= 30 | % sand >/= % gravel | < 15% gravel | sandy organic soil |
| | | | >/= 15% gravel | sandy organic soil w/gravel |
| | | % sand < % gravel | < 15% sand | gravelly organic soil |
| | | | >/= 15% sand | gravelly organic soil w/sand |

**Table 2-13.** Grain-Size Chart

| Classification | | Grain Size Range | | | |
|---|---|---|---|---|---|
| | | American System (inches and U.S. Standard sieve) | | Metric System (millimeters) | |
| | | lower | upper | lower | upper |
| **boulders** | -- | 12 | -- | 305 | -- |
| **cobbles** | -- | 3 | 12 | 76.2 | 305 |
| **gravel** | coarse | 0.75 | 3 | 19.1 | 76.2 |
| | fine | No. 4 | 0.75 | 4.76 | 19.1 |
| **sand** | coarse | No. 10 | No. 4 | 2.00 | 4.76 |
| | medium | No. 40 | No. 10 | 0.42 | 2.00 |
| | fine | No. 200 | No. 40 | 0.074 | 0.42 |
| **silt and clay** | -- | -- | No. 200 | -- | 0.074 |

| U.S. Standard Sieve | Size | | |
|---|---|---|---|
| | inches | millimeters | microns |
| -- | 12 | 300 | |
| -- | 3.0 | 75 | |
| -- | 0.75 | 19 | |
| No. 4 | | 4.75 | |
| No. 10 | | 2.00 | |
| No. 40 | | 0.425 | 425 |
| No. 200 | | 0.075 | 75 |

**Table 2-14.** Standard Penetration Test

| **blows per foot** | | **Relative Density** (sands and gravels) |
|---|---|---|
| lower | upper | |
| 50 | -- | very dense |
| 32 | 50 | dense |
| 10 | 30 | medium dense |
| 4 | 10 | loose |
| 0 | 4 | very loose |

| **blows per foot** | | **Consistency** (silts and clays) |
|---|---|---|
| lower | upper | |
| 32 | -- | hard |
| 16 | 32 | very stiff |
| 8 | 16 | stiff |
| 4 | 8 | medium stiff |
| 2 | 4 | soft |
| 0 | 2 | very soft |

**Table 2-15.** Unified Soil Classification System

| | | | |
|---|---|---|---|
| **Coarse-Grained Soils** (> 50% is coarser than No. 200 sieve) | **Gravels** (> 50% of coarse fraction is coarser than No. 4 sieve) | **GW** | well-graded gravels or gravel-sand mixtures, little or no fines |
| | | **GP** | poorly-graded gravels or gravel-sand mixtures, little or no fines |
| | | **GM** | sandy gravels, gravel-sand-silt mixtures |
| | | **GC** | clayey gravels, gravel-sand-silt mixtures |
| | **Sands** (> 50% of coarse fraction is finer than No. 4 sieve) | **SW** | well-graded sands or gravelly sands, little or no fines |
| | | **SP** | poorly-graded sands or gravelly sands, little or no fines |
| | | **SM** | silty sands, sand-silt mixtures |
| | | **SC** | inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| **Fine-Grained Soils** (> 50% is finer than No. 200 sieve) | **Silts and Clays** (liquid limit < 50%) | **ML** | inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity |
| | | **CL** | inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays |
| | | **OL** | organic silts and organic silty clays of low plasticity |
| | **Silts and Clays** (liquid limit > 50%) | **MH** | inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | **CH** | inorganic silts of high plasticity, fat clays |
| | | **OH** | organic clays of high plasticity, organic silty clays, organic silts |
| **Highly Organic Soils** | | **Pt** | peat and other highly organic soils |




# Legend

- Commercial Buildings
- Residence Type Building with Basement
- Residence Type Building on Slab
- Residence Type Building with Crawl Space
- Residence Type Building with Unknown Foundation
- Previous Indoor Air Sample Locations

**GIVF Data August 2002**

- Ambient Air
- Direct Push (Groundwater, Soil Gas)
- Soil Gas (Permanent Port)
- Indoor Air in Crawl Space
- Monitoring Well
- Indoor Air
- Area for GIVF Evaluation
- Contingency Area for GIVF Evaluation
- Roads

**Location of Sampling Points in the GIVF Study Area**

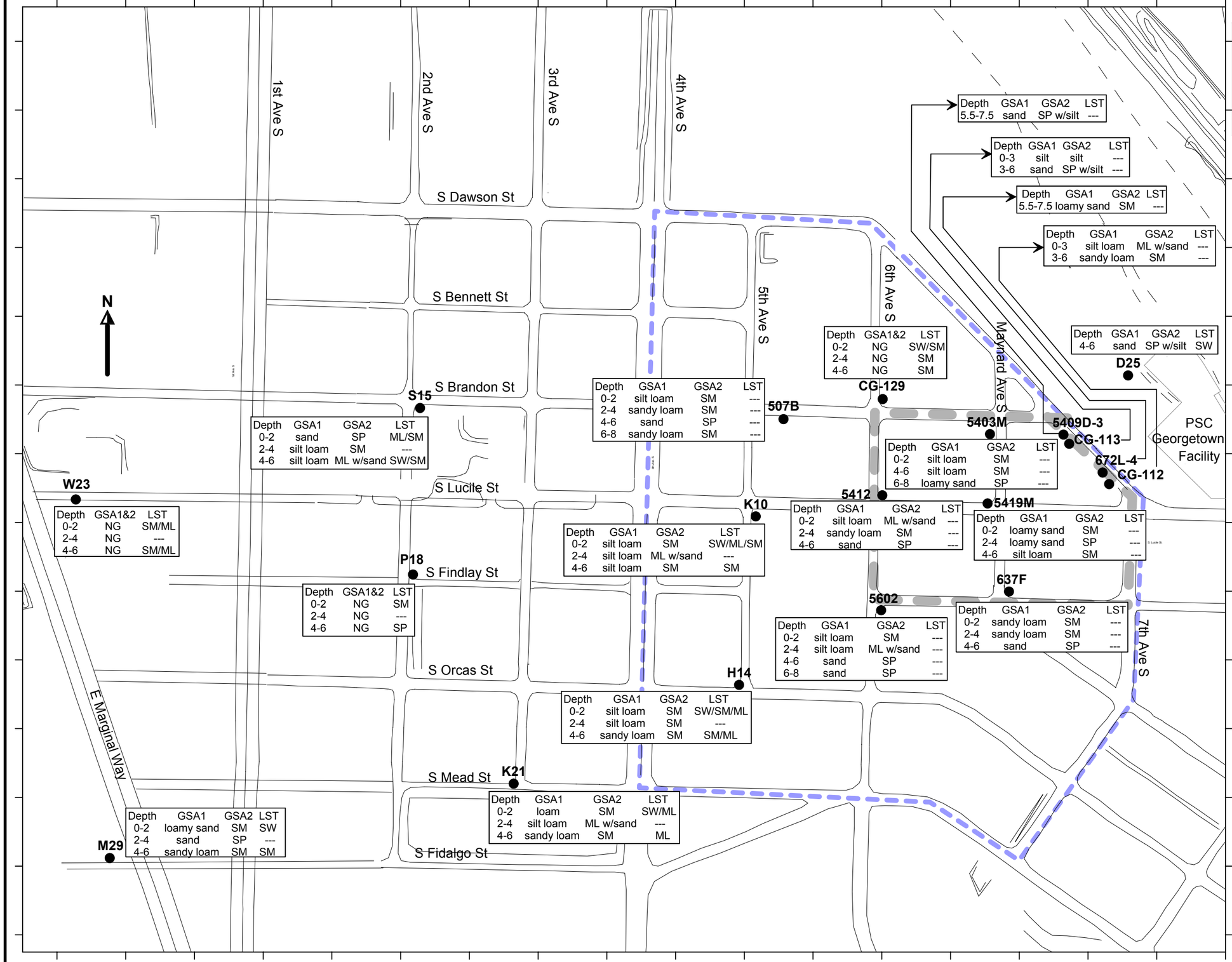
PSC Georgetown **Figure 2-1**

PIONEER TECHNOLOGIES CORPORATION

File: C:\Projects\PSC\Maps\November 2002\Tier 1 Maps

# Figure 2-2

## Soil Classification for the GIVF Study Area and Area 3




### Legend

Depths are in feet below ground surface

GSA1 Grain Size Analysis (US Department of Agriculture, SCS)

GSA2 Grain Size Analysis (ASTM Unified Soil Classification)

LST In-Field Logged Soil Type

--- Sample Not Logged

NG No Geotechnical Sample Collected

Area for GIVF Evaluation

Contingency Area for GIVF Evaluation

### Definitions

SW: well-graded sand

SP: poorly-graded sand

SM: silty-sand, sand-silt

ML: inorganic silts & very fine sands

Sand: 85% or more sand and the percentage of silt plus 1 1/2 times the % of clay is 15 or less

Loamy Sand: 70% or more sand and percentage of silt plus twice the percentage of clay is 30 or less

Sandy Loam: 30% or more very coarse, coarse, & medium sand & less than 30% either fine sand or very fine sand

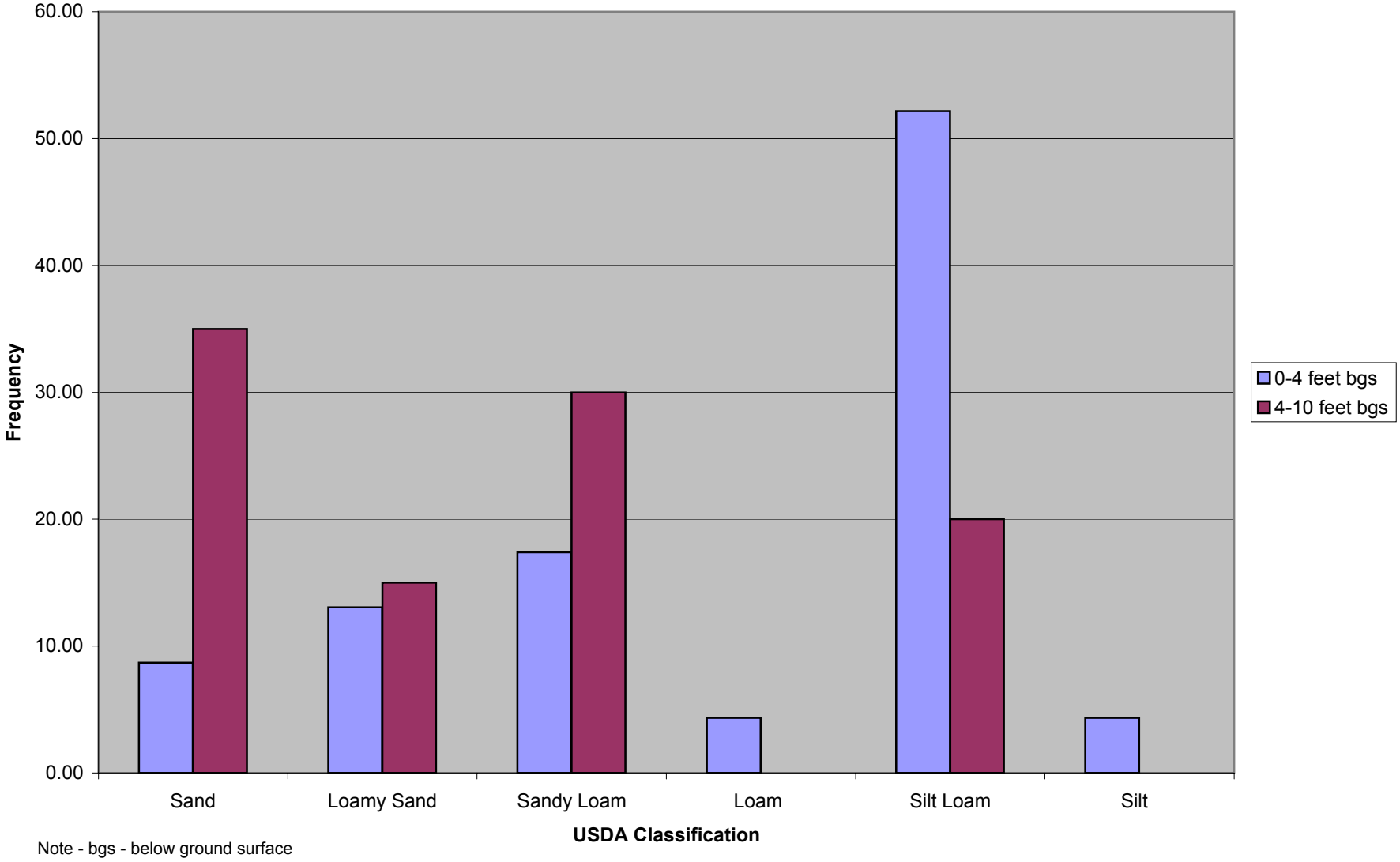
Loam: 7-27% clay, 28-50% silt, and less than 52% sand

Silt Loam: 50% or more silt and 12-27% clay; or 50-80% silt & less than 12% clay

NOTES:

- GSA1 and GSA2 results provided by Harold Benny, Laboratory Manager, Rosa Environmental & Geotechnical Lab, LLC.
- Detailed Classifications for GSA1 and GSA2 are presented in Tables 2-11 through 2-15 and Figure 2-7.

Figure 2-3a: Soil Types Classified in Area 3
(Based on Grain-size Analysis)




Note - bgs - below ground surface

Figure 2-3b: Moisture Content Measured in Area 3 Vadose Zone Soils.

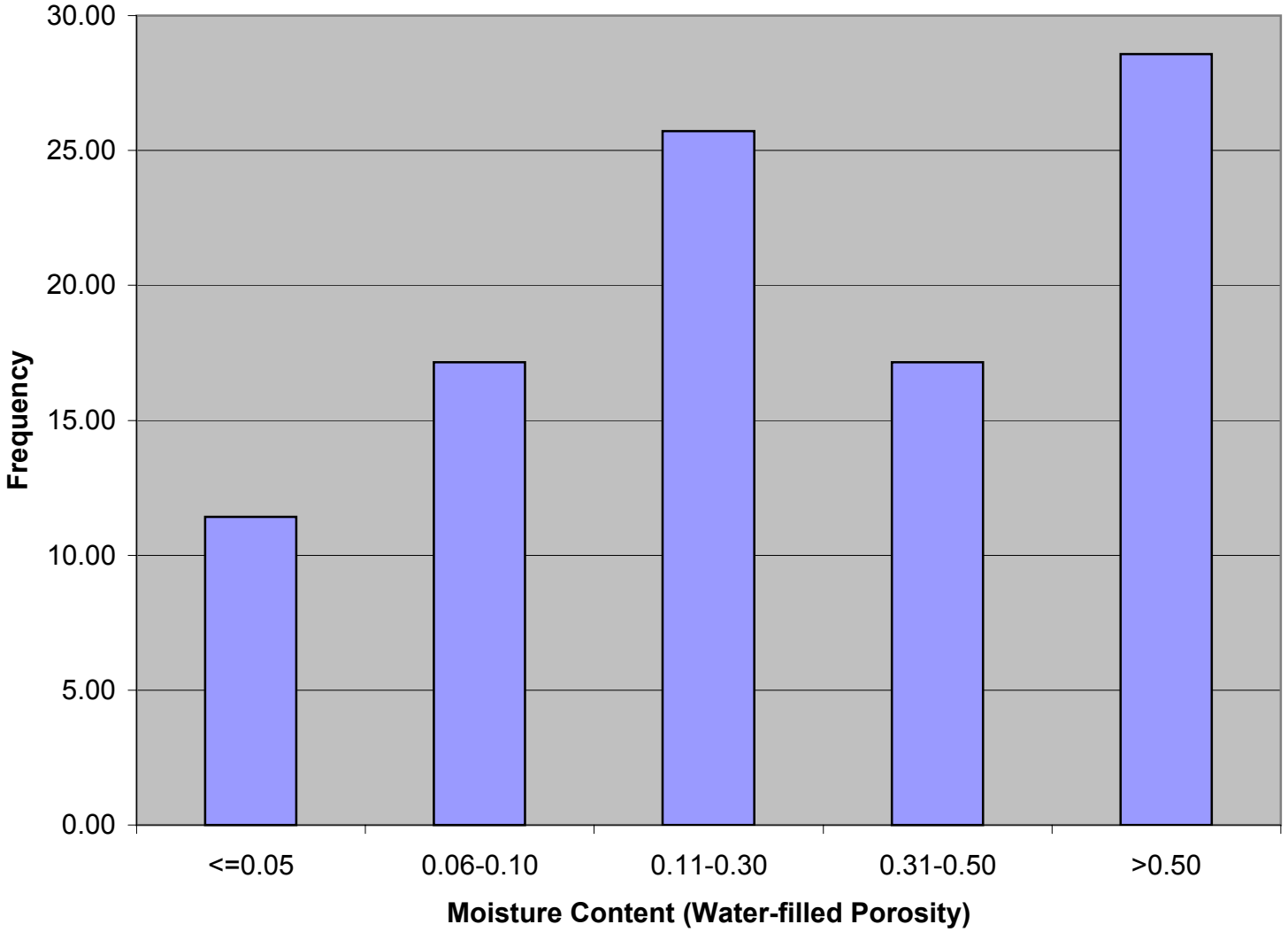


**Figure 2-4.** Approach for Developing Groundwater IPIMALs

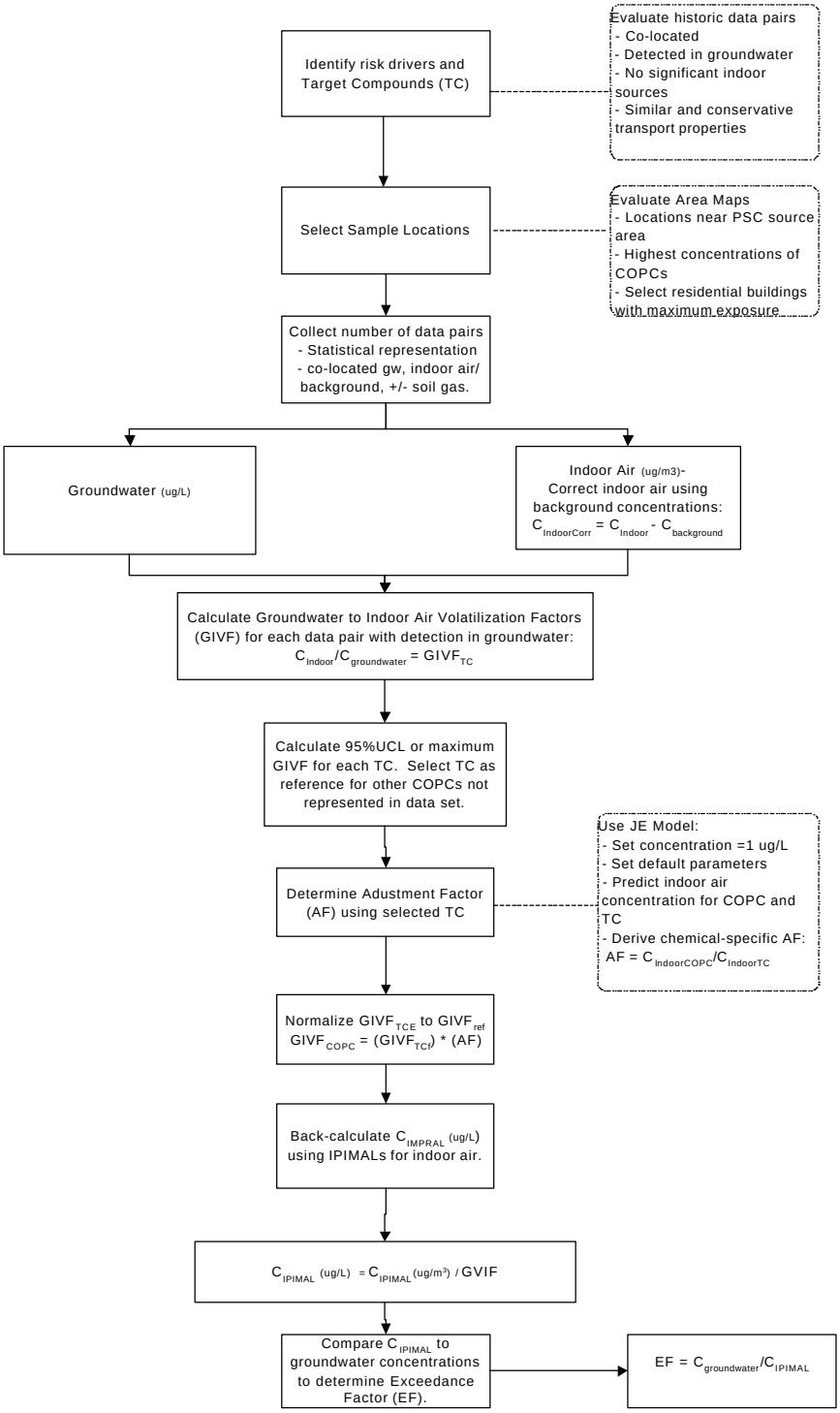


Figure 2-5a. Empirical GIVFs Plotted Against Maximum and Site-specific Boundary GIVFs Predicted by JEM

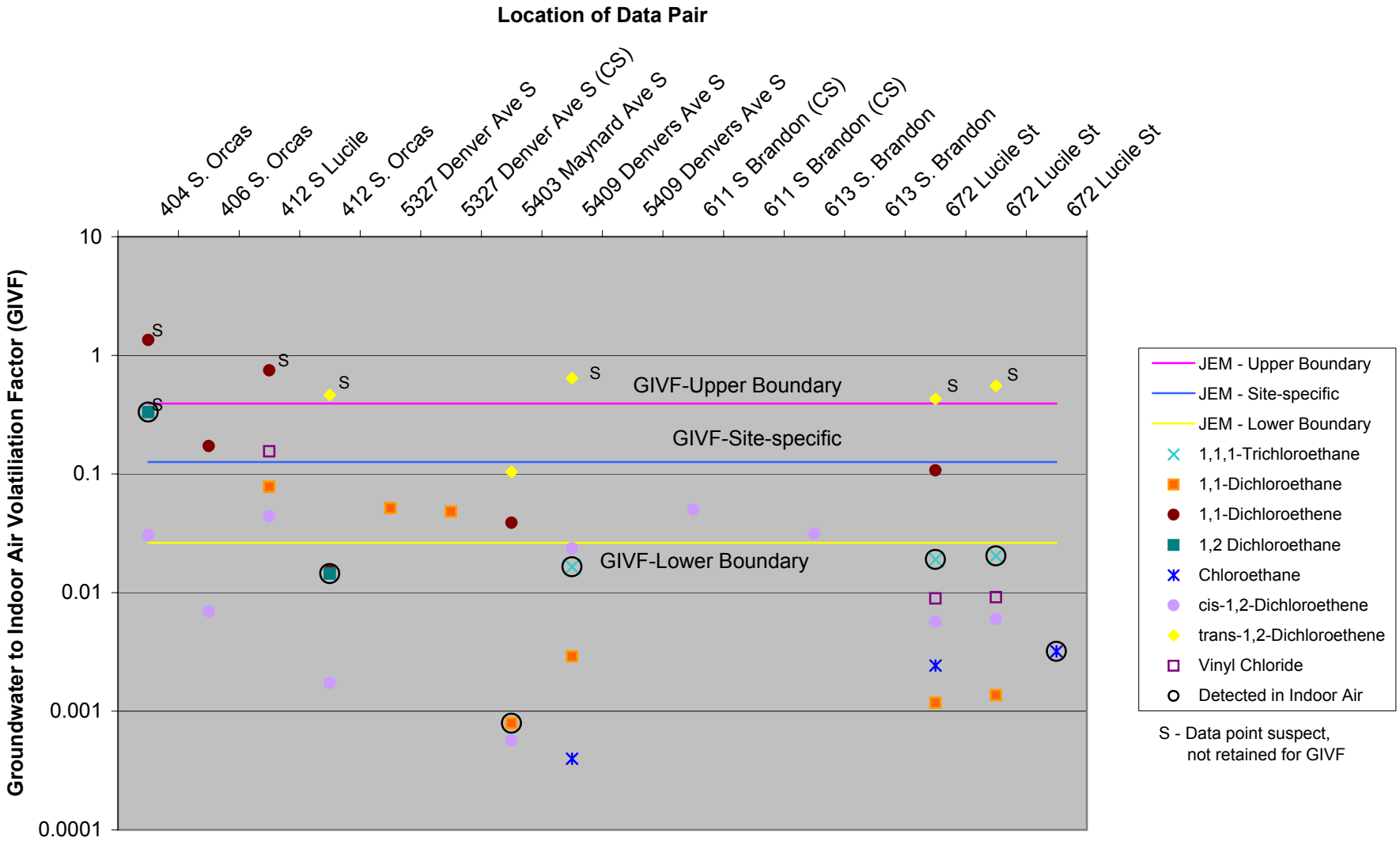
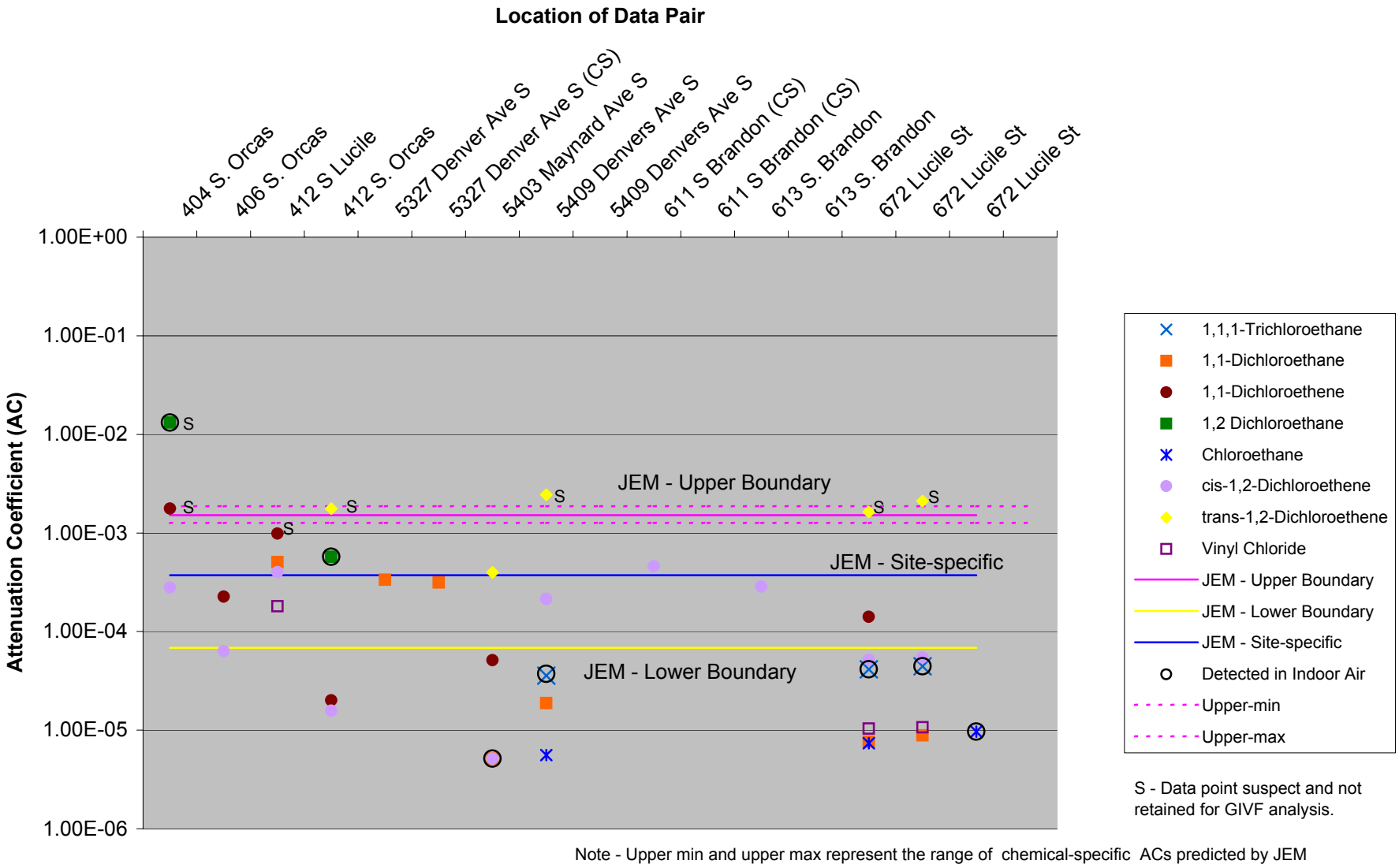


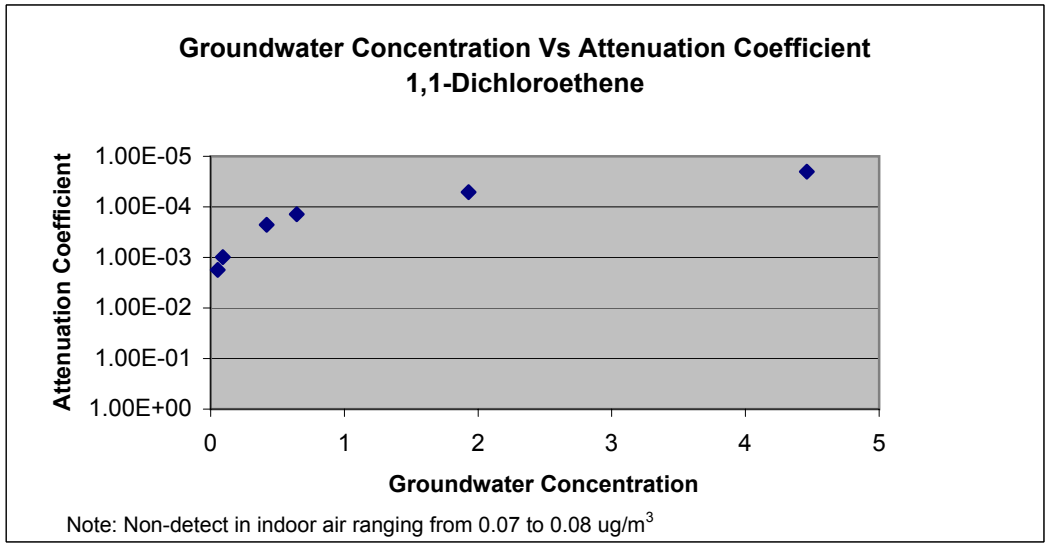
Figure 2-5b - Empirical ACs Plotted Against JEM Boundary and Site-specific Conditions

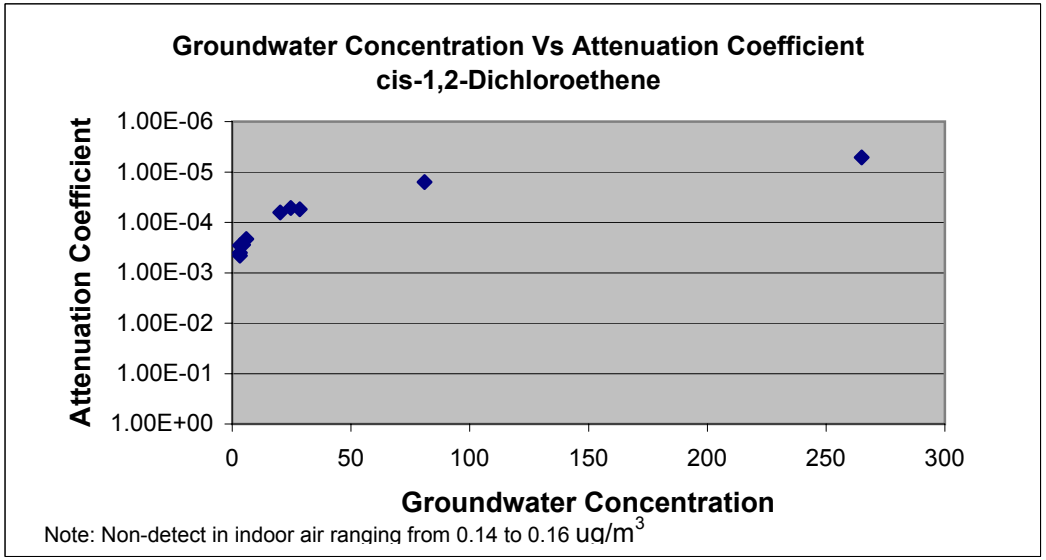



S - Data point suspect and not retained for GIVF analysis.

Note - Upper min and upper max represent the range of chemical-specific ACs predicted by JEM

Figure 2-6 - Comparison of Calculated Attenuation Coefficients with Groundwater Concentrations for Locations with Non-Detect in Indoor Air



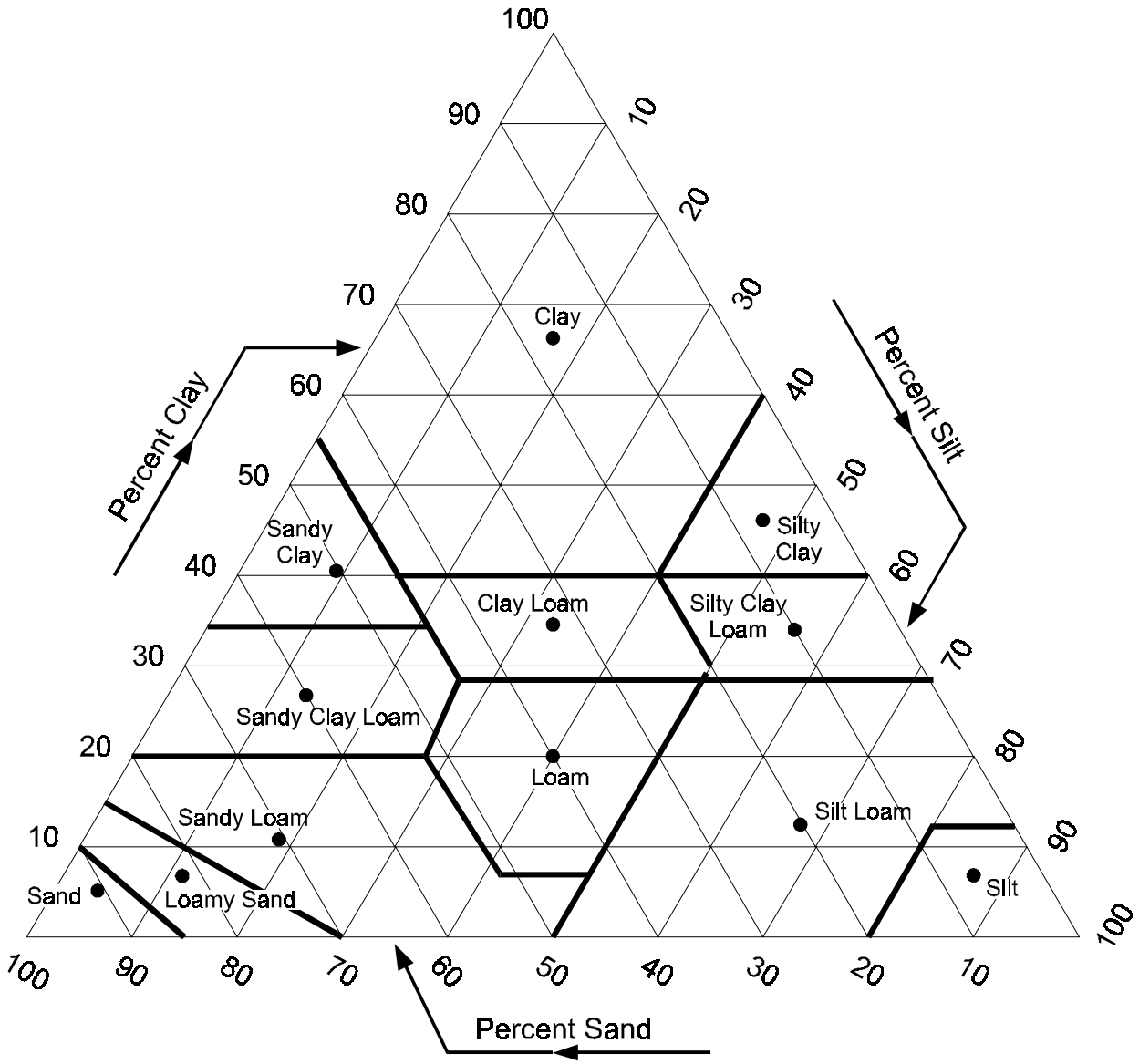



Figure 2-7. U.S. Soil Conservation Service Classification Chart Showing Centroid Compositions (Solid Circles) (EQM, 2000)

# 3. EVALUATION OF GROUNDWATER AND INDOOR AIR DATA USING THE IPIM DECISION TREE

This section presents the results of the integrated approach for evaluating groundwater and indoor air data to determine, through the use of the IPIM Decision Tree, if a building warrants further investigation or action through an IM. The IPIM Decision Tree (see Figure 3-1) is organized into four tiers to allow progressive evaluation of groundwater data and incorporation of site-specific information. The IPIM Decision Tree (described in the IPIM Work Plan) is also intended to be flexible so that at any time a decision can be made to proceed directly to consult with Ecology regarding the need to implement an IM.

The study area for determining if IMs are warranted (Area 3) is presented in Figure 1-3. Second Quarter 2002 groundwater monitoring data collected from the PCAMP monitoring wells in Area 3 (PSC, 2002b) and the most recent temporary (direct push) data were evaluated for Tier 1 and Tier 2. Groundwater monitoring wells applicable to this IPIM are shown on Figure 3-2a. Direct push sample locations from previous investigations are shown on Figure 3-2b.

Note: The groundwater monitoring wells screened across the water table were evaluated using the GIVFs. The only exceptions were wells: CG-121-40, CG-135-40, CG-139-40, CG-144-35, and CG-145-35. These wells were also evaluated using GIVFs because they are screened in the shallow aquifer and because there was not a well screened across the water table in the immediate vicinity of the well. These wells were included in the evaluation for screening purposes only in order to provide an estimate of the concentrations of VOCs that may occur at the water table at these locations. Uncertainties associated with using these wells are discussed in Section 4.2.2.1.

Sections 3.1 and 3.2 present and evaluate groundwater data via Tier 1 and Tier 2 of the IPIM Decision Tree. Section 3.3 presents the results of the Tier 3 analysis of indoor air data collected during the GIVF sampling program. Section 3.4 identifies locations that should be considered for Tier 4. Each Tier of the IPIM Decision Tree is discussed below.

## 3.1 TIER 1 – COMPARISON OF RESIDENTIAL-BASED IPIMALS WITH GROUNDWATER DATA

The first Tier in the IPIM Decision Tree is to compare PCAMP groundwater monitoring data from Area 3 to residential-based groundwater IPIMALs on a well-by-well basis. Section 3.1.1 describes the groundwater monitoring stations and data collected for use in the IPIM Decision Tree. Section 3.1.2 explains how the Cumulative Exceedance Factors (CEFs) for cancer effects (CCEFs) and non-cancer effects (NCEFs) were calculated, presents CCEFs and NCEFs for each sampling station, and provides an estimate of the area of impact represented by each data point.

### 3.1.1 Groundwater Data

A complete review of the 2nd Quarter 2002 groundwater monitoring data is presented in the PSC Georgetown Facility Quarterly Report (PSC, 2002c). Data used for this IPIM Decision Tree is limited to the inhalation pathway COPCs.

Groundwater data from 23 monitoring wells throughout Area 3 was used for the Tier 1 comparison (Figure 3-2a). Eighteen monitoring wells were water table monitoring wells. These wells best represent the groundwater that will volatilize into soil gas and migrate to the surface or into buildings. The screened interval for these wells extends from 7 feet below to 3 feet above the estimated high water level at that location. If there was not a water table well and there was a shallow well (i.e., less than 40 feet bgs) then PSC retained the shallow well in the data set to improve the spatial distribution/coverage. Five shallow wells were included in the data set (i.e., CG-121-40, CG-135-40, CG-139-40, CG-144-35, and CG-145-35). Samples from each well were submitted for analysis on a quarterly basis for an analyte list, which includes the inhalation pathway COPCs. PSC collected, analyzed, and validated quarterly monitoring samples in accordance with the approved PCAMP and associated QAPP (PSC, 2002b).

For this initial Tier 1 evaluation of the IPIM Decision Tree, PSC included results from one-time groundwater sampling events collected using direct push methodology. Seventy-nine direct push locations sampled after January 1, 2000 from the shallow interval (no deeper than 19 feet bgs) are shown on Figure 3-2b. These data were extracted primarily from the 2000 and 2001 Nature and Extent Investigation (PSC, 2001 [HHERA]).

### 3.1.2 Tier 1 Cumulative Exceedance Factors and Areas of Impact

PSC calculated chemical-specific exceedance factors (EFs) for each location using the following equation:

$$EF = \frac{C_{groundwater}}{\text{Residential}_{IPIMAL}}$$

*where:*

| Parameter | Description |
|---|---|
| $C_{groundwater}$ | Concentration in each groundwater well (µg/L). |
| $\text{Residential}_{IPIMAL}$ | Residential-based IPIMAL for groundwater (µg/L), based on a carcinogenic risk of 1E-06 and HQ of 0.1. |

The CCEFs and NCEFs for each location were calculated by summing the EFs for individual cancer and non-cancer COPCs.

Upon receipt of the validated data, PSC compiled and evaluated the data for purposes of calculating IM CCEFs and NCEFs:

- All data collected from Area 3 (east of Denver Avenue) were included in the evaluation;
- Field Duplicates were averaged; and
- Censored data (i.e., non-detected results) were assigned one-half the reporting limit for comparison purposes, in accordance with the IPIM Work Plan.

PSC calculated Tier 1 CCEFs and NCEFs for each sampling location by summing the EFs for individual cancer and non-cancer COPCs. Table 3-1 presents a summary of the residential CCEFs and NCEFs for each monitoring well or direct push station in Area 3. A CCEF or NCEF of 1 in Table 3-1 indicates exposure to indoor air concentrations from groundwater near that well should correlate to a potential cumulative risk of 1E-06 or an HI of 0.1, respectively. A CCEF and NCEF of 10 in Table 3-1 indicates that exposure to indoor air concentrations near the sample station could potentially lead to a cumulative risk of 1E-

05 or an HI of 1[23], respectively. The CCEFs and NCEFs in Table 3-1 are presented three ways: calculated for all data, calculated using just non-detects, and calculated using just detected data.

Figures 3-3a and 3-3c present the residential NCEFs (represented by variously shaded circles) for COPCs detected at each monitoring well or direct push station in Area 3. Figures 3-3b, 3-3d, and 3-3e present the residential CCEFs for COPCs detected in each monitoring well or direct push station in Area 3. The shaded areas associated with each location were contoured using an Inverse Distance Weighting (IDW) interpolation method. Interpolation methods, such as the IDW, create a grid of nodes where the value of each node is determined by interpolating values from known sample results. With IDW, data are weighted during interpolation such that the influence of one point relative to another declines with distance from the grid node. For example, areas closer to the measured data point are given more weight than more distant areas. As a result, there is much more confidence in contours generated for areas with higher sample density versus areas (e.g., west of 6th Avenue) where there are fewer samples.

A key advantage of applying the IDW is the ability to incorporate anisotropy into the interpolation. Many physical processes, such as groundwater flow, have preferred orientations (i.e., anisotropy). For example, groundwater in Area 3 flows in a west-southwest direction. This preferred flow direction was incorporated into the IDW model by setting an appropriate anisotropy angle. During the gridding process, points oriented in the direction of flow were weighted more heavily than other points, thus reducing the uncertainty associated with the interpolation algorithm used to estimate the area of influence. The IDW input parameters are summarized in Table 3-6.

Figures 3-3a through 3-3e are summarized below:

- Residential locations that fall within the contours representing CEFs for detected compounds exceeding 10 are proposed for further evaluation under Tier 3 of the

[23] Per WAC 173-340-700(5)(b)(c), PSC may elect to evaluate the chemical-specific toxicity information to determine if it is appropriate to segregate the hazard quotients (HQs) (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HQs, the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, the building will be proposed for Tier 4. If all of the segregated HIs are less than 1, the building will not be evaluated further until the next round of groundwater sampling. Segregation of HIs will be done with the chemical-specific prior approval of Ecology.

IPIM Decision Tree (see Figure 3-3e). These locations have a potential cumulative inhalation risk due to vapor intrusion of 1E-05 or greater (or greater than HI = 1).

- Commercial/industrial locations that fall within the contours representing CEFs for detected compounds exceeding 10 are further evaluated under Tier 2 of the Decision Tree (Section 3.2).

Note: Locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

An analysis of the residential EFs calculated using the detected monitoring well and direct push data indicates the following:

- Residential CCEFs: There were 34 locations in Area 3 with CCEFs greater than 10. Of these locations, 8 were monitoring wells and 26 were direct push samples. COPCs with EFs greater than 10 include:
    - TCE – at 21 locations
    - Vinyl chloride – at 18 locations
    - Chloroethane – at 1 location

  COPCs with EFs greater than 1 include:
    - TCE – at 40 locations
    - Vinyl chloride – at 30 locations
    - Chloroethane – at 7 locations
    - Benzene – at 5 locations
    - Chloroform – at 1 location
- Residential NCEFs: There were 3 locations in Area 3 with NCEFs greater than 10. All of these locations were direct push samples. Specific COPCs with NCEFs greater than 10 include:
    - cis1,2-DCE – at 2 locations. At the other location, cis1,2-DCE had an NCEF of 8. All other COPCs had NCEFs less than 5.

  Note: The 3 locations within Area 3 with NCEFs greater than 10 are co-located with locations in Area 3 with CCEFs greater than 10.

- The majority of the monitoring wells in Study Area 3 have CCEFs or NCEFs of less than 10. The CEFs in Study Area 3 are driven predominantly by direct push data.

Uncertainties associated with these locations are discussed in Section 4. However, subject to further review, residential locations associated with a CEF of 10 are proposed for further investigation/evaluation under Tier 3 or proceeding directly to Tier 4 depending on site-specific information, while commercial locations associated with a CEF of 10 are further evaluated under Tier 2, below. All locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event. All locations and chemicals will be retained for further evaluation in the Final Risk Assessment for the facility.

## 3.2 TIER 2 – DETERMINATION OF IMPACTS TO COMMERCIAL BUILDINGS

Commercial/industrial locations that fall within the contours representing CCEFs or NCEFs for detected compounds exceeding 10 in Tier 1 were evaluated under Tier 2 by comparing the monitoring well and direct push data in Area 3 to commercial-based IPIMALs as presented in Table 3-2. The approach for developing commercial-based IPIMALs is identical to the approach used to develop the residential-based IPIMALs except that the commercial exposure assumptions shown on Table 2-9 (from Table 3-5 of IPIM Work Plan) were used instead of residential exposure assumptions.

Figures 3-4a and 3-4c present the commercial NCEFs (represented by variously shaded circles) for COPCs detected at each monitoring well or direct push station in Area 3. Figures 3-4b, 3-4d, and 3-4e present the commercial CCEFs for COPCs detected in each monitoring well or direct push station in Area 3. The shaded areas associated with each location were contoured using the IDW interpolation method described in Section 3.1.2. Theses figures are summarized below:

An analysis of the commercial EFs calculated using the detected monitoring well and direct push data indicates the following:

- Commercial CCEFs: There were 24 locations in Area 3 with CCEFs greater than 10. Of these locations, 6 were monitoring wells and 18 were direct push samples. COPCs with EFs greater than 10 include:
    - TCE – at 16 locations
    - Vinyl chloride – at 10 locations

- Commercial NCEFs: There were no locations in Area 3 with NCEFs greater than 10.

Commercial locations that fall within the contours representing CEFs for detected compounds exceeding 10 are proposed for further evaluation under Tier 3 of the IPIM Decision Tree (see Figure 3-4e). These locations have a potential cumulative inhalation risk due to vapor intrusion of 1E-5 or greater (or greater than HI = 1).

Note: Locations with CEFs less than 10 will be re-evaluated after the next quarterly monitoring event.

## 3.3 TIER 3 – EVALUATION OF INDOOR AIR DATA COLLECTED DURING THE GIVF SAMPLING EVENT

This section presents the Tier 3 evaluation of indoor air data collected during the GIVF sampling performed in Study Area 1. In general, the purpose of a Tier 3 analysis is to collect additional site-specific data at locations exceeding a CEF of 10 in Tier 1 or Tier 2 to determine if an IM is warranted. PSC performed this accelerated Tier 3 analysis on the GIVF indoor air results to immediately identify locations warranting IMs.

### 3.3.1 Tier 3 Methodology

The locations sampled for indoor air during the GIVF sampling event as outlined in Section 3.1.1 of the IPIM Work Plan were selected using the following guidelines:

- Buildings located over/near areas with high concentrations in the groundwater plume for risk-driving COPCs;
- Residential buildings within the area with a construction type that is most likely to result in VOCs migrating from groundwater and becoming elevated in indoor air;
- Locations least likely to be impacted by other sources of chemicals in indoor or ambient air; and/or
- Locations that have been previously sampled and have shown detections of risk-drivers in groundwater or in indoor air.

The following site-specific data were collected at the building locations selected for Tier 3 analysis in Study Area 1 (see Figure 2-1):

- Indoor air samples,

- Groundwater samples,
- Nearby ambient air samples,
- Soil gas samples, and
- Nearby geotechnical samples.

PSC conducted all sampling and analysis in accordance with the IPIM Work Plan and associated SAP and QAPP (PSC, 2002a). Analytical results for each location are presented in Appendices B, C, and D.

In accordance with the IPIM Work Plan, PSC compiled and evaluated the data to determine if the location should proceed to Tier 4, as follows:

1. Groundwater, indoor air, ambient air, and soil gas data from each sample location were examined to determine if a complete groundwater to indoor air pathway was present at the location. Table 3-3 shows a summary of these data for those locations where the COPC was detected in groundwater.

   All COPCs detected in groundwater were targeted for analysis (Table 3-3) and evaluated in two ways:

   a. In accordance with the IPIM Work Plan, only COPCs that were detected in groundwater and soil gas at each location (shown in bold on Table 3-3) were included in the Tier 3 Decision Tree because these are assumed to have complete pathways.

   b. COPCs detected in groundwater but not soil gas were reviewed for comparison as part of the DQOs. These locations were included in the Tier 1 and Tier 2 evaluation using the PCAMP 2nd Quarter 2002 groundwater monitoring data (see Sections 3.1 and 3.2).

2. One-half of the MRL was assumed for non-detected results in indoor air. For comparison purposes, all data were presented in three ways: CEFs calculated for all data, CEFs calculated using just non-detects, and CEFs calculated using just detected data.

3. Indoor air values were adjusted for contributions from background using the process described to develop the GIVFs (Section 2.3.2). This was applied to both detected and non-detected data.

4. The adjusted indoor air concentrations at the locations retained for evaluation were compared to residential-based and commercial-based indoor air action levels (IPIMALs) to determine if an IM is warranted. CEFs were calculated using the same relationship as used for Tier 1 and Tier 2, but indoor air data were compared to indoor air IPIMALs, as follows:

$$CEF = \frac{C_{indoorair}}{\text{Residential or Commercial}_{IPIMAL}}$$

*where*:

| Parameter | Description |
|---|---|
| $C_{indoorair}$ | Concentration measured in indoor air at location ($\mu g/m^3$). |
| Residential or $Commercial_{IPIMAL}$ | Residential-based or commercial-based IPIMAL for indoor air ($\mu g/m^3$), based on a carcinogenic risk of 1E-06 and HQ of 0.1. |

The CEFs for each location were calculated by summing the EFs for individual cancer and non-cancer COPCs. A CEF of 1 indicates exposure to indoor air concentrations at that location could potentially lead to a cumulative cancer risk of 1E-06 or an HI of 0.1. A CEF of 10 indicates that exposure to indoor air concentrations could potentially lead to a cumulative risk of 1E-05 or an HI of 1.

### 3.3.2 Results of Tier 3 Evaluation

The indoor air data for COPCs highlighted in Table 3-3 (detected in groundwater and soil gas) were compared to indoor air IPIMALs and residential and commercial CEFs were calculated for each building location as presented in Table 3-4. In accordance with the IPIM Work Plan, residential or commercial/industrial locations with CEFs exceeding 10 are considered potential candidates for an IM under Tier 4. None of the locations had NCEFs of 10 or more. 406 South Orcas, 412 South Orcas, and 672 South Lucile have CCEFs of 10 or more. In all cases, the risk driver is TCE. Benzene was also a component of the CCEF at

672 South Lucile. Locations with CCEFs and NCEFs less than 10 will be reviewed again after the next quarterly monitoring event.

Table 3-5 presents a comparison of building-specific CEFs for COPCs detected in groundwater and indoor air (used for the Tier 3 Decision Tree) with the CEFs for all COPCs detected in groundwater. By including all COPCs detected in groundwater, two additional locations (404 Orcas and 5409 Denver) are identified that have indoor air CCEFs exceeding 10 (again driven by TCE concentrations). The weight of evidence indicates that elevated indoor air concentrations at these locations is not indicative of a complete pathway of soil gas migration from groundwater:

- Low TCE concentrations in groundwater (1.5 ug/L and 0.94 µg/L for 404 Orcas and 5409 Denver, respectively) and no detections in soil gas indicate that a pathway does not exist in these locations. Similarly, both 1,2-DCA and TCE were detected in indoor air leading to elevated CCEFs at 5409 Denver, but these COPCs were not detected in soil gas.
- The indoor air TCE concentration at 404 South Orcas (7.4 ug/$m^3$) is more than an order of magnitude greater than the indoor air concentration (0.13 ug/$m^3$) that would be predicted by applying the GIVF to the groundwater concentration.
- The concentration in ambient air at 404 Orcas (4.1 ug/$m^3$) indicates that the TCE measured in indoor air is most likely associated with ambient conditions.

However, following discussions held on January 17, 2003 between PSC and Ecology, it was agreed that 404 S Orcas and 5409 Denver would be considered for evaluation under Tier 4 based on groundwater contamination in the area. In addition, it was agreed during these discussions that additional Tier 3 sampling would be conducted at 412 S Lucile to assist in determining whether or not this location should move to Tier 4.

Table 3-3 also shows those locations in which ambient air concentrations either exceeds indoor air concentrations, or is within two times the indoor air values. This was commonly observed throughout Area 3. Background concentrations outside of the study area (727 Homer) were also elevated.

CCEFs and NCEFs using the measured ambient air data were calculated for each ambient air station and compared to the indoor air CEFs in Table 3-5. All ambient air locations show a CCEF and CEF of 10 or greater, with the maximum CCEFs located in the Orcas Street sample. Several NCEFs exceeded 10 for detected data in ambient air.

Note: The ambient air concentrations measured in the Georgetown neighborhood were elevated with respect to the IPIMALs for indoor air. This should be considered when evaluating locations for possible Tier 4 IMs as in many cases it will not be possible to meet the indoor air IPIMALs because of contributions from ambient air sources.

Buildings that should be considered for evaluation under Tier 4 are discussed in Section 3.4. The remaining locations will be re-evaluated again after the next quarterly monitoring event, which is currently underway, with Tier 1 and Tier 2 analysis occurring in Section 3.1 and 3.2 of the IPIM Tech Memo.

Note: All locations and chemicals will be retained for further evaluation in the Final Risk Assessment for the facility.

## 3.4 TIER 4 – CONSIDERING THE IMPLEMENTATION OF INTERIM MEASURES

Locations proposed for evaluation under Tier 4 of the IPIM Decision Tree have been selected based on the results of the accelerated Tier 3 analysis of GIVF indoor air data (Section 3.3) and discussions with Ecology. The following buildings are proposed for Tier 4 evaluation based on the GIVF indoor air data:

- 404 South Orcas
- 406 South Orcas
- 412 South Orcas
- 509 Denver
- 672 South Lucile

Pending final site-specific evaluations (e.g., building evaluations to determine the appropriate system), PSC will design and implement IPIMs at these locations upon the property owner's and Ecology's concurrence with the work plans. The schedule will proceed as outlined in Section 5, pending contractors' availability and access issues.

In addition, PSC will conduct additional Tier 3 sampling at 412 S Lucile to assist in determining whether or not this location should proceed to Tier 4.

## Table 3-1: Tier I Residential CCEFs and NCEFs Applied to 2Q02 Monitoring Well and Direct Push Data

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Residential - NCEFs Cumulative Exceedence Factors | | | Residential - CCEFs Cumulative Exceedence Factors | | |
|---|---|---|---|---|---|---|---|---|
| | | | All Data | Nondetected Results Only | Detected Results Only | All Data | Nondetected Results Only | Detected Results Only |
| 112-S-1 | 5/17/2002 | 15.00000 | 9.45E-01 | 6.79E-02 | 8.77E-01 | 7.97E+00 | 2.31E-01 | 7.74E+00 |
| 113-S-1 | 5/20/2002 | 15.00000 | 4.34E+00 | 6.79E-02 | 4.28E+00 | 1.81E+01 | 1.65E-01 | 1.80E+01 |
| 404O-GP1 | 8/22/2002 | 11.50000 | 2.02E-01 | 1.27E-01 | 7.50E-02 | 4.36E+00 | 2.15E-01 | 4.15E+00 |
| 406O-GP1 | 8/22/2002 | 11.50000 | 4.97E-01 | 1.27E-01 | 3.70E-01 | 2.73E+01 | 2.15E-01 | 2.71E+01 |
| 412L-GP1 | 8/22/2002 | 11.00000 | 1.38E-01 | 1.38E-01 | | 8.35E+00 | 2.31E-01 | 8.12E+00 |
| 412O-GP1 | 8/22/2002 | 11.50000 | 5.69E-01 | 1.87E-01 | 3.82E-01 | 2.45E+01 | 2.27E-01 | 2.43E+01 |
| 507B-GP1 | 8/23/2002 | 12.00000 | 1.38E-01 | 1.38E-01 | | 2.58E-01 | 2.58E-01 | |
| 5327D-GP1 | 8/28/2002 | 13.50000 | 1.41E-01 | 1.37E-01 | 4.11E-03 | 7.57E-01 | 1.89E-01 | 5.68E-01 |
| 5403M-GP1 | 8/22/2002 | 11.00000 | 4.48E+00 | 1.13E-01 | 4.37E+00 | 1.72E+02 | 1.60E+00 | 1.70E+02 |
| 5409D-2-00 | 8/29/2000 | 12.00000 | 1.99E-01 | | 1.99E-01 | 3.77E+00 | | 3.77E+00 |
| 5409D-3-00 | 8/29/2000 | 12.00000 | 6.58E-03 | | 6.58E-03 | 6.95E+00 | | 6.95E+00 |
| 5409D-4-00 | 8/29/2000 | 12.00000 | 9.46E-01 | | 9.46E-01 | 5.19E+01 | | 5.19E+01 |
| 613B-GP1 | 8/28/2002 | 13.00000 | 1.75E-01 | 1.31E-01 | 4.39E-02 | 1.24E+00 | 2.21E-01 | 1.02E+00 |
| 672L-1-00 | 8/29/2000 | 12.00000 | 1.12E+01 | | 1.12E+01 | 9.42E+01 | | 9.42E+01 |
| 672L-2-00 | 8/29/2000 | 12.00000 | 3.28E+00 | | 3.28E+00 | | | |
| 672L-4-00 | 8/29/2000 | 12.00000 | 7.34E+00 | | 7.34E+00 | 1.49E+01 | | 1.49E+01 |
| 672L-5-00 | 8/29/2000 | 12.00000 | 9.58E-02 | | 9.58E-02 | | | |
| 672L-6-00 | 8/29/2000 | 12.00000 | 5.03E+00 | | 5.03E+00 | 1.41E+02 | | 1.41E+02 |
| 672L-7-00 | 8/29/2000 | 12.00000 | 1.49E+01 | | 1.49E+01 | 2.09E+01 | | 2.09E+01 |
| CG-121-40 | 5/16/2002 | 40.00000 | 1.56E-01 | 1.36E-01 | 2.02E-02 | 1.34E+01 | 1.58E+00 | 1.18E+01 |
| CG-122-WT | 5/14/2002 | 15.00000 | 2.20E-01 | 1.29E-01 | 9.07E-02 | 8.33E+00 | 1.58E+00 | 6.75E+00 |
| CG-124-WT | 5/15/2002 | 14.50000 | 1.36E+00 | 7.47E-02 | 1.28E+00 | 5.63E+01 | | 5.63E+01 |
| CG-126-WT | 5/10/2002 | 14.50000 | 3.81E-01 | 8.34E-02 | 2.97E-01 | 7.76E+01 | 2.68E-01 | 7.73E+01 |
| CG-127-WT | 7/16/2002 | 16.00000 | 1.62E-01 | 8.02E-02 | 8.17E-02 | 4.29E+01 | 2.20E-01 | 4.27E+01 |
| CG-128-WT | 5/8/2002 | 14.50000 | 1.53E-01 | 1.51E-01 | 1.64E-03 | 2.16E+00 | 1.94E+00 | 2.21E-01 |
| CG-129-WT | 7/16/2002 | 15.00000 | 9.07E-02 | 9.07E-02 | | 3.13E-01 | 3.13E-01 | |
| CG-130-WT | 7/19/2002 | 14.00000 | 1.35E-01 | 8.02E-02 | 5.46E-02 | 4.77E+00 | 2.21E-01 | 4.55E+00 |
| CG-131-WT | 5/9/2002 | 15.00000 | 1.24E+00 | 7.67E-02 | 1.16E+00 | 1.32E+02 | 1.95E-01 | 1.32E+02 |
| CG-134-WT | 7/19/2002 | 14.33000 | 9.07E-02 | 9.07E-02 | | 3.13E-01 | 3.13E-01 | |
| CG-135-40 | 7/22/2002 | 40.00000 | 1.03E-01 | 9.01E-02 | 1.27E-02 | 6.05E+00 | 2.66E-01 | 5.78E+00 |
| CG-136-WT | 5/13/2002 | 14.00000 | 7.91E-01 | 1.43E-01 | 6.48E-01 | 7.57E+01 | 7.50E-01 | 7.50E+01 |
| CG-137-WT | 5/13/2002 | 14.50000 | 1.60E+00 | 7.70E-02 | 1.53E+00 | 1.30E+03 | 2.80E-01 | 1.30E+03 |
| CG-138-WT | 7/18/2002 | 14.50000 | 9.07E-02 | 9.07E-02 | | 8.04E-01 | 2.44E-01 | 5.59E-01 |
| CG-139-40 | 7/17/2002 | 40.00000 | 9.07E-02 | 9.07E-02 | | 1.46E+00 | 2.89E-01 | 1.18E+00 |
| CG-140-WT | 7/22/2002 | 15.00000 | 9.07E-02 | 9.07E-02 | | 3.13E-01 | 3.13E-01 | |
| CG-141-WT | 7/18/2002 | 14.50000 | 9.07E-02 | 9.07E-02 | | 3.99E-01 | 2.45E-01 | 1.54E-01 |
| CG-142-WT | 7/22/2002 | 15.00000 | 9.07E-02 | 9.07E-02 | | 3.13E-01 | 3.13E-01 | |
| CG-143-WT | 7/19/2002 | 14.50000 | 9.07E-02 | 9.07E-02 | | 3.13E-01 | 3.13E-01 | |

## Table 3-1: Tier I Residential CCEFs and NCEFs Applied to 2Q02 Monitoring Well and Direct Push Data

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Residential - NCEFs Cumulative Exceedence Factors All Data | Residential - NCEFs Cumulative Exceedence Factors Nondetected Results Only | Residential - NCEFs Cumulative Exceedence Factors Detected Results Only | Residential - CCEFs Cumulative Exceedence Factors All Data | Residential - CCEFs Cumulative Exceedence Factors Nondetected Results Only | Residential - CCEFs Cumulative Exceedence Factors Detected Results Only |
|---|---|---|---|---|---|---|---|---|
| CG-144-35 | 7/18/2002 | 35.00000 | 9.07E-02 | 9.07E-02 | | 1.02E+00 | 2.89E-01 | 7.28E-01 |
| CG-145-35 | 7/18/2002 | 35.00000 | 9.15E-02 | 9.01E-02 | 1.39E-03 | 3.13E-01 | 3.13E-01 | |
| E11 | 11/14/2000 | 15.00000 | 7.59E-02 | 7.59E-02 | | 1.96E+00 | 1.96E+00 | |
| E5 | 10/13/2000 | 15.00000 | 1.59E+00 | 1.93E-02 | 1.57E+00 | 4.29E+00 | 4.29E+00 | |
| E8 | 10/12/2000 | 15.00000 | 8.72E-02 | 8.48E-02 | 2.38E-03 | 9.02E+00 | 7.94E-01 | 8.22E+00 |
| F10 | 3/27/2001 | 15.00000 | 6.75E-02 | 1.15E-02 | 5.60E-02 | 1.91E+01 | 1.93E-01 | 1.89E+01 |
| F13 | 3/27/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 3.68E+00 | 7.62E-01 | 2.92E+00 |
| F16 | 12/13/2000 | 15.00000 | 7.59E-02 | 7.59E-02 | | 1.96E+00 | 1.96E+00 | |
| F20 | 3/28/2001 | 15.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| F33 | 2/7/2001 | 15.00000 | 4.01E-03 | 4.01E-03 | | 1.07E-01 | 1.07E-01 | |
| F7 | 10/3/2000 | 15.00000 | 1.34E+00 | 9.63E-03 | 1.33E+00 | 8.37E+01 | 2.48E-01 | 8.34E+01 |
| F7B | 3/29/2001 | 15.00000 | 1.87E+00 | 9.63E-03 | 1.86E+00 | 1.93E+02 | 2.48E-01 | 1.92E+02 |
| F9 | 10/5/2000 | 15.00000 | 8.55E-02 | 8.55E-02 | | 2.15E+00 | 2.15E+00 | |
| G10 | 3/27/2001 | 15.00000 | 4.94E-01 | 3.18E-03 | 4.91E-01 | 6.63E+00 | 1.93E-01 | 6.44E+00 |
| G13 | 3/28/2001 | 15.00000 | 1.23E+00 | 1.60E-04 | 1.23E+00 | 6.23E+01 | 1.78E-03 | 6.23E+01 |
| G18 | 3/28/2001 | 15.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| G6B | 3/29/2001 | 15.00000 | 9.45E-02 | 8.34E-02 | 1.11E-02 | 1.35E+01 | 2.07E+00 | 1.14E+01 |
| H14 | 11/15/2000 | 15.00000 | 9.17E-01 | 8.66E-03 | 9.08E-01 | 1.78E+02 | 7.61E-02 | 1.78E+02 |
| H17 | 12/11/2000 | 15.00000 | 9.68E-02 | 6.83E-02 | 2.84E-02 | 1.96E+00 | 1.96E+00 | |
| H21 | 3/26/2001 | 15.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| H7B | 3/27/2001 | 15.00000 | 1.86E-01 | 7.80E-02 | 1.08E-01 | 7.97E+00 | 1.77E-01 | 7.79E+00 |
| H9 | 10/16/2000 | 15.00000 | 8.80E-02 | 8.48E-02 | 3.17E-03 | 2.15E+00 | 2.15E+00 | |
| I13 | 3/27/2002 | 12.00000 | 4.64E-01 | 1.68E-01 | 2.96E-01 | 4.93E+01 | 2.48E-01 | 4.91E+01 |
| I17 | 4/2/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 2.11E+00 | 2.11E+00 | |
| I22 | 3/28/2002 | 12.00000 | 2.32E+00 | 6.50E-01 | 1.67E+00 | 4.01E+02 | 3.05E+00 | 3.98E+02 |
| I8 | 3/26/2001 | 15.00000 | 1.40E-01 | 1.17E-02 | 1.28E-01 | 7.09E+01 | 4.51E-02 | 7.09E+01 |
| J12 | 11/15/2000 | 15.00000 | 8.59E-02 | 6.83E-02 | 1.75E-02 | 1.96E+00 | 1.96E+00 | |
| J15 | 12/11/2000 | 15.00000 | 9.90E-02 | 6.83E-02 | 3.07E-02 | 1.96E+00 | 1.96E+00 | |
| J20 | 3/26/2001 | 19.00000 | 2.73E-01 | 2.31E-03 | 2.70E-01 | 1.54E+02 | 1.50E-01 | 1.54E+02 |
| J23 | 1/3/2001 | 15.00000 | 1.87E+00 | 1.38E+00 | 4.94E-01 | 4.10E+02 | 1.22E+01 | 3.98E+02 |
| J31 | 2/7/2001 | 15.00000 | 4.01E-03 | 4.01E-03 | | 1.07E-01 | 1.07E-01 | |
| J7B | 3/29/2001 | 15.00000 | 5.04E+00 | 7.80E-02 | 4.96E+00 | 2.42E+03 | 2.31E-01 | 2.41E+03 |
| J9 | 10/16/2000 | 15.00000 | 9.35E-02 | 7.86E-02 | 1.49E-02 | 2.18E+00 | 2.13E+00 | 4.16E-02 |
| K10 | 11/15/2000 | 15.00000 | 8.77E-02 | 6.90E-02 | 1.87E-02 | 3.75E+00 | 6.11E-01 | 3.14E+00 |
| K19 | 4/2/2002 | 12.00000 | 1.71E+01 | 3.40E+00 | 1.37E+01 | 3.12E+03 | 5.60E+00 | 3.11E+03 |
| K21 | 3/28/2002 | 12.00000 | 6.64E-01 | 4.25E-01 | 2.39E-01 | 2.48E+02 | 1.91E+00 | 2.46E+02 |
| K23 | 3/27/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 2.11E+00 | 2.11E+00 | |
| K6 | 3/28/2001 | 15.00000 | 1.32E-02 | 1.32E-02 | | 3.28E-01 | 3.28E-01 | |

## Table 3-1: Tier I Residential CCEFs and NCEFs Applied to 2Q02 Monitoring Well and Direct Push Data

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Residential - NCEFs Cumulative Exceedence Factors | | | Residential - CCEFs Cumulative Exceedence Factors | | |
|---|---|---|---|---|---|---|---|---|
| | | | All Data | Nondetected Results Only | Detected Results Only | All Data | Nondetected Results Only | Detected Results Only |
| K8 | 10/16/2000 | 15.00000 | 8.55E-02 | 8.55E-02 | | 2.15E+00 | 2.15E+00 | |
| L13 | 12/11/2000 | 15.00000 | 1.00E-01 | 6.83E-02 | 3.16E-02 | 8.16E+00 | 6.11E-01 | 7.55E+00 |
| L14 | 3/27/2001 | 15.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| L30 | 2/7/2001 | 15.00000 | 4.01E-03 | 4.01E-03 | | 1.07E-01 | 1.07E-01 | |
| M13 | 3/29/2001 | 15.00000 | 1.58E-01 | 6.83E-02 | 8.98E-02 | 2.45E+01 | 6.11E-01 | 2.39E+01 |
| M20 | 1/2/2001 | 15.00000 | 7.59E-02 | 7.59E-02 | | 1.96E+00 | 1.96E+00 | |
| M9 | 3/28/2001 | 15.00000 | 3.78E-02 | 1.07E-02 | 2.71E-02 | 2.97E-01 | 2.97E-01 | |
| N11 | 12/11/2000 | 15.00000 | 7.59E-02 | 7.59E-02 | | 1.96E+00 | 1.96E+00 | |
| P15 | 3/28/2001 | 15.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| P17 | 1/2/2001 | 15.00000 | 9.39E-02 | 6.90E-02 | 2.49E-02 | 1.53E+01 | 6.11E-01 | 1.47E+01 |
| P26 | 3/26/2001 | 19.00000 | 1.22E-02 | 1.22E-02 | | 2.97E-01 | 2.97E-01 | |
| Q32 | 2/28/2002 | 13.00000 | 1.52E-02 | 1.52E-02 | | 1.83E+00 | 1.83E+00 | |
| R15 | 1/2/2001 | 15.00000 | 7.59E-02 | 7.59E-02 | | 1.96E+00 | 1.96E+00 | |
| S24 | 2/6/2001 | 15.00000 | 4.01E-03 | 4.01E-03 | | 1.07E-01 | 1.07E-01 | |
| S34 | 2/25/2002 | 13.00000 | 1.52E-02 | 1.52E-02 | | 1.83E+00 | 1.83E+00 | |
| SG-10 | 3/22/2001 | 19.00000 | 8.54E-02 | 8.28E-02 | 2.63E-03 | 2.13E+00 | 2.13E+00 | |
| SG-12 | 3/22/2001 | 19.00000 | 1.55E-01 | 7.66E-02 | 7.83E-02 | 5.12E+00 | 1.58E+00 | 3.53E+00 |
| SG-13 | 3/22/2001 | 19.00000 | 9.67E-02 | 7.66E-02 | 2.01E-02 | 1.70E+01 | 7.65E-01 | 1.62E+01 |
| SG-15 | 3/22/2001 | 19.00000 | 1.28E+00 | 7.59E-02 | 1.20E+00 | 9.65E+01 | 2.31E-01 | 9.63E+01 |
| T20 | 4/3/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 2.11E+00 | 2.11E+00 | |
| V31 | 2/27/2002 | 13.00000 | 1.52E-02 | 1.52E-02 | | 1.83E+00 | 1.83E+00 | |
| X16 | 4/3/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 2.11E+00 | 2.11E+00 | |
| X20 | 4/3/2002 | 12.00000 | 1.77E-01 | 1.77E-01 | | 2.11E+00 | 2.11E+00 | |
| X23 | 3/26/2001 | 19.00000 | 2.00E+00 | 8.80E-03 | 2.00E+00 | 2.97E-01 | 2.97E-01 | |
| X28 | 2/27/2002 | 13.00000 | 1.52E-02 | 1.52E-02 | | 1.83E+00 | 1.83E+00 | |
| Y26 | 2/22/2002 | 13.00000 | 1.52E-02 | 1.52E-02 | | 1.83E+00 | 1.83E+00 | |

Notes:

CCEF - Cancer Cumulative Exceedance Factor  NCEF - Non-cancer Cumulative Exceedance Factor

The CCEFs and NCEFs presented in this table are based on groundwater IPIMALs developed through the GIVF method in Section 2. The IPIMALs are calculated using the Indoor Air Preliminary Remedial Action Levels (PRALs) presented in the HHERA (PSC, 2001) and do not take into account multipathway or multiconstituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.

The HHERA PRALs were developed using the following target risk goals for individual COPCs:

Cancer Risk (CR) = 1E-06

Hazard Quotient (HQ) = 0.1

**Table 3-2: Tier 2 Commercial CCEFs and NCEFs Applied to 2Q02 and Direct Push Data**

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Commercial - Noncancer Cumulative Exceedence Factors | | | Commercial - Cancer Cumulative Exceedence Factors | | |
|---|---|---|---|---|---|---|---|---|
| | | | All Data | Nondetected Results Only | Detected Results Only | All Data | Nondetected Results Only | Detected Results Only |
| 112-S-1 | 5/17/2002 | 15.00000 | 2.19E-01 | 1.59E-02 | 2.03E-01 | 2.85E+00 | 7.40E-02 | 2.78E+00 |
| 113-S-1 | 5/20/2002 | 15.00000 | 9.99E-01 | 1.59E-02 | 9.83E-01 | 6.38E+00 | 5.29E-02 | 6.33E+00 |
| 404O-GP1 | 8/22/2002 | 11.50000 | 4.69E-02 | 2.93E-02 | 1.77E-02 | 1.72E+00 | 7.01E-02 | 1.65E+00 |
| 406O-GP1 | 8/22/2002 | 11.50000 | 1.16E-01 | 2.93E-02 | 8.70E-02 | 1.01E+01 | 7.01E-02 | 1.01E+01 |
| 412L-GP1 | 8/22/2002 | 11.00000 | 3.18E-02 | 3.18E-02 | | 3.32E+00 | 7.53E-02 | 3.25E+00 |
| 412O-GP1 | 8/22/2002 | 11.50000 | 1.33E-01 | 4.33E-02 | 9.00E-02 | 8.90E+00 | 7.42E-02 | 8.82E+00 |
| 507B-GP1 | 8/23/2002 | 12.00000 | 3.18E-02 | 3.18E-02 | | 8.61E-02 | 8.61E-02 | |
| 5327D-GP1 | 8/28/2002 | 13.50000 | 3.26E-02 | 3.16E-02 | 9.72E-04 | 2.69E-01 | 6.08E-02 | 2.08E-01 |
| 5403M-GP1 | 8/22/2002 | 11.00000 | 1.05E+00 | 2.60E-02 | 1.03E+00 | 5.98E+01 | 6.21E-01 | 5.92E+01 |
| 5409D-2-00 | 8/29/2000 | 12.00000 | 4.68E-02 | | 4.68E-02 | 1.46E+00 | | 1.46E+00 |
| 5409D-3-00 | 8/29/2000 | 12.00000 | 1.55E-03 | | 1.55E-03 | 2.42E+00 | | 2.42E+00 |
| 5409D-4-00 | 8/29/2000 | 12.00000 | 2.23E-01 | | 2.23E-01 | 1.82E+01 | | 1.82E+01 |
| 613B-GP1 | 8/28/2002 | 13.00000 | 4.05E-02 | 3.01E-02 | 1.03E-02 | 4.33E-01 | 7.20E-02 | 3.61E-01 |
| 672L-1-00 | 8/29/2000 | 12.00000 | 2.63E+00 | | 2.63E+00 | 3.28E+01 | | 3.28E+01 |
| 672L-2-00 | 8/29/2000 | 12.00000 | 7.72E-01 | | 7.72E-01 | | | |
| 672L-4-00 | 8/29/2000 | 12.00000 | 1.73E+00 | | 1.73E+00 | 5.18E+00 | | 5.18E+00 |
| 672L-5-00 | 8/29/2000 | 12.00000 | 2.26E-02 | | 2.26E-02 | | | |
| 672L-6-00 | 8/29/2000 | 12.00000 | 1.18E+00 | | 1.18E+00 | 5.53E+01 | | 5.53E+01 |
| 672L-7-00 | 8/29/2000 | 12.00000 | 3.51E+00 | | 3.51E+00 | 7.70E+00 | | 7.70E+00 |
| CG-121-40 | 5/16/2002 | 40.00000 | 3.60E-02 | 3.13E-02 | 4.68E-03 | 4.68E+00 | 6.15E-01 | 4.07E+00 |
| CG-122-WT | 5/14/2002 | 15.00000 | 5.08E-02 | 2.99E-02 | 2.09E-02 | 2.95E+00 | 6.15E-01 | 2.33E+00 |
| CG-124-WT | 5/15/2002 | 14.50000 | 3.19E-01 | 1.70E-02 | 3.02E-01 | 2.18E+01 | | 2.18E+01 |
| CG-126-WT | 5/10/2002 | 14.50000 | 8.89E-02 | 1.90E-02 | 6.99E-02 | 3.08E+01 | 8.70E-02 | 3.07E+01 |
| CG-127-WT | 7/16/2002 | 16.00000 | 3.75E-02 | 1.82E-02 | 1.92E-02 | 1.71E+01 | 7.18E-02 | 1.70E+01 |
| CG-128-WT | 5/8/2002 | 14.50000 | 3.53E-02 | 3.49E-02 | 3.88E-04 | 8.14E-01 | 7.43E-01 | 7.11E-02 |
| CG-129-WT | 7/16/2002 | 15.00000 | 2.07E-02 | 2.07E-02 | | 1.07E-01 | 1.07E-01 | |
| CG-130-WT | 7/19/2002 | 14.00000 | 3.11E-02 | 1.82E-02 | 1.28E-02 | 1.88E+00 | 7.20E-02 | 1.81E+00 |
| CG-131-WT | 5/9/2002 | 15.00000 | 2.90E-01 | 1.75E-02 | 2.73E-01 | 5.17E+01 | 6.31E-02 | 5.16E+01 |
| CG-134-WT | 7/19/2002 | 14.33000 | 2.07E-02 | 2.07E-02 | | 1.07E-01 | 1.07E-01 | |
| CG-135-40 | 7/22/2002 | 40.00000 | 2.36E-02 | 2.06E-02 | 2.99E-03 | 2.10E+00 | 9.13E-02 | 2.00E+00 |
| CG-136-WT | 5/13/2002 | 14.00000 | 1.86E-01 | 3.30E-02 | 1.53E-01 | 3.02E+01 | 2.55E-01 | 3.00E+01 |
| CG-137-WT | 5/13/2002 | 14.50000 | 3.76E-01 | 1.76E-02 | 3.59E-01 | 5.19E+02 | 9.12E-02 | 5.19E+02 |
| CG-138-WT | 7/18/2002 | 14.50000 | 2.07E-02 | 2.07E-02 | | 3.04E-01 | 8.02E-02 | 2.24E-01 |
| CG-139-40 | 7/17/2002 | 40.00000 | 2.07E-02 | 2.07E-02 | | 5.09E-01 | 9.90E-02 | 4.10E-01 |
| CG-140-WT | 7/22/2002 | 15.00000 | 2.07E-02 | 2.07E-02 | | 1.07E-01 | 1.07E-01 | |
| CG-141-WT | 7/18/2002 | 14.50000 | 2.07E-02 | 2.07E-02 | | 1.42E-01 | 8.04E-02 | 6.17E-02 |
| CG-142-WT | 7/22/2002 | 15.00000 | 2.07E-02 | 2.07E-02 | | 1.07E-01 | 1.07E-01 | |
| CG-143-WT | 7/19/2002 | 14.50000 | 2.07E-02 | 2.07E-02 | | 1.07E-01 | 1.07E-01 | |

**Table 3-2: Tier 2 Commercial CCEFs and NCEFs Applied to 2Q02 and Direct Push Data**

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Commercial - Noncancer Cumulative Exceedence Factors | | | Commercial - Cancer Cumulative Exceedence Factors | | |
|---|---|---|---|---|---|---|---|---|
| | | | All Data | Nondetected Results Only | Detected Results Only | All Data | Nondetected Results Only | Detected Results Only |
| CG-144-35 | 7/18/2002 | 35.00000 | 2.07E-02 | 2.07E-02 | | 3.53E-01 | 9.90E-02 | 2.54E-01 |
| CG-145-35 | 7/18/2002 | 35.00000 | 2.09E-02 | 2.06E-02 | 3.28E-04 | 1.07E-01 | 1.07E-01 | |
| E11 | 11/14/2000 | 15.00000 | 1.78E-02 | 1.78E-02 | | 7.52E-01 | 7.52E-01 | |
| E5 | 10/13/2000 | 15.00000 | 3.73E-01 | 4.52E-03 | 3.69E-01 | 1.62E+00 | 1.62E+00 | |
| E8 | 10/12/2000 | 15.00000 | 2.04E-02 | 1.99E-02 | 5.63E-04 | 3.56E+00 | 2.70E-01 | 3.29E+00 |
| F10 | 3/27/2001 | 15.00000 | 1.59E-02 | 2.70E-03 | 1.32E-02 | 7.63E+00 | 6.62E-02 | 7.56E+00 |
| F13 | 3/27/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 1.43E+00 | 2.59E-01 | 1.17E+00 |
| F16 | 12/13/2000 | 15.00000 | 1.78E-02 | 1.78E-02 | | 7.52E-01 | 7.52E-01 | |
| F20 | 3/28/2001 | 15.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| F33 | 2/7/2001 | 15.00000 | 9.40E-04 | 9.40E-04 | | 4.01E-02 | 4.01E-02 | |
| F7 | 10/3/2000 | 15.00000 | 3.14E-01 | 2.26E-03 | 3.12E-01 | 3.19E+01 | 8.01E-02 | 3.18E+01 |
| F7B | 3/29/2001 | 15.00000 | 4.39E-01 | 2.26E-03 | 4.36E-01 | 7.02E+01 | 8.01E-02 | 7.01E+01 |
| F9 | 10/5/2000 | 15.00000 | 2.00E-02 | 2.00E-02 | | 8.11E-01 | 8.11E-01 | |
| G10 | 3/27/2001 | 15.00000 | 1.16E-01 | 7.33E-04 | 1.15E-01 | 2.64E+00 | 6.62E-02 | 2.58E+00 |
| G13 | 3/28/2001 | 15.00000 | 2.89E-01 | 3.78E-05 | 2.89E-01 | 2.43E+01 | 6.24E-04 | 2.43E+01 |
| G18 | 3/28/2001 | 15.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| G6B | 3/29/2001 | 15.00000 | 2.21E-02 | 1.96E-02 | 2.59E-03 | 4.71E+00 | 7.83E-01 | 3.92E+00 |
| H14 | 11/15/2000 | 15.00000 | 2.16E-01 | 1.99E-03 | 2.14E-01 | 7.07E+01 | 2.64E-02 | 7.07E+01 |
| H17 | 12/11/2000 | 15.00000 | 2.27E-02 | 1.60E-02 | 6.70E-03 | 7.52E-01 | 7.52E-01 | |
| H21 | 3/26/2001 | 15.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| H7B | 3/27/2001 | 15.00000 | 4.38E-02 | 1.83E-02 | 2.55E-02 | 2.92E+00 | 5.71E-02 | 2.86E+00 |
| H9 | 10/16/2000 | 15.00000 | 2.06E-02 | 1.99E-02 | 7.50E-04 | 8.11E-01 | 8.11E-01 | |
| I13 | 3/27/2002 | 12.00000 | 1.09E-01 | 3.90E-02 | 6.96E-02 | 1.73E+01 | 8.01E-02 | 1.73E+01 |
| I17 | 4/2/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 8.00E-01 | 8.00E-01 | |
| I22 | 3/28/2002 | 12.00000 | 5.42E-01 | 1.50E-01 | 3.92E-01 | 1.60E+02 | 1.04E+00 | 1.59E+02 |
| I8 | 3/26/2001 | 15.00000 | 3.30E-02 | 2.73E-03 | 3.03E-02 | 2.48E+01 | 1.46E-02 | 2.48E+01 |
| J12 | 11/15/2000 | 15.00000 | 2.01E-02 | 1.60E-02 | 4.13E-03 | 7.52E-01 | 7.52E-01 | |
| J15 | 12/11/2000 | 15.00000 | 2.32E-02 | 1.60E-02 | 7.22E-03 | 7.52E-01 | 7.52E-01 | |
| J20 | 3/26/2001 | 19.00000 | 6.41E-02 | 5.28E-04 | 6.36E-02 | 6.15E+01 | 5.22E-02 | 6.15E+01 |
| J23 | 1/3/2001 | 15.00000 | 4.39E-01 | 3.23E-01 | 1.16E-01 | 1.63E+02 | 4.23E+00 | 1.59E+02 |
| J31 | 2/7/2001 | 15.00000 | 9.40E-04 | 9.40E-04 | | 4.01E-02 | 4.01E-02 | |
| J7B | 3/29/2001 | 15.00000 | 1.19E+00 | 1.83E-02 | 1.17E+00 | 8.42E+02 | 7.40E-02 | 8.42E+02 |
| J9 | 10/16/2000 | 15.00000 | 2.19E-02 | 1.84E-02 | 3.50E-03 | 8.22E-01 | 8.07E-01 | 1.46E-02 |
| K10 | 11/15/2000 | 15.00000 | 2.06E-02 | 1.62E-02 | 4.40E-03 | 1.47E+00 | 2.11E-01 | 1.26E+00 |
| K19 | 4/2/2002 | 12.00000 | 4.00E+00 | 7.87E-01 | 3.21E+00 | 1.24E+03 | 1.82E+00 | 1.24E+03 |
| K21 | 3/28/2002 | 12.00000 | 1.55E-01 | 9.84E-02 | 5.63E-02 | 9.89E+01 | 6.48E-01 | 9.83E+01 |
| K23 | 3/27/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 8.00E-01 | 8.00E-01 | |
| K6 | 3/28/2001 | 15.00000 | 3.09E-03 | 3.09E-03 | | 1.20E-01 | 1.20E-01 | |

## Table 3-2: Tier 2 Commercial CCEFs and NCEFs Applied to 2Q02 and Direct Push Data

| SITE_ID | Sample Date | Bottom of Screen Interval (feet BGS) | Commercial - Noncancer Cumulative Exceedence Factors | | | Commercial - Cancer Cumulative Exceedence Factors | | |
|---|---|---|---|---|---|---|---|---|
| | | | All Data | Nondetected Results Only | Detected Results Only | All Data | Nondetected Results Only | Detected Results Only |
| K8 | 10/16/2000 | 15.00000 | 2.00E-02 | 2.00E-02 | | 8.11E-01 | 8.11E-01 | |
| L13 | 12/11/2000 | 15.00000 | 2.34E-02 | 1.60E-02 | 7.44E-03 | 3.23E+00 | 2.11E-01 | 3.02E+00 |
| L14 | 3/27/2001 | 15.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| L30 | 2/7/2001 | 15.00000 | 9.40E-04 | 9.40E-04 | | 4.01E-02 | 4.01E-02 | |
| M13 | 3/29/2001 | 15.00000 | 3.71E-02 | 1.60E-02 | 2.11E-02 | 9.76E+00 | 2.11E-01 | 9.54E+00 |
| M20 | 1/2/2001 | 15.00000 | 1.78E-02 | 1.78E-02 | | 7.52E-01 | 7.52E-01 | |
| M9 | 3/28/2001 | 15.00000 | 8.88E-03 | 2.49E-03 | 6.39E-03 | 1.10E-01 | 1.10E-01 | |
| N11 | 12/11/2000 | 15.00000 | 1.78E-02 | 1.78E-02 | | 7.52E-01 | 7.52E-01 | |
| P15 | 3/28/2001 | 15.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| P17 | 1/2/2001 | 15.00000 | 2.20E-02 | 1.62E-02 | 5.86E-03 | 6.08E+00 | 2.11E-01 | 5.87E+00 |
| P26 | 3/26/2001 | 19.00000 | 2.85E-03 | 2.85E-03 | | 1.10E-01 | 1.10E-01 | |
| Q32 | 2/28/2002 | 13.00000 | 3.53E-03 | 3.53E-03 | | 7.09E-01 | 7.09E-01 | |
| R15 | 1/2/2001 | 15.00000 | 1.78E-02 | 1.78E-02 | | 7.52E-01 | 7.52E-01 | |
| S24 | 2/6/2001 | 15.00000 | 9.40E-04 | 9.40E-04 | | 4.01E-02 | 4.01E-02 | |
| S34 | 2/25/2002 | 13.00000 | 3.53E-03 | 3.53E-03 | | 7.09E-01 | 7.09E-01 | |
| SG-10 | 3/22/2001 | 19.00000 | 2.00E-02 | 1.93E-02 | 6.22E-04 | 8.05E-01 | 8.05E-01 | |
| SG-12 | 3/22/2001 | 19.00000 | 3.63E-02 | 1.79E-02 | 1.84E-02 | 1.85E+00 | 6.15E-01 | 1.23E+00 |
| SG-13 | 3/22/2001 | 19.00000 | 2.26E-02 | 1.79E-02 | 4.72E-03 | 6.74E+00 | 2.60E-01 | 6.48E+00 |
| SG-15 | 3/22/2001 | 19.00000 | 3.01E-01 | 1.77E-02 | 2.83E-01 | 3.39E+01 | 7.40E-02 | 3.38E+01 |
| T20 | 4/3/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 8.00E-01 | 8.00E-01 | |
| V31 | 2/27/2002 | 13.00000 | 3.53E-03 | 3.53E-03 | | 7.09E-01 | 7.09E-01 | |
| X16 | 4/3/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 8.00E-01 | 8.00E-01 | |
| X20 | 4/3/2002 | 12.00000 | 4.10E-02 | 4.10E-02 | | 8.00E-01 | 8.00E-01 | |
| X23 | 3/26/2001 | 19.00000 | 4.71E-01 | 2.07E-03 | 4.69E-01 | 1.10E-01 | 1.10E-01 | |
| X28 | 2/27/2002 | 13.00000 | 3.53E-03 | 3.53E-03 | | 7.09E-01 | 7.09E-01 | |
| Y26 | 2/22/2002 | 13.00000 | 3.53E-03 | 3.53E-03 | | 7.09E-01 | 7.09E-01 | |

Notes:

CCEF - Cancer Cumulative Exceedance Factor NCEF - Non-cancer Cumulative Exceedance Factor

The CCEFs and NCEFs presented in this table are based on groundwater IPIMALs developed through the GIVF method in Section 2. The IPIMALs are calculated using the Indoor Air Preliminary Remedial Action Levels (PRALs) presented in the HHERA (PSC, 2001) and do not take into account multipathway or multiconstituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.

The HHERA PRALs were developed using the following target risk goals for individual COPCs:

Cancer Risk (CR) = 1E-06

Hazard Quotient (HQ) = 0.1

## **Table 3-3.** Chemical-specific Detections in Groundwater, Soil Gas, Indoor Air, and Ambient Air

| **Building Location** | **Closest Geotech Sample** | | | H14 |
|---|---|---|---|---|
| **404 South Orcas** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | sandy loam | |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 | |
| Building Type | Residence type - on slab | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| 1,1-Dichloroethane | 4.5 | 4.5 U | 0.14 U | 0.29 U | -- | 0.42 | Yes | -- |
| 1,1-Dichloroethene | 0.052 | 4.4 U | 0.07 U | 0.14 U | -- | 0.079 U | ND | -- |
| 1,2-Dichloroethane | 0.172 | 4.5 U | 0.22 | 0.29 U | -- | 0.16 U | No | No |
| cis-1,2-Dichloroethene | 4.57 | 4.4 U | 0.14 U | 0.29 U | -- | 0.16 U | ND | -- |
| **Tetrachloroethene** | **0.097** | **280** | **0.31** | **0.49 U** | -- | **0.27 U** | **No** | **No** |
| Trichloroethylene | 1.5 | 5.9 U | 5.35 | 7.4 | -- | 4.1 | No | Yes |
| Vinyl Chloride | 0.071 | 2.8 U | 0.045 U | 0.093 U | -- | 0.5 | Yes | -- |

| **Building Location** | **Closest Geotech Sample** | | | H14 |
|---|---|---|---|---|
| **406 S Orcas** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | sandy loam | |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 | |
| Building Type | Residence type – with basement | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1-Dichloroethane** | **31.7** | **0.68** | **0.15 U** | **0.15 U** | -- | **0.42** | **Yes** | -- |
| 1,1-Dichloroethene | 0.419 | 0.085 U | 0.072 U | 0.072 U | -- | 0.079 U | ND | -- |
| 1,2-Dichloroethane | 0.535 | 0.17 U | 0.15 U | 0.15 U | -- | 0.16 U | ND | -- |
| cis-1,2-Dichloroethene | 20.2 | 0.17 U | 0.14 U | 0.14 U | -- | 0.16 U | ND | -- |
| **Tetrachloroethene** | **0.06** | **8.2** | **0.25 U** | **0.25 U** | -- | **0.27 U** | **ND** | -- |
| **Trichloroethylene** | **4.38** | **3.4** | **7.25** | **7.5** | -- | **4.1** | **No** | **Yes** |
| **Vinyl Chloride** | **15.8** | **1.6** | **0.046 U** | **0.046 U** | -- | **0.5** | **Yes** | -- |

| **Building Location** | **Closest Geotech Sample** | | | H14 |
|---|---|---|---|---|
| **412 S Orcas** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | sandy loam | |
| Water-filled Porosity | 0.83 | 0.78 | 0.71 | |
| Building Type | Residence type - on slab | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1-Dichloroethane** | **38.8 D** | **0.63** | **0.14 U** | **0.15 U** | -- | **0.42** | **Yes** | -- |
| 1,1-Dichloroethene | 4.46 D | 0.081 U | 0.068 U | 0.072 U | -- | 0.079 U | ND | -- |
| 1,2-Dichloroethane | 1.87 | 0.16 U | 0.14 | 0.19 | -- | 0.16 U | No | -- |
| **Benzene** | **3.46 D** | **4** | **1.4** | **1.5** | -- | **1.2** | **No** | **Yes** |
| cis-1,2-Dichloroethene | 80.9 D | 0.16 U | 0.14 U | 0.14 U | -- | 0.16 U | ND | -- |
| trans-1,2-Dichloroethene | 1.47 D | 0.81 U | 0.68 U | 0.72 U | -- | 0.79 U | ND | -- |
| **Trichloroethylene** | **44.1 D** | **7.5** | **3.9** | **4.6** | -- | **4.1** | **No** | **Yes** |
| **Vinyl Chloride** | **51.1 D** | **0.49** | **0.044 U** | **0.046 U** | -- | **0.5** | **Yes** | -- |

**Table 3-3.** Chemical-specific Detections in Groundwater, Soil Gas, Indoor Air, and Ambient Air (Cont).

| **Building Location** | **Closest Geotech Sample** | | | K10 |
|---|---|---|---|---|
| **412 S Lucile** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | silt loam | |
| Water-filled Porosity | 0.57 | 0.56 | 0.82 | |
| Building Type | Residence type - with basement | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| 1,1-Dichloroethane | 1.8 | 4.4 U | 0.14 U | 0.15 U | 0.14 U | 0.19 U | ND | -- |
| 1,1-Dichloroethene | 0.091 | 4.3 U | 0.07 U | 0.074 U | 0.068 U | 0.19 U | ND | -- |
| cis-1,2-Dichloroethene | 3.18 | 4.3 U | 0.14 U | 0.15 U | 0.14 U | 0.15 U | ND | -- |
| Tetrachloroethene | 0.052 | 7.3 U | 0.24 U | 0.25 U | 0.26 | 0.26 U | No | No |
| Trichloroethylene | 1.54 | 5.8 U | 1.85 | 2.1 | 2.2 | 2.3 | No | Yes |
| Vinyl Chloride | 0.284 | 2.8 U | 0.045 U | 0.048 U | 0.044 U | 0.19 U | ND | -- |

| **Building Location** | **Closest Geotech Sample** | | | 5403M |
|---|---|---|---|---|
| **5327 Denver Ave S** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | loamy sand | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | |
| Building Type | Residence type with crawl space | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **IPIM Value ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|---|
| **1,1-Dichloroethane** | **3.11** | **2.7** | **0.16 U** | -- | -- | **0.14 U** | | **ND** | -- |
| **Benzene** | **1.32** | **2.9** | **1.75** | -- | -- | **1.8** | **4.7** | **Yes** | -- |
| **Trichloroethylene** | **0.073** | **0.89** | **0.335** | -- | -- | **0.41** | **0.59** | **Yes** | -- |
| **Vinyl Chloride** | **0.209** | **0.23** | **0.051 U** | -- | -- | **0.31** | | **Yes** | -- |

| **Building Location** | **Closest Geotech Sample** | | |
|---|---|---|---|
| **5327 Denver Ave S (CS)** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs |
| Soil Type | silt loam | silt loam | loamy sand |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 |
| Building Type | crawl space | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1-Dichloroethane** | **3.11** | **2.7** | **0.15 U** | -- | -- | **0.14 U** | **ND** | -- |
| **Benzene** | **1.32** | **2.9** | **1.25** | -- | -- | **1.8** | **Yes** | -- |
| **Trichloroethylene** | **0.073** | **0.89** | **0.35** | -- | -- | **0.41** | **Yes** | -- |
| **Vinyl Chloride** | **0.209** | **0.23** | **0.046 U** | -- | -- | **0.31** | **Yes** | -- |

**Table 3-3.** Chemical-specific Detections in Groundwater, Soil Gas, Indoor Air, and Ambient Air (Cont).

| **Building Location** | **Closest Geotech Sample** | | | 5403M |
|---|---|---|---|---|
| **5403 Maynard Ave S** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | loamy sand | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | |
| Building Type | Residence type with basement | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1-Dichloroethane** | **265 D** | **610** | **0.21** | **0.16 U** | -- | **0.12 U** | **ND** | -- |
| 1,1-Dichloroethene | 1.93 D | 16 U | 0.075 U | 0.077 U | -- | 0.06 U | ND | -- |
| 1,2,4-Trimethylbenzene | 2.68 D | 20 U | 0.905 | 0.7 | -- | 1.2 | Yes | -- |
| Benzene | 2.48 D | 13 U | 1.2 | 1.3 | -- | 1.1 | No | Yes |
| **cis-1,2-Dichloroethene** | **265 D** | **460** | **0.15 U** | **0.15 U** | -- | **0.12 U** | **NA** | -- |
| Ethyl Benzene | 2.18 D | 18 U | 0.91 | 1 | -- | 1.1 | Yes | -- |
| trans-1,2-Dichloroethene | 7.21 D | 65 U | 0.75 U | 0.77 U | -- | 0.6 U | ND | -- |
| **vinyl chloride** | **176 D** | **10 U** | **0.048 U** | **0.049 J** | -- | **0.68** | **Yes** | -- |

| **Building Location** | **Closest Geotech Sample** | | CG-113 |
|---|---|---|---|
| **5409 Denvers Ave S** | 0-3' bgs | 3-6' bgs | |
| Soil Type | silt | sand | |
| Water-filled Porosity | na | na | |
| Building Type | Residence type with basement | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1,1-Trichloroethane** | **5.47** | **27** | **0.295** | **0.31** | -- | **0.22** | **No** | **Yes** |
| 1,1-Dichloroethane | 48.4 | 0.16 U | 0.14 U | 0.14 U | -- | 0.15 U | ND | -- |
| 1,2-Dichloroethane | 1.92 J | 0.16 U | 2.15 | 0.87 | -- | 0.15 U | No | -- |
| **1,2,4-Trimethylbenzene** | **48.6** | **0.71** | **0.75** | **0.9** | -- | **0.35** | **No** | **No** |
| **1,3,5-Trimethylbenzene** | **10.3** | **0.44** | **0.295** | **0.3** | -- | **0.19 U** | **No** | **No** |
| **Benzene** | **5.76** | **0.51** | **0.955** | **1.2** | -- | **0.95** | **No** | **Yes** |
| Chloroethane | 552 D | 0.26 U | 0.23 U | 0.22 U | -- | 0.25 U | ND | -- |
| cis-1,2-Dichloroethene | 5.94 | 0.16 U | 0.14 U | 0.14 U | -- | 0.15 U | ND | -- |
| **Ethyl Benzene** | **2930 D** | **0.35** | **0.58** | **0.96** | -- | **0.54** | **No** | **Yes** |
| Naphthalene | 9.87 | 97 U | 91 U | 90 U | -- | 100 U | ND | -- |
| Propylbenzene | 16.3 | 18 U | 17 U | 17 U | -- | 19 U | ND | -- |
| sec-Butylbenzene | 1.42 | 20 U | 19 U | 19 U | -- | 21 U | ND | -- |
| **Tetrachloroethene** | **1.76 J** | **40** | **0.25** | **0.68** | -- | **0.26 U** | **No** | -- |
| **Trichloroethylene** | **0.943 J** | **0.21 U** | **0.495** | **0.83** | -- | **0.48** | **No** | **Yes** |
| **Toluene** | **119 [J]** | **3.1** | **4.35** | **8.3** | -- | **3.3** | **No** | **No** |
| trans-1,2-Dichloroethene | 1.06 | 0.79 U | 0.69 U | 0.68 U | -- | 0.75 U | ND | -- |
| **vinyl chloride** | **2.89 J** | **3.9** | **0.444** | **0.444** | -- | **0.048 U** | **No** | -- |

**Table 3-3.** Chemical-specific Detections in Groundwater, Soil Gas, Indoor Air, and Ambient Air (Cont).

| **Building Location** | **Closest Geotech Sample** | | | 5403M |
|---|---|---|---|---|
| **613 S Brandon** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | loamy sand | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | |
| Building Type | Residence Type with crawlspace | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| cis-1,2-Dichloroethene - 8/26/02 | 3.19 | 0.16 U | 0.1 U | 0.16 U | -- | 0.12 U | ND | -- |
| **Trichloroethylene** | **0.032** | **1.5** | **0.47** | **0.72** | -- | **0.42** | **No** | **Yes** |
| Vinyl Chloride - 8/19/02 | 0.194 | 2.4 U | 0.067 | 0.059 | -- | 0.68 | Yes | -- |
| **Vinyl Chloride – 8/26/02** | **0.972** | **0.5** | **0.098** | **0.074** | -- | **0.68** | **Yes** | -- |

| **Building Location** | **Closest Geotech Sample** | | | |
|---|---|---|---|---|
| **611 S Brandon (CS)** | 0-2' bgs | 2-4 ft bgs | 4-6' bgs | |
| Soil Type | silt loam | silt loam | loamy sand | |
| Water-filled Porosity | 0.36 | 0.35 | 0.20 | |
| Building Type | Residence Type with crawlspace | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| cis-1,2-Dichloroethene 8/26/02 | 3.19 | 0.16 U | 0.16 U | -- | -- | 0.12 U | ND | -- |
| **Trichloroethylene** | **0.032** | **1.5** | **0.23** | -- | -- | **0.42** | **Yes** | -- |
| Vinyl Chloride 8/19/02 | 0.194 | 2.4 U | 0.037 U | -- | -- | 0.68 | Yes | -- |
| **Vinyl Chloride 8/26/02** | **0.972** | **0.5** | **0.051 U** | -- | -- | **0.68** | **Yes** | -- |

| **Building Location** | **Closest Geotech Sample** | | | CG-112 and 672L |
|---|---|---|---|---|
| **672 Lucile St – 8/19/02** | 0-3' bgs | 3-6'bgs | | |
| Soil Type | silt loam | sandy loam/loamy sand | | |
| Water-filled Porosity | na | na | | |
| Building Type | residence with basement (basement apartment) | | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1,1-Trichloroethane** | **72.4 D** | **340** | **1.5** | **1.6** | -- | **0.22** | **No** | **Yes** |
| **1,1-Dichloroethane** | **119 D** | **11.9** | **0.14 U** | **0.14 U** | -- | **0.15 U** | **ND** | -- |
| **1,1-Dichloroethene** | **0.645** | **0.44** | **0.069 U** | **0.07 U** | -- | **0.075 U** | **ND** | -- |
| **1,2,4-Trimethylbenzene** | **21** | **0.62** | **0.87** | **0.8** | -- | **0.35** | **No** | **No** |
| 1,2-Dichloroethane | 0.357 | 0.31 U | 0 U | 0.14 U | -- | 0.15 U | ND | -- |
| **1,3,5-Trimethylbenzene** | **1.52** | **0.41** | **0.365** | **0.35** | -- | **0.19 U** | **No** | **No** |
| Benzene | 1.03 | 0.62 U | 1.2 | 1.2 | -- | 0.95 | No | **Yes** |
| Chloroethane | 94.8 D | 0.51 U | 0.23 U | 0.23 U | -- | 0.25 U | ND | -- |
| **cis-1,2-Dichloroethene** | **24.7** | **0.63** | **0.14 U** | **0.14 U** | -- | **0.15 U** | **ND** | -- |
| **Ethyl Benzene** | **44.9** | **0.54** | **1.75** | **1.6** | -- | **0.54** | **No** | **No** |
| Naphthalene | 16.9 | 100 U | 91 U | 93 U | -- | 100 U | ND | -- |
| **Tetrachloroethene** | **0.896** | **15.35** | **0.24 U** | **0.24 U** | -- | **0.26 U** | **ND** | -- |
| **Toluene** | **1.6** | **4.25** | **6** | **7** | -- | **3.3** | **No** | **No** |
| trans-1,2-Dichloroethene | 1.61 | 1.5 U | 0.69 U | 0.7 U | -- | 0.75 U | ND | -- |
| **Trichloroethylene** | **1.64** | **3.65** | **0.55** | **0.52** | -- | **0.48** | **No** | **Yes** |
| **Vinyl Chloride** | **4.94** | **2.9** | **0.044 U** | **0.045 U** | -- | **0.048 U** | **ND** | -- |

**Table 3-3.** Chemical-specific Detections in Groundwater, Soil Gas, Indoor Air, and Ambient Air (Cont).

| **Building Location** | **Closest Geotech Sample** | | CG-112 and 672L |
|---|---|---|---|
| **672 Lucile St - 8/27/02** | 0-3' bgs | 3-6'bgs | |
| Soil Type | silt loam | sandy loam/loamy sand | |
| Water-filled Porosity | na | na | |
| Building Type | residence with basement (basement apartment) | | |

| **COPCs Detected in Groundwater** | **Ground-water ug/L** | **Soil Gas ug/m3** | **Indoor Air_1 ug/m3** | **Indoor Air_2 ug/m3** | **Indoor Air_3 ug/m3** | **Ambient Air ug/m3** | **AA Greater Than Indoor Air Value?** | **AA within 2X Indoor Air Value?[a]** |
|---|---|---|---|---|---|---|---|---|
| **1,1,1-Trichloroethane** | **82.4 D** | **420** | **1.9** | **1.6** | **1.8** | **0.22** | **No** | **No** |
| **1,1-Dichloroethane** | **132 D** | **14.5** | **0.18 U** | **0.18 U** | **0.2 U** | **0.15 U** | **ND** | **--** |
| **1,2,4-Trimethylbenzene** | **29.2** | **0.91** | **1.415** | **1.3** | **2.2** | **0.35** | **No** | **No** |
| **1,3,5-Trimethylbenzene** | **2.51** | **0.67** | **0.54** | **0.49** | **0.85** | **0.19 U** | **No** | **No** |
| **Benzene** | **1.05** | **0.92** | **1.95** | **2** | **11** | **0.95** | **No** | **No** |
| Chloroethane | 119 D | 0.58 U | 0.38 | 0.3 U | 0.32 U | 0.25 U | No | No |
| cis-1,2-Dichloroethene | 28.4 | 0.35 U | 0.17 U | 0.18 U | 0.19 U | 0.15 U | ND | -- |
| **Ethyl Benzene** | **40.9** | **0.87** | **2.35** | **2.5** | **5.9** | **0.54** | **No** | **No** |
| Naphthalene | 20.8 | 93 U | 79 U | 120 U | 97 U | 100 U | ND | -- |
| Propylbenzene | 5.76 | 17 U | 15 U | 22 U | 18 U | 19 U | ND | -- |
| sec-Butylbenzene | 2.48 | 20 U | 17 U | 25 U | 20 U | 21 U | ND | -- |
| trans-1,2-Dichloroethene | 1.57 | 1.7 U | 0.87 U | 0.9 U | 0.96 U | 0.75 U | ND | -- |
| **Trichloroethylene** | **1.37** | **4.6** | **1.25** | **1.4** | **1.2** | **0.48** | **No** | **No** |
| **Vinyl Chloride** | **6.12** | **2.35** | **0.056 U** | **0.058 U** | **0.062 U** | **0.048 U** | **ND** | **--** |

Notes:

**COPCs were not detected in groundwater collected at 507 S Brandon; therefore, this location is not included in the table.**

**[a]The 2 X value is used for descriptive purposes only and does not represent a decisi on critierion.**

COPCs detected in groundwater and soil gas shown in bold.

D – indicates laboratory completed dilutions so that the quantified results were either within the linear range of the instrument and/or to minimize matrix interferences to obtain reportable limits (Exponent, 2002)

J –qualified as estimated (see Appendix B, Exponent, 2002)

U –result undetected

ND –not detected in ambient air or indoor air

AA –ambient air

**Table 3-4.** Tier 3 CCEFs and NCEFs For GIVF Indoor Air Data and COPCs Detected in Groundwater and Soil Gas

| | | Tier 3 - Indoor Air: Residential CEFs | | | | | | Tier 3 - Indoor Air: Commercial CEFs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Correction Factor: Maximum of Ambient Air and Average of 25%+75% National Indoor Air Background | | | | | | Correction Factor: Maximum of Ambient Air and Average of 25%+75% National Indoor Air Background | | | | | |
| | | Note: CEFs were calculated based on measured indoor air concentrations only for analytes that were detected in groundwater and soil gas at the location. | | | | | | Note: CEFs were calculated based on measured indoor air concentrations only for analytes that were detected in groundwater and soil gas at the location. | | | | | |
| | Sample | NonCancer | | | Cancer | | | NonCancer | | | Cancer | | |
| Location | Date | All Data | Non-Detects | Detects | All Data | Non-Detects | Detects | All Data | Non-Detects | Detects | All Data | Non-Detects | Detects |
| 404 S Orcas | 8/19/02 | | | | | | | | | | | | |
| 406 S Orcas | 8/19/02 | | | | 170.00 | | 170.00 | | | | 68.00 | | 68.00 |
| 412 S Lucile | 8/19/02 | | | | | | | | | | | | |
| 412 S Orcas | 8/19/02 | | | | 25.00 | | 25.00 | | | | 10.00 | | 10.00 |
| 507 S Brandon | 8/21/02 | | | | | | | | | | | | |
| 5327 Denver Ave S | 8/26/02 | 0.00 | 0.00 | | | | | 0.00 | 0.00 | | | | |
| 5327 Denver Ave S (CS) | 8/26/02 | 0.00 | 0.00 | | | | | 0.00 | 0.00 | | | | |
| 5403 Maynard Ave S | 8/19/02 | 0.06 | 0.05 | 0.01 | | | | 0.01 | 0.01 | 0.00 | | | |
| 5409 Denver Ave S | 8/19/02 | 1.11 | | 1.11 | 0.10 | 0.10 | | 0.25 | | 0.25 | 0.03 | 0.03 | |
| 611 S Brandon (CS) | 8/19/02 | | | | | | | | | | | | |
| 611 S Brandon (CS) | 8/26/02 | | | | | | | | | | | | |
| 613 S Brandon | 8/19/02 | | | | | | | | | | | | |
| 613 S Brandon | 8/26/02 | | | | 6.50 | | 6.50 | | | | 2.60 | | 2.60 |
| 672 Lucile St | 8/19/02 | 1.42 | 0.07 | 1.35 | 0.10 | 0.10 | | 0.32 | 0.02 | 0.30 | 0.03 | 0.03 | |
| 672 Lucile St | 8/27/02 | 6.17 | 0.00 | 6.17 | 64.85 | 0.12 | 64.73 | 1.39 | 0.00 | 1.39 | 24.64 | 0.04 | 24.60 |

[a]Note: The IPIMALs presented in this table are provided for purposes of this IM and are based on a chemical-specific carcinogenic risk goal of 1E-06, a hazard quotient of 0.1 for non-carcinogens, and the exposure assumptions for volatile inhalation from vapor intrusion for both residential and commercial workers. Specific exposure assumptions are noted below:

| Units | Exposure Assumption | Child Resident | Adult Resident | Commercial Worker |
|---|---|---|---|---|
| $m^3$/hr | Air inhalation intake rate | 0.417 | 0.833 | 1.5 |
| hr/day | Exposure time | 24 | 24 | 10 |
| day/yr | Exposure frequency | 365 | 365 | 250 |
| yr | Exposure duration | 6 | 24 | 25 |
| kg | Body weight | 16 | 70 | 70 |

**Table 3-5.** Comparison of Tier 3 Residential CEFs Calculated for Indoor Air and Ambient Air

| | | Tier 3 - Indoor Air: Residential CEFs[1] | | | | | | | | Tier 3 - Ambient Air: Residential CEFs[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CEFs Calculated Using Only COPCs Detected in Groundwater and Soil Gas | | | | CEFs Calculated Using all COPCs Detected in Groundwater | | | | CEFs Calculated Using Measured Ambient Air Concentrations | | | |
| | Sample | NCEFs | NCEFs | CCEFs | CCEFs | NCEFs | NCEFs | CCEFs | CCEFs | NCEFs | NCEFs | CCEFs | CCEFs[4] |
| Location | Date | All Data[3] | Detects[4] | All Data[3] | Detects[4] | All Data[3] | Detects[4] | All Data[3] | Detects[4] | All Data[3] | Detects[4] | All Data[3] | Detects[4] |
| 404 S Orcas | 8/19/02 | | | | | 0.07 | | 165.81 | 165.81 | 381.14 | 10.67 | 214.21 | 211.79 |
| 406 S Orcas | 8/19/02 | | | 170.00 | 170.00 | 0.07 | | 170.00 | 170.00 | 381.14 | 10.67 | 214.21 | 211.79 |
| 412 S Lucile | 8/19/02 | | | | | 0.07 | | 0.10 | | 372.97 | 2.24 | 121.45 | 119.62 |
| 412 S Orcas | 8/19/02 | | | 25.00 | 25.00 | 0.17 | | 25.39 | 25.39 | 381.14 | 10.67 | 214.21 | 211.79 |
| 507 S Brandon | 8/21/02 | | | | | | | | | 347.02 | 2.68 | 167.49 | 165.33 |
| 5327 Denver Ave S | 8/26/02 | 0.00 | | | | 0.00 | | | | 343.44 | 10.58 | 30.99 | 28.89 |
| 5327 Denver Ave S (CS) | 8/26/02 | 0.00 | | | | 0.00 | | | | 343.44 | 10.58 | 30.99 | 28.89 |
| 5403 Maynard Ave S | 8/19/02 | 0.06 | 0.01 | | | 0.20 | 0.01 | | | 300.97 | 8.68 | 30.05 | 28.19 |
| 5409 Denver Ave S | 8/19/02 | 1.11 | 1.11 | 0.10 | | 333.94 | 1.11 | 40.53 | 40.39 | 372.17 | 1.50 | 30.04 | 27.65 |
| 611 S Brandon (CS) | 8/19/02 | | | | | | | | | 300.97 | 8.68 | 30.05 | 28.19 |
| 611 S Brandon (CS) | 8/26/02 | | | | | 0.05 | | | | 300.97 | 8.68 | 30.05 | 28.19 |
| 613 S Brandon | 8/19/02 | | | | | | | | | 300.97 | 8.68 | 30.05 | 28.19 |
| 613 S Brandon | 8/26/02 | | | 6.50 | 6.50 | 0.03 | | 6.50 | 6.50 | 300.97 | 8.68 | 30.05 | 28.19 |
| 672 Lucile St | 8/19/02 | 1.42 | 1.35 | 0.10 | | 326.53 | 1.35 | 0.14 | | 372.17 | 1.50 | 30.04 | 27.65 |
| 672 Lucile St | 8/27/02 | 6.17 | 6.17 | 64.85 | 64.73 | 298.50 | 6.17 | 65.01 | 64.89 | 372.17 | 1.50 | 30.04 | 27.65 |

Notes

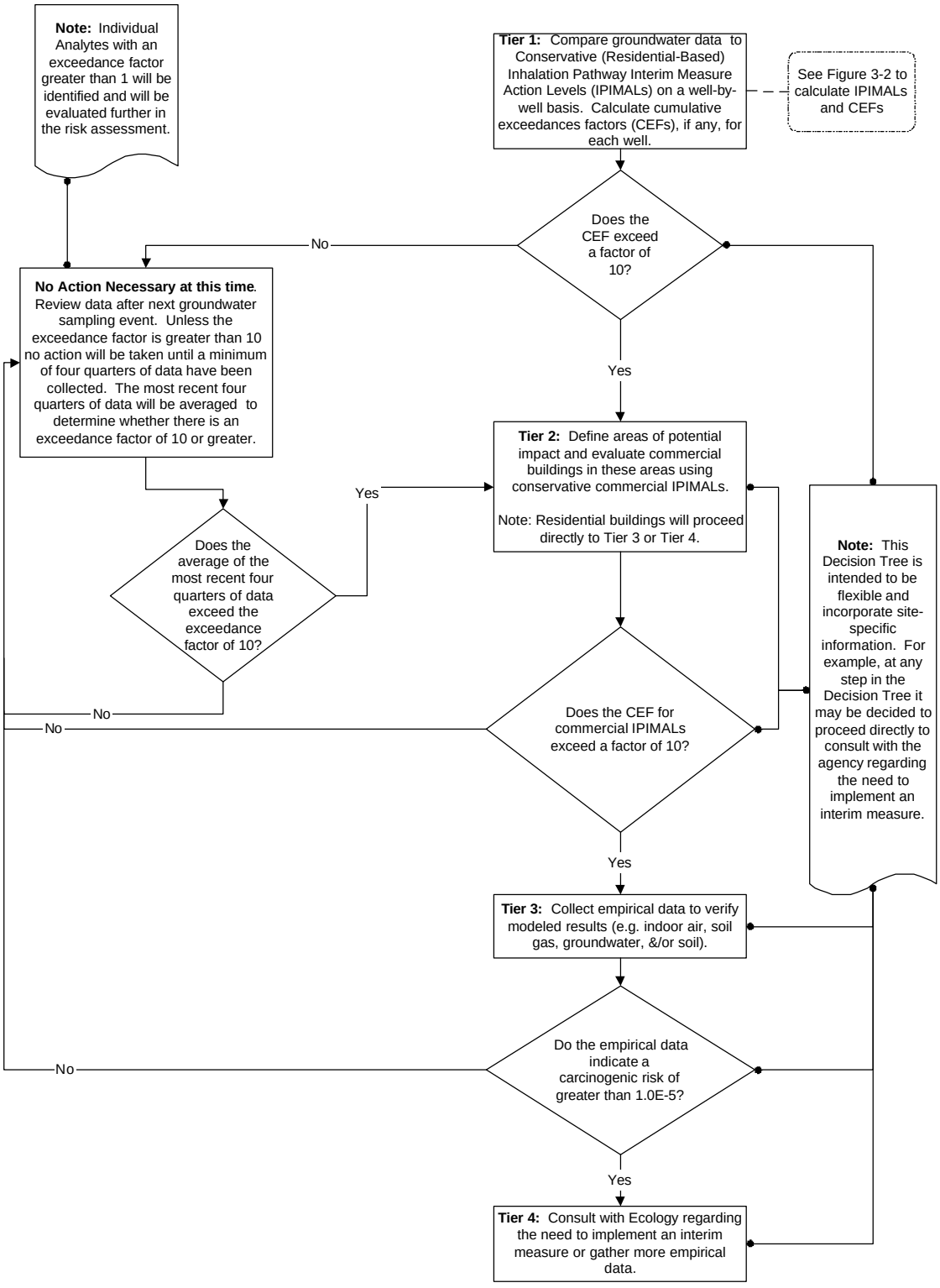
1. Indoor air residential CEFs calculated by comparing the measured indoor air concentrations (adjusted using the maximum of ambient air and average of 25% and 75% National Indoor Air Background) to the Indoor Air IPIMALs
2. Ambient air residential CEFs calculated by comparing the measured ambient air concentrations to the Indoor Air IPIMALs.
3. Per the IPIM Workplan, the exceedance factors (EFs) and CEFs for non-detected results in Tier 3 were calculated using 1/2 the reporting limit. Non-detects are included in the "All Data" Set.
4. CEFs calculated with only Detected results in indoor air.

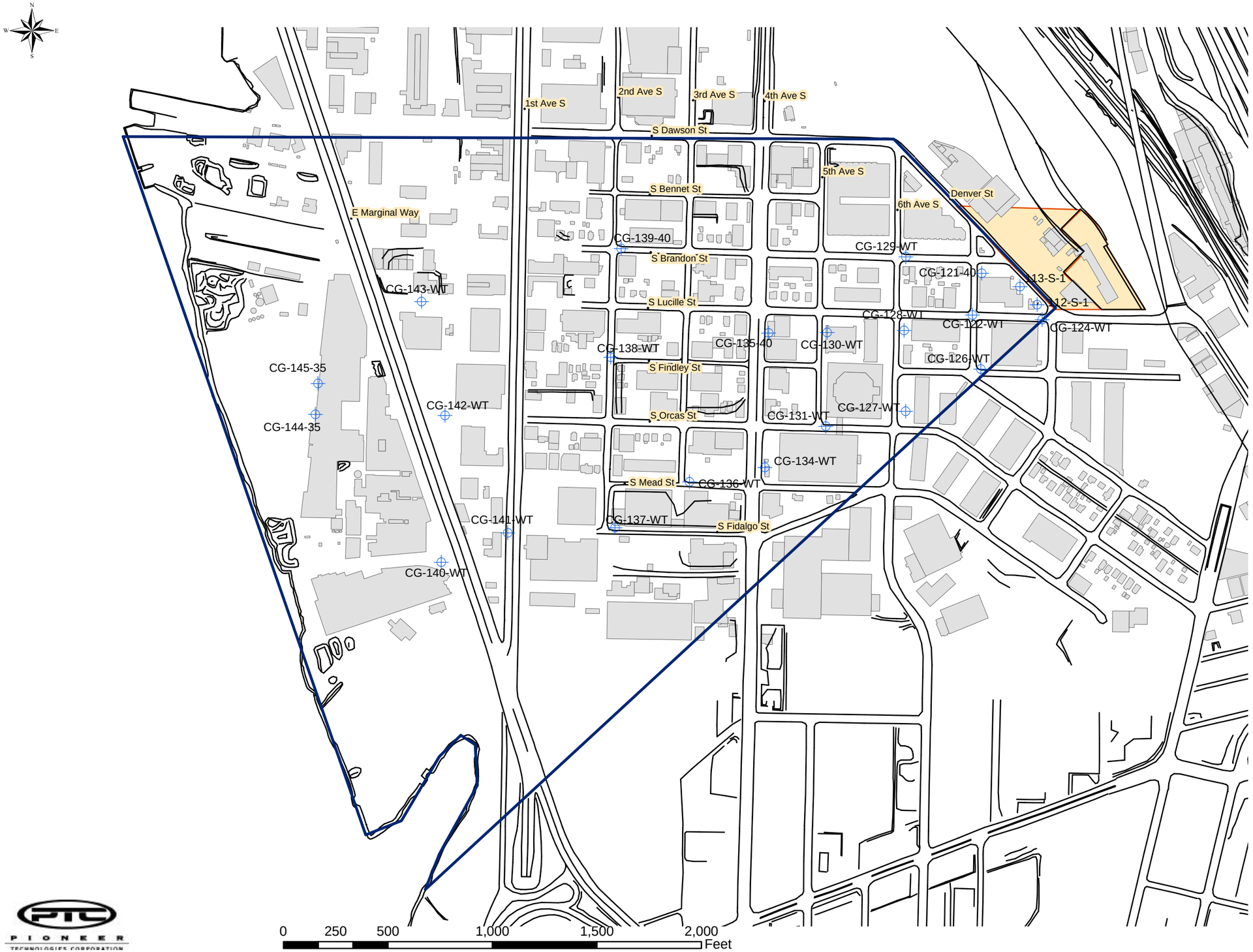
**Table 3-6.** IDW Input Parameters

| IDW Parameter | Parameters Used in Interpolation of CEFs Presented on Figures 3-3a – 3-3e & 3-4a – 3-4e | Description |
|---|---|---|
| Power | 4 | As the power increases, the grid node being interpolated is influenced more by points located closer than points located further away. The default value in many software applications (e.g., Surfer) is 2. For this analysis a power of 4 was assumed which results in contours that are less smooth but are heavily influenced by points located closer to the grid node being interpolated. The power parameter must be greater than 0 and less than 20. |
| Smoothing | 0 | Smoothing was not incorporated into the contours. Normally, IDW behaves as an exact interpolator. When calculating a grid node, the weights assigned to the data points are fractions, and the sums of all the weights are equal to 1.0. When a particular observation is coincident with a grid node, the distance between that observation and the grid node is 0.0, and that observation is given a weight of 1.0, while all other observations are given weights of 0.0. Thus, the grid node is assigned the value of the coincident observation. The smoothing parameter buffers this behavior. If a non-zero smoothing parameter is used, no point is given an overwhelming weight (i.e., no point is given a weighting factor equal to 1.0). |
| Radius 1 | 250[a] feet | The radius of the search ellipse in the X direction (east-west: parallel to groundwater flow) |
| Radius 2 | 100[a] feet | The radius of the search ellipse in the Y direction (north-south: perpendicular to groundwater flow). |
| Search Sectors | 4 | The search ellipse was divided into 4 search sectors of equal size. |
| Anisotropy Angle | 5$^{o}$ | The anisotropy angle is the offset of the search ellipse in the X direction. An anisotropy angle of 5 $^{o}$ results in an orientation of the X coordinate of the search ellipse parallel to the groundwater flow located hydraulically down gradient of the Georgetown Facility. |

[a]The EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (November 2002) recommends only evaluating buildings near (i.e., within approximately 100 feet laterally or vertically) locations with volatile organic compounds in the subsurface.

**Figure 3-1.** IPIM Decision Tree






## Legend

- Monitoring Well Stations in Area 3
- Roads
- Buildings
- Areas 1 and 2
- Area 3

## Notes

- All Wells Were Screened Across the Water Table Except: CG-121-40, CG-135-40, CG-139-40, CG-145-35, CG-144-35. These Wells Were Screened at Less Than or Equal to 40 Feet Below Ground Surface.

- Areas 1, 2 and 3 Were Designated in the Draft Risk Assessment PSC 2002.

**Location of PCAMP Monitoring Wells Evaluated in Tier 1 and Tier 2**

PSC Georgetown

**Figure 3-2a**

PIONEER TECHNOLOGIES CORPORATION

File:C:\PSC\Maps\November 2002\Tier 1 Maps




# Legend

- Direct Push Groundwater Samples in Area 3
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- All Samples Were Collected at or Less Than or Equal to 19 Feet Below Ground Surface.

- Areas 1, 2 and 3 Were Designated in the Draft Risk Assessment PSC 2002.

**Location of Shallow Temporary (direct-push) Water Samples Evaluated in Tier 1 and Tier 2**

PSC Georgetown

**Figure 3-2b**

PIONEER TECHNOLOGIES CORPORATION

File:C:\PSC\Maps\November 2002\Tier 1 Maps




# Legend

**IPIM Residential NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF

**IDW of IPIM Residential NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

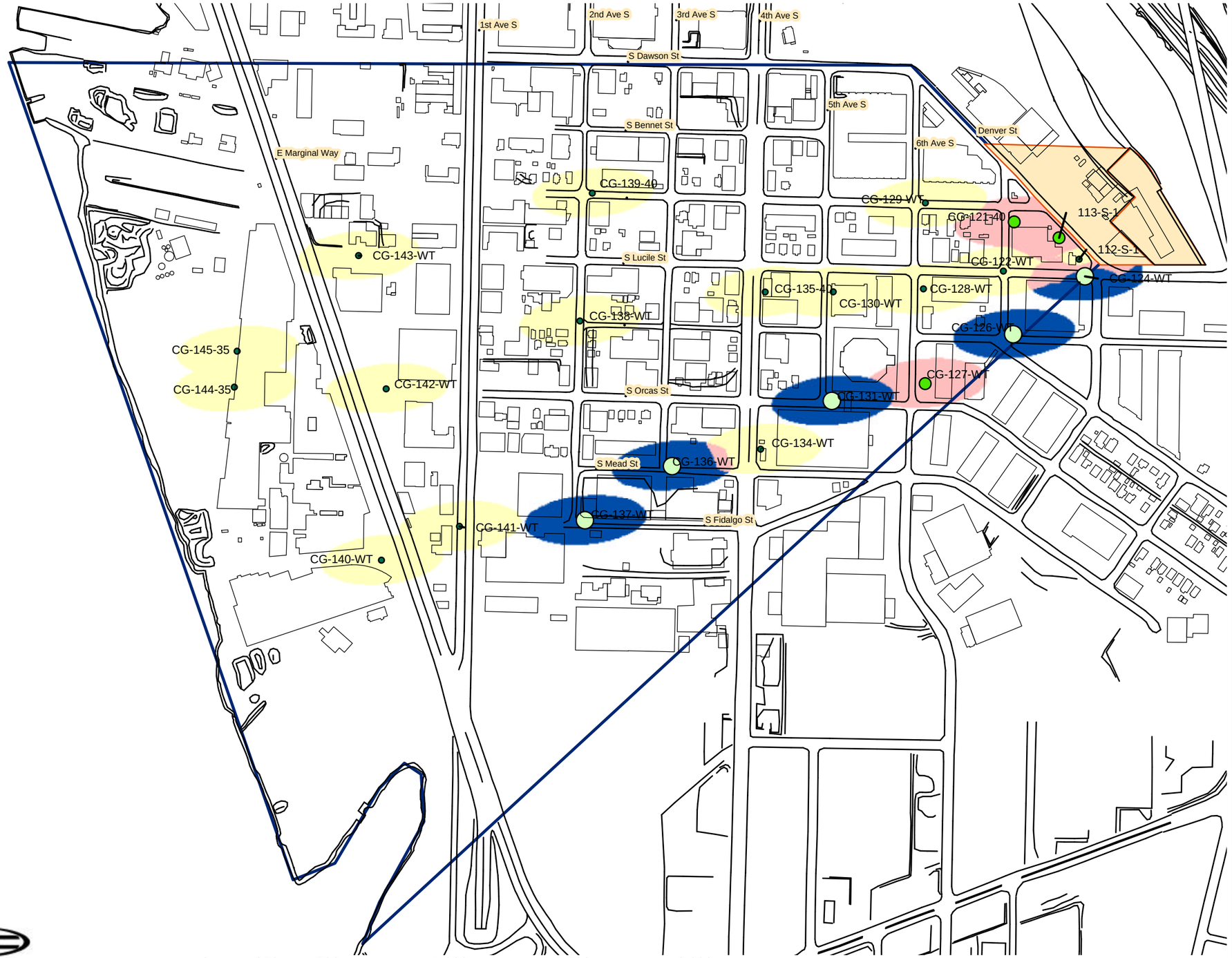
- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential NCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure 3-3a**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\Source\Maps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps




# Legend

**IPIM Residential CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF

**IDW of IPIM Residential CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential CCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure 3-3b**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\SourceMaps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps




C:\Projects\PSC\GIS\SourceMaps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps

PIONEER TECHNOLOGIES CORPORATION

# Legend

**IPIM Residential NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF

**IDW of IPIM Residential NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

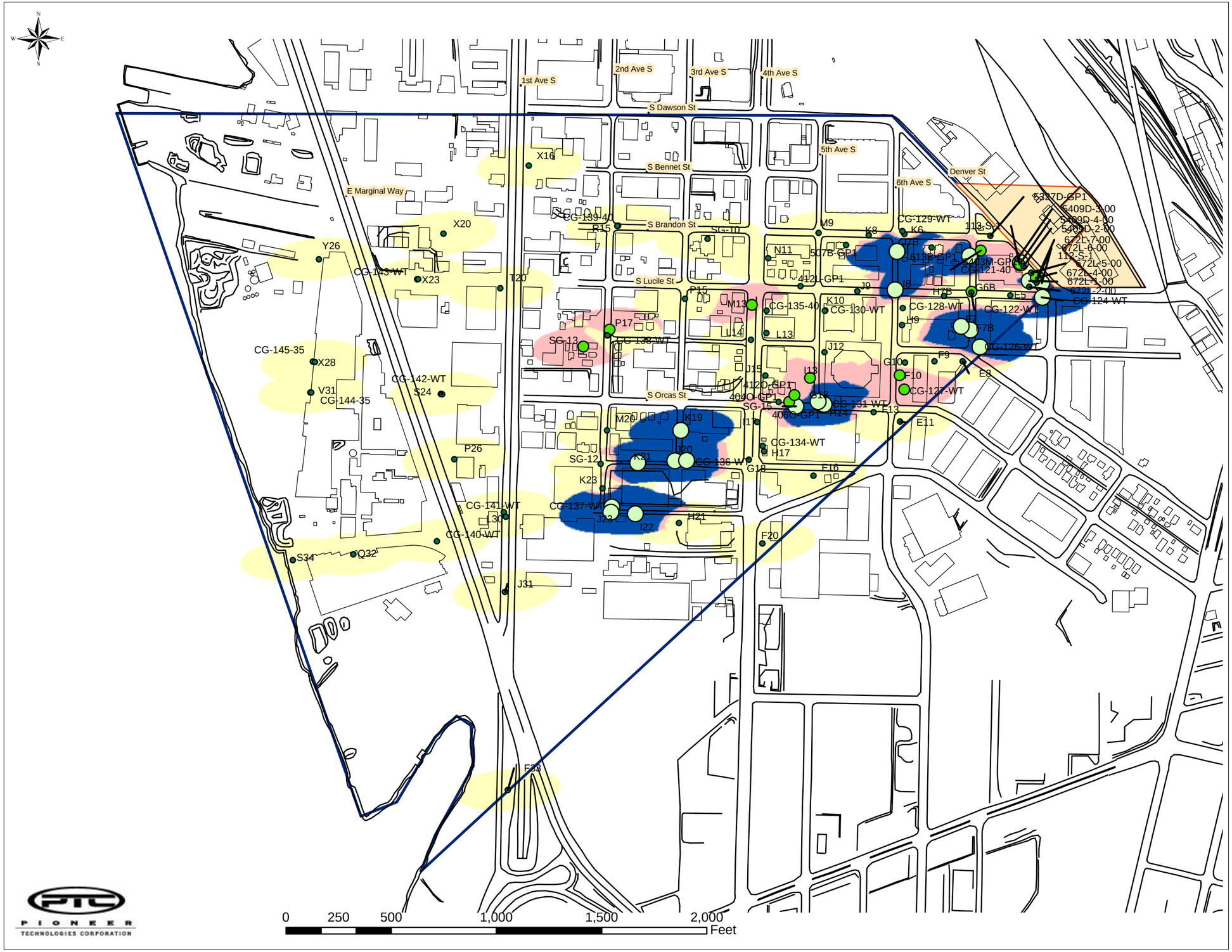
- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential NCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-3c**




# Legend

**IPIM Residential CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF

**IDW of IPIM Residential CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

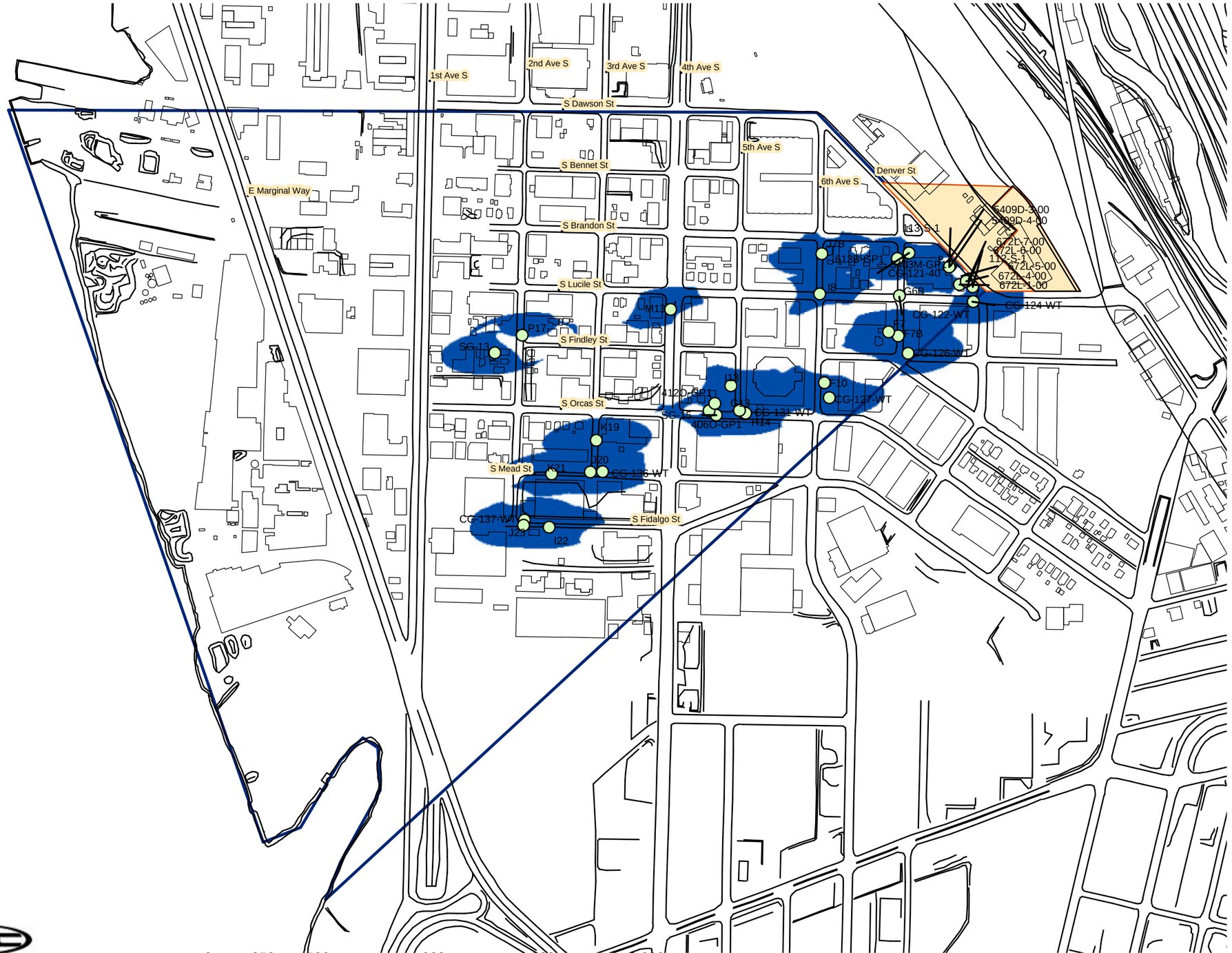
- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential CCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure 3-3d**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\Source\Maps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps




# Legend

**IPIM Residential CCEFs**

- >10 CCEF

**IDW of IPIM Residential CCEFs**

- >10 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

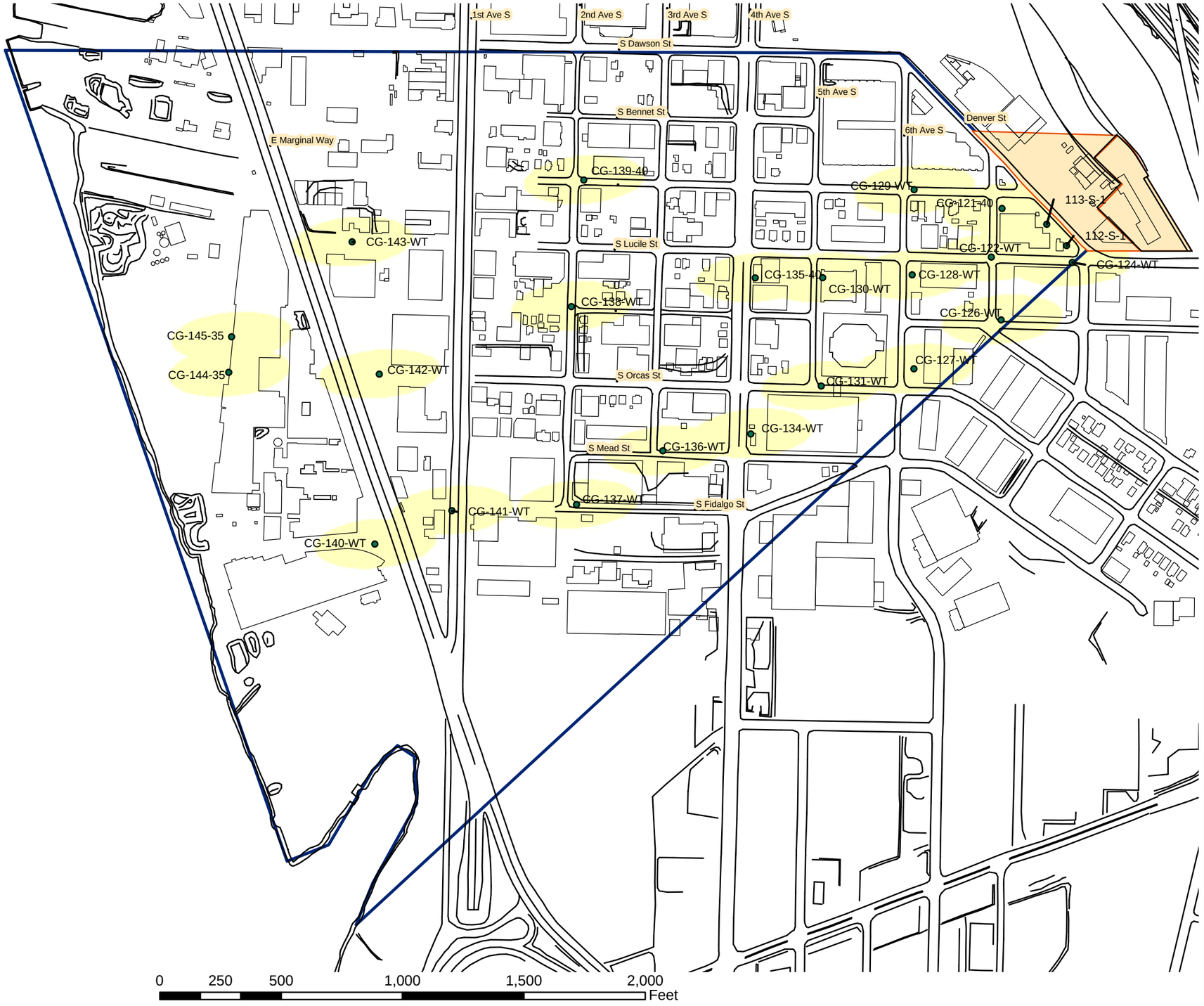
- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Residential CCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure 3-3e**

PIONEER TECHNOLOGIES CORPORATION

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## Legend

**IPIM Commercial NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF

**IDW of IPIM Commercial NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

## Notes

- Monitoring Wells Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 2 Commercial NCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-4a**

PIONEER TECHNOLOGIES CORPORATION

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# Legend

**IPIM Commercial CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF

**IDW of IPIM Commercial CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

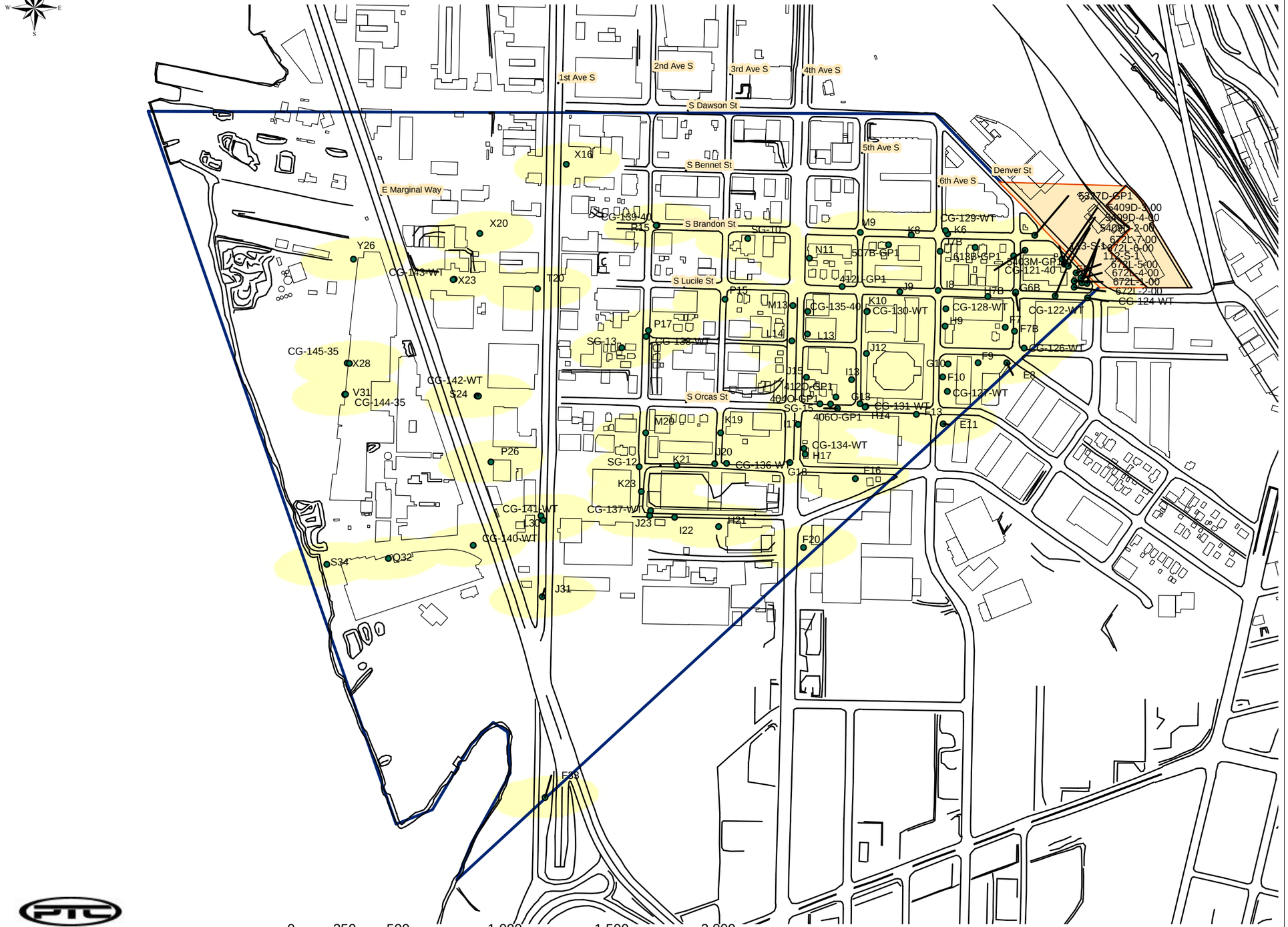
**Tier 2 Commercial CCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-4b**

PIONEER TECHNOLOGIES CORPORATION

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# Legend

**IPIM Commercial NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF

**IDW of IPIM Commercial NCEFs**

- 0-10 NCEF
- 10-50 NCEF
- >50 NCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only
- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.
- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.
- IDW = Inverse Distance Weighting Interpolation

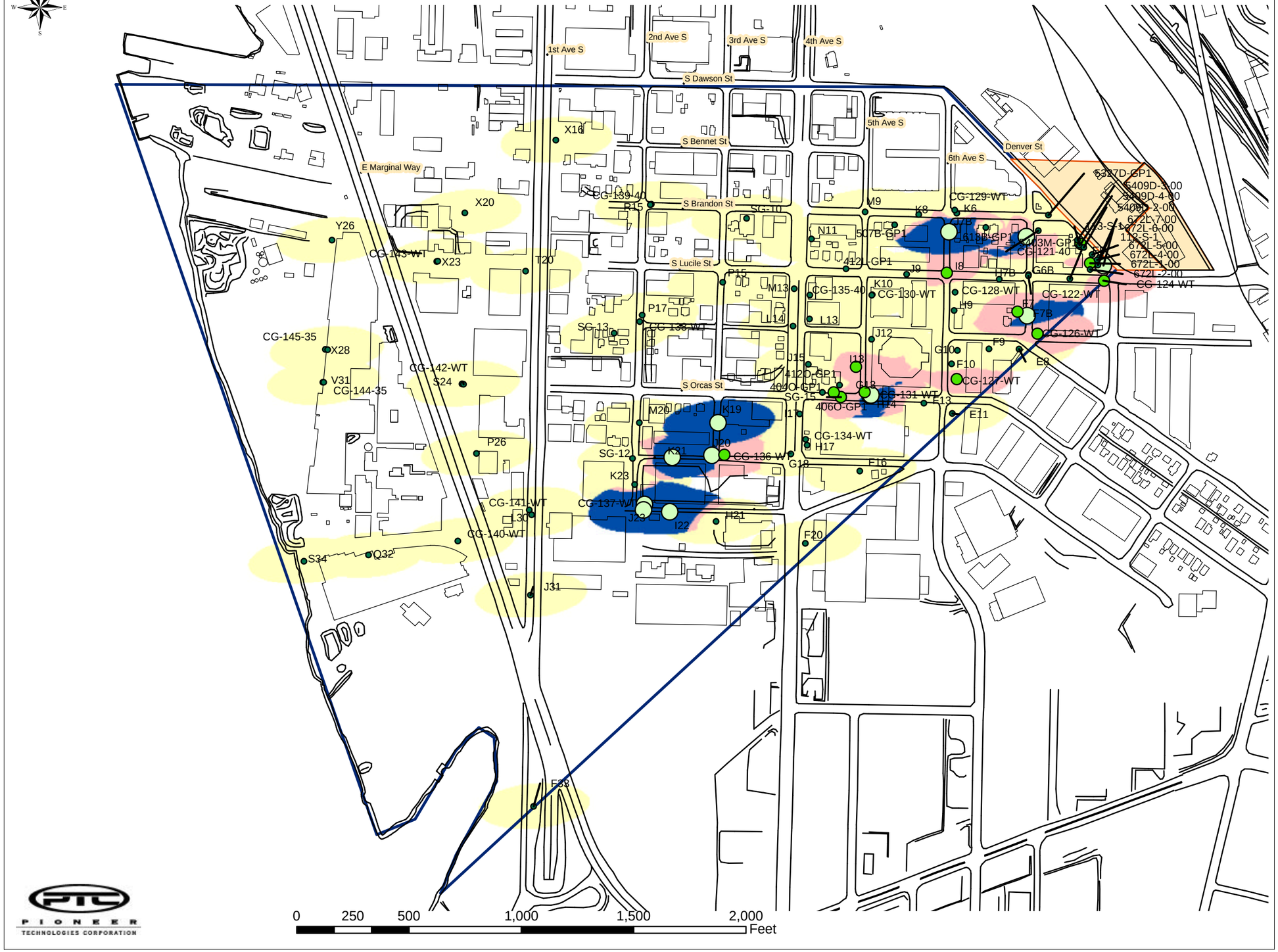
**Tier 2 Commercial NCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-4c**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\SourceMaps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps




# Legend

**IPIM Commercial CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF

**IDW of IPIM Commercial CCEFs**

- 0-10 CCEF
- 10-50 CCEF
- >50 CCEF
- Roads
- Buildings
- Areas 1 and 2
- Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

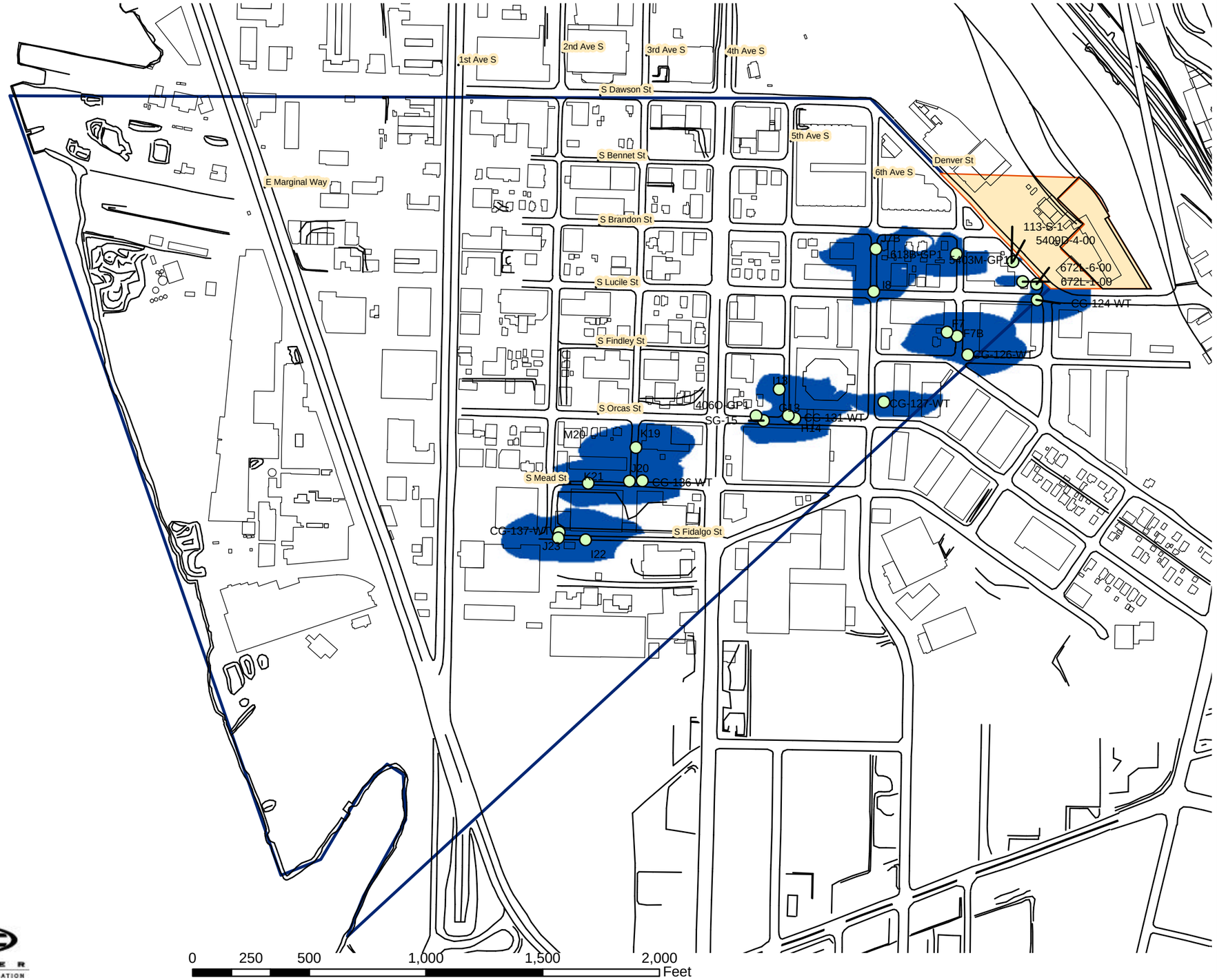
**Tier 2 Commercial CCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-4d**

PIONEER TECHNOLOGIES CORPORATION

C:\Projects\PSC\GIS\SourceMaps\February 2003\Revised Tech Memo Maps\Revised Interpolation Maps




# Legend

**IPIM Commercial CCEFs**

>10 CCEF

**IDW of IPIM Commercial CCEFs**

>10 CCEF

Roads

Buildings

Areas 1 and 2

Area 3

# Notes

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 2 Commercial CCEFs for COPCs Detected in Groundwater**

PSC Georgetown

**Figure 3-4e**

PIONEER TECHNOLOGIES CORPORATION

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# 4. DATA QUALITY OBJECTIVES AND UNCERTAINTY ANALYSIS

This section reviews the data quality objectives outlined in the IPIM Work Plan and the uncertainties associated with the GIVF evaluation and IPIM Decision Tree. While there are a number of sources of uncertainty associated with the GIVF study and evaluation process, PSC has attempted to minimize the total uncertainty so that decision making is biased towards taking interim measures where such measures may not be necessary (as opposed to not taking measures when they should be taken).

## 4.1 REVIEW OF DATA QUALITY OBJECTIVES

From Section 4 of the IPIM Work Plan, PSC outlined the following DQOs:

1. Achieve detection limits for groundwater, indoor air, ambient air, and soil gas samples that are at or below constituent-specific health-based action level concentrations (cancer risk=1E-6; HQ=0.1).
2. Use and evaluate quality control tests, calculate and evaluate values for data quality indicators, and validate data to ensure that risk-based decisions are based on quality data.
3. Collect groundwater data representative of actual current conditions in the upper portion of the shallow aquifer (particularly at the water table).
4. Take actions to ensure that the indoor air sampling data is representative of actual conditions in the building being sampled that day (particularly in those portions of the building where exposures would be the highest).
5. Maximize the ability to obtain indoor air data that is representative of that day's indoor air quality, as caused by vapor intrusion.

In order to meet these DQOs, PSC took the following measures, identified in the IPIM Work Plan, to minimize uncertainty and bias error toward more conservative decision making:

1. Collected duplicate co-located indoor air samples in each building to measure the precision of the indoor air measurements.

   *PSC collected a total of 17 field duplicates (14 in indoor air) to measure the precision of their analyses. For 36 out of 37 data points in which concentrations for the analytes were detected, both members agreed within a factor of two of each other (See Appendix B). This is equivalent to a relative percent difference (RPD) value of less than 67 percent. In 14 instances, a compound was detected in one member of the duplicate set but not the other. In these cases, the detected data point was slightly above the reporting limit (but still within 1-1/2 times the reporting limit). The results of the precision analysis are presented in a memo in Appendix B.*

2. Used conservative site-specific assumptions when applying models or performing calculations.

   *With completion of this GIVF study, PSC has collected 18 geotechnical samples (13 fairly uniformly distributed throughout the GIVF Study Area) in order to characterize the subsurface conditions that most influence vapor migration to indoor air. The geotechnical data (Section 2.1.4 and Appendix C) demonstrate that the soils in the Georgetown area consist of mixed finer-grained material (sandy silt to loamy sand) with sand observed in less than 10 percent of the upper 4-feet profile and in 35 percent of the lower 4-feet profile. In no case was sand identified throughout the profile. A review of lithologic logs from recent and prior borings throughout Georgetown further illustrate the presence of substantially silty fine sand associated commonly with silt interbeds.*

   *The Georgetown soils are typically very moist and moisture impedes soil gas diffusion and thus migration into indoor air. Low vadose zone moisture (represented as volume water/total volume in pore space) typical of dry sandy soil (0.05 or less) was observed in only 11 percent of the samples collected. Seventy-two percent had a soil moisture content of 0.11 or higher. The values observed at Georgetown are consistent with typical values for silts and loams (Hers, 2002).*

   *PSC applied the JEM to help evaluate the uncertainty of empirical predictions in indoor air quality made through use of the GIVF methodology, and did not apply it to*

*quantitatively predict indoor air concentrations using site-specific conditions. Therefore, uncertainties associated with the JEM analysis do not significantly impact GIVF calculations. The model is used only to develop AFs to determine the relative difference in migration potential for each COPC, regardless of the subsurface conditions. However, calculated empirical GIVFs and ACs were compared with Upper, Lower, and conservative Site-specific Boundary GIVFs and ACs predicted by the JEM in order to "ground-truth" the empirical GIVFs and ACs and to identify outliers. In this sense, the JEM was used to help reduce the uncertainty associated with evaluating empirically derived GIVFs.*

*In order to compensate for data gaps in the geotechnical analysis (outside of the GIVF Study Area), the site-specific values used in the JEM for comparison and for calculating the AFs were set using more conservative assumptions than were typically observed in the GIVF Study Area. For example, there is some evidence that the moisture level below buildings could be lower than that measured in surrounding soils. Fitzpatrick (MADEP, 2002) has observed that soil moisture beneath buildings is most frequently measured between 11 and 15 percent by volume but both Fitzpatrick and Hers (2002) recommend using a more conservative value (5 percent) when applying the JEM. A soil moisture of 5 percent was applied for both the Upper Boundary and Site-Specific conditions used in the Georgetown JEM comparison, although these conditions were observed in only 11 percent of the samples.*

3. Used procedures for collecting samples that would ensure that data represented reasonable maximum estimates of the actual concentrations of indoor air to which individuals may be exposed.

   *PSC collected indoor air samples for the GIVF study from locations where soil gas was most likely to migrate into the building (e.g., from basements near perimeter or floor cracks, sumps, and drains) and from areas considered to have the least amount of mixing with fresh air. Additional samples were collected from the main living areas. Crawl spaces were sampled to determine if VOCs concentrated more readily in these areas. All locations were selected during the building evaluation with the concurrence of Ecology and/or EPA representatives.*

4. Used the most conservative target compound GIVF ($GIVF_{TC}$) to calculate the GIVFs for constituents that are not TCs.

   *A thorough review process, presented in Section 2.3.2, was conducted to ensure that the most conservative TC-specific and building-specific GIVF was selected. Data points that were suspect and/or did not meet the DQOs of the SAP and QAPP were reviewed to ensure that they were indeed outliers and did not represent potential conditions at the site. Statistical information for the empirically calculated GIVFs (excluding outliers) summarized below demonstrates that the most conservative $GIVF_{TC}$ was used to calculate GIVFs for non-TC constituents and the maximum value (Max GIVF using all data) is equivalent to the Log 95 percent UCL for the data set.*

| **GIVF Analysis** | **Result (GIVF $\frac{mg/m3}{mg/L}$)** |
|---|---|
| Distribution Type | Lognormal |
| Max GIVF (using all data) | 0.1718 |
| Location and Target Compound for Max_all data | 406 South Orcas – 1,1-DCE |
| Max GIVF (using only detect results in indoor air) | 0.0204 |
| Location and Target Compound for Max_detect only | 672 South Lucile – 1,1,1-TCA |
| Min GIVF | 0.0004 |
| Location and Target Compound for Min | 5409 Denver – Chloroethane |
| Mean GIVF | 0.0335 |
| Median GIVF | 0.0159 |
| Geometric Mean | 0.0120 |
| Log 95% UCL | 0.1380 |
| Standard Deviation | 0.0444 |

5. Assigned the full detection limit value to all indoor air contaminants that are not detected in deriving GIVFs.

   *For the purposes of the GIVF Study, the full detection limit was assigned to all non-detect measurements. This ensured that a GIVF was calculated based on the maximum possible assumed indoor air concentration and resulted in GIVFs that*

*represented maximum vapor migration. Due to the selection protocol, this likely resulted in determining relationships where a pathway may not have existed. This resulted in overestimates of the GIVFs, as discussed further in Section 2.3.2, and ensured that the maximum GIVF selected would not underestimate potential vapor migration for screening purposes in the Decision Tree. For example, assigning a GIVF using the maximum GIVF from data pairs detected in both groundwater and indoor air rather than the maximum for all data pairs (including non-detect in indoor air) has the effect of lowering the GIVF for the risk-driver TCE from 0.06 to 0.01 and increasing the groundwater IPIMAL for TCE by a factor of 4.5.*

6. Achieved detection limits for groundwater, indoor air, ambient air, and soil gas samples that are at or below constituent-specific health based action level concentrations.

   *Both air and groundwater measurements were made using the GC/MS and GC/MS-SIM methods for specific compounds. As shown in the data validation report in Appendix B (Mc Ateer, 2002), data validation demonstrated that the data were of sufficient quality to support the GIVF analysis, although detected J-qualified data were considered bias-low. The use of non-detected results to calculate the GIVFs made this a very sensitive parameter in the GIVF analysis. Data pairs were scrutinized to ensure that values measured at or near the limits of detection were adequate for use in the GIVF analysis.*

7. Only subtracted contributions from ambient and background indoor air contaminant sources that are measured (for ambient air) or representative of the average household (for indoor air sources).

   *Background corrections were made in accordance with the IPIM Work Plan after a thorough review and statistical analysis of all readily available national surveys. The basis for selecting the indoor air background values is presented in Appendix D. Ambient air samples were collected near and upwind of each location where indoor air samples were collected. Ultimately, only two target compounds (tetrachloroethylene and 1,2-DCA) in some locations were adjusted using the national background indoor air value. In most cases the compound ambient air concentration, where detected, was higher than the indoor air background value.*

8. Did not exclude any COPCs measured in indoor air or target compounds from the data set without the concurrence of Ecology.

*During the GIVF Study, PSC performed a thorough review of all TCs detected in groundwater to identify suspect data points that would result in either significant over-estimates or under-estimates of the GIVF. Because of the conservative approach of using non-detected indoor air to calculate the GIVFs, the final data set, even after removal of outliers, included a number of upper bound GIVFs that likely overestimate conditions at these locations. The basis for review and selection of outliers is presented in Section 2.3.2 and Table 2-6 for Ecology's review and concurrence.*

9. Used groundwater data as inputs into the JEM (EQM, 2000) using a range of site-specific inputs to evaluate the uncertainty of the empirical predictions of indoor air quality made through use of the *volatilization factor* methodology.

   *See item #2.*

## 4.2 UNCERTAINTY ANALYSIS

Several sources of uncertainty are presented in Section 4 of the IPIM Work Plan. For many of these sources of uncertainty, an estimation of their potential magnitude, and effect on decision making, will not be developed until the preparation of the revised RI Report. Additional sampling and analysis in the interim, however, should aide the estimation process. Those sources that can be evaluated during this study are presented with respect to the GIVF Evaluation (Section 4.2.1) and the IPIM Decision Tree process (Section 4.2.2) below.

### 4.2.1 GIVF Calculations

The most significant sources of uncertainty related to the GIVF study are discussed below. The first three, and most significant, sources of uncertainty result in over-estimating the GIVF, which has the effect of biasing estimated groundwater IPIMALs to more conservative (stringent) values so that decision making is biased toward taking interim measures where such measures may not be necessary (as opposed to not taking measures when they should be taken).

1. GIVFs calculated using non-detect data in indoor air.

   *This uncertainty consistently results in an over-estimate of the GIVF because concentrations in indoor air are likely to be less than the full reporting limit. In*

*several cases, this effect was increased because detection limits were reported at concentrations up to two times the reporting limit.*

2. Data points measured at or near the detection limit in groundwater.

   *Groundwater concentrations reported at or near the detection limit commonly resulted in GIVFs that appeared to be biased high. This effect was compounded in the GIVF study when low-concentration-groundwater data were related to non-detect data in indoor air resulting in artificially elevated GIVFs.*

3. Concentrations detected in background indoor air and/or ambient air affecting calculated GIVFs.

   *PSC conducted a comprehensive review of available background indoor air data for representative populations as a follow-up to numerous discussions with Ecology. However, concerns remained whether the central tendency (median or mean of 25 percent and 75 percent of these values) for these values would result in assigning background levels at a number of Georgetown buildings that were higher than the actual concentrations. A second concern related to approval of the database from which these values were obtained. Details of the indoor air evaluation are presented in Appendix D. Ultimately, PSC adjusted indoor air values using statistics from national background databases for only two TCs (1,2-DCA and tetrachloroethylene) because the ambient air values at most locations were higher than the background indoor air values. Therefore, use of the central tendency background indoor air value was not considered a significant uncertainty in the process.*

   *Concentrations in ambient air led to much more uncertainty with respect to GIVF calculations. As shown on Table 3-3, most COPCs detected in groundwater were also detected in ambient air. With few exceptions (as shown on Table 3-3) COPCs measured in indoor air had lower concentrations or were within two times the measured ambient air concentration. Furthermore, ambient air measured outside of the immediate study area (727 Homer) had some of the highest ambient air concentrations reported[24]. This indicates that levels of COPCs in ambient air may*

[24] The 727 Homer ambient air sample was collected over a 24-hour period starting on 8/19/02 at 1822 and ending on 8/20/02 at 1219. Meteorological conditions observed at Boeing Field during this 24-hour period were as follows: air temperature (degrees F) ranged from 56 to 70; pressure (millibars) ranged from 1011.7 to 1014.3; and no rain was recorded. These data were obtained from the University of Washington's Atmospheric Sciences Department (http://www.atmos.washington.edu/data/).

*have a significant effect on calculated GIVFs for those TCs with concentrations detected in indoor air.*

4. The possibility that the choice of the most conservative target compound GIVF to "represent" all non-target compound GIVFs may result in using GIVFs that are too high or too low for certain COPCs. This is especially a concern for TCE, one of the primary risk drivers for this site and exposure pathway.

   *As discussed in Section 2.3.2 and above, it is more likely that the selected GIVF will result in GIVFs that are too high for certain COPCs. This is due to the artifact associated with the non-detected indoor air and low concentration groundwater data.*

   *TCE was the only other non-TC compound that was commonly detected in both groundwater and indoor air. However, as discussed in Section 2.3.1, the ubiquitous presence of TCE in both indoor and ambient air precluded its use as a TC. With the exception of the 672 South Lucile sampling event on 8/27/02, TCE was detected in ambient air at concentrations greater than (or within two times of) the indoor air value. In particular, the 4th and Orcas Street buildings showed high concentrations in indoor air and ambient air but low concentrations in groundwater. The lack of an apparent relationship between groundwater and indoor air concentrations for TCE was most evident at 404, 406, and 412 South Orcas. Groundwater concentrations varied from 1.5 to 44 ug/L, but indoor air concentrations varied little (4.6 to 7.5 ug/$m^3$), resulting in calculated GIVFs and ACs that varied by orders magnitude. Similarly high background concentrations resulted in high GIVFs at 613 Brandon where the groundwater concentration was measured near the detection limit. GIVFs calculated using the empirical data fell above the Upper Boundary JEM range for all locations except 412 Orcas, which had the highest concentration of TCE in groundwater. The $GIVF_{TCE}$ for 412 Orcas was within the range of GIVFs for other TCs.*

   *As discussed in Section 4.1 (item #5 above), the use of non-detect data in indoor air to select the maximum GIVF has the effect of increasing the potential GIVF for TCE by approximately 5 times over using the GIVF for detected data pairs only.*

5. The possibility that GIVFs, calculated between the facility and 4th Avenue, may overestimate or underestimate the GIVFs that would be calculated from paired sampling downgradient of 4th Avenue.

*PSC cannot be certain that the buildings or site-specific subsurface conditions selected for the GIVF study represent worst case, or even average, susceptibility to vapor intrusion. However, the highest groundwater COPC concentrations and the most susceptible buildings (i.e., homes) are located in the GIVF Study Area. Homes were selected from this area for sampling to minimize the uncertainty associated with underestimating the GIVFs. Although there were four residences that were proposed for sampling in the IPIM Work Plan that were not sampled, as PSC was not granted access (i.e., 601 S. Brandon, 605 S. Brandon, 616 S. Lucile, and 612 S. Lucile), there were homes located within the same block from which samples were collected and used in the GIVF calculations. In accordance with the IPIM Work Plan, PSC also extended the GIVF study area to include six additional residences, from which co-located samples were collected for use in the GIVF study. Additionally, PSC sampled during the summer when groundwater concentrations should be highest and volatilization factors should be highest.*

*Finally, PSC compared both calculated GIVFs and ACs (GIVFs adjusted for Henry's Law) with estimated GIVFs and ACs predicted by the JEM using Upper, Lower, and Site-specific parameters to further check the results of the empirical study and JEM modeling assumptions. The data plotted on Figures 2-5a and 2-5b show that most GIVFs and ACs fall at or below the Site-specific Boundary conditions predicted by the JEM, which is consistent with subsurface conditions observed throughout Area 3. The GIVF selected for use in setting groundwater IPIMs is the maximum value represented by these conditions.*

*In summary, available boring log and geotechnical data indicate that the conditions represented in the GIVF Study Area are not significantly different than conditions throughout Area 3, although PSC cannot be certain that unique Site-specific conditions do not exist. To the extent possible, PSC has identified the most conservative GIVF ($GIVF_{max}$) that is more equivalent to a modeled GIVF using parameters that are more conservative than what is observed in the GIVF Study Area, ensuring that the GIVF will not underestimate conditions that could occur in locations in Area 3.*

6. The exclusion of data from the GIVF calculations.

   *Six data pairs were excluded from the final GIVF calculations as the calculated results exceeded the JEM-predicted results using the Upper bound parameters, which was not*

*considered to be a plausible result for the site. The discrepancies appeared to be a consequence of the analytical results being reported near the limit of detection coupled with elevated detection limits for indoor air results. In addition, three groundwater data pairs and one indoor air data pair were excluded from the GIVF development process as these J-qualified data were considered by the data validators as biased low. Excluding these data from the GIVF calculations may have resulted in underestimating the GIVFs for groundwater and overestimating the GIVFs for air. However, this uncertainty is considered minor, as the excluded data points represent only a small subset of data, and other, more significant sources of uncertainty consistently resulted in overestimating GIVFs for groundwater.*

7. The use of a provisional slope factor for TCE that may overestimate risks to human health from the inhalation pathway.

   *The provisional cancer slope factor used for TCE in this assessment is uncertain and may result in an overestimation of the risks to human health from the inhalation pathway. In the Draft Risk Assessment (PSC, 2001), a provisional EPA inhalation slope factor of 0.006 mg/kg-day$^{-1}$ was used for TCE to evaluate risks. In August 2001, EPA's National Center for Environmental Assessment (NCEA) released the Preliminary Draft Trichloroethylene Health Risk Assessment: Synthesis and Characterization (THRA). This document proposes a range of slope factors for TCE (i.e., 0.02 to 0.4 mg/kg-day$^{-1}$). Based on a comment from Ecology, the 0.4 mg/kg-day$^{-1}$ slope factor was used in this assessment to develop IPIMALs for indoor air and groundwater. This value is at the high end of a range of slope factors presented in the THRA and is over 66 times higher than the provisional EPA slope factor used in the Draft RA.*

   *Figure 4-1 presents a comparison of residential CCEFs calculated using the 0.4 and 0.006 mg/kg-day$^{-1}$ slope factors for TCE. The parameters used to calculate the CCEFs are identical to those used to calculate the CCEFs presented in Section 3, except the slope factor for TCE was changed to 0.006 mg/kg-day$^{-1}$. Using the provisional slope factor of 0.4 for TCE has a significant impact on the results. Using this slope factor, 192 addresses and 63 buildings are potential candidates for Tier 3. However, when the 0.006 slope factor is used, only 136 addresses and 34 buildings would be potential candidates for Tier 3.*

*Both slope factors are highly uncertain, as is evidenced by the fact that the values are not on IRIS, and therefore do not represent EPA consensus values. The primary area of uncertainty associated with using the 0.4 slope factor for inhalation exposures is that it is based on a route-to-route extrapolation from an oral drinking water study in which EPA assumed 100 percent absorption efficiency. This is contrary to the EPA Guidance "Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry," which states, "Regardless of the toxic endpoint being considered, a minimum of information is required to construct the plausible dosimetry for the routes of interest. This information includes both the nature of the toxic effect and a description of the relationship between exposure and toxic effect." This information is needed to determine the "absorbed dose" for each route of exposure so that the appropriate route-to-route extrapolation can be made. The THRA recognizes this uncertainty by stating, "Route extrapolations can differ by 25-fold, depending on whether internal TCA or DCA is used as the dose metric. Further research could identify the appropriate internal dose metric for each toxic effect (see Section 4.2.3)."*

### 4.2.2 IPIM Decision Tree

#### 4.2.2.1 Tier 1 and Tier 2

Key uncertainties associated with evaluating the groundwater data in Area 3 via Tiers 1 and 2 in the IPIM Decision Tree are discussed below.

*1.) One of the key uncertainties in the Tier 1 and Tier 2 analyses is the use of direct push groundwater data. Direct push groundwater samples are representative of conditions at the time the samples were collected. Groundwater data from monitoring wells typically have a higher degree of confidence because the same well can be sampled repeatedly to determine if concentrations fluctuate based on seasonal or other factors, which is not the case for direct push samples. The uncertainty associated with the direct push data used in the Tier 1 and Tier 2 analyses was minimized by using more recent direct push data (i.e., direct push samples collected after January 1, 2000) in the analyses and by evaluating groundwater data from monitoring wells in the analyses. It should be noted that the use of direct push data also adds to the confidence in the application of Tier 1 and Tier 2 of the IPIM Decision Tree by increasing the spatial coverage of samples in Area 3.*

*The use of five shallow wells in the data set (in addition to the water table wells) was also applied to add confidence to the application of Tier 1 and Tier 2 by increasing spatial coverage in areas where a water table well was not available. Although this adds some uncertainty as to the degree that samples from this depth represent concentrations at the water table, excluding these data would have added more uncertainty in determining the spatial extent of contaminant influence. The potential need for installing water table wells in these areas will be addressed in a separate data gap analysis work plan, as agreed to by PSC and Ecology in a January 17, 2003 meeting.*

*2.) Another uncertainty in the Tier 1 and Tier 2 analyses is the interpolation method that was used to determine the area of influence associated with each well or direct push location. In order to minimize this uncertainty, an interpolation method called Inverse Distance Weighting (IDW) was used to develop the area of influence associated with each sample location. Interpolation methods, such as IDW, create a grid of nodes where the value of each node is determined by interpolating values from known sample results. With IDW, data are weighted during interpolation such that the influence of one point relative to another declines with distance from the grid node. Weighting is assigned to data through the use of a weighting power that controls how the weighting factors drop off as distance from a grid node increases. The greater the weighting power, the less effect points far from the grid node have during interpolation. As the power increases, the grid node value approaches the value of the nearest point.*

*A key advantage of IDW is the ability to incorporate anisotropy into the interpolation. Many physical processes, such as groundwater flow, have preferred orientations. For example, groundwater in the Area 3 flows in a west-southwest direction. When interpolating the concentration at a node, an observation located 100 feet away to the east or west is more likely to be similar to the value at the interpolation point than is an observation located 100 feet away to the north or south. Anisotropy takes these trends in the data into account during the gridding process by weighting points oriented in a particular direction more than others and thus reduces the uncertainty with the interpolation algorithm used to estimate the area of influence.*

#### 4.2.2.2 Tier 3

Key uncertainties associated with evaluating the indoor air data in Area 3 via Tier 3 in the IPIM Decision Tree are discussed below.

*1.) The background ambient air concentrations were in most cases higher than the measured indoor air concentration. There is uncertainty introduced into the Tier 3 evaluation because, in some cases, the indoor air concentrations of TCs and non-TCs may reflect background ambient concentrations rather than concentrations resulting from vapor migration from groundwater to indoor air. For example, the average detected concentration of TCE in ambient air was 1.47 ug/$m^3$, which is similar to the average ambient air concentration of TCE of 1.84 ug/$m^3$ reported in the Aerometric Information Retrieval System (AIRS) for 1990, based on data collected from 59 monitoring stations from eight states. AIRS data compiled for 1985 to 1998 across 25 states (approximately 1200 measurements) demonstrated a range of ambient air concentrations of TCE from 0.01 to 3.9 ug/$m^3$. EPA's Cumulative Exposure Project (CEP) modeled ambient air concentrations of TCE throughout the United States and derived a range of concentrations from 0 to 1.5 ug/$m^3$ with an average of 0.37 ug/$m^3$ and a maximum of 32 ug/$m^3$. The CEP data also suggested a pattern of distribution, in that commercial and industrial sectors across most states showed higher concentrations of ambient air TCE than rural or urban areas.*

*Comparisons with these values demonstrate that the IPIMALs for indoor air, which are 0.02 ug/$m^3$ (residential) and 0.05 ug/$m^3$ (commercial), are at the extreme low end of the measured and modeled ranges for TCE in ambient air. This has implications for evaluating future compliance with IM performance standards, in that it would be impossible to reduce indoor air concentrations below ambient background concentrations.*

*2.) There is uncertainty with using one-half of the MRL for non-detected results in indoor air. Non-detected COPCs could be present at or below the MRL, or not at all. This uncertainty was addressed to some extent by presenting the CEFs in three ways: CEFs calculated for all data, CEFs calculated using just non-detects, and CEFs calculated using just detected data. This uncertainty is inherent with all environmental data and using one-half of the MRL is a standard practice recommended by EPA and Ecology.*

*3.) There is uncertainty with evaluating indoor air concentration in general because it is difficult to identify, and quantitatively account for, possible site-specific indoor air sources of VOCs. This uncertainty was minimized in Tier 3 by performing building evaluations (see Appendix A) where potential indoor sources of VOCs were identified and*

*removed from the building. This process involved performing a building walk-through and interviewing the occupants to determine the historical and current uses of the building. This is important to ensure that past uses have not potentially resulted in indoor air sources of VOCs (e.g., spills of solvents). The building evaluations reduced the uncertainty associated with possible sources of indoor air VOCs; however, the site-specific contribution of VOCs from indoor air sources is considered potentially significant.*




## Legend

- Groundwater Sampling Locations
- Roads
- Buildings
- Areas 1 and 2
- Area 3
- CCEF > $10^a$
- CCEF > $10^b$

## Notes

[a] CCEF > 10 = Calculated Using a Slope Factor of 0.006 mg/kg-day-1 for TCE. All other parameters were identical to those used to create Figure 3-3e.

[b] CCEF > 10 = Calculated Using a Slope Factor of 0.4 mg/kg-day-1 for TCE. This is identical to those used to create Figure 3-3e.

- Monitoring Wells and Direct Push Only

- IPIMALs for Groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.

- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001a.

- IDW = Inverse Distance Weighting Interpolation

**Tier 1 Comparison of Residential CCEFs for COPCs Detected in Groundwater**

PSC Georgetown **Figure 4-1**

PIONEER TECHNOLOGIES CORPORATION

File: C:\Projects\PSC\Mags\November 2002\CEF Maps with IDW\Maps for Tech Memo

# 5. SCHEDULE

This section presents the schedule proposed for evaluating buildings via Tier 3 and/or Tier 4 of the IPIM Decision Tree. A proposed schedule for both Tier 3 evaluations and Tier 4 IMs is discussed below. In addition, the schedule for completing Tier 1 and 2 IPIM Decision Tree activities is provided in Table 5-2.

PSC conducted Tier 1 and Tier 2 evaluations of the PCAMP 2nd Quarter 2002 groundwater monitoring and direct push data and developed contour maps showing those locations that require further analysis and/or interim measures. Residential building footprints that fall within the contours shown on Figure 3-3e are potential candidates for Tier 3 investigations, or for proceeding to Tier 4. Commercial buildings that fell within these contours were evaluated further under Tier 2 of the IPIM Decision Tree, and those commercial buildings requiring evaluation under Tier 3 or to proceed to Tier 4 are shown on Figure 3-4e.

PSC also conducted an accelerated Tier 3 evaluation of the indoor air data collected in conjunction with the GIVF study. Based on this evaluation, as well as subsequent discussions with Ecology, five locations were proposed for evaluation of interim measures under Tier 4 of the Decision Tree (Section 3.4):

- 404 South Orcas
- 406 South Orcas
- 412 South Orcas
- 5409 Denver
- 672 South Lucile Street

A schedule for implementing Tier 3 and Tier 4 of the IPIM Decision Tree is presented in Table 5-1 for the residential and commercial locations that fall within the contours on Figures 3-3e and 3-4e, respectively. Table 5-3 shows residential use-type locations that fall within the area of influence of wells with a residential NCEF and/or CCEF greater than 10 and the proposed follow-up action for each location. Table 5-4 shows commercial use-type locations that fall within the area of influence of wells within a commercial NCEF and/or CCEF greater than 10 and the proposed follow-up action for each location. The determination of whether a building was a residential use-type versus commercial use-type was based on preliminary field verifications by PSC and PTC personnel. Additional field

verifications may be conducted prior to making final determinations of building use-types and follow-up actions.

Following a review of the areas under consideration and approval by Ecology of the locations proposed for further evaluation under Tier 3 or Tier 4, PSC will send out a letter of notification and request for access to the property. Once access is granted, the Tier 3 and Tier 4 IPIM Decision Tree will be implemented.

All properties identified for a Tier 3 or Tier 4 evaluation will be notified at the same time, including the Tier 4 decisions from the August GIVF sampling event and the Tier 3 and Tier 4 decisions from the second quarter 2002 groundwater sampling event. Notification will occur after Ecology approves this report and the locations identified for Tier 3 or Tier 4 decisions.

Properties selected for further evaluation and/or interim measures will be addressed in IM Groups, working with those properties closest to the facility first (i.e., starting at Denver Avenue and working west-southwest). PSC will evaluate properties for Tier 3 and/or Tier 4 one IM Group at a time. The number of buildings comprising an IM Group will depend on the type, size, and complexity of the buildings located in each city block. Performing these evaluations and IMs in IM Groups is necessary due to practical logistics of gaining access, scheduling contractors, and limited resources of the contractors performing the work. However, it is anticipated that IM Groups will be comprised of five to ten buildings that are located on the same city block. These groupings will be proposed for Ecology's approval prior to the start of building evaluations.

**Table 5-1.** Schedule for Implementation of Tier 3 and Tier 4 of IPIM Decision Tree

| | |
|---|---|
| **Tier 3: Indoor Air Sampling** | |
| Building Evaluation | • Begin work within 15 days of gaining access to the property and approval of the building locations identified for Tier 3 evaluations in the Tech Memo. |
| Develop Tier 3 Work Plan | • Develop work plan within 30 days of completing the building evaluation. |
| Sample Collection | • Begin work within 15 days of receiving approval of the Tier 3 Work Plan. |
| Prepare Tier 3 Tech Memo | • Submit Tech Memo within 30 days of receipt of validated data. |
| **Tier 4: Interim Measures** | |
| Building Evaluation | • Begin work within 15 days of gaining access to the property and approval of the building locations identified for Tier 4 evaluations in the Tech Memo. |
| Develop Tier 4 Work Plan | • Develop work plan within 30 days of completing the building evaluation. |
| Installation of Remedy | • Mobilize within 15 days of receiving approval of the Tier 4 Work Plan. |
| Verification Sampling | • Conduct sampling per the schedule presented in the Tier 4 Work Plan. |
| Progress Report on Interim Measures | • Report included in March 15 Interim Measure Progress Reports. |
| No Further Action | • One year of groundwater concentrations below IPIMALs. |

**Table 5-2.** Schedule for Completing Tier 1 and 2 of IPIM Decision Tree

| **Tier 1 & 2: IPIM Decision Tree** | |
|---|---|
| Revised Technical Memorandum IPIM1 | • Submit within 30 days of receipt of Ecology's comments. |
| Technical Memorandum IPIM2 | • Submit within 21 days of submitting Revised Technical Memorandum IPIM1. |
| Technical Memorandum IPIM3 | • Submit within 30 days after submittal of Technical Memorandum IPIM2 or 60 days of receipt of validated groundwater Fourth Quarter 2002 groundwater data, whichever is later. No later than March 31, 2003. |
| Technical Memorandum IPIM4 | • Submit within 30 days after submittal of Technical Memorandum IPIM3 or 60 days of receipt of validated groundwater First Quarter 2003 groundwater data, whichever is later. No later than June 30, 2003. |

**Table 5-3**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Residential NCEF and/or CCEF Greater Than Ten

| Address | Follow Up Action |
|---|---|
| 612 S LUCILE ST | Tier 4 |
| 616 S LUCILE ST | Tier 4 |
| 674 S LUCILE ST | Tier 4 |
| 672 S LUCILE ST | Tier 4 |
| 611 S BRANDON ST | Tier 4 |
| 613 S BRANDON ST | Tier 4 |
| 615 S BRANDON ST | Tier 4 |
| 605 S BRANDON ST | Tier 4 |
| 123 S FINDLAY ST | Tier 4 |
| 122 S FINDLAY ST | Tier 4 |
| 121 S FINDLAY ST | Tier 4 |
| 118 S FINDLAY ST | Tier 4 |
| 125 S FINDLAY ST | Tier 4 |
| 5601 2ND AV S | Tier 4 |
| 5610 2ND AV S | Tier 4 |
| 5606 2ND AV S | Tier 4 |
| 215 S ORCAS ST | Tier 4 |
| 217 S ORCAS ST | Tier 4 |
| 214 S FINDLAY ST | Tier 4 |
| 317 S LUCILE ST | Tier 4 |
| 5403 MAYNARD AV S | Tier 4 |
| 5409 DENVER AV S | Tier 4 |
| 404 S ORCAS | Tier 4 |
| 5607 2ND AV S | Tier 4 |

**Table 5-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 612 S ORCAS ST | Commercial | Tier 3 |
| 620 S ORCAS ST | Commercial | Tier 3 |
| 5600 6TH AV S | Commercial | Tier 3 |
| 5602 6TH AV S | Commercial | Tier 3 |
| 5604 6TH AV S | Commercial | Tier 3 |
| 5606 6TH AV S | Commercial | Tier 3 |
| 5608 6TH AV S | Commercial | Tier 3 |
| 5612 6TH AV S | Commercial | Tier 3 |
| 5616 6TH AV S | Commercial | Tier 3 |
| 5620 6TH AV S | Commercial | Tier 3 |
| 5618 6TH AV S | Commercial | Tier 3 |
| 5506 6TH AV S | Commercial | Tier 3 |
| 637 S LUCILE ST | Commercial | Tier 3 |
| 624 S FINDLAY ST | Commercial | Tier 3 |
| 5412 6TH AV S | Commercial | Tier 3 |
| 5413 MAYNARD AV S | Commercial | Tier 3 |
| 5419 MAYNARD AV S | Commercial | Tier 3 |
| 665 S LUCILE ST | Commercial | Tier 3 |
| 667 S LUCILE ST | Commercial | Tier 3 |
| 701 S LUCILE ST | Commercial | Tier 3 |
| 707 S LUCILE ST | Commercial | Tier 3 |
| 710 S LUCILE ST | Commercial | Tier 3 |
| 650 S LUCILE ST | Commercial | Tier 3 |
| 652 S LUCILE ST | Commercial | Tier 3 |
| 654 S LUCILE ST | Commercial | Tier 3 |
| 656 S LUCILE ST | Commercial | Tier 3 |
| 658 S LUCILE ST | Commercial | Tier 3 |
| 660 S LUCILE ST | Commercial | Tier 3 |
| 662 S LUCILE ST | Commercial | Tier 3 |
| 664 S LUCILE ST | Commercial | Tier 3 |

**Table 5-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 666 S LUCILE ST | Commercial | Tier 3 |
| 668 S LUCILE ST | Commercial | Tier 3 |
| 670 S LUCILE ST | Commercial | Tier 3 |
| 672 S LUCILE ST | Commercial | Tier 3 |
| 519 S BRANDON ST | Commercial | Tier 3 |
| 521 S BRANDON ST | Commercial | Tier 3 |
| 5900 1ST AV S | Commercial | Tier 3 |
| 111 S MEAD ST | Commercial | Tier 3 |
| 5801 2ND AV S | Commercial | Tier 3 |
| 508 S MEAD ST | Commercial | Tier 3 |
| 5601 6TH AV S | Commercial | Tier 3 |
| 500 S FINDLAY ST | Commercial | Tier 3 |
| 502 S FINDLAY ST | Commercial | Tier 3 |
| 504 S FINDLAY ST | Commercial | Tier 3 |
| 506 S FINDLAY ST | Commercial | Tier 3 |
| 508 S FINDLAY ST | Commercial | Tier 3 |
| 510 S FINDLAY ST | Commercial | Tier 3 |
| 512 S FINDLAY ST | Commercial | Tier 3 |
| 514 S FINDLAY ST | Commercial | Tier 3 |
| 516 S FINDLAY ST | Commercial | Tier 3 |
| 518 S FINDLAY ST | Commercial | Tier 3 |
| 520 S FINDLAY ST | Commercial | Tier 3 |
| 5603 6TH AV S | Commercial | Tier 3 |
| 5605 6TH AV S | Commercial | Tier 3 |
| 5607 6TH AV S | Commercial | Tier 3 |
| 5609 6TH AV S | Commercial | Tier 3 |
| 5611 6TH AV S | Commercial | Tier 3 |
| 5613 6TH AV S | Commercial | Tier 3 |
| 5615 6TH AV S | Commercial | Tier 3 |
| 5617 6TH AV S | Commercial | Tier 3 |
| 5619 6TH AV S | Commercial | Tier 3 |

**Table 5-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 5620 5TH AV S | Commercial | Tier 3 |
| 5621 6TH AV S | Commercial | Tier 3 |
| 500 S LUCILE ST | Commercial | Tier 3 |
| 502 S LUCILE ST | Commercial | Tier 3 |
| 504 S LUCILE ST | Commercial | Tier 3 |
| 506 S LUCILE ST | Commercial | Tier 3 |
| 508 S LUCILE ST | Commercial | Tier 3 |
| 510 S LUCILE ST | Commercial | Tier 3 |
| 512 S LUCILE ST | Commercial | Tier 3 |
| 514 S LUCILE ST | Commercial | Tier 3 |
| 516 S LUCILE ST | Commercial | Tier 3 |
| 518 S LUCILE ST | Commercial | Tier 3 |
| 520 S LUCILE ST | Commercial | Tier 3 |
| 522 S LUCILE ST | Commercial | Tier 3 |
| 524 S LUCILE ST | Commercial | Tier 3 |
| 526 S LUCILE ST | Commercial | Tier 3 |
| 528 S LUCILE ST | Commercial | Tier 3 |
| 530 S LUCILE ST | Commercial | Tier 3 |
| 532 S LUCILE ST | Commercial | Tier 3 |
| 534 S LUCILE ST | Commercial | Tier 3 |
| 536 S LUCILE ST | Commercial | Tier 3 |
| 538 S LUCILE ST | Commercial | Tier 3 |
| 540 S LUCILE ST | Commercial | Tier 3 |
| 542 S LUCILE ST | Commercial | Tier 3 |
| 544 S LUCILE ST | Commercial | Tier 3 |
| 546 S LUCILE ST | Commercial | Tier 3 |
| 548 S LUCILE ST | Commercial | Tier 3 |
| 550 S LUCILE ST | Commercial | Tier 3 |
| 552 S LUCILE ST | Commercial | Tier 3 |
| 554 S LUCILE ST | Commercial | Tier 3 |
| 556 S LUCILE ST | Commercial | Tier 3 |

**Table 5-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 558 S LUCILE ST | Commercial | Tier 3 |
| 560 S LUCILE ST | Commercial | Tier 3 |
| 562 S LUCILE ST | Commercial | Tier 3 |
| 564 S LUCILE ST | Commercial | Tier 3 |
| 566 S LUCILE ST | Commercial | Tier 3 |
| 568 S LUCILE ST | Commercial | Tier 3 |
| 570 S LUCILE ST | Commercial | Tier 3 |
| 572 S LUCILE ST | Commercial | Tier 3 |
| 574 S LUCILE ST | Commercial | Tier 3 |
| 576 S LUCILE ST | Commercial | Tier 3 |
| 578 S LUCILE ST | Commercial | Tier 3 |
| 580 S LUCILE ST | Commercial | Tier 3 |
| 202 S MEAD ST | Commercial | Tier 3 |
| 204 S MEAD ST | Commercial | Tier 3 |
| 206 S MEAD ST | Commercial | Tier 3 |
| 208 S MEAD ST | Commercial | Tier 3 |
| 210 S MEAD ST | Commercial | Tier 3 |
| 212 S MEAD ST | Commercial | Tier 3 |
| 214 S MEAD ST | Commercial | Tier 3 |
| 218 S MEAD ST | Commercial | Tier 3 |
| 220 S MEAD ST | Commercial | Tier 3 |
| 222 S MEAD ST | Commercial | Tier 3 |
| 224 S MEAD ST | Commercial | Tier 3 |
| 228 S MEAD ST | Commercial | Tier 3 |
| 5706 2ND AV S | Commercial | Tier 3 |
| 200 S MEAD ST | Commercial | Tier 3 |
| 316 S FIDALGO ST | Commercial | Tier 3 |
| 320 S FIDALGO ST | Commercial | Tier 3 |
| 5700 3RD AV S | Commercial | Tier 3 |
| 309 S ORCAS ST | Commercial | Tier 3 |
| 227 S ORCAS ST | House[1] | Tier 4 |

**Table 5-4**. Locations That Fall Within Area of Influence of Wells and Direct Push Locations with a Commercial NCEF and/or CCEF Greater Than Ten

| Address | Building Type | Follow Up Action |
|---|---|---|
| 412 S ORCAS ST | House[1] | Tier 4 |
| 601 S BRANDON ST | House[1] | Tier 4 |

[1]These are homes currently being used for commercial purposes.

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# APPENDIX A

# BUILDING EVALUATIONS AND FIELD DATA FOR GIVF STUDY

Note: Photographs of the sampling locations are available in the project file.

# APPENDIX B

# ANALYTICAL RESULTS FOR GIVF STUDY

# APPENDIX C

# GEOTECHNICAL DATA

# APPENDIX D

# BACKGROUND INDOOR AIR EVALUATION

# Appendix C

STATE OF WASHINGTON
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June 10, 2011

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**Re: Tier 5 Vapor Intrusion System Shutdown and Removal Process**

Dear Gentlemen:

On June 9, 2011, the Washington State Department of Ecology (Ecology) received a letter from PSC Environmental Services (PSC) with an attached *Tier 5 Vapor Intrusion System Shutdown and Removal Process* document. The letter was signed by PSC, Aspect Consulting (representing Art Brass Plating), Pacific Groundwater Group (representing Blaser Die Casting), and Farallon Consulting (representing Capital Industries) and proposes a process for mitigation system shutdown within the PSC site area, and areas being investigated by the three "west of 4th" PLPs (Art Brass, Blaser, and Capital). Thank you for submitting the document.

A draft version of the Tier 5 document was provided to affected members of the public for their review and comment last April. Only one comment was received during the comment period, and that comment supported the four PLPs' joint proposal. Prior to the public comment period the PLPs also provided a pre-draft version of the proposed Tier 5 process to EPA Region 10, the Washington State Department of Health, and the Georgetown Community Council's environmental consultant (Environmental international). A single requested change to the pre-draft document was received from the Georgetown Community Council's consultant.[1] Only minor changes were made, therefore, in revising the draft Tier 5 document to create the final version submitted on June 9.

[1] Environmental international requested that an ambient temperature criterion be added to the document's proposal for wintertime ("heating season") indoor air sampling.

The final Tier 5 process document is hereby approved. The four PLPs may now use the protocol to propose mitigation system shutdown at buildings east and west of 4th Ave S where indoor air quality is no longer threatened by vapor intrusion.

In the future the table of IPIMALs/VIRLs contained in the Tier 5 document (Table 2) should be updated as needed so that it is consistent with the latest Ecology (CLARC) air cleanup levels. Since the table was prepared the MTCA Method B air cleanup levels for vinyl chloride, dichloroethenes, toluene, and dichlorobenzenes have changed. Other IPIMAL/VIRL values may also need to be updated. Revisions to Table 2 can be made and submitted for Ecology approval without re-submitting the entire Tier 5 document.

Thank you for your efforts in preparing the shutdown document and conscientiously soliciting stakeholder input. If you have any questions about today's letter, please contact me at (425) 649-4449 or at ejon461@ecy.wa.gov.

Sincerely,

EJones

Ed Jones
Environmental Engineer
Hazardous Waste and Toxics Reduction Program

EJ:SA
By certified mail: 7010 3090 0002 0647 1307

cc: Chris Waldron, Pioneer
Marlys Palumbo, VNF
Nels Johnson, AAG
Doug Hillman/Dave Heffner, Aspect
William Joyce, SJZ
Peter Jewett/Akos Fekete, Farallon
Don Verfurth, G&R
Janet Knox/Jeff Parker, PGWG
William Chapman, K&LG
Pamela Bridgen, E.I.
Shawn Blocker, EPA R10
Central Files

May 25, 2011

Mr. Ed Jones
Washington State Department of Ecology, NWRO
3190 160th Ave, SE
Bellevue, WA 98008-5452

RE: Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)
Art Brass Plating - Agreed Order No. DE 5296
Blaser Die Casting - Enforcement Order No. DE 5479
Capital Industries - Agreed Order No. DE 5348
PSC Environmental Services, LLC - Agreed Order No. DE 7347

Dear Mr. Jones:

Attached please find two copies of the *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)*. The only changes to the memorandum since the April 2011 public review period were:

1. The date of the memo use changed to May 3, 2011.
2. The Draft watermark was removed from all pages.
3. The word Draft was removed from the title and was replaced with Final.
4. The line numbers were removed from the left margin of the pages.

The purpose of the attached memorandum is to present the general steps that will be followed to determine when it is appropriate to shut down and remove vapor intrusion (VI) mitigation systems that have been installed in residential and commercial buildings located in the Georgetown neighborhood in Seattle, Washington. This document reflects input from the Georgetown Potentially Liable Parties (Art Brass Plating, Blaser Die Casting, Capital Industries, PSC), Ecology, and the Public.

If you have any questions or concerns, please don't hesitate to contact us.

Sincerely,

Dave Heffner (Aspect Consulting) for
Art Brass Plating

Jeff Parker (PGG) for
Blaser Die Casting

Peter Jewett (Parallon Consulting) for
Capital Industries

William Beck
PSC Environmental Services, LLC

Enclosure: *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)*

cc:
Marcia Bailey, EPA Region 10
Barbara Trejo, WADOH
Pamela Bridgen, EI
Chris Waldron, PIONEER Technologies Corporation
Mike Merryfield, Art Brass Plating
Doug Hillman, Aspect Consulting
Georgetown Site - Public Repository

# MEMO

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To: Ed Jones (Washington State Department of Ecology)

From: Chris Waldron (waldronc@uspioneer.com)

Cc: Georgetown Potentially Liable Parties (Art Brass Plating, Blaser Die Casting, Capital Industries, PSC)

Date: May 3, 2011

Re: Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)

## Purpose

The purpose of this memorandum is to present the general steps that will be followed to determine when it is appropriate to shut down and remove vapor intrusion (VI) mitigation systems that have been installed in residential and commercial buildings located in the Georgetown neighborhood in Seattle, Washington. These steps, which will be considered Tier 5 of the Inhalation Pathway Interim Measure (IPIM) process, were developed in response to your email dated July 1, 2010 to Art Brass Plating, Blaser Die Casting, Capital Industries, and Philip Services Corporation (PSC) (i.e., the four potentially-liable parties [4-PLPs]) where you stated that the Washington State Department of Ecology (Ecology) would "prefer that the same process and decision making be used for all systems installed by the 4-PLPs" to decide when VI mitigation systems can be shut down and removed.

## Background

Since it was developed in 2002, a four-tiered IPIM process (PSC, 2002) has been used to determine whether a building warrants further investigation or requires mitigation through an interim measure. In the Georgetown neighborhood, between Denver Avenue and 1st Avenue South, 33 VI mitigation systems have been installed following the IPIM process (see Table 1 and Figure 1). An air sparging/soil vapor extraction system at the Art Brass Plating facility (312/391 S. Findlay St.) also performs the function of VI mitigation. However, that system is being operated as an interim remedial action (source removal) under an Agreed Order, and has its own shutdown criteria. It does not fall under the IPIM process. These systems (sub-slab depressurization systems [SSDSs] or sub-membrane depressurization systems [SMDSs]) were installed to mitigate the migration of subsurface vapors into the indoor air of overlying buildings that resulted, or may have resulted (in instances where mitigation systems were installed without the collection of indoor air samples), in concentrations that exceeded action levels established by Ecology. The four-tiered IPIM process is presented in Attachment A and is summarized below:

- **Tiers 1 and 2** – Groundwater quality data are compared to groundwater IPIM Action levels (IPIMALs) to determine if there is a potential VI concern in residential (Tier 1) or commercial (Tier 2) buildings. The groundwater data is used to calculate a cancer cumulative exceedance factor (CCEF) and a noncancer cumulative exceedance factor (NCCEF). If either the CCEF or the NCCEF exceeds a factor of 10 (indicating a carcinogenic risk greater than 1E-05 or hazard index greater than 1), then the building is further evaluated under Tier 3, or proceeds directly to Tier 4.
- **Tier 3** – Building-specific sampling (potentially including indoor air, ambient air, groundwater, and soil gas/sub-slab soil gas sampling) is conducted to empirically determine whether or not installation of a VI mitigation system (under Tier 4) is warranted. Under certain circumstances, the decision process may skip Tier 3 and proceed directly from Tiers 1 and 2 to Tier 4.

- **Tier 4** – A VI mitigation system is installed and operated as an interim measure to mitigate the VI pathway.

The 2002 four-tiered IPIM process did not include a tier or mechanism for determining if and when a VI mitigation system could be terminated (i.e., shut down and potentially removed from a building). Therefore, a fifth tier has been added to the IPIM process, which will allow for the shut down and potential removal of mitigation systems in the Georgetown neighborhood. The following steps comprise Tier 5 of the IPIM process.

### Tier 5: VI Mitigation System Shutdown and Removal Process

Tier 5 provides a process for determining when VI mitigation systems, installed in buildings in the Georgetown neighborhood based on Tiers 1 through 4 of the IPIM process, can be shut down and removed.[1] This process is only applicable to buildings where contaminated groundwater is the source of volatile organic compounds (VOCs) in soil gas/indoor air. If the VOCs in soil gas/indoor air are associated with another source (e.g., soil) then the approach presented in this memo does not apply and an alternative approach will be developed. Tier 5 includes a five-step decision process, which is presented in Figure 2 and summarized below:

**Step 1.** **Identify Candidate Buildings for VI Mitigation System Shutdown based on Reduction in Groundwater Concentrations**: The four most recent rounds of groundwater data from individual water table wells (limited to the two most recent calendar years) will be compared to VI remediation levels (VIRLs)/IPIMALs[2] on a well-by-well basis (see Table 2). Residential buildings will be compared to residential VIRLs and commercial buildings will be compared to commercial VIRLs. The groundwater data may be supplemented by direct push groundwater data, if available. Constituent-specific CCEFs and NCCEFs will be calculated based on the maximum detected groundwater concentration per Tier 1 of the IPIM process (see Attachment A).

***Decision Criteria***: Buildings with VI mitigation systems that are located proximate[3] to wells that have CCEFs less than or equal to 1[(4)] (i.e., an excess cancer risk of 1E-06) and NCCEFs less than or equal to 10 (i.e., a hazard index of 1) will be identified as candidates for shutdown of their VI mitigation systems. In addition, concentrations of VOCs in groundwater data must be stable or indicate a decreasing trend.[5] These buildings will proceed to Step 2.

**Step 2.** **Perform Building-Specific Confirmation Groundwater Sampling on Candidate Buildings, (if necessary):** If the monitoring well(s) that were evaluated in Step 1 are less than 100 feet from the

[1] The Tier 5 process described in this memorandum will typically be used by the 4-PLPs to determine whether or not VI mitigation systems can be shut down and potentially removed. However, the process does not preclude the use/development of site-specific or alternative approaches, with Ecology's concurrence, for determining if VI mitigation systems can be shut down and potentially removed. A work plan containing the following information will be developed and submitted to Ecology for approval prior to implementing an alternative approach for determining if a VI mitigation system can be shut down and potentially removed.

- Why the standard Tier 5 process should not be applied
- The proposed alternative process
- The actions the PLP will take to ensure that the affected members of the public agree with the alternative approach.

[2] The 4-PLPs' sites are at different stages of investigation/progress under the Model Toxics Control Act (Chapter 173-340 WAC). For example some of the sites are in the Remedial Investigation phase and other sites are in the Post-Feasibility Study/Cleanup Action Plan stage. Therefore, the term VIRL/IPIMAL is used in this memorandum in order to be inclusive and consistent with the current investigative phase at each site.

[3] For the purposes of this memo, proximate is defined as within a 250-foot upgradient and downgradient and 100-foot cross-gradient radius. However, in some instances the PLPs have "assigned," with Ecology's concurrence, sentinel groundwater monitoring wells to specific buildings. In these instances, the data from the sentinel groundwater monitoring wells will be evaluated to determine if the building is a candidate for VI mitigation system termination regardless of the distance between the well and the building.

[4] The CCEF goal of 1 (i.e., 1E-06) is more protective than required under MTCA and was selected by Ecology to minimize the possibility that a VI mitigation system that was shut down would need to be turned on again due to fluctuations in groundwater concentrations.

[5] Other factors will be considered/evaluated, including: (1) the location(s) of sources of VOCs in groundwater and direction of groundwater flow and, (2) whether or not subsurface remediation, if applicable, may result in increasing concentrations of VOCs in the shallow aquifer proximate to the building.

candidate building[6], then additional building-specific confirmation groundwater sampling will not be required. If the monitoring well(s) that were evaluated in Step 1 are located greater than or equal to 100 feet from the candidate building, then upgradient and downgradient[7] direct push groundwater samples will be collected from the water table as close as feasible to each candidate building (or building cluster). If samples must be collected, the building owner will be informed (Ecology will be CC'd) and that their building is a potential candidate for VI mitigation system shutdown but additional samples need to be collected from their building to make a determination. These sample results will be used to determine whether or not the concentrations of VOCs in groundwater may result in indoor air concentrations that exceed Ecology's health risk benchmarks. CCEFs and NCCEFs will be calculated based on the building-specific groundwater data per the approach presented in Tier 1 of the IPIM process (see Attachment A).

***Decision Criteria**:* Following the building-specific confirmation groundwater sampling, the VI mitigation systems in buildings that have groundwater-based CCEFs less than or equal to 1 and NCCEFs less than or equal to 10 will proceed to Step 3 or Step 4. Residential buildings will be evaluated using residential VIRLs and commercial buildings will be evaluated using commercial VIRLs. Buildings where soil gas, crawl space, and or/indoor air samples were previously collected and used as the basis for installing the VI mitigation system will proceed to Step 3. Buildings where only groundwater samples were collected and used as the basis for installing the VI mitigation system will usually proceed to Step 4. However, buildings where the mitigation was implemented based on Tier 3 data, and where groundwater and indoor air concentrations at that time were less than the current VIRL/IPIMAL mitigation threshold, will typically proceed to Step 4 (see the Different "Action Levels" for requiring VI Mitigation box on page 4).

**Step 3.** **Perform Building-Specific Confirmation Air Sampling (if necessary):** The PLP will inform the building owner (Ecology will be CC'd) of the possibility that their building may no longer need the VI mitigation system, and additional samples will need to be collected required to make this determination. The VI mitigation system will be temporarily shut down and sub-slab soil gas, crawl space, and/or indoor air and ambient air samples will be collected approximately 4 weeks later. This time period should be sufficient to collect samples that are representative of long-term "non-mitigated" conditions. These samples should be collected during the heating (i.e., late fall, winter, early spring) season[8] so they are representative of reasonable "worst-case" samples. After the samples have been collected, the VI mitigation system will be re-started pending completion of Step 4. CCEFs and NCCEFs will be calculated based on the building-specific indoor air data per the approach presented in Tier 3 of the IPIM process (see Attachment A). In addition, the results of historical (pre-VI mitigation and post-VI mitigation) building-specific vapor-phase sampling will be evaluated to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and representative of a stable or decreasing trend.

***Decision Criteria**:* Following the building-specific confirmation air sampling, the VI mitigation systems in buildings that have indoor air-based CCEFs and NCCEFs less than or equal to 10, and where historical (pre-VI mitigation and post-VI mitigation) building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend, will proceed to Step 4. Buildings that do not proceed to Step 4 will be eligible for additional confirmation air sampling (i.e., repeat Step 3) after one year.

**Step 4.** **Vapor Intrusion Mitigation System Shutdown:** Steps 1 through 3 of the Tier 5 process will be documented in a report, which will identify buildings where VI mitigation systems can be shut down based on the results of Steps 1, 2, and 3 (where appropriate) that indicate that VI risks from VOCs in groundwater

[6] However, in some instances the PLPs have "assigned," with Ecology's concurrence, sentinel groundwater monitoring wells to specific buildings. In these instances, the data from the sentinel groundwater monitoring wells will be evaluated per the Step 2 Decision Criteria to determine if the building proceeds to Step 3 or 4 regardless of the distance between the well and the building.

[7] Or other direction approved by Ecology.

no longer exceed Ecology's health risk benchmarks. This draft report will be submitted, by the PLP, to Ecology for review. The PLP will work with Ecology to resolve comments/questions.[9] Once Ecology approves the technical basis for shutting down a particular building's VI mitigation system, an approval letter will be sent by Ecology to the PLP and the building owner. The PLP will inform the owner that the system may now be turned off but that the system will remain in place for two more years before potential removal. This time period will enable the PLPs to continue to monitor environmental conditions to ensure that future conditions are consistent with the Tier 5 evaluation (e.g., stable or decreasing VOC concentrations in groundwater, soil vapor, and/or indoor air). The PLP will also explain that the building owner may elect to keep the VI mitigation system running; however, the PLP will no longer service or maintain the system (i.e., the system will be left in place at no further cost to the PLP [other than the cost to restart the system, if necessary, or cost to remove the VI mitigation system]).

**Step 5.** **Vapor Intrusion Mitigation System Removal**: The PLP will continue to monitor groundwater concentrations in the vicinity of buildings where VI mitigation systems have been shut down.[10] The groundwater monitoring results will be submitted to Ecology for review. The PLP will propose to remove the VI mitigation system if (1) the VOC concentrations in groundwater remain below Ecology's health risk benchmarks (i.e., CCEF less than or equal to 1 for groundwater and NCCEF less than or equal to 10 for groundwater), and (2) the VOC concentrations are consistent with a stable or decreasing trend.[11] In most cases, to ensure that VOC concentrations are low and will remain low, and thereby ensure that mitigation will not be needed in the future, groundwater monitoring will be conducted for two years after shut down before determining if the system's hardware can be removed.[12]

The PLP will work with Ecology to resolve comments/questions. Once Ecology approves the request to remove the VI mitigation system from a building, an approval letter will be sent by Ecology to the PLP and the building owner. The PLP will inform the owner (Ecology will be CC'd), that the VI mitigation system is no longer needed and request access to the building by the PLP to remove the system. The PLP will also explain that the building owner may elect to keep the VI mitigation system running; however, the PLP will no longer service or maintain the system (i.e., the system will be left in place at no further cost to the PLP). *Note: If concentrations of VOCs in groundwater exceed the* VIRLs/IPIMALs*, then the PLP will work with Ecology to investigate the reason for the change, which may include collecting additional samples (e.g., groundwater, soil gas, and indoor air) as well as restarting the VI mitigation system.*

***Different "Action Levels" for requiring VI Mitigation*** *– Ecology revised the VIRLs/IPIMALs in early 2009 based on updated toxicity information for some chemicals. For example, the cancer-based residential groundwater VIRL/IPIMAL for trichloroethylene (TCE) increased from 0.4 micrograms per liter (µg/L) to the current value of 1.8 µg/L listed in Table 2. Several VI mitigation systems that were installed before 2009 may not have been required by Ecology had the building been evaluated using the post-2009 groundwater and indoor air VIRL/IPIMALs. That is, if the higher, post-2009 VIRL/IMPMALs for TCE had been used for decision-making, Ecology may have concluded a mitigation system was unnecessary.*

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[8] The outdoor temperature must be below 65 degrees Fahrenheit for at least three weeks prior to sampling and during the sampling event.

[9] Ecology will be responsible for responding to any questions the owners or tenants may have regarding Ecology's 2009 revisions to the VIRLs/IPIMALs.

[10] Groundwater monitoring during the two year shutdown period will be conducted per individual PLP groundwater monitoring work plans as approved by Ecology.

[11] Other factors will be considered/evaluated when making this proposal, including: (1) the location(s) of sources of VOCs in groundwater and direction of groundwater flow and, (2) whether or not subsurface remediation, if applicable, may result in increasing concentrations of VOCs in the shallow aquifer proximate to the building.

[12] A number of VI mitigation systems were installed as long as seven years ago. For some of these buildings, nearby groundwater monitoring has been conducted for years following installation of the systems. Where this has occurred and where monitoring has confirmed that groundwater VOC concentrations near the buildings have been consistently low for some time, the PLP may propose a post-shut down monitoring period that is less than two years.

## References

PSC. 2002. Philip Services Corporation. Revised Inhalation Pathway Interim Measures Work Plan, August 12, 2002 and Errata Document, September 17, 2002.

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## Table 1
## Vapor Intrusion Mitigation Systems Operated in the Georgetown Community by the 4-PLPs

| PLP Responsible for VI Mitigation System[1] | Address | IPIM Mitigation System Type | Building Use |
|---|---|---|---|
| PSC | 615 S. Brandon | SMD | Residential |
| PSC | 611/613 S. Brandon | SMD | Residential |
| PSC | 605 S. Brandon | SSD/SMD | Residential |
| PSC | 601 S. Brandon | SMD | Residential |
| PSC | 402 S. Lucile | SMD | Residential |
| PSC | 412 S. Lucile | SSD | Residential |
| PSC | 406 S. Lucile | SSD | Residential |
| PSC | 416 S. Lucile | SSD | Residential |
| PSC | 672/674 S. Lucile | SSD/SMD | Residential |
| PSC | 710 S. Lucile (SDAJ) | SSD | Commercial |
| PSC | 747 S. Lucile (Western Trailer) | SSD | Commercial |
| PSC | 5403 Maynard Ave. S. | SSD | Residential |
| PSC | 412 S. Orcas | SSD | Commercial |
| PSC | 404 S. Orcas | SSD | Residential |
| PSC | 406 S. Orcas | SSD | Commercial |
| Art Brass Plating | 121 S. Findlay | SMD | Residential |
| Art Brass Plating | 122 S. Findlay | SMD | Residential |
| Art Brass Plating | 123 S. Findlay | SMD | Residential |
| Art Brass Plating | 125 S. Findlay | SMD | Residential |
| Art Brass Plating | 218 S. Findlay | SSD | Residential |
| Art Brass Plating | 220 S. Findlay | SSD | Commercial |
| Art Brass Plating | 5601 2nd Ave. S | SMD | Residential |
| Art Brass Plating | 5607 2nd Ave. S. | SMD | Residential |
| Art Brass Plating | 5607 ½ 2nd Ave. S. | SMD | Residential |
| Art Brass Plating | 5609 2nd Ave. S. | SMD | Commercial |
| Blaser | 128 S. Mead | SMD | Residential |
| Blaser | 132 S. Mead | SMD | Residential |
| Blaser | 134 S. Mead | SMD | Residential |
| Blaser | 215 S. Orcas | SSD | Residential |
| Blaser | 217 S. Orcas | SSD/SMD | Residential |
| Blaser | 227 S. Orcas | SSD | Residential |
| Blaser | 5700 3rd Ave. S | SSD | Commercial |
| Capital Industries | 5900 1st Ave. S | SSD | Commercial |

Notes:
[1] An air sparging/soil vapor extraction system at the Art Brass Plating facility (312/391 S. Findlay St.) also performs the function of VI mitigation. However, that system is being operated as an interim remedial action (source removal) under an Agreed Order, and has its own shutdown criteria. It does not fall under the IPIM process.

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## Table 2 – Indoor Air and Groundwater IPIMALs/VIRLs for Residential and Commercial Scenarios

| COPC | Residential Air VIRL/IPIMAL (ug/m$^3$) | | Commercial Air VIRL/IPIMAL (ug/m$^3$) | | Residential Groundwater[1] VIRL/IPIMAL (ug/L) | | Commercial Groundwater[1] VIRL/IPIMAL (ug/L) | | Inhalation Reference Dose (mg/kg-day) | | Inhalation Slope Factor (mg/kg-day)$^{-1}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cancer | Noncancer | Cancer | Noncancer | Cancer | Noncancer | Cancer | Noncancer | | | | |
| 1,1,1-Trichloroethane | -- | 2.3E+02 | -- | 9.7E+02 | -- | 2.5E+03 | -- | 1.1E+04 | 1.4E+00 | [3] | -- | [9] |
| 1,1-Dichloroethane | -- | 2.3E+01 | -- | 9.7E+01 | -- | 7.5E+02 | -- | 3.2E+03 | 1.4E-01 | [2] | -- | [9] |
| 1,1-Dichloroethylene | -- | 9.1E+00 | -- | 3.9E+01 | -- | 5.3E+01 | -- | 2.3E+02 | 5.7E-02 | [3] | -- | [8] |
| 1,2,4-Trimethylbenzene | -- | 2.7E-01 | -- | 1.2E+00 | -- | 1.3E+01 | -- | 5.5E+01 | 1.7E-03 | [4] | -- | [9] |
| 1,2-Dichloroethane | 9.6E-02 | 2.2E-01 | 2.2E-01 | 9.5E-01 | 1.3E+01 | 3.0E+01 | 3.0E+01 | 1.3E+02 | 1.4E-03 | [4] | 9.1E-02 | [3] |
| 1,3,5-Trimethylbenzene | -- | 2.7E-01 | -- | 1.2E+00 | -- | 9.8E+00 | -- | 4.2E+01 | 1.7E-03 | [4] | -- | [9] |
| 2-Hexanone | -- | 1.4E+00 | -- | 5.8E+00 | -- | 1.0E+03 | -- | 4.4E+03 | 8.6E-03 | [3] | -- | [9] |
| Benzene | 3.2E-01 | 1.4E+00 | 7.5E-01 | 5.8E+00 | 9.6E+00 | 4.1E+01 | 2.2E+01 | 1.7E+02 | 8.6E-03 | [3] | 2.7E-02 | [3] |
| Chloroethane | -- | 4.6E+02 | -- | 1.9E+03 | -- | 5.4E+03 | -- | 2.3E+04 | 2.9E+00 | [3] | -- | [9] |
| Chloroform | 1.1E-01 | 2.2E+00 | 2.5E-01 | 9.5E+00 | 4.1E+00 | 8.5E+01 | 9.6E+00 | 3.6E+02 | 1.4E-02 | [5] | 8.1E-02 | [3] |
| Cis-1,2-dichloroethylene | -- | 1.6E+00 | -- | 6.8E+00 | -- | 7.3E+01 | -- | 3.1E+02 | 1.0E-02 | [6] | -- | [9] |
| Ethylbenzene | -- | 4.6E+01 | -- | 1.9E+02 | -- | 1.3E+03 | -- | 5.4E+03 | 2.9E-01 | [3] | -- | [9] |
| Naphthalene | -- | 1.4E-01 | -- | 5.8E-01 | -- | 5.9E+01 | -- | 2.5E+02 | 8.6E-04 | [3] | -- | [9] |
| P-isopropyltoluene | -- | 1.8E+01 | -- | 7.8E+01 | -- | 7.5E+01 | -- | 3.2E+02 | 1.1E-01 | [6] | -- | [9] |
| Propylbenzene | -- | 1.6E+00 | -- | 6.8E+00 | -- | 2.7E+01 | -- | 1.1E+02 | 1.0E-02 | [6] | -- | [9] |
| Sec-butylbenzene | -- | 1.6E+00 | -- | 6.8E+00 | -- | 2.3E+01 | -- | 9.9E+01 | 1.0E-02 | [6] | -- | [9] |
| Tetrachloroethylene | 4.2E-01 | 2.7E+01 | 9.7E-01 | 1.2E+02 | 5.0E+00 | 3.3E+02 | 1.2E+01 | 1.4E+03 | 1.7E-01 | [7] | 2.1E-02 | [7] |
| Toluene | -- | 2.3E+02 | -- | 9.7E+02 | -- | 6.2E+03 | -- | 2.6E+04 | 1.4E+00 | [3] | -- | [9] |
| Trans-1,2-dichloroethylene | -- | 3.2E+00 | -- | 1.4E+01 | -- | 6.5E+01 | -- | 2.8E+02 | 2.0E-02 | [6] | -- | [9] |
| Trichloroethylene | 9.8E-02 | 1.6E+00 | 2.3E-01 | 6.8E+00 | 1.8E+00 | 3.0E+01 | 4.2E+00 | 1.3E+02 | 1.0E-02 | [7] | 8.9E-02 | [7] |
| Vinyl Chloride | 2.8E-01 | 4.6E+00 | 6.6E-01 | 1.9E+01 | 1.3E+00 | 2.1E+01 | 3.0E+00 | 8.8E+01 | 2.9E-02 | [3] | 3.1E-02 | [3] |

Notes:

-- = No toxicity value was available. Therefore, an IPIMAL/VIRL could not be calculated.

The IPIMALs/VIRLs presented in this table do not take into account multi-pathway or multi-constituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.

The IPIMALs/VIRLs were developed using the following target risk goals for individual COPCs:

Cancer Risk (CR) = 1E-06

Hazard Quotient (HQ) = 0.1

COPC – Constituent of Potential Concern

IPIMAL – Inhalation Pathway Interim Measure Action Level

VIRL – Vapor Intrusion Remediation Level

[1] Calculated using the Maximum GIVF for 1,1-DCE per IPIM Tech Memo 1

[2] HEAST2 (Table 2), 1997

[3] IRIS (2nd Quarter), 2010

[4] NCEA

[5] NCEA value provided by Marcia Bailey

[6] NTV - IPIMAL Surrogate Toxicity Value

[7] WA State Department of Ecology,10/20/08 Memo

[8] Email from M. Bailey of USEPA 06/17/03

[9] No toxicity value was available




## Legend

- Roads
- Buildings without VI Mitigation Systems

**Party Responsible for VI Mitigation System**

- Art Brass Plating
- Blaser
- Capital Industries
- PSC

0 62.5 125 250 375 500 Feet

## Notes

- Field reconnaissance performed by Tasya Gray from PSC and Jenifer Hill from PTC to validate buildings and addresses on January 27th and February 7th 2003.
- An air sparging/soil vapor extraction system at the Art Brass Plating facility (312/391 S. Findlay St.) also performs the function of VI mitigation. However, that system is being operated as an interim remedial action (source removal) under an Agreed Order, and has its own shutdown criteria. It does not fall under the IPIM process.
- PSC - Philip Services Corporation
- VI - Vapor Intrusion

**Georgetown Neighborhood Buildings with Vapor Intrusion Mitigation Systems**

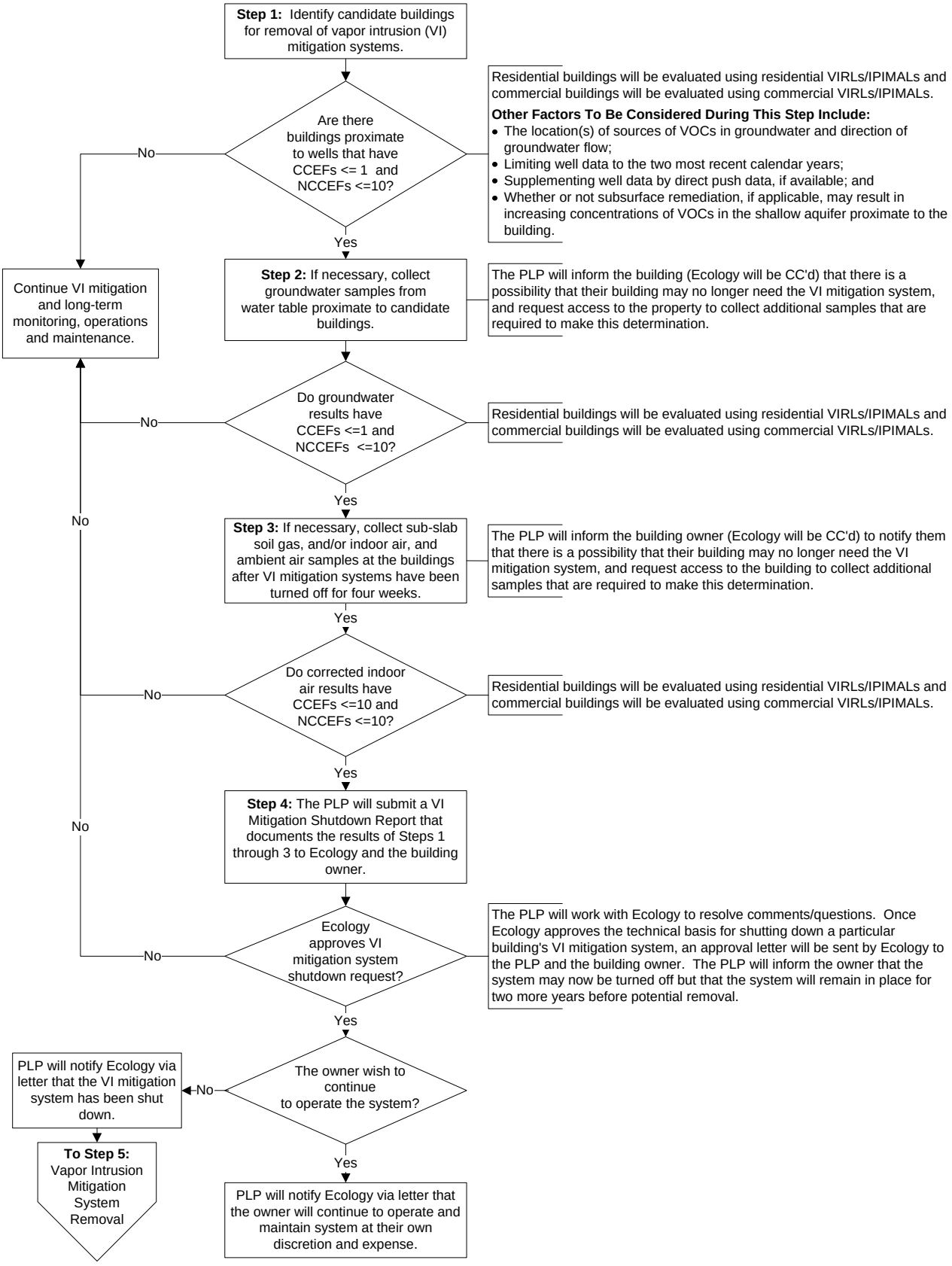
PSC - Georgetown
May 2011

**Figure 1**

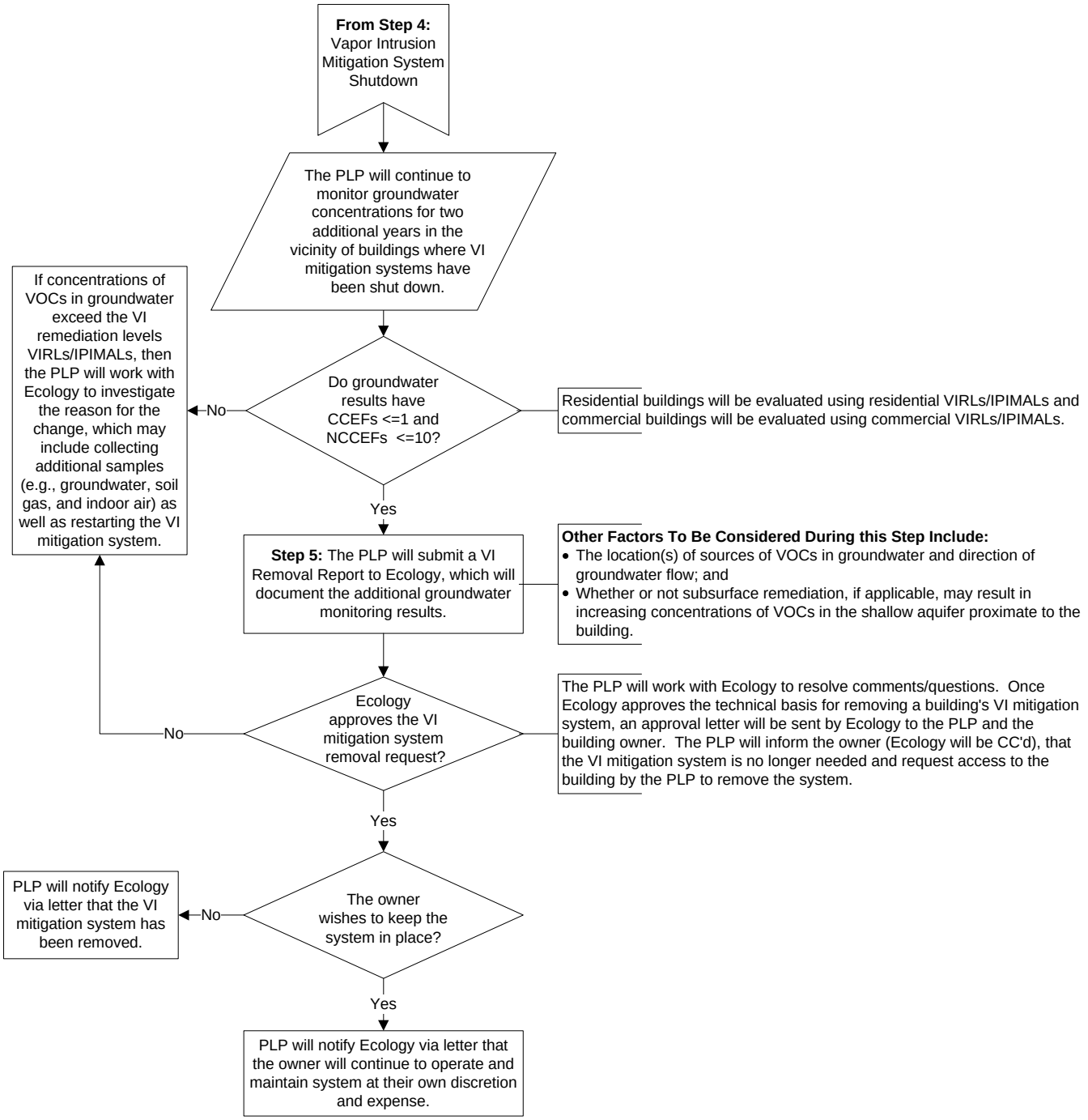
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## Figure 2 – Tier 5 Vapor Intrusion System Shutdown and Removal Process



## Figure 2 – Tier 5 Vapor Intrusion System Shutdown and Removal Process (continued)



## Attachment A – IPIM[1] Decision Tree

The Inhalation Pathway Interim Measure (IPIM) Decision Tree (see Figure A-1) is organized into four tiers to allow for a progressive evaluation of groundwater data and incorporation of site-specific information. Validated data from each quarterly groundwater monitoring event are compiled and evaluated to calculate cancer cumulative exceedance factors (CCEFs) and noncancer cumulative exceedance factors (NCCEFs) as follows:

- All groundwater data collected (west of Denver Avenue) are included in the evaluation; and
- Censored data (i.e., non-detected results) are assigned one-half the reporting limit for comparison purposes.

Residential buildings are evaluated in Tier 1. Commercial/industrial buildings are evaluated in Tier 2. The determination of whether or not a building is a residential-use type versus commercial-use type is based on preliminary field verifications. Additional field verifications may be conducted prior to making a final determination of building use-types and follow-up actions.

### Development of Groundwater IPIMALs

The IPIM action levels (IPIMALs) for groundwater were calculated using conservative risk-based indoor air action levels and the chemical-specific groundwater-to-indoor air volatilization factors (GIVFs). The IPIMALs are based on the action levels for indoor air developed in the Draft HHERA (PSC, 2001). Exposure parameters used to develop these IPIMALs are presented in Table A-1 for restricted (commercial/industrial) and unrestricted (residential) scenarios. These action levels were developed such that the maximum indoor air concentrations of each chemical of potential concern (COPC) are health protective action levels based on a chemical-specific carcinogenic risk goal of 1E-06 and a hazard quotient of 0.1 for noncarcinogens for both residential and commercial/industrial workers.

IPIMALs for groundwater were calculated using the IPIMALs for indoor air and the GIVFs, using the following equation:

$$IPIMAL\ Groundwater\ \ (\mu g / L) = \frac{IPIMAL\ IndoorAir\ \ (\mu g / m^3)}{GIVF\ \frac{(\mu g / m^3)}{(\mu g / L)}}$$

### Tier 1 – Determination of Potential Impacts to Residential Buildings

The first tier in the IPIM Decision Tree is to compare groundwater monitoring data to residential-based groundwater IPIMALs on a well-by-well basis. COPC-specific exceedance factors (EFs) for each building are calculated using the following equation:

$$EF = \frac{C_{groundwater}}{\text{Residential}_{IPIMAL}}$$

where:

| Parameter | Description |
|---|---|
| $C_{groundwater}$ | Concentration in each groundwater well (ug/L). |
| $\text{Residential}_{IPIMAL}$ | Residential-based IPIMAL for groundwater (ug/L), based on a carcinogenic risk of 1E-06 and a hazard quotient (HQ) of 0.1. |
| EF | Exceedance Factor |

[1] The 4-PLPs' sites are at different stages of investigation/progress under the Model Toxics Control Act (Chapter 173-340 WAC). For example some of the sites are in the Remedial Investigation phase and other sites are in the Post-Feasibility Study/Cleanup Action Plan stage. Therefore, the acronyms IPIMAL and vapor intrusion remediation level (VIRL) are used together in this memorandum in order to be inclusive and consistent with the current investigative phase at each site.

Under Tier 1, residential CCEFs and NCCEFs for each monitoring well are calculated by summing the EFs for individual cancer and noncancer COPCs, respectively. A CCEF and NCCEF of 10 indicate that exposure to indoor air concentrations associated with volatilization from groundwater near the sample station could potentially result in a cumulative risk of 1E-05 or a hazard index (HI) of 1[2], respectively.

Residential CCEFs and NCCEFs for COPCs detected at each monitoring well or direct push station are contoured using the Inverse Distance Weighting (IDW) interpolation method. IDW is used to create a grid of nodes (250-foot radius upgradient/downgradient of each well and 100-foot cross gradient from each well) where the value of each node is determined by interpolating values from known sample results. With IDW, data are weighted during interpolation such that the influence of one point relative to another declines with distance from the grid node. For example, areas closer to the measured data point are given more weight than more distant areas. As a result, there is much more confidence in contours generated for areas with higher sample density versus areas where there are fewer samples. The IDW input parameters are summarized in Table A-2.

A key advantage of applying the IDW interpolation method is the ability to incorporate anisotropy into the interpolation. Many physical processes, such as groundwater flow, have preferred orientations (i.e., anisotropy). For example, groundwater in the Georgetown Neighborhood generally flows in a west-southwest direction. This preferred flow direction is incorporated into the IDW model by setting an appropriate anisotropy angle. During the gridding process, points oriented in the direction of flow are weighted more heavily than other points, thus reducing the uncertainty associated with the interpolation algorithm used to estimate the area of influence.

Residential buildings that fall within the contours representing CCEFs or NCCEFs for COPCs detected in groundwater exceeding 10 are proposed for further evaluation under Tier 3 of the IPIM Decision Tree (see Figure A-1). These buildings have a potential cumulative inhalation cancer risk due to VI of 1E-05 or greater and/or an HI of 1 or greater. All buildings are re-evaluated after the next quarterly groundwater monitoring event.

### Tier 2 – Determination of Potential Impacts to Commercial Buildings

The approach for developing commercial-based IPIMALs is identical to the approach used to develop the residential-based IPIMALs except that the commercial exposure assumptions are used instead of residential exposure assumptions. Commercial/industrial buildings are evaluated under Tier 2 by comparing COPCs detected in groundwater to commercial-based IPIMALs as presented in Table A-2. Commercial/industrial buildings that are located within the contours representing CCEFs or NCCEFs for COPCs detected in groundwater exceeding 10 are proposed for further evaluation under Tier 3 of the IPIM Decision Tree (see Figure A-1). These buildings have a potential cumulative inhalation cancer risk due to VI of 1E-05 or greater and/or an HI of 1 or greater. All buildings are re-evaluated after the next quarterly groundwater monitoring event.

### Tier 3 – Site-Specific Sampling

Residential and commercial/industrial buildings identified in Tier 1 or Tier 2 for review under Tier 3 are evaluated to determine if site-specific data collection is warranted or if the location should move directly to Tier 4. Each building is evaluated independently. Site-specific, co-located, and contemporaneous groundwater, sub-slab, soil gas, indoor air, and ambient air samples are collected at buildings identified in Tier 1 and Tier 2 for evaluation in Tier 3.

The data are compiled and evaluated the data to determine if the building should proceed to Tier 4, as follows:

[2] Per WAC 173-340-700(5)(b)(c), the PLP may elect to evaluate the COPC-specific toxicity information to determine if it is appropriate to segregate the HQs (if the CEF for noncarcinogens is greater than 10). If the toxicity information indicates that it is appropriate to segregate the HQs, the decision rules for evaluating the segregated HIs are as follows: If any of the segregated HIs are greater than 1, the building will be proposed for Tier 4. If all of the segregated HIs are less than 1,

1. One-half of the reporting limit is assumed for non-detected results in indoor air. For comparison purposes, all data are presented in three ways: CCEFs and NCCEFs calculated for all data, CCEFs and NCCEFs calculated using just non-detected data, and CCEFs and NCCEFs calculated using just detected data.
2. Per the Revised IPIM Work Plan (PSC, 2002), indoor air concentrations are corrected by subtracting the maximum detected ambient air concentration from the maximum detected indoor air concentration, to account for the contribution of ambient air to the measured indoor air concentrations[3].

Noncancer exceedance factors (NCEFs) are calculated by dividing the corrected indoor air concentrations by noncancer-based indoor air IPIMALs. Cancer exceedance factors (CEFs) are calculated by dividing the corrected indoor air concentrations by cancer-based indoor air IPIMALs. The individual NCEFs and CEFs are summed to provide the NCCEF and CCEF. CEFs are calculated using the same relationship that was used for Tier 1 and Tier 2, but indoor air data are compared to indoor air IPIMALs, as follows:

$$EF = \frac{C_{Indoor\ air_Corr}}{\text{Residential or Commercial}_{IPIMAL}}$$

where:

| Parameter | Description |
|---|---|
| $C_{Indoor\ air_Corr}$ | Corrected maximum indoor air at location (µg/m3). These concentrations are determined by subtracting the maximum measured ambient (outdoor) air concentration from the maximum indoor air concentration. |
| Residential or Commercial$_{IPIMAL}$ | Residential-based or commercial-based IPIMAL for indoor air (µg/m3), based on a carcinogenic risk of 1E-06 and HQ of 0.1. |
| EF | Exceedance Factor. |

The CCEFs and NCCEFs for each building are calculated by summing the EFs for individual cancer and noncancer COPCs. A CCEF/NCCEF of 10 indicates that exposure to indoor air concentrations could potentially lead to a cumulative risk of 1E-05 or an HI of 1.

The CCEF and NCCEF for each building are compared to Ecology's noncancer and cancer benchmark of 10. Buildings with a CCEF and/or NCCEF greater than 10 are recommended for further evaluation to determine if the building should proceed to Tier 4. All other buildings are re-evaluated when the next round of groundwater sampling is performed.

### Tier 4 – Inhalation Pathway Interim Measures

Buildings proposed for evaluation under Tier 4 of the IPIM Decision Tree are selected based on the results of the Tier 3 analysis and discussions with Ecology[4]. Tier 3 sampling is conducted on a subset of buildings with exceedances of groundwater CCEFs and NCCEFs. When Tier 3 sampling indicates that a Tier 4 IPIM is warranted, proximate buildings (i.e., where Tier 3 sampling was not conducted) are also identified for Tier 4 IPIM installations.

Prior to installation of a Tier 4 VI mitigation system, the PLP will negotiate access agreements with the property owners at each building. These access agreements define the responsibilities of the PLP and the property owners as follows:

- The 4-PLPs will:
    - Install and provide maintenance of the system; and

---

the building will not be evaluated further until the next round of groundwater sampling. Segregation of HIs will be done with the COPC-specific prior approval of Ecology.

[3] Literature values for background indoor air sources (i.e., potential contributions from non-VI related indoor air sources) were originally proposed to be used to "correct" measured indoor air concentrations in addition to ambient air. However, Ecology ultimately did not agree to this adjustment (see March 3, 2003 letter from Ed Jones [Ecology] to Carolyn Mayer [PSC]) (Ecology, 2003).

[4] It may be decided that some buildings should proceed directly to Tier 4 following the Tier 1 or Tier 2 evaluation.

  - Monitor the performance of the system.
- The property owners will:
  - Provide PLP and its contractors with access to the property to perform maintenance of the systems;
  - Receive instruction on how to monitor the system to ensure it is operating properly; and
  - Contact PLP if the system is not operating properly.

The notification and coordination process implemented between the 4-PLPs and the property owners is a critical component of the effective operation of the Tier 4 systems.

## Attachment A – References

PSC. 2001. Philip Services Corporation. Draft Comprehensive RCRA Facility Investigation Report, Part I (Draft Comprehensive RFI Report) and Part II (Draft Human Health and Ecological Risk Assessment). June and August 2001.

PSC. 2002. Philip Services Corporation. Revised Inhalation Pathway Interim Measures Work Plan, August 12, 2002 and Errata Document, September 17, 2002.

## Table A-1 – Exposure Parameters Used to Calculate IPIMALs/VIRLs

| Parameter | Abbreviation | Units | Restricted – Industrial/Commercial Scenario | | | | Unrestricted – Residential Scenario | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Noncarcinogen | | Carcinogen | | Noncarcinogen | | Carcinogen | |
| | | | Value | Source | Value | Source | Value | Source | Adult Value | Source |
| Air inhalation intake rate | BR | $m^3$/hr | 1.5 | USEPA | 1.5 | USEPA | 0.417 | Eq. 750-1 | 0.833 | Eq. 750-2 |
| Exposure time | ET | hr/day | 10 | USEPA | 10 | USEPA | 24 | Eq. 750-1 | 24 | Eq. 750-2 |
| Exposure frequency | EXF | day/yr | 250 | USEPA | 250 | USEPA | 365 | Eq. 750-1 | 365 | Eq. 750-2 |
| Exposure duration | ED | yr | 25 | Eq. 745-1 | 25 | Eq. 745-2 | 6 | Eq. 750-1 | 24 | USEPA |
| Average body weight | ABW | kg | 70 | Eq. 745-1 | 70 | Eq. 745-2 | 16 | Eq. 750-1 | 70 | Eq. 750-2 |
| Averaging time | AT | day | 9125 | Eq. 745-1 | 27375 | Eq. 745-2 | 2190 | Eq. 750-1 | 27375 | Eq. 750-2 |
| Unit conversion factor | UCF | ug/mg | 1000 | -- | 1000 | USEPA | 1000 | -- | 1000 | -- |
| Target risk[1] | Risk | unitless | -- | -- | 1.00E-06 | SSRLG | n/a | -- | 1.00E-06 | SSRLG |
| Target hazard quotient[1] | THQ | unitless | 0.1 | SSRLG | -- | -- | 0.1 | SSRLG | 0.1 | -- |

Notes:

-- = Not applicable

USEPA = USEPA. 1991. Use of standard default exposure factors. Memo from P. Cirone to Risk Assessors. EPA Region 10, Seattle, WA. April 18, 1991.

Eq. 745-1, Eq. 745-2, Eq. 750-1, and Eq. 750-2 are Equations and Input Parameters defined in MTCA.

MTCA = Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC Amended February 12, 2001.

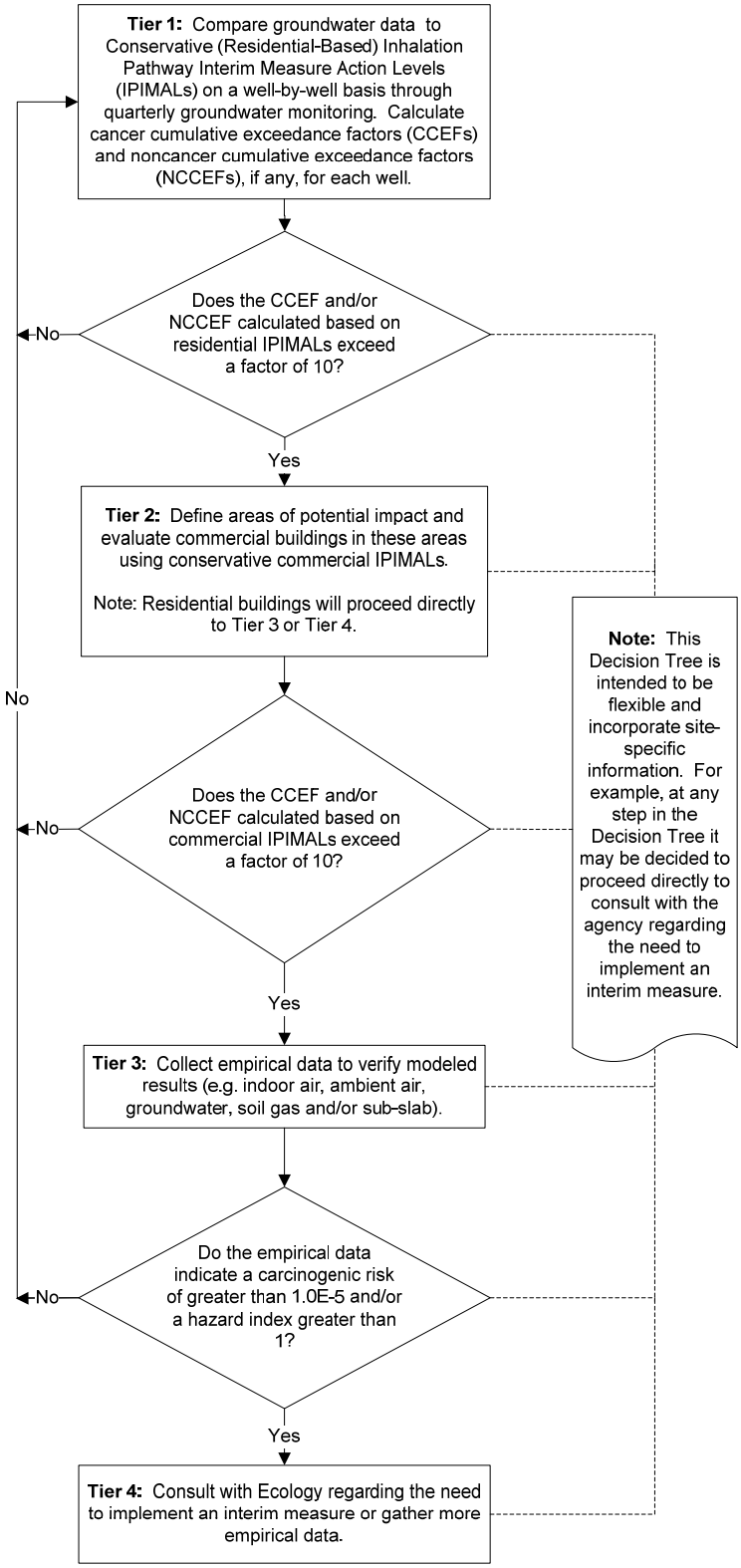
SSRLG = Site-Specific Remediation Level Goal

[1] Target hazard quotient of 0.1 and target risk of 1E-06 used for used for developing IPIMALs for both scenarios.

## Table A-2 – IDW Interpolation Input Parameters

| IDW Parameter | Parameters Used in Interpolation of CEFs | Description |
|---|---|---|
| Power | 4 | As the power increases, the grid node being interpolated is influenced more by points located closer than points located further away. The default value in many software applications (e.g., Surfer) is 2. For this analysis, a power of 4 was assumed which results in contours that are less smooth but are heavily influenced by points located closer to the grid node being interpolated. The power parameter must be greater than 0 and less than 20. |
| Smoothing | 0 | Smoothing was not incorporated into the contours. Normally, IDW behaves as an exact interpolator. When calculating a grid node, the weights assigned to the data points are fractions, and the sums of all the weights are equal to 1.0. When a particular observation is coincident with a grid node, the distance between that observation and the grid node is 0.0, and that observation is given a weight of 1.0, while all other observations are given weights of 0.0. Thus, the grid node is assigned the value of the coincident observation. The smoothing parameter buffers this behavior. If a non-zero smoothing parameter is used, no point is given an overwhelming weight (i.e., no point is given a weighting factor equal to 1.0). |
| Radius 1 | 250[a] feet | The radius of the search ellipse in the X direction (east-west: parallel to groundwater flow). |
| Radius 2 | 100[a] feet | The radius of the search ellipse in the Y direction (north-south: perpendicular to groundwater flow). |
| Search Sectors | 4 | The search ellipse was divided into 4 search sectors of equal size. |
| Anisotropy Angle | 5° | The anisotropy angle is the offset of the search ellipse in the X direction. An anisotropy angle of 5° results in an orientation of the X coordinate of the search ellipse parallel to the groundwater flow located hydraulically downgradient of the Georgetown Facility. |
| Cell Spacing | 2 feet | The cell spacing is the size of the node that will be assigned the interpolated value. Smaller cell spacing results in a smoother interpolation because more nodes are interpolated. |

## Figure A-1 – IPIM Decision Tree



# Appendix D

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
*Northwest Regional Office • 3190 160th Ave SE • Bellevue, WA 98008-5452 • 425-649-7000*
*711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341*

December 19, 2017

Mr. William Beck
Senior Environmental Project Manager
Stericycle Environmental Solutions
18000 72nd Avenue South, Suite 217
Kent, WA 98032

Re: **PSC-Georgetown Facility**
**Vapor Intrusion Mitigation: Inspection, Monitoring, and Maintenance**
**Ecology/EPA ID#: WAD 00081 2909**

Dear Mr. Beck:

On June 28, 2017, the Washington State Department of Ecology (Ecology) mailed letters to Stericycle Environmental Solutions and the West of 4th site PLPs concerning the inspection, monitoring, and maintenance programs for vapor intrusion mitigation systems installed east and west of 4th Ave. S. Our letter to Stericycle related to systems installed pursuant to the company's PSC-Georgetown site cleanup, and requirements contained in Agreed Order DE 7347. Ecology's letter stated that three initiatives should be implemented to better protect indoor receptors in east of 4th mitigated buildings. The three initiatives included:

(1) Executing formal/legal access agreements between current building owners and Stericycle that cover annual inspections as well as other anticipated inspection, monitoring, maintenance, and repair tasks.

(2) Supplementing "real-time" mitigation monitoring devices (usually manometers) with separate loss-of-vacuum indicators and alarms.[1] We asked that upon the owner/tenant's consent, installation of the devices should be scheduled to coincide with that building's next annual mitigation inspection.

(3) Prioritizing the Tier 5 shut-down process at buildings located in areas where it is now likely that continued mitigation operation is no longer needed.

[1] If such a device were not already in place. Ecology noted that among the mitigated buildings there may currently be mitigation-monitoring via telemetry or other approaches that could be utilized in lieu of these indicators/alarms. There may also be instances where mitigation performance monitoring is regularly checked much more often than yearly (e.g., monthly or more frequently), the checks are documented, and the PLPs are confident that this degree of scrutiny will continue into the future. Where this was the case, and with the building owner's concurrence, such enhanced inspection frequency could also be substituted for loss-of-vacuum indicators/alarms.

Stericycle and Ecology discussed Ecology's letter during a conference call held on July 28, 2017. Participants in that call included several Stericycle consultants and the West of 4th site project coordinator (Dana Cannon). The primary topic was loss-of-vacuum indicators and alarms. Stericycle and its consultants expressed concerns about the reliability of indicators and alarms currently on the market, and suggested alternative ways to better ensure continuous mitigation operation.

The following month, on August 23, Stericycle responded by letter to Ecology's June 28, 2017, letter. Stericycle's response was, in our view, consistent with the discussion held during the July conference call. We replied to the letter via email two days later, responding to various Stericycle proposals contained in the letter. These proposals included:

a) development of a fact sheet that could be provided to mitigated-building owners, tenants, and occupants;

b) meeting(s) with the owners/tenants/occupants of mitigated buildings;

c) continued efforts to execute access agreements with the current owners/tenants of mitigated buildings;

d) more frequent mitigation inspections (semi-annual);

e) the addition of pad locks to the mitigation fans' switch boxes; and,

f) development of a pre-failure fan replacement schedule.

Stericycle did not propose to install loss-of-vacuum indicators/alarms on any of its east-of-4th mitigation systems.

After Ecology emailed comments on Stericycle's August letter the company responded with an email on November 22. Attached to the email was a table listing the addresses of mitigated buildings, together with mitigation-related information specific to each building and a draft fact sheet (intended for the owners/tenants of mitigated buildings). Ecology provided emailed comments on the draft and revised versions of the fact sheet on November 29 and December 15, 2017; those comments are not reproduced in today's letter.

We appreciate Stericycle's serious consideration of our June 2017 letter, the company's thoughtful reply in August, and the various emails the parties have exchanged concerning the mitigation topic. Today, Ecology has provided the following:

(1) a summary of those newly proposed actions that will be taken in the eastern portion of Stericycle's PSC-Georgetown site. We believe this summary is consistent with Stericycle's August 23 letter and the PLPs' November 22 follow-up email; and,

(2) Ecology comments on the proposed actions, including comments on the mitigation-system table emailed to us on November 22. Although many of the proposed actions would be carried out in areas both east and west of 4th Ave. S., these comments apply specifically to the eastern portion of Stericycle's PSC-Georgetown site.

The summary is included in Enclosure A; Enclosure B contains our comments.

Within thirty (30) days of receipt of today's letter, Stericycle should provide by letter:

- concurrence with Comments #1, 2, and 3 in Enclosure B, or an explanation for any disagreement the company has with these three comments; and,
- a plan and schedule for addressing Comments #5 and 6 (also in Enclosure B). Comments 5 and 6 concern mitigated buildings in areas where shallow groundwater CVOC concentrations may no longer pose a significant vapor intrusion potential. In the table emailed to Ecology on November 22 Stericycle proposed certain actions – such as the installation of new monitoring wells – to better gauge the need for continued mitigation at these buildings. Ecology's two comments refer to these proposals, and discuss the near-term decisions we should make to expedite the retirement of any unnecessary mitigation systems. These comments should be addressed, and our future Tier 5 plans should be firmed up, before meeting with the owners/tenants of mitigated buildings.

If you have any questions concerning this letter, or would like to schedule a conference call or meeting to discuss its contents, please contact me at (425) 649-4449 or ejon461@ecy.wa.gov.

Sincerely,

Ed Jones
Environmental Engineer
Hazardous Waste and Toxics Reduction Program

By certified mail: 9171 9690 0935 0169 7331 81

Enclosures

cc: Marlys Palumbo, VNF
Dana Cannon, Aspect
Central Files

ecc: Nels Johnson, AAG
Patty Foley/Sherell Ehlers, GTCC

# Enclosure A

## Summary of Newly Proposed Actions for Mitigated Site Buildings

These proposals, approved by Ecology, include:

1. Development of a fact sheet that would be provided to mitigated-building owners, tenants, and occupants. A draft version of the fact sheet was emailed to Ecology on November 22. Our comments were emailed to Stericycle one week later. The comments were subsequently incorporated into a December 15 revision of the document. The fact sheets, once finalized, will be mailed or otherwise delivered to the owners and tenants of all mitigated buildings located east of 4th Ave. S.

2. Meeting(s) with building owners/occupants of mitigated buildings. Following the fact sheet mailing, Stericycle will begin contacting owners/tenants. The company will request an appointment to meet with each owner/tenant for the purpose of providing mitigation-related information and answering questions. If the owner/tenant agrees, a meeting will be scheduled.

   Stericycle will begin this process in the first quarter of 2018. As meeting appointments are scheduled, the company will notify me (the Ecology site manager) so that I can make plans to also attend.

3. Attempts to execute access agreements for all mitigated buildings where no such agreements are in place, or existing agreements are with a party no longer a tenant or owner. Stericycle has been very conscientious about securing such agreements in the past. Ecology appreciates the efforts the company has made, and realizes in some cases it can be difficult to contact – much less obtain signed consent – from a building owner.

4. More frequent mitigation inspections. Starting in 2018 Stericycle will inspect all operating mitigation systems no less frequently than semi-annually.

5. Addition of pad locks to the mitigation fans' switch boxes. Fans may be inadvertently switched off by building occupants. Or, occupants may intentionally turn switches off, not realizing the fan and the rest of the mitigation system has been installed to minimize any vapor intrusion contributions to indoor air contamination.

   Besides the reduced protection that accompanies fan shutdown, mitigation experts also believe that switching the fans on and off can significantly shorten fan life. Therefore, starting in 2018 Stericycle will begin installing pad locks on those mitigation system switch boxes where:

   a) the building owner has consented in writing and has been provided a copy of the pad lock key, and

b) locking the switch boxes in this manner meets all applicable electrical and fire codes.

6. Development of a pre-failure fan replacement schedule. Stericycle has proposed to replace the fans at 14 mitigated buildings next year. At one additional building, where the fan has already been replaced, no replacement is scheduled until 2026. Ecology agrees with these proposals. As we have noted previously, among the 14 mitigation systems scheduled for fan replacement next year we expect Stericycle to prioritize replacement at those buildings where:
    a) continued (uninterrupted) mitigation system operation is more critical. In general, these would be buildings where subsurface VOC levels are relatively more elevated and receptors are being potentially exposed to indoor air over longer periods (e.g., residents);
    b) the owner/tenant does not foresee major renovations to, or demolition of, the structure; and,
    c) Stericycle has not initiated the Tier 5 process.

# Enclosure B

## Ecology Comments on Newly Proposed Actions for Mitigated Site Buildings

1. Fact sheet. In those cases where Stericycle is unsure of the name of the owner/tenant currently occupying a building, fact sheets should be addressed to "current occupant."

   In addition, just prior to mailing the final versions of the fact sheets, the company should notify Ecology (me). Some building owners or tenants who receive the fact sheets may choose to contact us immediately thereafter, via phone or email.

2. Meeting(s) with owners/tenants/occupants. Prior to the first such meeting the individuals planning to participate should meet or convene on a conference call. The purpose of the meeting/call will be to confirm visit logistics, and to also discuss the various questions that owners/tenants may pose to us.

3. Access agreements. If Stericycle believes that Ecology can help secure certain access agreements by phoning or writing a letter to building owners, please notify us and provide the pertinent history and contact information.

4. Potential health risks posed by vapor intrusion. Stericycle's August letter states that there is a low risk of adverse health effects if a mitigation system fan stops running right after an annual inspection and does not start up again until after the next annual inspection (i.e., a 1-year down time). Depending on the building, its location, who is occupying the building, what a "low" risk means, and other factors, this may be true.

   However, neither Ecology nor Stericycle knows how high indoor air concentrations may rise – due to vapor intrusion – should mitigation systems in the east-of-4$^{th}$ area stop operating. At best, where the only vapor intrusion source is contaminated groundwater and we have nearby monitoring wells screened across the Water Table Zone (and those wells are routinely sampled), we can estimate "bounding" indoor concentrations for a building based on conservative groundwater-to-indoor air attenuation assumptions. If these building-specific indoor air "bounding" concentrations are below Method B VOC air cleanup levels, it is very unlikely that a mitigation failure would lead to unacceptably-elevated indoor air levels (due to vapor intrusion).[2] If, on the other hand, the estimated building-specific indoor air "bounding" concentrations are above Method B VOC air cleanup levels, a mitigation failure could lead to vapor intrusion-caused indoor air levels that are unacceptably elevated. At these buildings especially, system failures should be identified and rectified as soon as possible.

5. Tier 5. In Ecology's June 2017 letter we identified a number of east-of-4$^{th}$ addresses where it appeared (to us) that mitigation may no longer be needed. We referred to these buildings as "Tier V candidates." The buildings we identified are located in areas where

[2] And we should then consider why we have not initiated the Tier 5 process for the building's mitigation system.

trichloroethene (TCE) groundwater concentrations at the water table currently appear to be less than 6.8 µg/l.[3]

In the table Stericycle submitted via email on November 22, the company disagreed with the "Tier V candidates" Ecology identified last June. In general, it appears that Stericycle uses the term "candidate" less broadly – and perhaps more precisely – than we did. As a consequence, Stericycle does not appear to consider a mitigated building a Tier 5 "candidate" unless we have two years of groundwater monitoring data from a nearby Water Table Zone monitoring well, the calculated CCEF from those data is less than 1, and the NCCEF is less than 10.

We have chosen to mitigate buildings for various reasons, but the primary criterion has been a finding that vapor intrusion was resulting, or could result, in a risk greater than 1E-5 or an HI greater than 1. For TCE this meant that measured/estimated indoor air concentrations would need to be:[4]

- > 0.9 µg/m3, for residences, and
- > 3.9 µg/m3, for non-residences where indoor workers are the receptors of concern.

Typically, we have also sampled indoor at non-mitigated buildings (during Tier 3) when we thought that vapor intrusion could result in an indoor risk greater than 1E-5 or an HI greater than 1. For TCE, indoor air sampling was triggered by measuring Water Table Zone groundwater concentrations:

- > 17 µg/l, for residences, and
- > 72 µg/l, for non-residences where the receptors of concern are indoor workers.

These groundwater "mitigation triggers" are different than Method B groundwater cleanup levels (CULs) protective of indoor air. The groundwater CULs do not differentiate between residential receptors and workers. They also require that the acceptable carcinogenic risk per contaminant be no higher than 1E-6. For TCE, a groundwater CUL (measured at the water table) of 6.8 µg/l corresponds to a potential indoor air risk of 1E-6.

In areas where shallow groundwater TCE levels appear to currently be less than 6.8 µg/l, we should now decide, per mitigated building, if:

a) one or more new Water Table wells should be installed nearby so that the Tier 5 2-year sampling period can be initiated; or,

---

[3] This value is the updated carcinogenic TCE "Residential Groundwater IPIMAL/VIRL" provided in a 12/31/15 Pioneer Memorandum. The 1/27/17 West of 4th groundwater TCE PCUL, protective of indoor air quality, is 6.9 µg/l. In Comment #6 Ecology has rounded these values to 7 µg/l.

In addition, it should be noted that mitigation systems installed in commercial buildings are unlikely to be needed once TCE levels in shallow groundwater fall below 27 µg/l, the 1E-6 risk-based "commercial" VI groundwater screening level.

[4] Here, and in the following two paragraphs, Ecology is assuming a simplified scenario where TCE is the only potential VI driver in groundwater, groundwater contamination is the only VI source, and no soil gas sampling data are available.

b) sampling should begin at a nearby Water Table well that currently is not being monitored (or is being infrequently monitored) to develop a 2-year Tier 5 data set of VOC measurements; or,

c) there are alternative approaches for determining the need for continued mitigation (even if these approaches are not explicitly anticipated in the 2011 Tier 5 document). For example, there may be situations where several Water Table wells are in the general vicinity of a mitigated building, but much farther than 100' away. If they are being routinely monitored, it is possible that their VOC data could be used – or supplemented and used – to make Tier 5 decisions. Likewise, there are likely to be buildings located in east-of-4th areas where the collection of new direct-push groundwater or soil gas VOC data could – in the absence of a nearby Water Table well with two years of recent VOC data – be sufficient to complete Tier 5 decision-making.

Please see our building-by-building comments in Comment #6 below.

6. Mitigation System Table (listing the addresses of mitigated buildings, together with mitigation-related information per building). Ecology's only comments on this table relate to Stericycle's input concerning the suitability of certain mitigated-buildings for Tier 5 consideration.

   - 402, 406, 412, and 416 S. Lucile St: Ecology agrees that there are no Water Table Zone monitoring wells located immediately upgradient of these mitigated buildings. CVOC sampling results from water table wells in the vicinity have been low (including results from ABP MW-6 on the west side of 4th Ave), but we are not certain that shallow TCE groundwater concentrations very near the four buildings are consistently less than 7 µg/l.

     Unless, however, we think it likely that Water Table Zone TCE levels in groundwater near the buildings are currently greater than 7 µg/l, we should either carry out Stericycle's proposal (install new monitoring wells) or determine if there is a more cost-effective/judicious approach for determining the need for continued mitigation.[5] For example, rather than embarking on the installation of more wells and a 2-year waiting period (while we compile groundwater sampling results), implementing a targeted soil gas sampling investigation might be faster and cheaper.

   - 404, 406, and 412 S. Orcas St: TCE groundwater concentrations at well 131WT now appear to be less than 7, and certainly below 27, µg/l. If we believe that

[5] In the table Stericycle recommends the installation of a Water Table (WT) Zone monitoring well slightly northeast of 416 S. Lucile St. For the buildings along S. Orcas St., on Maynard Ave. S., and along S. Brandon St., the company recommends (respectively):

- a WT monitoring well slightly northeast of 412 S. Orcas St.,
- a WT monitoring well northeast of 5403 Maynard Ave. S., and
- WT monitoring wells southeast of 601 S. Brandon St., south of 605 Brandon, and northeast of 615 Brandon.

residents are likely to occupy these – or near-future – buildings at the three addresses, perhaps it is premature to start Tier 5 steps. Otherwise, we should carry out Stericycle's proposal (install new monitoring wells) or come to agreement on a different Tier 5/pre-Tier 5 approach (as described in the bullet above).

- 601, 605, 611/613, and 615 S. Brandon St: Well 129WT is located near the house at 601 Brandon, but is not sampled very frequently (last sampled in 2010?). Unless we think that TCE is currently higher than 7 µg/l in shallow GW near this building, we should carry out Stericycle's proposal (install a new monitoring well) or come to agreement on a different Tier 5/pre-Tier 5 approach (such as increasing the monitoring frequency at 129WT, or as described in the first bullet above).

  Water table wells in the general vicinity of 605, 611/613, or 615 Brandon are not ideally located for our Tier 5 purposes. Nevertheless, Water Table Zone TCE levels in this area are likely to be relatively low. Unless we believe that TCE concentrations currently exceed 7 µg/l in shallow groundwater near these buildings, we should therefore either carry out Stericycle's proposal (install new monitoring wells) or come to agreement on a different Tier 5/pre-Tier 5 approach (as described in the first bullet above).

- 5403 Maynard Ave. S: well 121-40 is very close to this house, but TCE levels measured from samples collected at 30-40' bgs are unlikely to accurately represent concentrations at the water table. TCE appears to currently be less than 7 µg/l at wells 116WT, 115WT, and 113-S1. If we are not confident that TCE concentrations are this low – because, perhaps, those wells have not been sampled recently or frequently enough – we should increase the sampling frequency. Otherwise, we should move forward with the Tier 5 process based on the recent 116/115/113 data, supplemented as needed with direct push groundwater sampling, soil gas sampling, or sampling of the new water table well recommended by Stericycle.

- 710 Lucile: Ecology does not consider this building a Tier 5 candidate. In the future perhaps we will. A future Tier 5 evaluation should include soil gas sampling; groundwater data alone will be insufficient for the building at this location.

# Appendix E

## Melisa Kegans

**From:** Melisa Kegans
**Sent:** Tuesday, July 26, 2022 1:04 PM
**To:** 'Tasya Gray'
**Cc:** Chris Waldron; Amber Lutey
**Subject:** RE: GT E4: Call Summary/deliverables
**Attachments:** Table 3 Residential.xlsx; Table 4 Commercial.xlsx

Hi Tasya,

Data from 3Q21 and 1Q22 were consistent with data in the Tier 5 report, there are no changes to our conclusions/recommendations. I've attached the data; only one residential sample was above VIRLs which was consistent with our past evaluations.

Thanks,

Melisa

**Melisa Kegans**
Project Scientist

**PIONEER Technologies Corporation**
5205 Corporate Ctr. Ct. SE, Ste. A
Olympia, WA 98503-5901
Office: 360.570.1700 Ext: 116
Cell: 503.758.7363
https://uspioneer.com/

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**From:** Tasya Gray <ngray@dofnw.com>
**Sent:** Monday, July 25, 2022 5:54 PM
**To:** Melisa Kegans <KegansM@uspioneer.com>
**Cc:** Chris Waldron <waldronc@uspioneer.com>; Amber Lutey <alutey@dofnw.com>
**Subject:** FW: GT E4: Call Summary/deliverables

Melisa,
See Ecology's response below. Can you confirm her assumption on recent Tier 5 data before we commence planning system shutdown?
Thanks,
Tasya

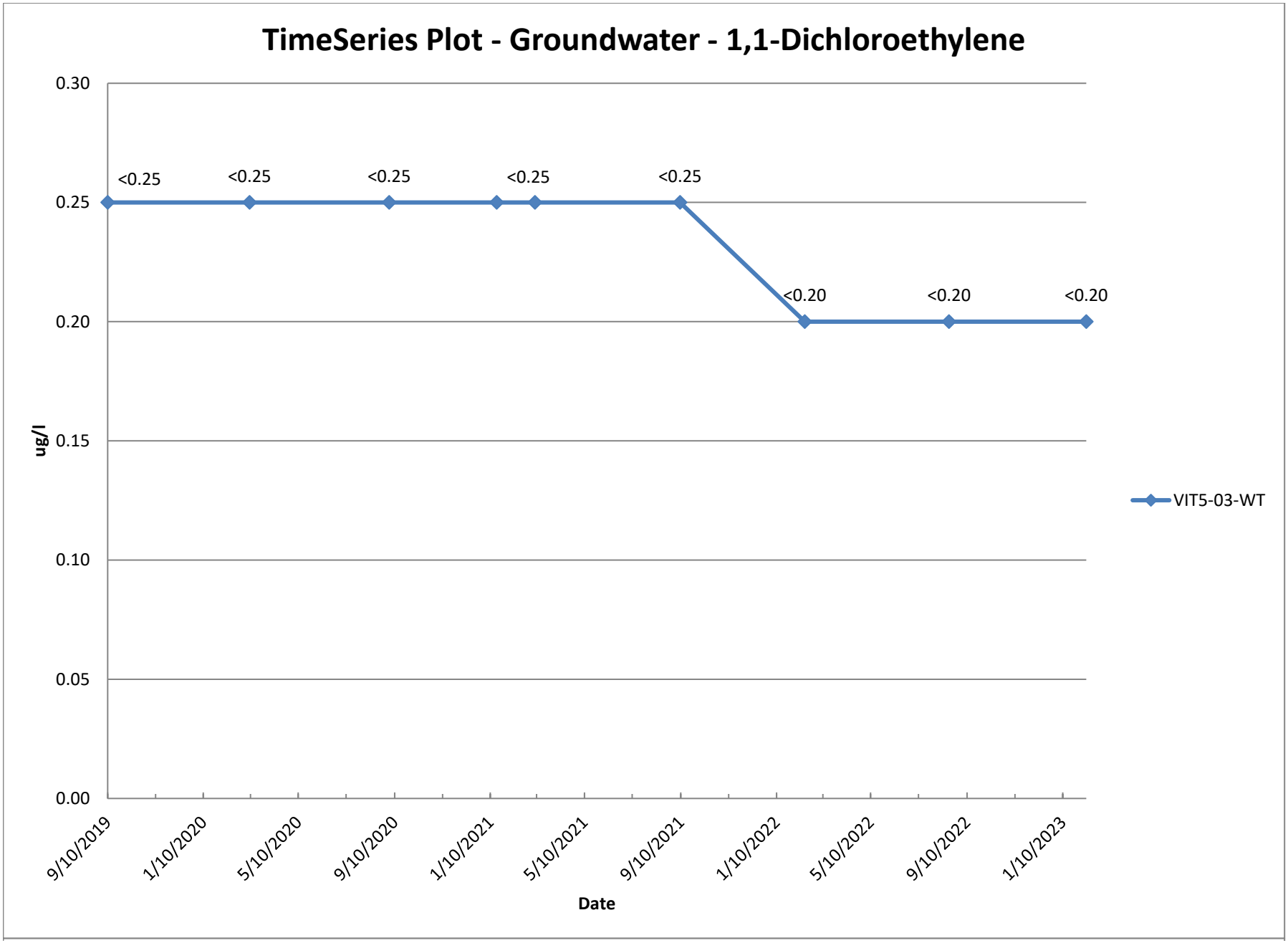
**From:** Hobbs, Erin (ECY) <EHOB461@ECY.WA.GOV>
**Sent:** Monday, July 25, 2022 5:09 PM
**To:** Tasya Gray <ngray@dofnw.com>
**Cc:** Amber Lutey <alutey@dofnw.com>
**Subject:** RE: GT E4: Call Summary/deliverables

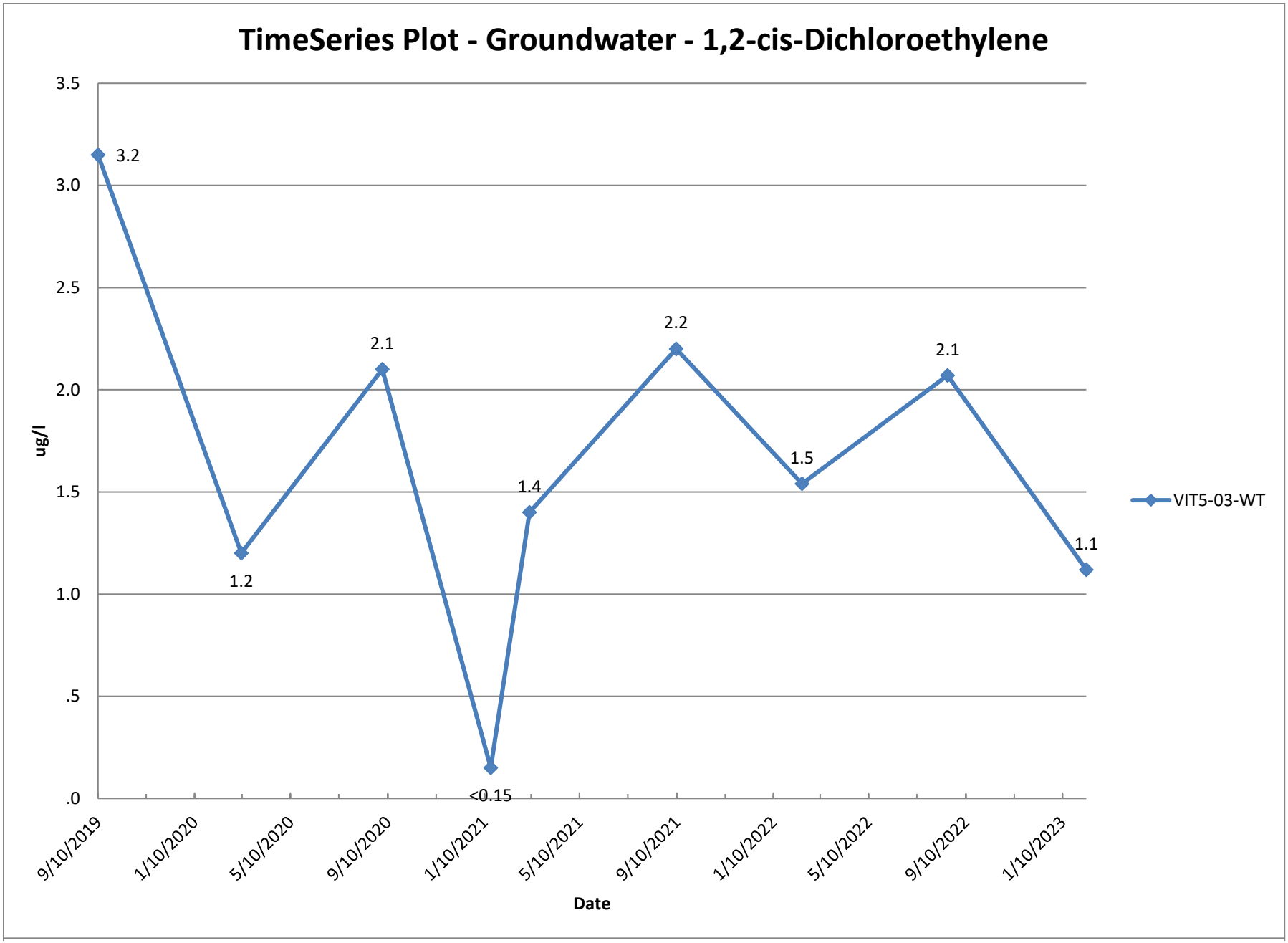
**CAUTION:** This is an external email. Please take care when clicking links or opening attachments. If you have any questions, Contact DOF IT group.

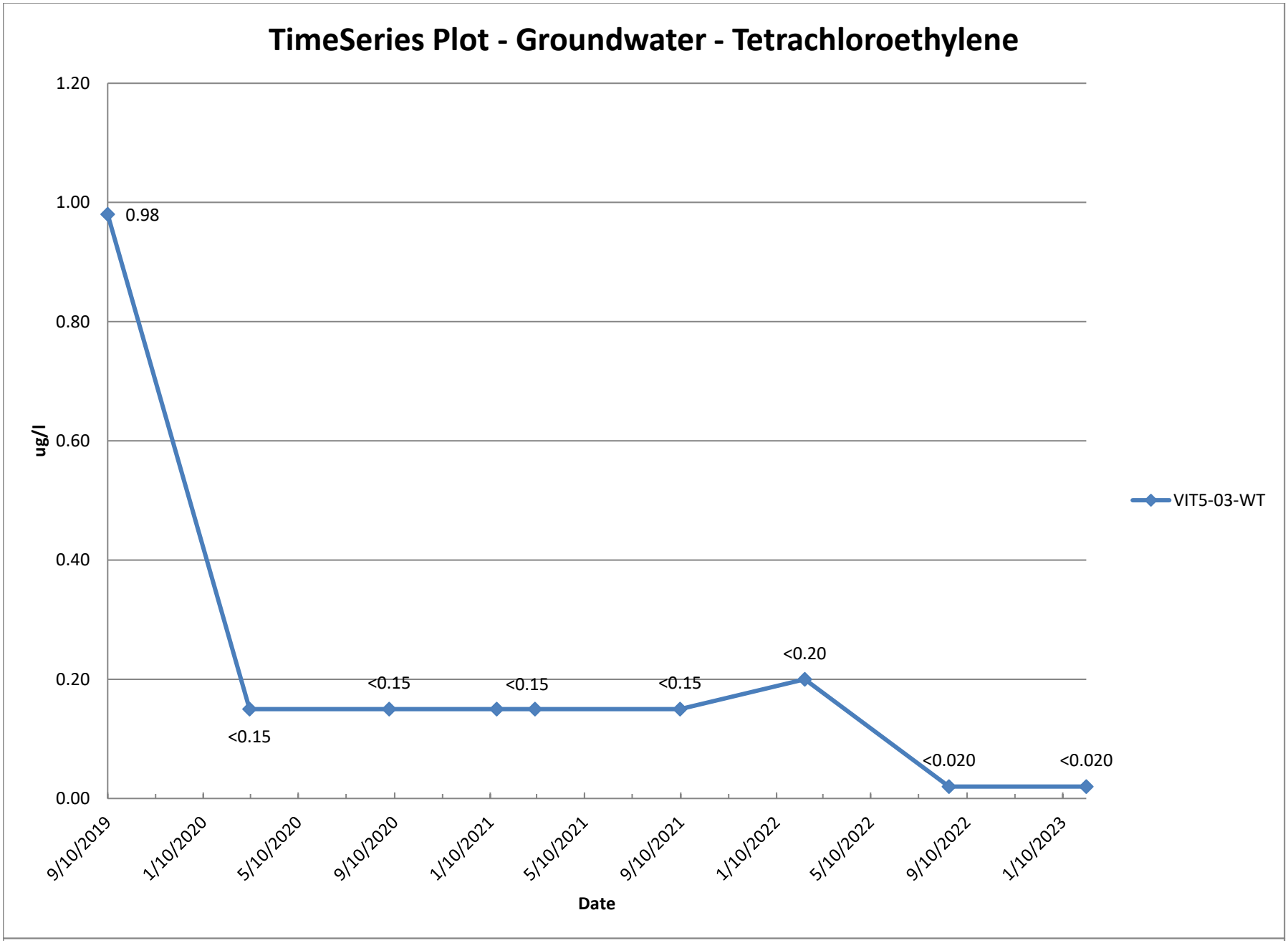
Yes, per our discussions the sampling for 3rd Q can be adjusted, as requested and the Tier 5 proceed with the next steps (assuming there were Q3 2021 and Q1 2022 sampling data that did not contradict any of the conclusions based on the 4 most recent sampling events included in the Tier 5 evaluation which whent through Q1 2021).

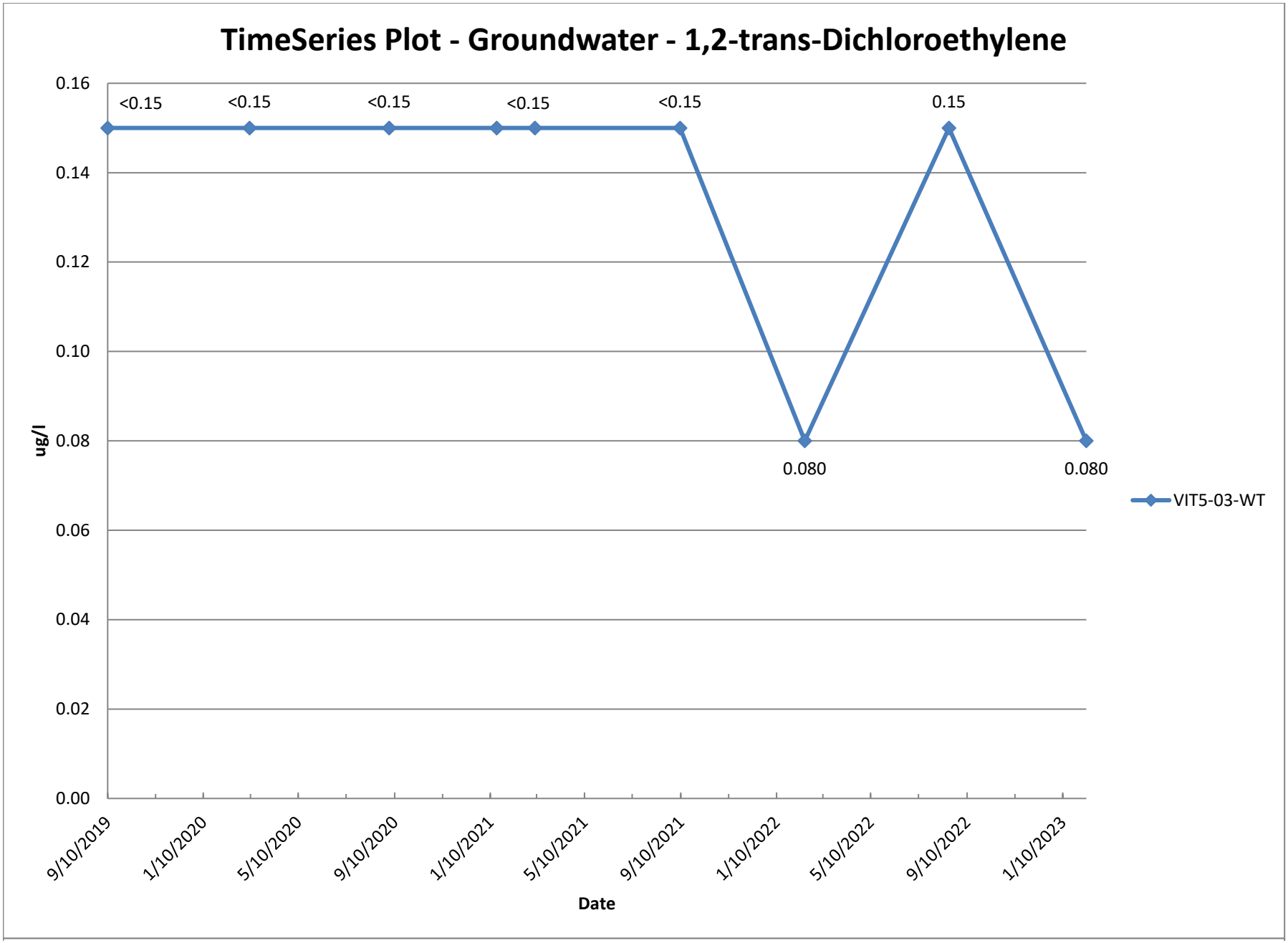
Thanks,
Erin

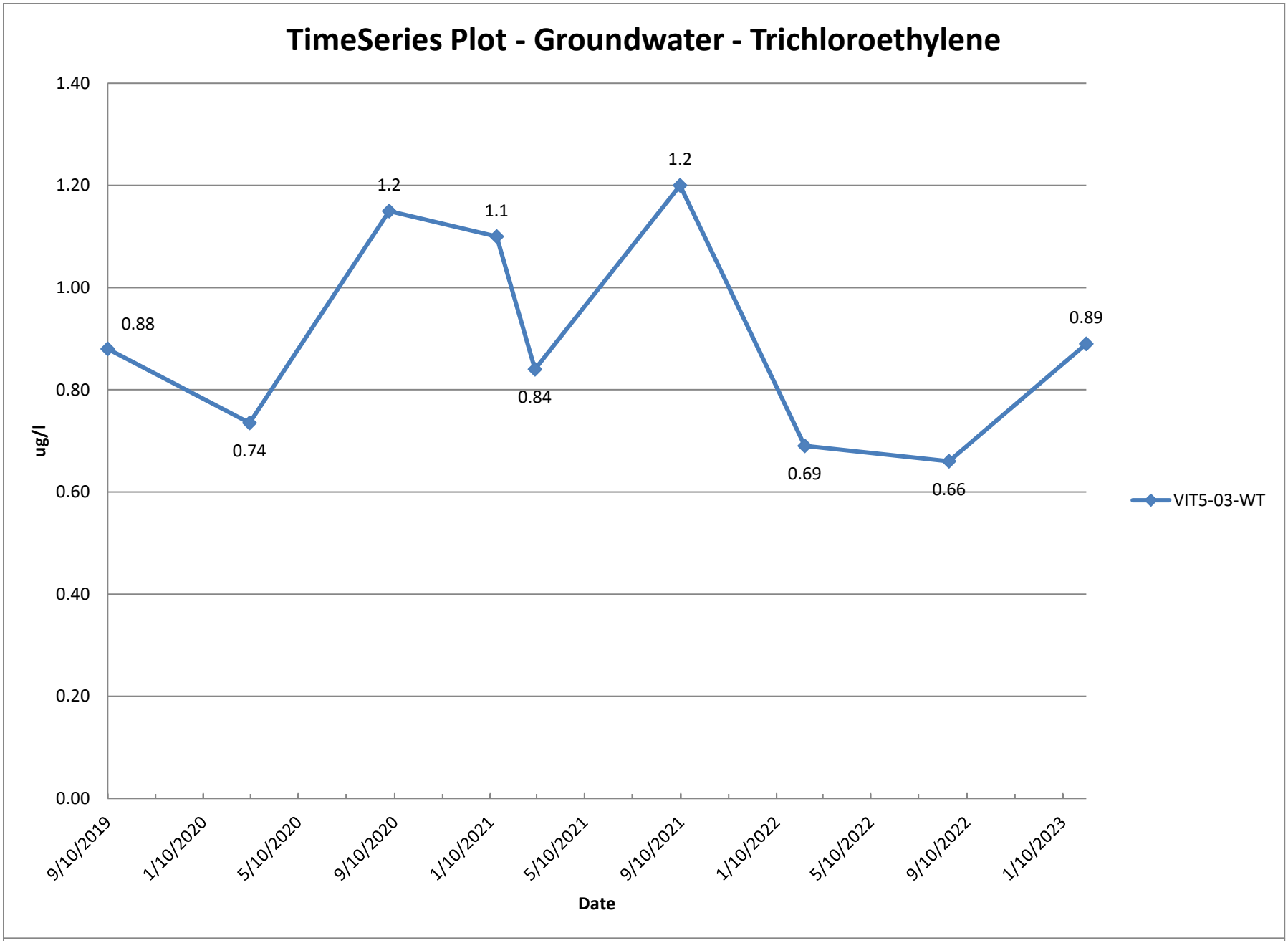
# Appendix F

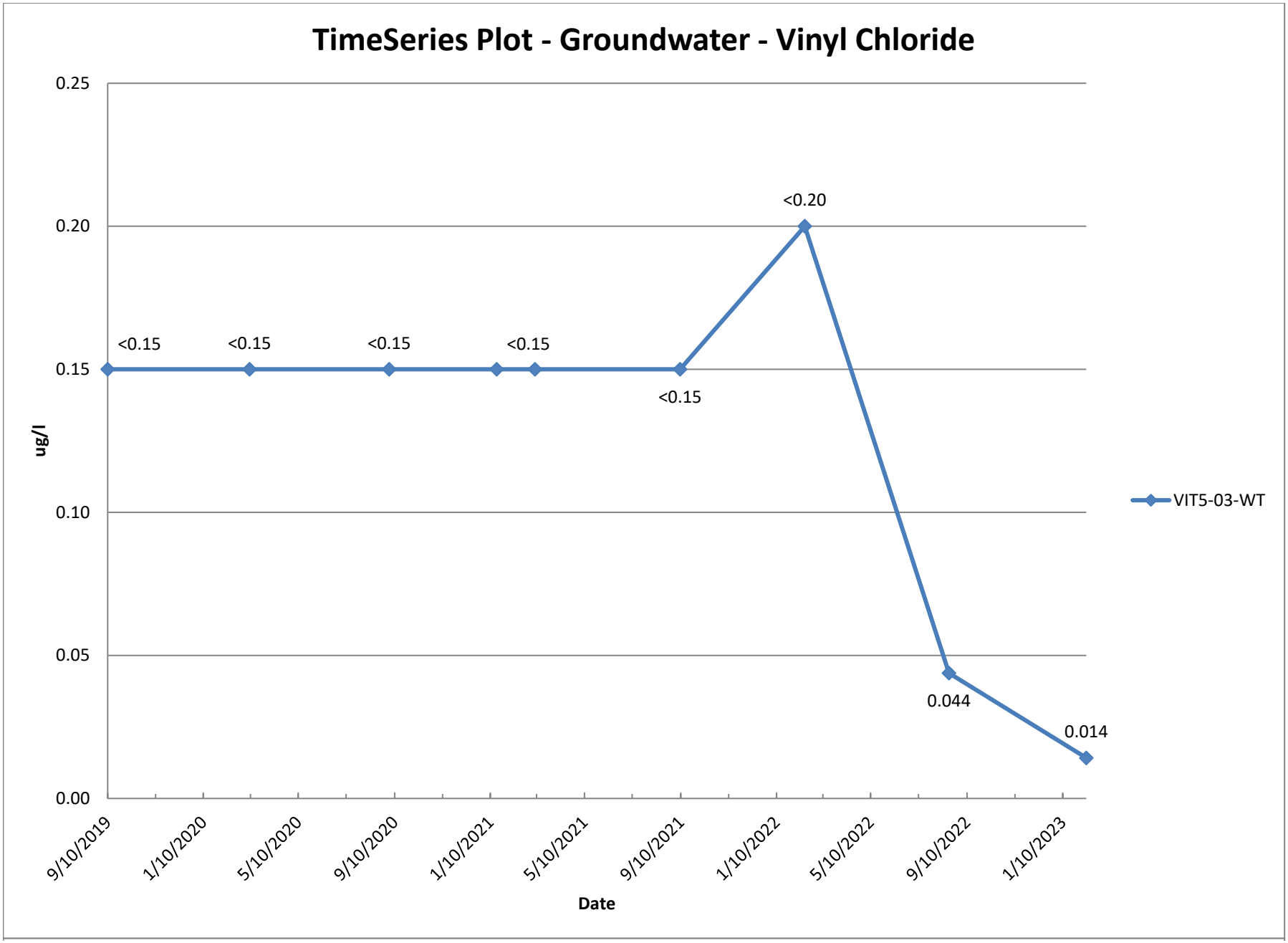

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.25
<0.25
<0.25
<0.25
<0.25
<0.20
<0.20
<0.20
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
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1/10/2022
5/10/2022
9/10/2022
1/10/2023
Date
VIT5-03-WT

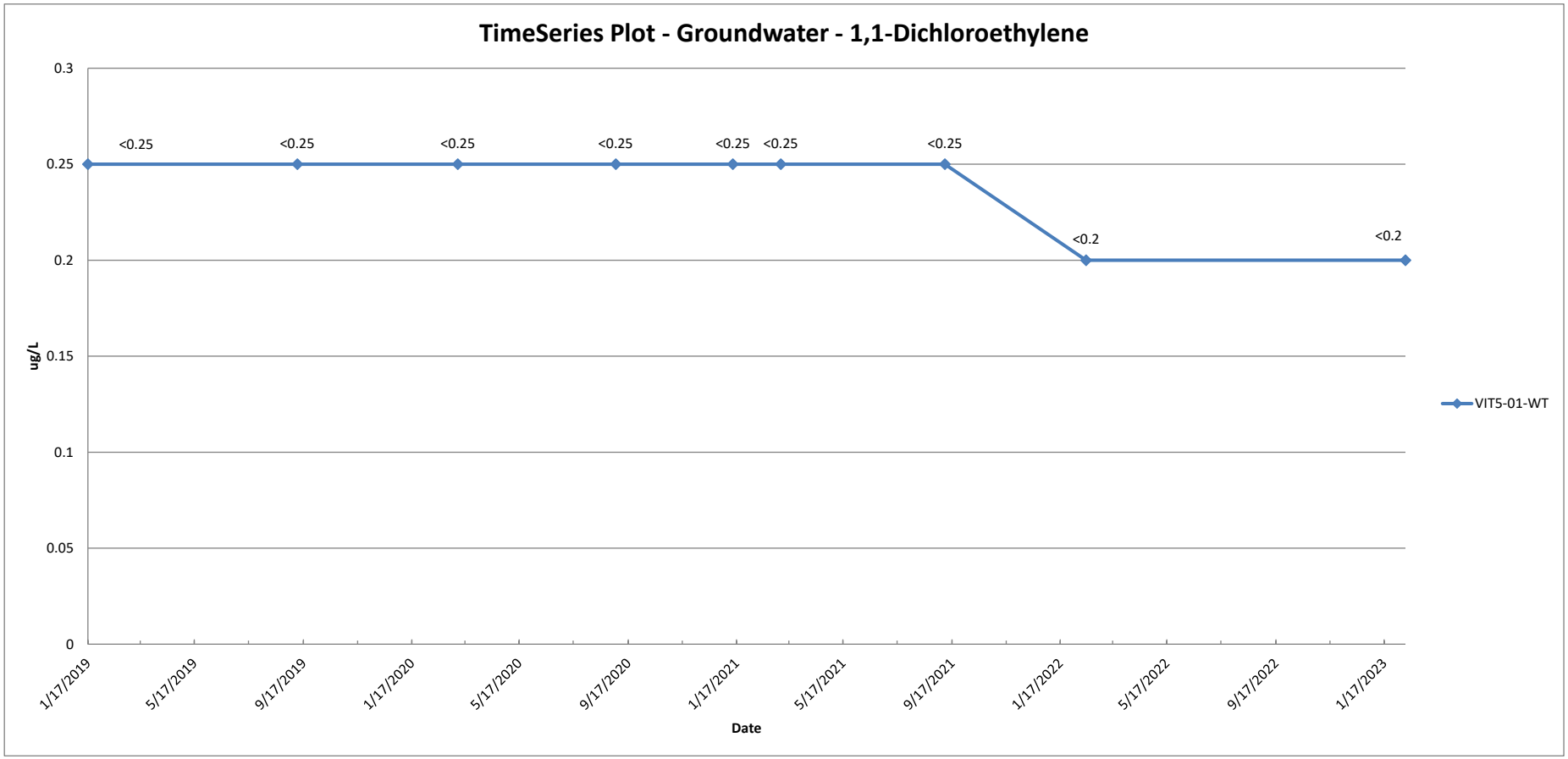

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
3.5
3.0
2.5
2.0
1.5
1.0
.5
.0
ug/l
3.2
1.2
2.1
<0.15
1.4
2.2
1.5
2.1
1.1
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
9/10/2021
1/10/2022
5/10/2022
9/10/2022
1/10/2023
Date
VIT5-03-WT

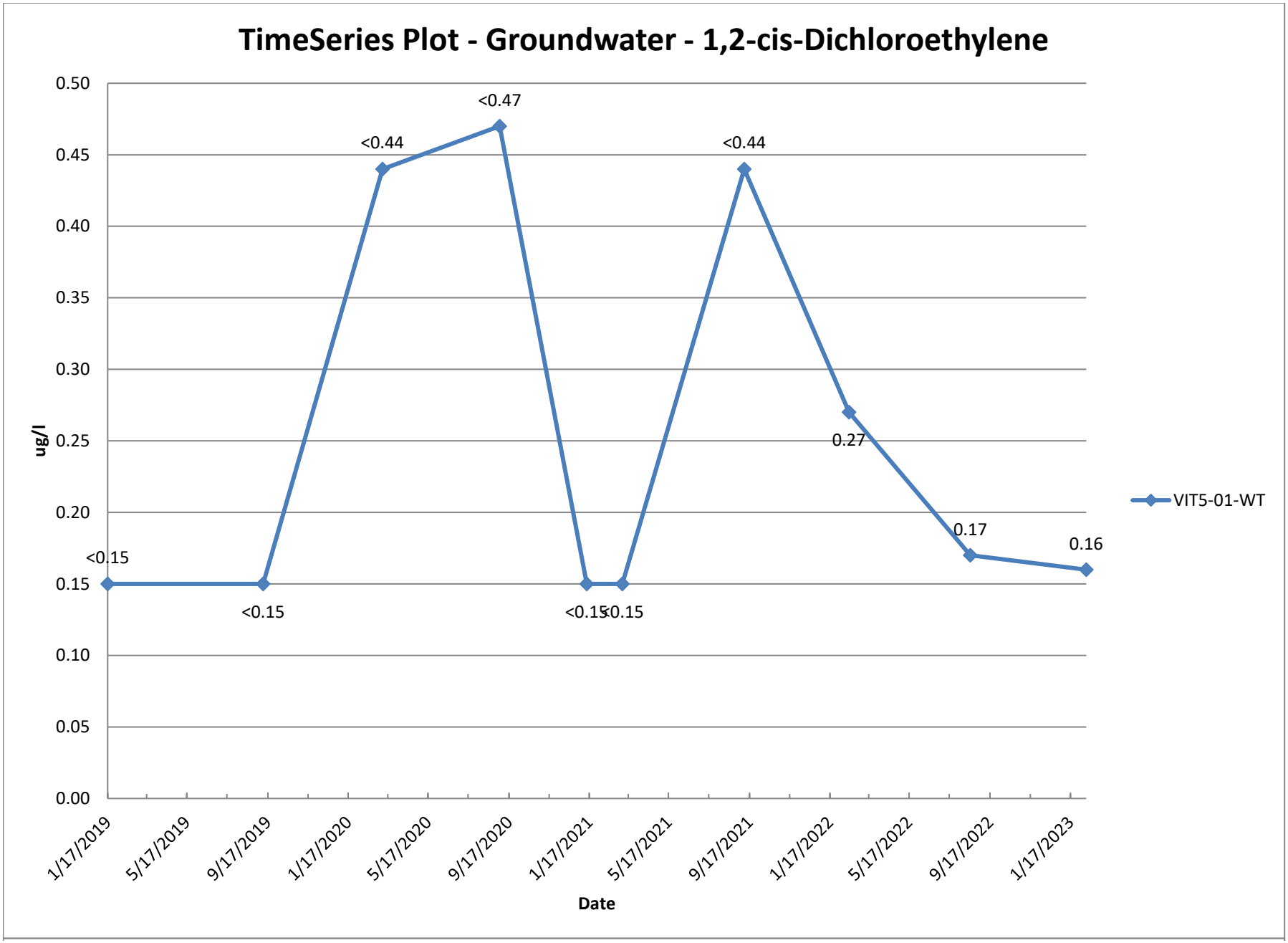

TimeSeries Plot - Groundwater - Tetrachloroethylene
1.20
1.00
0.80
0.60
0.40
0.20
0.00
ug/l
0.98
<0.15
<0.15
<0.15
<0.15
<0.20
<0.020
<0.020
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
9/10/2021
1/10/2022
5/10/2022
9/10/2022
1/10/2023
Date
VIT5-03-WT

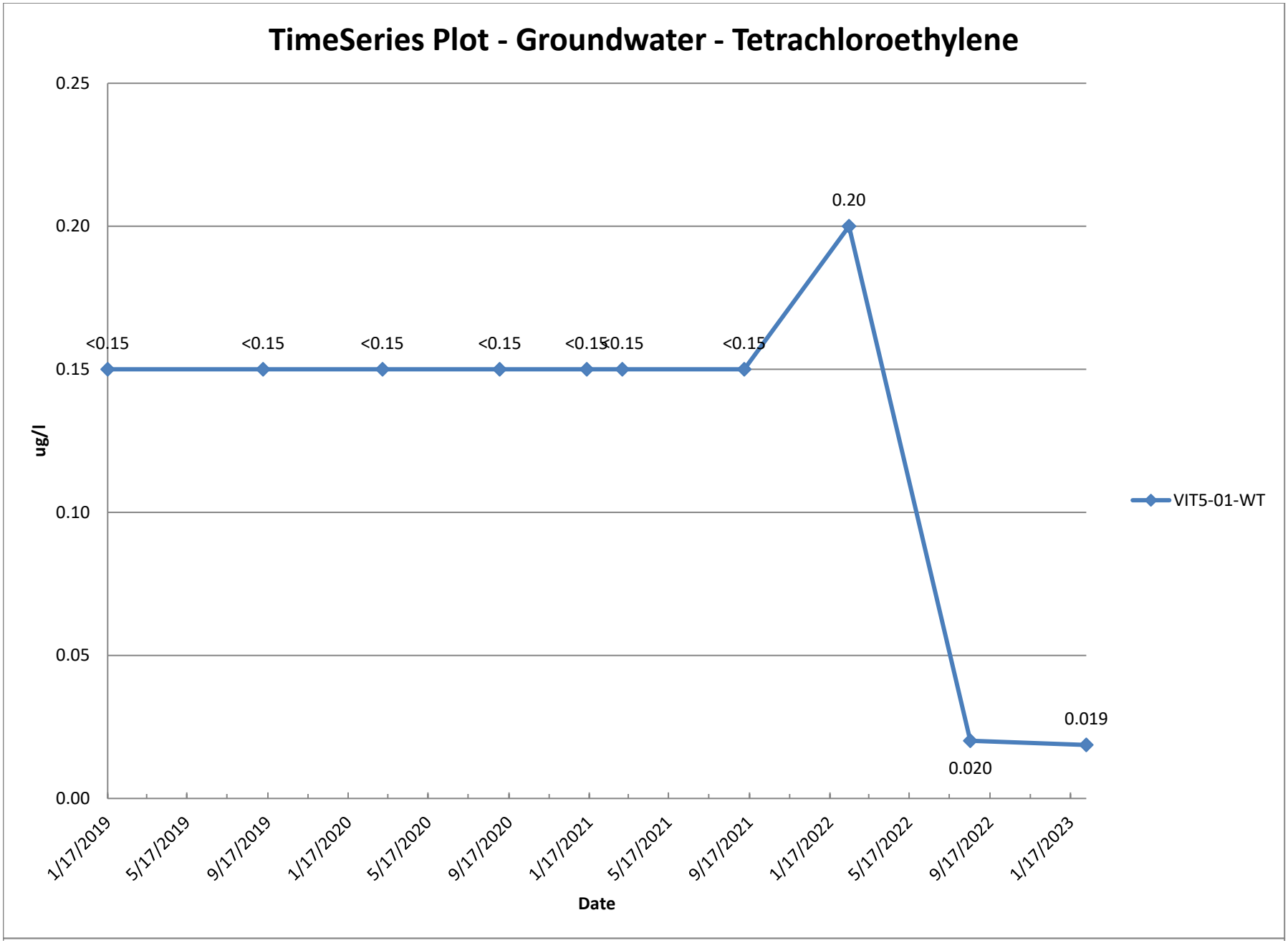

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
0.080
0.15
0.080
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
9/10/2021
1/10/2022
5/10/2022
9/10/2022
1/10/2023
Date
VIT5-03-WT

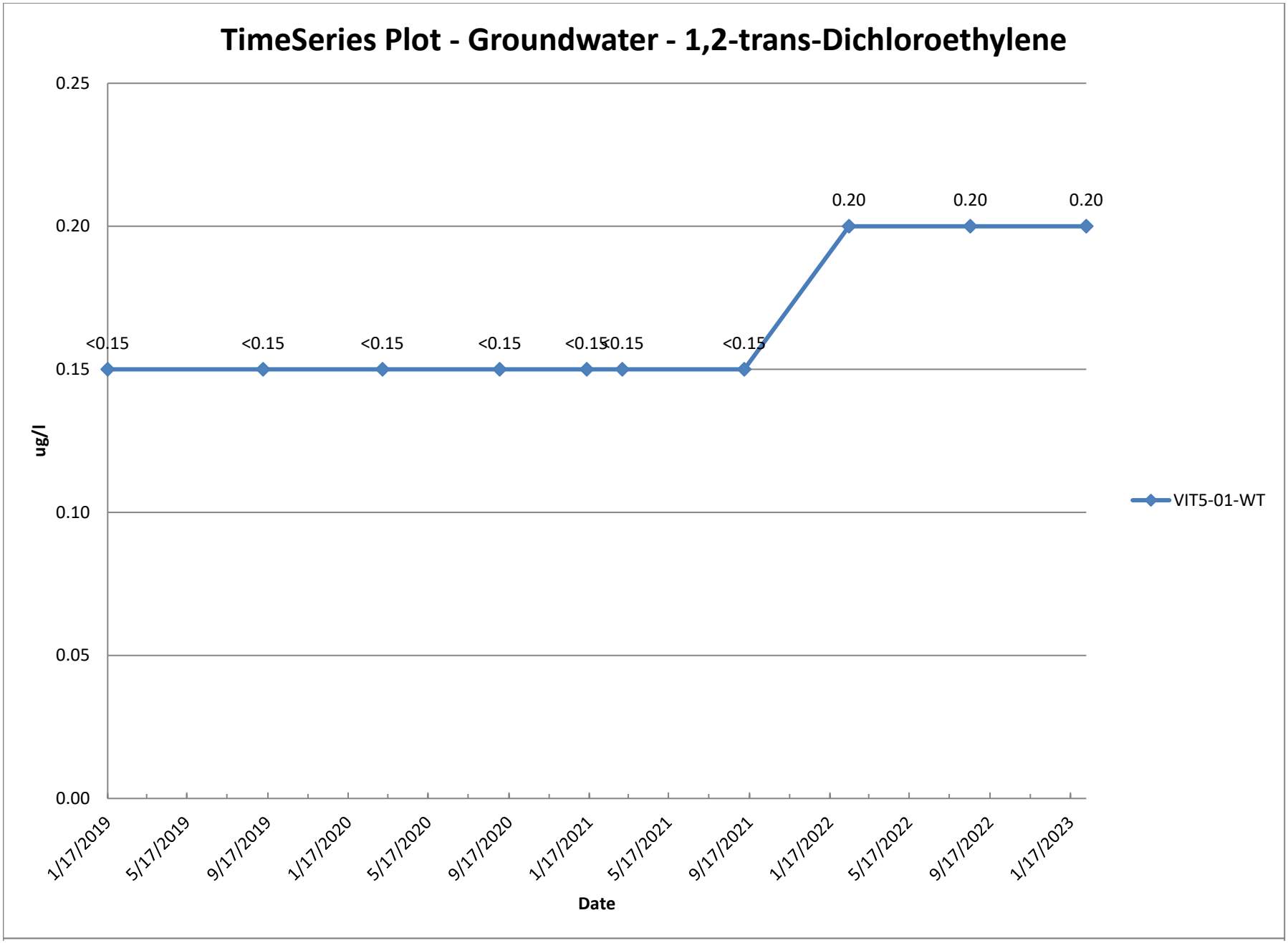

TimeSeries Plot - Groundwater - Trichloroethylene
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
ug/l
0.88
0.74
1.2
1.1
0.84
1.2
0.69
0.66
0.89
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
9/10/2021
1/10/2022
5/10/2022
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1/10/2023
Date
VIT5-03-WT

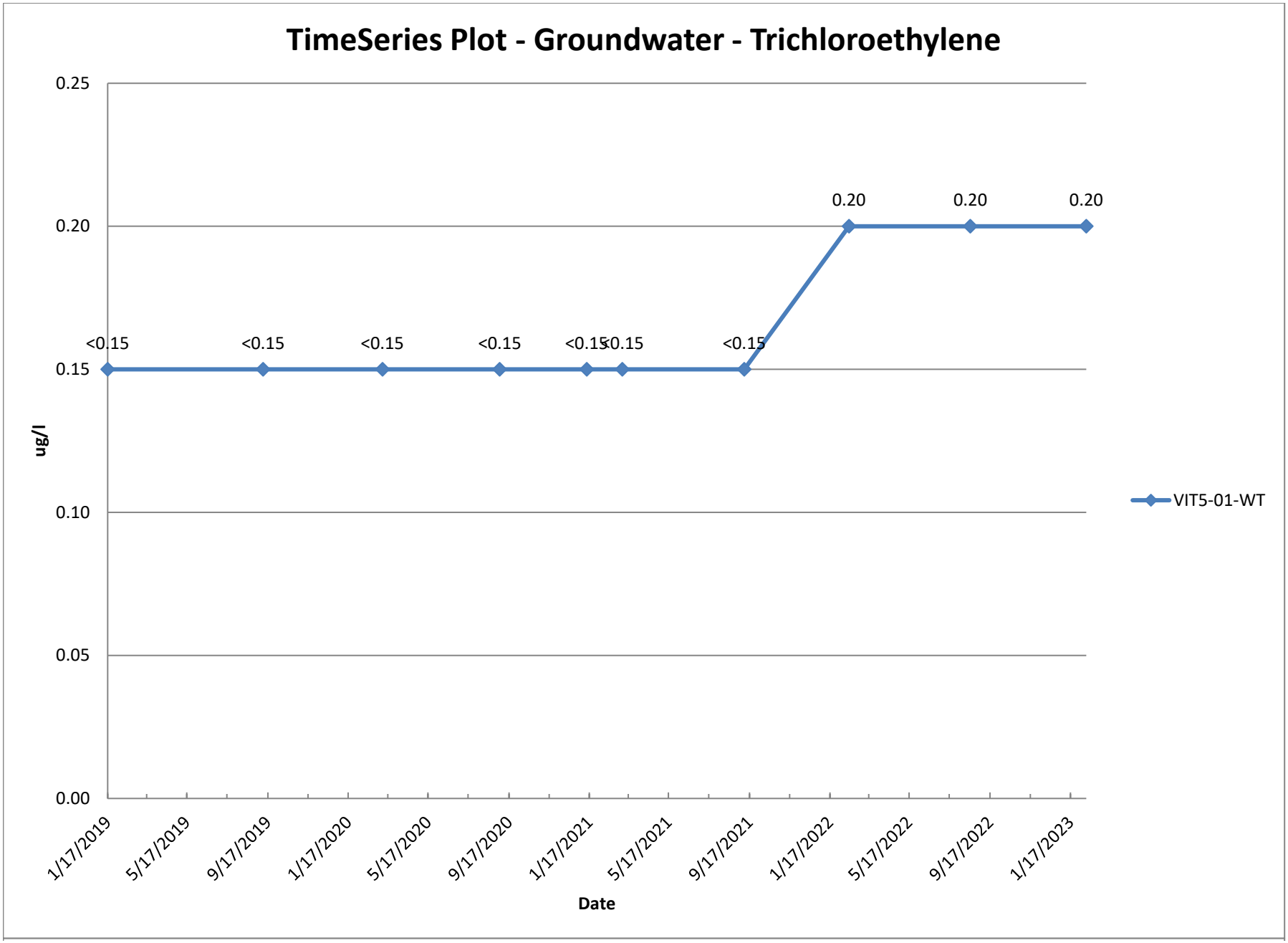

TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
0.044
0.014
9/10/2019
1/10/2020
5/10/2020
9/10/2020
1/10/2021
5/10/2021
9/10/2021
1/10/2022
5/10/2022
9/10/2022
1/10/2023
Date
VIT5-03-WT

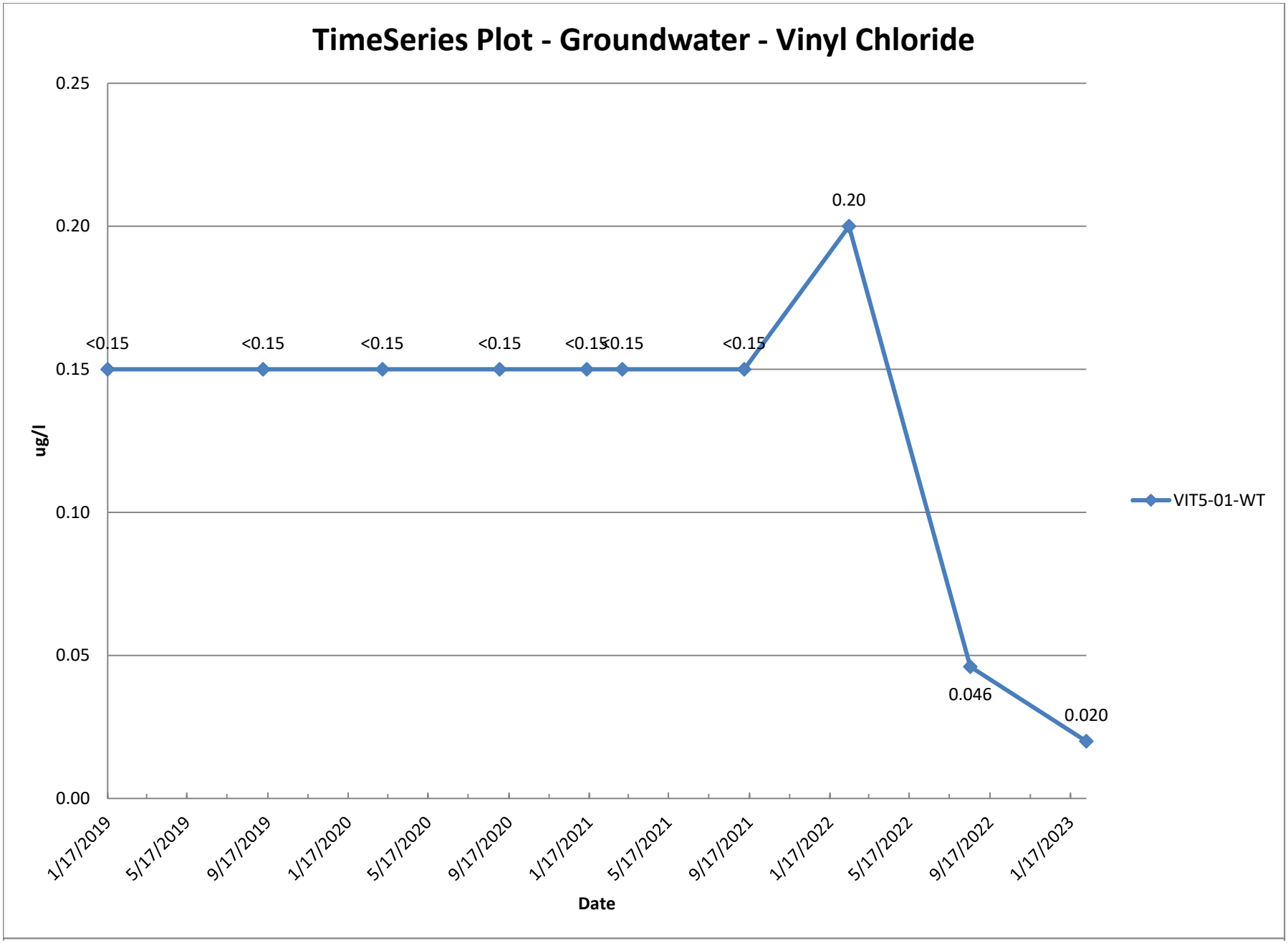

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.3
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.25
<0.25
<0.25
<0.25
<0.25
<0.25
<0.25
<0.2
<0.2
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-01-WT

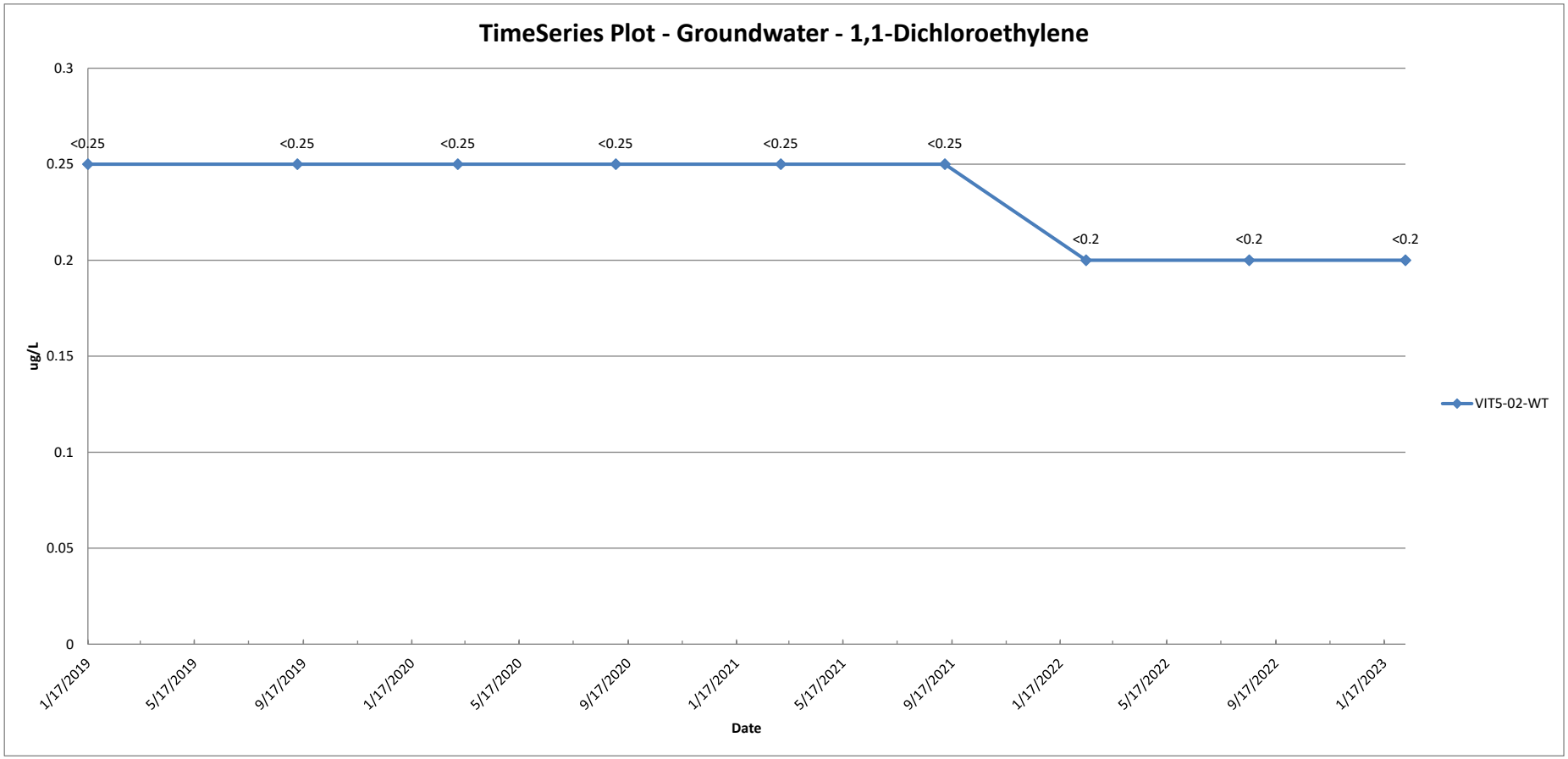

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.44
<0.47
<0.15
<0.15
<0.44
0.27
0.17
0.16
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-01-WT

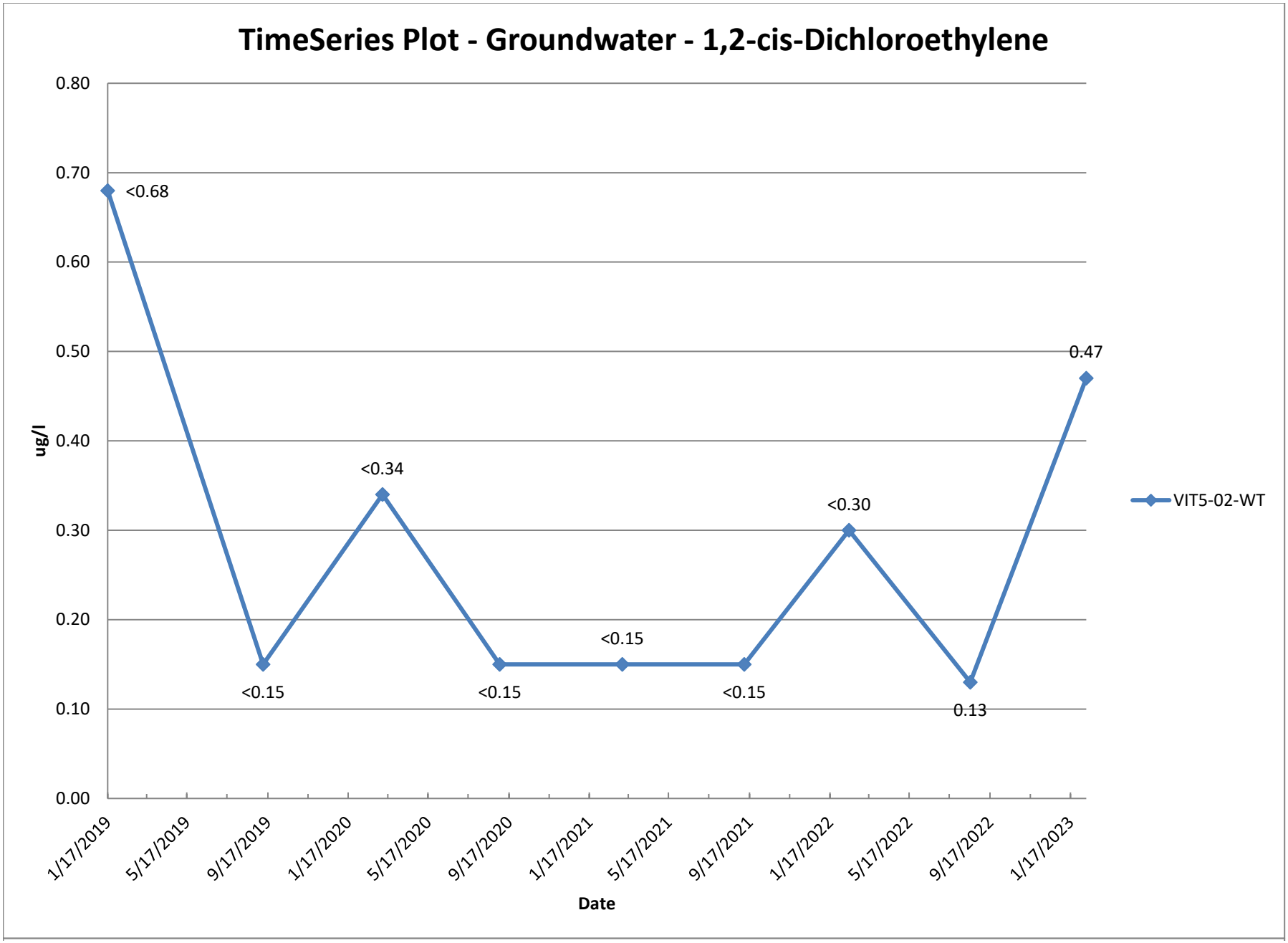

TimeSeries Plot - Groundwater - Tetrachloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.20
0.020
0.019
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-01-WT

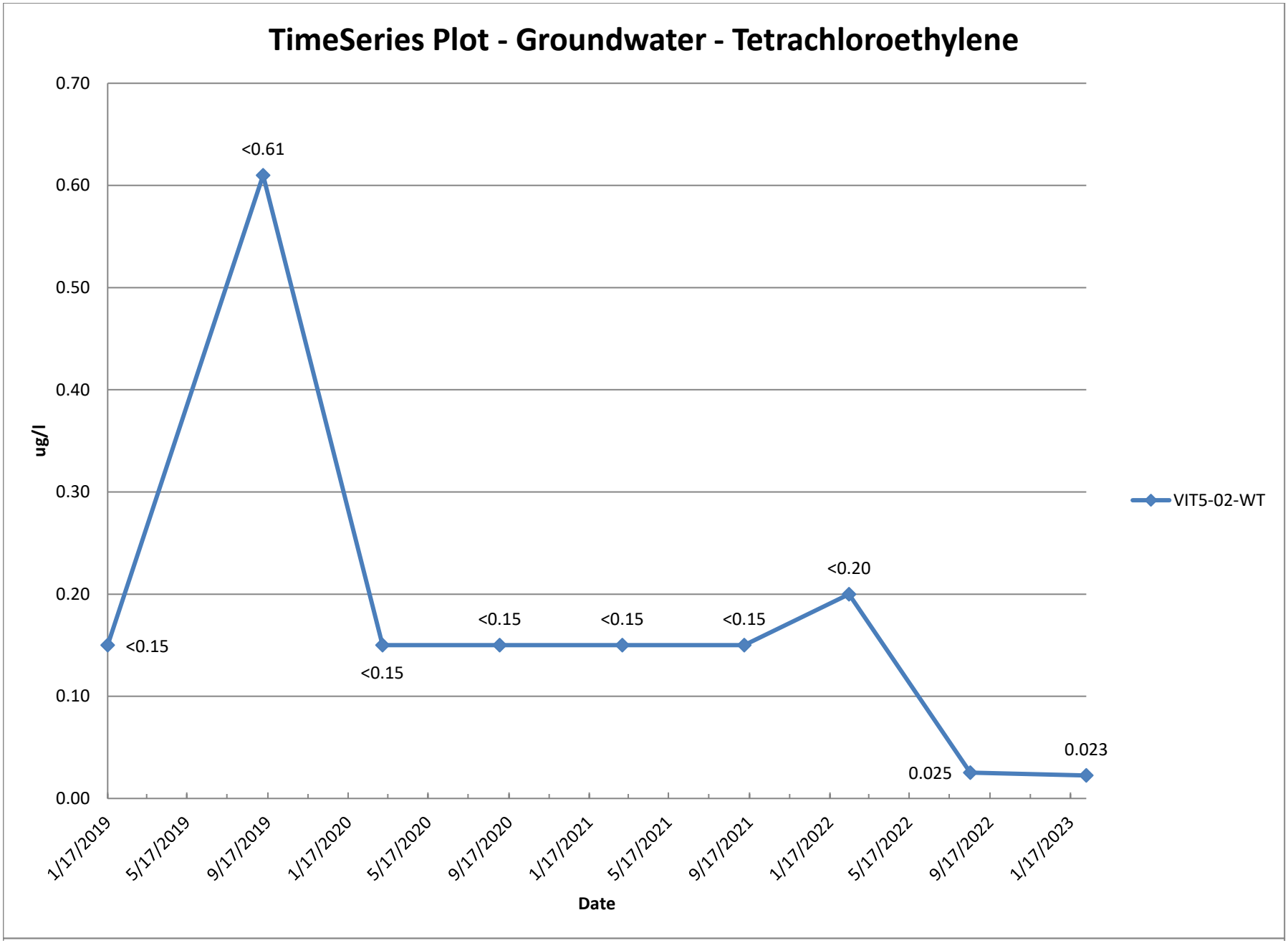

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.20
0.20
0.20
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-01-WT

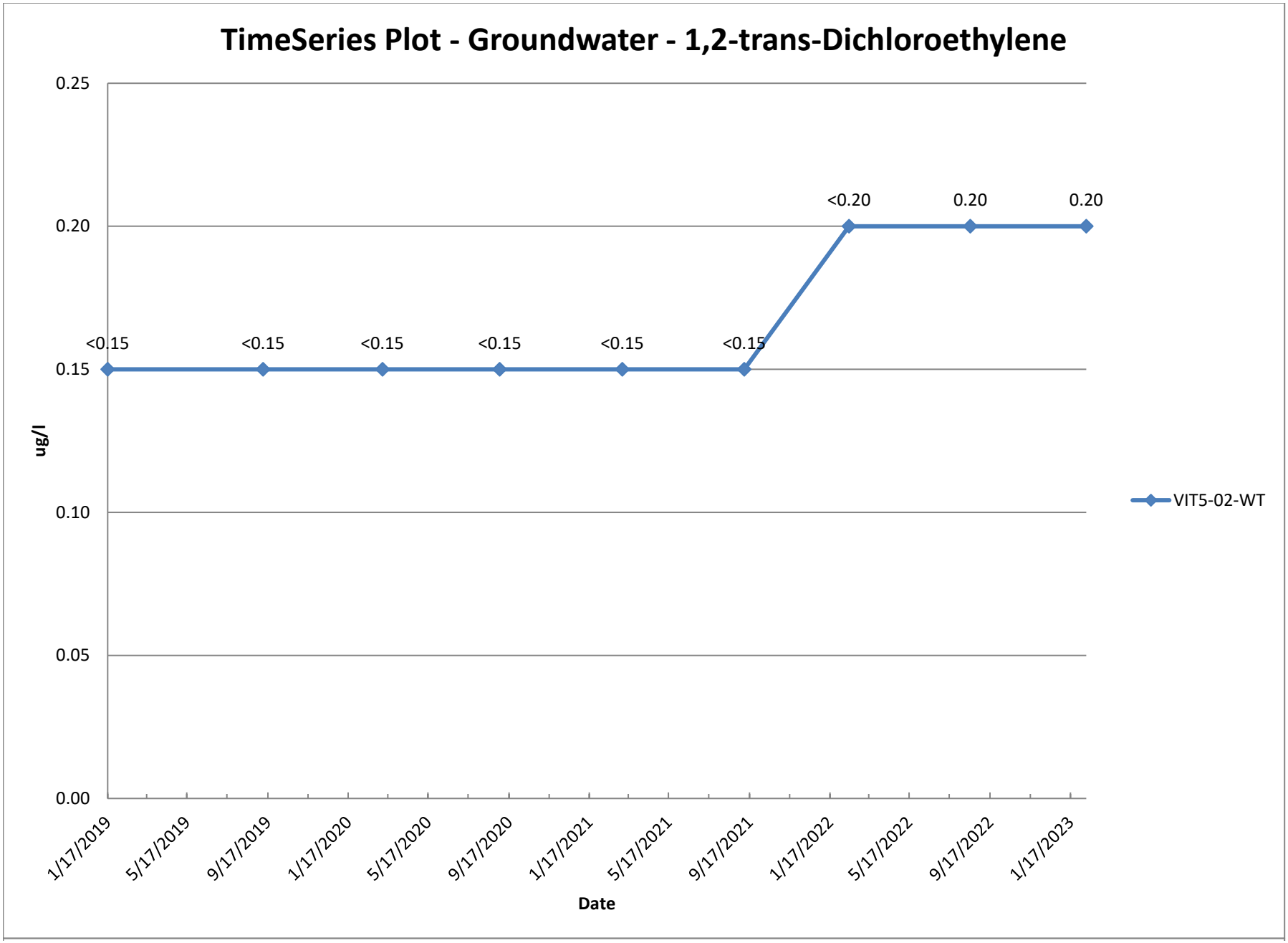

TimeSeries Plot - Groundwater - Trichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.20
0.20
0.20
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
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1/17/2023
Date
VIT5-01-WT

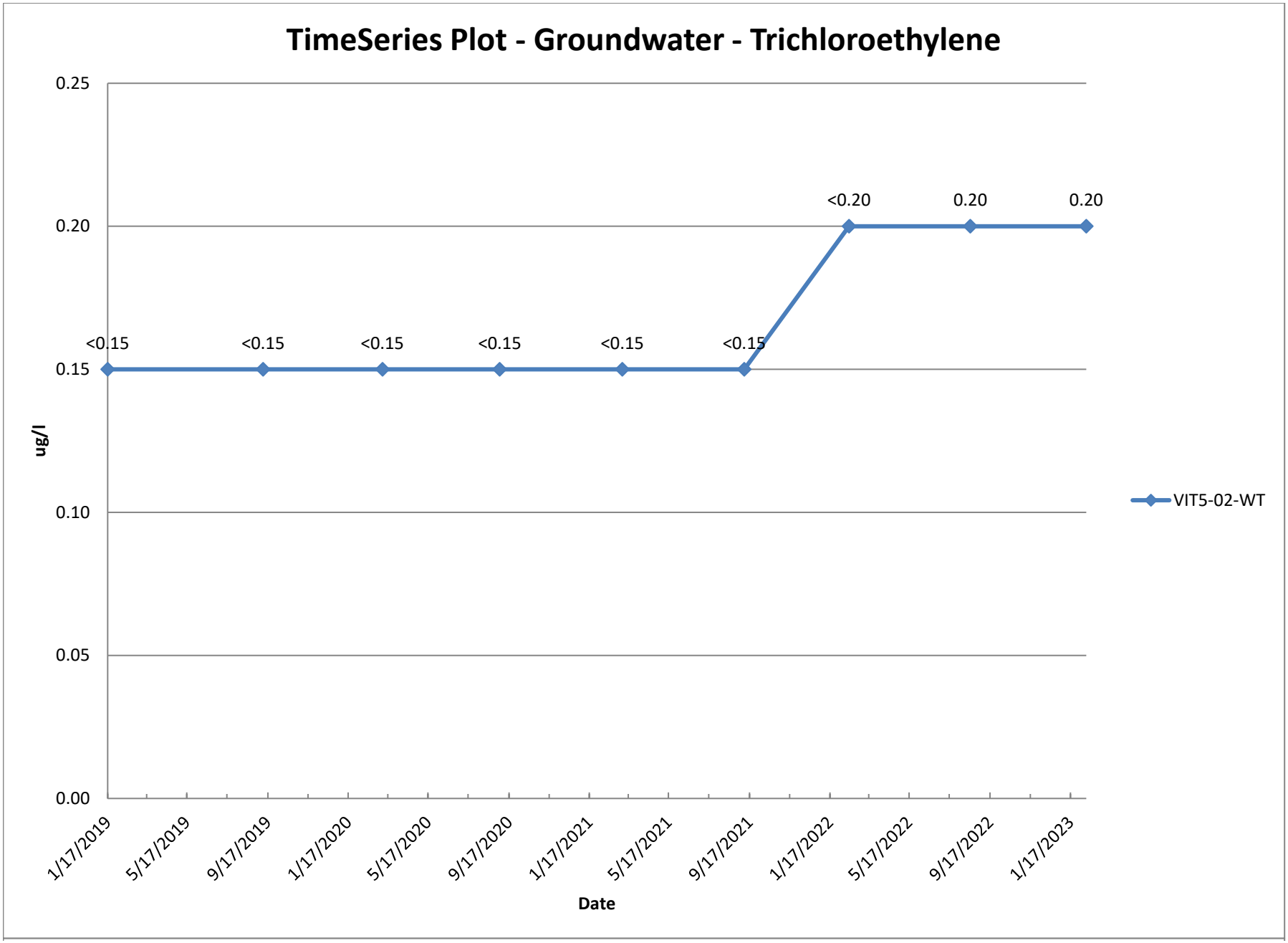

TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.20
0.046
0.020
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-01-WT

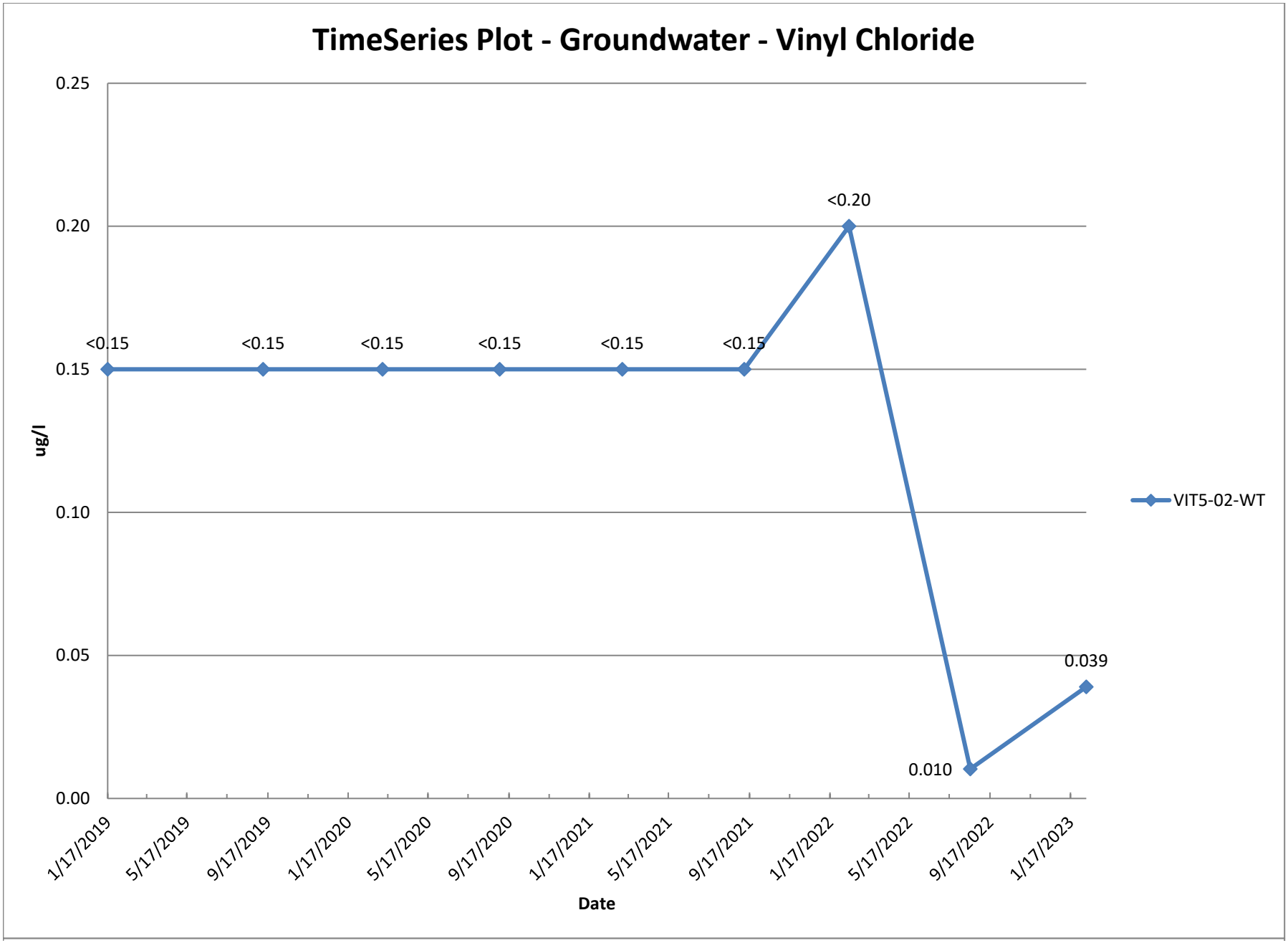

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.3
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.25
<0.25
<0.25
<0.25
<0.25
<0.25
<0.2
<0.2
<0.2
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-02-WT

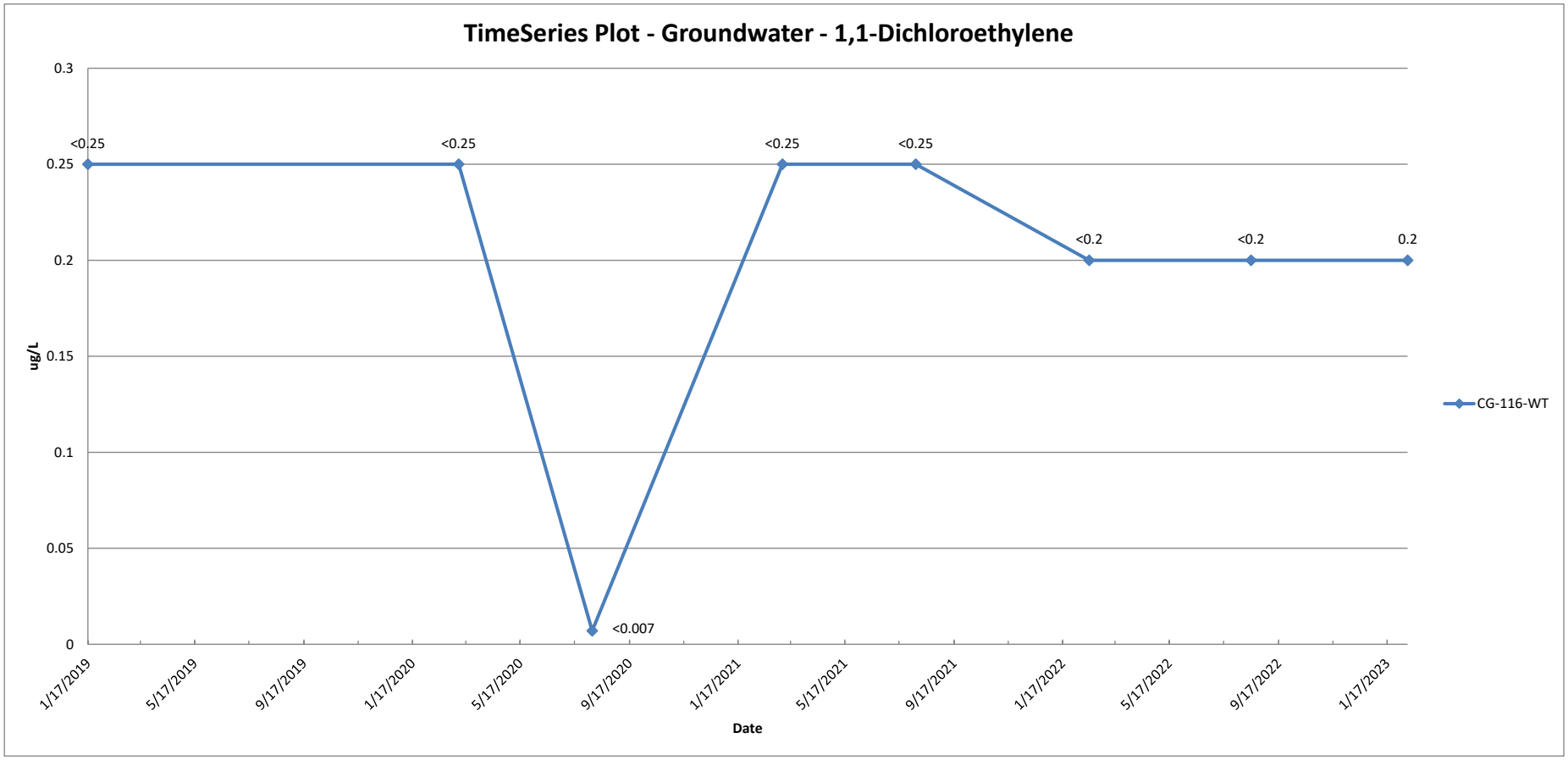

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
ug/l
<0.68
<0.15
<0.34
<0.15
<0.15
<0.15
<0.30
0.13
0.47
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
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1/17/2022
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1/17/2023
Date
VIT5-02-WT

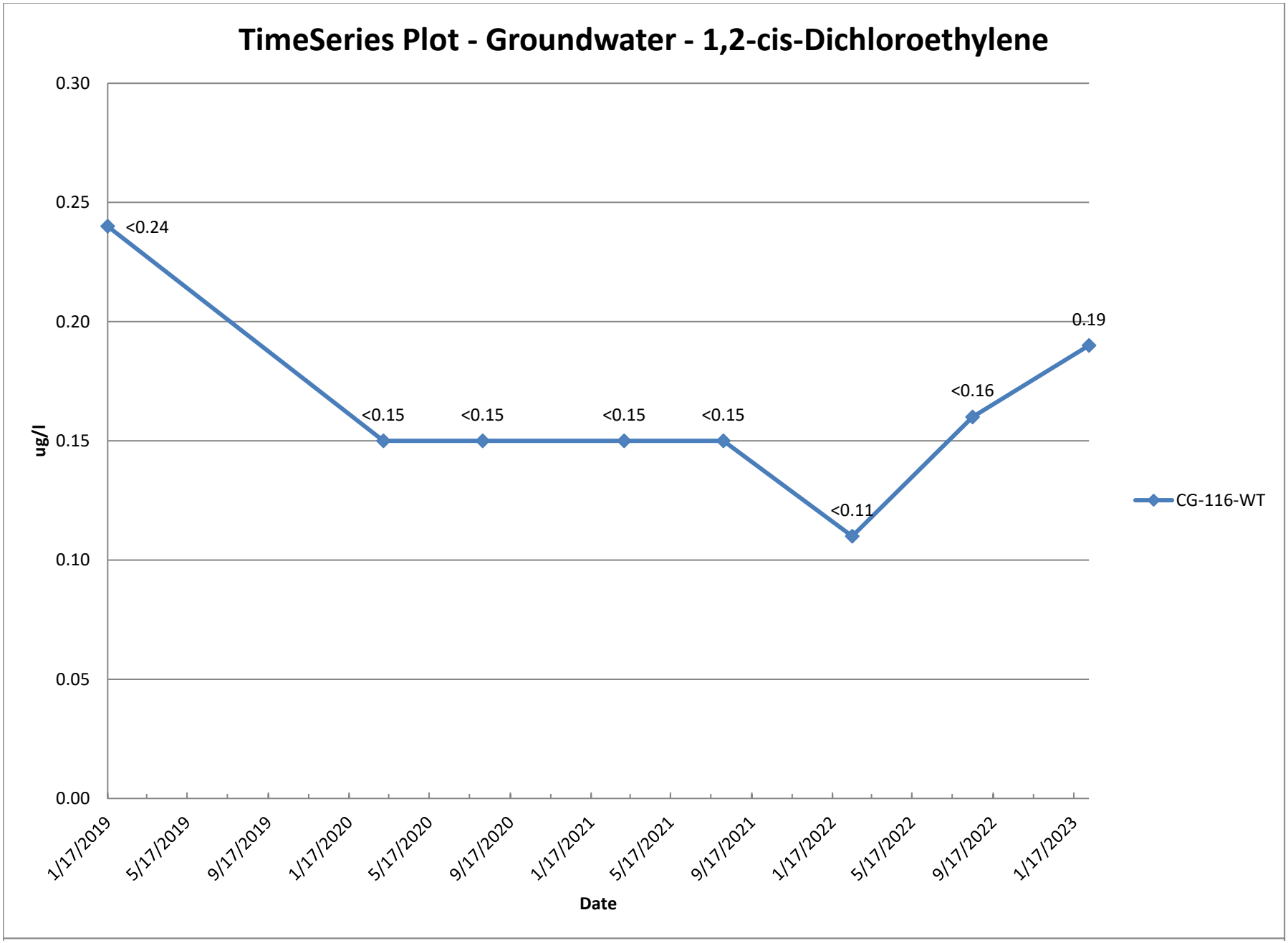

TimeSeries Plot - Groundwater - Tetrachloroethylene
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
ug/l
<0.61
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
0.025
0.023
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
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9/17/2022
1/17/2023
Date
VIT5-02-WT

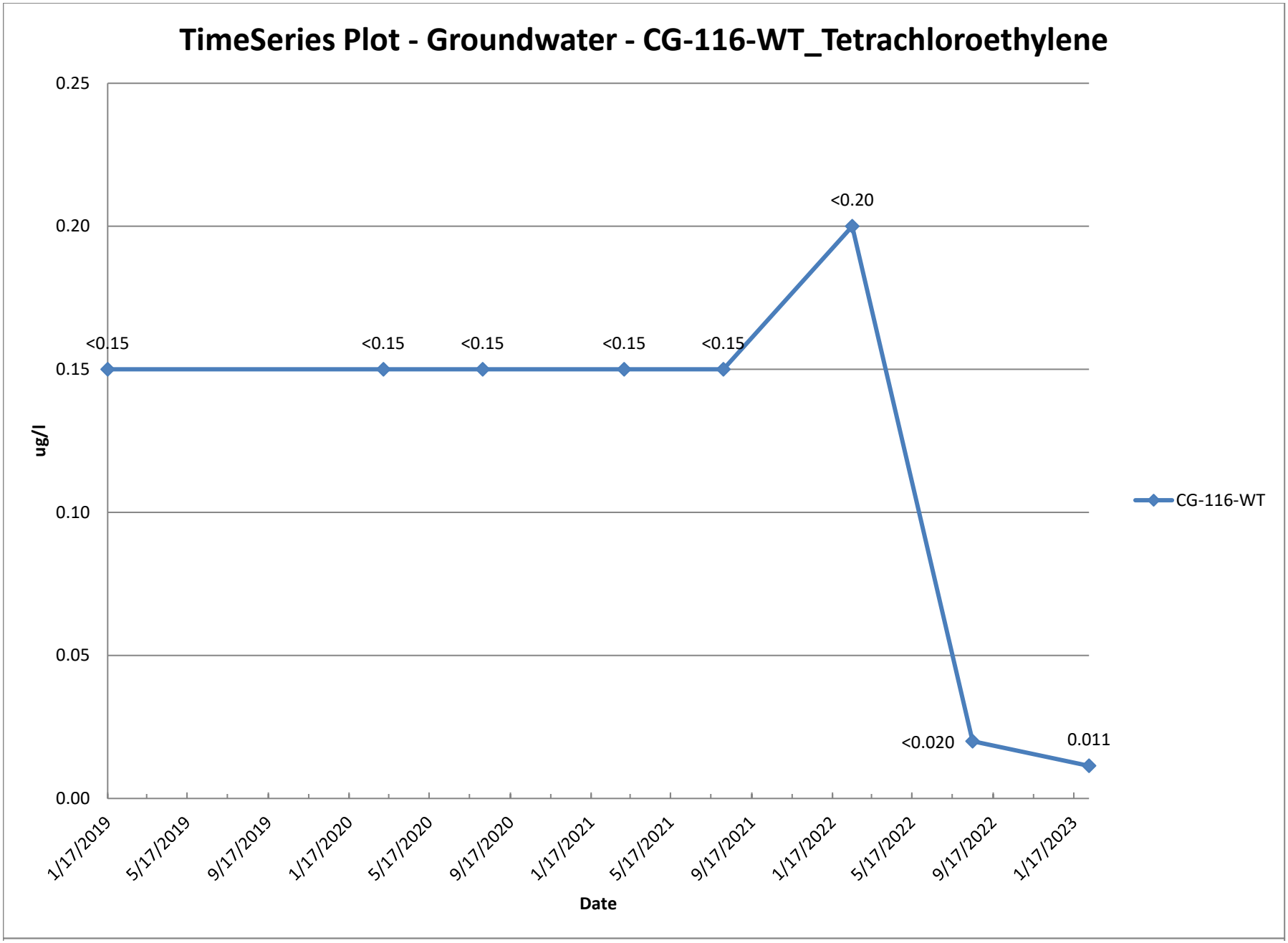

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
0.20
0.20
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-02-WT

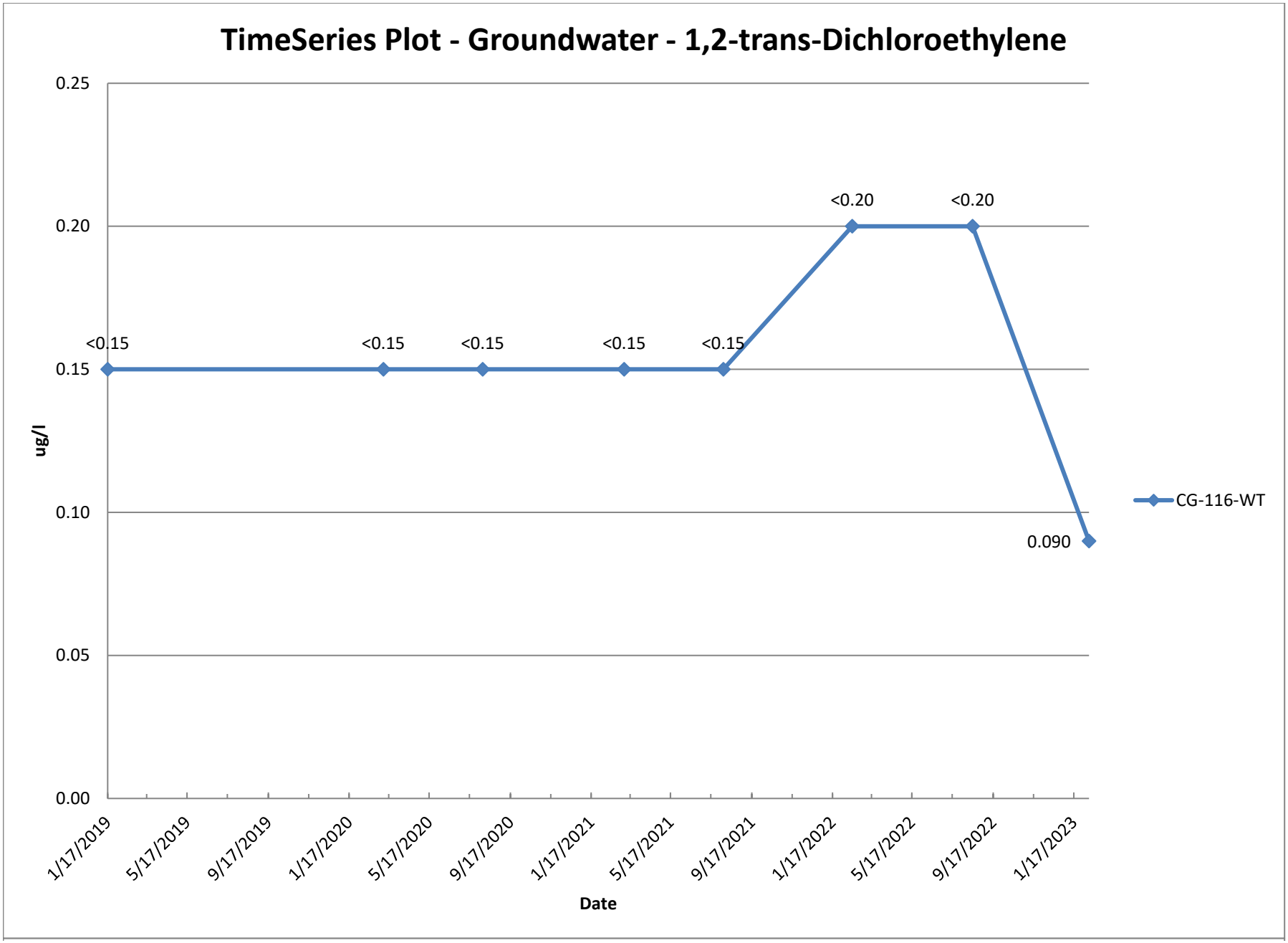

TimeSeries Plot - Groundwater - Trichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
0.20
0.20
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-02-WT

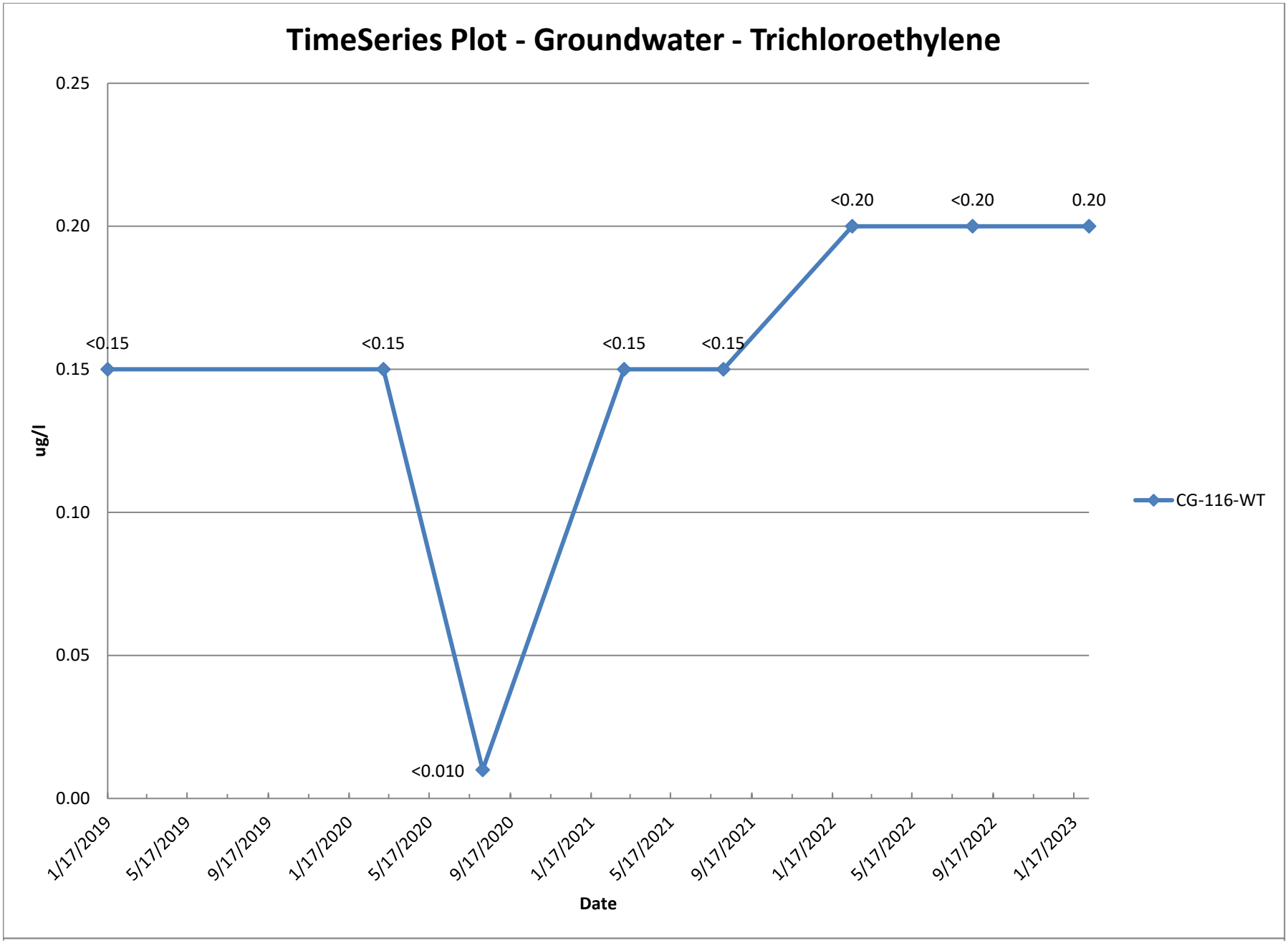

TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
0.010
0.039
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-02-WT

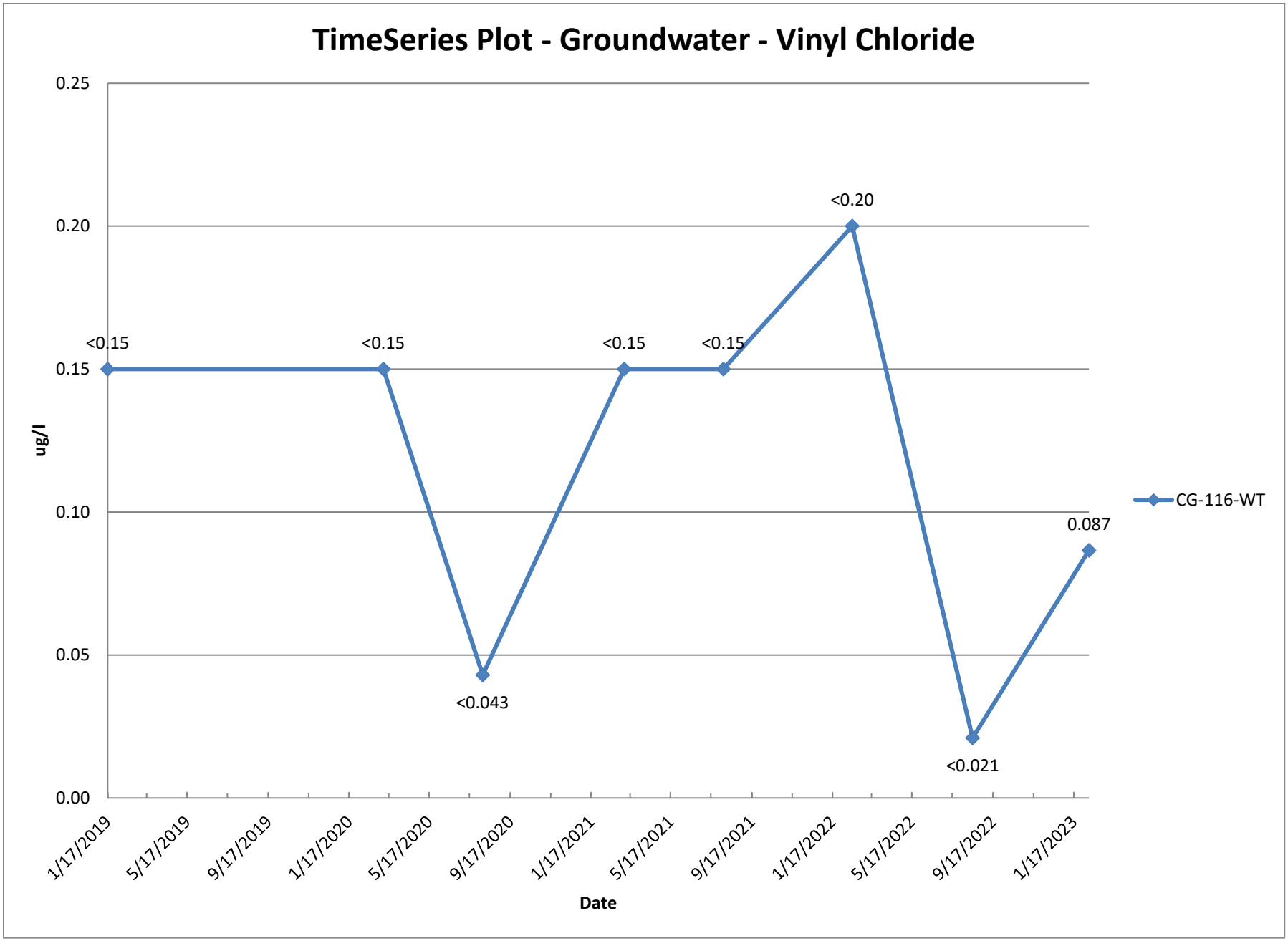

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.3
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.25
<0.25
<0.25
<0.25
<0.2
<0.2
0.2
<0.007
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

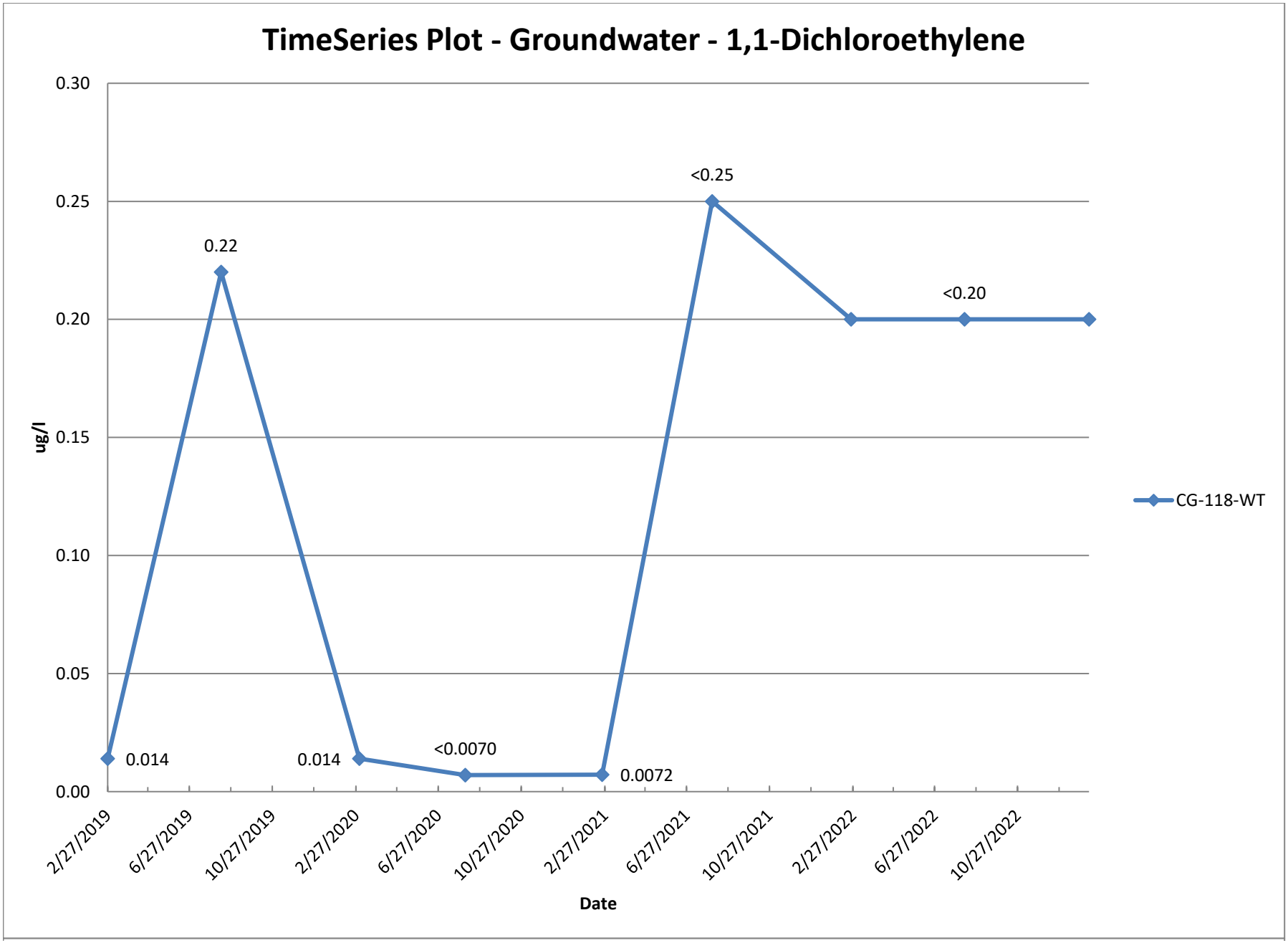

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.24
<0.15
<0.15
<0.15
<0.15
<0.11
<0.16
0.19
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

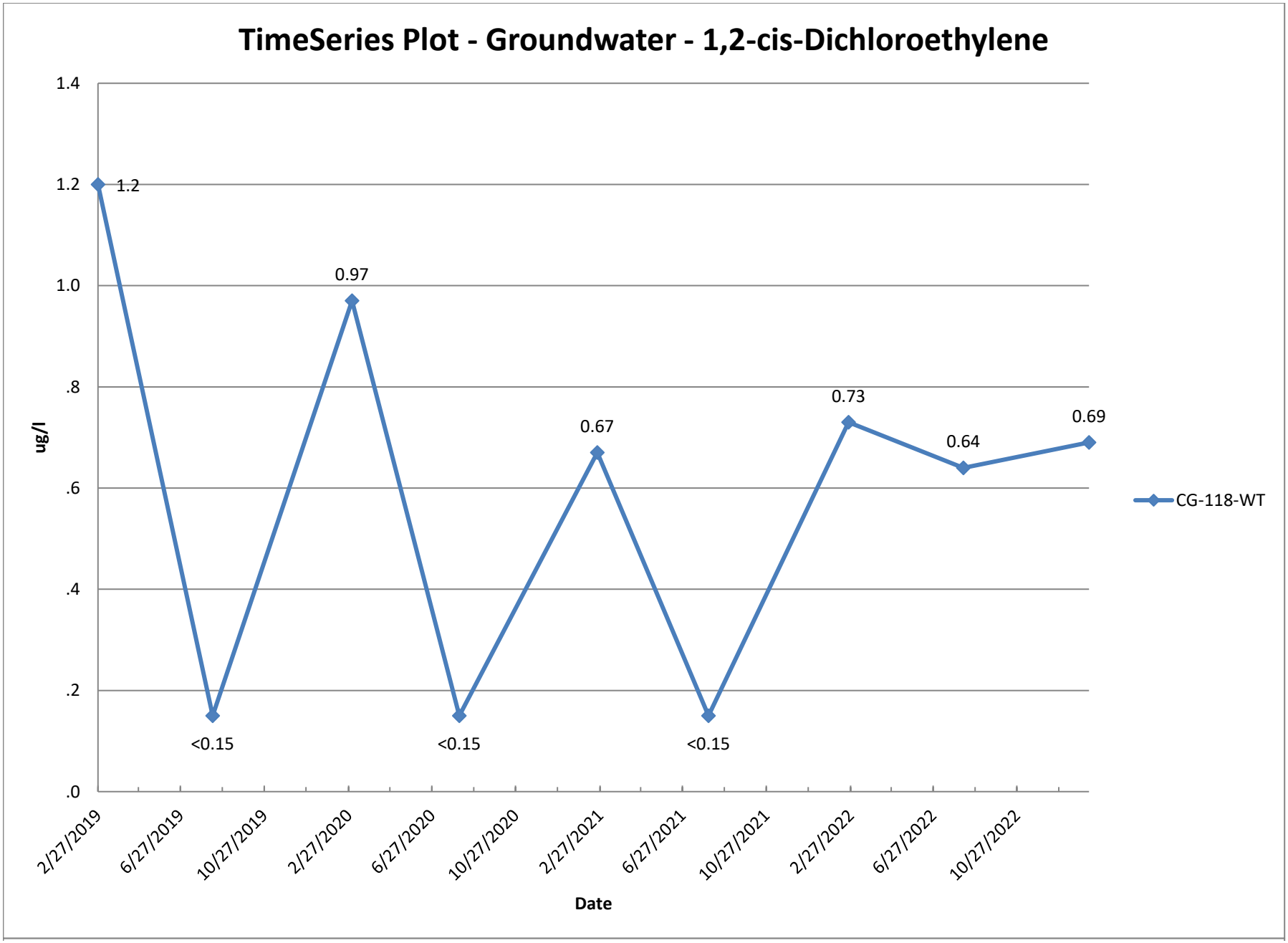

TimeSeries Plot - Groundwater - CG-116-WT_Tetrachloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
<0.020
0.011
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

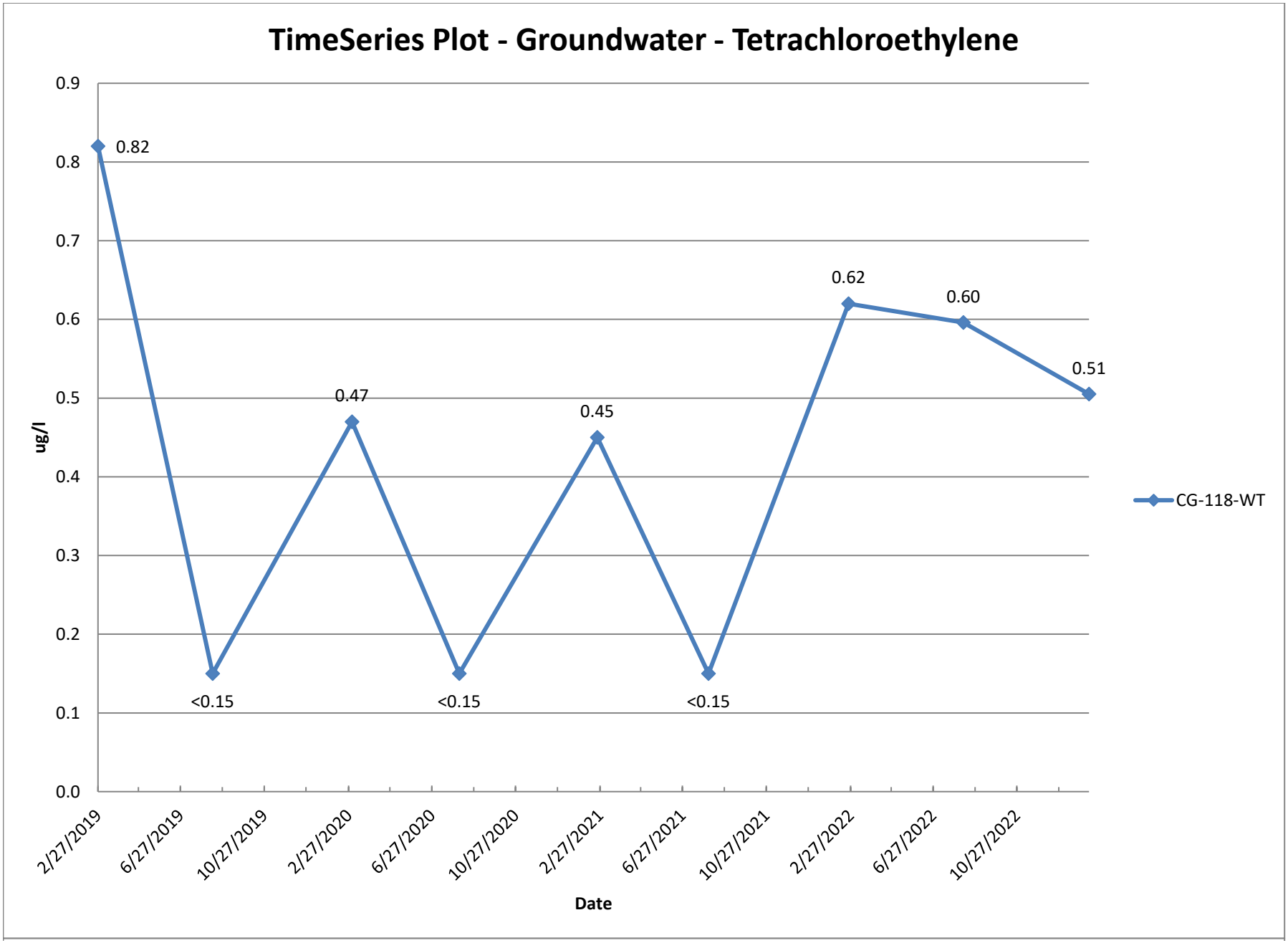

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
<0.20
0.090
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

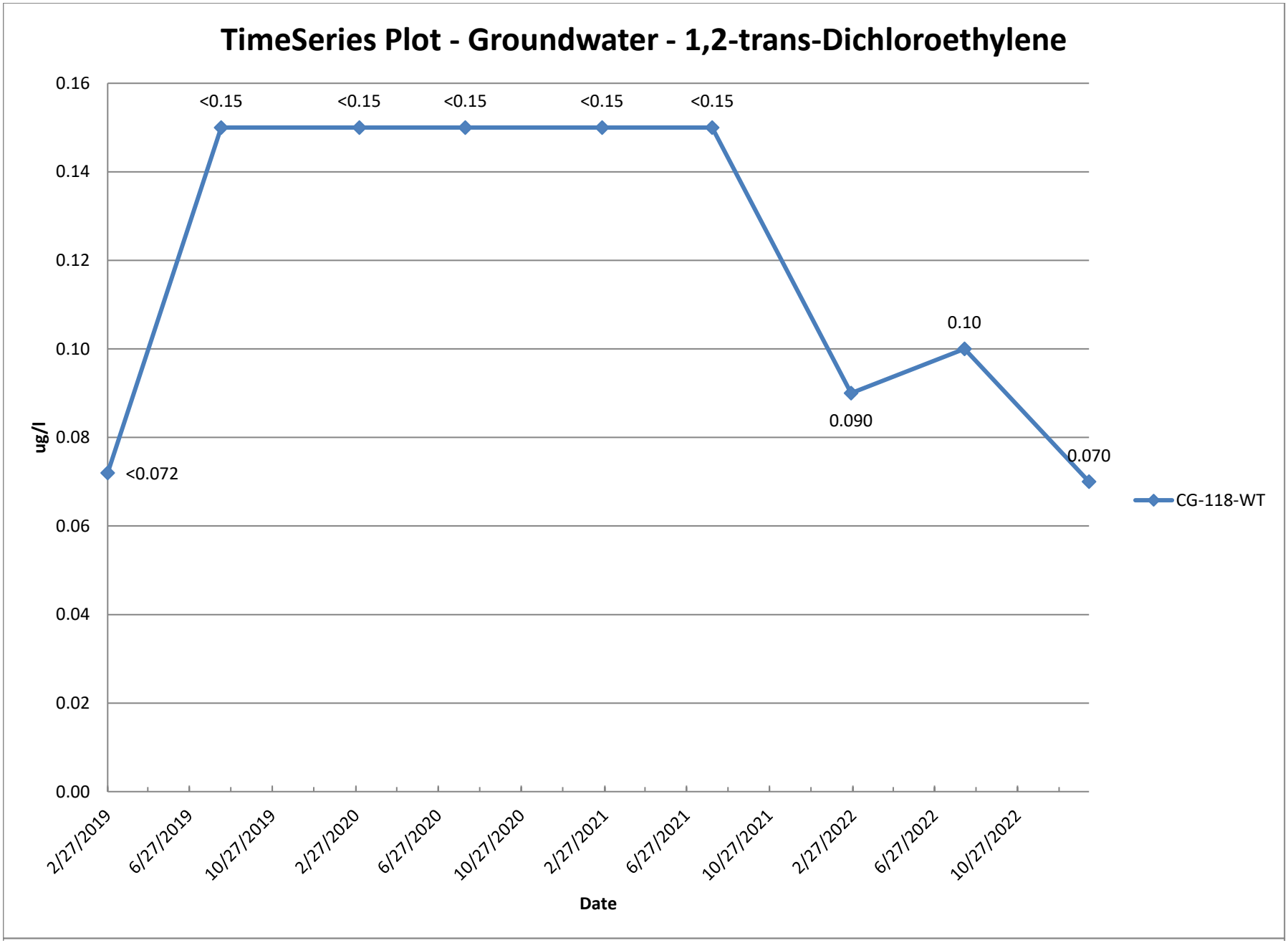

TimeSeries Plot - Groundwater - Trichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.010
<0.15
<0.15
<0.20
<0.20
0.20
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

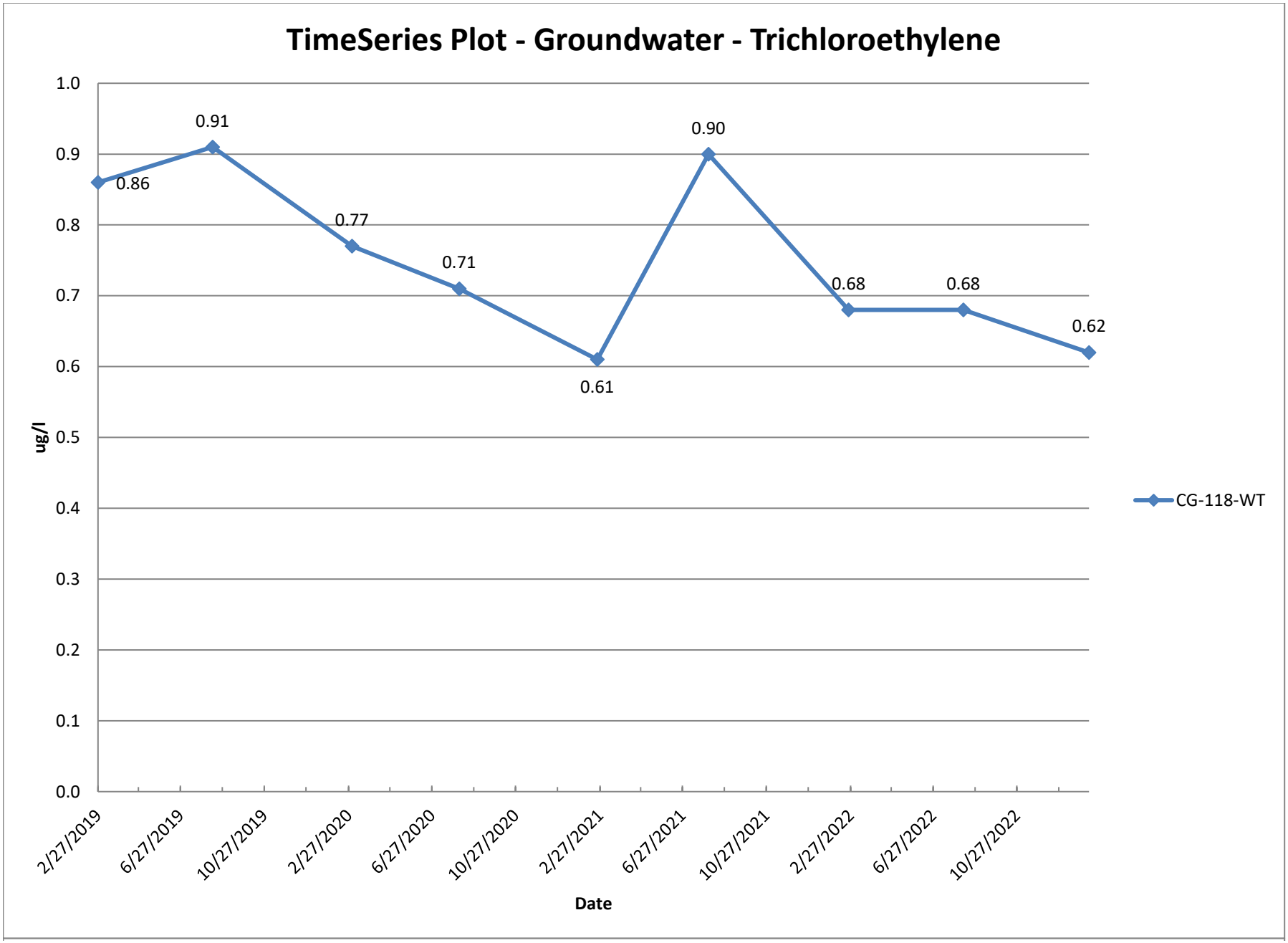

TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.20
<0.043
<0.021
0.087
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
CG-116-WT

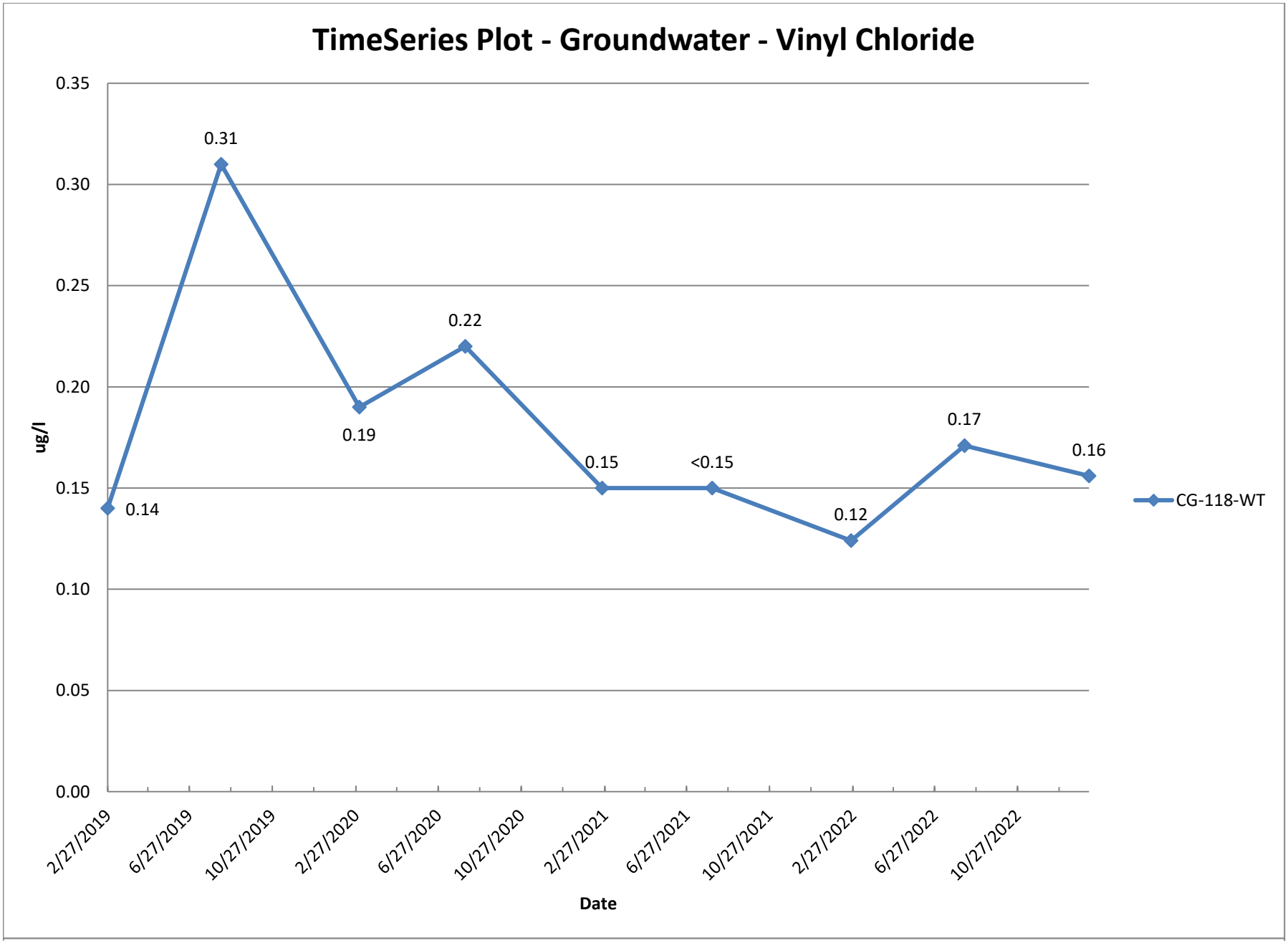

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
0.22
<0.25
<0.20
0.014
0.014
<0.0070
0.0072
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-118-WT

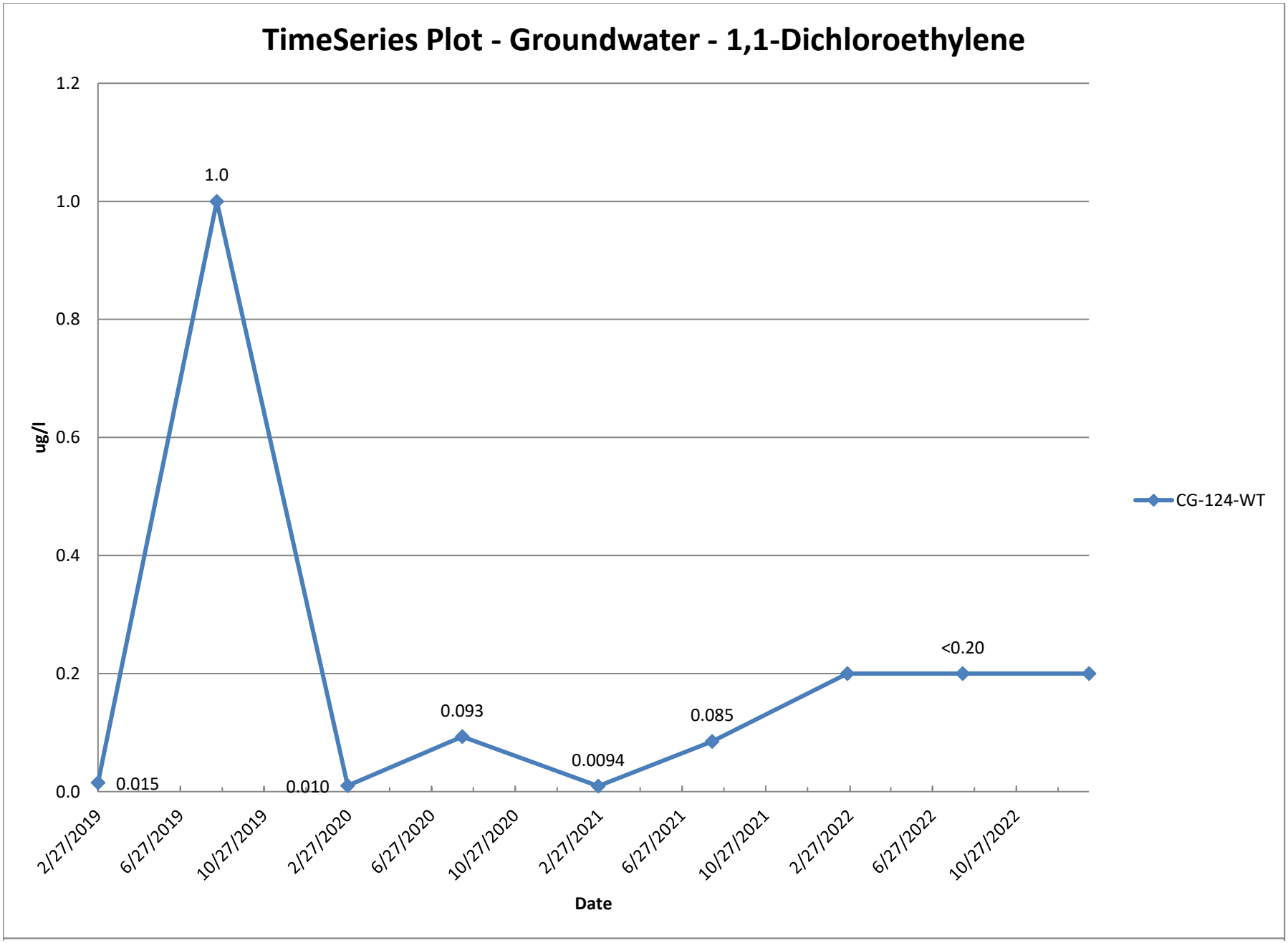

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
1.4
1.2
1.0
.8
.6
.4
.2
.0
ug/l
1.2
<0.15
0.97
<0.15
0.67
<0.15
0.73
0.64
0.69
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-118-WT

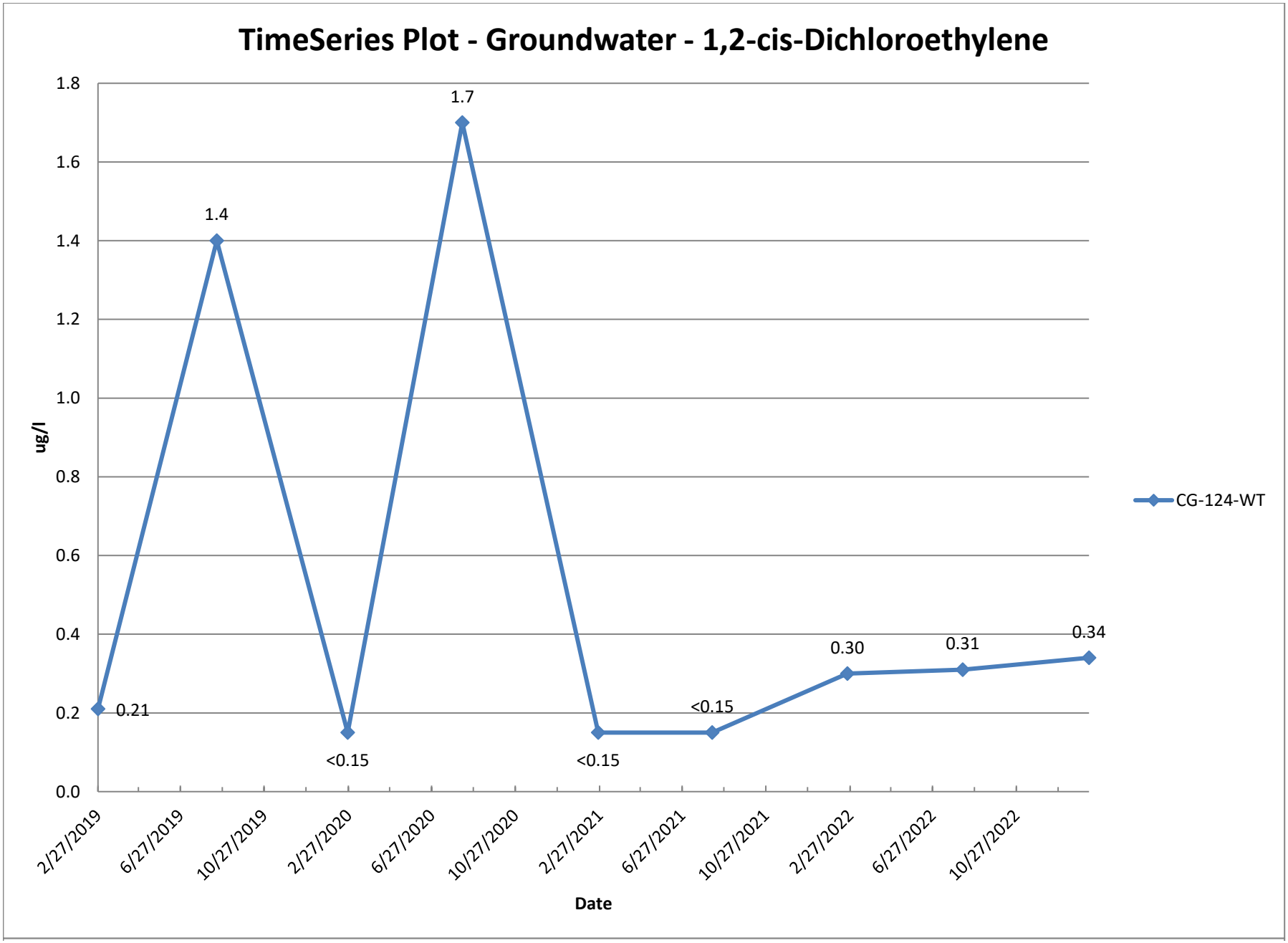

TimeSeries Plot - Groundwater - Tetrachloroethylene
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
ug/l
0.82
<0.15
0.47
<0.15
0.45
<0.15
0.62
0.60
0.51
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-118-WT

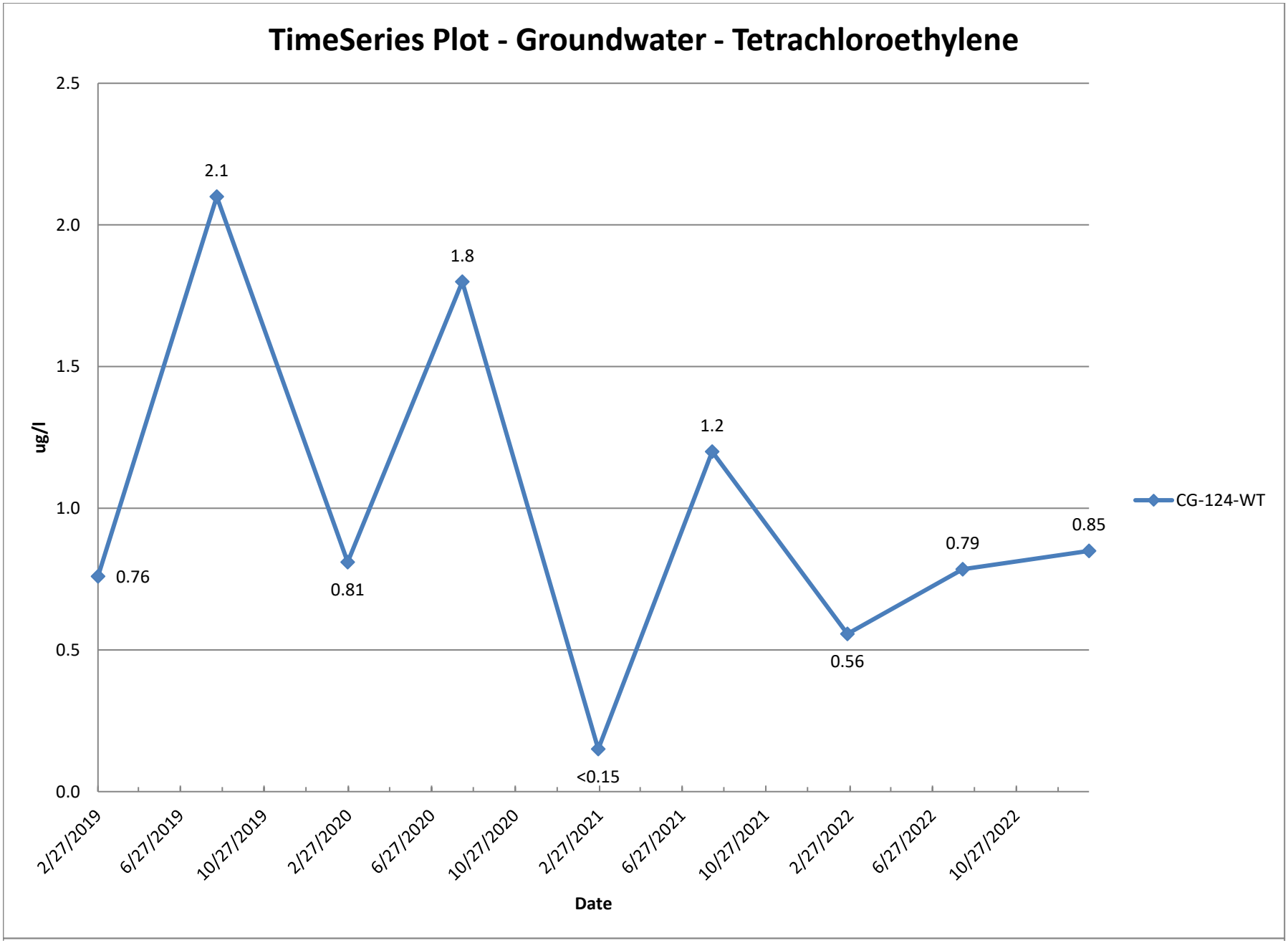

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.15
0.10
0.090
0.070
<0.072
CG-118-WT
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date

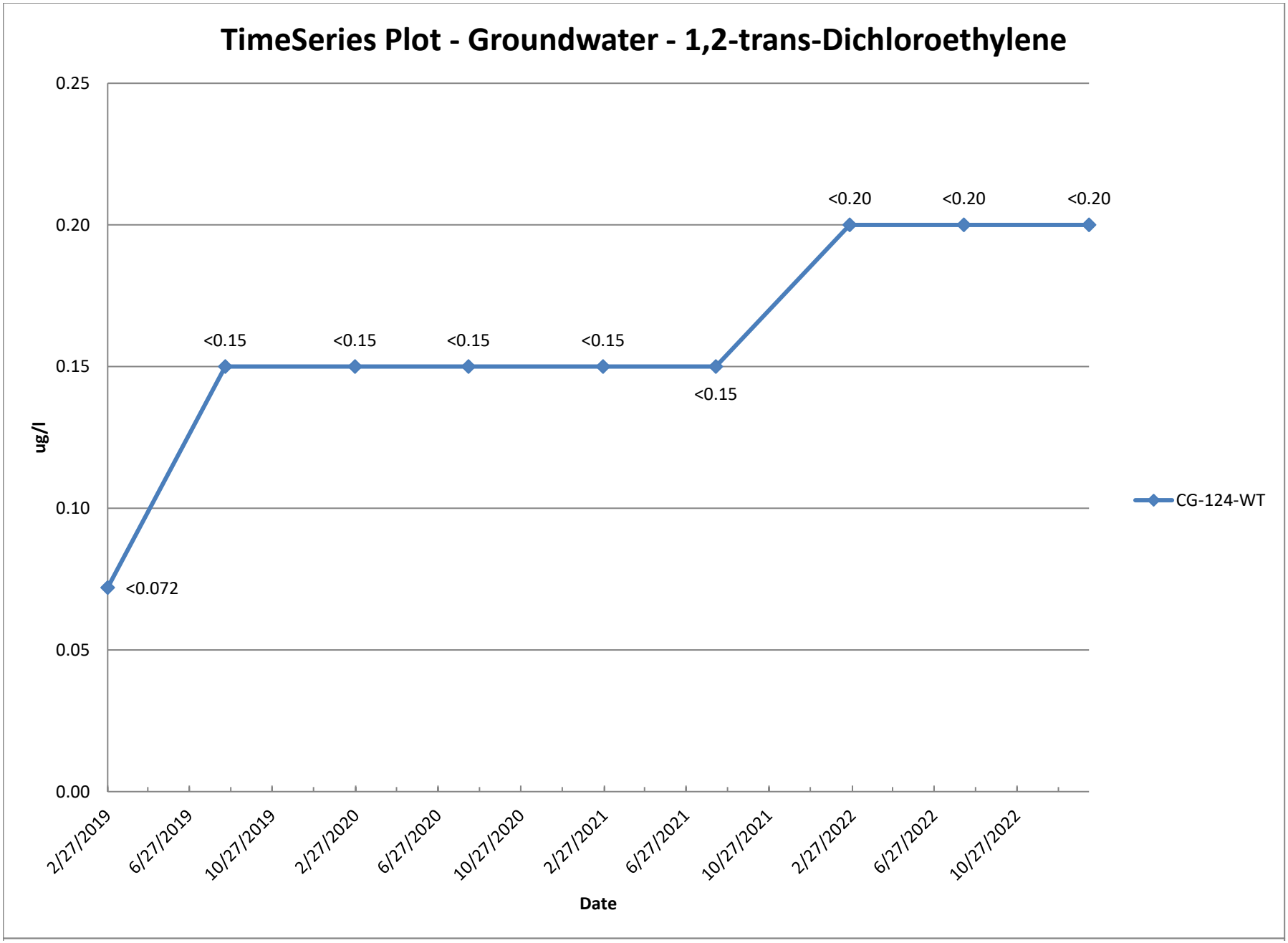

TimeSeries Plot - Groundwater - Trichloroethylene
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
ug/l
0.86
0.91
0.77
0.71
0.61
0.90
0.68
0.68
0.62
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-118-WT

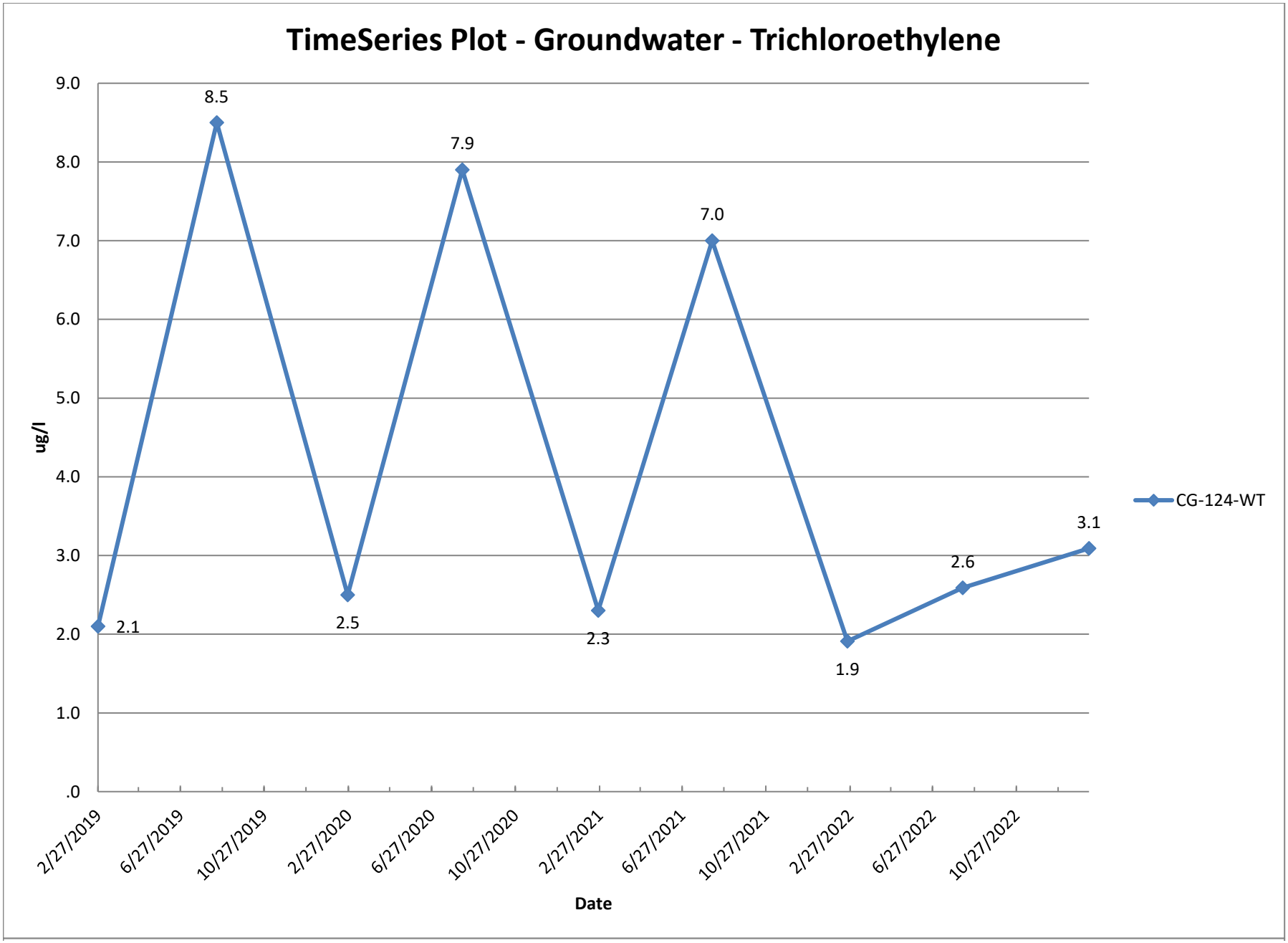

TimeSeries Plot - Groundwater - Vinyl Chloride
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
0.31
0.22
0.19
0.15
<0.15
0.17
0.16
0.14
0.12
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-118-WT

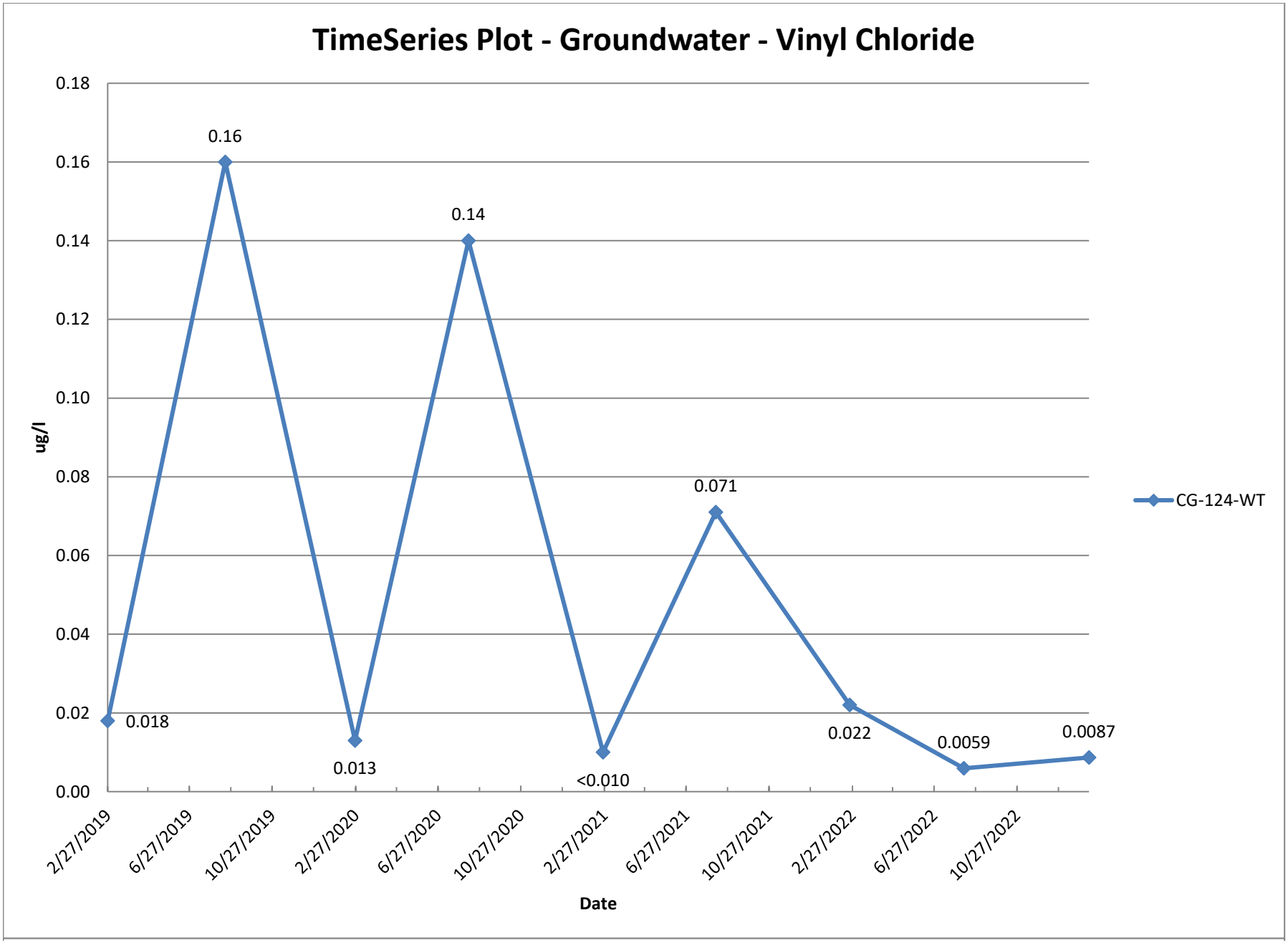

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ug/l
1.0
0.015
0.010
0.093
0.0094
0.085
<0.20
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-124-WT

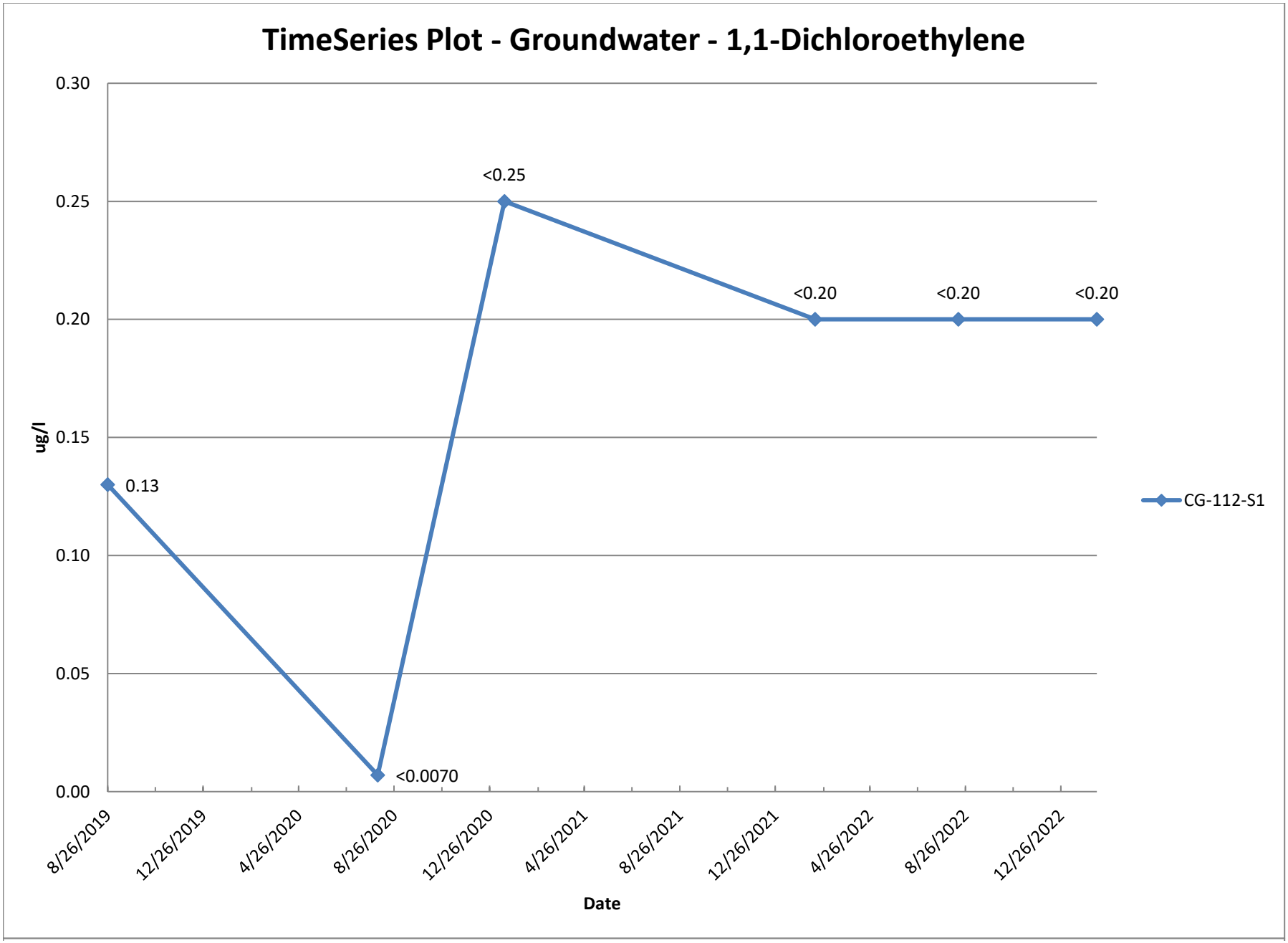

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ug/l
1.7
1.4
0.21
<0.15
<0.15
<0.15
0.30
0.31
0.34
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-124-WT

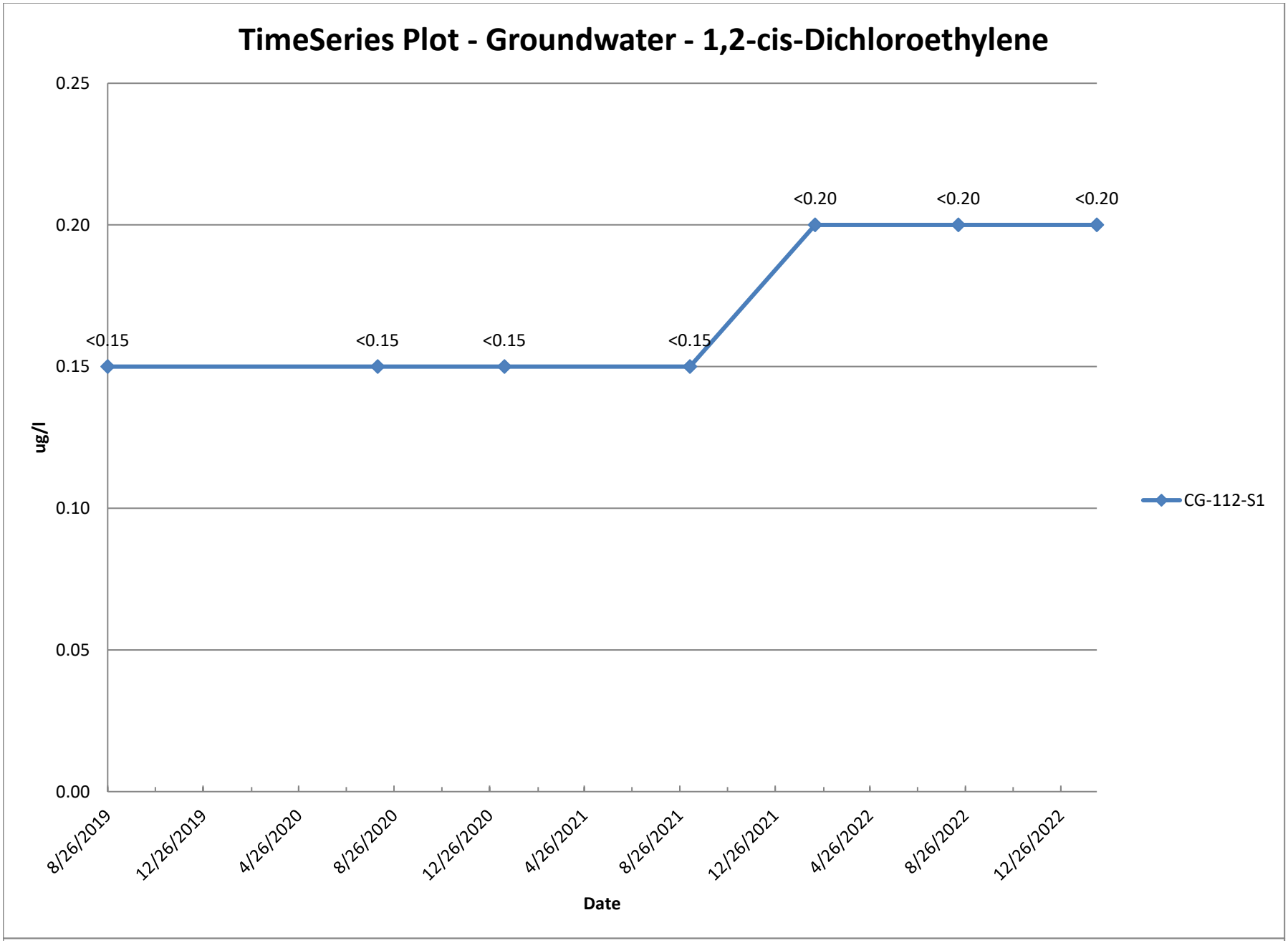

TimeSeries Plot - Groundwater - Tetrachloroethylene
2.5
2.0
1.5
1.0
0.5
0.0
ug/l
2.1
1.8
1.2
0.76
0.81
<0.15
0.56
0.79
0.85
CG-124-WT
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date

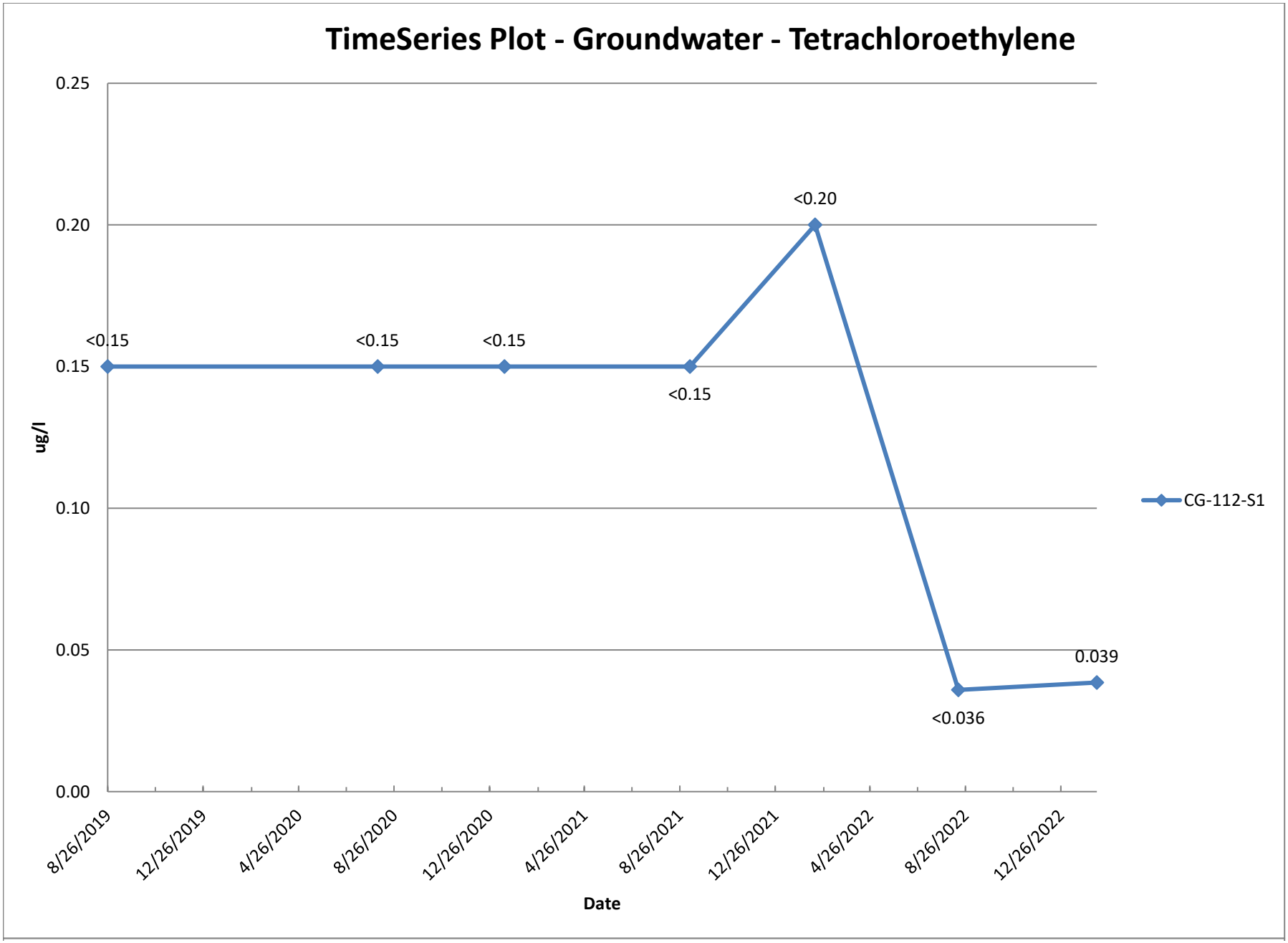

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.072
<0.15
<0.15
<0.15
<0.15
<0.15
<0.20
<0.20
<0.20
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-124-WT

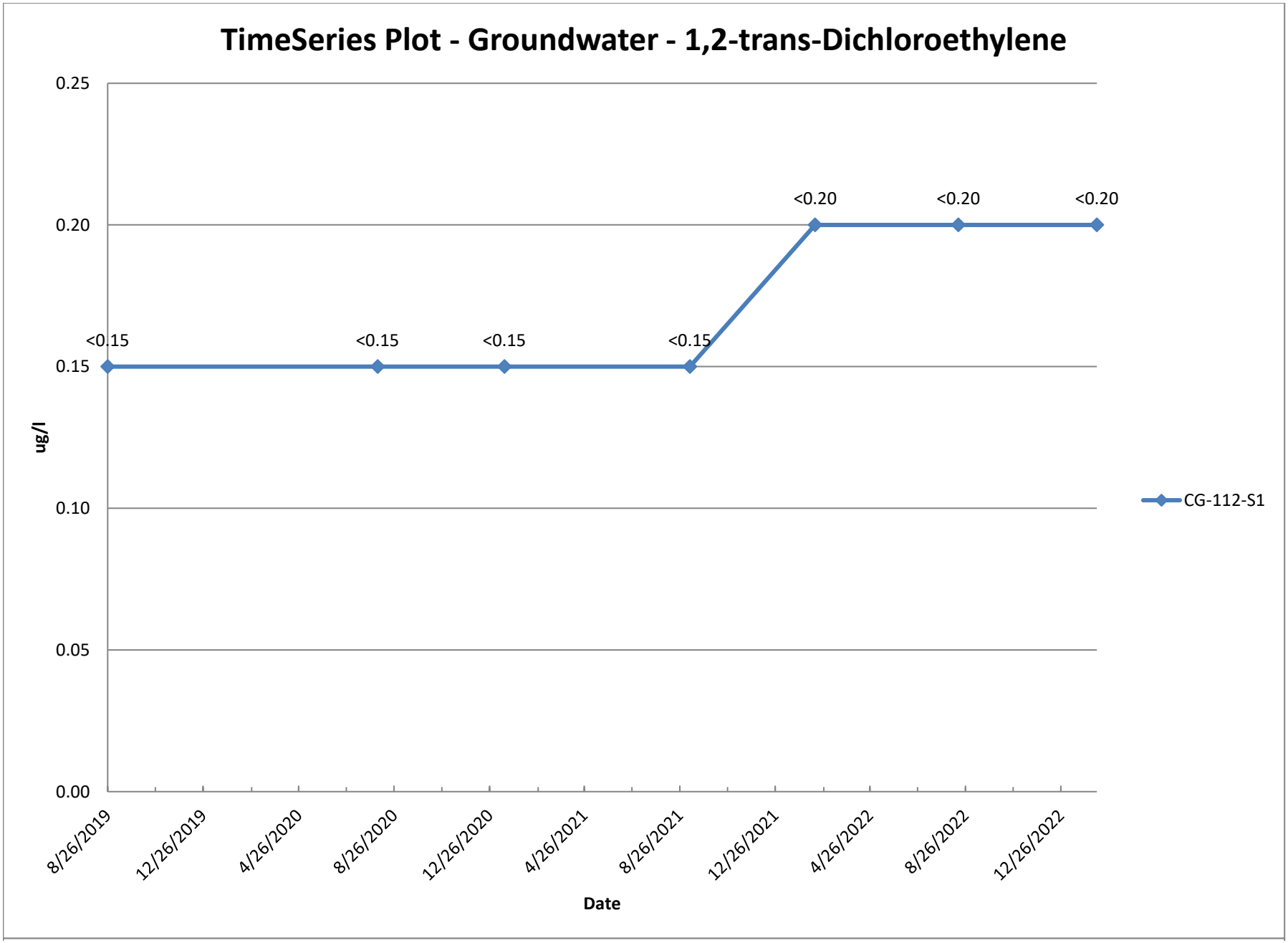

TimeSeries Plot - Groundwater - Trichloroethylene
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.0
ug/l
8.5
7.9
7.0
3.1
2.6
2.1
2.5
2.3
1.9
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-124-WT

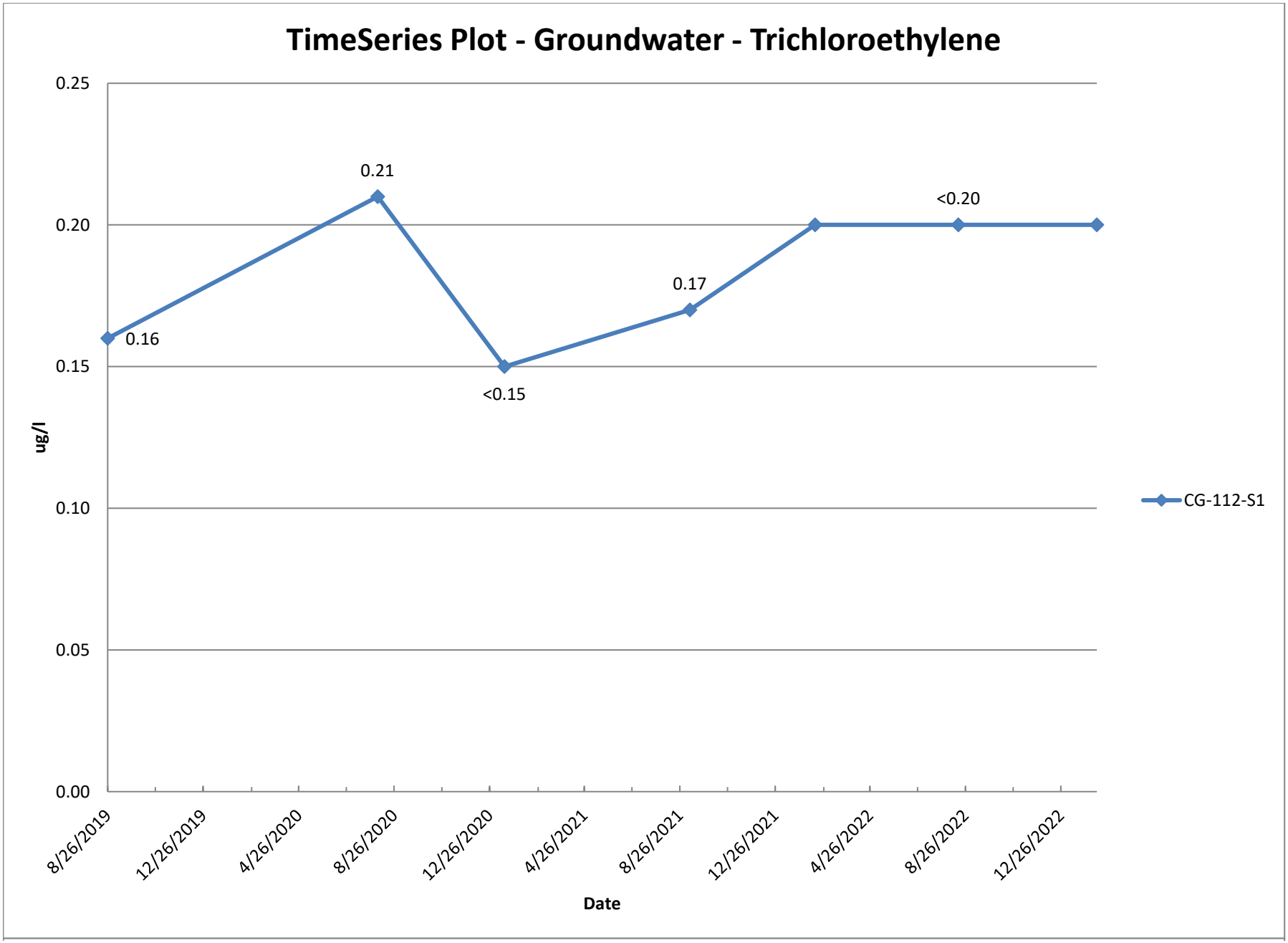

TimeSeries Plot - Groundwater - Vinyl Chloride
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
ug/l
0.16
0.14
0.071
0.018
0.013
<0.010
0.022
0.0059
0.0087
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
Date
CG-124-WT

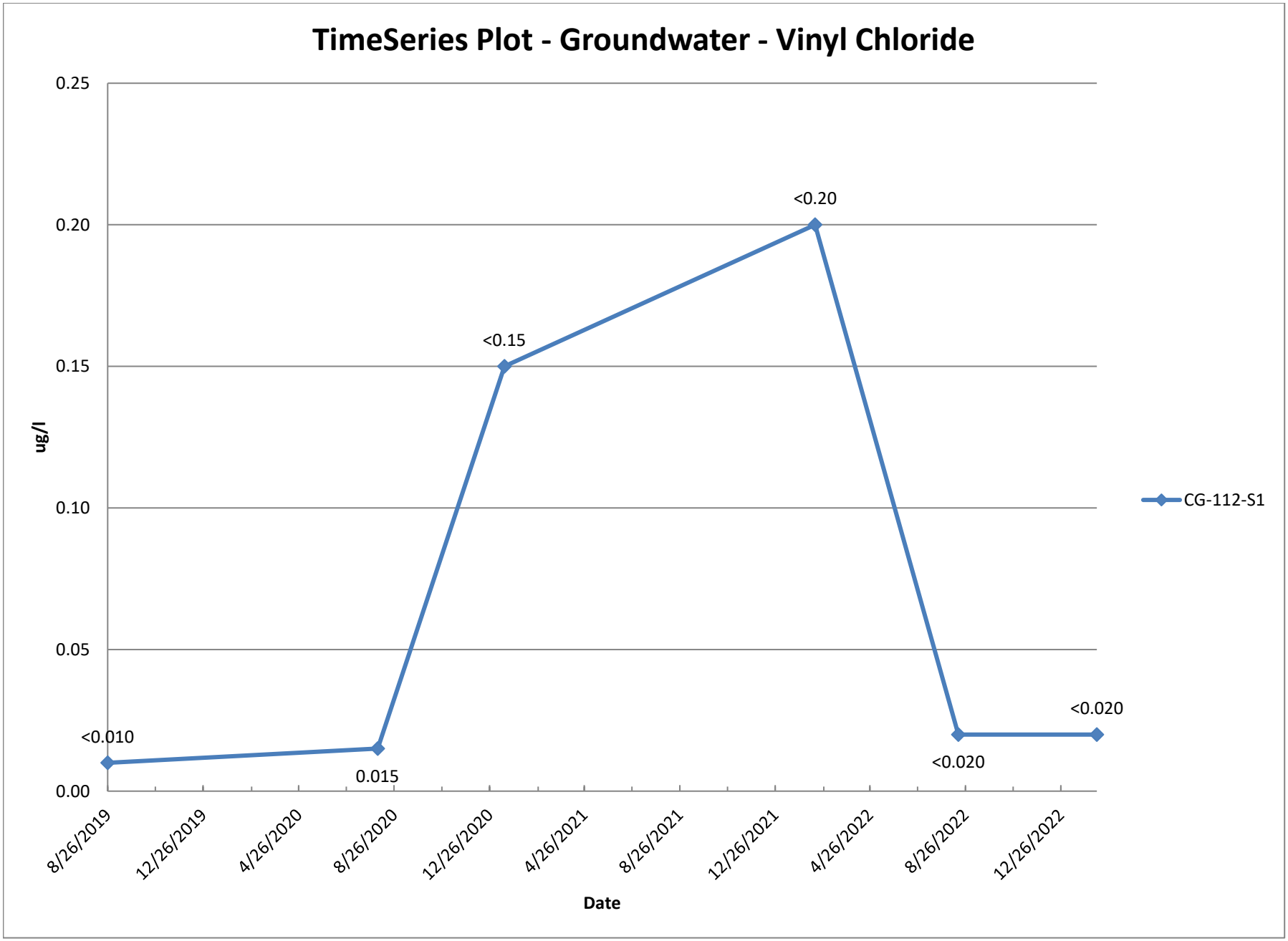

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
0.13
<0.0070
<0.25
<0.20
<0.20
<0.20
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1


TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.20
<0.20
<0.20
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1


TimeSeries Plot - Groundwater - Tetrachloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.20
<0.036
0.039
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1


TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.15
<0.15
<0.15
<0.15
<0.20
<0.20
<0.20
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1


TimeSeries Plot - Groundwater - Trichloroethylene
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
0.16
0.21
<0.15
0.17
<0.20
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1


TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.20
0.15
0.10
0.05
0.00
ug/l
<0.010
0.015
<0.15
<0.20
<0.020
<0.020
8/26/2019
12/26/2019
4/26/2020
8/26/2020
12/26/2020
4/26/2021
8/26/2021
12/26/2021
4/26/2022
8/26/2022
12/26/2022
Date
CG-112-S1

# Appendix G

# 2023 Tier V Evaluation for 710 South Lucile Street

## 710 South Lucile Street

Prepared for:

CLEANEARTH™
A HARSCO COMPANY

Prepared by:

PIONEER TECHNOLOGIES CORPORATION

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June 2023

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Figure 1 Sample Locations

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# List of Acronyms

| Acronym | Explanation |
|---|---|
| °F | Degrees Fahrenheit |
| 1,1,1-TCA | 1,1,1-Trichloroethane |
| 1,1-DCE | 1,1-Dichloroethylene |
| 1,2-DCA | 1,2-Dichloroethane |
| BE | Burlington Environmental, LLC |
| CCEF | Cumulative Cancer Exceedance Factor |
| CEF | Cancer Exceedance Factor |
| cis-1,2-DCE | cis-1,2-Dichloroethylene |
| CNCEF | Cumulative Noncancer Exceedance Factor |
| DL | Detection Limit |
| Ecology | Washington State Department of Ecology |
| EPA | United States Environmental Protection Agency |
| GW-IA | Groundwater-to-Indoor Air |
| IPIM | Inhalation Pathway Interim Measures |
| NCEF | Noncancer Exceedance Factor |
| PCE | Tetrachloroethylene |
| PIONEER | PIONEER Technologies Corporation |
| PSC | PSC Environmental Services, LLC |
| RCRA | Resource Conservation and Recovery Act |
| SG-IA | Soil Gas-to-Indoor Air |
| SSD | Sub-Slab Depressurization |
| Tier 5 | Final Vapor Intrusion System Shutdown and Removal Process |
| TCE | Trichloroethylene |
| trans-1,2-DCE | trans-1,2-Dichloroethylene |
| ug/L | Micrograms per Liter |
| $ug/m^3$ | Micrograms per Cubic Meter |
| VI | Vapor Intrusion |
| VIAM | Vapor Intrusion Assessment and Mitigation |
| VIRL | Vapor Intrusion Remediation Level |
| VOC | Volatile Organic Compound |

# SECTION 1: INTRODUCTION

Long-term monitoring activities are being conducted as part of corrective action for the Burlington Environmental, LLC (BE) Georgetown facility in Seattle, Washington.[1] Corrective action activities are being conducted per the requirements in Resource Conservation and Recovery Act (RCRA) dangerous waste permit number WAD 00081 2909. As part of the corrective action, a sub-slab depressurization (SSD) system was installed in the commercial building at 710 South Lucile Street in February 2004 due to the proximity of the building to the former facility and elevated volatile organic compound (VOC) concentrations in shallow groundwater and soil gas (PSC Environmental Services, LLC [PSC] 2002, 2003, 2004; Weston Solutions, Inc. [WESTON] 2002). Stone-Drew / Ashe & Jones currently occupy the building at 710 South Lucile Street, which includes a warehouse and office spaces (see Figure 1).

A Tier 5 evaluation was conducted for the building. The Tier 5 evaluation was conducted to determine if 710 South Lucile Street can proceed from Step 3 of the Tier 5 process (i.e., building-specific confirmation air sampling), to Step 4 (Vapor Intrusion [VI] Mitigation System Shutdown). The purpose of this report is to 1) document the results of the 2023 building-specific confirmation air sampling, 2) present Cumulative Cancer Exceedance Factors (CCEFs) and Cumulative Noncancer Exceedance Factors (CNCEFs) calculated using building-specific air data and Vapor Intrusion Remediation Levels (VIRLs),[2] 3) evaluate pre-VI mitigation and post-VI mitigation building-specific vapor-phase sampling results to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and representative of a stable or decreasing trend, and 4) determine if the building can proceed to the next step (Step 4) of the Tier 5 process.

## 1.1 Tier 5 Step 3 Evaluation

The Tier 5 process is used to determine when a VI mitigation system is a candidate for shutdown and removal, and is only applicable at a building where groundwater is the source of VOCs in indoor air. The five steps of a Tier 5 evaluation are described in the *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)* May 3, 2011 memo from Chris Waldron of PIONEER to Ed Jones of Washington State Department of Ecology (Ecology; PIONEER 2011a). Of the five steps, 710 South Lucile is currently on Step 3, which is summarized below:

*Step 3: Perform Building-Specific Confirmation Air Sampling*

- The VI mitigation system will be temporarily shut down and sub-slab soil gas, crawl space, and/or indoor air and ambient air samples will be collected approximately 4 weeks later.
- Samples should be collected during the heating season (i.e., late fall, winter, early spring) so they are representative of reasonable "worst-case" samples.

[1] BE is the legal owner of the facility, and is a wholly-owned subsidiary of PSC Environmental Services, LLC which is a wholly-owned indirect subsidiary of Enviri/Clean Earth.

[2] VIRLs were calculated per the Tier 3 approach in Attachment A of the 2011 *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process [Tier 5]* memo; PIONEER 2011a).

- CCEFs and CNCEFs will be calculated based on the building-specific indoor air data per the approach presented in Tier 3 of the Inhalation Pathway Interim Measures (IPIM) process (PSC 2002).
- Results of historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling will be evaluated to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and are representative of a stable or decreasing trend.

*Decision Criteria*

1. Indoor air-based CCEFs and CNCEFs are less than or equal to 10.
2. Historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend.

Buildings that do not proceed to Step 4 will be eligible for additional confirmation air sampling (i.e., repeat Step 3) after one year.

## 1.2 Previous Sampling

The building has been sampled as part of long-term monitoring activities since 2004. The results of previous sampling events are summarized in the table below.

| *Sampling Event* | Reason for Sampling | Sampling Results |
|---|---|---|
| *July 2004 Groundwater, indoor and ambient air (PSC 2004)* | Assess the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Indoor air concentrations associated with volatilization from groundwater were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *July 2005 Groundwater, indoor and ambient air (PIONEER 2005)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *November 2006 Groundwater, indoor and ambient air (PSC & PIONEER 2007)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *January 2008 Groundwater, indoor and ambient air (PSC & PIONEER 2008)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were slightly above Ecology's cancer health risk threshold (and below the noncancer health risk threshold); however, results indicated that volatilization from groundwater to indoor air was not responsible for the exceedances. It was unclear why the indoor air concentrations slightly increased compared to previous confirmation sampling events; multimedia analytical results and the negative pressure readings indicated that the SSD system was achieving performance standards. |
| *February 2009 Groundwater, soil gas, indoor and ambient air (PSC & PIONEER 2009)* | Determine whether or not the SSD system was restricting the flow of VOCs from groundwater to indoor air. | Concentrations were slightly above Ecology's cancer health risk threshold (and below the noncancer health risk threshold); however, results indicated that volatilization from groundwater to indoor air was not responsible for the exceedances. It was unclear why the indoor air concentrations slightly increased compared to previous confirmation sampling events; multimedia analytical results and the negative pressure readings indicated that the SSD system was achieving performance standards. |

| *Sampling Event* | Reason for Sampling | Sampling Results |
|---|---|---|
| *March 2010 Groundwater, soil gas, indoor and ambient air (PSC & PIONEER 2010)* | Determine whether or not the SSD system was restricting the flow of VOCs from groundwater to indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *March 2011 Groundwater, indoor and ambient air (PSC & PIONEER 2011)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *March 2012 Groundwater, indoor and ambient air (PIONEER 2012)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *March & September 2013 Groundwater, indoor and ambient air Resample: Ambient air (PIONEER 2013)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. Resample: Confirm that the concentration of trichloroethylene (TCE) was unrelated to site contamination. | Concentrations were below Ecology's cancer and noncancer health risk thresholds; however, the concentration of TCE in ambient air was unusually high. Resample: Concentrations were below Ecology's noncancer and cancer health risk thresholds. The unusually high TCE concentration in ambient air in March appeared to be an anomalous result, and was considered unrelated to the site. |
| *February 2014 Groundwater, indoor and ambient air (PIONEER 2014)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2015 Groundwater, indoor and ambient air (Stericycle & PIONEER 2015)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2016 Groundwater, indoor and ambient air (Stericycle & PIONEER 2016)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. . |
| *February 2017 Groundwater, indoor and ambient air (Stericycle & PIONEER 2017)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2018 Groundwater, indoor air, and ambient air (Stericycle & PIONEER 2018)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2019 Groundwater, indoor air, and ambient air (Stericycle & PIONEER 2019)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |

| *Sampling Event* | Reason for Sampling | Sampling Results |
|---|---|---|
| *January 2020 Groundwater, indoor air, and ambient air (Stericycle & PIONEER 2020)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2021 Groundwater, soil gas, indoor air, and ambient air (Clean Earth & PIONEER 2021)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *January 2022 Groundwater, soil gas, indoor air, and ambient air (Clean Earth & PIONEER 2022)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's cancer and noncancer health risk thresholds and the SSD system was operating as designed. |
| *Current Event: February 2023 Groundwater, soil gas, indoor and ambient air* | Tier 5 Step 3, Building-Specific Confirmation Air Sampling. Determine if the building meets criteria to move on to Step 4 (Mitigation System Shutdown). | The results of the 2023 Tier 5 evaluation indicate that 710 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., Mitigation System Shutdown). |

# SECTION 2: SAMPLING SUMMARY

Building-specific air samples (sub-slab soil gas, indoor air, and ambient air) were collected in accordance with Step 3 of the Tier 5 process (PIONEER 2011a). Groundwater was collected as part of biannual groundwater monitoring. Sampling was conducted during the heating season, and the VI mitigation system was temporarily shut down approximately 4 weeks prior to sampling to ensure that samples are representative of long-term "non-mitigated" conditions; the system was restarted once sampling was complete. The following samples were collected during the February 2023 sampling event (see Figure 1):

- One groundwater sample was collected from water table well CG-149-WT.
- Two soil gas samples were collected over an eight-hour period:
  - One sample was collected from the interior of the southern portion of the warehouse, south of the office area (AS-710L-SG1-0223).
  - One sample was collected from the interior of the east-central portion of the warehouse, west of the middle office (AS-710L-SG2-0223);
- Three indoor air samples were collected over an eight-hour period:
  - One sample was collected in the office on the southeast corner of the building (AS-710L-IA1-0223);
  - One sample was collected from the northeastern portion of the warehouse (AS-710L-IA2-0223);
  - One sample was collected from the middle office on the eastern side of the building (AS-710L-IA3-0223).
- One ambient air sample (TE-707L-AA1-0223) was collected near the southwest corner of the 707 South Lucile building, across the street and south of the 710 South Lucile building. Ambient air sampling was conducted over an eight-hour period, concurrently with indoor air sampling.

The weather during the February 6, 2023 sampling event was partly cloudy with periods of light rain and fog. The mean ambient air temperature was 46 degrees Fahrenheit ($°F$) and ranged from 43°F to 53°F throughout the period. The wind direction was generally south to southeast with the wind speed ranging from calm to 18 miles per hour during the sampling event. The field notes from the sampling event are included in Appendix A. A copy of the hourly weather report from the Weather Underground website is included in Appendix B. No problems were encountered during this sampling event.

The groundwater sample was sent to Analytical Resources Inc., LLC in Tukwila, Washington for analysis by United States Environmental Protection Agency (EPA) Method 8260 SIM and air samples were sent to Eurofins Air Toxics, Ltd. in Folsom, California for analysis by EPA Method TO-14/15. An independent, professional data validator validated all the laboratory data. The laboratory analytical data are presented in Appendix C; the data validation report is presented in Appendix D.

# SECTION 3: RESULTS AND RISK EVALUATION

## 3.1 Results

A constituent must be detected in groundwater *and* indoor air to be included in the risk evaluation since the groundwater-to-indoor air pathway is our primary concern and groundwater is the primary source of vapor intrusion in this area.

The building-specific sampling results for the commercial building at 710 South Lucile Street are provided in Table 1.

Eleven constituents were detected in groundwater. Three constituents, 1,1,1-Trichloroethane (1,1,1-TCA), 1,2-Dichloroethane (1,2-DCA), and TCE, were detected in groundwater, soil gas, and indoor air (at a concentration greater than ambient air [background]). All detected groundwater concentrations were below their respective commercial VIRLs. Commercial VIRLs are appropriate for evaluating the results at this building because it is used for commercial purposes and includes a warehouse and office spaces (see Figure 1).

Thirteen constituents were detected in soil gas. Of those detected in soil gas, five constituents (1,1,1-TCA, 1,2-DCA, ethylbenzene, toluene, and TCE) were also detected indoor air. Of the constituents detected in both soil gas and indoor air, none were above commercial indoor air VIRLs.

Eight constituents were detected in indoor air. Of those detected in indoor air, three constituents (1,2-DCA, ethylbenzene, and toluene) were also detected in ambient air (at a concentration greater than ambient air); these constituent concentrations will be corrected for background. There were higher concentrations of chloroform and benzene in ambient air which suggests that these constituents in ambient air may be contributing to indoor air concentrations. However, these constituents are not detected in groundwater; the groundwater-to-indoor air (GW-IA) pathway is our primary concern, therefore the impact on the evaluation is minimal.

Three indoor air constituents (benzene, chloroform, and naphthalene) were above commercial indoor air VIRLs. However, none were detected in groundwater. The groundwater-to-indoor air (GW-IA) pathway is our primary concern; therefore, the impact of these constituents on the evaluation is minimal. Additionally, a discussion of naphthalene's detection limits is presented in the following section.

### *3.1.1 Detection Limits*

Constituent detection limits (DLs) that exceeded VIRLs are presented in the table below. Soil gas, indoor air, and ambient air DLs for naphthalene exceeded the minimum commercial air VIRL but were not detected in groundwater. The GW-IA air pathway is our primary concern; therefore, the impact on the evaluation is minimal.

| Constituent | Media | Max Detection Limit | Minimum Commercial Air VIRL | DL > VIRL? |
|---|---|---|---|---|
| Naphthalene | Soil Gas | 0.35 ug/m$^3$ | 0.17 ug/m$^3$ | Yes |
| Naphthalene | Indoor Air | 0.38 ug/m$^3$ | 0.17 ug/m$^3$ | Yes |
| Naphthalene | Ambient Air | 0.37 ug/m$^3$ | 0.17 ug/m$^3$ | Yes |

## 3.2 Risk Evaluation

### *3.2.2 Summary of the Approach*

The corrected indoor air concentration noncancer exceedance factors (NCEFs) and cancer exceedance factors (CEFs) calculated for the risk evaluation are presented in Table 2. Indoor air concentrations were corrected by subtracting maximum detected ambient air concentrations from maximum detected indoor air concentrations to account for the contribution of ambient air to the measured indoor air concentrations (PSC 2002). Exceedance factors were only calculated for constituents detected in groundwater and indoor air (with concentrations greater than ambient air) because the only potential source of vapor intrusion in this area is shallow groundwater. A sensitivity analysis was also performed to calculate exceedances for constituents detected in groundwater and indoor air (with concentrations greater than ambient air). The NCEFs were calculated by dividing the corrected indoor air concentrations by noncancer-based indoor air VIRLs. The CEFs were calculated by dividing the corrected indoor air concentrations by cancer-based indoor air VIRLs. The individual NCEFs and CEFs were summed to provide the cumulative NCEF and CEF.

### *3.2.3 Results of Risk Evaluation*

The results of the risk evaluation for 710 South Lucile Street are presented in Table 2. Detected constituents in groundwater and indoor air (greater than background) were 1,1,1-TCA, 1,2-DCA, PCE, and TCE. Per the Revised IPIM Work Plan (PSC 2002), exceedances were only calculated for constituents with indoor air concentrations greater than the ambient air concentrations. The CNCEF for the GW-IA pathway is 0.40 which is below Ecology's noncancer benchmark of 10. The CCEF for the GW-IA pathway is 0.68 which is below Ecology's cancer benchmark of 10 (PSC 2002).

A sensitivity analysis was performed to calculate exceedances based on the soil gas-to-indoor air (SG-IA) pathway (see Table 2). Exceedances were calculated for the constituents detected in both soil gas and indoor air (greater than background), regardless if present in groundwater; 1,1,1-TCE, 1,2-DCA, ethylbenzene, toluene, and TCE. The CNCEF for the SG-IA pathway is 0.32 which is below Ecology's noncancer benchmark of 10. The CCEF for the SG-IA pathway is 0.73 which is below Ecology's cancer benchmark of 10 (PSC 2002).

The TCE concentration in groundwater was also evaluated for short-term exposures to pregnant women during the first trimester of pregnancy. The TCE concentration (1.8 ug/L) was below the groundwater subsurface screening level for short-term exposures (31 ug/L; Ecology 2019).

## 3.3 Comparison of Results Over Time

The following section presents a comparison of results over time for groundwater, soil gas, and indoor air results.

### 3.3.4 Comparison of 2023 Groundwater Results and Historical Groundwater Results

Monitoring well CG-149-WT was installed for long-term groundwater monitoring at the property and has been sampled at least biannually during the first and third quarters since 2004. For this evaluation, only results from biannual sampling during the first and third quarters beginning in January 2019 to the current February 2023 event, were evaluated.[3] Cumulative groundwater sampling results from 2019 through 2023 are presented in Table 3. Groundwater results from the nine most recent events are sufficient to conduct a trend analysis. Trend analyses were conducted for groundwater constituents detected in both Pre-and Post-VI installation samples, and for constituents associated with the breakdown of chlorinated solvents (i.e., PCE, TCE, DCE[4], and vinyl chloride). Overall, 2019-2023 trends indicate that groundwater constituents all have stabilizing or decreasing trends except for cis-1,2-DCE which exhibits a stable-to-slightly increasing trend (see Table 3). Additional analysis for cis-1,2-DCE is discussed in the following section; the analysis concludes that cis-1,2-DCE groundwater concentrations can be considered stable. Time-series plots supporting the trend analyses are presented in Appendix E.

Pre- and post-VI mitigation system groundwater results were also evaluated to determine the differences in constituent concentrations between the two events (pre- and post-VI mitigation). Groundwater concentrations decreased for all evaluated constituents between the two events (Table 3). These determinations will be compared with pre- and post-VI mitigation soil gas and indoor air differences.

*Additional Trend Analysis for cis-1,2-DCE*

Two additional time-series plots presenting data over five years (2018 – 2023) were developed to further evaluate groundwater trends for cis-1,2-DCE. The first plot presents groundwater results and linear trendlines for cis-1,2-DCE and vinyl chloride. The second time-series plot presents groundwater results for PCE, TCE, DCE, and vinyl chloride.[5] These time-series plots are included in Appendix E.

Linear trend lines for both constituents show stable trends. The trend line for cis-1,2-DCE appears stable and slightly increasing, and the trend line for vinyl chloride appears stable and slightly decreasing. Concentrations for both constituents appear to exhibit a predictable, seasonable pattern: 1) concentrations typically increase during the winter and 2) concentrations decrease in the summer (e.g.,

[3] 2019 was chosen as the start of the evaluation so that time-series plots would be comparable to plots used in the overall Tier 5 evaluation for the Georgetown Site, which includes the evaluation of other buildings.

[4] DCE: 1-dichloroethylene [1,1-DCE], cis-1,2-dichlorethylene [cis-1,2-DCE], and trans-1,2-dichloroethylene [trans-1,2-DCE].

[5] Note: Evaluating potential biotic/abiotic degradation of PCE, TCE, DCE, and vinyl chloride is beyond the scope of this evaluation. This assessment provides a high-level overview of the concentrations (mass) of PCE, TCE, DCE, and vinyl chloride in groundwater in monitoring well CG-149-WT and (1) how concentrations of these constituents have varied over time and (2) their potential stability or potential for change (e.g., accumulate) in the future based on an assessment of historical concentrations. Many contaminated subsurface environments are anaerobic, and often stepwise but incomplete reductive dechlorination leads to the accumulation of DCE and vinyl chloride via degradation from PCE and/or TCE. Since vinyl chloride is highly toxic (i.e., a lower groundwater VIRL), it is crucial to understand how vinyl chloride concentrations may be influenced by degradation, if occurring. For example, if high concentrations of PCE and/or TCE were present at CG-149-WT (they aren't) then there would be increased concern that biotic/abiotic degradation of PCE, TCE, and DCE (if occurring) may produce increased concentrations of vinyl chloride and, consequently, a higher risk to human health – especially if degradation stalled at vinyl chloride.

cis-1,2-DCE decreased to non-detect levels in 2019 and 2021). The concentrations of vinyl chloride are consistently lower than cis-1,2-DCE, and increases or decreases in vinyl chloride concentrations follow increases or decreases in cis-1,2-DCE concentrations – which indicates that vinyl chloride concentrations (associated with biotic/abiotic degradation) are not accumulating.

The potential for PCE and TCE to degrade to DCE and vinyl chloride was evaluated by comparing PCE, TCE, DCE, and vinyl chloride concentrations. Concentrations between 2018-2023 indicate that the concentrations of PCE and TCE have been significantly reduced and do not represent a potential significant source of DCE/vinyl chloride – if one assumes that degradation is occurring or will occur in the future. For example, PCE concentrations are intermittently detected at concentrations consistently less than 1 ug/L. TCE concentrations are also very low and are similar (but consistently less than) cis-1,2-DCE concentrations. The concentrations of vinyl chloride are consistently lower than cis-1,2-DCE, and increases or decreases in vinyl chloride concentrations follow increases or decreases in cis-1,2-DCE concentrations – which indicates that vinyl chloride concentrations (associated with biotic/abiotic degradation) are not accumulating.

The groundwater trend for cis-1,2-DCE can be considered stable as it exhibits a predictable, seasonable pattern, and PCE and TCE have been significantly reduced and do not represent a potential significant source of DCE/vinyl chloride – if one assumes that degradation is occurring or will occur in the future.

### *3.3.5 Comparison of Pre-VI Mitigation and Post-VI Mitigation Air Sampling Results*

A comparison Pre-VI Mitigation (September 2002) and Post-VI Mitigation (February 2023) soil gas and indoor air sampling results are presented in Table 4.

#### *Soil Gas*

Pre- and post-VI mitigation system soil gas results were evaluated to determine the differences in constituent concentrations between the two events. Trends were determined for constituents detected in both pre-and post-VI mitigation groundwater events, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride; Table 3). All evaluated constituents that were detected in soil gas have decreased/stabilized[6] since the pre-VI mitigation sampling event.

#### *Corrected Indoor Air*

Comparisons could not be made for corrected indoor air as no ambient air results were collected pre-VI mitigation; indoor air could not be corrected to make accurate comparisons.

[6] Given the slightly elevated DL for vinyl chloride during the pre-VI mitigation event, it cannot be determined if the concentration has decreased or remained stable.

## 3.4 Discussion

Building-specific sampling was conducted in accordance with Step 3 of the Tier 5 process (PIONEER 2011a). To proceed Step 4 of the Tier 5 process (i.e., system shutdown), the building must meet the following decision criteria:

1. Indoor air-based CCEFs and CNCEFs are less than or equal to 10.
2. Historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend.

The 710 South Lucile Street building was evaluated using 1) groundwater data from CG-149-WT, from biannual sampling spanning January 2019 to February 2023,[7] and 2) soil gas and indoor air results pre-mitigation system installation (August 2002) and post-mitigation system installation (February 2023). The risk evaluation conducted using the 2023 sampling event results confirmed that indoor air-based CCEFs and CNCEFs are less than or equal to 10 (see Table 2).

The risk evaluation conducted using the 2023 sampling event results confirmed that indoor air-based CCEFs and CNCEFs are less than or equal to 10 (see Table 2). Groundwater trends indicate that constituents all have stabilizing or decreasing trends (see Table 3). Pre- and post-VI mitigation groundwater, soil gas, and indoor air changes in constituent concentrations (between the two events) were compared to determine if results were consistent across all media. Both pre- and post-VI mitigation results for each constituent decreased or stabilized across all media (Tables 3 and 4).

[7] Excluding the additional time-series plots developed to further evaluate cis-1,2-DCE which spans five years, 2018—2023.

# SECTION 4: CONCLUSIONS

The results of the 2023 Tier 5 evaluation indicate that 710 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., system shutdown). The results of the 2023 groundwater, soil gas, indoor air, and ambient air sampling event show that indoor air concentrations associated with volatilization from groundwater are below Ecology's noncancer and cancer health risk thresholds (i.e., CNCEF of 10 and CCEF of 10), and constituents in groundwater have stable or decreasing trends. Pre- and post-VI mitigation system soil gas and indoor air results are consistent with stable/decreasing trends in groundwater and results for each constituent have decreased or stabilized across all media between the two events.

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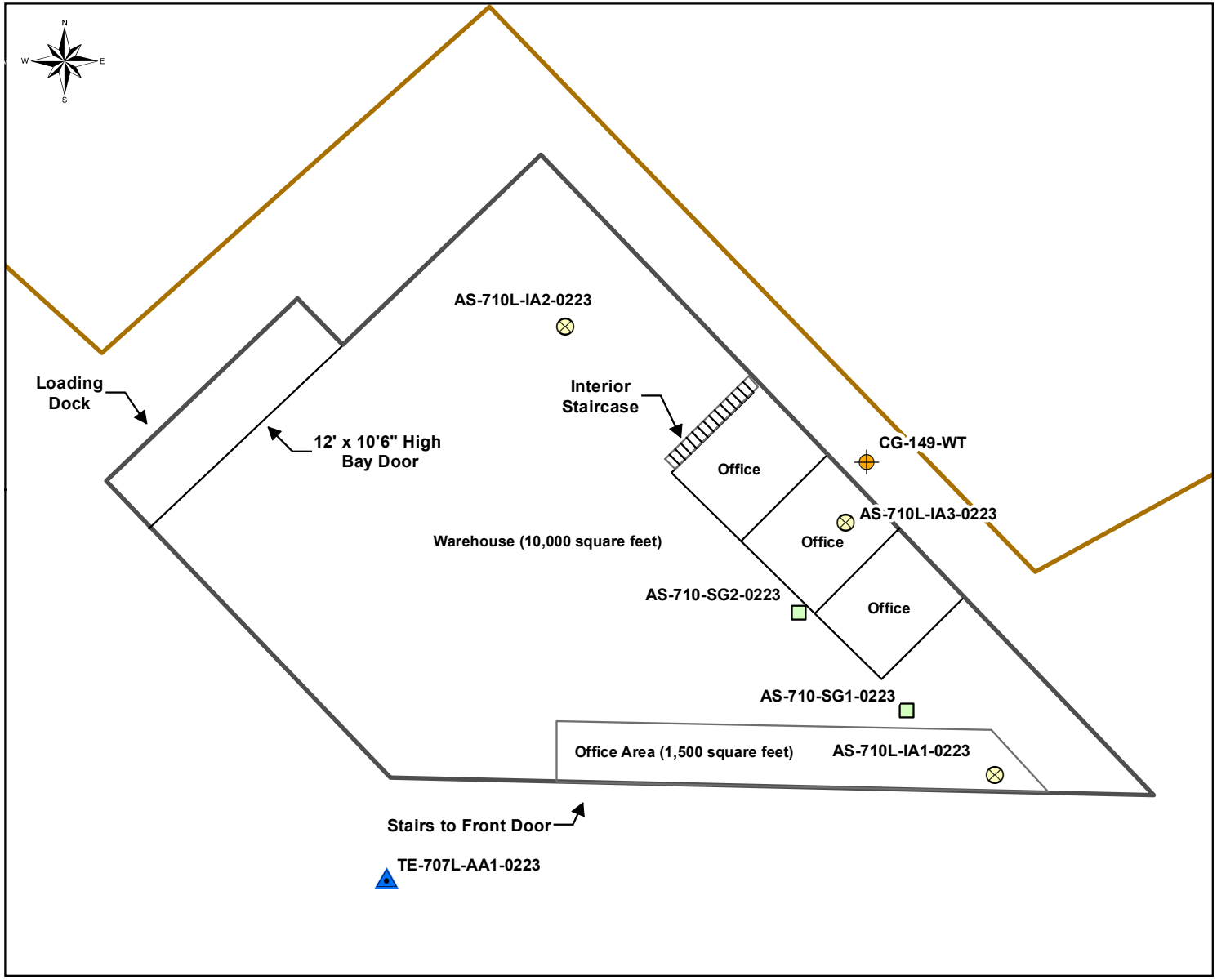
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Stericycle and PIONEER. 2020. 2020 VIAM Tier IV Long-Term Monitoring Report. 710 South Lucile Street. Georgetown Site. Seattle, Washington. April.

WESTON. 2002. Sub-Slab Vapor Investigation Report. Stone-Drew / Ashe & Jones, Inc. 710 South Lucile Street. Seattle, Washington. October.

# Figures







## Legend

- Soil Gas Sample Location
- Indoor Air Sample Location
- Ambient Air Sample Location
- Monitoring Well
- 710 South Lucile St. Building
- Barrier Wall

Notes:
-Map is not to scale.
-Locations are approximate.
-The ambient air sample location was determined the day of sampling based on wind direction.

PIONEER TECHNOLOGIES CORPORATION

# Sampling Locations
# 2023 Tier V Evaluation for 710 South Lucile Street
# Burlington Environmental Georgetown Site

Figure 1

Document Path: G:\Projects\PSC\GIS\Source\Maps\Maps 2023\1Q23 Event\710_S_Lucile_2023-Locations.mxd; Author: MK; Date Saved: 6/8/2023

# Tables

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## Table 1: 2023 Building-Specific Sampling Results

| Constituent | Groundwater (ug/L) | | Soil Gas (ug/m3) | | | | Indoor Air (ug/m$^3$) | | | | | | Ambient Air (ug/m$^3$) | | Commercial Groundwater VIRL (ug/L) | | Commercial Indoor Air VIRL (ug/m$^3$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CG-149-WT | | AS-710L-SG1-0223 | | AS-710L-SG2-0223 | | AS-710L-IA1-0223 | | AS-710L-IA2-0223 | | AS-710L-IA3-0223 | | TE-707L-AA1-0223[1] | | Noncancer | Cancer | Noncancer | Cancer |
| 1,1,1-Trichloroethane | 0.13 | J | 38 | | 17 | | 0.31 | | 0.15 | U | 0.16 | U | 0.15 | U | 10,361 | -- | 954 | -- |
| 1,1-Dichloroethane | 6.0 | | 5.3 | | 2.5 | | 0.12 | U | 0.11 | U | 0.12 | U | 0.11 | U | -- | 120 | -- | 3.7 |
| 1,1-Dichloroethylene | 0.090 | J | 0.67 | | 0.086 | | 0.057 | U | 0.056 | U | 0.057 | U | 0.056 | U | 227 | -- | 39 | -- |
| 1,2,4-Trimethylbenzene | 0.20 | U | 0.85 | | 0.96 | | 0.70 | U | 0.69 | U | 0.71 | U | 0.69 | U | 65 | -- | 1.4 | -- |
| 1,2-cis-Dichloroethylene | 4.1 | | 1.2 | | 0.34 | | 0.11 | U | 0.11 | U | 0.11 | U | 0.11 | U | -- | -- | -- | -- |
| 1,2-Dichloroethane | 0.090 | J | 0.12 | | 0.14 | | 0.21 | | 0.17 | | 0.20 | | 0.076 | | 183 | 30 | 1.4 | 0.22 |
| 1,2-trans-Dichloroethylene | 0.20 | J | 1.4 | | 0.52 | U | 0.57 | U | 0.56 | U | 0.57 | U | 0.56 | U | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | 0.20 | U | 0.66 | U | 0.64 | U | 0.70 | U | 0.69 | U | 0.71 | U | 0.69 | U | 35 | -- | 0.97 | -- |
| 2-Hexanone | 5.0 | U | 2.8 | U | 2.7 | U | 2.9 | U | 2.9 | U | 2.9 | U | 2.9 | U | 4,446 | -- | 5.8 | -- |
| Benzene | 0.20 | U | 2.1 | | 5.7 | | 0.59 | | 0.56 | | 0.82 | | 1.7 | | 175 | 22 | 5.8 | 0.75 |
| Chloroform | 0.20 | U | 1.0 | | 6.1 | | 0.36 | | 0.19 | | 0.65 | | 2.0 | | 721 | 9.5 | 19 | 0.25 |
| Ethyl Chloride | 0.20 | U | 0.18 | U | 0.17 | U | 0.19 | U | 0.18 | U | 0.19 | U | 0.18 | U | 23,154 | -- | 1,947 | - |
| Ethylbenzene | 0.20 | U | 1.1 | | 1.1 | | 0.34 | | 0.41 | | 0.49 | | 0.31 | | 5,376 | 65 | 195 | 2.3 |
| Naphthalene | 0.50 | U | 0.35 | U | 0.34 | U | 0.37 | U | 0.37 | U | 0.38 | U | 0.37 | U | 252 | 74 | 0.58 | 0.17 |
| p-Isopropyltoluene | 0.20 | U | 3.7 | U | 3.6 | U | 3.9 | U | 3.8 | U | 4.0 | U | 3.8 | U | -- | -- | -- | -- |
| Propyl benzene | 0.29 | | 0.66 | U | 0.64 | U | 0.70 | U | 0.69 | U | 0.71 | U | 0.69 | U | 3,318 | -- | 198 | -- |
| sec-Butylbenzene | 2.6 | | 3.7 | U | 3.6 | U | 3.9 | U | 3.8 | U | 4.0 | U | 3.8 | U | -- | -- | -- | -- |
| Tetrachloroethylene | 0.13 | J | 0.18 | U | 0.18 | U | 0.63 | | 0.19 | U | 0.25 | | 0.19 | U | 90 | 270 | 7.5 | 22 |
| Toluene | 0.20 | U | 8.5 | | 8.0 | | 1.4 | | 1.7 | | 2.0 | | 1.4 | | 25,880 | -- | 954 | -- |
| Trichloroethylene | 1.8 | | 0.20 | | 0.088 | | 0.084 | | 0.075 | U | 0.077 | U | 0.075 | U | 7.2 | 27 | 0.39 | 1.5 |
| Vinyl Chloride | 4.7 | | 0.040 | | 0.033 | U | 0.036 | U | 0.036 | U | 0.037 | U | 0.036 | U | 88 | 6.0 | 19 | 1.3 |

**Notes:**

--: No toxicity information was available to calculate a VIRL.

The data qualifiers presented in this table are:

J - The constituent was detected and the concentration is an estimated value.

U - The constituent was not detected (the reporting limit is presented).

VIRLs were developed based on a commercial exposure scenario using the following target risk goals for individual constituents:

Cancer Risk = 1E-06

Hazard Quotient = 0.10

-Soil gas VIRLs are not used as the primary concern in this evaluation is indoor air. Soil gas results are used as an indicator to determine what constituents in indoor air are site related.

[1] The 2023 ambient air sample was used for concurrent sampling at neighboring building 707 south Lucile.

## Table 2: 2023 Building-Specific Risk Evaluation for 710 South Lucile Street

| Constituent | Commercial Groundwater VIRL (ug/L) | | Commercial Indoor Air VIRL ($ug/m^3$) | | Maximum Groundwater Concentration | Maximum Soil Gas Concentration | Maximum Indoor Air Concentration | Maximum Ambient Air Concentration | Corrected Indoor Air Concentration (IA-AA)[1] | Constituent Detected in Groundwater and Indoor Air: Commercial Noncancer Exceedance Factor | Constituent Detected in Groundwater and Indoor Air: Commercial Cancer Exceedance Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Noncancer | Cancer | Noncancer | Cancer | (ug/L) | ($ug/m^3$) | ($ug/m^3$) | ($ug/m^3$) | ($ug/m^3$) | NCEF | CEF |
| 1,1,1-Trichloroethane | 10,361 | -- | 954 | -- | 0.13 | 38 | 0.31 | - | 0.31 | 0.00032 | - |
| 1,1-Dichloroethane | -- | 120 | -- | 3.7 | 6.0 | 5.3 | - | - | - | - | - |
| 1,1-Dichloroethylene | 227 | -- | 39 | -- | 0.090 | 0.67 | - | - | - | - | - |
| 1,2,4-Trimethylbenzene | 65 | -- | 1.4 | -- | - | 0.96 | - | - | - | - | - |
| 1,2-cis-Dichloroethylene | -- | -- | -- | -- | 4.1 | 1.2 | - | - | - | - | - |
| 1,2-Dichloroethane | 183 | 30 | 1.4 | 0.22 | 0.090 | 0.14 | 0.21 | 0.076 | 0.13 | 0.098 | 0.60 |
| 1,2-trans-Dichloroethylene | -- | -- | -- | -- | 0.20 | 1.4 | - | - | - | - | - |
| 1,3,5-Trimethylbenzene | 35 | -- | 0.97 | -- | - | - | - | - | - | - | - |
| 2-Hexanone | 4,446 | -- | 5.8 | -- | - | - | - | - | - | - | - |
| Benzene | 175 | 22 | 5.8 | 0.75 | - | 5.7 | 0.82 | 1.7 | 0[5] | - | - |
| Chloroform | 721 | 9.5 | 19 | 0.25 | - | 6.1 | 0.65 | 2.0 | 0[5] | - | - |
| Ethyl Chloride | 23,154 | -- | 1,947 | -- | - | - | - | - | - | - | - |
| Ethylbenzene | 5,376 | 65 | 195 | 2.3 | - | 1.1 | 0.49 | 0.31 | 0.18 | 0.00092 | 0.077 |
| Naphthalene | 252 | 74 | 0.58 | 0.17 | - | - | - | - | - | - | - |
| p-Isopropyltoluene | -- | -- | -- | -- | - | - | - | - | - | - | - |
| Propyl benzene | 3,318 | -- | 198 | -- | 0.29 | - | - | - | - | - | - |
| sec-Butylbenzene | -- | -- | -- | -- | 2.6 | - | - | - | - | - | - |
| Tetrachloroethylene | 90 | 270 | 7.5 | 22 | 0.13 | - | 0.63 | - | 0.63 | 0.084 | 0.028 |
| Toluene | 25,880 | -- | 954 | -- | - | 8.5 | 2.0 | 1.4 | 0.60 | 0.00063 | - |
| Trichloroethylene | 7.2 | 27 | 0.39 | 1.5 | 1.8 | 0.20 | 0.084 | - | 0.084 | 0.22 | 0.058 |
| Vinyl Chloride | 88 | 6.0 | 19 | 1.3 | 4.7 | 0.040 | - | - | - | - | - |
| | | | | | | | | | **TOTAL (GW-IA)** | 0.40 | 0.68 |
| | | | | | | | | | **TOTAL (SG-IA)** | 0.32 | 0.73 |

**Notes:**

--: No toxicity information was available to calculate a VIRL; -: The constituent was not detected

NCEFs and CEFs are calculated for constituents that exhibit a complete exposure pathway for the groundwater-to-indoor air (GW-to-IA) vapor intrusion pathway (i.e., the constituents are detected in both groundwater and indoor air), and are highlighted blue.

NCEFs and CEFs are calculated for the soil gas-to-indoor air (SG-to-IA) pathway (i.e., constituents detected in both soil gas and indoor air), and are highlighted green.

VIRLs were developed based on a commercial exposure scenario using the following target risk goals for individual constituents:

Cancer Risk = 1E-06

Hazard Quotient = 0.10

-Soil gas VIRLs are not used as the primary concern in this evaluation is indoor air. Soil gas results are used as an indicator to determine what constituents in indoor air are site related.

[1] Indoor air concentrations are corrected by subtracting the maximum detected ambient air concentration from the maximum detected indoor air concentration, to account for the contribution of ambient air to the measured indoor air concentration.

[2] There were higher concentrations in ambient air than in indoor air which suggests that concentrations in ambient air are contributing to indoor air concentrations. The corrected indoor air concentration is 0 $ug/m^3$.

## Table 3: Comparison of Groundwater Sampling Results

| Constituent | Pre-VI Mitigation System (August 2002) | | Groundwater Concentrations - CG-149-WT[1] | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | January 2019 | | August 2019 | | March 2020 | | August 2020 | | February 2021 | | August 2021 | | February 2022 | | August 2022 | | February 2023 | | 2019 - 2023 Trend[2] | Comparison of Detected Pre- and Post- VI Mitigation Results |
| | (ug/L) | | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | | |
| 1,1,1-Trichloroethane | 26 | | 0.42 | J | 0.14 | U | 0.14 | U | 0.14 | U | 0.34 | J | 0.14 | U | 0.090 | J | 0.18 | J | 0.13 | J | Stable | Decreased |
| 1,1-Dichloroethane | 31 | | 11 | | 2.6 | | 11 | | 2.8 | J | 8.1 | | 0.15 | U | 5.2 | | 1.6 | | 6.0 | | Stable | Decreased |
| 1,1-Dichloroethylene | 0.56 | | 0.25 | U | 0.16 | | 0.028 | | 0.0070 | UJ | 0.04 | J | 0.25 | U | 0.20 | U | 0.20 | U | 0.090 | J | Decreasing | Decreased |
| 1,2,4-Trimethylbenzene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| 1,2-cis-Dichloroethylene | 34 | | 0.96 | J | 0.15 | U | 2.0 | | 0.71 | J | 2.3 | | 0.15 | U | 2.2 | | 1.0 | | 4.1 | | Stable[4] | Decreased |
| 1,2-Dichloroethane | 0.47 | | 0.14 | U | 0.051 | J | 0.11 | | 0.030 | UJ | 0.07 | J | 0.14 | U | 0.20 | U | 0.20 | U | 0.090 | J | Stable | Decreased |
| 1,2-trans-Dichloroethylene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.17 | J | 0.10 | J | 0.20 | J | Stable | Decreased |
| 1,3,5-Trimethylbenzene | 1.0 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| 2-Hexanone | 10.0 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 5.0 | U | 5.0 | U | 5.0 | U | NE | NE |
| Benzene | 0.50 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Chloroform | 1.2 | | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Ethyl Chloride | 1.0 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Ethylbenzene | 1.0 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Naphthalene | 0.50 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.50 | U | 0.50 | U | 0.50 | U | NE | NE |
| p-Isopropyltoluene | na | | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE[3] | NE[3] |
| Propyl benzene | na | | 0.21 | J | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.20 | U | 0.19 | J | 0.29 | | NE[3] | NE[3] |
| sec-Butylbenzene | na | | 0.94 | J | 0.12 | U | 0.12 | U | 0.12 | U | 0.81 | J | 0.12 | U | 0.66 | | 1.2 | | 2.6 | | NE[3] | NE[3] |
| Tetrachloroethylene | 14 | | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.12 | J | 0.18 | | 0.13 | J | Stable | Decreased |
| Toluene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Trichloroethylene | 13 | | 1.4 | | 1.3 | | 1.9 | | 1.4 | J | 1.9 | J | 1.1 | | 2.6 | | 1.9 | | 1.8 | | Stable | Decreased |
| Vinyl Chloride | 16.1 | | 6.0 | | 0.75 | | 3.5 | | 0.84 | J | 2.5 | J | 0.49 | J | 2.8 | | 1.4 | | 4.7 | | Stable | Decreased |

**Notes:**

Q: qualifier; ug/L: micrograms per liter; na: Not analyzed; NE: Constituent was not detected during both pre-and post-VI samples, no trend analysis conducted.

The data qualifiers presented in this table are:

J - The constituent was detected and the concentration is an estimated value.

U - The constituent was not detected (the reporting limit is presented).

[1] Only biannual sampling event results are shown. Other groundwater sampling results collected in support of long-term monitoring (e.g., Tier 4 evaluations) are included in the time series plots in Appendix E.

[2] Supporting time series plots are presented in Appendix E. Trend analyses were conducted for groundwater constituents detected in both pre-and post-VI Installation samples, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride).

[3] A comparison could not be made with pre-VI mitigation results as this constituent was not analyzed for prior to system installation. However, according to past Tier 4 evaluations, this analyte has never been detected in soil gas or indoor air. In other words, it has never been associated with VI at 710 S Lucile Street (Clean Earth & PIONEER, 2022) therefore, a trend analysis was not conducted.

[4] The 2019 to 2023 time-series plot showed that the trend for cis-1,2-DCE was stable-to-slightly increasing. Additional time-series plots were developed to further evaluate cis-1,2-DCE. See discussion in Section 3.3.4 and Appendix E.

## Table 4: Comparison of Pre-VI Mitigation and Post-VI Mitigation Air Sampling Results

| Constituent[1] | Commercial Indoor Air VIRL (ug/m$^3$) | | Maximum Air Concentrations[2] | | | | Comparison of Detected Pre- and Post- VI Mitigation Results |
|---|---|---|---|---|---|---|---|
| | | | Pre-VI Mitigation September 2002[4] | | Post-VI Mitigation February 2023 | | |
| | Noncancer | Cancer | ug/m$^3$ | Q | ug/m$^3$ | Q | |
| **Soil Gas** | | | | | | | |
| 1,1,1-Trichloroethane | 954 | -- | 790,000 | | 38 | | Decreased |
| 1,1-Dichloroethane | -- | 3.7 | 190,000 | | 5.3 | | Decreased |
| 1,1-Dichloroethylene | 39 | -- | 6,000 | | 0.67 | | Decreased |
| 1,2-cis-Dichloroethylene | -- | -- | 120,000 | | 1.2 | | Decreased |
| 1,2-Dichloroethane | 1.4 | 0.22 | 2,400 | U | 0.14 | | Decreased |
| 1,2-trans-Dichloroethylene | -- | -- | 9,600 | U | 1.4 | | Decreased |
| Tetrachloroethylene | 7.5 | 22 | 4,100 | U | 0.18 | U | ND |
| Trichloroethylene | 0.39 | 1.5 | 60,000 | | 0.20 | | Decreased |
| Vinyl Chloride | 19 | 1.3 | 1,500 | U | 0.040 | | Stabilized/Decreased[5] |
| **Corrected Indoor Air[3]** | | | | | | | |
| 1,1,1-Trichloroethane | 954 | -- | ns | | 0.31 | | No comparison |
| 1,1-Dichloroethane | -- | 3.7 | ns | | - | | No comparison |
| 1,1-Dichloroethylene | 39 | -- | ns | | - | | No comparison |
| 1,2-cis-Dichloroethylene | -- | -- | ns | | - | | No comparison |
| 1,2-Dichloroethane | 1.4 | 0.22 | ns | | 0.13 | | No comparison |
| 1,2-trans-Dichloroethylene | -- | -- | ns | | - | | No comparison |
| Tetrachloroethylene | 7.5 | 22 | ns | | 0.63 | | No comparison |
| Trichloroethylene | 0.39 | 1.5 | ns | | 0.084 | | No comparison |
| Vinyl Chloride | 19 | 1.3 | ns | | - | | No comparison |

**Notes:**

--: No toxicity information was available to calculate a VIRL; -: The constituent was not detected therefore a correction was not calculated; Q: qualifier; ug/m$^3$: micrograms per meter cubed; ND: Constituent was not detected during both sampling events; Not detected value; J: The constituent was detected and the concentration is an estimated value; U: The constituent was not detected (the reporting limit is presented); na: Not analyzed; ns: Not sampled

[1] Constituents listed are those detected in both pre-and post-VI mitigation groundwater samples, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride; see Table 3).

[2] If multiple samples of the same media were collected during the event, the maximum concentration is shown.

[3] Indoor air concentrations are corrected by subtracting the maximum detected ambient air concentration from the maximum detected indoor air concentration, to account for the contribution of ambient air to the measured indoor air concentration.

[4] These data were obtained from the Sub-Slab Vapor Investigation Report prepared by Weston Solutions, Inc., October 2002.

[5] Given the slightly elevated DL for the non-detect result, it cannot be determined if the concentration has decreased or remained stable.

# Appendix A

2/6/2023

0830 T. Louviere & N. Weiss of DOF on site for installation of vapor pins @ 707 & 710 S Lucile St.

0852 NW off site to pick up Shop vac.

0925 NW back on site

0930 Conduct H&S meeting

0945 Arrive on site @ 710 S. Lucile (SOAJ). Check in w/ front desk.

0950 Begin install of AS-710-SG1

1000 Start leak testing AS-710-SG1

1005 Begin install of AS-710-SG2

1020 Start leak testing AS-710-SG2

1025 successful leak test @ AS-710-SG1 Use clean paper towel to remove water.

1040 successful leak test @ AS-710-SG2 use clean paper towel to remove water.

1045 off site @ SOAJ

1200 Arrive on site @ 707 S Lucile St for vapor pin install.

1205 Install ~~AS II~~ TE-707L-SG1

1215 Start leak test of TE-707L-SG1

1220 Install TE-707L-SG2

1230 Start leak test of TE-707L-SG2

2/6/2023 (Cont.)

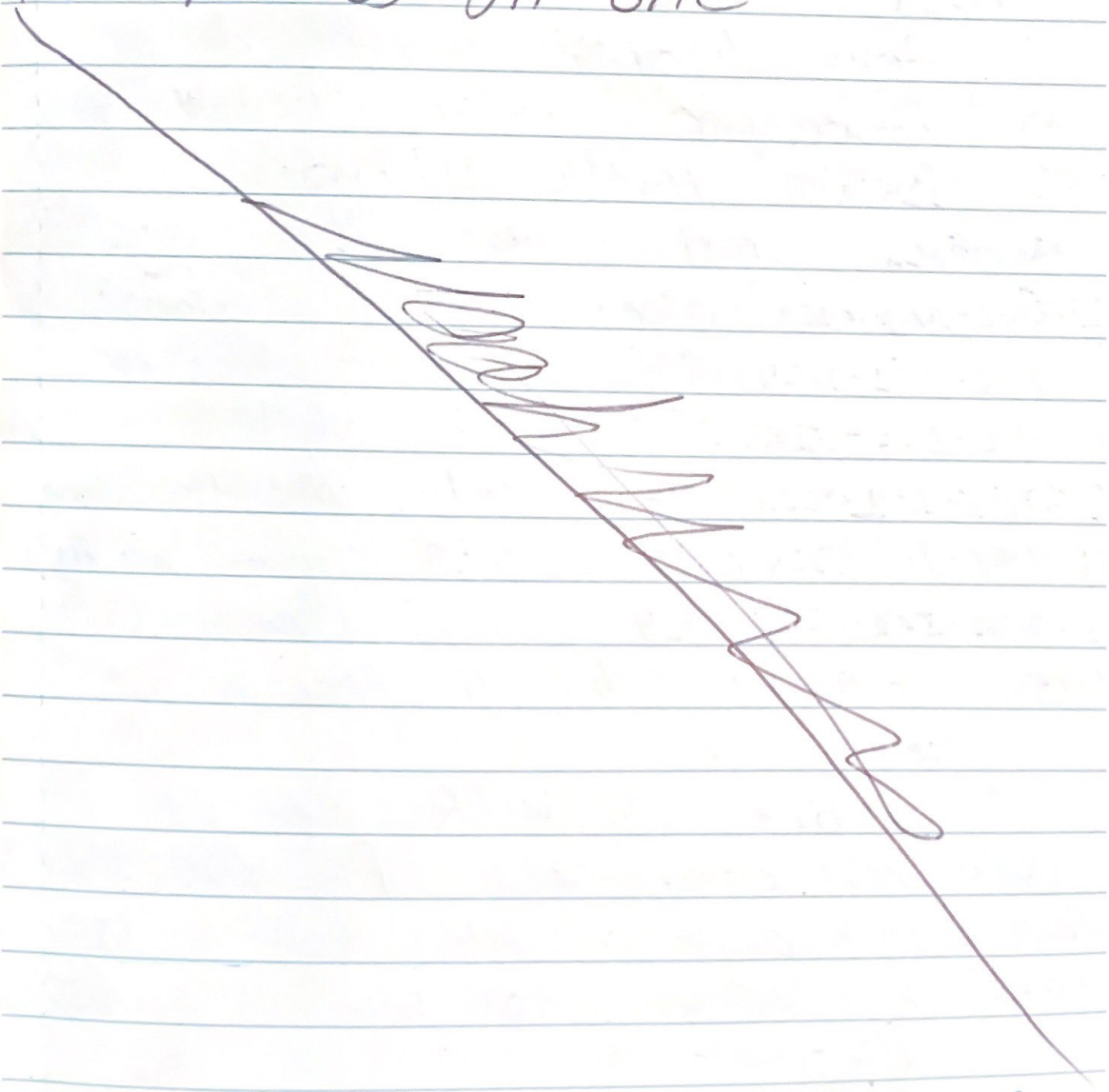
1235 successful leak test of TE-707L-561

1250 successful leak ~~test~~ of TE-707-562
Use clean paper towel to remove/dry water from both.

1255 N. Weiss/T. Lavliere off site @ WTR.

1330 Can Prep, T. Lavliere offsite

1415 N. Weiss off site



Rite in the Rain

2/7/23 Dark rain 40s

0630 N. Weiss OOG/E. Scheumann OOF/M. Wright CE on site for 1Q23 VIAM sampling

0640 Wind from S/SE @ Boeing Field., Check vacuum in cans.

0656 Set up CE van @ ~~SE~~ SW corner of WTR property

0700 Start collection of TE-707L-AA1-0223 locked inside CE van w/ ~~4~~ SW tubing hanging downward out of passenger window, Odor of Passing traffic exhaust.

| Sample | Start time | Initial ("Hg) Vac. | Note |
|---|---|---|---|
| TE-707L-AA1-0223 | 0700 | -29.0 | traffic exhaust |
| AS-710L-IA1-0223 | 0706 | -29.0 | coffee/paper |
| AS-710L-IA2-0223 | 0709 | -29.0 | Cardboard/rubber/plastic |
| AS-710L-IA3-0223 | 0712 | -29.0 | New carpet/cologne |
| TE-707L-IA1-0223 | 0712 | -29.0 | Cinnamon air fresh |
| TE-707L-IA2-0223 | 0724 | -29.5 | Cigarettes |

0750 Prep for sub slab pressure measurements

0805 on site @ WTR. Set up on NW corner office P= +0.002" wc

0820 set caulk in hole seal w/ tape

0825 Set up on west hole in warehouse P=-0.004" WC

0830 Set caulk in hole seal w/ tape

0836 set up on TE-707L-SG2
P= -0.004 → +0.016 "wc
0839 Close/Seal Vapor Pin.
1130 Check can Vacuum levels.

| Name | time | "Hg |
|---|---|---|
| TE-707L-AA1-0223 | 1130 | -16.0 |
| AS-710L-IA1-0223 | 1133 | -15.0 |
| AS-710L-IA1-0223 | 1134 | -16.0 |
| AS-710L-IA2-0223 | 1135 | -15.0 |
| TE-707L-IA1-0223 | 1138 | -15.0 |
| TE-707L-IA2-0223 | 1139 | -16.0 |

1209 Plastic/burning smelled ambiently @ GT GWPT building and White Satin parking lot.
1305 Check cans

| | | |
|---|---|---|
| 707L-AA1 | 1305 | -10.5 |
| 710L-IA1 | ~~1308~~ NW 1312 | ~~-10.0~~ NW -9.0 |
| 710L-IA2 | 1313 | -10.0 |
| 710L-IA3 | 1314 | -10.0 |
| 707L-IA1 | 1308 | -10.0 |
| 707L-IA2 | 1309 | -10.0 |

1330 Plastic burning odor no longer smelled ambiently outdoors.
1345 Begin can check @ 710L-IA1

Rite in the Rain.

2/7/23 (cont.)

| 1350 ID | Time | Final "Hg vac |
|---|---|---|
| 710L-IA1 | 1350 | -7.0 |
| 710L-IA3 | 1353 | -7.5 |
| 710L-IA2 | 1354 | -7.5 |
| 707L-IA1 | 1358 | -7.0 |
| 707L-IA2 | 1359 | -7.0 |
| 707L-AA1 | 1402 | -7.0 |

~~1st~~ 1413 SOAJ P-4 = -0.05" WC
1421 SOAJ AS-710-SG1 = 0.00 "WC
1426 SOAJ AS-710-SG2 = -0.003 "WC
1430 off SOAJ property
1440 check cans, COC.
1500 prep 2/8/23 soil gas cans.
1530 All parties off site

2/8/23 Dark 30's
0650 N. Weiss/E. Schermann (Corp Rep
Vaper Cans and Supplies.
0705 Arrive @ SDAT for SG sampling
0715 Europhins did not provide Swage
lok Nuts. Hts meeting.
0720 Go to FBI for nuts
0740 Set up Vacuum test on
AS-710-SG1
0800 Start Vacuum test: -3.5 "Hg
0803 Vacuum test: pass, Begin
sampling "AS-710-SG1-0223
0805 Using CE peri pump; E/S master
flex S/N: CP 77967
0810 Set up on AS-710-SG2
0812 Start Vacuum test: -3.5 "Hg
0815 Vacuum test: Pass. Begin
sampling "AS-710-SG2-0223"
0820 Leave SDAT, Check in w/ Steven
@ WTR
0823 Set up on TE-707L-SG1
0827 Start Vacuum test: -4.0 "Hg
0830 Vacuum test: Pass. Begin
sampling "AS-NW" TE-707L-SG1-0223"
0833 Set up @ TE-707L-SG2
0839 Start Vacuum test: -5.0 "Hg

Rite in the Rain

2/8/23 (cont.)

0842 Vacuum test: Pass begin sampling "TE-707L-SG2-0223"

| Sample ID | start time | intial Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 0803 | -28.5 |
| AS-710-SG2-0223 | 0815 | -29.0 |
| TE-707L-SG1-0223 | 0830 | -29.5 |
| TE-707L-SG2-0223 | 0842 | -30.0 |

1200 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1200 | -17.0 |
| AS-710-SG2-0223 | 1202 | -17.5 |
| TE-707L-SG1-0223 | 1206 | -18.5 |
| TE-707L-SG2-0223 | 1208 | -20.0 |

1400 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1401 | -10.0 |
| AS-710-SG2-0223 | 1402 | -11.0 |
| TE-707L-SG1-0223 | 1405 | -12.0 |
| TE-707L-SG2-0223 | 1407 | -13.0 |

1500 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1502 | -7.0 |
| AS-710-SG2-0223 | 1503 | -6.5 |
| TE-707L-SG1-0223 | 1506 | -8.5 |
| TE-707L-SG2-0223 | 1507 | -9.5 |

1519 Sampling stopped @ AS-710-SG2-0223 =-6 "Hg

| ID | Stop Time | Final vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1520 | -5.5 ~~-5~~ |
| AS-710-SG2-0223 | 1519 | ~~-6.0~~ -5.0 |
| TE-707L-SG1-0223 | 1529 | -6.5 |
| TE-707L-SG2-0223 | 1537 | -6.5 |

1540 Venting fan @ 707 S Lucille restarted
1542 Manometer reading = 10.80 "WC
1545 Venting fan @ 710 S Lucille restarted
1547 Manometer reading = 2.90 "WC

1550 → Odors detected @ SDAT warehouse include cardboard, rubber, & plastic
~~SDS~~
→ Odors detected in WTR office, same as 2/7 (cigarettes)
→ Sikaflex stored in closet w/ TE-707L-SG2

Rite in the Rain

2/8/23 (cont.)

1600 COC, pack cans for shipping.
1630 All parties off site.
1640 Relinquish samples to Fedex see ~~receipt~~ Reciept in daily email for tracking information

Dwyer

4

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24
8-12-08

TING SYSTEN
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COLUMNS ARE AT ZER
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CORPORATIO
7972

INCHES
OF WATER
USING .934
SP. GR. RED
OIL

DWYER
INSTRUMENTS, INC.
MICH CITY, IN
46360 U.S.A.

# Vapor Intrusion Depressurization System Inspection Form

Date: 12 / 13 / 2022

Time: 0900

Address: 710 S. Lucile St.

Tenant's Name and Contact Info: Stone Drew Ashe and Jones, Clay Young, 206-763-2850, clay@sdajnw.com

## Part 1- Documentation of Condition of System Components

### 1.1 Sub-Slab System:

| | | | |
|---|---|---|---|
| Exterior Pipe Free of Cracks | (Y) | N | N/A |
| Interior Pipe Free of Cracks | (Y) | N | N/A |
| Fan Running Appropriately (no excess vibration or noise) | (Y) | N | N/A |
| Caulk on Floor Penetrations in Good Condition | (Y) | N | N/A |
| Manometer In Good Condition | (Y) | N | N/A |
| Roof Flashing in Good Condition | (Y) | N | N/A |
| Significant basement floor cracking, or new openings in the floor | Y | (N) | N/A |
| Significantly different manometer readings | Y | (N) | N/A |

### 1.2 Crawl Space System:

| | | | |
|---|---|---|---|
| Exterior Pipe Free of Cracks | Y | N | (N/A) |
| Interior Pipe Free of Cracks | Y | N | (N/A) |
| Fan Running Appropriately (no excess vibration or noise) | Y | N | (N/A) |
| Membrane Material in Good Condition | Y | N | (N/A) |
| Membrane Seals in Good Condition | Y | N | (N/A) |
| Manometer In Good Condition | Y | N | (N/A) |
| Roof Flashing in Good Condition | Y | N | (N/A) |

| | | | |
|---|---|---|---|
| Significantly different manometer readings | Y | N | N/A |
| Any evidence that the membrane has been walked on, moved, or otherwise tinkered with | Y | N | N/A |
| Any holes in the membrane, broken seals, etc. | Y | N | N/A |

**1.3 Structural/Usage Changes:**

| | | | |
|---|---|---|---|
| Any Significant changes to the building's HVAC System | Y | N | N/A |
| Any new vents or openings in the roof/walls, less than 10' away from the stack (and < 2' below it) | Y | N | N/A |
| Any changes to the use of any chimneys that could result in re-entrainment | Y | N | N/A |
| Any new buildings near the mitigated building close enough that stack gasses could contaminate their indoor air | Y | N | N/A |
| Has the attic been remodeled into a living space (if the mitigation fan is located in the attic) | Y | N | N/A |
| Have there been any *significant* earthquake events | Y | N | N/A |
| Has the usage of the building changed since the last inspection (has use changed to/from commercial/ industrial or residential)? | Y | N | N/A |
| Have any new potentially sensitive receptors moved into the building (children, elderly)? | Y | N | N/A |
| Has the usage of rooms within the building changed (bedrooms becoming storage or storage areas becoming bedrooms; do occupants use different rooms in the building than they have in the past)? | Y * see notes | N TL | N/A |
| Does the owner operate the mitigation system fan continuously? | Y | N | N/A |

Part 2- Annual Negative Pressure Field Extension Measurements

| Location | Pressure (inches) |
|---|---|
| P-2 | -0.154 |
| P-1 | -0.484 |
| P-3 | -0.023 |
| P-4 | -0.171 |
| P-5 | cannot measure |
| P-6 | -0.513 |
| P-7 | -0.147 |
| P-8 | -0.025 |

Part 3- Pressure Differential Reading (U-tube manometer): 3.25 inches

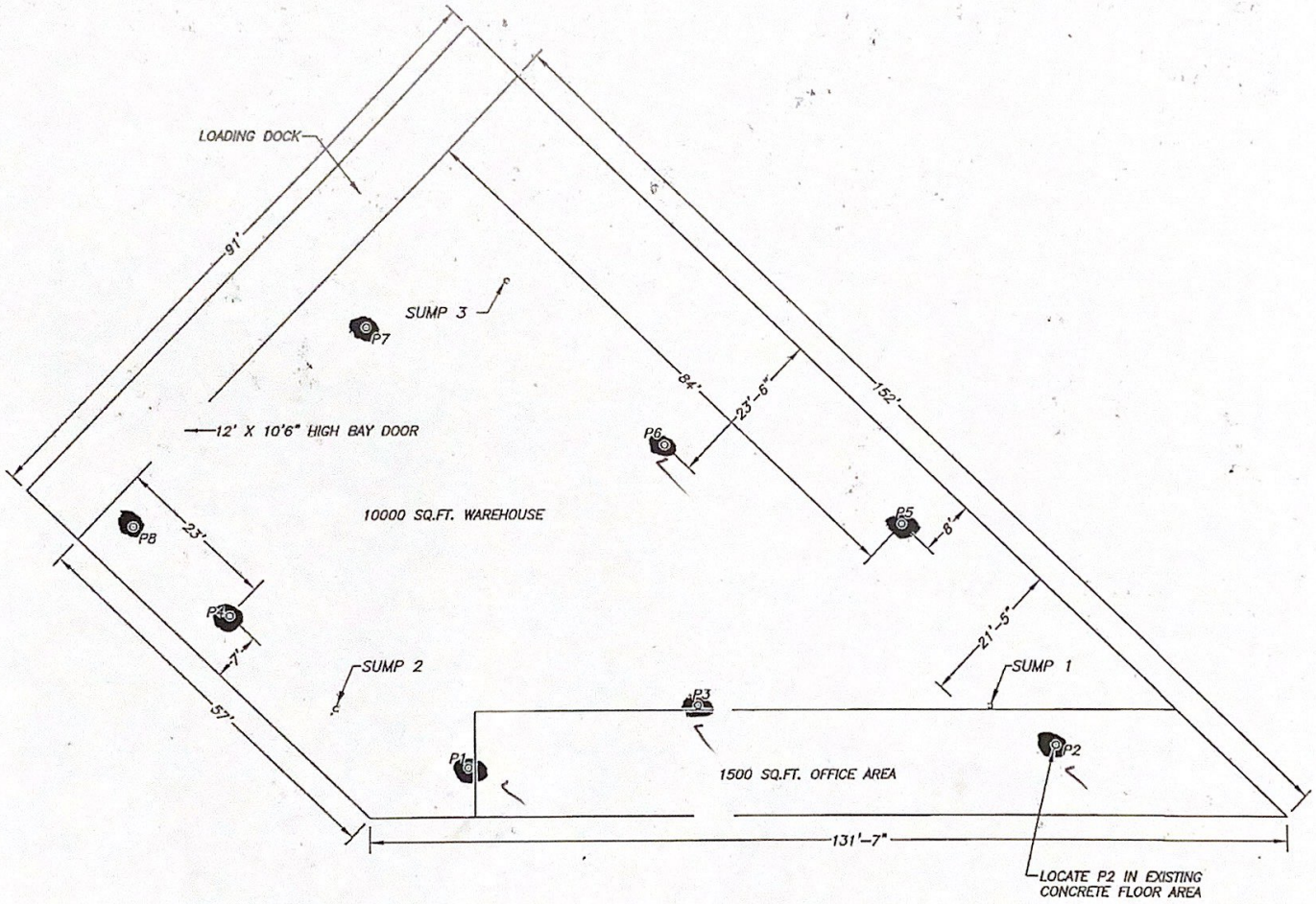
Other Observations/Comments

Location of manometer: inside warehouse by bathroom

P-5 inaccessible due to new offices. Per Clay, offices finished about 6 month ago. Glue down carpet present in offices

Inspected by: _____ (signature)

SADJ




STONE DREW ASHE & JONES BUILDING LAYOUT
LOCATION OF SUMPS AND PRESSURE SAMPLING POINTS
1/16" = 1'-0"

LEGEND
P# PRESSURE SAMPLE PORT
c SUMP

FIG. 2-1

# Appendix B

weather.gov

Weather observations for the past three days

# Boeing Field - King County International Airport

Enter Your "City, ST" or zip code Go

metric

| Date | Time (pst) | Wind (mph) | Vis. (mi.) | Weather | Sky Cond. | Temperature (ºF) Air | Dwpt | 6 hour Max. | Min. | Relative Humidity | Wind Chill (°F) | Heat Index (°F) | Pressure altimeter (in) | sea level (mb) | Precipitation (in.) 1 hr | 3 hr | 6 hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07 | 15:53 | S 14 G 25 | 10.00 | Partly Cloudy | SCT022 SCT095 | 49 | 39 | 52 | 47 | 69% | 44 | NA | 30.14 | 1020.5 | | | 0.10 |
| 07 | 14:53 | S 8 G 26 | 10.00 | Mostly Cloudy | SCT022 BKN100 | 51 | 45 | | | 80% | NA | NA | 30.12 | 1019.9 | | | |
| 07 | 13:53 | S 15 G 25 | 10.00 | Partly Cloudy | SCT020 SCT080 | 50 | 45 | | | 83% | 45 | NA | 30.11 | 1019.7 | | | |
| 07 | 12:53 | S 17 G 28 | 6.00 | Light Rain Fog/Mist | FEW019 BKN044 OVC050 | 48 | 44 | | | 86% | 42 | NA | 30.11 | 1019.4 | 0.10 | 0.10 | |
| 07 | 11:53 | S 13 G 25 | 10.00 | Overcast | FEW034 BKN044 OVC050 | 49 | 43 | | | 80% | 44 | NA | 30.11 | 1019.4 | | | |
| 07 | 10:53 | S 13 G 25 | 10.00 | Overcast | BKN028 OVC034 | 49 | 43 | | | 80% | 44 | NA | 30.11 | 1019.6 | | | |
| 07 | 09:53 | S 14 G 21 | 9.00 | Light Rain | BKN017 OVC033 | 47 | 43 | 47 | 44 | 86% | 41 | NA | 30.10 | 1019.3 | 0.01 | | 0.06 |
| 07 | 08:53 | S 12 | 6.00 | Light Rain Fog/Mist | BKN017 OVC033 | 46 | 42 | | | 86% | 40 | NA | 30.12 | 1019.7 | 0.02 | | |
| 07 | 07:53 | S 10 | 6.00 | Light Rain Fog/Mist | OVC033 | 45 | 42 | | | 90% | 40 | NA | 30.12 | 1020.0 | 0.01 | | |
| 07 | 06:53 | S 10 | 9.00 | Light Rain | OVC033 | 45 | 42 | | | 90% | 40 | NA | 30.14 | 1020.5 | 0.02 | 0.02 | |
| 07 | 05:53 | S 10 | 8.00 | Light Rain | BKN055 BKN075 OVC085 | 45 | 41 | | | 86% | 40 | NA | 30.17 | 1021.5 | | | |
| 07 | 04:53 | S 10 | 10.00 | Overcast | OVC040 | 46 | 41 | | | 83% | 41 | NA | 30.17 | 1021.7 | | | |
| 07 | 03:53 | S 15 | 9.00 | Light Rain | BKN048 OVC055 | 45 | 41 | 46 | 44 | 86% | 38 | NA | 30.20 | 1022.6 | | | |
| 07 | 02:53 | S 14 | 9.00 | Light Rain | OVC050 | 46 | 41 | | | 83% | 40 | NA | 30.24 | 1023.8 | | | |
| 07 | 01:53 | S 8 | 10.00 | Overcast | BKN047 BKN075 OVC090 | 45 | 41 | | | 86% | 41 | NA | 30.26 | 1024.6 | | | |
| 07 | 00:53 | SE 9 | 10.00 | Overcast | SCT037 OVC045 | 44 | 40 | | | 85% | 39 | NA | 30.28 | 1025.1 | | | |
| 06 | 23:53 | SE 9 | 10.00 | Overcast | OVC042 | 45 | 41 | | | 86% | 40 | NA | 30.29 | 1025.8 | | | |
| 06 | 22:53 | SE 9 | 10.00 | Overcast | OVC045 | 46 | 40 | | | 79% | 41 | NA | 30.31 | 1026.2 | | | |
| 06 | 21:53 | SE 9 | 10.00 | Overcast | OVC039 | 46 | 40 | 48 | 45 | 79% | 41 | NA | 30.31 | 1026.4 | | | |
| 06 | 20:53 | SE 9 | 10.00 | Overcast | OVC045 | 47 | 40 | | | 77% | 43 | NA | 30.32 | 1026.7 | | | |
| 06 | 19:53 | S 12 | 10.00 | Partly Cloudy | SCT050 | 47 | 39 | | | 74% | 42 | NA | 30.33 | 1026.8 | | | |
| 06 | 18:53 | S 12 G 21 | 10.00 | Fair | CLR | 47 | 40 | | | 77% | 42 | NA | 30.33 | 1027.1 | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06 | 17:53 | S 14 G 25 | 10.00 | Mostly Cloudy | FEW036 BKN050 | 48 | 41 | | | 77% | 42 | NA | 30.34 | 1027.4 | | |
| 06 | 16:53 | S 14 G 29 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 48 | 42 | | | 80% | 42 | NA | 30.36 | 1028.1 | | |
| 06 | 15:53 | S 17 G 28 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 48 | 42 | 49 | 46 | 80% | 42 | NA | 30.37 | 1028.3 | | |
| 06 | 14:53 | S 13 G 23 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 49 | 42 | | | 77% | 44 | NA | 30.38 | 1028.5 | | |
| 06 | 13:53 | S 13 G 25 | 10.00 | Mostly Cloudy | FEW017 SCT028 BKN036 | 48 | 43 | | | 83% | 43 | NA | 30.37 | 1028.5 | | |
| 06 | 12:53 | S 13 G 23 | 7.00 | Light Rain | SCT021 BKN040 OVC050 | 48 | 43 | | | 83% | 43 | NA | 30.39 | 1028.9 | | |
| 06 | 11:53 | S 18 G 29 | 10.00 | Overcast | BKN017 OVC110 | 49 | 42 | | | 77% | 43 | NA | 30.39 | 1029.2 | | |
| 06 | 10:53 | S 15 G 23 | 10.00 | Overcast | BKN017 OVC110 | 46 | 41 | | | 83% | 40 | NA | 30.40 | 1029.3 | | |
| 06 | 09:53 | S 13 G 23 | 10.00 | Mostly Cloudy | BKN017 | 46 | 41 | 46 | 43 | 83% | 40 | NA | 30.39 | 1029.0 | | |
| 06 | 08:53 | S 15 G 28 | 10.00 | Mostly Cloudy | BKN017 | 46 | 41 | | | 83% | 40 | NA | 30.38 | 1028.8 | | |
| 06 | 07:53 | S 16 G 25 | 10.00 | Mostly Cloudy | SCT011 BKN017 | 44 | 40 | | | 85% | 37 | NA | 30.37 | 1028.3 | | |
| 06 | 06:53 | S 13 | 10.00 | Overcast | BKN013 OVC020 | 43 | 40 | | | 89% | 36 | NA | 30.37 | 1028.3 | | |
| 06 | 05:53 | S 16 G 28 | 10.00 | Overcast | OVC015 | 44 | 39 | | | 83% | 37 | NA | 30.36 | 1028.2 | | |
| 06 | 04:53 | SE 10 | 10.00 | Overcast | OVC017 | 44 | 40 | | | 85% | 39 | NA | 30.36 | 1028.1 | | |
| 06 | 03:53 | SE 8 | 10.00 | Overcast | BKN021 OVC085 | 44 | 39 | 45 | 43 | 83% | 39 | NA | 30.36 | 1028.0 | | |
| 06 | 02:53 | SE 8 | 10.00 | Overcast | FEW021 OVC047 | 43 | 39 | | | 86% | 38 | NA | 30.36 | 1027.8 | | |
| 06 | 01:53 | S 9 | 10.00 | Mostly Cloudy | BKN020 | 43 | 39 | | | 86% | 38 | NA | 30.33 | 1027.0 | | |
| 06 | 00:53 | SE 9 | 10.00 | Overcast | BKN013 OVC025 | 43 | 40 | | | 89% | 38 | NA | 30.30 | 1025.8 | | |
| 05 | 23:53 | S 8 | 10.00 | Overcast | BKN013 OVC025 | 44 | 40 | | | 85% | 39 | NA | 30.27 | 1025.1 | | |
| 05 | 22:53 | S 7 | 10.00 | Overcast | OVC013 | 44 | 41 | | | 89% | 40 | NA | 30.24 | 1024.1 | | |
| 05 | 21:53 | S 5 | 10.00 | Overcast | OVC013 | 45 | 42 | 48 | 45 | 90% | 42 | NA | 30.21 | 1022.8 | | 0.01 |
| 05 | 20:53 | S 3 | 10.00 | Overcast | BKN013 OVC018 | 45 | 43 | | | 93% | NA | NA | 30.16 | 1021.1 | | |
| 05 | 19:53 | Calm | 7.00 | Light Rain | BKN008 OVC012 | 47 | 44 | | | 90% | NA | NA | 30.12 | 1019.7 | 0.01 | |
| 05 | 18:53 | Calm | 7.00 | Light Rain | SCT012 BKN015 OVC031 | 48 | 46 | | | 93% | NA | NA | 30.07 | 1018.2 | | |
| 05 | 17:53 | SE 3 | 10.00 | Overcast | SCT010 BKN016 OVC022 | 48 | 45 | | | 89% | NA | NA | 30.03 | 1016.8 | | |
| 05 | 16:53 | S 5 | 10.00 | Overcast | SCT012 BKN018 | 48 | 45 | | | 89% | 46 | NA | 30.00 | 1015.7 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | OVC050 | | | | | | | | | | | | |
| 05 | 15:53 | S 5 | 10.00 | Mostly Cloudy | BKN011 BKN036 | 48 | 45 | 48 | 46 | 89% | 46 | NA | 29.96 | 1014.5 | | | 0.03 |
| 05 | 14:53 | SW 5 | 10.00 | Overcast | SCT008 SCT012 OVC035 | 48 | 45 | | | 89% | 46 | NA | 29.94 | 1013.7 | | | |
| 05 | 13:53 | SE 5 | 9.00 | Light Rain | BKN008 OVC034 | 47 | 45 | | | 93% | 45 | NA | 29.90 | 1012.6 | | | |
| 05 | 12:53 | SE 7 | 4.00 | Light Rain Fog/Mist | BKN007 OVC034 | 46 | 45 | | | 96% | 42 | NA | 29.89 | 1012.1 | 0.03 | 0.03 | |
| 05 | 11:53 | SE 7 | 6.00 | Light Rain Fog/Mist | BKN009 | 46 | 45 | | | 96% | 42 | NA | 29.87 | 1011.5 | | | |
| 05 | 10:53 | S 7 | 10.00 | Light Rain | OVC060 | 47 | 44 | | | 90% | 44 | NA | 29.85 | 1010.9 | | | |
| 05 | 09:53 | SW 5 | 10.00 | Overcast | FEW020 BKN065 OVC090 | 46 | 44 | 46 | 41 | 93% | 44 | NA | 29.82 | 1009.8 | | | |
| 05 | 08:53 | Calm | 10.00 | Overcast | FEW070 OVC085 | 44 | 42 | | | 93% | NA | NA | 29.78 | 1008.4 | | | |
| 05 | 07:53 | Calm | 10.00 | Overcast | OVC090 | 42 | 41 | | | 96% | NA | NA | 29.74 | 1006.9 | | | |
| 05 | 06:53 | Calm | 10.00 | Overcast | OVC090 | 43 | 41 | | | 93% | NA | NA | 29.70 | 1005.6 | | | |
| 05 | 05:53 | Calm | 10.00 | Overcast | OVC085 | 44 | 41 | | | 89% | NA | NA | 29.67 | 1004.6 | | | |
| 05 | 04:53 | Calm | 10.00 | Overcast | OVC075 | 44 | 42 | | | 93% | NA | NA | 29.66 | 1004.2 | | | |
| 05 | 03:53 | NW 5 | 10.00 | A Few Clouds | FEW080 | 45 | 41 | 46 | 44 | 86% | 42 | NA | 29.65 | 1003.9 | | | |
| 05 | 02:53 | NW 3 | 10.00 | Mostly Cloudy | BKN110 | 44 | 41 | | | 89% | NA | NA | 29.65 | 1004.0 | | | |
| 05 | 01:53 | Calm | 10.00 | Overcast | OVC110 | 45 | 41 | | | 86% | NA | NA | 29.66 | 1004.4 | | | |
| 05 | 00:53 | NE 7 | 10.00 | Mostly Cloudy | FEW055 FEW070 BKN110 | 46 | 41 | | | 83% | 42 | NA | 29.67 | 1004.5 | | | |
| 04 | 23:53 | NE 7 | 10.00 | Overcast | BKN095 OVC120 | 46 | 41 | | | 83% | 42 | NA | 29.71 | 1005.9 | | | |
| 04 | 22:53 | NE 12 | 10.00 | Overcast | OVC095 | 46 | 43 | | | 89% | 40 | NA | 29.74 | 1007.0 | | | |
| 04 | 21:53 | E 5 | 9.00 | Light Rain | OVC047 | 46 | 44 | 50 | 46 | 93% | 44 | NA | 29.80 | 1009.2 | | | 0.01 |
| 04 | 20:53 | Calm | 8.00 | Light Rain | OVC047 | 46 | 44 | | | 93% | NA | NA | 29.84 | 1010.4 | | | |
| 04 | 19:53 | SE 5 | 6.00 | Light Rain Fog/Mist | BKN040 OVC048 | 46 | 45 | | | 96% | 44 | NA | 29.86 | 1011.2 | 0.01 | | |
| 04 | 18:53 | Calm | 10.00 | Light Rain | OVC050 | 48 | 44 | | | 86% | NA | NA | 29.86 | 1011.1 | | | |
| 04 | 17:53 | S 6 | 10.00 | Overcast | BKN050 OVC060 | 49 | 44 | | | 83% | 46 | NA | 29.87 | 1011.6 | | | |
| 04 | 16:53 | S 5 | 10.00 | Overcast | BKN060 OVC085 | 48 | 45 | | | 89% | 46 | NA | 29.88 | 1011.8 | | | |

| Date | Time (pst) | Wind (mph) | Vis. (mi.) | Weather | Sky Cond. | Air | Dwpt | Max. 6 hour | Min. 6 hour | Relative Humidity | Wind Chill (°F) | Heat Index (°F) | altimeter (in.) | sea level (mb) | 1 hr | 3 hr | 6 hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Temperature (ºF) | | | | | | | Pressure | | Precipitation (in.) | | |

National Weather Service
Southern Region Headquarters
Fort Worth, Texas
Disclaimer

Back to previous page

Last Modified: Febuary, 7 2012
Privacy Policy

# Appendix C

**Analytical Resources, LLC**
**Analytical Chemists and Consultants**

22 February 2023

Natasya Gray
Dalton, Olmsted & Fuglevand, Inc
1420 - 156th Ave., NE STE C1
Bellevue, WA 98007

RE: Georgetown (CLE-001 (375.01))

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 23B0223 | N/A |

---

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, LLC

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Kelly Bottem, Client Services Manager

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006-012

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0223 | Turn-around Requested: Standard | Page: 1 of 1 | |
| ARI Client Company: CleanEarth | Phone: (206)-375-0211 | Date: 02/09/23 | Ice Present? Y |
| Client Contact: Tasya Gray | | No. of Coolers: 1 | Cooler Temps: 9.0 |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: 8260 | Analysis Requested: 8260-SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| TB01-0223 | 02/09/23 | 0855 | W | 2 | X | X | |
| CG-149-WT-0223 | 02/09/23 | 0955 | W | 6 | X | X | |
| CG-118-WT-0223 | 02/09/23 | 1040 | W | 6 | X | X | |
| CG-116-WT-0223 | 02/09/23 | 1130 | W | 6 | X | X | |
| VIT5-03-WT-0223 | 02/09/23 | 1235 | W | 6 | X | X | |
| CG-131-WT-0223 | 02/09/23 | 1325 | W | 6 | X | X | |
| CG-126-WT-0223 | 02/09/23 | 1420 | W | 18 | X | X | MSMSD |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

EDS

| Comments/Special Instructions | Relinquished by: (Signature) | Received by: (Signature) | Relinquished by: (Signature) | Received by: (Signature) |
|---|---|---|---|---|
| Report to alutey@dofnw.com in addition to Tasya Gray | EDS | Phillip Bates | | |
| | Printed Name: Elliott Scheumann | Printed Name: Phillip Bates | Printed Name: | Printed Name: |
| | Company: DOF | Company: AR | Company: | Company: |
| | Date & Time: 2/9/23 1533 | Date & Time: 2/9/23 15:33 | Date & Time: | Date & Time: |


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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| TB01-0223 | 23B0223-01 | Water | 09-Feb-2023 08:55 | 09-Feb-2023 15:33 |
| CG-149-WT-0223 | 23B0223-02 | Water | 09-Feb-2023 09:55 | 09-Feb-2023 15:33 |
| CG-118-WT-0223 | 23B0223-03 | Water | 09-Feb-2023 10:40 | 09-Feb-2023 15:33 |
| CG-116-WT-0223 | 23B0223-04 | Water | 09-Feb-2023 11:30 | 09-Feb-2023 15:33 |
| VIT5-03-WT-0223 | 23B0223-05 | Water | 09-Feb-2023 12:35 | 09-Feb-2023 15:33 |
| CG-131-WT-0223 | 23B0223-06 | Water | 09-Feb-2023 13:25 | 09-Feb-2023 15:33 |
| CG-126-WT-0223 | 23B0223-07 | Water | 09-Feb-2023 14:20 | 09-Feb-2023 15:33 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

# Work Order Case Narrative

**Volatiles - EPA Method SW8260D**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

The matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and relative percent difference (RPD) were within advisory control limits.

**Volatiles - EPA Method 8260D-SIM (Selected Ion Monitoring)**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

The matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and relative percent difference (RPD) were within advisory control limits.

**Analytical Resources, LLC**
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Clean Earth / DOF  Project Name: Georgetown

COC No(s): _____ (NA)  Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: 23B0223  Tracking No: _____ (NA)

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of the cooler? | YES | (NO) |
| Were custody papers included with the cooler? | (YES) | NO |
| Were custody papers properly filled out (ink, signed, etc.) | (YES) | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 9.0

Time 15:33

If cooler temperature is out of compliance fill out form 00070F  Temp Gun ID#: 5009708

Cooler Accepted by: PIB  Date: 2/9/23  Time: 15:33

***Complete custody forms and attach all shipping documents***

## Log-In Phase:

| | | | |
|---|---|---|---|
| Was a temperature blank included in the cooler? | | YES | (NO) |
| What kind of packing material was used? | (Bubble Wrap) (Wet Ice) (Gel Packs) Baggies (Foam Block) Paper Other: _____ | | |
| Was sufficient ice used (if appropriate)? | NA | YES | (NO) |
| How were bottles sealed in plastic bags? | Individually | Grouped | (Not) |
| Did all bottles arrive in good condition (unbroken)? | | (YES) | NO |
| Were all bottle labels complete and legible? | | (YES) | NO |
| Did the number of containers listed on COC match with the number of containers received? | | (YES) | NO |
| Did all bottle labels and tags agree with custody papers? | | (YES) | NO |
| Were all bottles used correct for the requested analyses? | | (YES) | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) | (NA) | YES | NO |
| Were all VOC vials free of air bubbles? | NA | (YES) | NO |
| Was sufficient amount of sample sent in each bottle? | | (YES) | NO |
| Date VOC Trip Blank was made at ARI | PIB 2/9 (NA) | 1/31/23 | |

Were the sample(s) split by ARI? (NA) YES  Date/Time: _____  Equipment: _____  Split by: _____

Samples Logged by: PIB  Date: 2/9/23  Time: 2/9 PIB ~~11:32~~ 8:30  Labels checked by: _____

***** Notify Project Manager of discrepancies or concerns *****

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

***Additional Notes, Discrepancies, & Resolutions:***

By: _____  Date: _____

Analytical Resources, LLC
Analytical Chemists and Consultants

# Cooler Temperature Compliance Form

**ARI Work Order:** 23B0223

**Cooler#:** _____ **Temperature(°C):** 9.0

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| All samples received above 6°C | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

Completed by: DJB Date: 2/9/23 Time: 15:35

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 08:55

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:18

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-01 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 08:55
Analyzed: 02/13/2023 16:18

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *96.0* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 08:55
Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0306
Prepared: 02/13/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-01 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *117* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *95.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *92.6* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 09:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:59

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-02 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 4.07 | ug/L | |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.20 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 5.98 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 4.08 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.13 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.78 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.13 | ug/L | J |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.06 | ug/L | J |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | 0.29 | ug/L | |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | 1.20 | ug/L | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | 2.63 | ug/L | |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | 0.15 | ug/L | J |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.52 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 09:55
Analyzed: 02/13/2023 16:59

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *99.7* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *99.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 09:55
Analyzed: 02/14/2023 12:34

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-02 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 4.73 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.122 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *114* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *108* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *108* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 10:40
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 17:20

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-03 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.12 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.07 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.88 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.69 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.20 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.62 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.47 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.09 | ug/L | J |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | 0.26 | ug/L | |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | 0.33 | ug/L | |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.86 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 10:40
Analyzed: 02/13/2023 17:20

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *97.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/09/2023 10:40
Instrument: NT16 Analyst: KOTT — Analyzed: 02/14/2023 12:56

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-03 C
Preparation Batch: BLB0339 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.156 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.505 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *116* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *104* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *94.1* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 11:30
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 17:41

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-04 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.09 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.34 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.19 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.33 | ug/L | |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.24 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 11:30
Analyzed: 02/13/2023 17:41

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *98.3* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.5* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 11:30
Analyzed: 02/14/2023 13:17

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-04 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0866 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0114 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *119* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *102* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *86.4* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 12:35
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:02

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-05 E
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.08 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.21 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 1.12 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.89 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 12:35
Analyzed: 02/13/2023 18:02

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *100* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/09/2023 12:35
Instrument: NT16 Analyst: KOTT — Analyzed: 02/14/2023 13:38

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-05 C
Preparation Batch: BLB0339 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0142 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *118* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *101* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.0* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-131-WT-0223

**23B0223-06 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 13:25
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:23

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-06 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.32 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.29 | ug/L | |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.63 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 31.6 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | 0.13 | ug/L | J |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 8.19 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**CG-131-WT-0223**

**23B0223-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 13:25
Analyzed: 02/13/2023 18:23

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *93.6* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-131-WT-0223

**23B0223-06 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 13:25
Analyzed: 02/14/2023 13:59

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-06 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0882 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *111* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *91.2* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 14:20
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-07 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.30 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.85 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.13 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 4.52 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.49 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 14:20
Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.6* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *100* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 14:20
Analyzed: 02/13/2023 13:48

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0306
Prepared: 02/13/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-07 C

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0123 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.558 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *96.8* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.93 | | | ug/L | *5.00* | | *98.5* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.70 | | | ug/L | *5.00* | | *94.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0325-BS1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | | |
| Vinyl Chloride | 9.72 | 0.08 | 0.20 | ug/L | 10.0 | | 97.2 | 66-133 | | | |
| Chloroethane | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.83 | 0.11 | 0.20 | ug/L | 10.0 | | 98.3 | 76-129 | | | |
| 1,1-Dichloroethene | 9.58 | 0.08 | 0.20 | ug/L | 10.0 | | 95.8 | 69-135 | | | |
| Methylene Chloride | 9.13 | 0.53 | 1.00 | ug/L | 10.0 | | 91.3 | 65-135 | | | |
| Carbon Disulfide | 9.81 | 0.06 | 0.20 | ug/L | 10.0 | | 98.1 | 78-125 | | | |
| trans-1,2-Dichloroethene | 9.38 | 0.07 | 0.20 | ug/L | 10.0 | | 93.8 | 78-128 | | | |
| 1,1-Dichloroethane | 9.75 | 0.04 | 0.20 | ug/L | 10.0 | | 97.5 | 76-124 | | | |
| cis-1,2-Dichloroethene | 9.93 | 0.08 | 0.20 | ug/L | 10.0 | | 99.3 | 80-121 | | | |
| Chloroform | 9.82 | 0.05 | 0.20 | ug/L | 10.0 | | 98.2 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 79-123 | | | |
| Carbon tetrachloride | 8.94 | 0.09 | 0.20 | ug/L | 10.0 | | 89.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.65 | 0.08 | 0.20 | ug/L | 10.0 | | 96.5 | 75-123 | | | |
| Benzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Trichloroethene | 9.94 | 0.07 | 0.20 | ug/L | 10.0 | | 99.4 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 49.3 | 1.90 | 5.00 | ug/L | 50.0 | | 98.7 | 67-133 | | | |
| Toluene | 10.2 | 0.05 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| 2-Hexanone | 50.2 | 2.06 | 5.00 | ug/L | 50.0 | | 100 | 69-133 | | | |
| Tetrachloroethene | 9.75 | 0.09 | 0.20 | ug/L | 10.0 | | 97.5 | 80-120 | | | |
| Chlorobenzene | 10.1 | 0.06 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Ethylbenzene | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| m,p-Xylene | 21.4 | 0.14 | 0.40 | ug/L | 20.0 | | 107 | 80-121 | | | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | | | |
| Xylenes, total | 31.9 | 0.22 | 0.60 | ug/L | 30.0 | | 106 | 76-127 | | | |
| Styrene | 10.9 | 0.09 | 0.20 | ug/L | 10.0 | | 109 | 80-124 | | | |
| n-Propylbenzene | 10.9 | 0.07 | 0.20 | ug/L | 10.0 | | 109 | 78-130 | | | |
| Isopropyl Benzene | 10.8 | 0.07 | 0.20 | ug/L | 10.0 | | 108 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 80-129 | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0325-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.3 | 0.05 | 0.20 | ug/L | 10.0 | | 113 | 80-127 | | | |
| s-Butylbenzene | 11.3 | 0.06 | 0.20 | ug/L | 10.0 | | 113 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | | 116 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.3 | 0.10 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Naphthalene | 10.4 | 0.27 | 0.50 | ug/L | 10.0 | | 104 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 9.01 | 0.10 | 0.20 | ug/L | 10.0 | | 90.1 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.65 | | | ug/L | *5.00* | | *93.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.93 | | | ug/L | *5.00* | | *98.6* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.02 | | | ug/L | *5.00* | | *100* | *80-120* | | | |
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| Vinyl Chloride | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 66-133 | 4.81 | 30 | |
| Chloroethane | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | | 111 | 60-155 | 3.86 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 3.87 | 30 | |
| 1,1-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 69-135 | 5.08 | 30 | |
| Methylene Chloride | 9.50 | 0.53 | 1.00 | ug/L | 10.0 | | 95.0 | 65-135 | 3.99 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 4.89 | 30 | |
| trans-1,2-Dichloroethene | 9.85 | 0.07 | 0.20 | ug/L | 10.0 | | 98.5 | 78-128 | 4.85 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 4.64 | 30 | |
| cis-1,2-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 80-121 | 3.56 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 5.25 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 5.10 | 30 | |
| Carbon tetrachloride | 9.21 | 0.09 | 0.20 | ug/L | 10.0 | | 92.1 | 53-137 | 2.97 | 30 | |
| 1,2-Dichloroethane | 10.0 | 0.08 | 0.20 | ug/L | 10.0 | | 100 | 75-123 | 3.59 | 30 | |
| Benzene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 3.08 | 30 | |
| Trichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | 4.00 | 30 | |
| 4-Methyl-2-Pentanone | 53.9 | 1.90 | 5.00 | ug/L | 50.0 | | 108 | 67-133 | 8.83 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.82 | 30 | |
| 2-Hexanone | 55.2 | 2.06 | 5.00 | ug/L | 50.0 | | 110 | 69-133 | 9.38 | 30 | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 4.31 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.42 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.62 | 30 | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | 1.95 | 30 | |
| o-Xylene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | | 108 | 80-121 | 2.99 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 2.29 | 30 | |
| Styrene | 11.4 | 0.09 | 0.20 | ug/L | 10.0 | | 114 | 80-124 | 4.06 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 3.47 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 4.22 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 3.58 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 3.24 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 3.15 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 3.34 | 30 | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 3.66 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 5.08 | 30 | |
| Naphthalene | 11.3 | 0.27 | 0.50 | ug/L | 10.0 | | 113 | 50-134 | 8.22 | 30 | |
| Dichlorodifluoromethane | 9.95 | 0.13 | 0.20 | ug/L | 10.0 | | 99.5 | 48-147 | 5.18 | 30 | |
| n-Hexane | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 70-130 | 16.30 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.04 | | | ug/L | *5.00* | | *101* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.87 | | | ug/L | *5.00* | | *97.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.11 | | | ug/L | *5.00* | | *102* | *80-120* | | | |
| **Matrix Spike (BLB0325-MS1)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 22:51 | | | | | | |
| Vinyl Chloride | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 103 | 66-133 | | | |
| Chloroethane | 9.47 | 0.05 | 0.20 | ug/L | 10.0 | ND | 94.7 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.29 | 0.11 | 0.20 | ug/L | 10.0 | ND | 92.9 | 76-129 | | | |
| 1,1-Dichloroethene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | ND | 106 | 69-135 | | | |
| Methylene Chloride | 9.77 | 0.53 | 1.00 | ug/L | 10.0 | ND | 97.7 | 65-135 | | | |
| Carbon Disulfide | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | ND | 104 | 78-125 | | | |
| trans-1,2-Dichloroethene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 78-128 | | | |
| 1,1-Dichloroethane | 10.9 | 0.04 | 0.20 | ug/L | 10.0 | 0.30 | 106 | 76-124 | | | |
| cis-1,2-Dichloroethene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | 0.85 | 104 | 80-121 | | | |
| Chloroform | 10.8 | 0.05 | 0.20 | ug/L | 10.0 | ND | 108 | 80-122 | | | |
| 1,1,1-Trichloroethane | 11.1 | 0.08 | 0.20 | ug/L | 10.0 | 0.13 | 109 | 79-123 | | | |
| Carbon tetrachloride | 8.87 | 0.09 | 0.20 | ug/L | 10.0 | ND | 88.7 | 53-137 | | | |
| 1,2-Dichloroethane | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | ND | 107 | 75-123 | | | |
| Benzene | 11.0 | 0.05 | 0.20 | ug/L | 10.0 | ND | 110 | 80-120 | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike (BLB0325-MS1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 22:51 | | | | | | | |
| Trichloroethene | 15.0 | 0.07 | 0.20 | ug/L | 10.0 | 4.52 | 105 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 56.3 | 1.90 | 5.00 | ug/L | 50.0 | ND | 113 | 67-133 | | | |
| Toluene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | ND | 107 | 80-120 | | | |
| 2-Hexanone | 56.4 | 2.06 | 5.00 | ug/L | 50.0 | ND | 113 | 69-133 | | | |
| Tetrachloroethene | 10.4 | 0.09 | 0.20 | ug/L | 10.0 | 0.49 | 99.4 | 80-120 | | | |
| Chlorobenzene | 10.6 | 0.06 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| Ethylbenzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| m,p-Xylene | 22.1 | 0.14 | 0.40 | ug/L | 20.0 | ND | 110 | 80-121 | | | |
| o-Xylene | 11.0 | 0.08 | 0.20 | ug/L | 10.0 | ND | 110 | 80-121 | | | |
| Xylenes, total | 33.0 | 0.22 | 0.60 | ug/L | 30.0 | ND | 110 | 76-127 | | | |
| Styrene | 11.5 | 0.09 | 0.20 | ug/L | 10.0 | ND | 115 | 80-124 | | | |
| n-Propylbenzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | ND | 111 | 78-130 | | | |
| Isopropyl Benzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | ND | 111 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 80-129 | | | |
| 1,2,4-Trimethylbenzene | 11.5 | 0.05 | 0.20 | ug/L | 10.0 | ND | 115 | 80-127 | | | |
| s-Butylbenzene | 11.1 | 0.06 | 0.20 | ug/L | 10.0 | ND | 111 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 113 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 108 | 80-120 | | | |
| Naphthalene | 11.1 | 0.27 | 0.50 | ug/L | 10.0 | ND | 111 | 50-134 | | | |
| Dichlorodifluoromethane | 9.32 | 0.13 | 0.20 | ug/L | 10.0 | ND | 93.2 | 48-147 | | | |
| n-Hexane | 7.14 | 0.10 | 0.20 | ug/L | 10.0 | ND | 71.4 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.18 | | | ug/L | *5.00* | *5.23* | *104* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | *4.88* | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.95 | | | ug/L | *5.00* | *4.72* | *99.1* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.12 | | | ug/L | *5.00* | *5.01* | *102* | *80-120* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| Vinyl Chloride | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | ND | 107 | 66-133 | 3.51 | 30 | |
| Chloroethane | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | ND | 101 | 60-155 | 6.52 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.0 | 0.11 | 0.20 | ug/L | 10.0 | ND | 100 | 76-129 | 7.43 | 30 | |
| 1,1-Dichloroethene | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | ND | 109 | 69-135 | 2.43 | 30 | |
| Methylene Chloride | 10.0 | 0.53 | 1.00 | ug/L | 10.0 | ND | 100 | 65-135 | 2.74 | 30 | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| Carbon Disulfide | 10.7 | 0.06 | 0.20 | ug/L | 10.0 | ND | 107 | 78-125 | 2.93 | 30 | |
| trans-1,2-Dichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | ND | 103 | 78-128 | 10.10 | 30 | |
| 1,1-Dichloroethane | 11.2 | 0.04 | 0.20 | ug/L | 10.0 | 0.30 | 109 | 76-124 | 2.76 | 30 | |
| cis-1,2-Dichloroethene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | 0.85 | 108 | 80-121 | 2.76 | 30 | |
| Chloroform | 11.0 | 0.05 | 0.20 | ug/L | 10.0 | ND | 110 | 80-122 | 2.40 | 30 | |
| 1,1,1-Trichloroethane | 11.5 | 0.08 | 0.20 | ug/L | 10.0 | 0.13 | 114 | 79-123 | 4.12 | 30 | |
| Carbon tetrachloride | 9.34 | 0.09 | 0.20 | ug/L | 10.0 | ND | 93.4 | 53-137 | 5.15 | 30 | |
| 1,2-Dichloroethane | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 108 | 75-123 | 1.03 | 30 | |
| Benzene | 11.2 | 0.05 | 0.20 | ug/L | 10.0 | ND | 112 | 80-120 | 2.03 | 30 | |
| Trichloroethene | 15.2 | 0.07 | 0.20 | ug/L | 10.0 | 4.52 | 107 | 80-120 | 1.20 | 30 | |
| 4-Methyl-2-Pentanone | 57.1 | 1.90 | 5.00 | ug/L | 50.0 | ND | 114 | 67-133 | 1.55 | 30 | |
| Toluene | 10.8 | 0.05 | 0.20 | ug/L | 10.0 | ND | 108 | 80-120 | 0.94 | 30 | |
| 2-Hexanone | 58.5 | 2.06 | 5.00 | ug/L | 50.0 | ND | 117 | 69-133 | 3.71 | 30 | |
| Tetrachloroethene | 11.0 | 0.09 | 0.20 | ug/L | 10.0 | 0.49 | 105 | 80-120 | 5.27 | 30 | |
| Chlorobenzene | 11.0 | 0.06 | 0.20 | ug/L | 10.0 | ND | 110 | 80-120 | 3.27 | 30 | |
| Ethylbenzene | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | ND | 111 | 80-120 | 4.54 | 30 | |
| m,p-Xylene | 23.1 | 0.14 | 0.40 | ug/L | 20.0 | ND | 115 | 80-121 | 4.38 | 30 | |
| o-Xylene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 113 | 80-121 | 3.20 | 30 | |
| Xylenes, total | 34.4 | 0.22 | 0.60 | ug/L | 30.0 | ND | 115 | 76-127 | 3.99 | 30 | |
| Styrene | 11.9 | 0.09 | 0.20 | ug/L | 10.0 | ND | 119 | 80-124 | 3.09 | 30 | |
| n-Propylbenzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 78-130 | 2.19 | 30 | |
| Isopropyl Benzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 80-128 | 2.25 | 30 | |
| 1,3,5-Trimethylbenzene | 11.9 | 0.07 | 0.20 | ug/L | 10.0 | ND | 119 | 80-129 | 3.83 | 30 | |
| 1,2,4-Trimethylbenzene | 11.9 | 0.05 | 0.20 | ug/L | 10.0 | ND | 119 | 80-127 | 2.98 | 30 | |
| s-Butylbenzene | 11.7 | 0.06 | 0.20 | ug/L | 10.0 | ND | 117 | 78-129 | 4.97 | 30 | |
| 4-Isopropyl Toluene | 11.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 118 | 79-130 | 4.69 | 30 | |
| 1,4-Dichlorobenzene | 10.9 | 0.10 | 0.20 | ug/L | 10.0 | ND | 109 | 80-120 | 3.22 | 30 | |
| 1,2-Dichlorobenzene | 11.1 | 0.08 | 0.20 | ug/L | 10.0 | ND | 111 | 80-120 | 3.29 | 30 | |
| Naphthalene | 11.6 | 0.27 | 0.50 | ug/L | 10.0 | ND | 116 | 50-134 | 4.20 | 30 | |
| Dichlorodifluoromethane | 10.7 | 0.13 | 0.20 | ug/L | 10.0 | ND | 107 | 48-147 | 13.70 | 30 | |
| n-Hexane | 9.64 | 0.10 | 0.20 | ug/L | 10.0 | ND | 96.4 | 70-130 | 29.90 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.12 | | | ug/L | *5.00* | *5.23* | *102* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.04 | | | ug/L | *5.00* | *4.88* | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.92 | | | ug/L | *5.00* | *4.72* | *98.5* | *80-120* | | | |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.03 | | | ug/L | *5.00* | *5.01* | *101* | *80-120* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0306 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0306-BLK1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 10:04 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5000 | | | ug/L | *5000* | | *100* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4650 | | | ug/L | *5000* | | *93.0* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4920 | | | ug/L | *5000* | | *98.4* | *75-125* | | | |
| **LCS (BLB0306-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 08:55 | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.11 | 0.00682 | 0.0200 | ug/L | 2.00 | | 105 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4960 | | | ug/L | *5000* | | *99.2* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4930 | | | ug/L | *5000* | | *98.6* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5430 | | | ug/L | *5000* | | *109* | *75-125* | | | |
| **LCS Dup (BLB0306-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 09:43 | | | | | | |
| Vinyl chloride | 2.00 | 0.00501 | 0.0200 | ug/L | 2.00 | | 100 | 62-141 | 16.20 | 30 | |
| Tetrachloroethene | 1.81 | 0.00682 | 0.0200 | ug/L | 2.00 | | 90.7 | 76-127 | 14.90 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4970 | | | ug/L | *5000* | | *99.4* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4780 | | | ug/L | *5000* | | *95.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **Matrix Spike (BLB0306-MS2)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:09 | | | | | | |
| Vinyl chloride | 2.04 | 0.00501 | 0.0200 | ug/L | 2.00 | 0.0123 | 102 | 62-141 | | | |
| Tetrachloroethene | 2.50 | 0.00682 | 0.0200 | ug/L | 2.00 | 0.558 | 96.9 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5390 | | | ug/L | *5000* | *5170* | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4970 | | | ug/L | *5000* | *4940* | *99.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5460 | | | ug/L | *5000* | *4840* | *109* | *75-125* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0306-MSD2)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:30 | | | | | | |
| Vinyl chloride | 2.05 | 0.00501 | 0.0200 | ug/L | 2.00 | 0.0123 | 102 | 62-141 | 0.29 | 30 | |
| Tetrachloroethene | 2.49 | 0.00682 | 0.0200 | ug/L | 2.00 | 0.558 | 96.6 | 76-127 | 0.23 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5520 | | | ug/L | *5000* | *5170* | *110* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | *4940* | *98.9* | *80-120* | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0306 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0306-MSD2)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:30 | | | | | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5410 | | | ug/L | *5000* | *4840* | *108* | *75-125* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0339 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0339-BLK1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:52 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5320 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | | *98.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4860 | | | ug/L | *5000* | | *97.2* | *75-125* | | | |
| **LCS (BLB0339-BS1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 10:30 | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.07 | 0.00682 | 0.0200 | ug/L | 2.00 | | 103 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5400 | | | ug/L | *5000* | | *108* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **LCS Dup (BLB0339-BSD1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:11 | | | | | | |
| Vinyl chloride | 2.16 | 0.00501 | 0.0200 | ug/L | 2.00 | | 108 | 62-141 | 9.20 | 30 | |
| Tetrachloroethene | 1.93 | 0.00682 | 0.0200 | ug/L | 2.00 | | 96.7 | 76-127 | 6.58 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5400 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5280 | | | ug/L | *5000* | | *106* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5380 | | | ug/L | *5000* | | *108* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 8260D in Water*** | |
| Chloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichlorofluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrolein | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acetone | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Iodomethane | DoD-ELAP,NELAP,WADOE |
| Methylene Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrylonitrile | DoD-ELAP,NELAP,WADOE |
| Carbon Disulfide | DoD-ELAP,NELAP,WADOE |
| trans-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Acetate | DoD-ELAP,NELAP,WADOE |
| 1,1-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Butanone | DoD-ELAP,NELAP,WADOE |
| 2,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| cis-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroform | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Carbon tetrachloride | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Benzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromodichloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Chloroethyl vinyl ether | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Methyl-2-Pentanone | DoD-ELAP,NELAP,WADOE |
| cis-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Toluene | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

| | |
|---|---|
| 2-Hexanone | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,3-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Tetrachloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromoethane | DoD-ELAP,NELAP,WADOE |
| Chlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Ethylbenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| m,p-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| o-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| Styrene | DoD-ELAP,NELAP,WADOE |
| Bromoform | DoD-ELAP,NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,4-Dichloro 2-Butene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Propylbenzene | DoD-ELAP,NELAP,WADOE |
| Bromobenzene | DoD-ELAP,NELAP,WADOE |
| Isopropyl Benzene | DoD-ELAP,NELAP,WADOE |
| 2-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| t-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,3,5-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2,4-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| s-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 4-Isopropyl Toluene | DoD-ELAP,NELAP,WADOE |
| 1,3-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,4-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromo-3-chloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,4-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Hexachloro-1,3-Butadiene | DoD-ELAP,ADEC,NELAP,WADOE |
| Naphthalene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dichlorodifluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Methyl tert-butyl Ether | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Hexane | WADOE |
| 2-Pentanone | WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

***EPA 8260D-SIM in Water***

| | |
|---|---|
| Acrylonitrile | NELAP,WADOE |
| Vinyl chloride | NELAP,WADOE |
| 1,1-Dichloroethene | NELAP,WADOE |
| cis-1,2-Dichloroethene | NELAP,WADOE |
| trans-1,2-Dichloroethene | NELAP,WADOE |
| Trichloroethene | NELAP,WADOE |
| Tetrachloroethene | NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | NELAP,WADOE |
| 1,2-Dichloroethane | NELAP,WADOE |
| Benzene | NELAP,WADOE |

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | 17-015 | 03/28/2023 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program, PJLA Testing | 66169 | 02/28/2023 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006-012 | 05/12/2023 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2023 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2023 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## Notes and Definitions

| | |
|---|---|
| * | Flagged value is not within established control limits. |
| J | Estimated concentration value detected below the reporting limit. |
| U | This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD). |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

**Analytical Resources, LLC**
**Analytical Chemists and Consultants**

27 February 2023

Natasya Gray
Dalton, Olmsted & Fuglevand, Inc
1420 - 156th Ave., NE STE C1
Bellevue, WA 98007

RE: Georgetown (Georgetown/CLE-001(375.01))

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 23B0265 | N/A |

---

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, LLC

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Kelly Bottem, Client Services Manager

Cert# 100006-012

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0265 | Turn-around Requested: Standard | Page: 1 of 2 | |
| ARI Client Company: Clean Earth | Phone: (206)-375-0211 | Date: 02/10/23 | Ice Present? yes |
| Client Contact: Tasya Gray | | No. of Coolers: 1 | Cooler Temps: 6.0° |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: S260 | Analysis Requested: S260 - SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| CG-5-S1-0223 | 2/10/23 | 0855 | W | 6 | X | X | |
| TB02-0223 | 2/10/23 | 0755 | W | 2 | X | X | |
| VIT5-04-WT-0223 | 2/10/23 | 0945 | W | 6 | X | X | |
| VIT5-9-04-WT-0223 | 2/10/23 | 0950 | W | 6 | X | X | |
| CG-102-S1-0223 | 2/10/23 | 1055 | W | 6 | X | X | |
| FB01-0223 | 2/10/23 | 1035 | W | 6 | X | X | |
| CG-103-S1-0223 | 2/10/23 | 1200 | W | 6 | X | X | |
| CG-112-S1-0223 | 2/10/23 | 1300 | W | 6 | X | X | |
| CG-124-WT-0223 | 2/10/23 | 1335 | W | 6 | X | X | |
| CG-121-40-0223 | 2/10/23 | 1440 | W | 6 | X | X | |

| Comments/Special Instructions | Relinquished by: (Signature) | Received by: (Signature) | Relinquished by: (Signature) | Received by: (Signature) |
|---|---|---|---|---|
| Report to alutey@dofnw.com in addition to Tasya Gray | Printed Name: Michael Knight | Printed Name: Roman M. | Printed Name: | Printed Name: |
| | Company: Clean Earth | Company: ARI | Company: | Company: |
| | Date & Time: 2/10/23 0510 | Date & Time: 2-10-23 1740 | Date & Time: | Date & Time: |

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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0265 | Turn-around Requested: Standard | Page: 2 of 2 | |
| ARI Client Company: CleanEarth | Phone: (206)-375-0211 | Date: 02/10/23 | Ice Present? |
| Client Contact: Tasya Gray | | No. of Coolers: | Cooler Temps: |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: 8260 | Analysis Requested: 8260 + SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| VIT5-01-WT-0223 | 2/10/23 | 1525 | W | 6 | X | X | |
| VIT5-02-WT-0223 | 2/10/23 | 1610 | W | 6 | X | X | |

| Comments/Special Instructions | Relinquished by: | Received by: | Relinquished by: | Received by: |
|---|---|---|---|---|
| Report results to alutey@defnw.com in addition to Tasya Gray | (Signature) | (Signature) | (Signature) | (Signature) |
| | Printed Name: Michael Wright | Printed Name: Rowan M. Wr | Printed Name: | Printed Name: |
| | Company: Clean Earth | Company: ARI | Company: | Company: |
| | Date & Time: 2/10/23 0510 | Date & Time: 2-10-23 1740 | Date & Time: | Date & Time: |

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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| CG-5-S1-0223 | 23B0265-01 | Water | 10-Feb-2023 08:55 | 10-Feb-2023 17:40 |
| TB02-0223 | 23B0265-02 | Water | 10-Feb-2023 08:55 | 10-Feb-2023 17:40 |
| VIT5-04-WT-0223 | 23B0265-03 | Water | 10-Feb-2023 09:45 | 10-Feb-2023 17:40 |
| VIT5-9-04-WT-0223 | 23B0265-04 | Water | 10-Feb-2023 09:50 | 10-Feb-2023 17:40 |
| CG-102-S1-0223 | 23B0265-05 | Water | 10-Feb-2023 10:55 | 10-Feb-2023 17:40 |
| FB01-0223 | 23B0265-06 | Water | 10-Feb-2023 10:35 | 10-Feb-2023 17:40 |
| CG-103-S1-0223 | 23B0265-07 | Water | 10-Feb-2023 12:00 | 10-Feb-2023 17:40 |
| CG-112-S1-0223 | 23B0265-08 | Water | 10-Feb-2023 13:00 | 10-Feb-2023 17:40 |
| CG-124-WT-0223 | 23B0265-09 | Water | 10-Feb-2023 13:35 | 10-Feb-2023 17:40 |
| CG-121-40-0223 | 23B0265-10 | Water | 10-Feb-2023 14:40 | 10-Feb-2023 17:40 |
| VIT5-01-WT-0223 | 23B0265-11 | Water | 10-Feb-2023 15:25 | 10-Feb-2023 17:40 |
| VIT5-02-WT-0223 | 23B0265-12 | Water | 10-Feb-2023 16:10 | 10-Feb-2023 17:40 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

# Work Order Case Narrative

**Volatiles - EPA Method SW8260D**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

**Volatiles - EPA Method 8260D-SIM (Selected Ion Monitoring)**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client:** Dalton, Olmsted & Fuglevand, Inc **Project Manager:** Kelly Bottem

**Project:** Georgetown **Project Number:** Georgetown/CLE-001(375.01)

## Preservation Confirmation

| Container ID | Container Type | pH |
|---|---|---|
| 23B0265-01 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-02 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-02 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-04 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 B | VOA Vial, Clear, 40 mL, HCL | |

Reviewed By Date

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client: Dalton, Olmsted & Fuglevand, Inc** **Project Manager: Kelly Bottem**

**Project: Georgetown** **Project Number: Georgetown/CLE-001(375.01)**

| | | |
|---|---|---|
| 23B0265-07 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-09 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-10 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 F | VOA Vial, Clear, 40 mL, HCL | |

Reviewed By

Date

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client:** Dalton, Olmsted & Fuglevand, Inc

**Project Manager:** Kelly Bottem

**Project:** Georgetown

**Project Number:** Georgetown/CLE-001(375.01)

JG

Preservation Confirmed By

2/11/23

Date

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Clean Earth/DOF  Project Name: Georgetown

COC No(s): NA  Delivered by: Fed-Ex UPS Courier Hand Delivered Other:

Assigned ARI Job No: 23B0265  Tracking No: NA

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of the cooler? | YES | NO |
| Were custody papers included with the cooler? | YES | NO |
| Were custody papers properly filled out (ink, signed, etc.) | YES | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 6.0°

Time 1740

If cooler temperature is out of compliance fill out form 00070F  Temp Gun ID#: 9708

Cooler Accepted by: [signature]  Date: 2-10-23  Time: 1740

***Complete custody forms and attach all shipping documents***

## Log-In Phase:

| | | | |
|---|---|---|---|
| Was a temperature blank included in the cooler? | | YES | NO |
| What kind of packing material was used? | Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: | | |
| Was sufficient ice used (if appropriate)? | NA | YES | NO |
| How were bottles sealed in plastic bags? | Individually | Grouped | Not |
| Did all bottles arrive in good condition (unbroken)? | | YES | NO |
| Were all bottle labels complete and legible? | | YES | NO |
| Did the number of containers listed on COC match with the number of containers received? | | YES | NO |
| Did all bottle labels and tags agree with custody papers? | | YES | NO |
| Were all bottles used correct for the requested analyses? | | YES | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) | NA | YES | NO |
| Were all VOC vials free of air bubbles? | NA | YES | NO |
| Was sufficient amount of sample sent in each bottle? | | YES | NO |
| Date VOC Trip Blank was made at ARI | NA | 01/31/23 | |

Were the sample(s) split by ARI? NA YES  Date/Time: _____  Equipment: _____  Split by: _____

Samples Logged by: JSm  Date: 02/11/23  Time: 0835  Labels checked by: JSm

*** Notify Project Manager of discrepancies or concerns ***

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

***Additional Notes, Discrepancies, & Resolutions:***

VOA vials w/air bubbles marked on preservation sheet, lab to determine size.

By: JSm  Date: 02/11/23

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-5-S1-0223

**23B0265-01 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 08:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/14/2023 17:31

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-01 D
Preparation Batch: BLB0351 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.07 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.19 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 2.42 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.78 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.24 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-5-S1-0223

**23B0265-01 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 17:31

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *109* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.7* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-5-S1-0223**

**23B0265-01 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 14:41

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-01 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.211 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *111* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *95.3* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 08:55

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:39

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-02 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 08:55
Analyzed: 02/13/2023 16:39

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *99.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.1* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.1* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 14:20

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-02 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *113* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 09:45

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 19:24

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-03 F

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.26 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.07 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | 0.13 | ug/L | J |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 4.73 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.41 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.41 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 09:45
Analyzed: 02/13/2023 19:24

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *98.2* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 09:45
Analyzed: 02/14/2023 15:03

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-03 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.395 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *84.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.3* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 09:50

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 19:45

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-04 C

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.26 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.02 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | 0.12 | ug/L | J |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 4.61 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.38 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.40 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 09:50
Analyzed: 02/13/2023 19:45

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 09:50
Analyzed: 02/14/2023 15:24

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-04 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.382 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *82.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *97.0* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-102-S1-0223

**23B0265-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 10:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:05

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-05 B
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.33 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 2.77 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 6.45 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.19 | ug/L | J |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.10 | ug/L | J |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-102-S1-0223

**23B0265-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 10:55
Analyzed: 02/13/2023 20:05

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.8* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-102-S1-0223**

**23B0265-05 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/10/2023 10:55

Instrument: NT16 Analyst: KOTT — Analyzed: 02/23/2023 13:12

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-05 F

Preparation Batch: BLB0603 — Sample Size: 10 mL

Prepared: 02/23/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0876 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.4* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 10:35

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:26

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-06 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 10:35
Analyzed: 02/13/2023 20:26

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.8* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 10:35
Analyzed: 02/14/2023 16:06

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023

Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-06 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.3* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *87.4* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-103-S1-0223

**23B0265-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 12:00
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:46

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-07 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.23 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 1.00 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.23 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 5.14 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 3.11 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-103-S1-0223

**23B0265-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 12:00
Analyzed: 02/13/2023 20:46

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *101* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.3* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-103-S1-0223**

**23B0265-07 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 12:00
Analyzed: 02/16/2023 12:47

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-07 C

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.114 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 2.97 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *95.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-112-S1-0223

**23B0265-08 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 13:00
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:07

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-08 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.05 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-112-S1-0223**

**23B0265-08 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 13:00
Analyzed: 02/13/2023 21:07

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.4* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.8* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-112-S1-0223

**23B0265-08 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 13:00
Analyzed: 02/16/2023 13:08

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-08 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0385 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *109* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *92.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 13:35

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:28

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-09 C

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.12 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.34 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.32 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 3.09 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.85 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 13:35
Analyzed: 02/13/2023 21:28

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *90.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/10/2023 13:35

Instrument: NT16 Analyst: PB — Analyzed: 02/16/2023 13:29

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-09 A

Preparation Batch: BLB0419 — Sample Size: 10 mL

Prepared: 02/16/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.00870 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.823 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 14:40

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:48

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-10 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | 2.34 | ug/L | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.09 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.10 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | 0.12 | ug/L | J |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 14:40
Analyzed: 02/13/2023 21:48

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.6* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *90.1* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *100* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 14:40
Analyzed: 02/16/2023 13:50

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-10 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0764 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.00709 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *91.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 15:25

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 22:09

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-11 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.11 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.16 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 15:25
Analyzed: 02/13/2023 22:09

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.7* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *102* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 15:25
Analyzed: 02/16/2023 14:11

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-11 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0187 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 16:10

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 22:30

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-12 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.64 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.47 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 16:10
Analyzed: 02/13/2023 22:30

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *113* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.6* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 16:10
Analyzed: 02/16/2023 14:33

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-12 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0390 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0225 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *91.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.93 | | | ug/L | *5.00* | | *98.5* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.70 | | | ug/L | *5.00* | | *94.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0325-BS1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | | |
| Vinyl Chloride | 9.72 | 0.08 | 0.20 | ug/L | 10.0 | | 97.2 | 66-133 | | | |
| Chloroethane | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.83 | 0.11 | 0.20 | ug/L | 10.0 | | 98.3 | 76-129 | | | |
| 1,1-Dichloroethene | 9.58 | 0.08 | 0.20 | ug/L | 10.0 | | 95.8 | 69-135 | | | |
| Methylene Chloride | 9.13 | 0.53 | 1.00 | ug/L | 10.0 | | 91.3 | 65-135 | | | |
| Carbon Disulfide | 9.81 | 0.06 | 0.20 | ug/L | 10.0 | | 98.1 | 78-125 | | | |
| trans-1,2-Dichloroethene | 9.38 | 0.07 | 0.20 | ug/L | 10.0 | | 93.8 | 78-128 | | | |
| 1,1-Dichloroethane | 9.75 | 0.04 | 0.20 | ug/L | 10.0 | | 97.5 | 76-124 | | | |
| cis-1,2-Dichloroethene | 9.93 | 0.08 | 0.20 | ug/L | 10.0 | | 99.3 | 80-121 | | | |
| Chloroform | 9.82 | 0.05 | 0.20 | ug/L | 10.0 | | 98.2 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 79-123 | | | |
| Carbon tetrachloride | 8.94 | 0.09 | 0.20 | ug/L | 10.0 | | 89.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.65 | 0.08 | 0.20 | ug/L | 10.0 | | 96.5 | 75-123 | | | |
| Benzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Trichloroethene | 9.94 | 0.07 | 0.20 | ug/L | 10.0 | | 99.4 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 49.3 | 1.90 | 5.00 | ug/L | 50.0 | | 98.7 | 67-133 | | | |
| Toluene | 10.2 | 0.05 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| 2-Hexanone | 50.2 | 2.06 | 5.00 | ug/L | 50.0 | | 100 | 69-133 | | | |
| Tetrachloroethene | 9.75 | 0.09 | 0.20 | ug/L | 10.0 | | 97.5 | 80-120 | | | |
| Chlorobenzene | 10.1 | 0.06 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Ethylbenzene | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| m,p-Xylene | 21.4 | 0.14 | 0.40 | ug/L | 20.0 | | 107 | 80-121 | | | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | | | |
| Xylenes, total | 31.9 | 0.22 | 0.60 | ug/L | 30.0 | | 106 | 76-127 | | | |
| Styrene | 10.9 | 0.09 | 0.20 | ug/L | 10.0 | | 109 | 80-124 | | | |
| n-Propylbenzene | 10.9 | 0.07 | 0.20 | ug/L | 10.0 | | 109 | 78-130 | | | |
| Isopropyl Benzene | 10.8 | 0.07 | 0.20 | ug/L | 10.0 | | 108 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 80-129 | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0325-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.3 | 0.05 | 0.20 | ug/L | 10.0 | | 113 | 80-127 | | | |
| s-Butylbenzene | 11.3 | 0.06 | 0.20 | ug/L | 10.0 | | 113 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | | 116 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.3 | 0.10 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Naphthalene | 10.4 | 0.27 | 0.50 | ug/L | 10.0 | | 104 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 9.01 | 0.10 | 0.20 | ug/L | 10.0 | | 90.1 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.65 | | | ug/L | *5.00* | | *93.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.93 | | | ug/L | *5.00* | | *98.6* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.02 | | | ug/L | *5.00* | | *100* | *80-120* | | | |
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| Vinyl Chloride | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 66-133 | 4.81 | 30 | |
| Chloroethane | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | | 111 | 60-155 | 3.86 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 3.87 | 30 | |
| 1,1-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 69-135 | 5.08 | 30 | |
| Methylene Chloride | 9.50 | 0.53 | 1.00 | ug/L | 10.0 | | 95.0 | 65-135 | 3.99 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 4.89 | 30 | |
| trans-1,2-Dichloroethene | 9.85 | 0.07 | 0.20 | ug/L | 10.0 | | 98.5 | 78-128 | 4.85 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 4.64 | 30 | |
| cis-1,2-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 80-121 | 3.56 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 5.25 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 5.10 | 30 | |
| Carbon tetrachloride | 9.21 | 0.09 | 0.20 | ug/L | 10.0 | | 92.1 | 53-137 | 2.97 | 30 | |
| 1,2-Dichloroethane | 10.0 | 0.08 | 0.20 | ug/L | 10.0 | | 100 | 75-123 | 3.59 | 30 | |
| Benzene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 3.08 | 30 | |
| Trichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | 4.00 | 30 | |
| 4-Methyl-2-Pentanone | 53.9 | 1.90 | 5.00 | ug/L | 50.0 | | 108 | 67-133 | 8.83 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.82 | 30 | |
| 2-Hexanone | 55.2 | 2.06 | 5.00 | ug/L | 50.0 | | 110 | 69-133 | 9.38 | 30 | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 4.31 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.42 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.62 | 30 | |

| | | |
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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | 1.95 | 30 | |
| o-Xylene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | | 108 | 80-121 | 2.99 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 2.29 | 30 | |
| Styrene | 11.4 | 0.09 | 0.20 | ug/L | 10.0 | | 114 | 80-124 | 4.06 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 3.47 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 4.22 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 3.58 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 3.24 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 3.15 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 3.34 | 30 | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 3.66 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 5.08 | 30 | |
| Naphthalene | 11.3 | 0.27 | 0.50 | ug/L | 10.0 | | 113 | 50-134 | 8.22 | 30 | |
| Dichlorodifluoromethane | 9.95 | 0.13 | 0.20 | ug/L | 10.0 | | 99.5 | 48-147 | 5.18 | 30 | |
| n-Hexane | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 70-130 | 16.30 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.04 | | | ug/L | *5.00* | | *101* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.87 | | | ug/L | *5.00* | | *97.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.11 | | | ug/L | *5.00* | | *102* | *80-120* | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0351-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 17:11 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0351-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 17:11 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.43 | | | ug/L | *5.00* | | *109* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.96 | | | ug/L | *5.00* | | *99.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.72 | | | ug/L | *5.00* | | *94.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0351-BS1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:25 | | | | | | | |
| Vinyl Chloride | 9.99 | 0.08 | 0.20 | ug/L | 10.0 | | 99.9 | 66-133 | | | |
| Chloroethane | 9.97 | 0.05 | 0.20 | ug/L | 10.0 | | 99.7 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.5 | 0.11 | 0.20 | ug/L | 10.0 | | 105 | 76-129 | | | |
| 1,1-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 69-135 | | | |
| Methylene Chloride | 9.36 | 0.53 | 1.00 | ug/L | 10.0 | | 93.6 | 65-135 | | | |
| Carbon Disulfide | 10.2 | 0.06 | 0.20 | ug/L | 10.0 | | 102 | 78-125 | | | |
| trans-1,2-Dichloroethene | 11.0 | 0.07 | 0.20 | ug/L | 10.0 | | 110 | 78-128 | | | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | | | |
| cis-1,2-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-121 | | | |
| Chloroform | 10.3 | 0.05 | 0.20 | ug/L | 10.0 | | 103 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | | 107 | 79-123 | | | |
| Carbon tetrachloride | 8.84 | 0.09 | 0.20 | ug/L | 10.0 | | 88.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.94 | 0.08 | 0.20 | ug/L | 10.0 | | 99.4 | 75-123 | | | |
| Benzene | 10.5 | 0.05 | 0.20 | ug/L | 10.0 | | 105 | 80-120 | | | |
| Trichloroethene | 10.1 | 0.07 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 47.3 | 1.90 | 5.00 | ug/L | 50.0 | | 94.5 | 67-133 | | | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| 2-Hexanone | 47.7 | 2.06 | 5.00 | ug/L | 50.0 | | 95.3 | 69-133 | | | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Ethylbenzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | | | |
| o-Xylene | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | | 107 | 80-121 | | | |
| Xylenes, total | 32.5 | 0.22 | 0.60 | ug/L | 30.0 | | 108 | 76-127 | | | |
| Styrene | 11.3 | 0.09 | 0.20 | ug/L | 10.0 | | 113 | 80-124 | | | |
| n-Propylbenzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | | 111 | 78-130 | | | |
| Isopropyl Benzene | 11.0 | 0.07 | 0.20 | ug/L | 10.0 | | 110 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.6 | 0.07 | 0.20 | ug/L | 10.0 | | 116 | 80-129 | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0351-BS1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:25 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.6 | 0.05 | 0.20 | ug/L | 10.0 | | 116 | 80-127 | | | |
| s-Butylbenzene | 11.4 | 0.06 | 0.20 | ug/L | 10.0 | | 114 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.8 | 0.08 | 0.20 | ug/L | 10.0 | | 118 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.5 | 0.10 | 0.20 | ug/L | 10.0 | | 105 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.4 | 0.08 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Naphthalene | 9.90 | 0.27 | 0.50 | ug/L | 10.0 | | 99.0 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 10.4 | 0.10 | 0.20 | ug/L | 10.0 | | 104 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.80 | | | ug/L | *5.00* | | *96.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 4.96 | | | ug/L | *5.00* | | *99.1* | *80-120* | | | |
| **LCS Dup (BLB0351-BSD1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:45 | | | | | | |
| Vinyl Chloride | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 66-133 | 1.47 | 30 | |
| Chloroethane | 10.5 | 0.05 | 0.20 | ug/L | 10.0 | | 105 | 60-155 | 4.77 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 2.28 | 30 | |
| 1,1-Dichloroethene | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 69-135 | 0.72 | 30 | |
| Methylene Chloride | 9.36 | 0.53 | 1.00 | ug/L | 10.0 | | 93.6 | 65-135 | 0.01 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 0.43 | 30 | |
| trans-1,2-Dichloroethene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-128 | 3.28 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 0.47 | 30 | |
| cis-1,2-Dichloroethene | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 80-121 | 1.50 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 0.92 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 1.08 | 30 | |
| Carbon tetrachloride | 9.04 | 0.09 | 0.20 | ug/L | 10.0 | | 90.4 | 53-137 | 2.21 | 30 | |
| 1,2-Dichloroethane | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 75-123 | 1.62 | 30 | |
| Benzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 0.69 | 30 | |
| Trichloroethene | 10.2 | 0.07 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 0.63 | 30 | |
| 4-Methyl-2-Pentanone | 51.1 | 1.90 | 5.00 | ug/L | 50.0 | | 102 | 67-133 | 7.69 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 0.05 | 30 | |
| 2-Hexanone | 52.1 | 2.06 | 5.00 | ug/L | 50.0 | | 104 | 69-133 | 8.91 | 30 | |
| Tetrachloroethene | 10.1 | 0.09 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | 0.94 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 0.05 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.88 | 30 | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0351-BSD1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:45 | | | | | | | |
| m,p-Xylene | 22.1 | 0.14 | 0.40 | ug/L | 20.0 | | 110 | 80-121 | 1.16 | 30 | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | 1.36 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 0.34 | 30 | |
| Styrene | 11.3 | 0.09 | 0.20 | ug/L | 10.0 | | 113 | 80-124 | 0.14 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 1.45 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 1.97 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 0.31 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 1.14 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 1.80 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 1.52 | 30 | |
| 1,4-Dichlorobenzene | 10.7 | 0.10 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 1.55 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 2.42 | 30 | |
| Naphthalene | 10.8 | 0.27 | 0.50 | ug/L | 10.0 | | 108 | 50-134 | 8.98 | 30 | |
| Dichlorodifluoromethane | 10.6 | 0.13 | 0.20 | ug/L | 10.0 | | 106 | 48-147 | 0.99 | 30 | |
| n-Hexane | 10.5 | 0.10 | 0.20 | ug/L | 10.0 | | 105 | 70-130 | 0.45 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.91 | | | ug/L | *5.00* | | *98.3* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.99 | | | ug/L | *5.00* | | *99.8* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.71 | | | ug/L | *5.00* | | *94.1* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 4.88 | | | ug/L | *5.00* | | *97.6* | *80-120* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0339 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0339-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:52 | | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5320 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | | *98.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4860 | | | ug/L | *5000* | | *97.2* | *75-125* | | | |
| **LCS (BLB0339-BS1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 10:30 | | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.07 | 0.00682 | 0.0200 | ug/L | 2.00 | | 103 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5400 | | | ug/L | *5000* | | *108* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **LCS Dup (BLB0339-BSD1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:11 | | | | | | | |
| Vinyl chloride | 2.16 | 0.00501 | 0.0200 | ug/L | 2.00 | | 108 | 62-141 | 9.20 | 30 | |
| Tetrachloroethene | 1.93 | 0.00682 | 0.0200 | ug/L | 2.00 | | 96.7 | 76-127 | 6.58 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5400 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5280 | | | ug/L | *5000* | | *106* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5380 | | | ug/L | *5000* | | *108* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0419 - EPA 8260D-SIM

Instrument: NT16 Analyst: PB

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0419-BLK1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 12:25 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4630 | | | ug/L | *5000* | | *92.6* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5230 | | | ug/L | *5000* | | *105* | *75-125* | | | |
| **LCS (BLB0419-BS1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 10:24 | | | | | | |
| Vinyl chloride | 2.04 | 0.00501 | 0.0200 | ug/L | 2.00 | | 102 | 62-141 | | | |
| Tetrachloroethene | 1.91 | 0.00682 | 0.0200 | ug/L | 2.00 | | 95.7 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5290 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4870 | | | ug/L | *5000* | | *97.4* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5550 | | | ug/L | *5000* | | *111* | *75-125* | | | |
| **LCS Dup (BLB0419-BSD1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 12:04 | | | | | | |
| Vinyl chloride | 2.24 | 0.00501 | 0.0200 | ug/L | 2.00 | | 112 | 62-141 | 9.65 | 30 | |
| Tetrachloroethene | 1.99 | 0.00682 | 0.0200 | ug/L | 2.00 | | 99.6 | 76-127 | 4.02 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5290 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4840 | | | ug/L | *5000* | | *96.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5550 | | | ug/L | *5000* | | *111* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0603 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0603-BLK1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 10:37 | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5520 | | | ug/L | *5000* | | *110* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4660 | | | ug/L | *5000* | | *93.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5260 | | | ug/L | *5000* | | *105* | *75-125* | | | |
| **LCS (BLB0603-BS1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 09:20 | | | | |
| Vinyl chloride | 1.97 | 0.00501 | 0.0200 | ug/L | 2.00 | | 98.5 | 62-141 | | | |
| Tetrachloroethene | 1.81 | 0.00682 | 0.0200 | ug/L | 2.00 | | 90.3 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4840 | | | ug/L | *5000* | | *96.9* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5510 | | | ug/L | *5000* | | *110* | *75-125* | | | |
| **LCS Dup (BLB0603-BSD1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 10:16 | | | | |
| Vinyl chloride | 1.90 | 0.00501 | 0.0200 | ug/L | 2.00 | | 95.0 | 62-141 | 3.60 | 30 | |
| Tetrachloroethene | 1.70 | 0.00682 | 0.0200 | ug/L | 2.00 | | 85.1 | 76-127 | 5.87 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5350 | | | ug/L | *5000* | | *107* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4830 | | | ug/L | *5000* | | *96.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5500 | | | ug/L | *5000* | | *110* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 8260D in Water*** | |
| Chloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichlorofluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrolein | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acetone | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Iodomethane | DoD-ELAP,NELAP,WADOE |
| Methylene Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrylonitrile | DoD-ELAP,NELAP,WADOE |
| Carbon Disulfide | DoD-ELAP,NELAP,WADOE |
| trans-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Acetate | DoD-ELAP,NELAP,WADOE |
| 1,1-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Butanone | DoD-ELAP,NELAP,WADOE |
| 2,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| cis-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroform | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Carbon tetrachloride | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Benzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromodichloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Chloroethyl vinyl ether | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Methyl-2-Pentanone | DoD-ELAP,NELAP,WADOE |
| cis-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Toluene | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

| | |
|---|---|
| 2-Hexanone | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,3-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Tetrachloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromoethane | DoD-ELAP,NELAP,WADOE |
| Chlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Ethylbenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| m,p-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| o-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| Styrene | DoD-ELAP,NELAP,WADOE |
| Bromoform | DoD-ELAP,NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,4-Dichloro 2-Butene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Propylbenzene | DoD-ELAP,NELAP,WADOE |
| Bromobenzene | DoD-ELAP,NELAP,WADOE |
| Isopropyl Benzene | DoD-ELAP,NELAP,WADOE |
| 2-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| t-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,3,5-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2,4-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| s-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 4-Isopropyl Toluene | DoD-ELAP,NELAP,WADOE |
| 1,3-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,4-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromo-3-chloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,4-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Hexachloro-1,3-Butadiene | DoD-ELAP,ADEC,NELAP,WADOE |
| Naphthalene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dichlorodifluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Methyl tert-butyl Ether | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Hexane | WADOE |
| 2-Pentanone | WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

***EPA 8260D-SIM in Water***

| | |
|---|---|
| Acrylonitrile | NELAP,WADOE |
| Vinyl chloride | NELAP,WADOE |
| 1,1-Dichloroethene | NELAP,WADOE |
| cis-1,2-Dichloroethene | NELAP,WADOE |
| trans-1,2-Dichloroethene | NELAP,WADOE |
| Trichloroethene | NELAP,WADOE |
| Tetrachloroethene | NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | NELAP,WADOE |
| 1,2-Dichloroethane | NELAP,WADOE |
| Benzene | NELAP,WADOE |

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | 17-015 | 03/28/2023 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program, PJLA Testing | 66169 | 02/28/2023 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006-012 | 05/12/2023 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2023 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2023 |

| | | | |
|---|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: | Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: | Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: | Natasya Gray | 27-Feb-2023 17:57 |

## Notes and Definitions

| | |
|---|---|
| * | Flagged value is not within established control limits. |
| J | Estimated concentration value detected below the reporting limit. |
| M | Estimated value for a GC/MS analyte detected and confirmed by an analyst but with low spectral match parameters. |
| U | This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD). |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

eurofins | Air Toxics

2/22/2023
Mr. Duane Beery
Stericycle Environmental Solutions, Inc.
18000 72nd Ave. S
Suite 217
Kent WA 98032

Project Name: Georgetown
Project #: CLE-001 375.09
Workorder #: 2302212

Dear Mr. Duane Beery

The following report includes the data for the above referenced project for sample(s) received on 2/9/2023 at Eurofins Air Toxics LLC.

The data and associated QC analyzed by Modified TO-14A 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 Eurofins Air Toxics LLC. for your air analysis needs. Eurofins Air Toxics Inc. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Monica Tran at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Monica Tran

Project Manager

eurofins | Air Toxics

# WORK ORDER #: 2302212

Work Order Summary

| | | | |
|---|---|---|---|
| **CLIENT:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 | **BILL TO:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 |
| **PHONE:** | 425-227-6128 | **P.O. #** | |
| **FAX:** | | **PROJECT #** | CLE-001 375.09 Georgetown |
| **DATE RECEIVED:** | 02/09/2023 | **CONTACT:** | Monica Tran |
| **DATE COMPLETED:** | 02/22/2023 | | |

| FRACTION # | NAME | TEST | RECEIPT VAC./PRES. | FINAL PRESSURE |
|---|---|---|---|---|
| 01A | TE-707L-AA1-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 01B | TE-707L-AA1-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 02A | TE-707L-IA1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 02B | TE-707L-IA1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 03A | TE-707L-IA2-0223 | Modified TO-14A | 6.9 "Hg | 1.9 psi |
| 03B | TE-707L-IA2-0223 | Modified TO-14A | 6.9 "Hg | 1.9 psi |
| 04A | AS-710L-IA1-0223 | Modified TO-14A | 6.3 "Hg | 1.9 psi |
| 04B | AS-710L-IA1-0223 | Modified TO-14A | 6.3 "Hg | 1.9 psi |
| 05A | AS-710L-IA2-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 05B | AS-710L-IA2-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 06A | AS-710L-IA3-0223 | Modified TO-14A | 6.9 "Hg | 1.6 psi |
| 06B | AS-710L-IA3-0223 | Modified TO-14A | 6.9 "Hg | 1.6 psi |
| 07A | AS-710-SG1-0223 | Modified TO-14A | 4.9 "Hg | 1.9 psi |
| 07B | AS-710-SG1-0223 | Modified TO-14A | 4.9 "Hg | 1.9 psi |
| 08A | AS-710-SG2-0223 | Modified TO-14A | 3.9 "Hg | 1.9 psi |
| 08B | AS-710-SG2-0223 | Modified TO-14A | 3.9 "Hg | 1.9 psi |
| 09A | TE-707L-SG1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 09B | TE-707L-SG1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 10A | TE-707L-SG2-0223 | Modified TO-14A | 6.1 "Hg | 1.9 psi |
| 10B | TE-707L-SG2-0223 | Modified TO-14A | 6.1 "Hg | 1.9 psi |
| 11A | Lab Blank | Modified TO-14A | NA | NA |
| 11B | Lab Blank | Modified TO-14A | NA | NA |
| 11C | Lab Blank | Modified TO-14A | NA | NA |

Continued on next page

eurofins | Air Toxics

# WORK ORDER #: 2302212

Work Order Summary

| | | | |
|---|---|---|---|
| **CLIENT:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 | **BILL TO:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 |
| **PHONE:** | 425-227-6128 | **P.O. #** | |
| **FAX:** | | **PROJECT #** | CLE-001 375.09 Georgetown |
| **DATE RECEIVED:** | 02/09/2023 | **CONTACT:** | Monica Tran |
| **DATE COMPLETED:** | 02/22/2023 | | |

| FRACTION # | NAME | TEST | RECEIPT VAC./PRES. | FINAL PRESSURE |
|---|---|---|---|---|
| 11D | Lab Blank | Modified TO-14A | NA | NA |
| 11E | Lab Blank | Modified TO-14A | NA | NA |
| 11F | Lab Blank | Modified TO-14A | NA | NA |
| 12A | CCV | Modified TO-14A | NA | NA |
| 12B | CCV | Modified TO-14A | NA | NA |
| 12C | CCV | Modified TO-14A | NA | NA |
| 12D | CCV | Modified TO-14A | NA | NA |
| 12E | CCV | Modified TO-14A | NA | NA |
| 12F | CCV | Modified TO-14A | NA | NA |
| 13A | LCS | Modified TO-14A | NA | NA |
| 13AA | LCSD | Modified TO-14A | NA | NA |
| 13B | LCS | Modified TO-14A | NA | NA |
| 13BB | LCSD | Modified TO-14A | NA | NA |
| 13C | LCS | Modified TO-14A | NA | NA |
| 13CC | LCSD | Modified TO-14A | NA | NA |
| 13D | LCS | Modified TO-14A | NA | NA |
| 13DD | LCSD | Modified TO-14A | NA | NA |
| 13E | LCS | Modified TO-14A | NA | NA |
| 13EE | LCSD | Modified TO-14A | NA | NA |
| 13F | LCS | Modified TO-14A | NA | NA |
| 13FF | LCSD | Modified TO-14A | NA | NA |

CERTIFIED BY: Heidi Hayes DATE: 02/22/23

Technical Director

Certification numbers: AZ Licensure AZ0775, FL NELAP – E87680, LA NELAP – 02089, NH NELAP – 209222, NJ NELAP - CA016, NY NELAP - 11291, TX NELAP – T104704434-22-18, UT NELAP – CA009332022-14, VA NELAP - 12240, WA NELAP - C935
Name of Accreditation Body: NELAP/ORELAP (Oregon Environmental Laboratory Accreditation Program)
Accreditation number: CA300005-017, Effective date: 10/18/2022, Expiration date: 10/17/2023.
Eurofins Air Toxics, LLC certifies that the test results contained in this report meet all requirements of the NELAC standards

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**LABORATORY NARRATIVE**
**Modified TO-15 Full Scan/SIM**
**Stericycle Environmental Solutions, Inc.**
**Workorder# 2302212**

Ten 6 Liter Summa Canister (100% SIM Ambient) samples were received on February 09, 2023. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the Full Scan and SIM acquisition modes. The method involves concentrating up to 1.0 liters of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

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

| ***Requirement*** | ***TO-15*** | ***ATL Modifications*** |
|---|---|---|
| ICAL %RSD acceptance criteria | </=30% RSD with 2 compounds allowed out to < 40% RSD | For Full Scan:<br>30% RSD with 4 compounds allowed out to < 40% RSD<br><br>For SIM:<br>Project specific; default criteria is </=30% RSD with 10% of compounds allowed out to < 40% RSD |
| Daily Calibration | +- 30% Difference | For Full Scan:<br></= 30% Difference with four allowed out up to </=40%.; flag and narrate outliers<br><br>For SIM:<br>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

The Chain of Custody (COC) information for sample TE-707L-AA1-0223 did not match the information on the canister with regard to canister barcode. The sample labeled 6L0397 on the COC is labeled as 6L0379 on the canister. The client was notified of the discrepancy and the information on the canister was used to process and report the sample.

## Analytical Notes

The results for each sample in this report were acquired from two separate data files originating from the same analytical run. The two data files have the same base file name and are differentiated with a "sim" extension on the SIM data file.

Non-standard compounds may have different acceptance criteria than the standard TO-14A/TO-15 compound list as per contract or verbal agreement.

**Definition of Data Qualifying Flags**

Nine 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.

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

N - The identification is based on presumptive evidence.

CN - See case narrative explanation

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

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01A**

No Detections Were Found.

**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.42 | 0.068 | 2.0 |
| Benzene | 0.070 | 0.54 | 0.22 | 1.7 |
| 1,2-Dichloroethane | 0.014 | 0.019 | 0.057 | 0.076 |
| Toluene | 0.070 | 0.36 | 0.26 | 1.4 |
| Ethyl Benzene | 0.028 | 0.072 | 0.12 | 0.31 |

**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02A**

No Detections Were Found.

**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.17 | 0.070 | 0.83 |
| Benzene | 0.072 | 0.36 | 0.23 | 1.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.058 | 0.12 |
| Toluene | 0.072 | 4.0 | 0.27 | 15 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.10 | 0.12 | 0.45 |

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03A**

No Detections Were Found.

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.015 | 0.14 | 0.072 | 0.70 |
| Benzene | 0.074 | 0.39 | 0.23 | 1.2 |
| 1,2-Dichloroethane | 0.015 | 0.027 | 0.059 | 0.11 |
| Toluene | 0.074 | 4.6 | 0.28 | 17 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.12 | 0.13 | 0.52 |

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.074 | 0.070 | 0.36 |
| 1,1,1-Trichloroethane | 0.029 | 0.058 | 0.16 | 0.31 |
| Benzene | 0.072 | 0.18 | 0.23 | 0.59 |
| 1,2-Dichloroethane | 0.014 | 0.052 | 0.058 | 0.21 |
| Trichloroethene | 0.014 | 0.016 | 0.077 | 0.084 |
| Toluene | 0.072 | 0.39 | 0.27 | 1.4 |
| Tetrachloroethene | 0.029 | 0.093 | 0.19 | 0.63 |
| Ethyl Benzene | 0.029 | 0.077 | 0.12 | 0.34 |

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.038 | 0.068 | 0.19 |
| Benzene | 0.070 | 0.17 | 0.22 | 0.56 |
| 1,2-Dichloroethane | 0.014 | 0.041 | 0.057 | 0.17 |
| Toluene | 0.070 | 0.45 | 0.26 | 1.7 |
| Ethyl Benzene | 0.028 | 0.094 | 0.12 | 0.41 |

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.13 | 0.070 | 0.65 |
| Benzene | 0.072 | 0.26 | 0.23 | 0.82 |
| 1,2-Dichloroethane | 0.014 | 0.049 | 0.058 | 0.20 |
| Toluene | 0.072 | 0.54 | 0.27 | 2.0 |
| Tetrachloroethene | 0.029 | 0.037 | 0.20 | 0.25 |
| Ethyl Benzene | 0.029 | 0.11 | 0.12 | 0.49 |

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.17 | 0.66 | 0.85 |

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.016 | 0.034 | 0.040 |

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

| | | | | |
|---|---|---|---|---|
| 1,1-Dichloroethene | 0.014 | 0.17 | 0.054 | 0.67 |
| 1,1-Dichloroethane | 0.027 | 1.3 | 0.11 | 5.3 |
| Chloroform | 0.014 | 0.22 | 0.066 | 1.0 |
| cis-1,2-Dichloroethene | 0.027 | 0.30 | 0.11 | 1.2 |
| 1,1,1-Trichloroethane | 0.027 | 7.0 | 0.15 | 38 |
| Benzene | 0.068 | 0.65 | 0.22 | 2.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.055 | 0.12 |
| Trichloroethene | 0.014 | 0.038 | 0.072 | 0.20 |
| Toluene | 0.068 | 2.3 | 0.25 | 8.5 |
| Ethyl Benzene | 0.027 | 0.25 | 0.12 | 1.1 |
| trans-1,2-Dichloroethene | 0.14 | 0.34 | 0.54 | 1.4 |

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.13 | 0.20 | 0.64 | 0.96 |

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,1-Dichloroethene | 0.013 | 0.022 | 0.052 | 0.086 |
| 1,1-Dichloroethane | 0.026 | 0.62 | 0.10 | 2.5 |
| Chloroform | 0.013 | 1.2 | 0.063 | 6.1 |
| cis-1,2-Dichloroethene | 0.026 | 0.087 | 0.10 | 0.34 |
| 1,1,1-Trichloroethane | 0.026 | 3.2 | 0.14 | 17 |
| Benzene | 0.065 | 1.8 | 0.21 | 5.7 |
| 1,2-Dichloroethane | 0.013 | 0.035 | 0.053 | 0.14 |
| Trichloroethene | 0.013 | 0.016 | 0.070 | 0.088 |
| Toluene | 0.065 | 2.1 | 0.24 | 8.0 |
| Ethyl Benzene | 0.026 | 0.26 | 0.11 | 1.1 |

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.34 | 0.71 | 1.7 |

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.029 | 0.037 | 0.075 |
| Chloroform | 0.014 | 0.35 | 0.070 | 1.7 |
| Benzene | 0.072 | 0.94 | 0.23 | 3.0 |
| 1,2-Dichloroethane | 0.014 | 0.027 | 0.058 | 0.11 |
| Toluene | 0.072 | 5.5 | 0.27 | 21 |
| Tetrachloroethene | 0.029 | 0.10 | 0.20 | 0.70 |
| Ethyl Benzene | 0.029 | 0.48 | 0.12 | 2.1 |
| Naphthalene | 0.072 | 0.077 | 0.38 | 0.40 |

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.32 | 0.70 | 1.6 |

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.024 | 0.036 | 0.061 |
| Chloroform | 0.014 | 0.12 | 0.069 | 0.58 |
| Benzene | 0.071 | 0.48 | 0.23 | 1.5 |
| 1,2-Dichloroethane | 0.014 | 0.024 | 0.057 | 0.096 |
| Toluene | 0.071 | 6.2 | 0.27 | 23 |
| Tetrachloroethene | 0.028 | 0.070 | 0.19 | 0.47 |
| Ethyl Benzene | 0.028 | 0.44 | 0.12 | 1.9 |

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**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021719** | **Date of Collection: 2/7/23 1:58:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/17/23 10:11 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.70 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| sec-Butylbenzene | 0.70 | Not Detected | 3.8 | Not Detected |
| p-Cymene | 0.70 | Not Detected | 3.8 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

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**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021719sim** | **Date of Collection: 2/7/23 1:58:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/17/23 10:11 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.070 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.42 | 0.068 | 2.0 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.070 | 0.54 | 0.22 | 1.7 |
| 1,2-Dichloroethane | 0.014 | 0.019 | 0.057 | 0.076 |
| Trichloroethene | 0.014 | Not Detected | 0.075 | Not Detected |
| Toluene | 0.070 | 0.36 | 0.26 | 1.4 |
| Tetrachloroethene | 0.028 | Not Detected | 0.19 | Not Detected |
| Ethyl Benzene | 0.028 | 0.072 | 0.12 | 0.31 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.070 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 98 | 70-130 |
| 4-Bromofluorobenzene | 79 | 70-130 |

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**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021720** | **Date of Collection: 2/7/23 1:59:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/17/23 10:48 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 93 | 70-130 |

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**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021720sim** | **Date of Collection:** | **2/7/23 1:59:00 PM** |
| **Dil. Factor:** | **1.44** | **Date of Analysis:** | **2/17/23 10:48 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.037 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.17 | 0.070 | 0.83 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.36 | 0.23 | 1.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.058 | 0.12 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 4.0 | 0.27 | 15 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.10 | 0.12 | 0.45 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 84 | 70-130 |

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**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022016** | **Date of Collection: 2/7/23 2:02:00 PM** | |
| **Dil. Factor:** | **1.47** | **Date of Analysis: 2/20/23 06:53 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.74 | Not Detected | 3.0 | Not Detected |
| Propylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| sec-Butylbenzene | 0.74 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.74 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 91 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

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**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022016sim** | **Date of Collection: 2/7/23 2:02:00 PM** | |
| **Dil. Factor:** | **1.47** | **Date of Analysis: 2/20/23 06:53 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.015 | Not Detected | 0.038 | Not Detected |
| Chloroethane | 0.074 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.015 | Not Detected | 0.058 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.015 | 0.14 | 0.072 | 0.70 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.12 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.074 | 0.39 | 0.23 | 1.2 |
| 1,2-Dichloroethane | 0.015 | 0.027 | 0.059 | 0.11 |
| Trichloroethene | 0.015 | Not Detected | 0.079 | Not Detected |
| Toluene | 0.074 | 4.6 | 0.28 | 17 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.12 | 0.13 | 0.52 |
| trans-1,2-Dichloroethene | 0.15 | Not Detected | 0.58 | Not Detected |
| Naphthalene | 0.074 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 87 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022017** | **Date of Collection: 2/7/23 1:50:00 PM** | |
| **Dil. Factor:** | **1.43** | **Date of Analysis: 2/20/23 07:30 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 3.9 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 3.9 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 112 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022017sim** | **Date of Collection:** | **2/7/23 1:50:00 PM** |
| **Dil. Factor:** | **1.43** | **Date of Analysis:** | **2/20/23 07:30 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.074 | 0.070 | 0.36 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | 0.058 | 0.16 | 0.31 |
| Benzene | 0.072 | 0.18 | 0.23 | 0.59 |
| 1,2-Dichloroethane | 0.014 | 0.052 | 0.058 | 0.21 |
| Trichloroethene | 0.014 | 0.016 | 0.077 | 0.084 |
| Toluene | 0.072 | 0.39 | 0.27 | 1.4 |
| Tetrachloroethene | 0.029 | 0.093 | 0.19 | 0.63 |
| Ethyl Benzene | 0.029 | 0.077 | 0.12 | 0.34 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022018** | **Date of Collection: 2/7/23 1:54:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/20/23 08:31 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.70 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| sec-Butylbenzene | 0.70 | Not Detected | 3.8 | Not Detected |
| p-Cymene | 0.70 | Not Detected | 3.8 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 111 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 99 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022018sim** | **Date of Collection:** | **2/7/23 1:54:00 PM** |
| **Dil. Factor:** | **1.40** | **Date of Analysis:** | **2/20/23 08:31 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.070 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.038 | 0.068 | 0.19 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.070 | 0.17 | 0.22 | 0.56 |
| 1,2-Dichloroethane | 0.014 | 0.041 | 0.057 | 0.17 |
| Trichloroethene | 0.014 | Not Detected | 0.075 | Not Detected |
| Toluene | 0.070 | 0.45 | 0.26 | 1.7 |
| Tetrachloroethene | 0.028 | Not Detected | 0.19 | Not Detected |
| Ethyl Benzene | 0.028 | 0.094 | 0.12 | 0.41 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.070 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 89 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022019** | **Date of Collection: 2/7/23 1:53:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/20/23 09:07 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 112 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022019sim** | **Date of Collection: 2/7/23 1:53:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/20/23 09:07 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.037 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.13 | 0.070 | 0.65 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.26 | 0.23 | 0.82 |
| 1,2-Dichloroethane | 0.014 | 0.049 | 0.058 | 0.20 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 0.54 | 0.27 | 2.0 |
| Tetrachloroethene | 0.029 | 0.037 | 0.20 | 0.25 |
| Ethyl Benzene | 0.029 | 0.11 | 0.12 | 0.49 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 92 | 70-130 |

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**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022020** | **Date of Collection: 2/8/23 3:20:00 PM** | |
| **Dil. Factor:** | **1.35** | **Date of Analysis: 2/20/23 09:44 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.68 | Not Detected | 2.8 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.66 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.66 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.17 | 0.66 | 0.85 |
| sec-Butylbenzene | 0.68 | Not Detected | 3.7 | Not Detected |
| p-Cymene | 0.68 | Not Detected | 3.7 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 101 | 70-130 |
| Toluene-d8 | 106 | 70-130 |
| 4-Bromofluorobenzene | 103 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022020sim** | **Date of Collection:** | **2/8/23 3:20:00 PM** |
| **Dil. Factor:** | **1.35** | **Date of Analysis:** | **2/20/23 09:44 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.016 | 0.034 | 0.040 |
| Chloroethane | 0.068 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | 0.17 | 0.054 | 0.67 |
| 1,1-Dichloroethane | 0.027 | 1.3 | 0.11 | 5.3 |
| Chloroform | 0.014 | 0.22 | 0.066 | 1.0 |
| cis-1,2-Dichloroethene | 0.027 | 0.30 | 0.11 | 1.2 |
| 1,1,1-Trichloroethane | 0.027 | 7.0 | 0.15 | 38 |
| Benzene | 0.068 | 0.65 | 0.22 | 2.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.055 | 0.12 |
| Trichloroethene | 0.014 | 0.038 | 0.072 | 0.20 |
| Toluene | 0.068 | 2.3 | 0.25 | 8.5 |
| Tetrachloroethene | 0.027 | Not Detected | 0.18 | Not Detected |
| Ethyl Benzene | 0.027 | 0.25 | 0.12 | 1.1 |
| trans-1,2-Dichloroethene | 0.14 | 0.34 | 0.54 | 1.4 |
| Naphthalene | 0.068 | Not Detected | 0.35 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 101 | 70-130 |
| Toluene-d8 | 107 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022021** | **Date of Collection: 2/8/23 3:19:00 PM** | |
| **Dil. Factor:** | **1.30** | **Date of Analysis: 2/20/23 10:21 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.65 | Not Detected | 2.7 | Not Detected |
| Propylbenzene | 0.13 | Not Detected | 0.64 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.13 | Not Detected | 0.64 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.13 | 0.20 | 0.64 | 0.96 |
| sec-Butylbenzene | 0.65 | Not Detected | 3.6 | Not Detected |
| p-Cymene | 0.65 | Not Detected | 3.6 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 103 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 108 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022021sim** | **Date of Collection:** | **2/8/23 3:19:00 PM** |
| **Dil. Factor:** | **1.30** | **Date of Analysis:** | **2/20/23 10:21 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.013 | Not Detected | 0.033 | Not Detected |
| Chloroethane | 0.065 | Not Detected | 0.17 | Not Detected |
| 1,1-Dichloroethene | 0.013 | 0.022 | 0.052 | 0.086 |
| 1,1-Dichloroethane | 0.026 | 0.62 | 0.10 | 2.5 |
| Chloroform | 0.013 | 1.2 | 0.063 | 6.1 |
| cis-1,2-Dichloroethene | 0.026 | 0.087 | 0.10 | 0.34 |
| 1,1,1-Trichloroethane | 0.026 | 3.2 | 0.14 | 17 |
| Benzene | 0.065 | 1.8 | 0.21 | 5.7 |
| 1,2-Dichloroethane | 0.013 | 0.035 | 0.053 | 0.14 |
| Trichloroethene | 0.013 | 0.016 | 0.070 | 0.088 |
| Toluene | 0.065 | 2.1 | 0.24 | 8.0 |
| Tetrachloroethene | 0.026 | Not Detected | 0.18 | Not Detected |
| Ethyl Benzene | 0.026 | 0.26 | 0.11 | 1.1 |
| trans-1,2-Dichloroethene | 0.13 | Not Detected | 0.52 | Not Detected |
| Naphthalene | 0.065 | Not Detected | 0.34 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 102 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022108** | **Date of Collection: 2/8/23 3:29:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/21/23 12:05 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.34 | 0.71 | 1.7 |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022108sim** | **Date of Collection: 2/8/23 3:29:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/21/23 12:05 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.029 | 0.037 | 0.075 |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.35 | 0.070 | 1.7 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.94 | 0.23 | 3.0 |
| 1,2-Dichloroethane | 0.014 | 0.027 | 0.058 | 0.11 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 5.5 | 0.27 | 21 |
| Tetrachloroethene | 0.029 | 0.10 | 0.20 | 0.70 |
| Ethyl Benzene | 0.029 | 0.48 | 0.12 | 2.1 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | 0.077 | 0.38 | 0.40 |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022109** | **Date of Collection: 2/8/23 3:36:00 PM** | |
| **Dil. Factor:** | **1.42** | **Date of Analysis: 2/21/23 12:52 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.71 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.32 | 0.70 | 1.6 |
| sec-Butylbenzene | 0.71 | Not Detected | 3.9 | Not Detected |
| p-Cymene | 0.71 | Not Detected | 3.9 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 90 | 70-130 |
| 4-Bromofluorobenzene | 104 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022109sim** | **Date of Collection: 2/8/23 3:36:00 PM** | |
| **Dil. Factor:** | **1.42** | **Date of Analysis: 2/21/23 12:52 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.024 | 0.036 | 0.061 |
| Chloroethane | 0.071 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.12 | 0.069 | 0.58 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.071 | 0.48 | 0.23 | 1.5 |
| 1,2-Dichloroethane | 0.014 | 0.024 | 0.057 | 0.096 |
| Trichloroethene | 0.014 | Not Detected | 0.076 | Not Detected |
| Toluene | 0.071 | 6.2 | 0.27 | 23 |
| Tetrachloroethene | 0.028 | 0.070 | 0.19 | 0.47 |
| Ethyl Benzene | 0.028 | 0.44 | 0.12 | 1.9 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.071 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 108 | 70-130 |
| Toluene-d8 | 90 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021707a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 11:46 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 94 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021707sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 11:46 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 95 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022006a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 10:45 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 95 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022006sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 10:45 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 99 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022107a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 11:01 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 103 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022107sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 11:01 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 88 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021703** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 08:54 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 112 |
| Propylbenzene | 108 |
| 1,3,5-Trimethylbenzene | 112 |
| 1,2,4-Trimethylbenzene | 113 |
| sec-Butylbenzene | 118 |
| p-Cymene | 109 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 100 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021703sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 08:54 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 101 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 84 |
| 1,1-Dichloroethane | 93 |
| Chloroform | 88 |
| cis-1,2-Dichloroethene | 95 |
| 1,1,1-Trichloroethane | 87 |
| Benzene | 95 |
| 1,2-Dichloroethane | 89 |
| Trichloroethene | 90 |
| Toluene | 100 |
| Tetrachloroethene | 89 |
| Ethyl Benzene | 107 |
| trans-1,2-Dichloroethene | 92 |
| Naphthalene | 75 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 96 | 70-130 |
| Toluene-d8 | 116 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022002** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 07:54 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 109 |
| Propylbenzene | 109 |
| 1,3,5-Trimethylbenzene | 114 |
| 1,2,4-Trimethylbenzene | 115 |
| sec-Butylbenzene | 121 |
| p-Cymene | 111 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 117 | 70-130 |
| 4-Bromofluorobenzene | 100 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022002sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 07:54 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 99 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 83 |
| 1,1-Dichloroethane | 93 |
| Chloroform | 88 |
| cis-1,2-Dichloroethene | 93 |
| 1,1,1-Trichloroethane | 88 |
| Benzene | 97 |
| 1,2-Dichloroethane | 91 |
| Trichloroethene | 91 |
| Toluene | 101 |
| Tetrachloroethene | 90 |
| Ethyl Benzene | 109 |
| trans-1,2-Dichloroethene | 92 |
| Naphthalene | 72 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 118 | 70-130 |
| 4-Bromofluorobenzene | 96 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022102** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 06:59 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 110 |
| Propylbenzene | 115 |
| 1,3,5-Trimethylbenzene | 118 |
| 1,2,4-Trimethylbenzene | 119 |
| sec-Butylbenzene | 128 |
| p-Cymene | 116 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 99 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 106 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022102sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 06:59 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 97 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 87 |
| 1,1-Dichloroethane | 94 |
| Chloroform | 90 |
| cis-1,2-Dichloroethene | 95 |
| 1,1,1-Trichloroethane | 92 |
| Benzene | 95 |
| 1,2-Dichloroethane | 92 |
| Trichloroethene | 90 |
| Toluene | 102 |
| Tetrachloroethene | 92 |
| Ethyl Benzene | 110 |
| trans-1,2-Dichloroethene | 93 |
| Naphthalene | 72 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021704** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 09:30 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 113 | 70-130 |
| Propylbenzene | 97 | 70-130 |
| 1,3,5-Trimethylbenzene | 103 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 107 | 60-140 |
| p-Cymene | 102 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 99 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13AA**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021705** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 10:12 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 108 | 70-130 |
| Propylbenzene | 96 | 70-130 |
| 1,3,5-Trimethylbenzene | 100 | 70-130 |
| 1,2,4-Trimethylbenzene | 101 | 70-130 |
| sec-Butylbenzene | 107 | 60-140 |
| p-Cymene | 100 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 94 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021704sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 09:30 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 95 | 70-130 |
| Chloroethane | 95 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 83 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 88 | 70-130 |
| 1,2-Dichloroethane | 84 | 70-130 |
| Trichloroethene | 86 | 70-130 |
| Toluene | 92 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 89 | 70-130 |
| Naphthalene | 91 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 96 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 96 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13BB**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021705sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 10:12 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 98 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 79 | 70-130 |
| cis-1,2-Dichloroethene | 89 | 70-130 |
| 1,1,1-Trichloroethane | 81 | 70-130 |
| Benzene | 85 | 70-130 |
| 1,2-Dichloroethane | 77 | 70-130 |
| Trichloroethene | 83 | 70-130 |
| Toluene | 94 | 70-130 |
| Tetrachloroethene | 79 | 70-130 |
| Ethyl Benzene | 95 | 70-130 |
| trans-1,2-Dichloroethene | 86 | 70-130 |
| Naphthalene | 90 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 91 | 70-130 |
| Toluene-d8 | 116 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022003** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 08:31 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 112 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 106 | 70-130 |
| 1,2,4-Trimethylbenzene | 108 | 70-130 |
| sec-Butylbenzene | 110 | 60-140 |
| p-Cymene | 106 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 110 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13CC**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022004** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 09:07 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 110 | 70-130 |
| Propylbenzene | 98 | 70-130 |
| 1,3,5-Trimethylbenzene | 103 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 106 | 60-140 |
| p-Cymene | 102 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 108 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022003sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 08:31 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 93 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 85 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 83 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 87 | 70-130 |
| 1,2-Dichloroethane | 83 | 70-130 |
| Trichloroethene | 86 | 70-130 |
| Toluene | 92 | 70-130 |
| Tetrachloroethene | 84 | 70-130 |
| Ethyl Benzene | 101 | 70-130 |
| trans-1,2-Dichloroethene | 88 | 70-130 |
| Naphthalene | 87 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 97 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 93 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13DD**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022004sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 09:07 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 92 | 70-130 |
| Chloroethane | 93 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 82 | 70-130 |
| cis-1,2-Dichloroethene | 89 | 70-130 |
| 1,1,1-Trichloroethane | 86 | 70-130 |
| Benzene | 84 | 70-130 |
| 1,2-Dichloroethane | 81 | 70-130 |
| Trichloroethene | 83 | 70-130 |
| Toluene | 89 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 87 | 70-130 |
| Naphthalene | 92 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 97 | 70-130 |
| Toluene-d8 | 108 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022104** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 08:14 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 109 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 104 | 70-130 |
| 1,2,4-Trimethylbenzene | 105 | 70-130 |
| sec-Butylbenzene | 111 | 60-140 |
| p-Cymene | 105 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 104 | 70-130 |
| 4-Bromofluorobenzene | 101 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13EE**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022105** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 09:20 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 107 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 104 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 114 | 60-140 |
| p-Cymene | 105 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 94 | 70-130 |
| Toluene-d8 | 104 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022104sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 08:14 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 96 | 70-130 |
| Chloroethane | 95 | 70-130 |
| 1,1-Dichloroethene | 89 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 82 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 83 | 70-130 |
| 1,2-Dichloroethane | 77 | 70-130 |
| Trichloroethene | 82 | 70-130 |
| Toluene | 88 | 70-130 |
| Tetrachloroethene | 84 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 89 | 70-130 |
| Naphthalene | 97 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 105 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13FF**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022105sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 09:20 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 92 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 88 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 81 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 86 | 70-130 |
| Benzene | 81 | 70-130 |
| 1,2-Dichloroethane | 76 | 70-130 |
| Trichloroethene | 82 | 70-130 |
| Toluene | 88 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 97 | 70-130 |
| trans-1,2-Dichloroethene | 87 | 70-130 |
| Naphthalene | 93 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 105 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

# Appendix D

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**Sayler Data Solutions, Inc.**
14257 93rd Court NE Kirkland, Washington 98034 (425) 820-7504 cari.say@saylerdata.com

# DATA VALIDATION REPORT

*Georgetown Facility Vapor Intrusion Assessment and Mitigation, 707 and 710 S. Lucille Data, February 2023*

CleanEarth
20245 77th Ave S.
Kent, Washington 98032

March 28, 2023

## 1.0 Introduction

Data set: Data were received for validation in one laboratory sample delivery group (SDG). Data submissions included both a laboratory report and an electronic data deliverable (EDD) as follows:

| SDG | EDD File Name | Report File Name | Report Date |
|---|---|---|---|
| 2302212 | ATLSTDEDD_2302212.xls | 2302212_d.pdfpdf<br>2302212COC.pdf | 02/22/2023 |

Analyses were submitted by Eurofins Air Toxics LLC in Folsom, California (ATL).

Analytical methods: Analyses were performed by the following methods:

| Analysis | Analytical Method |
|---|---|
| Volatile Organic Analysis (VOAs) in air | TO-14A/TO-15 Modified, Full Scan and SIM |

Analytical Schedule: The following air samples were included in this review:

| SDG | Sample ID | Sample Date/Time | Lab ID | Analysis |
|---|---|---|---|---|
| 2302212 | TE-707L-AA1-0223 | 02/07/2023 13:58 | 2302212-01 | VOAs |
| 2302212 | TE-707L-IA1-0223 | 02/07/2023 13:59 | 2302212-02 | VOAs |
| 2302212 | TE-707L-IA2-0223 | 02/07/2023 14:02 | 2302212-03 | VOAs |
| 2302212 | AS-710L-IA1-0223 | 02/07/2023 13:50 | 2302212-04 | VOAs |
| 2302212 | AS-710L-IA2-0223 | 02/07/2023 13:54 | 2302212-05 | VOAs |
| 2302212 | AS-710L-IA3-0223 | 02/07/2023 13:53 | 2302212-06 | VOAs |
| 2302212 | AS-710-SG1-0223 | 02/08/2023 15:20 | 2302212-07 | VOAs |
| 2302212 | AS-710-SG2-0223 | 02/08/2023 15:19 | 2302212-08 | VOAs |
| 2302212 | TE-707L-SG1-0223 | 02/08/2023 15:29 | 2302212-09 | VOAs |
| 2302212 | TE-707L-SG2-0223 | 02/08/2023 15:36 | 2302212-10 | VOAs |

## 2.0 Validation

Results were evaluated based on criteria from the analytical methods, project QAPPs, the VIAM plan, and current EPA guidance documents. References for these documents are listed in

section 6.0 of this report. The criteria gathered from the above documents are briefly summarized in the Appendix "Data Validation Criteria" at the end of this report.

A stage 2A validation was performed on the results including both the laboratory report and EDD, earning EPA OSWER validation label code S2AVEM. All validation was performed by Cari Sayler.

## 3.0 Validation Findings

Data validation criteria specified in the appendix were met.

## 4.0 Validation Qualifiers

No qualifiers were assigned during this data validation.

## 5.0 Common Abbreviations and Definitions

| DV Qualifier | Definition |
|---|---|
| U | The material was analyzed for, but was not detected above the level of the associated value. |
| UY | The reporting limit was elevated due to chromatographic overlap with related compounds. The material was analyzed for, but was not detected above the level of the associated value. |
| J | The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample. |
| N | The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification. |
| UJ | The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise. |
| R | The sample result is rejected. The presence or absence of the analyte cannot be verified and data are not usable. |
| R1 | This sample result has been rejected in favor of a more accurate, precise or conservative result. The other result should be used. |
| R2 | This sample result has been rejected in favor of a more accurate, precise or conservative result from another analytical method. The other result should be used. |

| QC Element | Definition |
|---|---|
| ICAL | Initial calibration |
| ICV | Initial calibration verification |
| CCV | Continuing calibration verification |
| LCS | Laboratory control sample |
| LCSD | Laboratory control sample |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| SRM | Standard reference material |
| RRM | Regional reference material |
| FD | Field duplicate |
| FB | Field blank |
| RB | Rinse blank |
| TB | Trip blank |

| QC Element | Definition |
|---|---|
| IS | Internal standard |
| RT | Retention time |
| RRT | Relative retention time |
| RPD | Relative percent difference |

| Abbreviation | Definition |
|---|---|
| CRDL | Contract required detection limit |
| DV | Data validation |
| EDL | Estimated detection limit |
| EMPC | Estimated maximum possible concentration |
| MDL | Method detection limit |
| NA | Not applicable |
| QAPP | Quality Assurance Project Plan |
| RL | Reporting limit |
| RSD | Relative standard deviations |
| SDG | Sample delivery group |
| SIM | Selective ion monitoring |
| SRM | Selective reaction monitoring |

## 6.0 References


*USEPA 2009: USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, EPA 540-R-08-005, January 2009.

*Method TO-14A: Determination of Volatile Organic Compounds (VOCs) in Ambient Air using Specially Prepared Canisters with Subsequent Analysis by Gas chromatography,* US Environmental Protection Agency, Office of Research and Development, January 1999.

*Method TO-15: Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).* US Environmental Protection Agency, Office of Research and Development, January 1999.

*VIAM Plan: Vapor Intrusion Assessment and Mitigation Plan, Philip Services Corporation Georgetown Facility.* Prepared for Philip Services Corporation. Prepared by Pioneer Technologies Corporation, Olympia, Washington. June 2011.

*QAPP: Quality Assurance Project Plan, Inhalation Pathway Interim Measures, Georgetown Facility.* Prepared for Philip Services Corporation. Prepared by Exponent, Lake Oswego Oregon, August 2002.

*Laboratory QAM: Laboratory Quality Assurance Manual Excerpt, Appendix E, Analytical Methods Section 12.0.* Prepared by Eurofins Air Toxics Laboratory. Effective Date: November 4, 2020

# *APPENDIX – DATA VALIDATION CRITERIA*

## Data Package Completeness and Sample Integrity

| QC Element | Criteria |
|---|---|
| Completeness | Laboratory report includes the appropriate level of detail as described in the EPA Guidance documents (USEPA, January 2009) |
| Sample ID transcription | Chain of custodies and/or sample log-in documentation are present for all samples reported and match sample IDs used in the laboratory report and electronic data deliverable (EDD). |
| Sample receipt condition | Sample containers are intact upon receipt at the laboratory and preservation and storage requirements meet method specific guidelines. |
| Requested methods | The VIAM Plan specifies method 8260B for groundwater samples and TO-14A/TO-15 with laboratory modifications for air samples. |
| Requested analyte list and reporting limits | Requested target analytes were included and specified reporting limits were met. The 21 target analytes for both air and groundwater VOCs are specified in Table 2 of the IPIM QAPP. |
| Laboratory Narrative | The laboratory narrative, data flags and corrective action documentation detailing any preparation or analytical anomalies are evaluated for impact on data usability. |

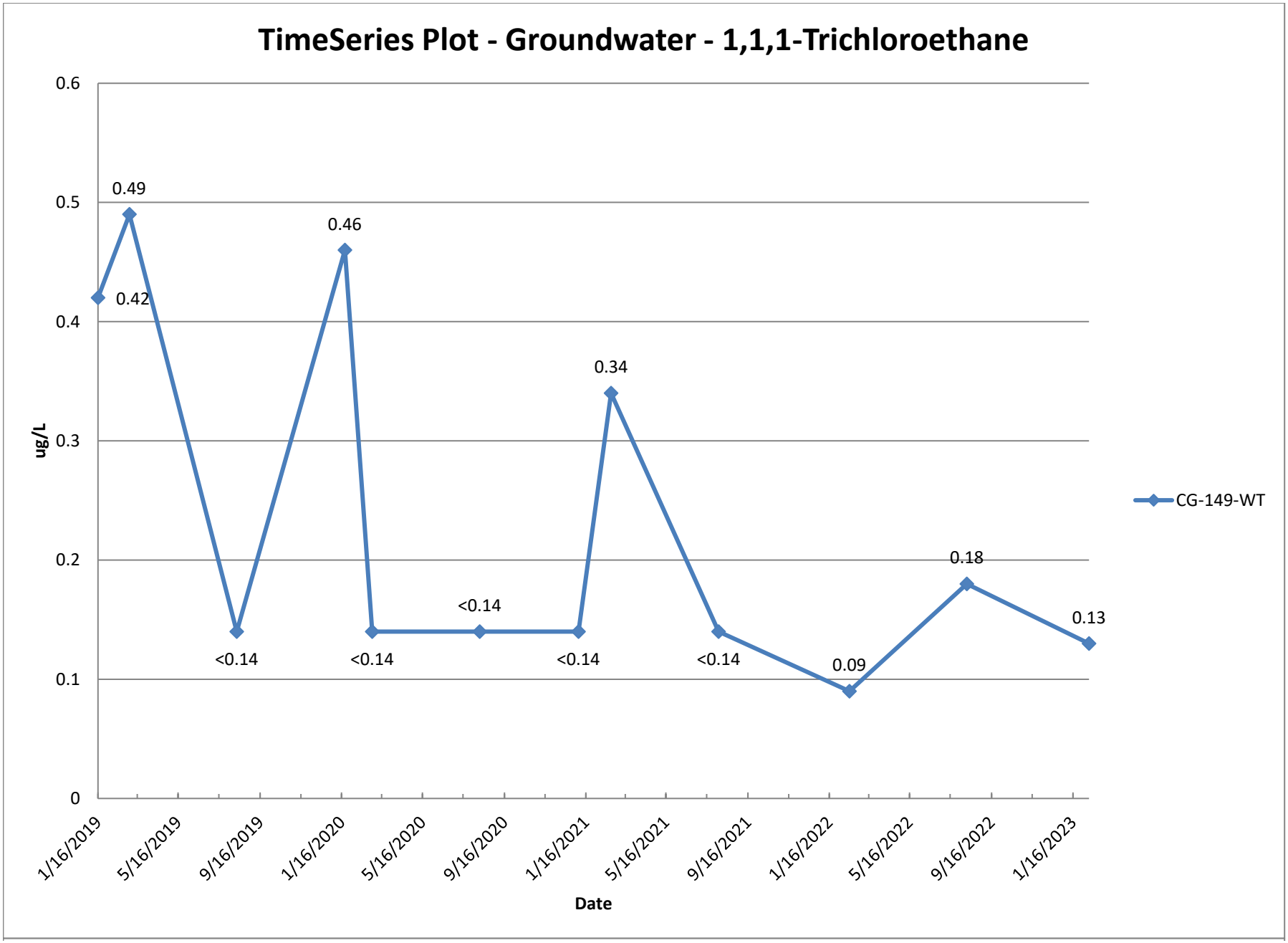
Notes
- Newer versions of published analytical methods are considered acceptable substitutions. Data referencing older versions of published analytical methods may be assessed based on numerical criteria present in newer versions.

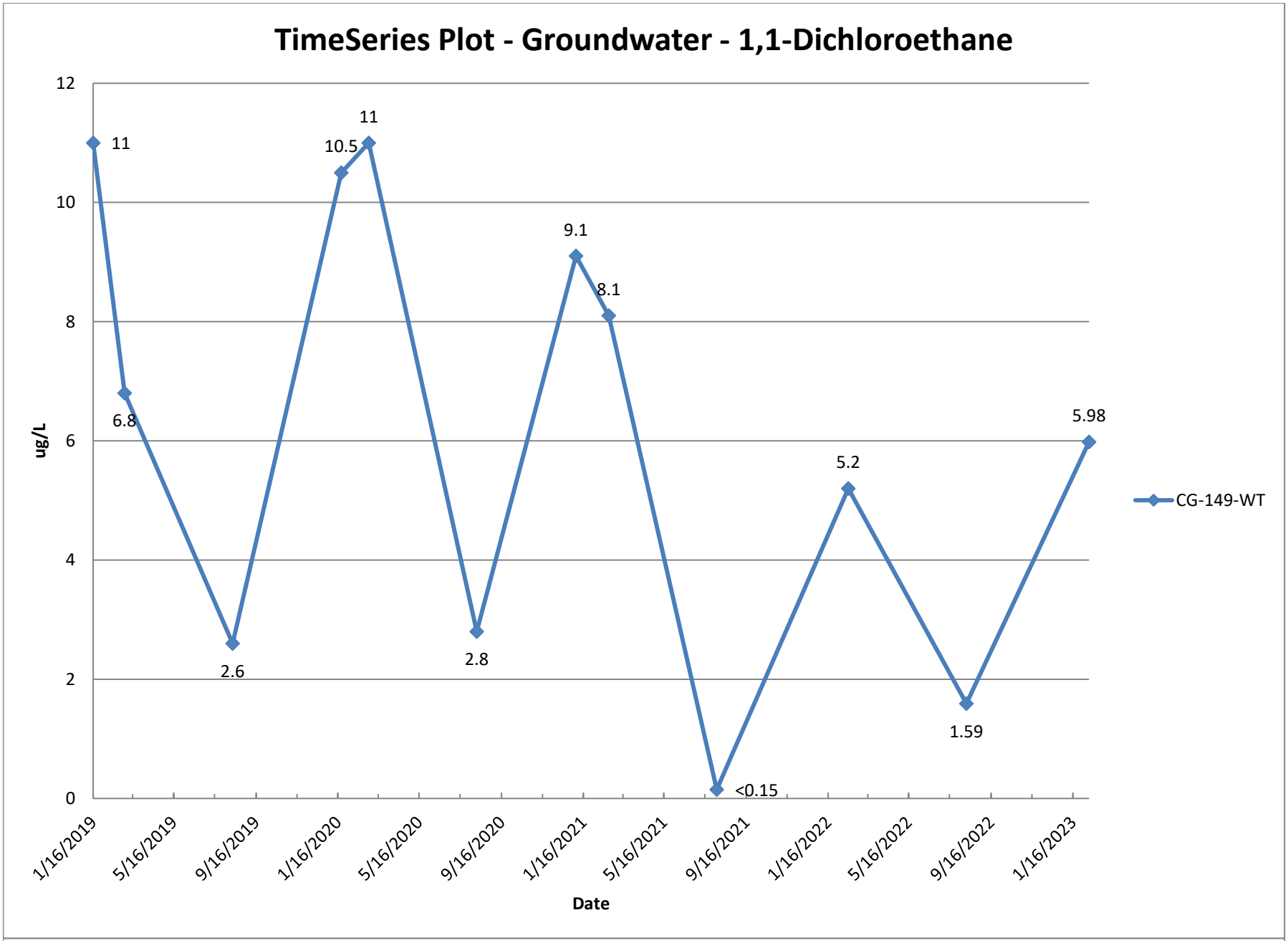
## Volatile Analyses in Air, Stage 2A Validation

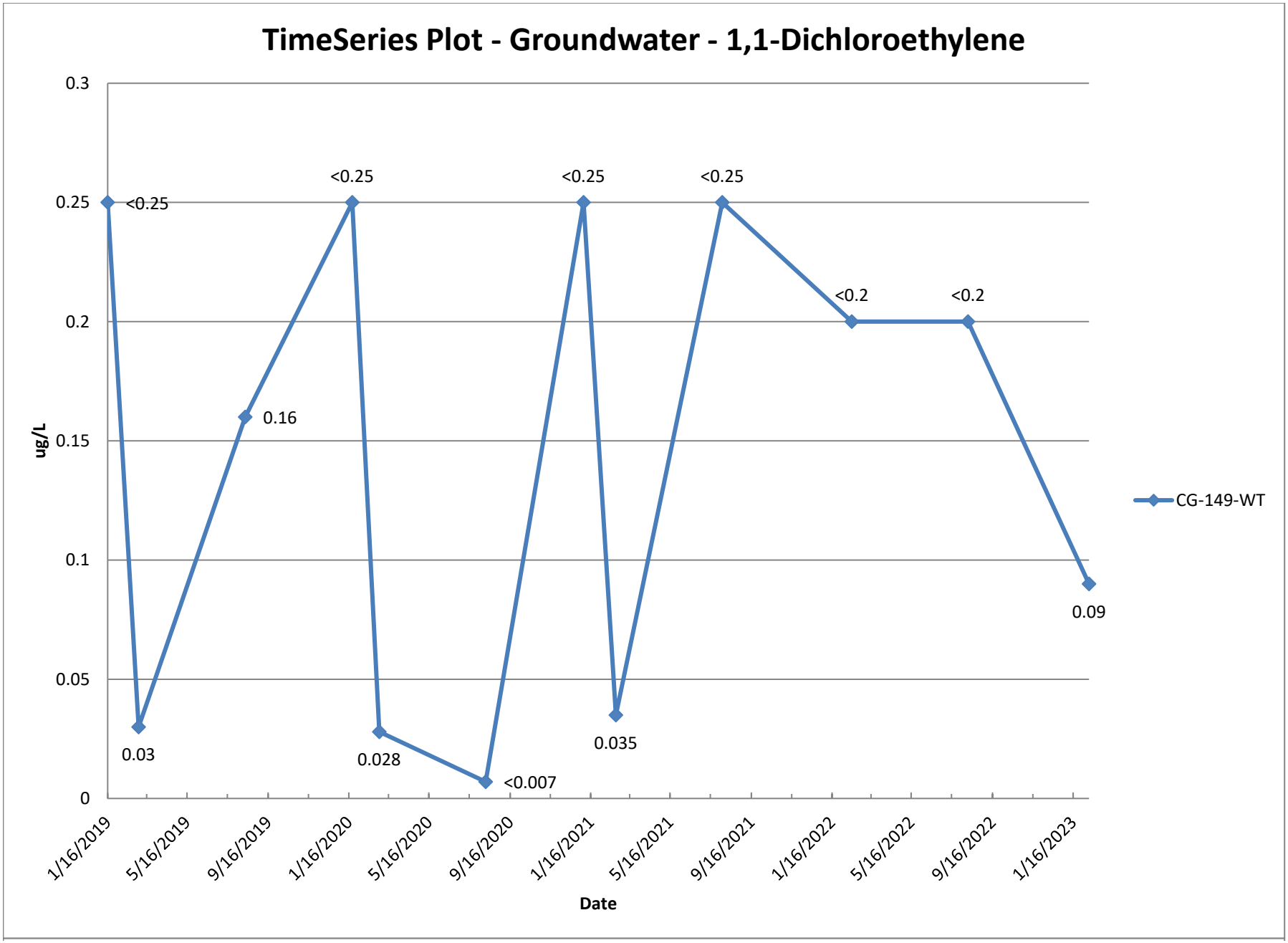
| QC Element | Frequency | Criteria |
|---|---|---|
| Holding times | Each sample | Air samples must be analyzed within 30 days. |
| Daily calibration (CCV), if present | Daily | • RF %difference vs ICAL mean RF ≤30% |
| Laboratory blank (LB) | Daily | Target analyte concentrations < RL, or < 10% of concentration in field samples. |
| Laboratory control sample (LCS) | After each CCV prior to samples | % Recoveries within 70-130%. |
| LCS duplicate (LCSD) | Once per analytical batch | • % Recoveries within 70-130%.<br>• RPDs ≤25%. |
| Surrogates | Each sample and QC sample | % Recoveries within 70-130% |

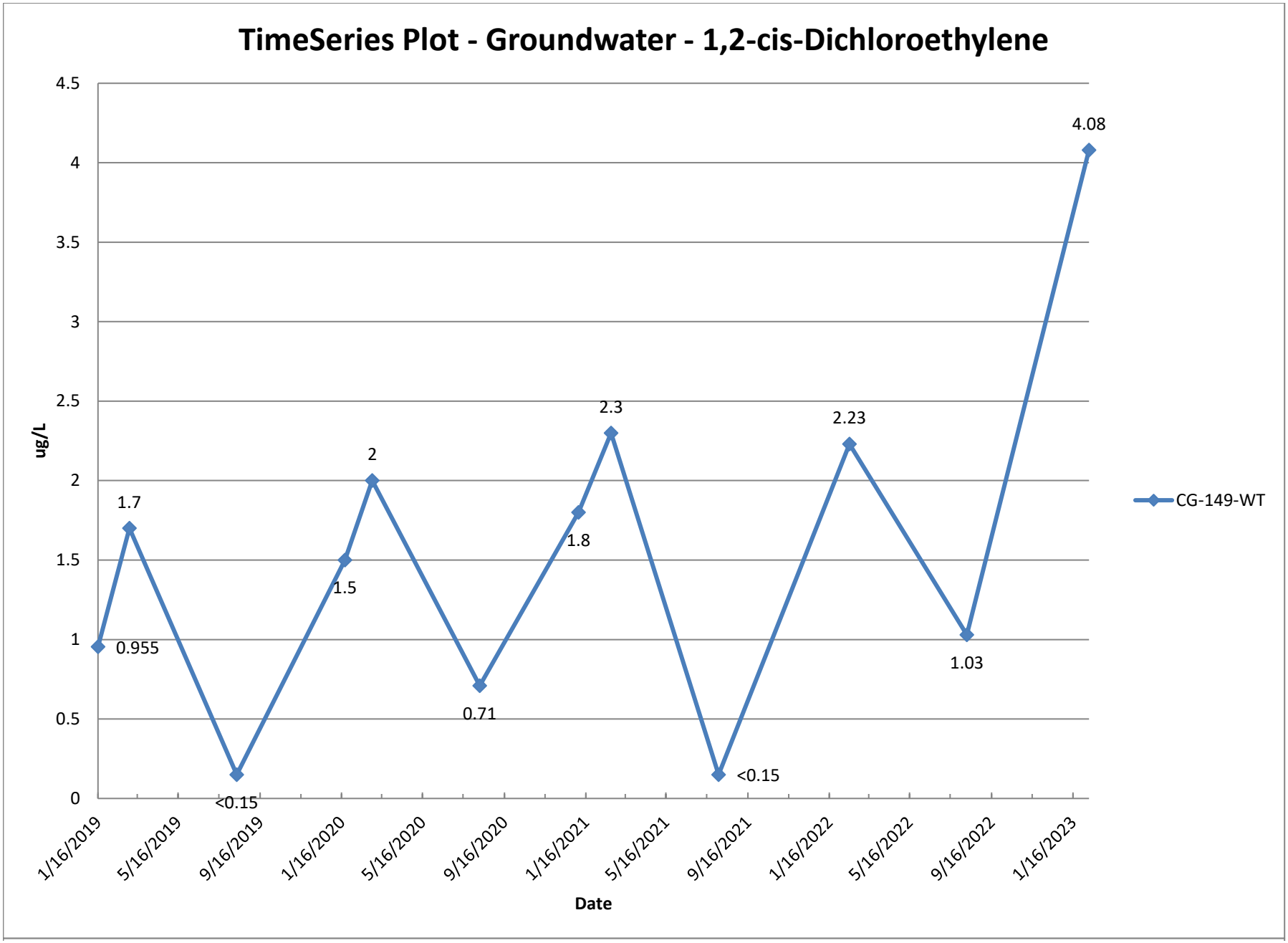
Notes:
- Method TO-14A incorporates method TO-15 QC criteria by reference. Above criteria is pulled from both analytical methods (TO-14A and TO-15), as well as the laboratory QAM.
- CCV data are not typically included in Stage 2A validation. However, when included in the summary report, recoveries are evaluated.

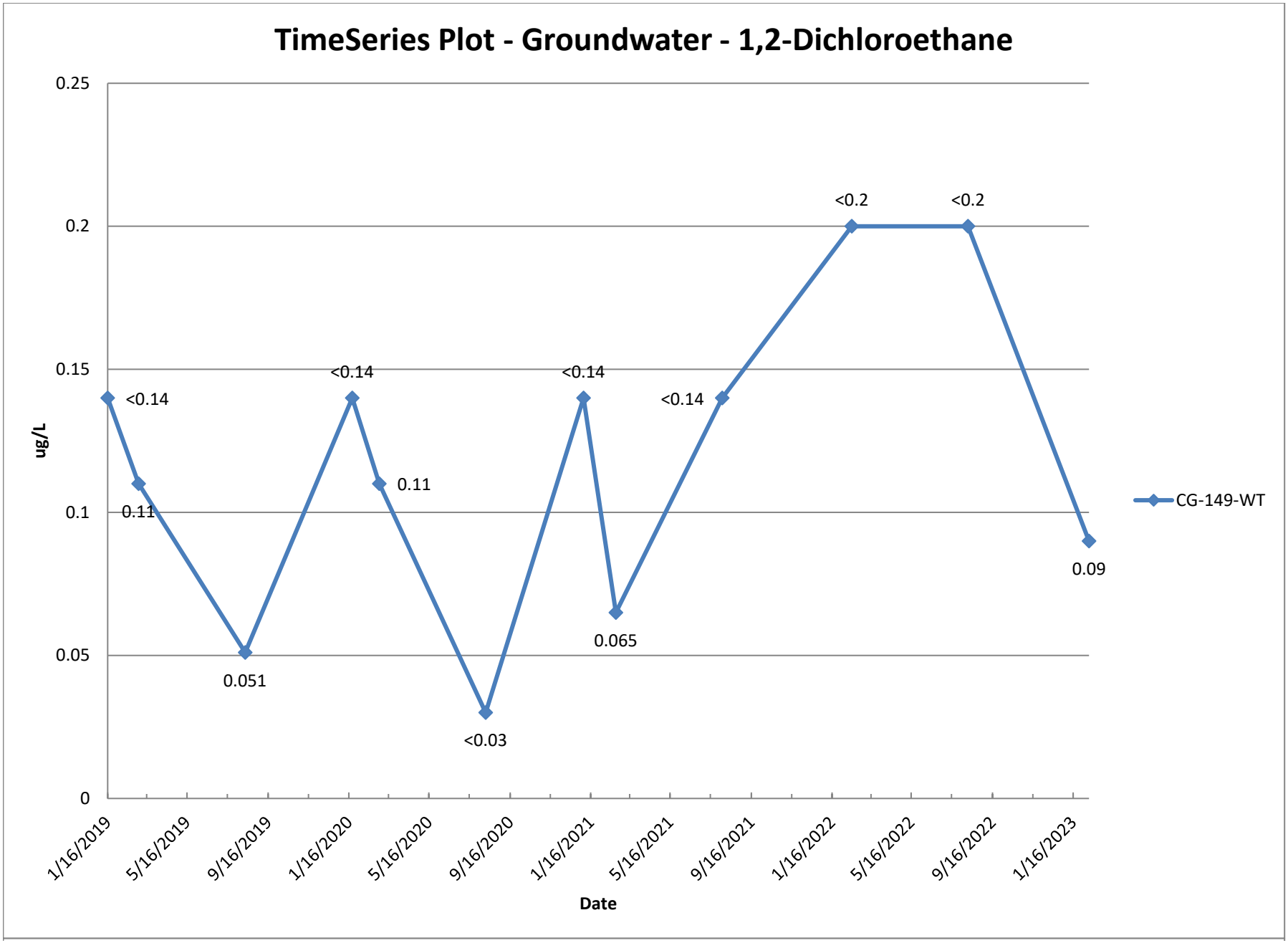
# Appendix E

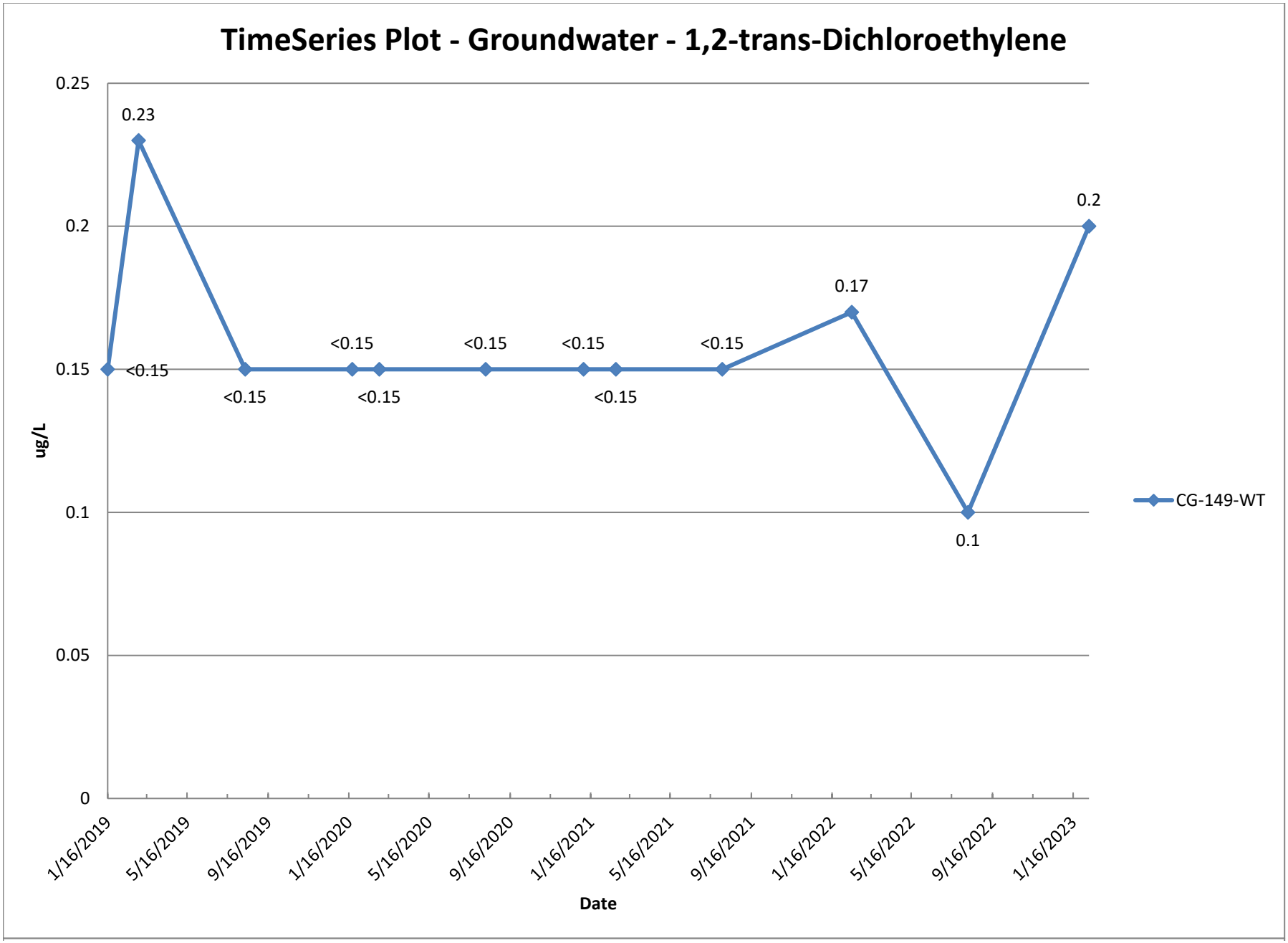

TimeSeries Plot - Groundwater - 1,1,1-Trichloroethane
0.6
0.5
0.4
0.3
0.2
0.1
0
ug/L
0.49
0.42
<0.14
0.46
<0.14
<0.14
0.34
<0.14
0.09
0.18
0.13
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT

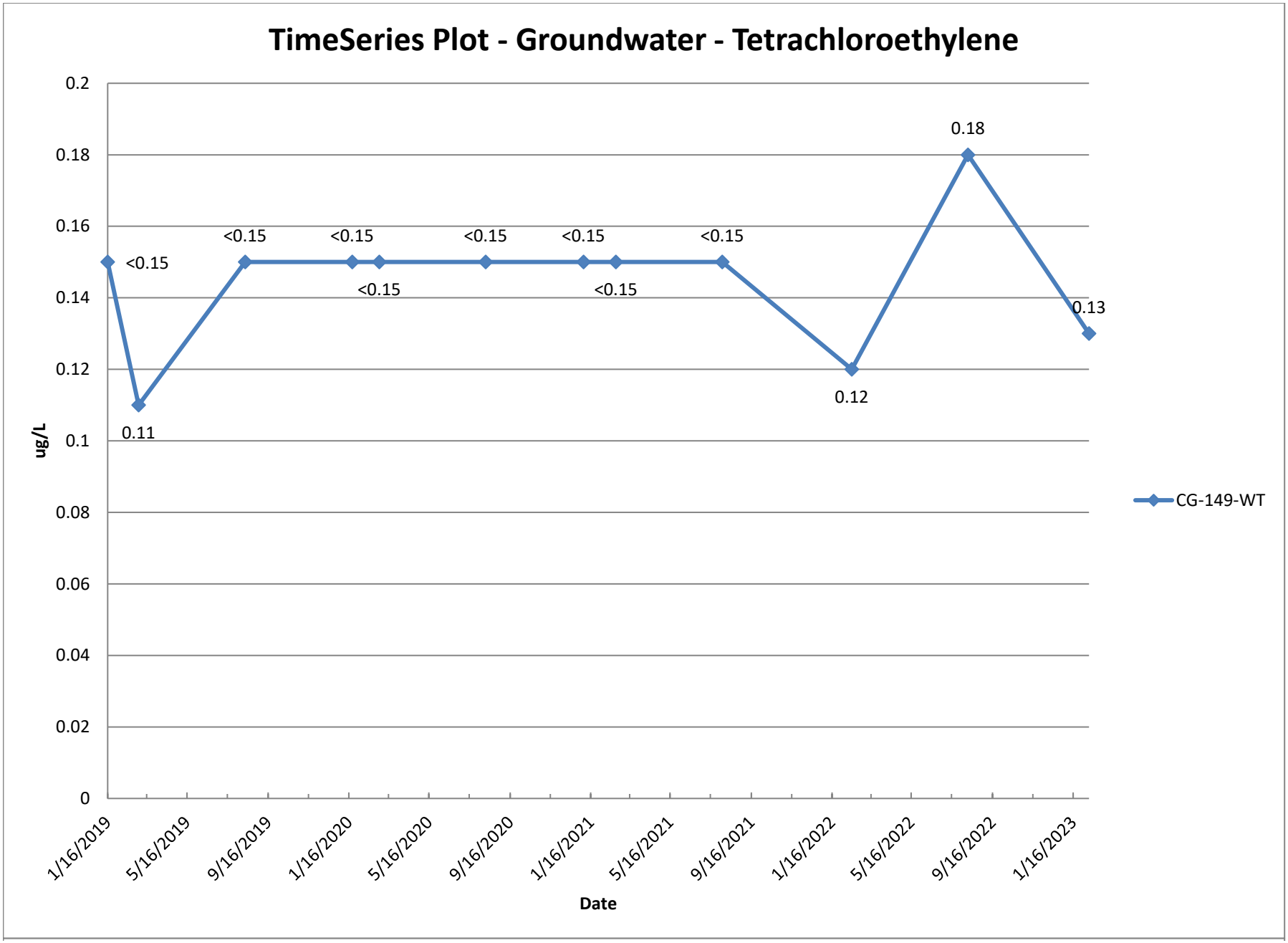

TimeSeries Plot - Groundwater - 1,1-Dichloroethane
12
10
8
6
4
2
0
ug/L
11
6.8
2.6
10.5
11
2.8
9.1
8.1
<0.15
5.2
1.59
5.98
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT

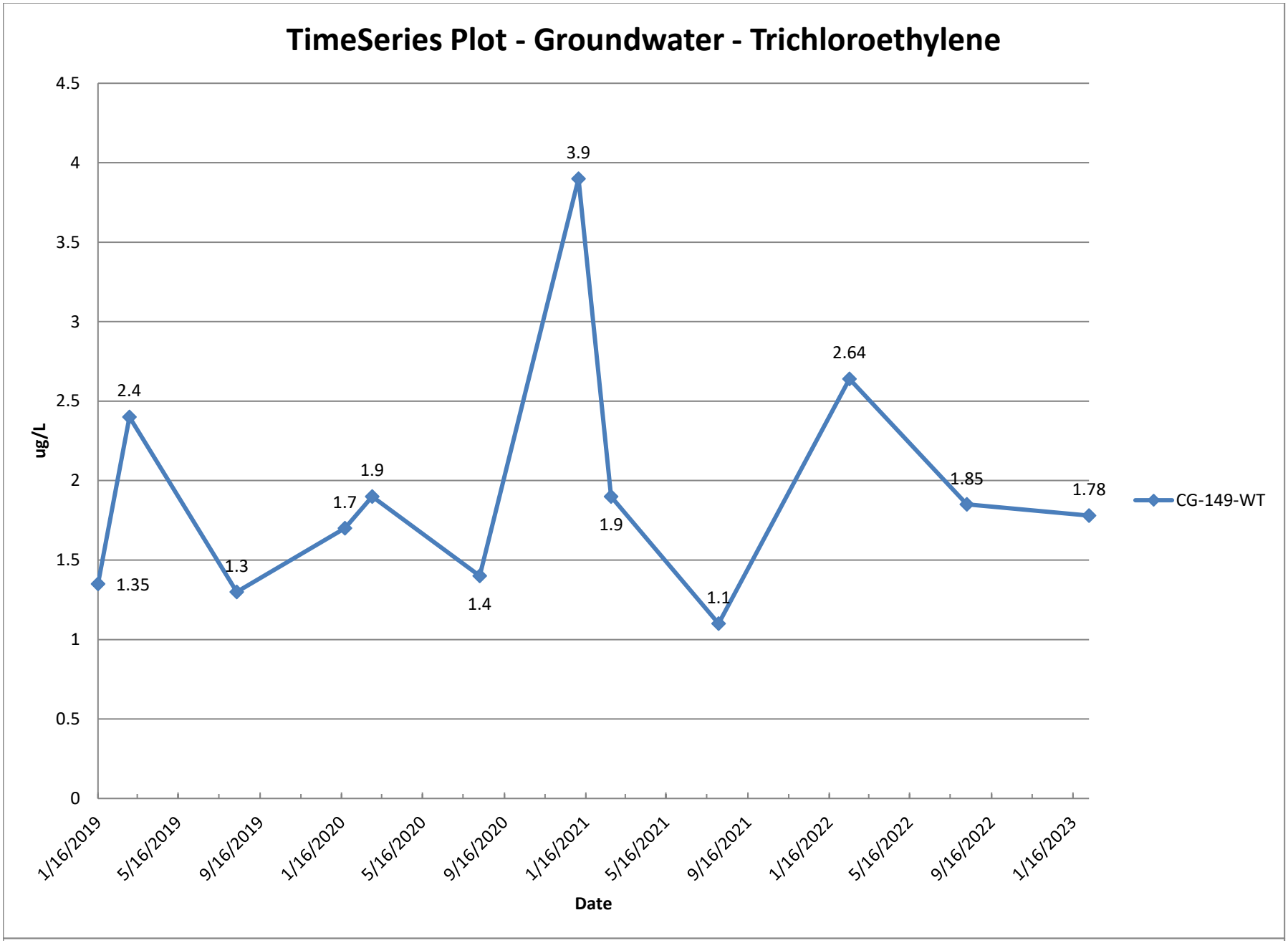

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.3
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.25
0.03
0.16
<0.25
0.028
<0.007
<0.25
0.035
<0.25
<0.2
<0.2
0.09
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT

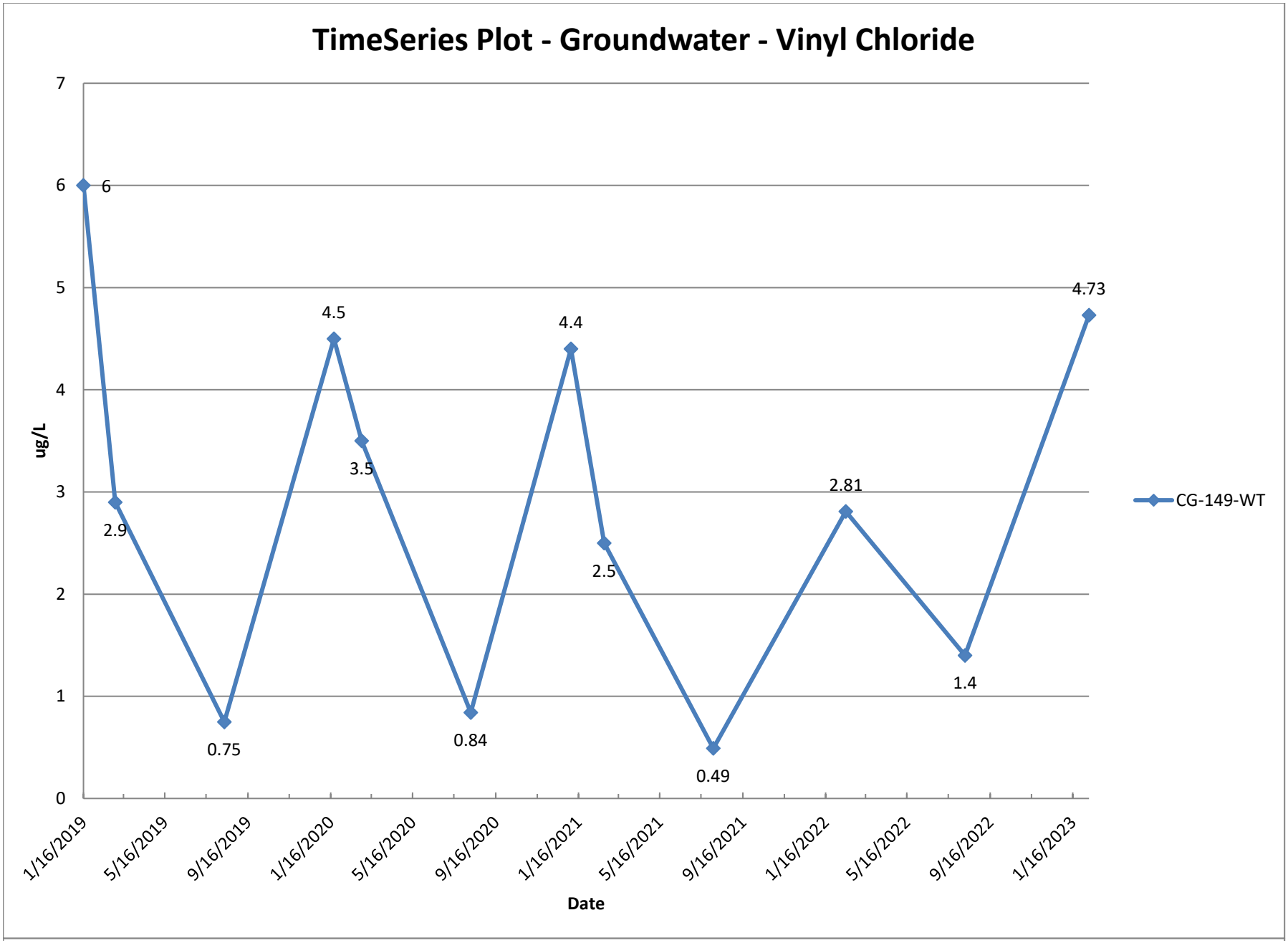

TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
ug/L
1.7
0.955
<0.15
2
1.5
0.71
2.3
1.8
<0.15
2.23
1.03
4.08
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT


TimeSeries Plot - Groundwater - 1,2-Dichloroethane
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.14
0.11
0.051
<0.14
0.11
<0.03
<0.14
0.065
<0.14
<0.2
<0.2
0.09
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT

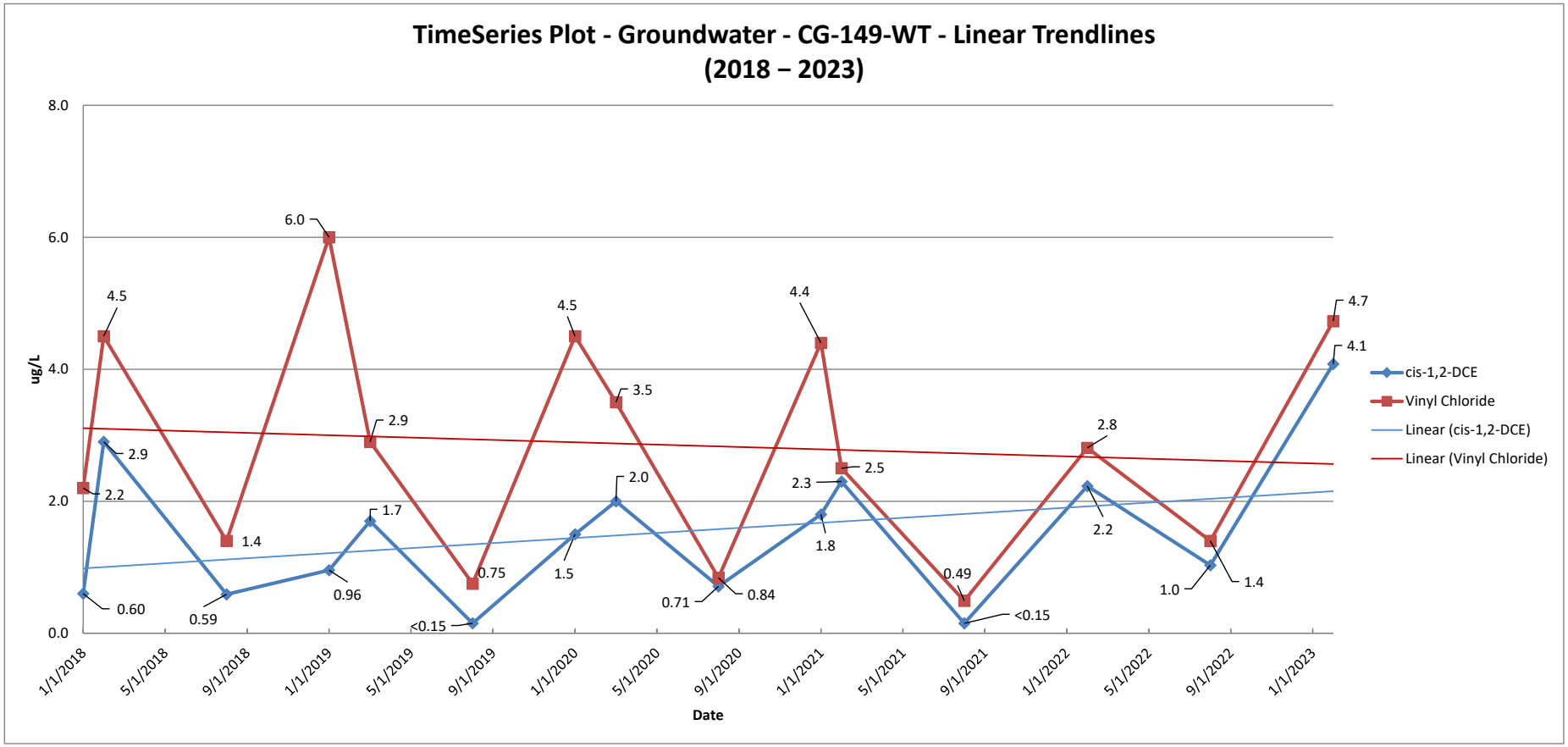

TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.2
0.15
0.1
0.05
0
ug/L
0.23
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.17
0.1
0.2
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT

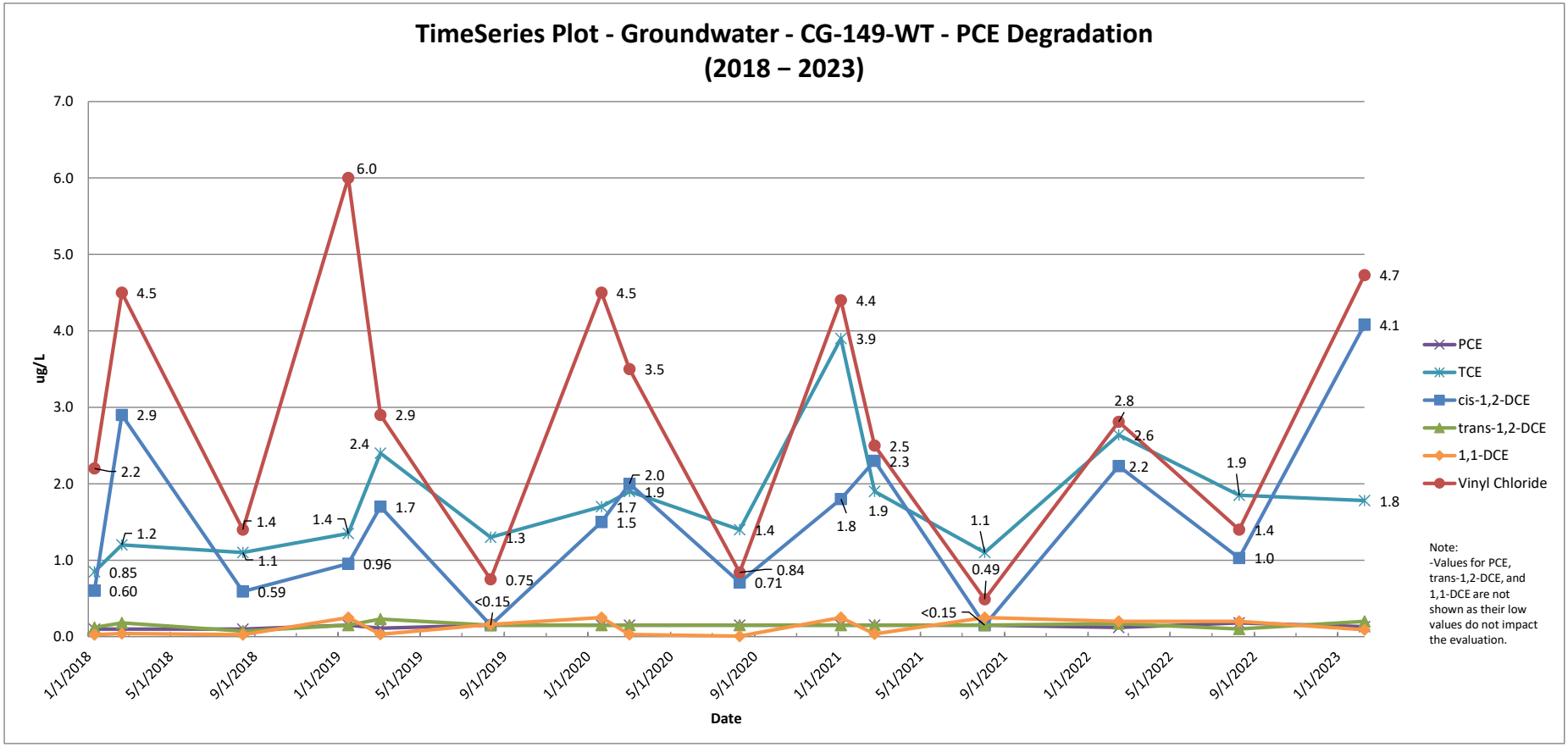

TimeSeries Plot - Groundwater - Tetrachloroethylene
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
ug/L
<0.15
0.11
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
0.12
0.18
0.13
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT


TimeSeries Plot - Groundwater - Trichloroethylene
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
ug/L
2.4
1.35
1.3
1.7
1.9
1.4
3.9
1.9
1.1
2.64
1.85
1.78
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023
Date
CG-149-WT


TimeSeries Plot - Groundwater - Vinyl Chloride
ug/L
Date
CG-149-WT
7
6
5
4
3
2
1
0
6
2.9
0.75
4.5
3.5
0.84
4.4
2.5
0.49
2.81
1.4
4.73
1/16/2019
5/16/2019
9/16/2019
1/16/2020
5/16/2020
9/16/2020
1/16/2021
5/16/2021
9/16/2021
1/16/2022
5/16/2022
9/16/2022
1/16/2023

# Additional Trend Analysis for cis-1,2-DCE


TimeSeries Plot - Groundwater - CG-149-WT - Linear Trendlines
(2018 – 2023)
ug/L
Date
8.0
6.0
4.0
2.0
0.0
1/1/2018
5/1/2018
9/1/2018
1/1/2019
5/1/2019
9/1/2019
1/1/2020
5/1/2020
9/1/2020
1/1/2021
5/1/2021
9/1/2021
1/1/2022
5/1/2022
9/1/2022
1/1/2023
4.5
2.2
2.9
0.60
6.0
1.4
0.59
2.9
0.96
1.7
<0.15
0.75
4.5
1.5
3.5
2.0
0.71
0.84
4.4
1.8
2.3
2.5
0.49
<0.15
2.8
2.2
1.0
1.4
4.7
4.1
cis-1,2-DCE
Vinyl Chloride
Linear (cis-1,2-DCE)
Linear (Vinyl Chloride)


TimeSeries Plot - Groundwater - CG-149-WT - PCE Degradation
(2018 – 2023)
ug/L
Date
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE
1,1-DCE
Vinyl Chloride
Note:
-Values for PCE, trans-1,2-DCE, and 1,1-DCE are not shown as their low values do not impact the evaluation.

# Appendix H

# 2023 Tier V Evaluation for 707 South Lucile Street

## 707 South Lucile Street

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# List of Acronyms

| Acronym | Explanation |
|---|---|
| °F | Degrees Fahrenheit |
| 1,1-DCE | 1,1-Dichloroethylene |
| 1,2-DCA | 1,2-Dichloroethane |
| BE | Burlington Environmental, LLC |
| cis-1,2-DCE | cis-1,2-Dichloroethylene |
| CCEF | Cumulative Cancer Exceedance Factor |
| CEF | Cancer Exceedance Factor |
| CNCEF | Cumulative Noncancer Exceedance Factor |
| DL | Detection Limit |
| Ecology | Washington State Department of Ecology |
| EPA | United States Environmental Protection Agency |
| GW-IA | Groundwater-to-Indoor Air |
| IPIM | Inhalation Pathway Interim Measures |
| NCEF | Noncancer Exceedance Factor |
| PCE | Tetrachloroethylene |
| PIONEER | PIONEER Technologies Corporation |
| PSC | PSC Environmental Services, LLC |
| RCRA | Resource Conservation and Recovery Act |
| SG-IA | Soil Gas-to-Indoor Air |
| SSD | Sub-Slab Depressurization |
| TCE | Trichloroethylene |
| trans-1,2-DCE | trans-1,2-dichloroethylene |
| ug/L | Micrograms per Liter |
| $ug/m^3$ | Micrograms per Cubic Meter |
| VI | Vapor Intrusion |
| VIAM | Vapor Intrusion Assessment and Mitigation |
| VIRL | Vapor Intrusion Remediation Level |
| VOC | Volatile Organic Compound |

# SECTION 1: INTRODUCTION

Long-term monitoring activities are being conducted as part of corrective action for the Burlington Environmental, LLC (BE) Georgetown facility in Seattle, Washington.[1] Corrective action activities are being conducted per the requirements in Resource Conservation and Recovery Act (RCRA) dangerous waste permit number WAD 00081 2909. As part of the corrective action, a sub-slab depressurization (SSD) system was installed in the commercial building at 707 South Lucile Street in January 2005 due to elevated volatile organic compound (VOC) concentrations in shallow groundwater and indoor air (PSC Environmental Services, LLC [PSC] 2002, 2003). Western Trailer Repair (Parts Dept.) currently occupies the building at 707 South Lucile Street, which includes a warehouse, a showroom, storage rooms, and office spaces (see Figure 1).

A Tier 5 evaluation was conducted for the building. The Tier 5 evaluation was conducted to determine if 707 South Lucile Street can proceed from Step 3 of the Tier 5 process (i.e., building-specific confirmation air sampling), to Step 4 (Vapor Intrusion [VI] Mitigation System Shutdown). The purpose of this report is to 1) document the results of the 2023 building-specific confirmation sampling, 2) present Cumulative Cancer Exceedance Factors (CCEFs) and Cumulative Noncancer Exceedance Factors (CNCEFs) calculated using building-specific air data and Vapor Intrusion Remediation Levels (VIRLs),[2] 3) evaluate pre-VI mitigation and post-VI mitigation building-specific vapor-phase sampling results to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and representative of a stable or decreasing trend, and 4) determine if the building can proceed to the next step (Step 4) of the Tier 5 process.

## 1.1 Tier 5 Step 3 Evaluation

The Tier 5 process is used to determine when a VI mitigation system is a candidate for shutdown and removal, and is only applicable at a building where groundwater is the source of VOCs in indoor air. The five steps of a Tier 5 evaluation are described in the *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process (Tier 5)* May 3, 2011 memo from Chris Waldron of PIONEER to Ed Jones of Washington State Department of Ecology (Ecology; PIONEER 2011a). Of the five steps, 707 South Lucile is currently on Step 3, which is summarized below:

*Step 3: Perform Building-Specific Confirmation Air Sampling*

- The VI mitigation system will be temporarily shut down and sub-slab soil gas, crawl space, and/or indoor air and ambient air samples will be collected approximately 4 weeks later.
- Samples should be collected during the heating season (i.e., late fall, winter, early spring) so they are representative of reasonable "worst-case" samples.

[1] BE is the legal owner of the facility, and is a wholly-owned subsidiary of PSC Environmental Services, LLC which is a wholly-owned indirect subsidiary of Enviri/Clean Earth.

[2] VIRLs were calculated per the Tier 3 approach in Attachment A of the 2011 *Georgetown: Final Vapor Intrusion System Shutdown and Removal Process [Tier 5]* memo; PIONEER Technologies Corporation [PIONEER] 2011a).

- CCEFs and CNCEFs will be calculated based on the building-specific indoor air data per the approach presented in Tier 3 of the Inhalation Pathway Interim Measures (IPIM) process (PSC 2002).
- Results of historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling will be evaluated to determine if soil gas and indoor air concentrations are consistent with groundwater concentrations and are representative of a stable or decreasing trend.

*Decision Criteria*

1. Indoor air-based CCEFs and CNCEFs are less than or equal to 10.
2. Historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend.

Buildings that do not proceed to Step 4 will be eligible for additional confirmation air sampling (i.e., repeat Step 3) after one year.

## 1.2 Previous Sampling

The building has been sampled as part of long-term monitoring activities since 2005. The results of previous sampling events for 707 South Lucile Street are summarized in the table below.

| *Sampling Event* | Reason for Sampling | Sampling Results |
|---|---|---|
| *March 2005 Indoor and ambient air (PSC 2005a)* | Assess the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Indoor air concentrations associated with volatilization from groundwater were above Ecology's cancer health risk threshold. It was unclear why the indoor air concentration in the office area (where the SSD system was installed) was higher after installation of the system. Based on post-installation pressure measurements, the SSD system was functioning as designed. Additional sampling was recommended for the office area. |
| *August 2005 Groundwater, soil gas indoor and ambient air (PSC 2005b)* | Assess the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *November 2006 Groundwater, indoor and ambient air (PSC 2007)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *January 2008 Groundwater, indoor and ambient air (PSC 2008)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were above Ecology's cancer health risk threshold, primarily due to trichloroethylene (TCE). The source was not believed to be volatilization from groundwater to indoor air as the elevated concentration in groundwater was two times the previous result and the concentration in indoor air was 10 times previous result. It was unclear what was responsible for the exceedance. |
| *February 2009 Groundwater, soil gas, indoor and ambient air (PSC 2009)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |

| *Sampling Event* | Reason for Sampling | Sampling Results |
|---|---|---|
| *March 2010 Groundwater, indoor and ambient air (PSC 2010)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *March 2011 Groundwater, indoor and ambient air (PSC 2011)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *March 2012 Ambient air (PSC 2012)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *January 2015 Groundwater, indoor and ambient air (PSC 2015)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *January 2018 Groundwater, indoor and ambient air (PSC 2018)* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *January 2021 Groundwater, indoor and ambient air (Clean Earth & PIONEER 2021))* | Confirm the effectiveness of the SSD system in restricting the flow of VOCs from groundwater into indoor air. | Concentrations were below Ecology's noncancer and cancer health risk thresholds and the SSD system was operating as designed. |
| *Current Event: February 2023 Groundwater, soil gas, indoor and ambient air* | Tier 5 Step 3, Building-Specific Confirmation Air Sampling. Determine if the building meets criteria to move on to Step 4 (Mitigation System Shutdown). | The results of the 2023 Tier 5 evaluation indicate that 707 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., Mitigation System Shutdown). |

# SECTION 2: SAMPLING SUMMARY

Building-specific air samples (sub-slab soil gas, indoor air, and ambient air) were collected in accordance with Step 3 of the Tier 5 process (PIONEER 2011a). Groundwater was collected as part of biannual groundwater monitoring. Sampling was conducted during the heating season, and the VI mitigation system was temporarily shut down approximately 4 weeks prior to sampling to ensure that samples are representative of long-term "non-mitigated" conditions; the system was restarted once sampling was complete. The following samples were collected during the February 2023 sampling event (see Figure 1):

- One groundwater sample was collected from water table well VIT5-04-WT.[3]
- Two soil gas samples were collected over an eight-hour period:
  - One sample was collected from an office located on the north side of the building (TE-707L-SG1-0223).
  - One sample was collected from the storage room (TE-707L-SG2-0223).
- Two indoor air samples were collected over an eight-hour period from the offices located on the north side of the building. One sample was collected from each office (TE-707L-IA1-0223, TE-707L-IA2-0223).
- One ambient air sample (TE-707L-AA1-0223) was collected by the southwest corner of the building. Ambient air sampling was conducted over an eight-hour period, concurrently with indoor air sampling.

The weather during the February 6, 2023 sampling event was partly cloudy with periods of light rain and fog. The mean ambient air temperature was 46 degrees Fahrenheit ($°F$) and ranged from 43°F to 53°F. The wind direction was generally south to southeast with the wind speed ranging from calm to 18 miles per hour during the sampling event. The field notes from the sampling event are included in Appendix A. A copy of the hourly weather report from the Weather Underground website is included in Appendix B. No problems were encountered during this sampling event.

The groundwater sample was sent to Analytical Resources Inc., LLC in Tukwila, Washington for analysis by United States Environmental Protection Agency (EPA) Method 8260 SIM and air samples were sent to Eurofins Air Toxics, Ltd. in Folsom, California for analysis by EPA Method TO-14/15. An independent, professional data validator validated all the laboratory data. The laboratory analytical data are presented in Appendix C; the data validation report is presented in Appendix D.

[3] The 2023 groundwater sample was collected from water table well VIT5-04-WT, which was installed in late-2018 to support Tier 5 evaluations. Since installation, VIT5-04-WT has been used to evaluate the 707 South Lucile building in lieu of CG-103-S1, which has been sampled historically to evaluate the building, as VIT5-04-WT is closer to the building than CG-103-S1.

# SECTION 3: RESULTS AND RISK EVALUATION

## 3.1 Results

The building-specific sampling results for the commercial building at 707 South Lucile Street are provided in Table 1.

Only tetrachloroethylene (PCE), was detected in groundwater, soil gas, and indoor air (at a concentration greater than ambient air [background]). The groundwater and air concentrations for PCE were below their respective commercial VIRLs. Commercial VIRLs are appropriate for evaluating the results at this building because it is used for commercial purposes and includes a warehouse, showroom, storage rooms, and office spaces (see Figure 1).

A constituent must be detected in groundwater *and* indoor air to be included in the risk evaluation since the groundwater-to-indoor air pathway is our primary concern and groundwater is the primary source of vapor intrusion in this area.

Seven constituents were detected in groundwater. Of those detected in groundwater, chloroform and PCE were also detected in soil gas. No groundwater concentrations were above commercial groundwater VIRLs.

Nine constituents were detected in soil gas. Of those detected in soil gas, four constituents (1,2, -Dichloroethane [1,2-DCA], ethylbenzene, PCE, and toluene) were also detected indoor air. Of the constituents detected in both soil gas and indoor air, none were above commercial indoor air VIRLs.

Six constituents were detected in indoor air. Of those detected in indoor air, four constituents (1,2-DCA, ethylbenzene, PCE, and toluene) were detected at concentrations greater than ambient air; these indoor air concentrations will be corrected for background.

Three indoor constituents (benzene, chloroform, and naphthalene) were above commercial indoor air VIRLs. Only chloroform was detected in groundwater, which suggests that benzene and naphthalene concentrations may be influenced by sources other than groundwater. Chloroform and benzene's ambient air concentration were greater than indoor air concentrations, which suggests that ambient air may be contributing to indoor air. However, the groundwater-to-indoor air (GW-IA) pathway is our primary concern, therefore the impact on the evaluation is minimal. A discussion of naphthalene's detection limits is presented in the following section.

### *3.1.1 Detection Limits*

Constituent detection limits (DLs) that exceeded VIRLs are presented in the table below. Indoor air and ambient air DLs for naphthalene exceeded the minimum commercial air VIRL but naphthalene was not detected in groundwater. As the GW-IA air pathway is our primary concern, the impact on the evaluation is minimal.

| Constituent | Media | Detection Limit | Minimum Commercial Air VIRL | DL > VIRL? |
|---|---|---|---|---|
| Naphthalene | Indoor Air | 0.38 ug/m$^3$ | 0.17 ug/m$^3$ | Yes |
| Naphthalene | Ambient Air | 0.37 ug/m$^3$ | 0.17 ug/m$^3$ | Yes |

## 3.2 Risk Evaluation

### *3.2.2 Summary of the Approach*

The corrected indoor air concentration noncancer exceedance factors (NCEFs) and cancer exceedance factors (CEFs) calculated for the risk evaluation are presented in Table 2. Indoor air concentrations were corrected by subtracting maximum detected ambient air concentrations from maximum detected indoor air concentrations to account for the contribution of ambient air to the measured indoor air concentrations (PSC 2002). Exceedance factors were only calculated for constituents detected in both groundwater and indoor air (with concentrations greater than ambient air) because the only potential source of vapor intrusion in this area is shallow groundwater. A sensitivity analysis was also performed to calculate exceedances for constituents detected in groundwater and indoor air (with concentrations greater than ambient air). The NCEFs were calculated by dividing the corrected indoor air concentrations by noncancer-based indoor air VIRLs. The CEFs were calculated by dividing the corrected indoor air concentrations by cancer-based indoor air VIRLs. The individual NCEFs and CEFs were summed to provide the cumulative NCEF and CEF.

### *3.2.3 Results of Risk Evaluation*

The results of the risk evaluation for 707 South Lucile Street are presented in Table 2. The only constituent detected in groundwater and indoor air (greater than background) was PCE. Per the Revised IPIM Work Plan (PSC 2002), exceedances were only calculated for constituents with indoor air concentrations greater than the ambient air concentrations. The CNCEF for the GW-IA pathway is 0.16, which is below Ecology's noncancer benchmark of 10. The CCEF for the GW-IA pathway is 0.053, which is below Ecology's cancer benchmark of 10 (PSC 2002).

A sensitivity analysis was performed to calculate exceedances based on the soil gas-to-indoor air (SG-IA) pathway (see Table 2). Exceedances were calculated for the constituents detected in both soil gas and indoor air (greater than background), regardless if present in groundwater; 1,2-DCA, ethylbenzene, PCE, and toluene. The CNCEF for the SG-IA pathway is 0.21 which is below Ecology's noncancer benchmark of 10. The CCEF for the SG-IA pathway is 0.34 which is below Ecology's cancer benchmark of 10 (PSC 2002).

The groundwater trichloroethylene (TCE) concentration was also evaluated for short-term exposures to pregnant women during the first trimester of pregnancy. The TCE concentration (1.4 micrograms per liter [ug/L]) was below the groundwater subsurface screening level for short-term exposures (31 ug/L; Ecology 2019). Trichloroethylene was not detected in any air samples.

## 3.3 Comparison of Results Over Time

The following section presents a comparison of results over time for groundwater, soil gas, and indoor air results.

### 3.3.4 Comparison of 2023 Groundwater Results and Historical Groundwater Results

Monitoring well VIT5-04-WT was installed in late-2018 to support Tier 5 evaluations. Since January 2019, it has been sampled biannually during the first and third quarters (see Table 3). Results from this well are used in lieu of results from older wells in the area because it is the closest to the building; in other words, it most accurately represents groundwater conditions under the building. Groundwater results from the 2023 event were compared to historical events to determine groundwater concentration trends. Trend analyses were conducted for groundwater constituents detected in both pre-and post-VI mitigation events, and for constituents associated with the breakdown of chlorinated solvents (1,1-dichloroethylene [1,1-DCE], cis-1,2-dichloroethylene [cis-1,2-DCE], PCE, trans-1,2-dichloroethylene [trans-1,2-DCE], TCE, and vinyl chloride). Overall, trends indicate that groundwater constituents all have stabilizing or decreasing trends (see Table 3). Time series plots supporting the trend analyses are presented in Appendix E.

Pre- and post-VI mitigation system groundwater results were also evaluated to determine the differences in constituent concentrations between the two events. Groundwater concentrations decreased for all evaluated constituents between the two events (Table 3). These determinations will be compared with pre- and post-VI mitigation soil gas and indoor air differences.

### 3.3.5 Comparison of Pre-VI Mitigation and Post-VI Mitigation Air Sampling Results

A comparison Pre-VI Mitigation (August 2003) and Post-VI Mitigation (February 2023) soil gas and indoor air sampling results are presented in Table 4.

*Soil Gas*

Pre- and post-VI mitigation system soil gas results were evaluated to determine the differences in constituent concentrations between the two events. Trends were determined for constituents detected in both pre-and post-VI mitigation groundwater events, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride; Table 3). All evaluated constituents that were detected in soil gas have decreased/stabilized[4] since the pre-VI mitigation sampling event.

*Corrected Indoor Air*

Pre- and post-VI mitigation system indoor air results were evaluated to determine the differences in constituent concentrations between the two events. Trends were determined for constituents detected in both pre-and post-VI mitigation groundwater events, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride; Table 3). All evaluated constituents that were detected in indoor air have decreased/stabilized since the pre-VI mitigation sampling event.

[4] Given the slightly elevated DL for 1,2-DCA during the pre-VI mitigation event, it cannot be determined if the concentration has decreased or remained stable.

## 3.4 Discussion

Building-specific sampling was conducted in accordance with Step 3 of the Tier 5 process (PIONEER 2011a). To proceed Step 4 of the Tier 5 process (i.e., system shutdown), the building must meet the following decision criteria:

1. Indoor air-based CCEFs and CNCEFs are less than or equal to 10.
2. Historical (pre-VI mitigation) and post-VI mitigation building-specific vapor-phase sampling results (if available) are consistent with groundwater concentrations and representative of a stable or decreasing trend.

The 707 South Lucile Street building was evaluated using 1) groundwater data from VIT5-04-WT, sampled biannually since January 2019, and 2) soil gas and indoor results from pre-mitigation system installation in August 2003 and post-mitigation system installation in February 2023.

The risk evaluation conducted using the 2023 sampling event results confirmed that indoor air-based CCEFs and CNCEFs are less than or equal to 10 (see Table 2). Groundwater trends indicate that constituents all have stabilizing or decreasing trends (see Table 3). Pre- and post-VI mitigation groundwater, soil gas, and indoor air changes in constituent concentrations (between the two events) were compared to determine if results were consistent across all media. Both pre- and post-VI mitigation results for each constituent decreased or stabilized across all media (Tables 3 and 4)

# SECTION 4: CONCLUSIONS

The results of the 2023 Tier 5 evaluation indicate that 707 South Lucile Street meets the Step 3 decision criteria to proceed to Step 4 of the Tier 5 process (i.e., system shutdown). The results of the 2023 groundwater, soil gas, indoor air, and ambient air sampling event show that indoor air concentrations associated with volatilization from groundwater are below Ecology's noncancer and cancer health risk thresholds (i.e., CNCEF of 10 and CCEF of 10), and constituents in groundwater have stable or decreasing trends. Pre- and post-VI mitigation system soil gas and indoor air results are consistent with stable/decreasing trends in groundwater and results for each constituent have decreased or stabilized across all media between the two events.

# SECTION 5: REFERENCES

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# Figures







## Legend

- Soil Gas Sampling Location
- Water Table Well
- Indoor Air Sample
- Ambient Air Sample
- Roads
- Building Footprint

N
W E
S

Notes:
- Building is not to scale.
- Sample locations are approximate.
- Basemap Source: NAIP 2013

PIONEER TECHNOLOGIES CORPORATION

# Sample Locations
## 2023 Tier V Evaluation for 707 South Lucile Street
## Burlington Environmental Georgetown Site

Figure 1

Document Path: G:\Projects\PSC\GIS\Source\Maps\Maps 2023\1Q23 Event\707-S-Lucile-2023-Locations_Actual.mxd; Author: MCK; Date Saved: 6/9/2023

# Tables

## Table 1: 2023 Building-Specific Sampling Results

| Constituent | Groundwater (ug/L) | | Soil Gas (ug/m3) | | | | Indoor Air (ug/m$^3$) | | | | Ambient Air (ug/m$^3$) | | Commercial Groundwater VIRL (ug/L) | | Commercial Indoor Air VIRL (ug/m$^3$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VIT5-04-WT[1] | | TE-707L-SG1-0223 | | TE-707L-SG2-0223 | | TE-707L-IA1-0223 | | TE-707L-IA2-0223 | | TE-707L-AA1-0223 | | Noncancer | Cancer | Noncancer | Cancer |
| 1,1,1-Trichloroethane | 4.7 | | 0.16 | U | 0.15 | U | 0.16 | U | 0.16 | U | 0.15 | U | 10,361 | -- | 954 | -- |
| 1,1-Dichloroethane | 1.1 | | 0.12 | U | 0.11 | U | 0.12 | U | 0.12 | U | 0.11 | U | -- | 120 | -- | 3.7 |
| 1,1-Dichloroethylene | 0.26 | | 0.057 | U | 0.056 | U | 0.057 | U | 0.058 | U | 0.056 | U | 227 | -- | 39 | -- |
| 1,2,4-Trimethylbenzene | 0.20 | U | 1.7 | | 1.6 | | 0.71 | U | 0.72 | U | 0.69 | U | 65 | -- | 1.4 | -- |
| 1,2-cis-Dichloroethylene | 0.10 | J | 0.11 | U | 0.11 | U | 0.11 | U | 0.12 | U | 0.11 | U | -- | -- | -- | -- |
| 1,2-Dichloroethane | 0.20 | U | 0.11 | | 0.096 | | 0.12 | | 0.11 | | 0.076 | | 183 | 30 | 1.4 | 0.22 |
| 1,2-trans-Dichloroethylene | 0.20 | U | 0.57 | U | 0.56 | U | 0.57 | U | 0.58 | U | 0.56 | U | -- | -- | -- | -- |
| 1,3,5-Trimethylbenzene | 0.20 | U | 0.71 | U | 0.70 | U | 0.71 | U | 0.72 | U | 0.69 | U | 35 | -- | 0.97 | -- |
| 2-Hexanone | 5.0 | U | 2.9 | U | 2.9 | U | 2.9 | U | 3.0 | U | 2.9 | U | 4,446 | -- | 5.8 | -- |
| Benzene | 0.20 | U | 3.0 | | 1.5 | | 1.1 | | 1.2 | | 1.7 | | 175 | 22 | 5.8 | 0.75 |
| Chloroform | 0.13 | J | 1.7 | | 0.58 | | 0.83 | | 0.70 | | 2.0 | | 721 | 9.5 | 19 | 0.25 |
| Ethyl Chloride | 0.20 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.18 | U | 23,154 | -- | 1,947 | - |
| Ethylbenzene | 0.20 | U | 2.1 | | 1.9 | | 0.45 | | 0.52 | | 0.31 | | 5,376 | 65 | 195 | 2.3 |
| Naphthalene | 0.50 | U | 0.40 | | 0.37 | U | 0.38 | U | 0.38 | U | 0.37 | U | 252 | 74 | 0.58 | 0.17 |
| p-Isopropyltoluene | 0.20 | U | 4.0 | U | 3.9 | U | 4.0 | U | 4.0 | U | 3.8 | U | -- | -- | -- | -- |
| Propyl benzene | 0.20 | U | 0.71 | U | 0.70 | U | 0.71 | U | 0.72 | U | 0.69 | U | 3,318 | -- | 198 | -- |
| sec-Butylbenzene | 0.20 | U | 4.0 | U | 3.9 | U | 4.0 | U | 4.0 | U | 3.8 | U | -- | -- | -- | -- |
| Tetrachloroethylene | 0.41 | | 0.70 | | 0.47 | | 1.2 | | 1.2 | | 0.19 | U | 90 | 270 | 7.5 | 22 |
| Toluene | 0.20 | U | 21 | | 23 | | 15 | | 17 | | 1.4 | | 25,880 | -- | 954 | -- |
| Trichloroethylene | 1.4 | | 0.077 | U | 0.076 | U | 0.077 | U | 0.079 | U | 0.075 | U | 7.2 | 27 | 0.39 | 1.5 |
| Vinyl Chloride | 0.020 | U | 0.075 | | 0.061 | | 0.037 | U | 0.038 | U | 0.036 | U | 88 | 6.0 | 19 | 1.3 |

**Notes:**

--: No toxicity information was available to calculate a VIRL.

The data qualifiers presented in this table are:

J - The constituent was detected and the concentration is an estimated value.

U - The constituent was not detected (the reporting limit is presented).

VIRLs were developed based on a commercial exposure scenario using the following target risk goals for individual constituents:

Cancer Risk = 1E-06

Hazard Quotient = 0.10

[1] Monitoring well VIT5-04-WT was installed in 2019 to support Tier 5 evaluations; it is the closest well to the building.

## Table 2: 2023 Building-Specific Risk Evaluation for 707 South Lucile Street

| Constituent | Commercial Groundwater VIRL (ug/L) | | Commercial Indoor Air VIRL ($ug/m^3$) | | Maximum Groundwater Concentration | Maximum Soil Gas Concentration | Maximum Indoor Air Concentration | Maximum Ambient Air Concentration | Corrected Indoor Air Concentration (IA-AA)[1] | Constituent Detected in Groundwater and Indoor Air: Commercial Noncancer Exceedance Factor | Constituent Detected in Groundwater and Indoor Air: Commercial Cancer Exceedance Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Noncancer | Cancer | Noncancer | Cancer | (ug/L) | ($ug/m^3$) | ($ug/m^3$) | ($ug/m^3$) | ($ug/m^3$) | NCEF | CEF |
| 1,1,1-Trichloroethane | 10,361 | -- | 954 | -- | 4.7 | - | - | - | - | - | - |
| 1,1-Dichloroethane | -- | 120 | -- | 3.7 | 1.1 | - | - | - | - | - | - |
| 1,1-Dichloroethylene | 227 | -- | 39 | -- | 0.26 | - | - | - | - | - | - |
| 1,2,4-Trimethylbenzene | 65 | -- | 1.4 | -- | - | 1.7 | - | - | - | - | - |
| 1,2-cis-Dichloroethylene | -- | -- | -- | -- | 0.10 | - | - | - | - | - | - |
| 1,2-Dichloroethane | 183 | 30 | 1.4 | 0.22 | - | 0.11 | 0.12 | 0.076 | 0.044 | 0.032 | 0.20 |
| 1,2-trans-Dichloroethylene | -- | -- | -- | -- | - | - | - | - | - | - | - |
| 1,3,5-Trimethylbenzene | 35 | -- | 0.97 | -- | - | - | - | - | - | - | - |
| 2-Hexanone | 4,446 | -- | 5.8 | -- | - | - | - | - | - | - | - |
| Benzene | 175 | 22 | 5.8 | 0.75 | - | 3.0 | 1.2 | 1.7 | 0[5] | - | - |
| Chloroform | 721 | 9.5 | 19 | 0.25 | 0.13 | 1.7 | 0.83 | 2.0 | 0[5] | - | - |
| Ethyl Chloride | 23,154 | -- | 1,947 | - | - | - | - | - | - | - | - |
| Ethylbenzene | 5,376 | 65 | 195 | 2.3 | - | 2.1 | 0.52 | 0.31 | 0.21 | 0.0011 | 0.090 |
| Naphthalene | 252 | 74 | 0.58 | 0.17 | - | 0.40 | - | - | - | - | - |
| p-Isopropyltoluene | -- | -- | -- | -- | - | - | - | - | - | - | - |
| Propyl benzene | 3,318 | -- | 198 | -- | - | - | - | - | - | - | - |
| sec-Butylbenzene | -- | -- | -- | -- | - | - | - | - | - | - | - |
| Tetrachloroethylene | 90 | 270 | 7.5 | 22 | 0.41 | 0.70 | 1.2 | - | 1.2 | 0.16 | 0.053 |
| Toluene | 25,880 | -- | 954 | -- | - | 23 | 17 | 1.4 | 16 | 0.016 | -- |
| Trichloroethylene | 7.2 | 27 | 0.39 | 1.5 | 1.4 | - | - | - | - | - | - |
| Vinyl Chloride | 88 | 6.0 | 19 | 1.3 | - | 0.075 | - | - | - | - | - |
| | | | | | | | | | **TOTAL (GW-IA)** | 0.16 | 0.053 |
| | | | | | | | | | **TOTAL (SG-IA)** | 0.21 | 0.34 |

**Notes:**

--: No toxicity information was available to calculate a VIRL; -: The constituent was not detected

NCEFs and CEFs are calculated for constituents that exhibit a complete exposure pathway for the groundwater-to-indoor air (GW-to-IA) vapor intrusion pathway (i.e., the constituents are detected in both groundwater and indoor air), and are highlighted blue.

NCEFs and CEFs are calculated for the soil gas-to-indoor air (SG-to-IA) pathway (i.e., constituents detected in both soil gas and indoor air), and are highlighted green.

VIRLs were developed based on a commercial exposure scenario using the following target risk goals for individual constituents:

Cancer Risk = 1E-06

Hazard Quotient = 0.10

[1] Indoor air concentrations are corrected by subtracting the maximum detected ambient air concentration from the maximum detected indoor air concentration, to account for the contribution of ambient air to the measured indoor air concentration.

[2] There were higher concentrations in ambient air than in indoor air which suggests that concentrations in ambient air are contributing to indoor air concentrations. The corrected indoor air concentration is 0 $ug/m^3$.

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## Table 3: Comparison of Groundwater Sampling Results

| Constituent | Pre-VI Mitigation System (August 2003) | | Groundwater Concentrations - Well VIT5-04-WT[1] | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | January 2019 | | September 2019 | | March 2020 | | September 2020 | | January 2021 | | March 2021 | | September 2021 | | February 2022 | | August 2022 | | February 2023 | | 2019 - 2023 Trend[2] | Comparison of Detected Pre- and Post- VI Mitigation Results |
| | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | (ug/L) | Q | | |
| 1,1,1-Trichloroethane | 5.4 | | 6.2 | | 5.1 | | 4.5 | | 7.0 | | 5.5 | | 4.3 | J | 3.8 | | 4.8 | | 3.7 | | 4.7 | | Stable | Decreased |
| 1,1-Dichloroethane | 4.7 | | 1.5 | | 1.5 | | 0.93 | J | 1.1 | | 1.0 | | 0.15 | U | 0.81 | J | 0.72 | | 0.65 | | 1.1 | | Stable | Decreased |
| 1,1-Dichloroethylene | 0.18 | | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.39 | | 0.19 | J | 0.26 | | Stable | Stabilized |
| 1,2,4-Trimethylbenzene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| 1,2-cis-Dichloroethylene | 1.7 | | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.10 | J | Stable | Decreased |
| 1,2-Dichloroethane | 1.0 | U | 0.14 | U | 0.14 | U | 0.14 | U | 0.14 | U | 0.14 | U | 0.14 | U | 0.14 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| 1,2-trans-Dichloroethylene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | Stable | Decreased |
| 1,3,5-Trimethylbenzene | 1.0 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| 2-Hexanone | 10.0 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 0.92 | U | 5.0 | U | 5.0 | U | 5.0 | U | NE | NE |
| Benzene | 0.50 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Chloroform | 1.0 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | U | 0.070 | J | 0.20 | UJ | 0.13 | J | NE | NE |
| Ethyl Chloride | 1.0 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Ethylbenzene | 1.0 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.23 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Naphthalene | 0.50 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.50 | U | 0.50 | U | 0.50 | U | NE | NE |
| p-Isopropyltoluene | 1.0 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Propyl benzene | 1.0 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.21 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| sec-Butylbenzene | 1.0 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.12 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Tetrachloroethylene | 2.7 | | 0.39 | J | 0.83 | J | 0.15 | U | 0.54 | J | 0.15 | U | 0.15 | U | 0.52 | J | 0.46 | | 0.45 | | 0.41 | | Stable | Decreased |
| Toluene | 1.0 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.20 | U | 0.20 | U | NE | NE |
| Trichloroethylene | 17 | | 1.5 | | 1.4 | | 0.99 | J | 1.2 | | 1.4 | | 1.3 | J | 1.4 | | 1.3 | | 1.3 | | 1.4 | | Stable | Decreased |
| Vinyl Chloride | 0.18 | | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.15 | U | 0.20 | U | 0.0099 | J | 0.020 | U | Stable | Decreased |

**Notes:**

Q: qualifier; ug/L: micrograms per liter; NE: Constituent was not detected during both pre-and post-VI samples, no trend analysis conducted.
The data qualifiers presented in this table are:

J - The constituent was detected and the concentration is an estimated value.

U - The constituent was not detected (the reporting limit is presented).

[1] Monitoring well VIT5-04-WT was installed in 2019 to support Tier 5 evaluations; it is the closest well to the building.

[2] Supporting time series plots are presented in Appendix E. Trend analyses were conducted for groundwater constituents detcted in both pre-and post-VI mitigation groundwater samples, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride.

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## Table 4: Comparison of Pre-VI Mitigation and Post-VI Mitigation Air Sampling Results

| Constituent[1] | Commercial Indoor Air VIRL (ug/m$^3$) | | Maximum Air Concentrations[2] | | | | Comparison of Detected Pre- and Post- VI Mitigation Results |
|---|---|---|---|---|---|---|---|
| | | | Pre-VI Mitigation August 2003 | | Post-VI Mitigation February 2023 | | |
| | Noncancer | Cancer | ug/m$^3$ | Q | ug/m$^3$ | Q | |
| **Soil Gas** | | | | | | | |
| 1,1,1-Trichloroethane | 954 | -- | 1.6 | | 0.16 | U | Decreased |
| 1,1-Dichloroethane | -- | 3.7 | 2.3 | U | 0.12 | U | ND |
| 1,1-Dichloroethylene | 39 | -- | 0.17 | U | 0.057 | U | Decreased |
| 1,2,4-Trimethylbenzene | 1.4 | -- | 1.8 | | 1.7 | | Stabilized |
| 1,2-cis-Dichloroethylene | -- | -- | 0.34 | U | 0.11 | U | ND |
| 1,2-Dichloroethane | 1.4 | 0.22 | 0.35 | U | 0.11 | | Stabilized/Decreased[4] |
| 1,2-trans-Dichloroethylene | -- | -- | 1.7 | U | 0.57 | U | ND |
| sec-Butylbenzene | -- | -- | 19 | U | 4.0 | U | ND |
| Tetrachloroethylene | 7.5 | 22 | 34 | | 0.70 | | Decreased |
| Toluene | 954 | -- | 110 | | 21 | | Decreased |
| Trichloroethylene | 0.39 | 1.5 | 12 | | 0.077 | U | Decreased |
| Vinyl Chloride | 19 | 1.3 | 0.11 | | 0.075 | | Decreased |
| **Corrected Indoor Air[3]** | | | | | | | |
| 1,1,1-Trichloroethane | 954 | -- | 0.40 | | - | | Decreased |
| 1,1-Dichloroethane | -- | 3.7 | - | | - | | ND |
| 1,1-Dichloroethylene | 39 | -- | - | | - | | ND |
| 1,2,4-Trimethylbenzene | 1.4 | -- | 1.0 | | - | | Decreased |
| 1,2-cis-Dichloroethylene | -- | -- | - | | - | | ND |
| 1,2-Dichloroethane | 1.4 | 0.22 | 0.044 | | 0.044 | | Stabilized |
| 1,2-trans-Dichloroethylene | -- | -- | - | | - | | ND |
| sec-Butylbenzene | -- | -- | - | | - | | ND |
| Tetrachloroethylene | 7.5 | 22 | 3.3 | | 1.2 | | Decreased |
| Toluene | 954 | -- | 254 | | 16 | | Decreased |
| Trichloroethylene | 0.39 | 1.5 | 1.4 | | - | | Decreased |
| Vinyl Chloride | 19 | 1.3 | - | | - | | ND |

**Notes:**

--: No toxicity information was available to calculate a VIRL; -: The constituent was not detected therefore a correction was not calculated; Q: qualifier; ug/m$^3$: micrograms per meter cubed; ND: Constituent was not detected during both sampling events; J: The constituent was detected and the concentration is an estimated value; U: The constituent was not detected (the reporting limit is presented).

[1] Constituents listed are those detected in both pre-and post-VI mitigation groundwater samples, and for constituents associated with the breakdown of chlorinated solvents (1,1-DCE, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride; see Table 3).

[2] If multiple samples of the same media were collected during the event, the maximum concentration is shown.

[3] Indoor air concentrations are corrected by subtracting the maximum detected ambient air concentration from the maximum detected indoor air concentration, to account for the contribution of ambient air to the measured indoor air concentration.

[4] Given the slightly elevated DL for the non-detect result, it cannot be determined if the concentration has decreased or remained stable.

# Appendix A

2/6/2023

0830 T. Louviere & N. Weiss of DOF on site for installation of vapor pins @ 707 & 710 S Lucile St.

0852 NW off site to pick up Shop vac.

0925 NW back on site

0930 Conduct H&S meeting

0945 Arrive on site @ 710 S. Lucile (SOAJ). Check in w/ front desk.

0950 Begin install of AS-710-SG1

1000 Start leak testing AS-710-SG1

1005 Begin install of AS-710-SG2

1020 Start leak testing AS-710-SG2

1025 successful leak test @ AS-710-SG1 Use clean paper towel to remove water.

1040 successful leak test @ AS-710-SG2 use clean paper towel to remove water.

1045 off site @ SOAJ

1200 Arrive on site @ 707 S Lucile St for vapor pin install.

1205 Install ~~AS II~~ TE-707L-SG1

1215 Start leak test of TE-707L-SG1

1220 Install TE-707L-SG2

1230 Start leak test of TE-707L-SG2

2/6/2023 (Cont.)

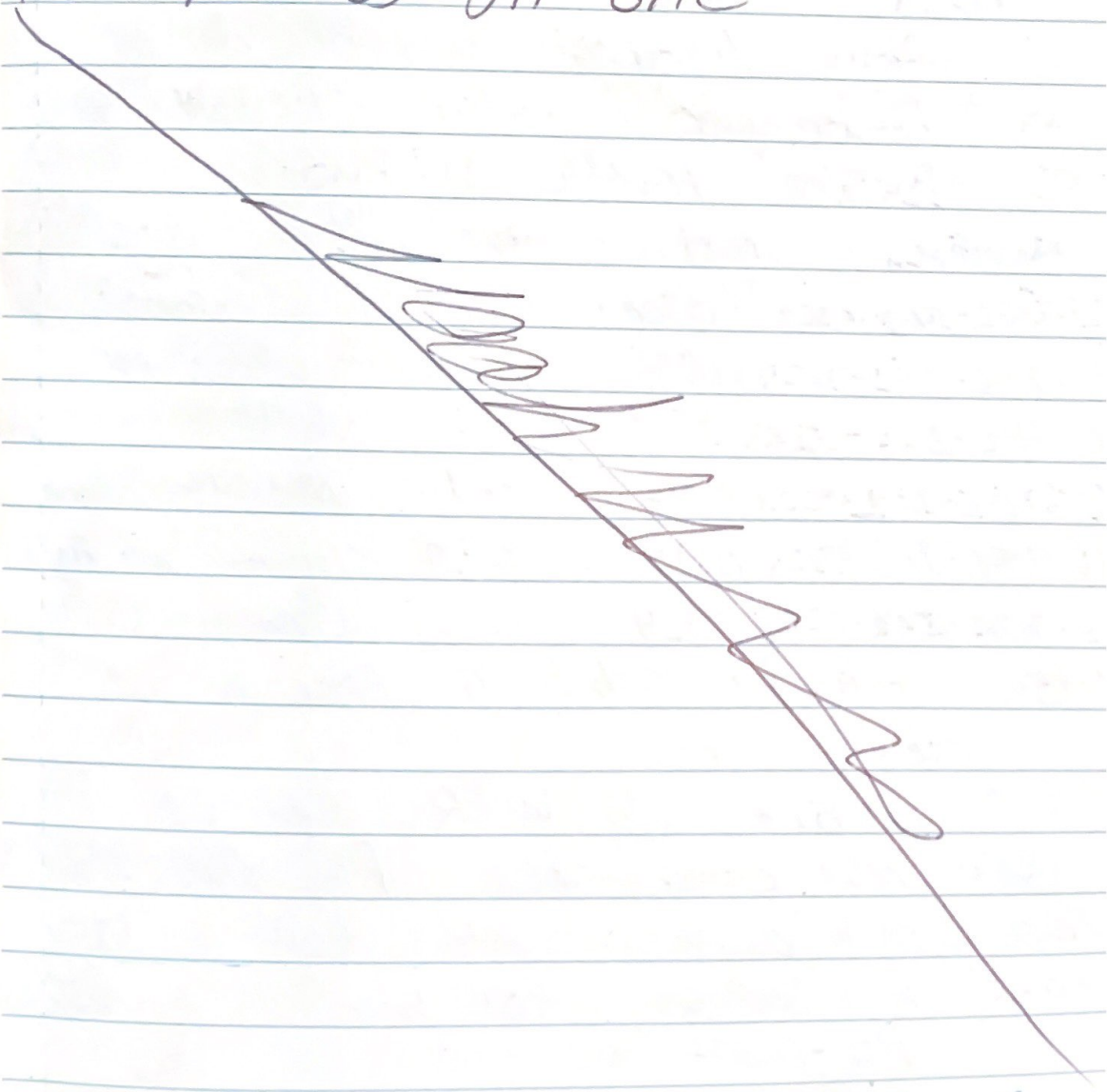
1235 successful leak test of TE-707L-561

1250 successful leak ~~test~~ of TE-707-562
Use clean paper towel to remove/dry water from both.

1255 N. Weiss/T. Lavliere off site @ WTR.

1330 Can Prep, T. Lavliere offsite

1415 N. Weiss off site



Rite in the Rain

2/7/23 Dark rain 40s

0630 N. Weiss OOG/E. Scheumann OOF/M. Wright CE on site for 1Q23 VIAM sampling

0640 Wind from S/SE @ Boeing Field., Check vacuum in cans.

0656 Set up CE van @ ~~SE~~ SW corner of WTR property

0700 Start collection of TE-707L-AA1-0223 locked inside CE van w/ ~~4~~ SW tubing hanging downward out of passenger window, Odor of Passing traffic exhaust.

| Sample | Start time | Initial ("Hg) Vac. | Note |
|---|---|---|---|
| TE-707L-AA1-0223 | 0700 | -29.0 | traffic exhaust |
| AS-710L-IA1-0223 | 0706 | -29.0 | coffee/paper |
| AS-710L-IA2-0223 | 0709 | -29.0 | Cardboard/rubber/plastic |
| AS-710L-IA3-0223 | 0712 | -29.0 | New carpet/cologne |
| TE-707L-IA1-0223 | 0712 | -29.0 | Cinnamon air fresh |
| TE-707L-IA2-0223 | 0724 | -29.5 | Cigarettes |

0750 Prep for sub slab pressure measurements

0805 on site @ WTR. Set up on NW corner office P= +0.002" wc

0820 set caulk in hole seal w/ tape

0825 Set up on west hole in warehouse P=-0.004" WC

0830 Set caulk in hole seal w/ tape

0836 set up on TE-707L-SG2
P= -0.004 → +0.016 "wc
0839 Close/Seal Vapor Pin.
1130 Check can Vacuum levels.

| Name | time | "Hg |
|---|---|---|
| TE-707L-AA1-0223 | 1130 | -16.0 |
| AS-710L-IA1-0223 | 1133 | -15.0 |
| AS-710L-IA1-0223 | 1134 | -16.0 |
| AS-710L-IA2-0223 | 1135 | -15.0 |
| TE-707L-IA1-0223 | 1138 | -15.0 |
| TE-707L-IA2-0223 | 1139 | -16.0 |

1209 Plastic/burning smelled ambiently @ GT GWPT building and White Satin parking lot.
1305 Check cans

| | | |
|---|---|---|
| 707L-AA1 | 1305 | -10.5 |
| 710L-IA1 | ~~1308~~ NW 1312 | ~~-10.0~~ NW -9.0 |
| 710L-IA2 | 1313 | -10.0 |
| 710L-IA3 | 1314 | -10.0 |
| 707L-IA1 | 1308 | -10.0 |
| 707L-IA2 | 1309 | -10.0 |

1330 Plastic burning odor no longer smelled ambiently outdoors.
1345 Begin can check @ 710L-IA1

Rite in the Rain.

2/7/23 (cont.)

| 1350 ID | Time | Final "Hg vac |
|---|---|---|
| 710L-IA1 | 1350 | -7.0 |
| 710L-IA3 | 1353 | -7.5 |
| 710L-IA2 | 1354 | -7.5 |
| 707L-IA1 | 1358 | -7.0 |
| 707L-IA2 | 1359 | -7.0 |
| 707L-AA1 | 1402 | -7.0 |

~~1st~~ 1413 SOAJ P-4 = -0.05" WC
1421 SOAJ AS-710-SG1 = 0.00 "WC
1426 SOAJ AS-710-SG2 = -0.003 "WC
1430 off SOAJ property
1440 check cans, COC.
1500 prep 2/8/23 soil gas cans.
1530 All parties off site

2/8/23 Dark 30's
0650 N. Weiss/E. Schermann (Corp Rep
Vaper Cans and Supplies.
0705 Arrive @ SDAT for SG sampling
0715 Europhins did not provide Swage
lok Nuts. Hts meeting.
0720 Go to FBI for nuts
0740 Set up Vacuum test on
AS-710-SG1
0800 Start Vacuum test: -3.5 "Hg
0803 Vacuum test: pass, Begin
sampling "AS-710-SG1-0223
0805 Using CE peri pump; E/S master
flex S/N: CP 77967
0810 Set up on AS-710-SG2
0812 Start Vacuum test: -3.5 "Hg
0815 Vacuum test: Pass. Begin
sampling "AS-710-SG2-0223"
0820 Leave SDAT, Check in w/ Steven
@ WTR
0823 Set up on TE-707L-SG1
0827 Start Vacuum test: -4.0 "Hg
0830 Vacuum test: Pass. Begin
sampling "AS-NW" TE-707L-SG1-0223"
0833 Set up @ TE-707L-SG2
0839 Start Vacuum test: -5.0 "Hg

Rite in the Rain

2/8/23 (cont.)

0842 Vacuum test: Pass begin sampling "TE-707L-SG2-0223"

| Sample ID | start time | intial Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 0803 | -28.5 |
| AS-710-SG2-0223 | 0815 | -29.0 |
| TE-707L-SG1-0223 | 0830 | -29.5 |
| TE-707L-SG2-0223 | 0842 | -30.0 |

1200 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1200 | -17.0 |
| AS-710-SG2-0223 | 1202 | -17.5 |
| TE-707L-SG1-0223 | 1206 | -18.5 |
| TE-707L-SG2-0223 | 1208 | -20.0 |

1400 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1401 | -10.0 |
| AS-710-SG2-0223 | 1402 | -11.0 |
| TE-707L-SG1-0223 | 1405 | -12.0 |
| TE-707L-SG2-0223 | 1407 | -13.0 |

1500 Check can vacuums

| ID | Time | Curr. Vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1502 | -7.0 |
| AS-710-SG2-0223 | 1503 | -6.5 |
| TE-707L-SG1-0223 | 1506 | -8.5 |
| TE-707L-SG2-0223 | 1507 | -9.5 |

1519 Sampling stopped @ AS-710-SG2-0223 =-6 "Hg

| ID | Stop Time | Final vac "Hg |
|---|---|---|
| AS-710-SG1-0223 | 1520 | -5.5 ~~-5~~ |
| AS-710-SG2-0223 | 1519 | ~~-6.0~~ -5.0 |
| TE-707L-SG1-0223 | 1529 | -6.5 |
| TE-707L-SG2-0223 | 1537 | -6.5 |

1540 Venting fan @ 707 S Lucille restarted
1542 Manometer reading = 10.80 "WC
1545 Venting fan @ 710 S Lucille restarted
1547 Manometer reading = 2.90 "WC

1550 → Odors detected @ SDAT warehouse include cardboard, rubber, & plastic
~~SDS~~
→ Odors detected in WTR office, same as 2/7 (cigarettes)
→ Sikaflex stored in closet w/ TE-707L-SG2

Rite in the Rain

2/8/23 (cont.)

1600 COC, pack cans for shipping.
1630 All parties off site.
1640 Relinquish samples to Fedex see ~~receipt~~ Reciept in daily email for tracking information

WAB06A00255
INNER TRIM
PIECE - 47 1/2

Western T
SEATTLE

DWYER INSTRUMENTS, INC.
MICH. CITY, IN 46360 U.S.A.

1. USE .826 SPECIFIC GRAVITY DWYER GAUGE FLUID ONLY. FILL TO MID POINT OF U-TUBE AND MOUNT VERTICALLY.
2. FOR HIGH RANGE, SLIDE SCALE TO ZERO. APPLY PRESSURE, READ ON RIGHT LEG IN INCHES OF WATER.
3. FOR LOW RANGE: ZERO SCALE IN VERTICAL POSITION. HOLDING SCALE IN PLACE, INCLINE MANOMETER UNTIL MENISCUS IS BELOW ZERO IN LEFT LEG. APPLY PRESSURE AND READ LEFT LEG.

INSTRUCTIONS
CAT. NO. 1237

CAUTION: CLEAN WITH SOAP AND WATER ONLY

11-30-07

TRAILER AIR VALVE SYSTEMS

TWO PORT RELAY VALVES

FOUR PORT RELAY VALVES

CHARGING RELAY EMERGENCY VALVES

TANDEM AXLE TRAILER 2 TANK - 3 VALVE

TANDEM AXLE TRAILER 2 TANK - 2 VALVE

TANDEM AXLE TRAILER 1 TANK - 2 VALVE

SINGLE AXLE TRAILERS DOUBLE

SINGLE AXLE TRAILERS SINGLE

SINGLE AXLE TRAILERS TO CHASSIS

DOLLY

DOLLY TO CHASSIS

DOLLY TO SINGLE AXLE TRAILER

DOLLY TO TANDEM AXLE TRAILER

DOLLY TO TRIDEM AXLE TRAILER

TRIDEM AXLE TRAILER

TRIDEM AXLE TRAILER TO CHASSIS

TRIDEM AXLE TRAILER TO SINGLE AXLE TRAILER

TRIDEM AXLE TRAILER TO TANDEM AXLE TRAILER

TRIDEM AXLE TRAILER TO TRIDEM AXLE TRAILER

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TRAILER TO TRAILER TO TRAILER TO SINGLE AXLE TRAILER

TRAILER TO TRAILER TO TRAILER TO TANDEM AXLE TRAILER

TRAILER TO TRAILER TO TRAILER TO TRIDEM AXLE TRAILER

BENDIX
BERG
KELSEY HAYES SYSTEM
MIDLAND
WAGNER CORPORATION

RESTROOM

# Vapor Intrusion Depressurization System Inspection Form

Date: 12 / 13 / 2022

Time: 1100

Address: 707 S. Lucile St.

Tenant's Name and Contact Info: Western Trailer, Gary Serrett, 206-762-7850, gserrett@wtrseattle.com

## Part 1- Documentation of Condition of System Components

### 1.1 Sub-Slab System:

| | | | |
|---|---|---|---|
| Exterior Pipe Free of Cracks | Y | N | N/A |
| Interior Pipe Free of Cracks | Y | N | N/A |
| Fan Running Appropriately (no excess vibration or noise) | Y | N | N/A |
| Caulk on Floor Penetrations in Good Condition | Y | N | N/A |
| Manometer In Good Condition | Y | N | N/A |
| Roof Flashing in Good Condition | Y | N | N/A |
| Significant basement floor cracking, or new openings in the floor | Y | N | N/A |
| Significantly different manometer readings | Y | N | N/A |

### 1.2 Crawl Space System:

| | | | |
|---|---|---|---|
| Exterior Pipe Free of Cracks | Y | N | (N/A) |
| Interior Pipe Free of Cracks | Y | N | (N/A) |
| Fan Running Appropriately (no excess vibration or noise) | Y | N | (N/A) |
| Membrane Material in Good Condition | Y | N | (N/A) |
| Membrane Seals in Good Condition | Y | N | (N/A) |
| Manometer In Good Condition | Y | N | (N/A) |
| Roof Flashing in Good Condition | Y | N | (N/A) |

| | | | |
|---|---|---|---|
| Significantly different manometer readings | Y | N | N/A |
| Any evidence that the membrane has been walked on, moved, or otherwise tinkered with | Y | N | N/A |
| Any holes in the membrane, broken seals, etc. | Y | N | N/A |

**1.3 Structural/Usage Changes:**

| | | | |
|---|---|---|---|
| Any Significant changes to the building's HVAC System | Y | N | N/A |
| Any new vents or openings in the roof/walls, less than 10' away from the stack (and < 2' below it) | Y | N | N/A |
| Any changes to the use of any chimneys that could result in re-entrainment | Y | N | N/A |
| Any new buildings near the mitigated building close enough that stack gasses could contaminate their indoor air | Y | N | N/A |
| Has the attic been remodeled into a living space (if the mitigation fan is located in the attic) | Y | N | N/A |
| Have there been any *significant* earthquake events | Y | N | N/A |
| Has the usage of the building changed since the last inspection (has use changed to/from commercial/ industrial or residential)? | Y | N | N/A |
| Have any new potentially sensitive receptors moved into the building (children, elderly)? | Y | N | N/A |
| Has the usage of rooms within the building changed (bedrooms becoming storage or storage areas becoming bedrooms; do occupants use different rooms in the building than they have in the past)? | Y | N | N/A |
| Does the owner operate the mitigation system fan continuously? | Y | N | N/A |

Part 2- Annual Negative Pressure Field Extension Measurements

| Location | Pressure (inches) |
|---|---|
| P-1 | -0.009 |
| P-2 | ~ 0.050 |
| P-3 | ~~-0.009~~ -0.070 |
| | |
| | |
| | |

Part 3- Pressure Differential Reading (U-tube manometer): 11.0 inches

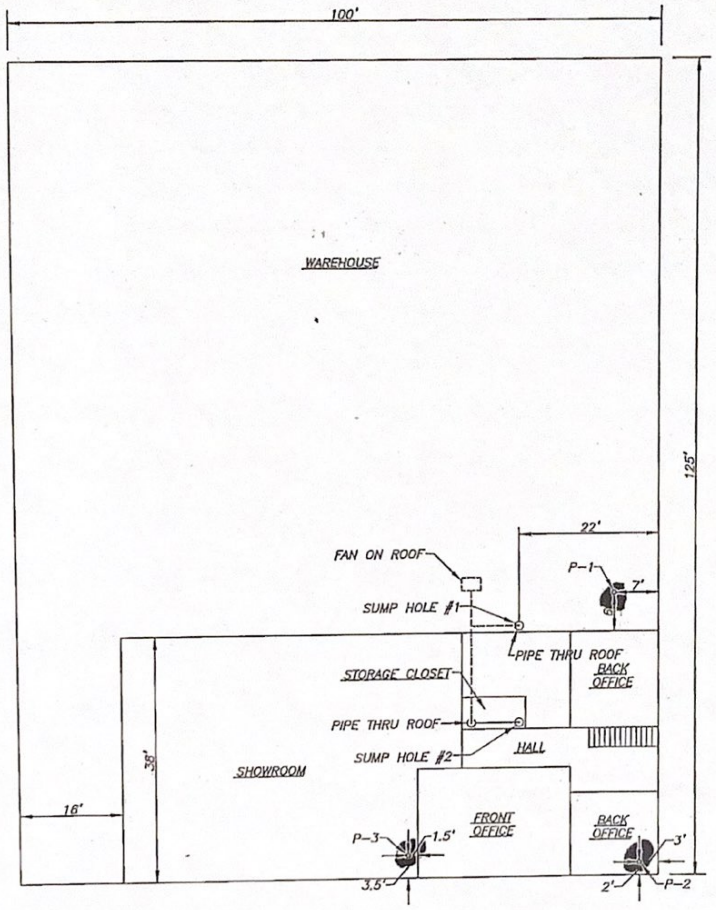
Other Observations/Comments

Location of manometer: inside warehouse, in corner

System is operating normally. Vacuum observed at monitoring points is less than last year, but manometer reading similar to last year.

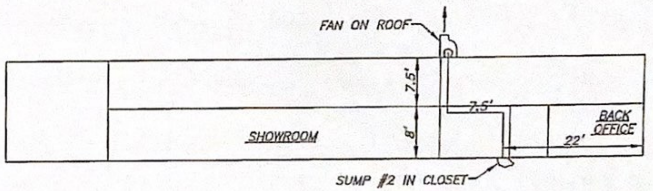
Inspected by: _____ (signature)

Western




FLOOR PLAN
SCALE: 1/16" = 1'-0"

NORTH




ELEVATION
SCALE: 1/16" = 1'-0"

| |
|---|
| WESTERN TRAILER |
| 10/18/04 |
| R1 |

ADVANCED RADON TECHNOLOGIES
RADON MITIGATION TESTING AND INSTALLATION
NORTH 2901 MONROE, SUITE A
SPOKANE, WASHINGTON
(509) 326-5127

326-5127

PROJECT:
Western Trailer
IPTM Design

JOB NO.: 030048
DATE: 10/18/04
DRAWN: JV
CHECKED: RE

SHEET NO.:
R1

# Appendix B

weather.gov

Weather observations for the past three days

# Boeing Field - King County International Airport

Enter Your "City, ST" or zip code Go

metric

| Date | Time (pst) | Wind (mph) | Vis. (mi.) | Weather | Sky Cond. | Temperature (ºF) Air | Dwpt | 6 hour Max. | Min. | Relative Humidity | Wind Chill (°F) | Heat Index (°F) | Pressure altimeter (in) | sea level (mb) | Precipitation (in.) 1 hr | 3 hr | 6 hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07 | 15:53 | S 14 G 25 | 10.00 | Partly Cloudy | SCT022 SCT095 | 49 | 39 | 52 | 47 | 69% | 44 | NA | 30.14 | 1020.5 | | | 0.10 |
| 07 | 14:53 | S 8 G 26 | 10.00 | Mostly Cloudy | SCT022 BKN100 | 51 | 45 | | | 80% | NA | NA | 30.12 | 1019.9 | | | |
| 07 | 13:53 | S 15 G 25 | 10.00 | Partly Cloudy | SCT020 SCT080 | 50 | 45 | | | 83% | 45 | NA | 30.11 | 1019.7 | | | |
| 07 | 12:53 | S 17 G 28 | 6.00 | Light Rain Fog/Mist | FEW019 BKN044 OVC050 | 48 | 44 | | | 86% | 42 | NA | 30.11 | 1019.4 | 0.10 | 0.10 | |
| 07 | 11:53 | S 13 G 25 | 10.00 | Overcast | FEW034 BKN044 OVC050 | 49 | 43 | | | 80% | 44 | NA | 30.11 | 1019.4 | | | |
| 07 | 10:53 | S 13 G 25 | 10.00 | Overcast | BKN028 OVC034 | 49 | 43 | | | 80% | 44 | NA | 30.11 | 1019.6 | | | |
| 07 | 09:53 | S 14 G 21 | 9.00 | Light Rain | BKN017 OVC033 | 47 | 43 | 47 | 44 | 86% | 41 | NA | 30.10 | 1019.3 | 0.01 | | 0.06 |
| 07 | 08:53 | S 12 | 6.00 | Light Rain Fog/Mist | BKN017 OVC033 | 46 | 42 | | | 86% | 40 | NA | 30.12 | 1019.7 | 0.02 | | |
| 07 | 07:53 | S 10 | 6.00 | Light Rain Fog/Mist | OVC033 | 45 | 42 | | | 90% | 40 | NA | 30.12 | 1020.0 | 0.01 | | |
| 07 | 06:53 | S 10 | 9.00 | Light Rain | OVC033 | 45 | 42 | | | 90% | 40 | NA | 30.14 | 1020.5 | 0.02 | 0.02 | |
| 07 | 05:53 | S 10 | 8.00 | Light Rain | BKN055 BKN075 OVC085 | 45 | 41 | | | 86% | 40 | NA | 30.17 | 1021.5 | | | |
| 07 | 04:53 | S 10 | 10.00 | Overcast | OVC040 | 46 | 41 | | | 83% | 41 | NA | 30.17 | 1021.7 | | | |
| 07 | 03:53 | S 15 | 9.00 | Light Rain | BKN048 OVC055 | 45 | 41 | 46 | 44 | 86% | 38 | NA | 30.20 | 1022.6 | | | |
| 07 | 02:53 | S 14 | 9.00 | Light Rain | OVC050 | 46 | 41 | | | 83% | 40 | NA | 30.24 | 1023.8 | | | |
| 07 | 01:53 | S 8 | 10.00 | Overcast | BKN047 BKN075 OVC090 | 45 | 41 | | | 86% | 41 | NA | 30.26 | 1024.6 | | | |
| 07 | 00:53 | SE 9 | 10.00 | Overcast | SCT037 OVC045 | 44 | 40 | | | 85% | 39 | NA | 30.28 | 1025.1 | | | |
| 06 | 23:53 | SE 9 | 10.00 | Overcast | OVC042 | 45 | 41 | | | 86% | 40 | NA | 30.29 | 1025.8 | | | |
| 06 | 22:53 | SE 9 | 10.00 | Overcast | OVC045 | 46 | 40 | | | 79% | 41 | NA | 30.31 | 1026.2 | | | |
| 06 | 21:53 | SE 9 | 10.00 | Overcast | OVC039 | 46 | 40 | 48 | 45 | 79% | 41 | NA | 30.31 | 1026.4 | | | |
| 06 | 20:53 | SE 9 | 10.00 | Overcast | OVC045 | 47 | 40 | | | 77% | 43 | NA | 30.32 | 1026.7 | | | |
| 06 | 19:53 | S 12 | 10.00 | Partly Cloudy | SCT050 | 47 | 39 | | | 74% | 42 | NA | 30.33 | 1026.8 | | | |
| 06 | 18:53 | S 12 G 21 | 10.00 | Fair | CLR | 47 | 40 | | | 77% | 42 | NA | 30.33 | 1027.1 | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06 | 17:53 | S 14 G 25 | 10.00 | Mostly Cloudy | FEW036 BKN050 | 48 | 41 | | | 77% | 42 | NA | 30.34 | 1027.4 | | |
| 06 | 16:53 | S 14 G 29 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 48 | 42 | | | 80% | 42 | NA | 30.36 | 1028.1 | | |
| 06 | 15:53 | S 17 G 28 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 48 | 42 | 49 | 46 | 80% | 42 | NA | 30.37 | 1028.3 | | |
| 06 | 14:53 | S 13 G 23 | 10.00 | Overcast | SCT016 BKN045 OVC060 | 49 | 42 | | | 77% | 44 | NA | 30.38 | 1028.5 | | |
| 06 | 13:53 | S 13 G 25 | 10.00 | Mostly Cloudy | FEW017 SCT028 BKN036 | 48 | 43 | | | 83% | 43 | NA | 30.37 | 1028.5 | | |
| 06 | 12:53 | S 13 G 23 | 7.00 | Light Rain | SCT021 BKN040 OVC050 | 48 | 43 | | | 83% | 43 | NA | 30.39 | 1028.9 | | |
| 06 | 11:53 | S 18 G 29 | 10.00 | Overcast | BKN017 OVC110 | 49 | 42 | | | 77% | 43 | NA | 30.39 | 1029.2 | | |
| 06 | 10:53 | S 15 G 23 | 10.00 | Overcast | BKN017 OVC110 | 46 | 41 | | | 83% | 40 | NA | 30.40 | 1029.3 | | |
| 06 | 09:53 | S 13 G 23 | 10.00 | Mostly Cloudy | BKN017 | 46 | 41 | 46 | 43 | 83% | 40 | NA | 30.39 | 1029.0 | | |
| 06 | 08:53 | S 15 G 28 | 10.00 | Mostly Cloudy | BKN017 | 46 | 41 | | | 83% | 40 | NA | 30.38 | 1028.8 | | |
| 06 | 07:53 | S 16 G 25 | 10.00 | Mostly Cloudy | SCT011 BKN017 | 44 | 40 | | | 85% | 37 | NA | 30.37 | 1028.3 | | |
| 06 | 06:53 | S 13 | 10.00 | Overcast | BKN013 OVC020 | 43 | 40 | | | 89% | 36 | NA | 30.37 | 1028.3 | | |
| 06 | 05:53 | S 16 G 28 | 10.00 | Overcast | OVC015 | 44 | 39 | | | 83% | 37 | NA | 30.36 | 1028.2 | | |
| 06 | 04:53 | SE 10 | 10.00 | Overcast | OVC017 | 44 | 40 | | | 85% | 39 | NA | 30.36 | 1028.1 | | |
| 06 | 03:53 | SE 8 | 10.00 | Overcast | BKN021 OVC085 | 44 | 39 | 45 | 43 | 83% | 39 | NA | 30.36 | 1028.0 | | |
| 06 | 02:53 | SE 8 | 10.00 | Overcast | FEW021 OVC047 | 43 | 39 | | | 86% | 38 | NA | 30.36 | 1027.8 | | |
| 06 | 01:53 | S 9 | 10.00 | Mostly Cloudy | BKN020 | 43 | 39 | | | 86% | 38 | NA | 30.33 | 1027.0 | | |
| 06 | 00:53 | SE 9 | 10.00 | Overcast | BKN013 OVC025 | 43 | 40 | | | 89% | 38 | NA | 30.30 | 1025.8 | | |
| 05 | 23:53 | S 8 | 10.00 | Overcast | BKN013 OVC025 | 44 | 40 | | | 85% | 39 | NA | 30.27 | 1025.1 | | |
| 05 | 22:53 | S 7 | 10.00 | Overcast | OVC013 | 44 | 41 | | | 89% | 40 | NA | 30.24 | 1024.1 | | |
| 05 | 21:53 | S 5 | 10.00 | Overcast | OVC013 | 45 | 42 | 48 | 45 | 90% | 42 | NA | 30.21 | 1022.8 | | 0.01 |
| 05 | 20:53 | S 3 | 10.00 | Overcast | BKN013 OVC018 | 45 | 43 | | | 93% | NA | NA | 30.16 | 1021.1 | | |
| 05 | 19:53 | Calm | 7.00 | Light Rain | BKN008 OVC012 | 47 | 44 | | | 90% | NA | NA | 30.12 | 1019.7 | 0.01 | |
| 05 | 18:53 | Calm | 7.00 | Light Rain | SCT012 BKN015 OVC031 | 48 | 46 | | | 93% | NA | NA | 30.07 | 1018.2 | | |
| 05 | 17:53 | SE 3 | 10.00 | Overcast | SCT010 BKN016 OVC022 | 48 | 45 | | | 89% | NA | NA | 30.03 | 1016.8 | | |
| 05 | 16:53 | S 5 | 10.00 | Overcast | SCT012 BKN018 | 48 | 45 | | | 89% | 46 | NA | 30.00 | 1015.7 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | OVC050 | | | | | | | | | | | | |
| 05 | 15:53 | S 5 | 10.00 | Mostly Cloudy | BKN011 BKN036 | 48 | 45 | 48 | 46 | 89% | 46 | NA | 29.96 | 1014.5 | | | 0.03 |
| 05 | 14:53 | SW 5 | 10.00 | Overcast | SCT008 SCT012 OVC035 | 48 | 45 | | | 89% | 46 | NA | 29.94 | 1013.7 | | | |
| 05 | 13:53 | SE 5 | 9.00 | Light Rain | BKN008 OVC034 | 47 | 45 | | | 93% | 45 | NA | 29.90 | 1012.6 | | | |
| 05 | 12:53 | SE 7 | 4.00 | Light Rain Fog/Mist | BKN007 OVC034 | 46 | 45 | | | 96% | 42 | NA | 29.89 | 1012.1 | 0.03 | 0.03 | |
| 05 | 11:53 | SE 7 | 6.00 | Light Rain Fog/Mist | BKN009 | 46 | 45 | | | 96% | 42 | NA | 29.87 | 1011.5 | | | |
| 05 | 10:53 | S 7 | 10.00 | Light Rain | OVC060 | 47 | 44 | | | 90% | 44 | NA | 29.85 | 1010.9 | | | |
| 05 | 09:53 | SW 5 | 10.00 | Overcast | FEW020 BKN065 OVC090 | 46 | 44 | 46 | 41 | 93% | 44 | NA | 29.82 | 1009.8 | | | |
| 05 | 08:53 | Calm | 10.00 | Overcast | FEW070 OVC085 | 44 | 42 | | | 93% | NA | NA | 29.78 | 1008.4 | | | |
| 05 | 07:53 | Calm | 10.00 | Overcast | OVC090 | 42 | 41 | | | 96% | NA | NA | 29.74 | 1006.9 | | | |
| 05 | 06:53 | Calm | 10.00 | Overcast | OVC090 | 43 | 41 | | | 93% | NA | NA | 29.70 | 1005.6 | | | |
| 05 | 05:53 | Calm | 10.00 | Overcast | OVC085 | 44 | 41 | | | 89% | NA | NA | 29.67 | 1004.6 | | | |
| 05 | 04:53 | Calm | 10.00 | Overcast | OVC075 | 44 | 42 | | | 93% | NA | NA | 29.66 | 1004.2 | | | |
| 05 | 03:53 | NW 5 | 10.00 | A Few Clouds | FEW080 | 45 | 41 | 46 | 44 | 86% | 42 | NA | 29.65 | 1003.9 | | | |
| 05 | 02:53 | NW 3 | 10.00 | Mostly Cloudy | BKN110 | 44 | 41 | | | 89% | NA | NA | 29.65 | 1004.0 | | | |
| 05 | 01:53 | Calm | 10.00 | Overcast | OVC110 | 45 | 41 | | | 86% | NA | NA | 29.66 | 1004.4 | | | |
| 05 | 00:53 | NE 7 | 10.00 | Mostly Cloudy | FEW055 FEW070 BKN110 | 46 | 41 | | | 83% | 42 | NA | 29.67 | 1004.5 | | | |
| 04 | 23:53 | NE 7 | 10.00 | Overcast | BKN095 OVC120 | 46 | 41 | | | 83% | 42 | NA | 29.71 | 1005.9 | | | |
| 04 | 22:53 | NE 12 | 10.00 | Overcast | OVC095 | 46 | 43 | | | 89% | 40 | NA | 29.74 | 1007.0 | | | |
| 04 | 21:53 | E 5 | 9.00 | Light Rain | OVC047 | 46 | 44 | 50 | 46 | 93% | 44 | NA | 29.80 | 1009.2 | | | 0.01 |
| 04 | 20:53 | Calm | 8.00 | Light Rain | OVC047 | 46 | 44 | | | 93% | NA | NA | 29.84 | 1010.4 | | | |
| 04 | 19:53 | SE 5 | 6.00 | Light Rain Fog/Mist | BKN040 OVC048 | 46 | 45 | | | 96% | 44 | NA | 29.86 | 1011.2 | 0.01 | | |
| 04 | 18:53 | Calm | 10.00 | Light Rain | OVC050 | 48 | 44 | | | 86% | NA | NA | 29.86 | 1011.1 | | | |
| 04 | 17:53 | S 6 | 10.00 | Overcast | BKN050 OVC060 | 49 | 44 | | | 83% | 46 | NA | 29.87 | 1011.6 | | | |
| 04 | 16:53 | S 5 | 10.00 | Overcast | BKN060 OVC085 | 48 | 45 | | | 89% | 46 | NA | 29.88 | 1011.8 | | | |

| Date | Time (pst) | Wind (mph) | Vis. (mi.) | Weather | Sky Cond. | Air | Dwpt | Max. 6 hour | Min. 6 hour | Relative Humidity | Wind Chill (°F) | Heat Index (°F) | altimeter (in.) | sea level (mb) | 1 hr | 3 hr | 6 hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Temperature (ºF) | | | | | | | Pressure | | Precipitation (in.) | | |

National Weather Service
Southern Region Headquarters
Fort Worth, Texas
Disclaimer

Back to previous page

Last Modified: Febuary, 7 2012
Privacy Policy

# Appendix C

**Analytical Resources, LLC**
**Analytical Chemists and Consultants**

22 February 2023

Natasya Gray
Dalton, Olmsted & Fuglevand, Inc
1420 - 156th Ave., NE STE C1
Bellevue, WA 98007

RE: Georgetown (CLE-001 (375.01))

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 23B0223 | N/A |

---

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, LLC

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Kelly Bottem, Client Services Manager

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006-012

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0223 | Turn-around Requested: Standard | Page: 1 of 1 | |
| ARI Client Company: CleanEarth | Phone: (206)-375-0211 | Date: 02/09/23 | Ice Present? Y |
| Client Contact: Tasya Gray | | No. of Coolers: 1 | Cooler Temps: 9.0 |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: 8260 | Analysis Requested: 8260-SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| TB01-0223 | 02/09/23 | 0855 | W | 2 | X | X | |
| CG-149-WT-0223 | 02/09/23 | 0955 | W | 6 | X | X | |
| CG-118-WT-0223 | 02/09/23 | 1040 | W | 6 | X | X | |
| CG-116-WT-0223 | 02/09/23 | 1130 | W | 6 | X | X | |
| VIT5-03-WT-0223 | 02/09/23 | 1235 | W | 6 | X | X | |
| CG-131-WT-0223 | 02/09/23 | 1325 | W | 6 | X | X | |
| CG-126-WT-0223 | 02/09/23 | 1420 | W | 18 | X | X | MSMSD |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

EDS

| Comments/Special Instructions | Relinquished by: (Signature) | Received by: (Signature) | Relinquished by: (Signature) | Received by: (Signature) |
|---|---|---|---|---|
| Report to alutey@dofnw.com in addition to Tasya Gray | EDS | Phillip Bates | | |
| | Printed Name: Elliott Scheumann | Printed Name: Phillip Bates | Printed Name: | Printed Name: |
| | Company: DOF | Company: AR | Company: | Company: |
| | Date & Time: 2/9/23 1533 | Date & Time: 2/9/23 15:33 | Date & Time: | Date & Time: |


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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| TB01-0223 | 23B0223-01 | Water | 09-Feb-2023 08:55 | 09-Feb-2023 15:33 |
| CG-149-WT-0223 | 23B0223-02 | Water | 09-Feb-2023 09:55 | 09-Feb-2023 15:33 |
| CG-118-WT-0223 | 23B0223-03 | Water | 09-Feb-2023 10:40 | 09-Feb-2023 15:33 |
| CG-116-WT-0223 | 23B0223-04 | Water | 09-Feb-2023 11:30 | 09-Feb-2023 15:33 |
| VIT5-03-WT-0223 | 23B0223-05 | Water | 09-Feb-2023 12:35 | 09-Feb-2023 15:33 |
| CG-131-WT-0223 | 23B0223-06 | Water | 09-Feb-2023 13:25 | 09-Feb-2023 15:33 |
| CG-126-WT-0223 | 23B0223-07 | Water | 09-Feb-2023 14:20 | 09-Feb-2023 15:33 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

# Work Order Case Narrative

**Volatiles - EPA Method SW8260D**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

The matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and relative percent difference (RPD) were within advisory control limits.

**Volatiles - EPA Method 8260D-SIM (Selected Ion Monitoring)**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

The matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and relative percent difference (RPD) were within advisory control limits.

**Analytical Resources, LLC**
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Clean Earth / DOF  Project Name: Georgetown

COC No(s): _____ (NA)  Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: 23B0223  Tracking No: _____ (NA)

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of the cooler? | YES | (NO) |
| Were custody papers included with the cooler? | (YES) | NO |
| Were custody papers properly filled out (ink, signed, etc.) | (YES) | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 9.0

Time 15:33

If cooler temperature is out of compliance fill out form 00070F  Temp Gun ID#: 5009708

Cooler Accepted by: PIB  Date: 2/9/23  Time: 15:33

***Complete custody forms and attach all shipping documents***

## Log-In Phase:

| | | | |
|---|---|---|---|
| Was a temperature blank included in the cooler? | | YES | (NO) |
| What kind of packing material was used? | (Bubble Wrap) (Wet Ice) (Gel Packs) Baggies (Foam Block) Paper Other: _____ | | |
| Was sufficient ice used (if appropriate)? | NA | YES | (NO) |
| How were bottles sealed in plastic bags? | Individually | Grouped | (Not) |
| Did all bottles arrive in good condition (unbroken)? | | (YES) | NO |
| Were all bottle labels complete and legible? | | (YES) | NO |
| Did the number of containers listed on COC match with the number of containers received? | | (YES) | NO |
| Did all bottle labels and tags agree with custody papers? | | (YES) | NO |
| Were all bottles used correct for the requested analyses? | | (YES) | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) | (NA) | YES | NO |
| Were all VOC vials free of air bubbles? | NA | (YES) | NO |
| Was sufficient amount of sample sent in each bottle? | | (YES) | NO |
| Date VOC Trip Blank was made at ARI | PIB 2/9 (NA) | 1/31/23 | |

Were the sample(s) split by ARI? (NA) YES  Date/Time: _____  Equipment: _____  Split by: _____

Samples Logged by: PIB  Date: 2/9/23  Time: 2/9 PIB ~~11:32~~ 8:30  Labels checked by: _____

***** Notify Project Manager of discrepancies or concerns *****

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

***Additional Notes, Discrepancies, & Resolutions:***

By: _____  Date: _____

Analytical Resources, LLC
Analytical Chemists and Consultants

# Cooler Temperature Compliance Form

**ARI Work Order:** 23B0223

**Cooler#:** _____ **Temperature(°C):** 9.0

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| All samples received above 6°C | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

**Cooler#:** _____ **Temperature(°C):** _____

| Sample ID | Bottle Count | Bottle Type |
|---|---|---|
| | | |

Completed by: DJB Date: 2/9/23 Time: 15:35

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 08:55

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:18

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-01 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 08:55
Analyzed: 02/13/2023 16:18

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *96.0* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**TB01-0223**

**23B0223-01 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 08:55
Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0306
Prepared: 02/13/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-01 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *117* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *95.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *92.6* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 09:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:59

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-02 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 4.07 | ug/L | |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.20 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 5.98 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 4.08 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.13 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.78 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.13 | ug/L | J |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.06 | ug/L | J |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | 0.29 | ug/L | |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | 1.20 | ug/L | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | 2.63 | ug/L | |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | 0.15 | ug/L | J |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.52 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 09:55
Analyzed: 02/13/2023 16:59

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *99.7* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *99.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-149-WT-0223

**23B0223-02 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 09:55
Analyzed: 02/14/2023 12:34

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-02 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 4.73 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.122 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *114* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *108* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *108* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 10:40
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 17:20

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-03 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.12 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.07 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.88 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.69 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.20 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.62 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.47 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.09 | ug/L | J |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | 0.26 | ug/L | |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | 0.33 | ug/L | |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.86 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 10:40
Analyzed: 02/13/2023 17:20

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *97.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-118-WT-0223

**23B0223-03 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/09/2023 10:40
Instrument: NT16 Analyst: KOTT — Analyzed: 02/14/2023 12:56

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-03 C
Preparation Batch: BLB0339 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.156 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.505 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *116* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *104* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *94.1* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 11:30
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 17:41

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-04 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.09 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.34 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.19 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | 0.33 | ug/L | |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | 0.24 | ug/L | |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 11:30
Analyzed: 02/13/2023 17:41

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *98.3* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.5* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-116-WT-0223

**23B0223-04 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 11:30
Analyzed: 02/14/2023 13:17

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-04 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0866 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0114 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *119* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *102* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *86.4* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 12:35
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:02

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-05 E
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.08 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.21 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 1.12 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.89 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 12:35
Analyzed: 02/13/2023 18:02

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *100* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## VIT5-03-WT-0223

**23B0223-05 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/09/2023 12:35
Instrument: NT16 Analyst: KOTT — Analyzed: 02/14/2023 13:38

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-05 C
Preparation Batch: BLB0339 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0142 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *118* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *101* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.0* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-131-WT-0223

**23B0223-06 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 13:25
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:23

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-06 D
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.32 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.29 | ug/L | |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.63 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 31.6 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | 0.13 | ug/L | J |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 8.19 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**CG-131-WT-0223**

**23B0223-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 13:25
Analyzed: 02/13/2023 18:23

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *93.6* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-131-WT-0223

**23B0223-06 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 13:25
Analyzed: 02/14/2023 13:59

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-06 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0882 | ug/L | |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *111* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *91.2* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/09/2023 14:20
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0223-07 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.30 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.85 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.13 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 4.52 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.49 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/09/2023 14:20
Analyzed: 02/13/2023 18:44

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.6* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *100* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## CG-126-WT-0223

**23B0223-07 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/09/2023 14:20
Analyzed: 02/13/2023 13:48

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0306
Prepared: 02/13/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0223-07 C

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0123 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.558 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.9* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *96.8* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.93 | | | ug/L | *5.00* | | *98.5* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.70 | | | ug/L | *5.00* | | *94.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0325-BS1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | | |
| Vinyl Chloride | 9.72 | 0.08 | 0.20 | ug/L | 10.0 | | 97.2 | 66-133 | | | |
| Chloroethane | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.83 | 0.11 | 0.20 | ug/L | 10.0 | | 98.3 | 76-129 | | | |
| 1,1-Dichloroethene | 9.58 | 0.08 | 0.20 | ug/L | 10.0 | | 95.8 | 69-135 | | | |
| Methylene Chloride | 9.13 | 0.53 | 1.00 | ug/L | 10.0 | | 91.3 | 65-135 | | | |
| Carbon Disulfide | 9.81 | 0.06 | 0.20 | ug/L | 10.0 | | 98.1 | 78-125 | | | |
| trans-1,2-Dichloroethene | 9.38 | 0.07 | 0.20 | ug/L | 10.0 | | 93.8 | 78-128 | | | |
| 1,1-Dichloroethane | 9.75 | 0.04 | 0.20 | ug/L | 10.0 | | 97.5 | 76-124 | | | |
| cis-1,2-Dichloroethene | 9.93 | 0.08 | 0.20 | ug/L | 10.0 | | 99.3 | 80-121 | | | |
| Chloroform | 9.82 | 0.05 | 0.20 | ug/L | 10.0 | | 98.2 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 79-123 | | | |
| Carbon tetrachloride | 8.94 | 0.09 | 0.20 | ug/L | 10.0 | | 89.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.65 | 0.08 | 0.20 | ug/L | 10.0 | | 96.5 | 75-123 | | | |
| Benzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Trichloroethene | 9.94 | 0.07 | 0.20 | ug/L | 10.0 | | 99.4 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 49.3 | 1.90 | 5.00 | ug/L | 50.0 | | 98.7 | 67-133 | | | |
| Toluene | 10.2 | 0.05 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| 2-Hexanone | 50.2 | 2.06 | 5.00 | ug/L | 50.0 | | 100 | 69-133 | | | |
| Tetrachloroethene | 9.75 | 0.09 | 0.20 | ug/L | 10.0 | | 97.5 | 80-120 | | | |
| Chlorobenzene | 10.1 | 0.06 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Ethylbenzene | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| m,p-Xylene | 21.4 | 0.14 | 0.40 | ug/L | 20.0 | | 107 | 80-121 | | | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | | | |
| Xylenes, total | 31.9 | 0.22 | 0.60 | ug/L | 30.0 | | 106 | 76-127 | | | |
| Styrene | 10.9 | 0.09 | 0.20 | ug/L | 10.0 | | 109 | 80-124 | | | |
| n-Propylbenzene | 10.9 | 0.07 | 0.20 | ug/L | 10.0 | | 109 | 78-130 | | | |
| Isopropyl Benzene | 10.8 | 0.07 | 0.20 | ug/L | 10.0 | | 108 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 80-129 | | | |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0325-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.3 | 0.05 | 0.20 | ug/L | 10.0 | | 113 | 80-127 | | | |
| s-Butylbenzene | 11.3 | 0.06 | 0.20 | ug/L | 10.0 | | 113 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | | 116 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.3 | 0.10 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Naphthalene | 10.4 | 0.27 | 0.50 | ug/L | 10.0 | | 104 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 9.01 | 0.10 | 0.20 | ug/L | 10.0 | | 90.1 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.65 | | | ug/L | *5.00* | | *93.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.93 | | | ug/L | *5.00* | | *98.6* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.02 | | | ug/L | *5.00* | | *100* | *80-120* | | | |
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| Vinyl Chloride | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 66-133 | 4.81 | 30 | |
| Chloroethane | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | | 111 | 60-155 | 3.86 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 3.87 | 30 | |
| 1,1-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 69-135 | 5.08 | 30 | |
| Methylene Chloride | 9.50 | 0.53 | 1.00 | ug/L | 10.0 | | 95.0 | 65-135 | 3.99 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 4.89 | 30 | |
| trans-1,2-Dichloroethene | 9.85 | 0.07 | 0.20 | ug/L | 10.0 | | 98.5 | 78-128 | 4.85 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 4.64 | 30 | |
| cis-1,2-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 80-121 | 3.56 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 5.25 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 5.10 | 30 | |
| Carbon tetrachloride | 9.21 | 0.09 | 0.20 | ug/L | 10.0 | | 92.1 | 53-137 | 2.97 | 30 | |
| 1,2-Dichloroethane | 10.0 | 0.08 | 0.20 | ug/L | 10.0 | | 100 | 75-123 | 3.59 | 30 | |
| Benzene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 3.08 | 30 | |
| Trichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | 4.00 | 30 | |
| 4-Methyl-2-Pentanone | 53.9 | 1.90 | 5.00 | ug/L | 50.0 | | 108 | 67-133 | 8.83 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.82 | 30 | |
| 2-Hexanone | 55.2 | 2.06 | 5.00 | ug/L | 50.0 | | 110 | 69-133 | 9.38 | 30 | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 4.31 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.42 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.62 | 30 | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | 1.95 | 30 | |
| o-Xylene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | | 108 | 80-121 | 2.99 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 2.29 | 30 | |
| Styrene | 11.4 | 0.09 | 0.20 | ug/L | 10.0 | | 114 | 80-124 | 4.06 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 3.47 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 4.22 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 3.58 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 3.24 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 3.15 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 3.34 | 30 | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 3.66 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 5.08 | 30 | |
| Naphthalene | 11.3 | 0.27 | 0.50 | ug/L | 10.0 | | 113 | 50-134 | 8.22 | 30 | |
| Dichlorodifluoromethane | 9.95 | 0.13 | 0.20 | ug/L | 10.0 | | 99.5 | 48-147 | 5.18 | 30 | |
| n-Hexane | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 70-130 | 16.30 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.04 | | | ug/L | *5.00* | | *101* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.87 | | | ug/L | *5.00* | | *97.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.11 | | | ug/L | *5.00* | | *102* | *80-120* | | | |
| **Matrix Spike (BLB0325-MS1)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 22:51 | | | | | | |
| Vinyl Chloride | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 103 | 66-133 | | | |
| Chloroethane | 9.47 | 0.05 | 0.20 | ug/L | 10.0 | ND | 94.7 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.29 | 0.11 | 0.20 | ug/L | 10.0 | ND | 92.9 | 76-129 | | | |
| 1,1-Dichloroethene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | ND | 106 | 69-135 | | | |
| Methylene Chloride | 9.77 | 0.53 | 1.00 | ug/L | 10.0 | ND | 97.7 | 65-135 | | | |
| Carbon Disulfide | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | ND | 104 | 78-125 | | | |
| trans-1,2-Dichloroethene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 78-128 | | | |
| 1,1-Dichloroethane | 10.9 | 0.04 | 0.20 | ug/L | 10.0 | 0.30 | 106 | 76-124 | | | |
| cis-1,2-Dichloroethene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | 0.85 | 104 | 80-121 | | | |
| Chloroform | 10.8 | 0.05 | 0.20 | ug/L | 10.0 | ND | 108 | 80-122 | | | |
| 1,1,1-Trichloroethane | 11.1 | 0.08 | 0.20 | ug/L | 10.0 | 0.13 | 109 | 79-123 | | | |
| Carbon tetrachloride | 8.87 | 0.09 | 0.20 | ug/L | 10.0 | ND | 88.7 | 53-137 | | | |
| 1,2-Dichloroethane | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | ND | 107 | 75-123 | | | |
| Benzene | 11.0 | 0.05 | 0.20 | ug/L | 10.0 | ND | 110 | 80-120 | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike (BLB0325-MS1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 22:51 | | | | | | | |
| Trichloroethene | 15.0 | 0.07 | 0.20 | ug/L | 10.0 | 4.52 | 105 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 56.3 | 1.90 | 5.00 | ug/L | 50.0 | ND | 113 | 67-133 | | | |
| Toluene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | ND | 107 | 80-120 | | | |
| 2-Hexanone | 56.4 | 2.06 | 5.00 | ug/L | 50.0 | ND | 113 | 69-133 | | | |
| Tetrachloroethene | 10.4 | 0.09 | 0.20 | ug/L | 10.0 | 0.49 | 99.4 | 80-120 | | | |
| Chlorobenzene | 10.6 | 0.06 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| Ethylbenzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| m,p-Xylene | 22.1 | 0.14 | 0.40 | ug/L | 20.0 | ND | 110 | 80-121 | | | |
| o-Xylene | 11.0 | 0.08 | 0.20 | ug/L | 10.0 | ND | 110 | 80-121 | | | |
| Xylenes, total | 33.0 | 0.22 | 0.60 | ug/L | 30.0 | ND | 110 | 76-127 | | | |
| Styrene | 11.5 | 0.09 | 0.20 | ug/L | 10.0 | ND | 115 | 80-124 | | | |
| n-Propylbenzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | ND | 111 | 78-130 | | | |
| Isopropyl Benzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | ND | 111 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 80-129 | | | |
| 1,2,4-Trimethylbenzene | 11.5 | 0.05 | 0.20 | ug/L | 10.0 | ND | 115 | 80-127 | | | |
| s-Butylbenzene | 11.1 | 0.06 | 0.20 | ug/L | 10.0 | ND | 111 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 113 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | ND | 106 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 108 | 80-120 | | | |
| Naphthalene | 11.1 | 0.27 | 0.50 | ug/L | 10.0 | ND | 111 | 50-134 | | | |
| Dichlorodifluoromethane | 9.32 | 0.13 | 0.20 | ug/L | 10.0 | ND | 93.2 | 48-147 | | | |
| n-Hexane | 7.14 | 0.10 | 0.20 | ug/L | 10.0 | ND | 71.4 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.18 | | | ug/L | *5.00* | *5.23* | *104* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | *4.88* | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.95 | | | ug/L | *5.00* | *4.72* | *99.1* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.12 | | | ug/L | *5.00* | *5.01* | *102* | *80-120* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| Vinyl Chloride | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | ND | 107 | 66-133 | 3.51 | 30 | |
| Chloroethane | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | ND | 101 | 60-155 | 6.52 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.0 | 0.11 | 0.20 | ug/L | 10.0 | ND | 100 | 76-129 | 7.43 | 30 | |
| 1,1-Dichloroethene | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | ND | 109 | 69-135 | 2.43 | 30 | |
| Methylene Chloride | 10.0 | 0.53 | 1.00 | ug/L | 10.0 | ND | 100 | 65-135 | 2.74 | 30 | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| Carbon Disulfide | 10.7 | 0.06 | 0.20 | ug/L | 10.0 | ND | 107 | 78-125 | 2.93 | 30 | |
| trans-1,2-Dichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | ND | 103 | 78-128 | 10.10 | 30 | |
| 1,1-Dichloroethane | 11.2 | 0.04 | 0.20 | ug/L | 10.0 | 0.30 | 109 | 76-124 | 2.76 | 30 | |
| cis-1,2-Dichloroethene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | 0.85 | 108 | 80-121 | 2.76 | 30 | |
| Chloroform | 11.0 | 0.05 | 0.20 | ug/L | 10.0 | ND | 110 | 80-122 | 2.40 | 30 | |
| 1,1,1-Trichloroethane | 11.5 | 0.08 | 0.20 | ug/L | 10.0 | 0.13 | 114 | 79-123 | 4.12 | 30 | |
| Carbon tetrachloride | 9.34 | 0.09 | 0.20 | ug/L | 10.0 | ND | 93.4 | 53-137 | 5.15 | 30 | |
| 1,2-Dichloroethane | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 108 | 75-123 | 1.03 | 30 | |
| Benzene | 11.2 | 0.05 | 0.20 | ug/L | 10.0 | ND | 112 | 80-120 | 2.03 | 30 | |
| Trichloroethene | 15.2 | 0.07 | 0.20 | ug/L | 10.0 | 4.52 | 107 | 80-120 | 1.20 | 30 | |
| 4-Methyl-2-Pentanone | 57.1 | 1.90 | 5.00 | ug/L | 50.0 | ND | 114 | 67-133 | 1.55 | 30 | |
| Toluene | 10.8 | 0.05 | 0.20 | ug/L | 10.0 | ND | 108 | 80-120 | 0.94 | 30 | |
| 2-Hexanone | 58.5 | 2.06 | 5.00 | ug/L | 50.0 | ND | 117 | 69-133 | 3.71 | 30 | |
| Tetrachloroethene | 11.0 | 0.09 | 0.20 | ug/L | 10.0 | 0.49 | 105 | 80-120 | 5.27 | 30 | |
| Chlorobenzene | 11.0 | 0.06 | 0.20 | ug/L | 10.0 | ND | 110 | 80-120 | 3.27 | 30 | |
| Ethylbenzene | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | ND | 111 | 80-120 | 4.54 | 30 | |
| m,p-Xylene | 23.1 | 0.14 | 0.40 | ug/L | 20.0 | ND | 115 | 80-121 | 4.38 | 30 | |
| o-Xylene | 11.3 | 0.08 | 0.20 | ug/L | 10.0 | ND | 113 | 80-121 | 3.20 | 30 | |
| Xylenes, total | 34.4 | 0.22 | 0.60 | ug/L | 30.0 | ND | 115 | 76-127 | 3.99 | 30 | |
| Styrene | 11.9 | 0.09 | 0.20 | ug/L | 10.0 | ND | 119 | 80-124 | 3.09 | 30 | |
| n-Propylbenzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 78-130 | 2.19 | 30 | |
| Isopropyl Benzene | 11.4 | 0.07 | 0.20 | ug/L | 10.0 | ND | 114 | 80-128 | 2.25 | 30 | |
| 1,3,5-Trimethylbenzene | 11.9 | 0.07 | 0.20 | ug/L | 10.0 | ND | 119 | 80-129 | 3.83 | 30 | |
| 1,2,4-Trimethylbenzene | 11.9 | 0.05 | 0.20 | ug/L | 10.0 | ND | 119 | 80-127 | 2.98 | 30 | |
| s-Butylbenzene | 11.7 | 0.06 | 0.20 | ug/L | 10.0 | ND | 117 | 78-129 | 4.97 | 30 | |
| 4-Isopropyl Toluene | 11.8 | 0.08 | 0.20 | ug/L | 10.0 | ND | 118 | 79-130 | 4.69 | 30 | |
| 1,4-Dichlorobenzene | 10.9 | 0.10 | 0.20 | ug/L | 10.0 | ND | 109 | 80-120 | 3.22 | 30 | |
| 1,2-Dichlorobenzene | 11.1 | 0.08 | 0.20 | ug/L | 10.0 | ND | 111 | 80-120 | 3.29 | 30 | |
| Naphthalene | 11.6 | 0.27 | 0.50 | ug/L | 10.0 | ND | 116 | 50-134 | 4.20 | 30 | |
| Dichlorodifluoromethane | 10.7 | 0.13 | 0.20 | ug/L | 10.0 | ND | 107 | 48-147 | 13.70 | 30 | |
| n-Hexane | 9.64 | 0.10 | 0.20 | ug/L | 10.0 | ND | 96.4 | 70-130 | 29.90 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.12 | | | ug/L | *5.00* | *5.23* | *102* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.04 | | | ug/L | *5.00* | *4.88* | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.92 | | | ug/L | *5.00* | *4.72* | *98.5* | *80-120* | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0325-MSD1)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 23:12 | | | | | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.03 | | | ug/L | *5.00* | *5.01* | *101* | *80-120* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0306 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0306-BLK1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 10:04 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5000 | | | ug/L | *5000* | | *100* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4650 | | | ug/L | *5000* | | *93.0* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4920 | | | ug/L | *5000* | | *98.4* | *75-125* | | | |
| **LCS (BLB0306-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 08:55 | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.11 | 0.00682 | 0.0200 | ug/L | 2.00 | | 105 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4960 | | | ug/L | *5000* | | *99.2* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4930 | | | ug/L | *5000* | | *98.6* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5430 | | | ug/L | *5000* | | *109* | *75-125* | | | |
| **LCS Dup (BLB0306-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 09:43 | | | | | | |
| Vinyl chloride | 2.00 | 0.00501 | 0.0200 | ug/L | 2.00 | | 100 | 62-141 | 16.20 | 30 | |
| Tetrachloroethene | 1.81 | 0.00682 | 0.0200 | ug/L | 2.00 | | 90.7 | 76-127 | 14.90 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4970 | | | ug/L | *5000* | | *99.4* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4780 | | | ug/L | *5000* | | *95.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **Matrix Spike (BLB0306-MS2)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:09 | | | | | | |
| Vinyl chloride | 2.04 | 0.00501 | 0.0200 | ug/L | 2.00 | 0.0123 | 102 | 62-141 | | | |
| Tetrachloroethene | 2.50 | 0.00682 | 0.0200 | ug/L | 2.00 | 0.558 | 96.9 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5390 | | | ug/L | *5000* | *5170* | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4970 | | | ug/L | *5000* | *4940* | *99.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5460 | | | ug/L | *5000* | *4840* | *109* | *75-125* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0306-MSD2)** | | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:30 | | | | | | |
| Vinyl chloride | 2.05 | 0.00501 | 0.0200 | ug/L | 2.00 | 0.0123 | 102 | 62-141 | 0.29 | 30 | |
| Tetrachloroethene | 2.49 | 0.00682 | 0.0200 | ug/L | 2.00 | 0.558 | 96.6 | 76-127 | 0.23 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5520 | | | ug/L | *5000* | *5170* | *110* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | *4940* | *98.9* | *80-120* | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0306 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BLB0306-MSD2)** | **Source: 23B0223-07** | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:30 | | | | | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5410 | | | ug/L | *5000* | *4840* | *108* | *75-125* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0339 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0339-BLK1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:52 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5320 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | | *98.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4860 | | | ug/L | *5000* | | *97.2* | *75-125* | | | |
| **LCS (BLB0339-BS1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 10:30 | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.07 | 0.00682 | 0.0200 | ug/L | 2.00 | | 103 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5400 | | | ug/L | *5000* | | *108* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **LCS Dup (BLB0339-BSD1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:11 | | | | | | |
| Vinyl chloride | 2.16 | 0.00501 | 0.0200 | ug/L | 2.00 | | 108 | 62-141 | 9.20 | 30 | |
| Tetrachloroethene | 1.93 | 0.00682 | 0.0200 | ug/L | 2.00 | | 96.7 | 76-127 | 6.58 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5400 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5280 | | | ug/L | *5000* | | *106* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5380 | | | ug/L | *5000* | | *108* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 8260D in Water*** | |
| Chloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichlorofluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrolein | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acetone | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Iodomethane | DoD-ELAP,NELAP,WADOE |
| Methylene Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrylonitrile | DoD-ELAP,NELAP,WADOE |
| Carbon Disulfide | DoD-ELAP,NELAP,WADOE |
| trans-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Acetate | DoD-ELAP,NELAP,WADOE |
| 1,1-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Butanone | DoD-ELAP,NELAP,WADOE |
| 2,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| cis-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroform | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Carbon tetrachloride | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Benzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromodichloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Chloroethyl vinyl ether | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Methyl-2-Pentanone | DoD-ELAP,NELAP,WADOE |
| cis-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Toluene | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

| | |
|---|---|
| 2-Hexanone | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,3-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Tetrachloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromoethane | DoD-ELAP,NELAP,WADOE |
| Chlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Ethylbenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| m,p-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| o-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| Styrene | DoD-ELAP,NELAP,WADOE |
| Bromoform | DoD-ELAP,NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,4-Dichloro 2-Butene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Propylbenzene | DoD-ELAP,NELAP,WADOE |
| Bromobenzene | DoD-ELAP,NELAP,WADOE |
| Isopropyl Benzene | DoD-ELAP,NELAP,WADOE |
| 2-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| t-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,3,5-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2,4-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| s-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 4-Isopropyl Toluene | DoD-ELAP,NELAP,WADOE |
| 1,3-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,4-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromo-3-chloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,4-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Hexachloro-1,3-Butadiene | DoD-ELAP,ADEC,NELAP,WADOE |
| Naphthalene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dichlorodifluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Methyl tert-butyl Ether | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Hexane | WADOE |
| 2-Pentanone | WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

***EPA 8260D-SIM in Water***

| | |
|---|---|
| Acrylonitrile | NELAP,WADOE |
| Vinyl chloride | NELAP,WADOE |
| 1,1-Dichloroethene | NELAP,WADOE |
| cis-1,2-Dichloroethene | NELAP,WADOE |
| trans-1,2-Dichloroethene | NELAP,WADOE |
| Trichloroethene | NELAP,WADOE |
| Tetrachloroethene | NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | NELAP,WADOE |
| 1,2-Dichloroethane | NELAP,WADOE |
| Benzene | NELAP,WADOE |

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | 17-015 | 03/28/2023 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program, PJLA Testing | 66169 | 02/28/2023 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006-012 | 05/12/2023 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2023 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2023 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: CLE-001 (375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 22-Feb-2023 17:40 |

## Notes and Definitions

| | |
|---|---|
| * | Flagged value is not within established control limits. |
| J | Estimated concentration value detected below the reporting limit. |
| U | This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD). |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

**Analytical Resources, LLC**
**Analytical Chemists and Consultants**

27 February 2023

Natasya Gray
Dalton, Olmsted & Fuglevand, Inc
1420 - 156th Ave., NE STE C1
Bellevue, WA 98007

RE: Georgetown (Georgetown/CLE-001(375.01))

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 23B0265 | N/A |

---

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, LLC

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Kelly Bottem, Client Services Manager

Cert# 100006-012

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0265 | Turn-around Requested: Standard | Page: 1 of 2 | |
| ARI Client Company: Clean Earth | Phone: (206)-375-0211 | Date: 02/10/23 | Ice Present? yes |
| Client Contact: Tasya Gray | | No. of Coolers: 1 | Cooler Temps: 6.0° |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: S260 | Analysis Requested: S260 - SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| CG-5-S1-0223 | 2/10/23 | 0855 | W | 6 | X | X | |
| TB02-0223 | 2/10/23 | 0755 | W | 2 | X | X | |
| VIT5-04-WT-0223 | 2/10/23 | 0945 | W | 6 | X | X | |
| VIT5-9-04-WT-0223 | 2/10/23 | 0950 | W | 6 | X | X | |
| CG-102-S1-0223 | 2/10/23 | 1055 | W | 6 | X | X | |
| FB01-0223 | 2/10/23 | 1035 | W | 6 | X | X | |
| CG-103-S1-0223 | 2/10/23 | 1200 | W | 6 | X | X | |
| CG-112-S1-0223 | 2/10/23 | 1300 | W | 6 | X | X | |
| CG-124-WT-0223 | 2/10/23 | 1335 | W | 6 | X | X | |
| CG-121-40-0223 | 2/10/23 | 1440 | W | 6 | X | X | |

| Comments/Special Instructions | Relinquished by: (Signature) | Received by: (Signature) | Relinquished by: (Signature) | Received by: (Signature) |
|---|---|---|---|---|
| Report to alutey@dofnw.com in addition to Tasya Gray | Printed Name: Michael Knight | Printed Name: Roman M. | Printed Name: | Printed Name: |
| | Company: Clean Earth | Company: ARI | Company: | Company: |
| | Date & Time: 2/10/23 0510 | Date & Time: 2-10-23 1740 | Date & Time: | Date & Time: |

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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

## Chain of Custody Record & Laboratory Analysis Request

| | | | |
|---|---|---|---|
| ARI Assigned Number: 23B0265 | Turn-around Requested: Standard | Page: 2 of 2 | |
| ARI Client Company: CleanEarth | Phone: (206)-375-0211 | Date: 02/10/23 | Ice Present? |
| Client Contact: Tasya Gray | | No. of Coolers: | Cooler Temps: |
| Client Project Name: Georgetown | | | |
| Client Project #: CLE-001 (375.01) | Samplers: NW/ES/MW | | |


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


| Sample ID | Date | Time | Matrix | No. Containers | Analysis Requested: 8260 | Analysis Requested: 8260 + SIM | Notes/Comments |
|---|---|---|---|---|---|---|---|
| VIT5-01-WT-0223 | 2/10/23 | 1525 | W | 6 | X | X | |
| VIT5-02-WT-0223 | 2/10/23 | 1610 | W | 6 | X | X | |

| Comments/Special Instructions | Relinquished by: | Received by: | Relinquished by: | Received by: |
|---|---|---|---|---|
| Report results to alutey@defnw.com in addition to Tasya Gray | (Signature) | (Signature) | (Signature) | (Signature) |
| | Printed Name: Michael Wright | Printed Name: Rowan M. Wr | Printed Name: | Printed Name: |
| | Company: Clean Earth | Company: ARI | Company: | Company: |
| | Date & Time: 2/10/23 0510 | Date & Time: 2-10-23 1740 | Date & Time: | Date & Time: |

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

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| CG-5-S1-0223 | 23B0265-01 | Water | 10-Feb-2023 08:55 | 10-Feb-2023 17:40 |
| TB02-0223 | 23B0265-02 | Water | 10-Feb-2023 08:55 | 10-Feb-2023 17:40 |
| VIT5-04-WT-0223 | 23B0265-03 | Water | 10-Feb-2023 09:45 | 10-Feb-2023 17:40 |
| VIT5-9-04-WT-0223 | 23B0265-04 | Water | 10-Feb-2023 09:50 | 10-Feb-2023 17:40 |
| CG-102-S1-0223 | 23B0265-05 | Water | 10-Feb-2023 10:55 | 10-Feb-2023 17:40 |
| FB01-0223 | 23B0265-06 | Water | 10-Feb-2023 10:35 | 10-Feb-2023 17:40 |
| CG-103-S1-0223 | 23B0265-07 | Water | 10-Feb-2023 12:00 | 10-Feb-2023 17:40 |
| CG-112-S1-0223 | 23B0265-08 | Water | 10-Feb-2023 13:00 | 10-Feb-2023 17:40 |
| CG-124-WT-0223 | 23B0265-09 | Water | 10-Feb-2023 13:35 | 10-Feb-2023 17:40 |
| CG-121-40-0223 | 23B0265-10 | Water | 10-Feb-2023 14:40 | 10-Feb-2023 17:40 |
| VIT5-01-WT-0223 | 23B0265-11 | Water | 10-Feb-2023 15:25 | 10-Feb-2023 17:40 |
| VIT5-02-WT-0223 | 23B0265-12 | Water | 10-Feb-2023 16:10 | 10-Feb-2023 17:40 |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

# Work Order Case Narrative

**Volatiles - EPA Method SW8260D**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

**Volatiles - EPA Method 8260D-SIM (Selected Ion Monitoring)**

The sample(s) were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The blank spike and blank spike duplicate (BS/LCS and BSD/LCSD) spike recoveries and relative percent difference (RPD) were within control limits.

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client:** Dalton, Olmsted & Fuglevand, Inc **Project Manager:** Kelly Bottem

**Project:** Georgetown **Project Number:** Georgetown/CLE-001(375.01)

## Preservation Confirmation

| Container ID | Container Type | pH |
|---|---|---|
| 23B0265-01 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-01 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-02 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-02 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-03 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-04 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-04 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-05 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-06 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 B | VOA Vial, Clear, 40 mL, HCL | |

Reviewed By Date

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client: Dalton, Olmsted & Fuglevand, Inc** **Project Manager: Kelly Bottem**

**Project: Georgetown** **Project Number: Georgetown/CLE-001(375.01)**

| | | |
|---|---|---|
| 23B0265-07 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-07 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-08 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-09 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-09 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 A | VOA Vial, Clear, 40 mL, HCL | Bubble |
| 23B0265-10 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-10 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-11 F | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 A | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 B | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 C | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 D | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 E | VOA Vial, Clear, 40 mL, HCL | |
| 23B0265-12 F | VOA Vial, Clear, 40 mL, HCL | |

Reviewed By

Date

**WORK ORDER**

23B0265

Samples will be discarded 90 days after submission of a final report unless other instructions are received

**Client:** Dalton, Olmsted & Fuglevand, Inc

**Project Manager:** Kelly Bottem

**Project:** Georgetown

**Project Number:** Georgetown/CLE-001(375.01)

JG

Preservation Confirmed By

2/11/23

Date

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Clean Earth/DOF  Project Name: Georgetown

COC No(s): NA  Delivered by: Fed-Ex UPS Courier Hand Delivered Other:

Assigned ARI Job No: 23B0265  Tracking No: NA

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of the cooler? | YES | NO |
| Were custody papers included with the cooler? | YES | NO |
| Were custody papers properly filled out (ink, signed, etc.) | YES | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 6.0°

Time 1740

If cooler temperature is out of compliance fill out form 00070F  Temp Gun ID#: 9708

Cooler Accepted by: [signature]  Date: 2-10-23  Time: 1740

***Complete custody forms and attach all shipping documents***

## Log-In Phase:

| | | | |
|---|---|---|---|
| Was a temperature blank included in the cooler? | | YES | NO |
| What kind of packing material was used? | Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: | | |
| Was sufficient ice used (if appropriate)? | NA | YES | NO |
| How were bottles sealed in plastic bags? | Individually | Grouped | Not |
| Did all bottles arrive in good condition (unbroken)? | | YES | NO |
| Were all bottle labels complete and legible? | | YES | NO |
| Did the number of containers listed on COC match with the number of containers received? | | YES | NO |
| Did all bottle labels and tags agree with custody papers? | | YES | NO |
| Were all bottles used correct for the requested analyses? | | YES | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) | NA | YES | NO |
| Were all VOC vials free of air bubbles? | NA | YES | NO |
| Was sufficient amount of sample sent in each bottle? | | YES | NO |
| Date VOC Trip Blank was made at ARI | NA | 01/31/23 | |

Were the sample(s) split by ARI? NA YES  Date/Time: _____  Equipment: _____  Split by: _____

Samples Logged by: JSm  Date: 02/11/23  Time: 0835  Labels checked by: JSm

*** Notify Project Manager of discrepancies or concerns ***

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

***Additional Notes, Discrepancies, & Resolutions:***

VOA vials w/air bubbles marked on preservation sheet, lab to determine size.

By: JSm  Date: 02/11/23

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-5-S1-0223

**23B0265-01 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 08:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/14/2023 17:31

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-01 D
Preparation Batch: BLB0351 — Sample Size: 10 mL
Prepared: 02/14/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.07 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.19 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 2.42 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.78 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.24 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-5-S1-0223

**23B0265-01 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 17:31

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *109* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.7* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-5-S1-0223**

**23B0265-01 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 14:41

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-01 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.211 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *111* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *95.3* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 08:55

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 16:39

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-02 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 08:55
Analyzed: 02/13/2023 16:39

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *99.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.1* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.1* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**TB02-0223**

**23B0265-02 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 08:55
Analyzed: 02/14/2023 14:20

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-02 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *113* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.9* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 09:45

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 19:24

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-03 F

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.26 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.07 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | 0.13 | ug/L | J |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 4.73 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.41 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.41 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 09:45
Analyzed: 02/13/2023 19:24

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *98.2* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-04-WT-0223**

**23B0265-03 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 09:45
Analyzed: 02/14/2023 15:03

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-03 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.395 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *84.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *93.3* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 09:50

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 19:45

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-04 C

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.26 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 1.02 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.10 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | 0.12 | ug/L | J |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 4.61 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 1.38 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.40 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 09:50
Analyzed: 02/13/2023 19:45

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.3* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-9-04-WT-0223**

**23B0265-04 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 09:50
Analyzed: 02/14/2023 15:24

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-04 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.382 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *102* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *82.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *97.0* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-102-S1-0223

**23B0265-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 10:55
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:05

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-05 B
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.33 | ug/L | |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 2.77 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 6.45 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 0.19 | ug/L | J |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.10 | ug/L | J |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-102-S1-0223

**23B0265-05 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 10:55
Analyzed: 02/13/2023 20:05

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *96.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *99.8* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-102-S1-0223**

**23B0265-05 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/10/2023 10:55

Instrument: NT16 Analyst: KOTT — Analyzed: 02/23/2023 13:12

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-05 F

Preparation Batch: BLB0603 — Sample Size: 10 mL

Prepared: 02/23/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0876 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.4* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 10:35

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:26

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-06 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | ND | ug/L | U |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 10:35
Analyzed: 02/13/2023 20:26

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.8* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**FB01-0223**

**23B0265-06 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: KOTT

Sampled: 02/10/2023 10:35
Analyzed: 02/14/2023 16:06

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0339
Prepared: 02/14/2023

Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-06 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *103* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.3* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *87.4* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-103-S1-0223

**23B0265-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 12:00
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 20:46

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-07 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | 0.09 | ug/L | J |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.23 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 1.00 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.23 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 5.14 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 3.11 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-103-S1-0223

**23B0265-07 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 12:00
Analyzed: 02/13/2023 20:46

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *101* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.3* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.4* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-103-S1-0223**

**23B0265-07 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 12:00
Analyzed: 02/16/2023 12:47

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-07 C

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.114 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 2.97 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *95.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *103* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-112-S1-0223

**23B0265-08 (Water)**

### Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 13:00
Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:07

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-08 A
Preparation Batch: BLB0325 — Sample Size: 10 mL
Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.05 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.08 | ug/L | J |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-112-S1-0223**

**23B0265-08 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 13:00
Analyzed: 02/13/2023 21:07

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *104* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *97.4* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *92.8* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *101* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## CG-112-S1-0223

**23B0265-08 (Water)**

### Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 13:00
Analyzed: 02/16/2023 13:08

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-08 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0385 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *109* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *92.1* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 13:35

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:28

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-09 C

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.12 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.34 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | 0.32 | ug/L | |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | 3.09 | ug/L | |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | 0.85 | ug/L | |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 13:35
Analyzed: 02/13/2023 21:28

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *90.9* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-124-WT-0223**

**23B0265-09 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM — Sampled: 02/10/2023 13:35

Instrument: NT16 Analyst: PB — Analyzed: 02/16/2023 13:29

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-09 A

Preparation Batch: BLB0419 — Sample Size: 10 mL

Prepared: 02/16/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.00870 | ug/L | J |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.823 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *93.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 14:40

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 21:48

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-10 B

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | 2.34 | ug/L | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | 0.09 | ug/L | J |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.10 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | 0.12 | ug/L | J |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 14:40
Analyzed: 02/13/2023 21:48

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *108* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.6* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *90.1* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *100* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**CG-121-40-0223**

**23B0265-10 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 14:40
Analyzed: 02/16/2023 13:50

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-10 A

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0764 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.00709 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *91.2* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 15:25

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 22:09

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-11 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.11 | ug/L | J |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.16 | ug/L | J |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 15:25
Analyzed: 02/13/2023 22:09

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *105* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *98.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *95.7* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *102* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-01-WT-0223**

**23B0265-11 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 15:25
Analyzed: 02/16/2023 14:11

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-11 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0187 | ug/L | J |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *90.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D — Sampled: 02/10/2023 16:10

Instrument: NT2 Analyst: PKC — Analyzed: 02/13/2023 22:30

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap) — Extract ID: 23B0265-12 A

Preparation Batch: BLB0325 — Sample Size: 10 mL

Prepared: 02/13/2023 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl Chloride | 75-01-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Chloroethane | 75-00-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 76-13-1 | 1 | 0.11 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethene | 75-35-4 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Methylene Chloride | 75-09-2 | 1 | 0.53 | 1.00 | ND | ug/L | U |
| Carbon Disulfide | 75-15-0 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,1-Dichloroethane | 75-34-3 | 1 | 0.04 | 0.20 | 0.64 | ug/L | |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 0.08 | 0.20 | 0.47 | ug/L | |
| Chloroform | 67-66-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Carbon tetrachloride | 56-23-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| 1,2-Dichloroethane | 107-06-2 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| Trichloroethene | 79-01-6 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 4-Methyl-2-Pentanone | 108-10-1 | 1 | 1.90 | 5.00 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| 2-Hexanone | 591-78-6 | 1 | 2.06 | 5.00 | ND | ug/L | U |
| Tetrachloroethene | 127-18-4 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| Chlorobenzene | 108-90-7 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| Ethylbenzene | 100-41-4 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| m,p-Xylene | 179601-23-1 | 1 | 0.14 | 0.40 | ND | ug/L | U |
| o-Xylene | 95-47-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Xylenes, total | 1330-20-7 | 1 | 0.22 | 0.60 | ND | ug/L | U |
| Styrene | 100-42-5 | 1 | 0.09 | 0.20 | ND | ug/L | U |
| n-Propylbenzene | 103-65-1 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| Isopropyl Benzene | 98-82-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 0.07 | 0.20 | ND | ug/L | U |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 0.05 | 0.20 | ND | ug/L | U |
| s-Butylbenzene | 135-98-8 | 1 | 0.06 | 0.20 | ND | ug/L | U |
| 4-Isopropyl Toluene | 99-87-6 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 0.08 | 0.20 | ND | ug/L | U |
| Naphthalene | 91-20-3 | 1 | 0.27 | 0.50 | ND | ug/L | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds

Method: EPA 8260D
Instrument: NT2 Analyst: PKC

Sampled: 02/10/2023 16:10
Analyzed: 02/13/2023 22:30

**Analysis by: Analytical Resources, LLC**

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Dichlorodifluoromethane | 75-71-8 | 1 | 0.13 | 0.20 | ND | ug/L | U |
| n-Hexane | 110-54-3 | 1 | 0.10 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *113* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *96.7* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *80-120 %* | *94.6* | *%* | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | | | | *80-120 %* | *104* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**VIT5-02-WT-0223**

**23B0265-12 (Water)**

## Volatile Organic Compounds - SIM

Method: EPA 8260D-SIM
Instrument: NT16 Analyst: PB

Sampled: 02/10/2023 16:10
Analyzed: 02/16/2023 14:33

**Analysis by: Analytical Resources, LLC**

Sample Preparation: Preparation Method: EPA 5030C (Purge and Trap)
Preparation Batch: BLB0419
Prepared: 02/16/2023
Sample Size: 10 mL
Final Volume: 10 mL

Extract ID: 23B0265-12 B

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | 75-01-4 | 1 | 0.00501 | 0.0200 | 0.0390 | ug/L | M |
| Tetrachloroethene | 127-18-4 | 1 | 0.00682 | 0.0200 | 0.0225 | ug/L | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | | *80-129 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | | *80-120 %* | *91.0* | *%* | |
| *Surrogate: 4-Bromofluorobenzene* | | | | *75-125 %* | *105* | *%* | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | 0.07 | 0.06 | 0.20 | ug/L | | | | | | | J |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0325-BLK1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:58 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.93 | | | ug/L | *5.00* | | *98.5* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.70 | | | ug/L | *5.00* | | *94.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0325-BS1)** | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | | |
| Vinyl Chloride | 9.72 | 0.08 | 0.20 | ug/L | 10.0 | | 97.2 | 66-133 | | | |
| Chloroethane | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 9.83 | 0.11 | 0.20 | ug/L | 10.0 | | 98.3 | 76-129 | | | |
| 1,1-Dichloroethene | 9.58 | 0.08 | 0.20 | ug/L | 10.0 | | 95.8 | 69-135 | | | |
| Methylene Chloride | 9.13 | 0.53 | 1.00 | ug/L | 10.0 | | 91.3 | 65-135 | | | |
| Carbon Disulfide | 9.81 | 0.06 | 0.20 | ug/L | 10.0 | | 98.1 | 78-125 | | | |
| trans-1,2-Dichloroethene | 9.38 | 0.07 | 0.20 | ug/L | 10.0 | | 93.8 | 78-128 | | | |
| 1,1-Dichloroethane | 9.75 | 0.04 | 0.20 | ug/L | 10.0 | | 97.5 | 76-124 | | | |
| cis-1,2-Dichloroethene | 9.93 | 0.08 | 0.20 | ug/L | 10.0 | | 99.3 | 80-121 | | | |
| Chloroform | 9.82 | 0.05 | 0.20 | ug/L | 10.0 | | 98.2 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 79-123 | | | |
| Carbon tetrachloride | 8.94 | 0.09 | 0.20 | ug/L | 10.0 | | 89.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.65 | 0.08 | 0.20 | ug/L | 10.0 | | 96.5 | 75-123 | | | |
| Benzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Trichloroethene | 9.94 | 0.07 | 0.20 | ug/L | 10.0 | | 99.4 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 49.3 | 1.90 | 5.00 | ug/L | 50.0 | | 98.7 | 67-133 | | | |
| Toluene | 10.2 | 0.05 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| 2-Hexanone | 50.2 | 2.06 | 5.00 | ug/L | 50.0 | | 100 | 69-133 | | | |
| Tetrachloroethene | 9.75 | 0.09 | 0.20 | ug/L | 10.0 | | 97.5 | 80-120 | | | |
| Chlorobenzene | 10.1 | 0.06 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Ethylbenzene | 10.1 | 0.05 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| m,p-Xylene | 21.4 | 0.14 | 0.40 | ug/L | 20.0 | | 107 | 80-121 | | | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | | | |
| Xylenes, total | 31.9 | 0.22 | 0.60 | ug/L | 30.0 | | 106 | 76-127 | | | |
| Styrene | 10.9 | 0.09 | 0.20 | ug/L | 10.0 | | 109 | 80-124 | | | |
| n-Propylbenzene | 10.9 | 0.07 | 0.20 | ug/L | 10.0 | | 109 | 78-130 | | | |
| Isopropyl Benzene | 10.8 | 0.07 | 0.20 | ug/L | 10.0 | | 108 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 80-129 | | | |

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| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0325-BS1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 14:56 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.3 | 0.05 | 0.20 | ug/L | 10.0 | | 113 | 80-127 | | | |
| s-Butylbenzene | 11.3 | 0.06 | 0.20 | ug/L | 10.0 | | 113 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.6 | 0.08 | 0.20 | ug/L | 10.0 | | 116 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.3 | 0.10 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| Naphthalene | 10.4 | 0.27 | 0.50 | ug/L | 10.0 | | 104 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 9.01 | 0.10 | 0.20 | ug/L | 10.0 | | 90.1 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.65 | | | ug/L | *5.00* | | *93.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.03 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.93 | | | ug/L | *5.00* | | *98.6* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.02 | | | ug/L | *5.00* | | *100* | *80-120* | | | |
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| Vinyl Chloride | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 66-133 | 4.81 | 30 | |
| Chloroethane | 11.1 | 0.05 | 0.20 | ug/L | 10.0 | | 111 | 60-155 | 3.86 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 3.87 | 30 | |
| 1,1-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 69-135 | 5.08 | 30 | |
| Methylene Chloride | 9.50 | 0.53 | 1.00 | ug/L | 10.0 | | 95.0 | 65-135 | 3.99 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 4.89 | 30 | |
| trans-1,2-Dichloroethene | 9.85 | 0.07 | 0.20 | ug/L | 10.0 | | 98.5 | 78-128 | 4.85 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 4.64 | 30 | |
| cis-1,2-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 80-121 | 3.56 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 5.25 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 5.10 | 30 | |
| Carbon tetrachloride | 9.21 | 0.09 | 0.20 | ug/L | 10.0 | | 92.1 | 53-137 | 2.97 | 30 | |
| 1,2-Dichloroethane | 10.0 | 0.08 | 0.20 | ug/L | 10.0 | | 100 | 75-123 | 3.59 | 30 | |
| Benzene | 10.7 | 0.05 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 3.08 | 30 | |
| Trichloroethene | 10.3 | 0.07 | 0.20 | ug/L | 10.0 | | 103 | 80-120 | 4.00 | 30 | |
| 4-Methyl-2-Pentanone | 53.9 | 1.90 | 5.00 | ug/L | 50.0 | | 108 | 67-133 | 8.83 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.82 | 30 | |
| 2-Hexanone | 55.2 | 2.06 | 5.00 | ug/L | 50.0 | | 110 | 69-133 | 9.38 | 30 | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 4.31 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.42 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 2.62 | 30 | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0325 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0325-BSD1)** | | | | | Prepared: 13-Feb-2023 Analyzed: 13-Feb-2023 15:17 | | | | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | 1.95 | 30 | |
| o-Xylene | 10.8 | 0.08 | 0.20 | ug/L | 10.0 | | 108 | 80-121 | 2.99 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 2.29 | 30 | |
| Styrene | 11.4 | 0.09 | 0.20 | ug/L | 10.0 | | 114 | 80-124 | 4.06 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 3.47 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 4.22 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 3.58 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 3.24 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 3.15 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 3.34 | 30 | |
| 1,4-Dichlorobenzene | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 3.66 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 5.08 | 30 | |
| Naphthalene | 11.3 | 0.27 | 0.50 | ug/L | 10.0 | | 113 | 50-134 | 8.22 | 30 | |
| Dichlorodifluoromethane | 9.95 | 0.13 | 0.20 | ug/L | 10.0 | | 99.5 | 48-147 | 5.18 | 30 | |
| n-Hexane | 10.6 | 0.10 | 0.20 | ug/L | 10.0 | | 106 | 70-130 | 16.30 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.04 | | | ug/L | *5.00* | | *101* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.87 | | | ug/L | *5.00* | | *97.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.11 | | | ug/L | *5.00* | | *102* | *80-120* | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0351-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 17:11 | | | | | | | |
| Vinyl Chloride | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroethane | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | ND | 0.11 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Methylene Chloride | ND | 0.53 | 1.00 | ug/L | | | | | | | U |
| Carbon Disulfide | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| trans-1,2-Dichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,1-Dichloroethane | ND | 0.04 | 0.20 | ug/L | | | | | | | U |
| cis-1,2-Dichloroethene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Chloroform | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 1,1,1-Trichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Carbon tetrachloride | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichloroethane | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Benzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| Trichloroethene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 4-Methyl-2-Pentanone | ND | 1.90 | 5.00 | ug/L | | | | | | | U |
| Toluene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| 2-Hexanone | ND | 2.06 | 5.00 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| Chlorobenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| Ethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| m,p-Xylene | ND | 0.14 | 0.40 | ug/L | | | | | | | U |
| o-Xylene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Xylenes, total | ND | 0.22 | 0.60 | ug/L | | | | | | | U |
| Styrene | ND | 0.09 | 0.20 | ug/L | | | | | | | U |
| n-Propylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| Isopropyl Benzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,3,5-Trimethylbenzene | ND | 0.07 | 0.20 | ug/L | | | | | | | U |
| 1,2,4-Trimethylbenzene | ND | 0.05 | 0.20 | ug/L | | | | | | | U |
| s-Butylbenzene | ND | 0.06 | 0.20 | ug/L | | | | | | | U |
| 4-Isopropyl Toluene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| 1,4-Dichlorobenzene | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| 1,2-Dichlorobenzene | ND | 0.08 | 0.20 | ug/L | | | | | | | U |
| Naphthalene | ND | 0.27 | 0.50 | ug/L | | | | | | | U |
| Dichlorodifluoromethane | ND | 0.13 | 0.20 | ug/L | | | | | | | U |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0351-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 17:11 | | | | | | | |
| n-Hexane | ND | 0.10 | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.43 | | | ug/L | *5.00* | | *109* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.96 | | | ug/L | *5.00* | | *99.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.72 | | | ug/L | *5.00* | | *94.4* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 5.07 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| **LCS (BLB0351-BS1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:25 | | | | | | | |
| Vinyl Chloride | 9.99 | 0.08 | 0.20 | ug/L | 10.0 | | 99.9 | 66-133 | | | |
| Chloroethane | 9.97 | 0.05 | 0.20 | ug/L | 10.0 | | 99.7 | 60-155 | | | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.5 | 0.11 | 0.20 | ug/L | 10.0 | | 105 | 76-129 | | | |
| 1,1-Dichloroethene | 10.3 | 0.08 | 0.20 | ug/L | 10.0 | | 103 | 69-135 | | | |
| Methylene Chloride | 9.36 | 0.53 | 1.00 | ug/L | 10.0 | | 93.6 | 65-135 | | | |
| Carbon Disulfide | 10.2 | 0.06 | 0.20 | ug/L | 10.0 | | 102 | 78-125 | | | |
| trans-1,2-Dichloroethene | 11.0 | 0.07 | 0.20 | ug/L | 10.0 | | 110 | 78-128 | | | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | | | |
| cis-1,2-Dichloroethene | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 80-121 | | | |
| Chloroform | 10.3 | 0.05 | 0.20 | ug/L | 10.0 | | 103 | 80-122 | | | |
| 1,1,1-Trichloroethane | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | | 107 | 79-123 | | | |
| Carbon tetrachloride | 8.84 | 0.09 | 0.20 | ug/L | 10.0 | | 88.4 | 53-137 | | | |
| 1,2-Dichloroethane | 9.94 | 0.08 | 0.20 | ug/L | 10.0 | | 99.4 | 75-123 | | | |
| Benzene | 10.5 | 0.05 | 0.20 | ug/L | 10.0 | | 105 | 80-120 | | | |
| Trichloroethene | 10.1 | 0.07 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | | | |
| 4-Methyl-2-Pentanone | 47.3 | 1.90 | 5.00 | ug/L | 50.0 | | 94.5 | 67-133 | | | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| 2-Hexanone | 47.7 | 2.06 | 5.00 | ug/L | 50.0 | | 95.3 | 69-133 | | | |
| Tetrachloroethene | 10.2 | 0.09 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | | | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Ethylbenzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | | | |
| m,p-Xylene | 21.8 | 0.14 | 0.40 | ug/L | 20.0 | | 109 | 80-121 | | | |
| o-Xylene | 10.7 | 0.08 | 0.20 | ug/L | 10.0 | | 107 | 80-121 | | | |
| Xylenes, total | 32.5 | 0.22 | 0.60 | ug/L | 30.0 | | 108 | 76-127 | | | |
| Styrene | 11.3 | 0.09 | 0.20 | ug/L | 10.0 | | 113 | 80-124 | | | |
| n-Propylbenzene | 11.1 | 0.07 | 0.20 | ug/L | 10.0 | | 111 | 78-130 | | | |
| Isopropyl Benzene | 11.0 | 0.07 | 0.20 | ug/L | 10.0 | | 110 | 80-128 | | | |
| 1,3,5-Trimethylbenzene | 11.6 | 0.07 | 0.20 | ug/L | 10.0 | | 116 | 80-129 | | | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BLB0351-BS1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:25 | | | | | | |
| 1,2,4-Trimethylbenzene | 11.6 | 0.05 | 0.20 | ug/L | 10.0 | | 116 | 80-127 | | | |
| s-Butylbenzene | 11.4 | 0.06 | 0.20 | ug/L | 10.0 | | 114 | 78-129 | | | |
| 4-Isopropyl Toluene | 11.8 | 0.08 | 0.20 | ug/L | 10.0 | | 118 | 79-130 | | | |
| 1,4-Dichlorobenzene | 10.5 | 0.10 | 0.20 | ug/L | 10.0 | | 105 | 80-120 | | | |
| 1,2-Dichlorobenzene | 10.4 | 0.08 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | | | |
| Naphthalene | 9.90 | 0.27 | 0.50 | ug/L | 10.0 | | 99.0 | 50-134 | | | |
| Dichlorodifluoromethane | 10.5 | 0.13 | 0.20 | ug/L | 10.0 | | 105 | 48-147 | | | |
| n-Hexane | 10.4 | 0.10 | 0.20 | ug/L | 10.0 | | 104 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.90 | | | ug/L | *5.00* | | *98.0* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5.06 | | | ug/L | *5.00* | | *101* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.80 | | | ug/L | *5.00* | | *96.0* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 4.96 | | | ug/L | *5.00* | | *99.1* | *80-120* | | | |
| **LCS Dup (BLB0351-BSD1)** | | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:45 | | | | | | |
| Vinyl Chloride | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 66-133 | 1.47 | 30 | |
| Chloroethane | 10.5 | 0.05 | 0.20 | ug/L | 10.0 | | 105 | 60-155 | 4.77 | 30 | |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 10.2 | 0.11 | 0.20 | ug/L | 10.0 | | 102 | 76-129 | 2.28 | 30 | |
| 1,1-Dichloroethene | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 69-135 | 0.72 | 30 | |
| Methylene Chloride | 9.36 | 0.53 | 1.00 | ug/L | 10.0 | | 93.6 | 65-135 | 0.01 | 30 | |
| Carbon Disulfide | 10.3 | 0.06 | 0.20 | ug/L | 10.0 | | 103 | 78-125 | 0.43 | 30 | |
| trans-1,2-Dichloroethene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-128 | 3.28 | 30 | |
| 1,1-Dichloroethane | 10.2 | 0.04 | 0.20 | ug/L | 10.0 | | 102 | 76-124 | 0.47 | 30 | |
| cis-1,2-Dichloroethene | 10.2 | 0.08 | 0.20 | ug/L | 10.0 | | 102 | 80-121 | 1.50 | 30 | |
| Chloroform | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-122 | 0.92 | 30 | |
| 1,1,1-Trichloroethane | 10.9 | 0.08 | 0.20 | ug/L | 10.0 | | 109 | 79-123 | 1.08 | 30 | |
| Carbon tetrachloride | 9.04 | 0.09 | 0.20 | ug/L | 10.0 | | 90.4 | 53-137 | 2.21 | 30 | |
| 1,2-Dichloroethane | 10.1 | 0.08 | 0.20 | ug/L | 10.0 | | 101 | 75-123 | 1.62 | 30 | |
| Benzene | 10.6 | 0.05 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 0.69 | 30 | |
| Trichloroethene | 10.2 | 0.07 | 0.20 | ug/L | 10.0 | | 102 | 80-120 | 0.63 | 30 | |
| 4-Methyl-2-Pentanone | 51.1 | 1.90 | 5.00 | ug/L | 50.0 | | 102 | 67-133 | 7.69 | 30 | |
| Toluene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 0.05 | 30 | |
| 2-Hexanone | 52.1 | 2.06 | 5.00 | ug/L | 50.0 | | 104 | 69-133 | 8.91 | 30 | |
| Tetrachloroethene | 10.1 | 0.09 | 0.20 | ug/L | 10.0 | | 101 | 80-120 | 0.94 | 30 | |
| Chlorobenzene | 10.4 | 0.06 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 0.05 | 30 | |
| Ethylbenzene | 10.4 | 0.05 | 0.20 | ug/L | 10.0 | | 104 | 80-120 | 1.88 | 30 | |

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|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - Quality Control

### Batch BLB0351 - EPA 8260D

Instrument: NT2 Analyst: PKC

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCS Dup (BLB0351-BSD1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 15:45 | | | | | | | |
| m,p-Xylene | 22.1 | 0.14 | 0.40 | ug/L | 20.0 | | 110 | 80-121 | 1.16 | 30 | |
| o-Xylene | 10.5 | 0.08 | 0.20 | ug/L | 10.0 | | 105 | 80-121 | 1.36 | 30 | |
| Xylenes, total | 32.6 | 0.22 | 0.60 | ug/L | 30.0 | | 109 | 76-127 | 0.34 | 30 | |
| Styrene | 11.3 | 0.09 | 0.20 | ug/L | 10.0 | | 113 | 80-124 | 0.14 | 30 | |
| n-Propylbenzene | 11.3 | 0.07 | 0.20 | ug/L | 10.0 | | 113 | 78-130 | 1.45 | 30 | |
| Isopropyl Benzene | 11.2 | 0.07 | 0.20 | ug/L | 10.0 | | 112 | 80-128 | 1.97 | 30 | |
| 1,3,5-Trimethylbenzene | 11.7 | 0.07 | 0.20 | ug/L | 10.0 | | 117 | 80-129 | 0.31 | 30 | |
| 1,2,4-Trimethylbenzene | 11.7 | 0.05 | 0.20 | ug/L | 10.0 | | 117 | 80-127 | 1.14 | 30 | |
| s-Butylbenzene | 11.6 | 0.06 | 0.20 | ug/L | 10.0 | | 116 | 78-129 | 1.80 | 30 | |
| 4-Isopropyl Toluene | 12.0 | 0.08 | 0.20 | ug/L | 10.0 | | 120 | 79-130 | 1.52 | 30 | |
| 1,4-Dichlorobenzene | 10.7 | 0.10 | 0.20 | ug/L | 10.0 | | 107 | 80-120 | 1.55 | 30 | |
| 1,2-Dichlorobenzene | 10.6 | 0.08 | 0.20 | ug/L | 10.0 | | 106 | 80-120 | 2.42 | 30 | |
| Naphthalene | 10.8 | 0.27 | 0.50 | ug/L | 10.0 | | 108 | 50-134 | 8.98 | 30 | |
| Dichlorodifluoromethane | 10.6 | 0.13 | 0.20 | ug/L | 10.0 | | 106 | 48-147 | 0.99 | 30 | |
| n-Hexane | 10.5 | 0.10 | 0.20 | ug/L | 10.0 | | 105 | 70-130 | 0.45 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.91 | | | ug/L | *5.00* | | *98.3* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.99 | | | ug/L | *5.00* | | *99.8* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4.71 | | | ug/L | *5.00* | | *94.1* | *80-120* | | | |
| *Surrogate: 1,2-Dichlorobenzene-d4* | 4.88 | | | ug/L | *5.00* | | *97.6* | *80-120* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0339 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0339-BLK1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:52 | | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5320 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4940 | | | ug/L | *5000* | | *98.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 4860 | | | ug/L | *5000* | | *97.2* | *75-125* | | | |
| **LCS (BLB0339-BS1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 10:30 | | | | | | | |
| Vinyl chloride | 2.36 | 0.00501 | 0.0200 | ug/L | 2.00 | | 118 | 62-141 | | | |
| Tetrachloroethene | 2.07 | 0.00682 | 0.0200 | ug/L | 2.00 | | 103 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5400 | | | ug/L | *5000* | | *108* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5420 | | | ug/L | *5000* | | *108* | *75-125* | | | |
| **LCS Dup (BLB0339-BSD1)** | | | | Prepared: 14-Feb-2023 Analyzed: 14-Feb-2023 11:11 | | | | | | | |
| Vinyl chloride | 2.16 | 0.00501 | 0.0200 | ug/L | 2.00 | | 108 | 62-141 | 9.20 | 30 | |
| Tetrachloroethene | 1.93 | 0.00682 | 0.0200 | ug/L | 2.00 | | 96.7 | 76-127 | 6.58 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5400 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 5280 | | | ug/L | *5000* | | *106* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5380 | | | ug/L | *5000* | | *108* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0419 - EPA 8260D-SIM

Instrument: NT16 Analyst: PB

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0419-BLK1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 12:25 | | | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4630 | | | ug/L | *5000* | | *92.6* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5230 | | | ug/L | *5000* | | *105* | *75-125* | | | |
| **LCS (BLB0419-BS1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 10:24 | | | | | | |
| Vinyl chloride | 2.04 | 0.00501 | 0.0200 | ug/L | 2.00 | | 102 | 62-141 | | | |
| Tetrachloroethene | 1.91 | 0.00682 | 0.0200 | ug/L | 2.00 | | 95.7 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5290 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4870 | | | ug/L | *5000* | | *97.4* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5550 | | | ug/L | *5000* | | *111* | *75-125* | | | |
| **LCS Dup (BLB0419-BSD1)** | | | | | Prepared: 16-Feb-2023 Analyzed: 16-Feb-2023 12:04 | | | | | | |
| Vinyl chloride | 2.24 | 0.00501 | 0.0200 | ug/L | 2.00 | | 112 | 62-141 | 9.65 | 30 | |
| Tetrachloroethene | 1.99 | 0.00682 | 0.0200 | ug/L | 2.00 | | 99.6 | 76-127 | 4.02 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5290 | | | ug/L | *5000* | | *106* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4840 | | | ug/L | *5000* | | *96.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5550 | | | ug/L | *5000* | | *111* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

**Analysis by: Analytical Resources, LLC**

## Volatile Organic Compounds - SIM - Quality Control

### Batch BLB0603 - EPA 8260D-SIM

Instrument: NT16 Analyst: KOTT

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BLB0603-BLK1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 10:37 | | | | |
| Vinyl chloride | ND | 0.00501 | 0.0200 | ug/L | | | | | | | U |
| Tetrachloroethene | ND | 0.00682 | 0.0200 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5520 | | | ug/L | *5000* | | *110* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4660 | | | ug/L | *5000* | | *93.3* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5260 | | | ug/L | *5000* | | *105* | *75-125* | | | |
| **LCS (BLB0603-BS1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 09:20 | | | | |
| Vinyl chloride | 1.97 | 0.00501 | 0.0200 | ug/L | 2.00 | | 98.5 | 62-141 | | | |
| Tetrachloroethene | 1.81 | 0.00682 | 0.0200 | ug/L | 2.00 | | 90.3 | 76-127 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5410 | | | ug/L | *5000* | | *108* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4840 | | | ug/L | *5000* | | *96.9* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5510 | | | ug/L | *5000* | | *110* | *75-125* | | | |
| **LCS Dup (BLB0603-BSD1)** | | | | | Prepared: 23-Feb-2023 | | Analyzed: 23-Feb-2023 10:16 | | | | |
| Vinyl chloride | 1.90 | 0.00501 | 0.0200 | ug/L | 2.00 | | 95.0 | 62-141 | 3.60 | 30 | |
| Tetrachloroethene | 1.70 | 0.00682 | 0.0200 | ug/L | 2.00 | | 85.1 | 76-127 | 5.87 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 5350 | | | ug/L | *5000* | | *107* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4830 | | | ug/L | *5000* | | *96.7* | *80-120* | | | |
| *Surrogate: 4-Bromofluorobenzene* | 5500 | | | ug/L | *5000* | | *110* | *75-125* | | | |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 8260D in Water*** | |
| Chloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichlorofluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrolein | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Acetone | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Iodomethane | DoD-ELAP,NELAP,WADOE |
| Methylene Chloride | DoD-ELAP,ADEC,NELAP,WADOE |
| Acrylonitrile | DoD-ELAP,NELAP,WADOE |
| Carbon Disulfide | DoD-ELAP,NELAP,WADOE |
| trans-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Vinyl Acetate | DoD-ELAP,NELAP,WADOE |
| 1,1-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Butanone | DoD-ELAP,NELAP,WADOE |
| 2,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| cis-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Chloroform | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Carbon tetrachloride | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Benzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Trichloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Bromodichloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromomethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 2-Chloroethyl vinyl ether | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Methyl-2-Pentanone | DoD-ELAP,NELAP,WADOE |
| cis-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |
| Toluene | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

| | |
|---|---|
| 2-Hexanone | DoD-ELAP,NELAP,WADOE |
| 1,1,2-Trichloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,3-Dichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| Tetrachloroethene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dibromochloromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromoethane | DoD-ELAP,NELAP,WADOE |
| Chlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Ethylbenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,1,1,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| m,p-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| o-Xylene | DoD-ELAP,ADEC,NELAP,WADOE |
| Styrene | DoD-ELAP,NELAP,WADOE |
| Bromoform | DoD-ELAP,NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| trans-1,4-Dichloro 2-Butene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Propylbenzene | DoD-ELAP,NELAP,WADOE |
| Bromobenzene | DoD-ELAP,NELAP,WADOE |
| Isopropyl Benzene | DoD-ELAP,NELAP,WADOE |
| 2-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| 4-Chlorotoluene | DoD-ELAP,ADEC,NELAP,WADOE |
| t-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,3,5-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2,4-Trimethylbenzene | DoD-ELAP,NELAP,WADOE |
| s-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 4-Isopropyl Toluene | DoD-ELAP,NELAP,WADOE |
| 1,3-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,4-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Butylbenzene | DoD-ELAP,NELAP,WADOE |
| 1,2-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2-Dibromo-3-chloropropane | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,4-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Hexachloro-1,3-Butadiene | DoD-ELAP,ADEC,NELAP,WADOE |
| Naphthalene | DoD-ELAP,ADEC,NELAP,WADOE |
| 1,2,3-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,WADOE |
| Dichlorodifluoromethane | DoD-ELAP,ADEC,NELAP,WADOE |
| Methyl tert-butyl Ether | DoD-ELAP,ADEC,NELAP,WADOE |
| n-Hexane | WADOE |
| 2-Pentanone | WADOE |

| | | |
|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: Natasya Gray | 27-Feb-2023 17:57 |

***EPA 8260D-SIM in Water***

| | |
|---|---|
| Acrylonitrile | NELAP,WADOE |
| Vinyl chloride | NELAP,WADOE |
| 1,1-Dichloroethene | NELAP,WADOE |
| cis-1,2-Dichloroethene | NELAP,WADOE |
| trans-1,2-Dichloroethene | NELAP,WADOE |
| Trichloroethene | NELAP,WADOE |
| Tetrachloroethene | NELAP,WADOE |
| 1,1,2,2-Tetrachloroethane | NELAP,WADOE |
| 1,2-Dichloroethane | NELAP,WADOE |
| Benzene | NELAP,WADOE |

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | 17-015 | 03/28/2023 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program, PJLA Testing | 66169 | 02/28/2023 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006-012 | 05/12/2023 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2023 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2023 |

| | | | |
|---|---|---|---|
| Dalton, Olmsted & Fuglevand, Inc | Project: | Georgetown | |
| 1420 - 156th Ave., NE STE C1 | Project Number: | Georgetown/CLE-001(375.01) | **Reported:** |
| Bellevue WA, 98007 | Project Manager: | Natasya Gray | 27-Feb-2023 17:57 |

## Notes and Definitions

| | |
|---|---|
| * | Flagged value is not within established control limits. |
| J | Estimated concentration value detected below the reporting limit. |
| M | Estimated value for a GC/MS analyte detected and confirmed by an analyst but with low spectral match parameters. |
| U | This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD). |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

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2/22/2023
Mr. Duane Beery
Stericycle Environmental Solutions, Inc.
18000 72nd Ave. S
Suite 217
Kent WA 98032

Project Name: Georgetown
Project #: CLE-001 375.09
Workorder #: 2302212

Dear Mr. Duane Beery

The following report includes the data for the above referenced project for sample(s) received on 2/9/2023 at Eurofins Air Toxics LLC.

The data and associated QC analyzed by Modified TO-14A 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 Eurofins Air Toxics LLC. for your air analysis needs. Eurofins Air Toxics Inc. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Monica Tran at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Monica Tran

Project Manager

eurofins | Air Toxics

# WORK ORDER #: 2302212

Work Order Summary

| | | | |
|---|---|---|---|
| **CLIENT:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 | **BILL TO:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 |
| **PHONE:** | 425-227-6128 | **P.O. #** | |
| **FAX:** | | **PROJECT #** | CLE-001 375.09 Georgetown |
| **DATE RECEIVED:** | 02/09/2023 | **CONTACT:** | Monica Tran |
| **DATE COMPLETED:** | 02/22/2023 | | |

| FRACTION # | NAME | TEST | RECEIPT VAC./PRES. | FINAL PRESSURE |
|---|---|---|---|---|
| 01A | TE-707L-AA1-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 01B | TE-707L-AA1-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 02A | TE-707L-IA1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 02B | TE-707L-IA1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 03A | TE-707L-IA2-0223 | Modified TO-14A | 6.9 "Hg | 1.9 psi |
| 03B | TE-707L-IA2-0223 | Modified TO-14A | 6.9 "Hg | 1.9 psi |
| 04A | AS-710L-IA1-0223 | Modified TO-14A | 6.3 "Hg | 1.9 psi |
| 04B | AS-710L-IA1-0223 | Modified TO-14A | 6.3 "Hg | 1.9 psi |
| 05A | AS-710L-IA2-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 05B | AS-710L-IA2-0223 | Modified TO-14A | 5.7 "Hg | 1.9 psi |
| 06A | AS-710L-IA3-0223 | Modified TO-14A | 6.9 "Hg | 1.6 psi |
| 06B | AS-710L-IA3-0223 | Modified TO-14A | 6.9 "Hg | 1.6 psi |
| 07A | AS-710-SG1-0223 | Modified TO-14A | 4.9 "Hg | 1.9 psi |
| 07B | AS-710-SG1-0223 | Modified TO-14A | 4.9 "Hg | 1.9 psi |
| 08A | AS-710-SG2-0223 | Modified TO-14A | 3.9 "Hg | 1.9 psi |
| 08B | AS-710-SG2-0223 | Modified TO-14A | 3.9 "Hg | 1.9 psi |
| 09A | TE-707L-SG1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 09B | TE-707L-SG1-0223 | Modified TO-14A | 6.5 "Hg | 1.9 psi |
| 10A | TE-707L-SG2-0223 | Modified TO-14A | 6.1 "Hg | 1.9 psi |
| 10B | TE-707L-SG2-0223 | Modified TO-14A | 6.1 "Hg | 1.9 psi |
| 11A | Lab Blank | Modified TO-14A | NA | NA |
| 11B | Lab Blank | Modified TO-14A | NA | NA |
| 11C | Lab Blank | Modified TO-14A | NA | NA |

Continued on next page

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# WORK ORDER #: 2302212

Work Order Summary

| | | | |
|---|---|---|---|
| **CLIENT:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 | **BILL TO:** | Mr. Duane Beery<br>Stericycle Environmental Solutions, Inc.<br>18000 72nd Ave. S<br>Suite 217<br>Kent, WA 98032 |
| **PHONE:** | 425-227-6128 | **P.O. #** | |
| **FAX:** | | **PROJECT #** | CLE-001 375.09 Georgetown |
| **DATE RECEIVED:** | 02/09/2023 | **CONTACT:** | Monica Tran |
| **DATE COMPLETED:** | 02/22/2023 | | |

| FRACTION # | NAME | TEST | RECEIPT VAC./PRES. | FINAL PRESSURE |
|---|---|---|---|---|
| 11D | Lab Blank | Modified TO-14A | NA | NA |
| 11E | Lab Blank | Modified TO-14A | NA | NA |
| 11F | Lab Blank | Modified TO-14A | NA | NA |
| 12A | CCV | Modified TO-14A | NA | NA |
| 12B | CCV | Modified TO-14A | NA | NA |
| 12C | CCV | Modified TO-14A | NA | NA |
| 12D | CCV | Modified TO-14A | NA | NA |
| 12E | CCV | Modified TO-14A | NA | NA |
| 12F | CCV | Modified TO-14A | NA | NA |
| 13A | LCS | Modified TO-14A | NA | NA |
| 13AA | LCSD | Modified TO-14A | NA | NA |
| 13B | LCS | Modified TO-14A | NA | NA |
| 13BB | LCSD | Modified TO-14A | NA | NA |
| 13C | LCS | Modified TO-14A | NA | NA |
| 13CC | LCSD | Modified TO-14A | NA | NA |
| 13D | LCS | Modified TO-14A | NA | NA |
| 13DD | LCSD | Modified TO-14A | NA | NA |
| 13E | LCS | Modified TO-14A | NA | NA |
| 13EE | LCSD | Modified TO-14A | NA | NA |
| 13F | LCS | Modified TO-14A | NA | NA |
| 13FF | LCSD | Modified TO-14A | NA | NA |

CERTIFIED BY: Heidi Hayes DATE: 02/22/23

Technical Director

Certification numbers: AZ Licensure AZ0775, FL NELAP – E87680, LA NELAP – 02089, NH NELAP – 209222, NJ NELAP - CA016, NY NELAP - 11291, TX NELAP – T104704434-22-18, UT NELAP – CA009332022-14, VA NELAP - 12240, WA NELAP - C935
Name of Accreditation Body: NELAP/ORELAP (Oregon Environmental Laboratory Accreditation Program)
Accreditation number: CA300005-017, Effective date: 10/18/2022, Expiration date: 10/17/2023.
Eurofins Air Toxics, LLC certifies that the test results contained in this report meet all requirements of the NELAC standards

*This report shall not be reproduced, except in full, without the written approval of Eurofins Air Toxics, LLC.*

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630
(916) 985-1000 . (800) 985-5955 . FAX (916) 351-8279

**LABORATORY NARRATIVE**
**Modified TO-15 Full Scan/SIM**
**Stericycle Environmental Solutions, Inc.**
**Workorder# 2302212**

Ten 6 Liter Summa Canister (100% SIM Ambient) samples were received on February 09, 2023. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the Full Scan and SIM acquisition modes. The method involves concentrating up to 1.0 liters of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

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

| ***Requirement*** | ***TO-15*** | ***ATL Modifications*** |
|---|---|---|
| ICAL %RSD acceptance criteria | </=30% RSD with 2 compounds allowed out to < 40% RSD | For Full Scan:<br>30% RSD with 4 compounds allowed out to < 40% RSD<br><br>For SIM:<br>Project specific; default criteria is </=30% RSD with 10% of compounds allowed out to < 40% RSD |
| Daily Calibration | +- 30% Difference | For Full Scan:<br></= 30% Difference with four allowed out up to </=40%.; flag and narrate outliers<br><br>For SIM:<br>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

The Chain of Custody (COC) information for sample TE-707L-AA1-0223 did not match the information on the canister with regard to canister barcode. The sample labeled 6L0397 on the COC is labeled as 6L0379 on the canister. The client was notified of the discrepancy and the information on the canister was used to process and report the sample.

## Analytical Notes

The results for each sample in this report were acquired from two separate data files originating from the same analytical run. The two data files have the same base file name and are differentiated with a "sim" extension on the SIM data file.

Non-standard compounds may have different acceptance criteria than the standard TO-14A/TO-15 compound list as per contract or verbal agreement.

**Definition of Data Qualifying Flags**

Nine 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.

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

N - The identification is based on presumptive evidence.

CN - See case narrative explanation

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

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01A**

No Detections Were Found.

**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.42 | 0.068 | 2.0 |
| Benzene | 0.070 | 0.54 | 0.22 | 1.7 |
| 1,2-Dichloroethane | 0.014 | 0.019 | 0.057 | 0.076 |
| Toluene | 0.070 | 0.36 | 0.26 | 1.4 |
| Ethyl Benzene | 0.028 | 0.072 | 0.12 | 0.31 |

**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02A**

No Detections Were Found.

**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.17 | 0.070 | 0.83 |
| Benzene | 0.072 | 0.36 | 0.23 | 1.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.058 | 0.12 |
| Toluene | 0.072 | 4.0 | 0.27 | 15 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.10 | 0.12 | 0.45 |

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03A**

No Detections Were Found.

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.015 | 0.14 | 0.072 | 0.70 |
| Benzene | 0.074 | 0.39 | 0.23 | 1.2 |
| 1,2-Dichloroethane | 0.015 | 0.027 | 0.059 | 0.11 |
| Toluene | 0.074 | 4.6 | 0.28 | 17 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.12 | 0.13 | 0.52 |

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.074 | 0.070 | 0.36 |
| 1,1,1-Trichloroethane | 0.029 | 0.058 | 0.16 | 0.31 |
| Benzene | 0.072 | 0.18 | 0.23 | 0.59 |
| 1,2-Dichloroethane | 0.014 | 0.052 | 0.058 | 0.21 |
| Trichloroethene | 0.014 | 0.016 | 0.077 | 0.084 |
| Toluene | 0.072 | 0.39 | 0.27 | 1.4 |
| Tetrachloroethene | 0.029 | 0.093 | 0.19 | 0.63 |
| Ethyl Benzene | 0.029 | 0.077 | 0.12 | 0.34 |

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.038 | 0.068 | 0.19 |
| Benzene | 0.070 | 0.17 | 0.22 | 0.56 |
| 1,2-Dichloroethane | 0.014 | 0.041 | 0.057 | 0.17 |
| Toluene | 0.070 | 0.45 | 0.26 | 1.7 |
| Ethyl Benzene | 0.028 | 0.094 | 0.12 | 0.41 |

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06A**

No Detections Were Found.

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Chloroform | 0.014 | 0.13 | 0.070 | 0.65 |
| Benzene | 0.072 | 0.26 | 0.23 | 0.82 |
| 1,2-Dichloroethane | 0.014 | 0.049 | 0.058 | 0.20 |
| Toluene | 0.072 | 0.54 | 0.27 | 2.0 |
| Tetrachloroethene | 0.029 | 0.037 | 0.20 | 0.25 |
| Ethyl Benzene | 0.029 | 0.11 | 0.12 | 0.49 |

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.17 | 0.66 | 0.85 |

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.016 | 0.034 | 0.040 |

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

| | | | | |
|---|---|---|---|---|
| 1,1-Dichloroethene | 0.014 | 0.17 | 0.054 | 0.67 |
| 1,1-Dichloroethane | 0.027 | 1.3 | 0.11 | 5.3 |
| Chloroform | 0.014 | 0.22 | 0.066 | 1.0 |
| cis-1,2-Dichloroethene | 0.027 | 0.30 | 0.11 | 1.2 |
| 1,1,1-Trichloroethane | 0.027 | 7.0 | 0.15 | 38 |
| Benzene | 0.068 | 0.65 | 0.22 | 2.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.055 | 0.12 |
| Trichloroethene | 0.014 | 0.038 | 0.072 | 0.20 |
| Toluene | 0.068 | 2.3 | 0.25 | 8.5 |
| Ethyl Benzene | 0.027 | 0.25 | 0.12 | 1.1 |
| trans-1,2-Dichloroethene | 0.14 | 0.34 | 0.54 | 1.4 |

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.13 | 0.20 | 0.64 | 0.96 |

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,1-Dichloroethene | 0.013 | 0.022 | 0.052 | 0.086 |
| 1,1-Dichloroethane | 0.026 | 0.62 | 0.10 | 2.5 |
| Chloroform | 0.013 | 1.2 | 0.063 | 6.1 |
| cis-1,2-Dichloroethene | 0.026 | 0.087 | 0.10 | 0.34 |
| 1,1,1-Trichloroethane | 0.026 | 3.2 | 0.14 | 17 |
| Benzene | 0.065 | 1.8 | 0.21 | 5.7 |
| 1,2-Dichloroethane | 0.013 | 0.035 | 0.053 | 0.14 |
| Trichloroethene | 0.013 | 0.016 | 0.070 | 0.088 |
| Toluene | 0.065 | 2.1 | 0.24 | 8.0 |
| Ethyl Benzene | 0.026 | 0.26 | 0.11 | 1.1 |

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# Summary of Detected Compounds
# MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.34 | 0.71 | 1.7 |

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.029 | 0.037 | 0.075 |
| Chloroform | 0.014 | 0.35 | 0.070 | 1.7 |
| Benzene | 0.072 | 0.94 | 0.23 | 3.0 |
| 1,2-Dichloroethane | 0.014 | 0.027 | 0.058 | 0.11 |
| Toluene | 0.072 | 5.5 | 0.27 | 21 |
| Tetrachloroethene | 0.029 | 0.10 | 0.20 | 0.70 |
| Ethyl Benzene | 0.029 | 0.48 | 0.12 | 2.1 |
| Naphthalene | 0.072 | 0.077 | 0.38 | 0.40 |

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10A**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 0.14 | 0.32 | 0.70 | 1.6 |

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10B**

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.024 | 0.036 | 0.061 |
| Chloroform | 0.014 | 0.12 | 0.069 | 0.58 |
| Benzene | 0.071 | 0.48 | 0.23 | 1.5 |
| 1,2-Dichloroethane | 0.014 | 0.024 | 0.057 | 0.096 |
| Toluene | 0.071 | 6.2 | 0.27 | 23 |
| Tetrachloroethene | 0.028 | 0.070 | 0.19 | 0.47 |
| Ethyl Benzene | 0.028 | 0.44 | 0.12 | 1.9 |

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**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021719** | **Date of Collection: 2/7/23 1:58:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/17/23 10:11 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.70 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| sec-Butylbenzene | 0.70 | Not Detected | 3.8 | Not Detected |
| p-Cymene | 0.70 | Not Detected | 3.8 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

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**Client Sample ID: TE-707L-AA1-0223**

**Lab ID#: 2302212-01B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021719sim** | **Date of Collection: 2/7/23 1:58:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/17/23 10:11 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.070 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.42 | 0.068 | 2.0 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.070 | 0.54 | 0.22 | 1.7 |
| 1,2-Dichloroethane | 0.014 | 0.019 | 0.057 | 0.076 |
| Trichloroethene | 0.014 | Not Detected | 0.075 | Not Detected |
| Toluene | 0.070 | 0.36 | 0.26 | 1.4 |
| Tetrachloroethene | 0.028 | Not Detected | 0.19 | Not Detected |
| Ethyl Benzene | 0.028 | 0.072 | 0.12 | 0.31 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.070 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 98 | 70-130 |
| 4-Bromofluorobenzene | 79 | 70-130 |

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**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021720** | **Date of Collection: 2/7/23 1:59:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/17/23 10:48 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 93 | 70-130 |

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**Client Sample ID: TE-707L-IA1-0223**

**Lab ID#: 2302212-02B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021720sim** | **Date of Collection:** | **2/7/23 1:59:00 PM** |
| **Dil. Factor:** | **1.44** | **Date of Analysis:** | **2/17/23 10:48 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.037 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.17 | 0.070 | 0.83 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.36 | 0.23 | 1.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.058 | 0.12 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 4.0 | 0.27 | 15 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.10 | 0.12 | 0.45 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 84 | 70-130 |

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**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022016** | **Date of Collection: 2/7/23 2:02:00 PM** | |
| **Dil. Factor:** | **1.47** | **Date of Analysis: 2/20/23 06:53 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.74 | Not Detected | 3.0 | Not Detected |
| Propylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.15 | Not Detected | 0.72 | Not Detected |
| sec-Butylbenzene | 0.74 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.74 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 91 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

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**Client Sample ID: TE-707L-IA2-0223**

**Lab ID#: 2302212-03B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022016sim** | **Date of Collection: 2/7/23 2:02:00 PM** | |
| **Dil. Factor:** | **1.47** | **Date of Analysis: 2/20/23 06:53 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.015 | Not Detected | 0.038 | Not Detected |
| Chloroethane | 0.074 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.015 | Not Detected | 0.058 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.015 | 0.14 | 0.072 | 0.70 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.12 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.074 | 0.39 | 0.23 | 1.2 |
| 1,2-Dichloroethane | 0.015 | 0.027 | 0.059 | 0.11 |
| Trichloroethene | 0.015 | Not Detected | 0.079 | Not Detected |
| Toluene | 0.074 | 4.6 | 0.28 | 17 |
| Tetrachloroethene | 0.029 | 0.18 | 0.20 | 1.2 |
| Ethyl Benzene | 0.029 | 0.12 | 0.13 | 0.52 |
| trans-1,2-Dichloroethene | 0.15 | Not Detected | 0.58 | Not Detected |
| Naphthalene | 0.074 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 87 | 70-130 |

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**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022017** | **Date of Collection: 2/7/23 1:50:00 PM** | |
| **Dil. Factor:** | **1.43** | **Date of Analysis: 2/20/23 07:30 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 3.9 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 3.9 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 112 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA1-0223**

**Lab ID#: 2302212-04B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022017sim** | **Date of Collection:** | **2/7/23 1:50:00 PM** |
| **Dil. Factor:** | **1.43** | **Date of Analysis:** | **2/20/23 07:30 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.074 | 0.070 | 0.36 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | 0.058 | 0.16 | 0.31 |
| Benzene | 0.072 | 0.18 | 0.23 | 0.59 |
| 1,2-Dichloroethane | 0.014 | 0.052 | 0.058 | 0.21 |
| Trichloroethene | 0.014 | 0.016 | 0.077 | 0.084 |
| Toluene | 0.072 | 0.39 | 0.27 | 1.4 |
| Tetrachloroethene | 0.029 | 0.093 | 0.19 | 0.63 |
| Ethyl Benzene | 0.029 | 0.077 | 0.12 | 0.34 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022018** | **Date of Collection: 2/7/23 1:54:00 PM** | |
| **Dil. Factor:** | **1.40** | **Date of Analysis: 2/20/23 08:31 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.70 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.69 | Not Detected |
| sec-Butylbenzene | 0.70 | Not Detected | 3.8 | Not Detected |
| p-Cymene | 0.70 | Not Detected | 3.8 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 111 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 99 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA2-0223**

**Lab ID#: 2302212-05B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022018sim** | **Date of Collection:** | **2/7/23 1:54:00 PM** |
| **Dil. Factor:** | **1.40** | **Date of Analysis:** | **2/20/23 08:31 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.036 | Not Detected |
| Chloroethane | 0.070 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.038 | 0.068 | 0.19 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.070 | 0.17 | 0.22 | 0.56 |
| 1,2-Dichloroethane | 0.014 | 0.041 | 0.057 | 0.17 |
| Trichloroethene | 0.014 | Not Detected | 0.075 | Not Detected |
| Toluene | 0.070 | 0.45 | 0.26 | 1.7 |
| Tetrachloroethene | 0.028 | Not Detected | 0.19 | Not Detected |
| Ethyl Benzene | 0.028 | 0.094 | 0.12 | 0.41 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.070 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 114 | 70-130 |
| Toluene-d8 | 97 | 70-130 |
| 4-Bromofluorobenzene | 89 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022019** | **Date of Collection: 2/7/23 1:53:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/20/23 09:07 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 112 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710L-IA3-0223**

**Lab ID#: 2302212-06B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022019sim** | **Date of Collection: 2/7/23 1:53:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/20/23 09:07 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | Not Detected | 0.037 | Not Detected |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.13 | 0.070 | 0.65 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.26 | 0.23 | 0.82 |
| 1,2-Dichloroethane | 0.014 | 0.049 | 0.058 | 0.20 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 0.54 | 0.27 | 2.0 |
| Tetrachloroethene | 0.029 | 0.037 | 0.20 | 0.25 |
| Ethyl Benzene | 0.029 | 0.11 | 0.12 | 0.49 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | Not Detected | 0.38 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 113 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 92 | 70-130 |

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**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022020** | **Date of Collection: 2/8/23 3:20:00 PM** | |
| **Dil. Factor:** | **1.35** | **Date of Analysis: 2/20/23 09:44 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.68 | Not Detected | 2.8 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.66 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.66 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.17 | 0.66 | 0.85 |
| sec-Butylbenzene | 0.68 | Not Detected | 3.7 | Not Detected |
| p-Cymene | 0.68 | Not Detected | 3.7 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 101 | 70-130 |
| Toluene-d8 | 106 | 70-130 |
| 4-Bromofluorobenzene | 103 | 70-130 |

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**Client Sample ID: AS-710-SG1-0223**

**Lab ID#: 2302212-07B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022020sim** | **Date of Collection:** | **2/8/23 3:20:00 PM** |
| **Dil. Factor:** | **1.35** | **Date of Analysis:** | **2/20/23 09:44 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.016 | 0.034 | 0.040 |
| Chloroethane | 0.068 | Not Detected | 0.18 | Not Detected |
| 1,1-Dichloroethene | 0.014 | 0.17 | 0.054 | 0.67 |
| 1,1-Dichloroethane | 0.027 | 1.3 | 0.11 | 5.3 |
| Chloroform | 0.014 | 0.22 | 0.066 | 1.0 |
| cis-1,2-Dichloroethene | 0.027 | 0.30 | 0.11 | 1.2 |
| 1,1,1-Trichloroethane | 0.027 | 7.0 | 0.15 | 38 |
| Benzene | 0.068 | 0.65 | 0.22 | 2.1 |
| 1,2-Dichloroethane | 0.014 | 0.030 | 0.055 | 0.12 |
| Trichloroethene | 0.014 | 0.038 | 0.072 | 0.20 |
| Toluene | 0.068 | 2.3 | 0.25 | 8.5 |
| Tetrachloroethene | 0.027 | Not Detected | 0.18 | Not Detected |
| Ethyl Benzene | 0.027 | 0.25 | 0.12 | 1.1 |
| trans-1,2-Dichloroethene | 0.14 | 0.34 | 0.54 | 1.4 |
| Naphthalene | 0.068 | Not Detected | 0.35 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 101 | 70-130 |
| Toluene-d8 | 107 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

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**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022021** | **Date of Collection: 2/8/23 3:19:00 PM** | |
| **Dil. Factor:** | **1.30** | **Date of Analysis: 2/20/23 10:21 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.65 | Not Detected | 2.7 | Not Detected |
| Propylbenzene | 0.13 | Not Detected | 0.64 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.13 | Not Detected | 0.64 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.13 | 0.20 | 0.64 | 0.96 |
| sec-Butylbenzene | 0.65 | Not Detected | 3.6 | Not Detected |
| p-Cymene | 0.65 | Not Detected | 3.6 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 103 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 108 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: AS-710-SG2-0223**

**Lab ID#: 2302212-08B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022021sim** | **Date of Collection:** | **2/8/23 3:19:00 PM** |
| **Dil. Factor:** | **1.30** | **Date of Analysis:** | **2/20/23 10:21 PM** |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.013 | Not Detected | 0.033 | Not Detected |
| Chloroethane | 0.065 | Not Detected | 0.17 | Not Detected |
| 1,1-Dichloroethene | 0.013 | 0.022 | 0.052 | 0.086 |
| 1,1-Dichloroethane | 0.026 | 0.62 | 0.10 | 2.5 |
| Chloroform | 0.013 | 1.2 | 0.063 | 6.1 |
| cis-1,2-Dichloroethene | 0.026 | 0.087 | 0.10 | 0.34 |
| 1,1,1-Trichloroethane | 0.026 | 3.2 | 0.14 | 17 |
| Benzene | 0.065 | 1.8 | 0.21 | 5.7 |
| 1,2-Dichloroethane | 0.013 | 0.035 | 0.053 | 0.14 |
| Trichloroethene | 0.013 | 0.016 | 0.070 | 0.088 |
| Toluene | 0.065 | 2.1 | 0.24 | 8.0 |
| Tetrachloroethene | 0.026 | Not Detected | 0.18 | Not Detected |
| Ethyl Benzene | 0.026 | 0.26 | 0.11 | 1.1 |
| trans-1,2-Dichloroethene | 0.13 | Not Detected | 0.52 | Not Detected |
| Naphthalene | 0.065 | Not Detected | 0.34 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 102 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022108** | **Date of Collection: 2/8/23 3:29:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/21/23 12:05 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.72 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.71 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.34 | 0.71 | 1.7 |
| sec-Butylbenzene | 0.72 | Not Detected | 4.0 | Not Detected |
| p-Cymene | 0.72 | Not Detected | 4.0 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG1-0223**

**Lab ID#: 2302212-09B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022108sim** | **Date of Collection: 2/8/23 3:29:00 PM** | |
| **Dil. Factor:** | **1.44** | **Date of Analysis: 2/21/23 12:05 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.029 | 0.037 | 0.075 |
| Chloroethane | 0.072 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.057 | Not Detected |
| 1,1-Dichloroethane | 0.029 | Not Detected | 0.12 | Not Detected |
| Chloroform | 0.014 | 0.35 | 0.070 | 1.7 |
| cis-1,2-Dichloroethene | 0.029 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.029 | Not Detected | 0.16 | Not Detected |
| Benzene | 0.072 | 0.94 | 0.23 | 3.0 |
| 1,2-Dichloroethane | 0.014 | 0.027 | 0.058 | 0.11 |
| Trichloroethene | 0.014 | Not Detected | 0.077 | Not Detected |
| Toluene | 0.072 | 5.5 | 0.27 | 21 |
| Tetrachloroethene | 0.029 | 0.10 | 0.20 | 0.70 |
| Ethyl Benzene | 0.029 | 0.48 | 0.12 | 2.1 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.57 | Not Detected |
| Naphthalene | 0.072 | 0.077 | 0.38 | 0.40 |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022109** | **Date of Collection: 2/8/23 3:36:00 PM** | |
| **Dil. Factor:** | **1.42** | **Date of Analysis: 2/21/23 12:52 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.71 | Not Detected | 2.9 | Not Detected |
| Propylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.14 | Not Detected | 0.70 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.14 | 0.32 | 0.70 | 1.6 |
| sec-Butylbenzene | 0.71 | Not Detected | 3.9 | Not Detected |
| p-Cymene | 0.71 | Not Detected | 3.9 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 90 | 70-130 |
| 4-Bromofluorobenzene | 104 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: TE-707L-SG2-0223**

**Lab ID#: 2302212-10B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022109sim** | **Date of Collection: 2/8/23 3:36:00 PM** | |
| **Dil. Factor:** | **1.42** | **Date of Analysis: 2/21/23 12:52 PM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.014 | 0.024 | 0.036 | 0.061 |
| Chloroethane | 0.071 | Not Detected | 0.19 | Not Detected |
| 1,1-Dichloroethene | 0.014 | Not Detected | 0.056 | Not Detected |
| 1,1-Dichloroethane | 0.028 | Not Detected | 0.11 | Not Detected |
| Chloroform | 0.014 | 0.12 | 0.069 | 0.58 |
| cis-1,2-Dichloroethene | 0.028 | Not Detected | 0.11 | Not Detected |
| 1,1,1-Trichloroethane | 0.028 | Not Detected | 0.15 | Not Detected |
| Benzene | 0.071 | 0.48 | 0.23 | 1.5 |
| 1,2-Dichloroethane | 0.014 | 0.024 | 0.057 | 0.096 |
| Trichloroethene | 0.014 | Not Detected | 0.076 | Not Detected |
| Toluene | 0.071 | 6.2 | 0.27 | 23 |
| Tetrachloroethene | 0.028 | 0.070 | 0.19 | 0.47 |
| Ethyl Benzene | 0.028 | 0.44 | 0.12 | 1.9 |
| trans-1,2-Dichloroethene | 0.14 | Not Detected | 0.56 | Not Detected |
| Naphthalene | 0.071 | Not Detected | 0.37 | Not Detected |

**Container Type: 6 Liter Summa Canister (100% SIM Ambient)**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 108 | 70-130 |
| Toluene-d8 | 90 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021707a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 11:46 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 94 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021707sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 11:46 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 107 | 70-130 |
| Toluene-d8 | 95 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022006a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 10:45 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 95 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

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**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022006sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 10:45 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 99 | 70-130 |
| Toluene-d8 | 96 | 70-130 |
| 4-Bromofluorobenzene | 86 | 70-130 |

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**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022107a** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 11:01 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| 2-Hexanone | 0.50 | Not Detected | 2.0 | Not Detected |
| Propylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,3,5-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| 1,2,4-Trimethylbenzene | 0.10 | Not Detected | 0.49 | Not Detected |
| sec-Butylbenzene | 0.50 | Not Detected | 2.7 | Not Detected |
| p-Cymene | 0.50 | Not Detected | 2.7 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 103 | 70-130 |
| Toluene-d8 | 92 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

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**Client Sample ID: Lab Blank**

**Lab ID#: 2302212-11F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022107sima** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 11:01 AM** | |

| Compound | Rpt. Limit (ppbv) | Amount (ppbv) | Rpt. Limit (ug/m3) | Amount (ug/m3) |
|---|---|---|---|---|
| Vinyl Chloride | 0.010 | Not Detected | 0.026 | Not Detected |
| Chloroethane | 0.050 | Not Detected | 0.13 | Not Detected |
| 1,1-Dichloroethene | 0.010 | Not Detected | 0.040 | Not Detected |
| 1,1-Dichloroethane | 0.020 | Not Detected | 0.081 | Not Detected |
| Chloroform | 0.010 | Not Detected | 0.049 | Not Detected |
| cis-1,2-Dichloroethene | 0.020 | Not Detected | 0.079 | Not Detected |
| 1,1,1-Trichloroethane | 0.020 | Not Detected | 0.11 | Not Detected |
| Benzene | 0.050 | Not Detected | 0.16 | Not Detected |
| 1,2-Dichloroethane | 0.010 | Not Detected | 0.040 | Not Detected |
| Trichloroethene | 0.010 | Not Detected | 0.054 | Not Detected |
| Toluene | 0.050 | Not Detected | 0.19 | Not Detected |
| Tetrachloroethene | 0.020 | Not Detected | 0.14 | Not Detected |
| Ethyl Benzene | 0.020 | Not Detected | 0.087 | Not Detected |
| trans-1,2-Dichloroethene | 0.10 | Not Detected | 0.40 | Not Detected |
| Naphthalene | 0.050 | Not Detected | 0.26 | Not Detected |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 105 | 70-130 |
| Toluene-d8 | 93 | 70-130 |
| 4-Bromofluorobenzene | 88 | 70-130 |

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**Client Sample ID: CCV**

**Lab ID#: 2302212-12A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021703** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 08:54 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 112 |
| Propylbenzene | 108 |
| 1,3,5-Trimethylbenzene | 112 |
| 1,2,4-Trimethylbenzene | 113 |
| sec-Butylbenzene | 118 |
| p-Cymene | 109 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 100 | 70-130 |

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**Client Sample ID: CCV**

**Lab ID#: 2302212-12B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021703sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 08:54 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 101 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 84 |
| 1,1-Dichloroethane | 93 |
| Chloroform | 88 |
| cis-1,2-Dichloroethene | 95 |
| 1,1,1-Trichloroethane | 87 |
| Benzene | 95 |
| 1,2-Dichloroethane | 89 |
| Trichloroethene | 90 |
| Toluene | 100 |
| Tetrachloroethene | 89 |
| Ethyl Benzene | 107 |
| trans-1,2-Dichloroethene | 92 |
| Naphthalene | 75 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 96 | 70-130 |
| Toluene-d8 | 116 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

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**Client Sample ID: CCV**

**Lab ID#: 2302212-12C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022002** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 07:54 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 109 |
| Propylbenzene | 109 |
| 1,3,5-Trimethylbenzene | 114 |
| 1,2,4-Trimethylbenzene | 115 |
| sec-Butylbenzene | 121 |
| p-Cymene | 111 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 117 | 70-130 |
| 4-Bromofluorobenzene | 100 | 70-130 |

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**Client Sample ID: CCV**

**Lab ID#: 2302212-12D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022002sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 07:54 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 99 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 83 |
| 1,1-Dichloroethane | 93 |
| Chloroform | 88 |
| cis-1,2-Dichloroethene | 93 |
| 1,1,1-Trichloroethane | 88 |
| Benzene | 97 |
| 1,2-Dichloroethane | 91 |
| Trichloroethene | 91 |
| Toluene | 101 |
| Tetrachloroethene | 90 |
| Ethyl Benzene | 109 |
| trans-1,2-Dichloroethene | 92 |
| Naphthalene | 72 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 118 | 70-130 |
| 4-Bromofluorobenzene | 96 | 70-130 |

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**Client Sample ID: CCV**

**Lab ID#: 2302212-12E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022102** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 06:59 AM** | |

| Compound | %Recovery |
|---|---|
| 2-Hexanone | 110 |
| Propylbenzene | 115 |
| 1,3,5-Trimethylbenzene | 118 |
| 1,2,4-Trimethylbenzene | 119 |
| sec-Butylbenzene | 128 |
| p-Cymene | 116 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 99 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 106 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: CCV**

**Lab ID#: 2302212-12F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022102sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 06:59 AM** | |

| Compound | %Recovery |
|---|---|
| Vinyl Chloride | 97 |
| Chloroethane | 95 |
| 1,1-Dichloroethene | 87 |
| 1,1-Dichloroethane | 94 |
| Chloroform | 90 |
| cis-1,2-Dichloroethene | 95 |
| 1,1,1-Trichloroethane | 92 |
| Benzene | 95 |
| 1,2-Dichloroethane | 92 |
| Trichloroethene | 90 |
| Toluene | 102 |
| Tetrachloroethene | 92 |
| Ethyl Benzene | 110 |
| trans-1,2-Dichloroethene | 93 |
| Naphthalene | 72 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

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**Client Sample ID: LCS**

**Lab ID#: 2302212-13A**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021704** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 09:30 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 113 | 70-130 |
| Propylbenzene | 97 | 70-130 |
| 1,3,5-Trimethylbenzene | 103 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 107 | 60-140 |
| p-Cymene | 102 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 99 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13AA**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021705** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 10:12 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 108 | 70-130 |
| Propylbenzene | 96 | 70-130 |
| 1,3,5-Trimethylbenzene | 100 | 70-130 |
| 1,2,4-Trimethylbenzene | 101 | 70-130 |
| sec-Butylbenzene | 107 | 60-140 |
| p-Cymene | 100 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 94 | 70-130 |
| Toluene-d8 | 115 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

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**Client Sample ID: LCS**

**Lab ID#: 2302212-13B**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021704sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 09:30 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 95 | 70-130 |
| Chloroethane | 95 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 83 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 88 | 70-130 |
| 1,2-Dichloroethane | 84 | 70-130 |
| Trichloroethene | 86 | 70-130 |
| Toluene | 92 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 89 | 70-130 |
| Naphthalene | 91 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 96 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 96 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13BB**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22021705sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/17/23 10:12 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 98 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 79 | 70-130 |
| cis-1,2-Dichloroethene | 89 | 70-130 |
| 1,1,1-Trichloroethane | 81 | 70-130 |
| Benzene | 85 | 70-130 |
| 1,2-Dichloroethane | 77 | 70-130 |
| Trichloroethene | 83 | 70-130 |
| Toluene | 94 | 70-130 |
| Tetrachloroethene | 79 | 70-130 |
| Ethyl Benzene | 95 | 70-130 |
| trans-1,2-Dichloroethene | 86 | 70-130 |
| Naphthalene | 90 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 91 | 70-130 |
| Toluene-d8 | 116 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13C**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022003** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 08:31 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 112 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 106 | 70-130 |
| 1,2,4-Trimethylbenzene | 108 | 70-130 |
| sec-Butylbenzene | 110 | 60-140 |
| p-Cymene | 106 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 100 | 70-130 |
| Toluene-d8 | 110 | 70-130 |
| 4-Bromofluorobenzene | 97 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13CC**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022004** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 09:07 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 110 | 70-130 |
| Propylbenzene | 98 | 70-130 |
| 1,3,5-Trimethylbenzene | 103 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 106 | 60-140 |
| p-Cymene | 102 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 98 | 70-130 |
| Toluene-d8 | 108 | 70-130 |
| 4-Bromofluorobenzene | 98 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13D**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022003sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 08:31 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 93 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 85 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 83 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 87 | 70-130 |
| 1,2-Dichloroethane | 83 | 70-130 |
| Trichloroethene | 86 | 70-130 |
| Toluene | 92 | 70-130 |
| Tetrachloroethene | 84 | 70-130 |
| Ethyl Benzene | 101 | 70-130 |
| trans-1,2-Dichloroethene | 88 | 70-130 |
| Naphthalene | 87 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 97 | 70-130 |
| Toluene-d8 | 111 | 70-130 |
| 4-Bromofluorobenzene | 93 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13DD**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022004sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/20/23 09:07 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 92 | 70-130 |
| Chloroethane | 93 | 70-130 |
| 1,1-Dichloroethene | 86 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 82 | 70-130 |
| cis-1,2-Dichloroethene | 89 | 70-130 |
| 1,1,1-Trichloroethane | 86 | 70-130 |
| Benzene | 84 | 70-130 |
| 1,2-Dichloroethane | 81 | 70-130 |
| Trichloroethene | 83 | 70-130 |
| Toluene | 89 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 87 | 70-130 |
| Naphthalene | 92 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 97 | 70-130 |
| Toluene-d8 | 108 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13E**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022104** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 08:14 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 109 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 104 | 70-130 |
| 1,2,4-Trimethylbenzene | 105 | 70-130 |
| sec-Butylbenzene | 111 | 60-140 |
| p-Cymene | 105 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 104 | 70-130 |
| 4-Bromofluorobenzene | 101 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13EE**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022105** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 09:20 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| 2-Hexanone | 107 | 70-130 |
| Propylbenzene | 102 | 70-130 |
| 1,3,5-Trimethylbenzene | 104 | 70-130 |
| 1,2,4-Trimethylbenzene | 104 | 70-130 |
| sec-Butylbenzene | 114 | 60-140 |
| p-Cymene | 105 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 94 | 70-130 |
| Toluene-d8 | 104 | 70-130 |
| 4-Bromofluorobenzene | 102 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCS**

**Lab ID#: 2302212-13F**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022104sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 08:14 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 96 | 70-130 |
| Chloroethane | 95 | 70-130 |
| 1,1-Dichloroethene | 89 | 70-130 |
| 1,1-Dichloroethane | 88 | 70-130 |
| Chloroform | 82 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 85 | 70-130 |
| Benzene | 83 | 70-130 |
| 1,2-Dichloroethane | 77 | 70-130 |
| Trichloroethene | 82 | 70-130 |
| Toluene | 88 | 70-130 |
| Tetrachloroethene | 84 | 70-130 |
| Ethyl Benzene | 98 | 70-130 |
| trans-1,2-Dichloroethene | 89 | 70-130 |
| Naphthalene | 97 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 105 | 70-130 |
| 4-Bromofluorobenzene | 94 | 70-130 |

eurofins | Air Toxics

**Client Sample ID: LCSD**

**Lab ID#: 2302212-13FF**

**MODIFIED EPA METHOD TO-14A GC/MS SIM/FULL SCAN**

| | | | |
|---|---|---|---|
| **File Name:** | **22022105sim** | **Date of Collection: NA** | |
| **Dil. Factor:** | **1.00** | **Date of Analysis: 2/21/23 09:20 AM** | |

| Compound | %Recovery | Method Limits |
|---|---|---|
| Vinyl Chloride | 92 | 70-130 |
| Chloroethane | 94 | 70-130 |
| 1,1-Dichloroethene | 88 | 70-130 |
| 1,1-Dichloroethane | 86 | 70-130 |
| Chloroform | 81 | 70-130 |
| cis-1,2-Dichloroethene | 90 | 70-130 |
| 1,1,1-Trichloroethane | 86 | 70-130 |
| Benzene | 81 | 70-130 |
| 1,2-Dichloroethane | 76 | 70-130 |
| Trichloroethene | 82 | 70-130 |
| Toluene | 88 | 70-130 |
| Tetrachloroethene | 82 | 70-130 |
| Ethyl Benzene | 97 | 70-130 |
| trans-1,2-Dichloroethene | 87 | 70-130 |
| Naphthalene | 93 | 60-140 |

**Container Type: NA - Not Applicable**

| Surrogates | %Recovery | Method Limits |
|---|---|---|
| 1,2-Dichloroethane-d4 | 93 | 70-130 |
| Toluene-d8 | 105 | 70-130 |
| 4-Bromofluorobenzene | 95 | 70-130 |

# Appendix D

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**Sayler Data Solutions, Inc.**
14257 93rd Court NE Kirkland, Washington 98034 (425) 820-7504 cari.say@saylerdata.com

# DATA VALIDATION REPORT

*Georgetown Facility Vapor Intrusion Assessment and Mitigation, 707 and 710 S. Lucille Data, February 2023*

CleanEarth
20245 77th Ave S.
Kent, Washington 98032

March 28, 2023

## 1.0 Introduction

Data set: Data were received for validation in one laboratory sample delivery group (SDG). Data submissions included both a laboratory report and an electronic data deliverable (EDD) as follows:

| SDG | EDD File Name | Report File Name | Report Date |
|---|---|---|---|
| 2302212 | ATLSTDEDD_2302212.xls | 2302212_d.pdfpdf<br>2302212COC.pdf | 02/22/2023 |

Analyses were submitted by Eurofins Air Toxics LLC in Folsom, California (ATL).

Analytical methods: Analyses were performed by the following methods:

| Analysis | Analytical Method |
|---|---|
| Volatile Organic Analysis (VOAs) in air | TO-14A/TO-15 Modified, Full Scan and SIM |

Analytical Schedule: The following air samples were included in this review:

| SDG | Sample ID | Sample Date/Time | Lab ID | Analysis |
|---|---|---|---|---|
| 2302212 | TE-707L-AA1-0223 | 02/07/2023 13:58 | 2302212-01 | VOAs |
| 2302212 | TE-707L-IA1-0223 | 02/07/2023 13:59 | 2302212-02 | VOAs |
| 2302212 | TE-707L-IA2-0223 | 02/07/2023 14:02 | 2302212-03 | VOAs |
| 2302212 | AS-710L-IA1-0223 | 02/07/2023 13:50 | 2302212-04 | VOAs |
| 2302212 | AS-710L-IA2-0223 | 02/07/2023 13:54 | 2302212-05 | VOAs |
| 2302212 | AS-710L-IA3-0223 | 02/07/2023 13:53 | 2302212-06 | VOAs |
| 2302212 | AS-710-SG1-0223 | 02/08/2023 15:20 | 2302212-07 | VOAs |
| 2302212 | AS-710-SG2-0223 | 02/08/2023 15:19 | 2302212-08 | VOAs |
| 2302212 | TE-707L-SG1-0223 | 02/08/2023 15:29 | 2302212-09 | VOAs |
| 2302212 | TE-707L-SG2-0223 | 02/08/2023 15:36 | 2302212-10 | VOAs |

## 2.0 Validation

Results were evaluated based on criteria from the analytical methods, project QAPPs, the VIAM plan, and current EPA guidance documents. References for these documents are listed in

section 6.0 of this report. The criteria gathered from the above documents are briefly summarized in the Appendix "Data Validation Criteria" at the end of this report.

A stage 2A validation was performed on the results including both the laboratory report and EDD, earning EPA OSWER validation label code S2AVEM. All validation was performed by Cari Sayler.

## 3.0 Validation Findings

Data validation criteria specified in the appendix were met.

## 4.0 Validation Qualifiers

No qualifiers were assigned during this data validation.

## 5.0 Common Abbreviations and Definitions

| DV Qualifier | Definition |
|---|---|
| U | The material was analyzed for, but was not detected above the level of the associated value. |
| UY | The reporting limit was elevated due to chromatographic overlap with related compounds. The material was analyzed for, but was not detected above the level of the associated value. |
| J | The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample. |
| N | The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification. |
| UJ | The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise. |
| R | The sample result is rejected. The presence or absence of the analyte cannot be verified and data are not usable. |
| R1 | This sample result has been rejected in favor of a more accurate, precise or conservative result. The other result should be used. |
| R2 | This sample result has been rejected in favor of a more accurate, precise or conservative result from another analytical method. The other result should be used. |

| QC Element | Definition |
|---|---|
| ICAL | Initial calibration |
| ICV | Initial calibration verification |
| CCV | Continuing calibration verification |
| LCS | Laboratory control sample |
| LCSD | Laboratory control sample |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| SRM | Standard reference material |
| RRM | Regional reference material |
| FD | Field duplicate |
| FB | Field blank |
| RB | Rinse blank |
| TB | Trip blank |

| QC Element | Definition |
|---|---|
| IS | Internal standard |
| RT | Retention time |
| RRT | Relative retention time |
| RPD | Relative percent difference |

| Abbreviation | Definition |
|---|---|
| CRDL | Contract required detection limit |
| DV | Data validation |
| EDL | Estimated detection limit |
| EMPC | Estimated maximum possible concentration |
| MDL | Method detection limit |
| NA | Not applicable |
| QAPP | Quality Assurance Project Plan |
| RL | Reporting limit |
| RSD | Relative standard deviations |
| SDG | Sample delivery group |
| SIM | Selective ion monitoring |
| SRM | Selective reaction monitoring |

## 6.0 References


*USEPA 2009: USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, EPA 540-R-08-005, January 2009.

*Method TO-14A: Determination of Volatile Organic Compounds (VOCs) in Ambient Air using Specially Prepared Canisters with Subsequent Analysis by Gas chromatography,* US Environmental Protection Agency, Office of Research and Development, January 1999.

*Method TO-15: Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).* US Environmental Protection Agency, Office of Research and Development, January 1999.

*VIAM Plan: Vapor Intrusion Assessment and Mitigation Plan, Philip Services Corporation Georgetown Facility.* Prepared for Philip Services Corporation. Prepared by Pioneer Technologies Corporation, Olympia, Washington. June 2011.

*QAPP: Quality Assurance Project Plan, Inhalation Pathway Interim Measures, Georgetown Facility.* Prepared for Philip Services Corporation. Prepared by Exponent, Lake Oswego Oregon, August 2002.

*Laboratory QAM: Laboratory Quality Assurance Manual Excerpt, Appendix E, Analytical Methods Section 12.0.* Prepared by Eurofins Air Toxics Laboratory. Effective Date: November 4, 2020

# *APPENDIX – DATA VALIDATION CRITERIA*

## Data Package Completeness and Sample Integrity

| QC Element | Criteria |
|---|---|
| Completeness | Laboratory report includes the appropriate level of detail as described in the EPA Guidance documents (USEPA, January 2009) |
| Sample ID transcription | Chain of custodies and/or sample log-in documentation are present for all samples reported and match sample IDs used in the laboratory report and electronic data deliverable (EDD). |
| Sample receipt condition | Sample containers are intact upon receipt at the laboratory and preservation and storage requirements meet method specific guidelines. |
| Requested methods | The VIAM Plan specifies method 8260B for groundwater samples and TO-14A/TO-15 with laboratory modifications for air samples. |
| Requested analyte list and reporting limits | Requested target analytes were included and specified reporting limits were met. The 21 target analytes for both air and groundwater VOCs are specified in Table 2 of the IPIM QAPP. |
| Laboratory Narrative | The laboratory narrative, data flags and corrective action documentation detailing any preparation or analytical anomalies are evaluated for impact on data usability. |

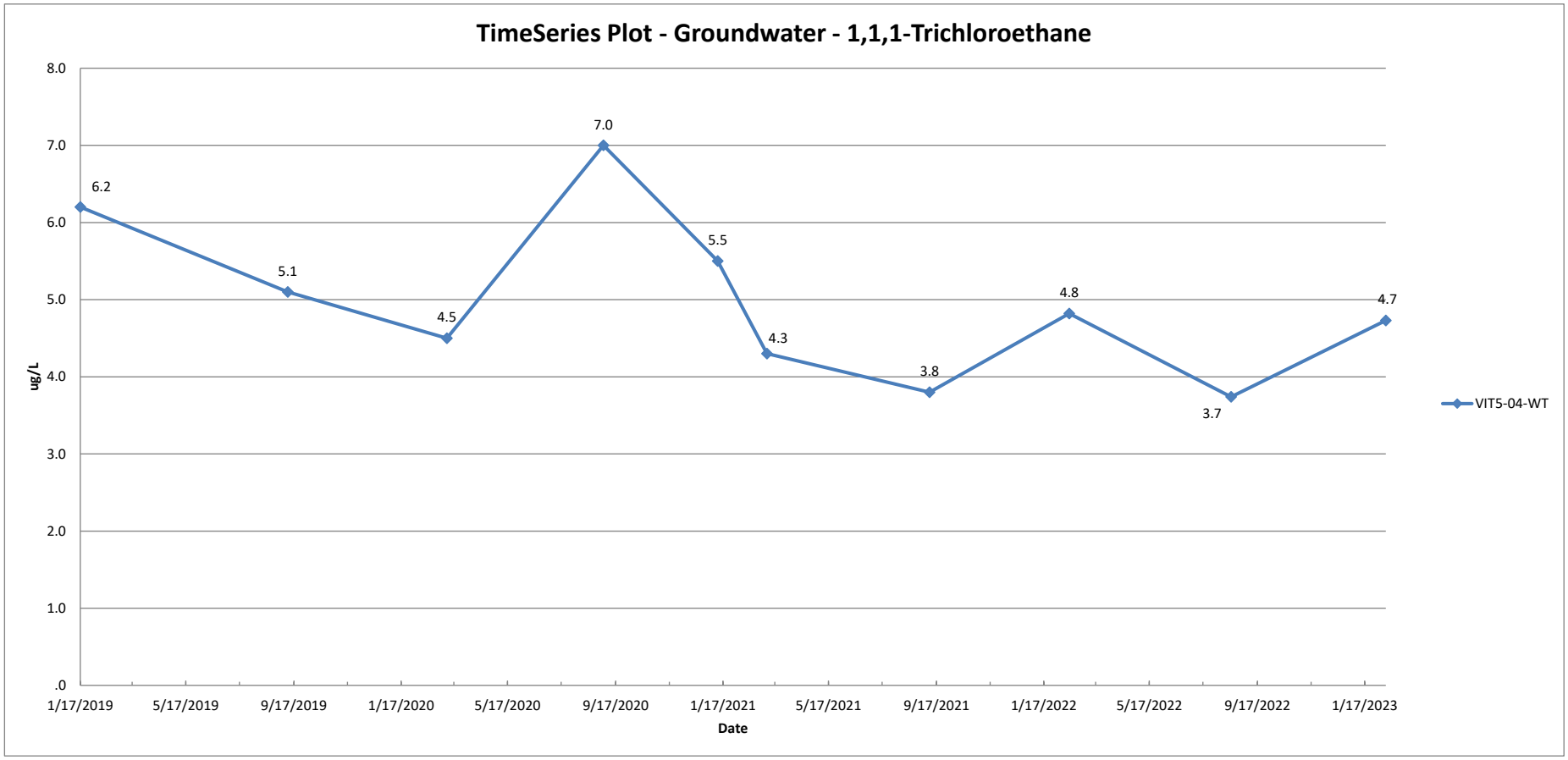
Notes
- Newer versions of published analytical methods are considered acceptable substitutions. Data referencing older versions of published analytical methods may be assessed based on numerical criteria present in newer versions.

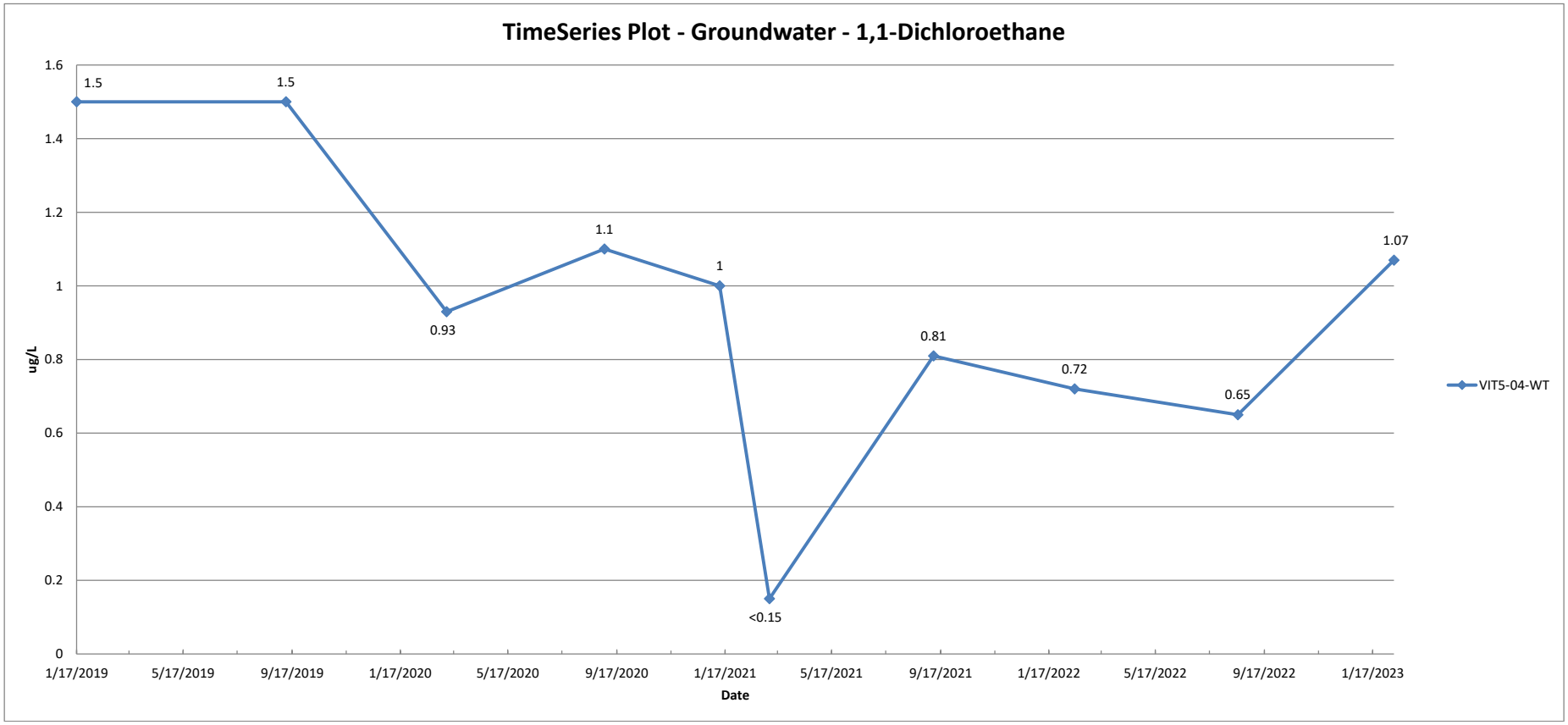
## Volatile Analyses in Air, Stage 2A Validation

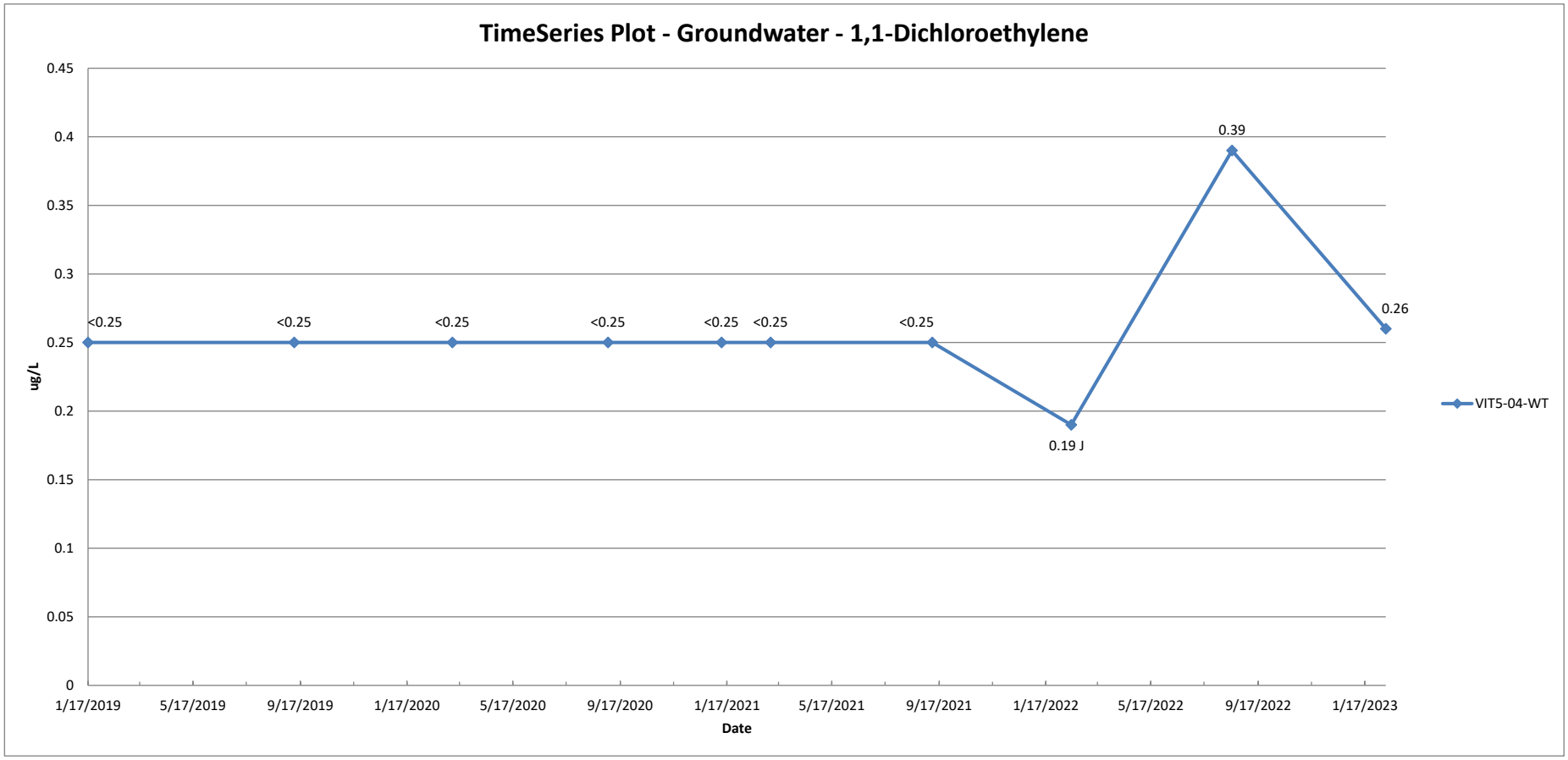
| QC Element | Frequency | Criteria |
|---|---|---|
| Holding times | Each sample | Air samples must be analyzed within 30 days. |
| Daily calibration (CCV), if present | Daily | • RF %difference vs ICAL mean RF ≤30% |
| Laboratory blank (LB) | Daily | Target analyte concentrations < RL, or < 10% of concentration in field samples. |
| Laboratory control sample (LCS) | After each CCV prior to samples | % Recoveries within 70-130%. |
| LCS duplicate (LCSD) | Once per analytical batch | • % Recoveries within 70-130%.<br>• RPDs ≤25%. |
| Surrogates | Each sample and QC sample | % Recoveries within 70-130% |

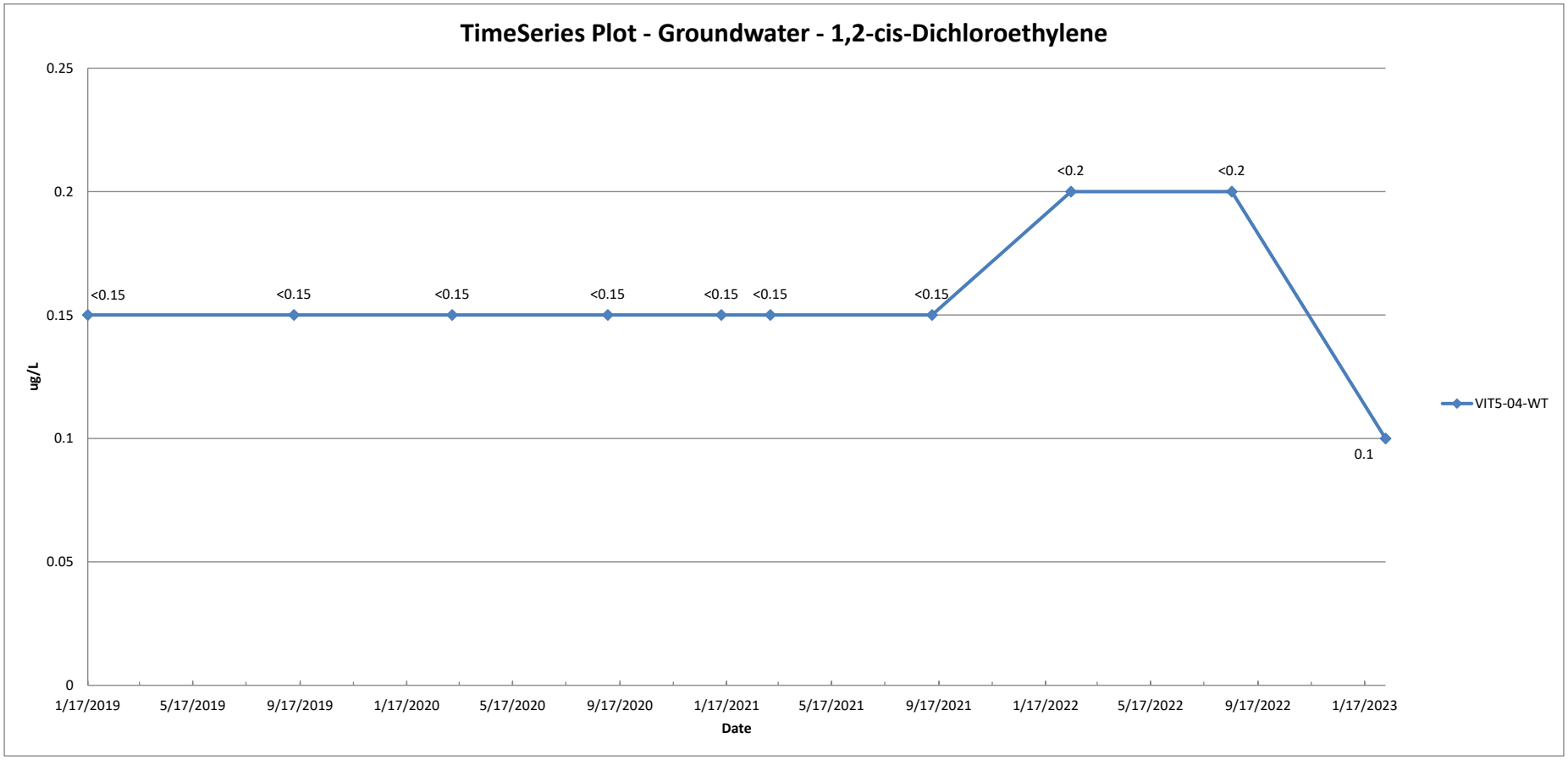
Notes:
- Method TO-14A incorporates method TO-15 QC criteria by reference. Above criteria is pulled from both analytical methods (TO-14A and TO-15), as well as the laboratory QAM.
- CCV data are not typically included in Stage 2A validation. However, when included in the summary report, recoveries are evaluated.

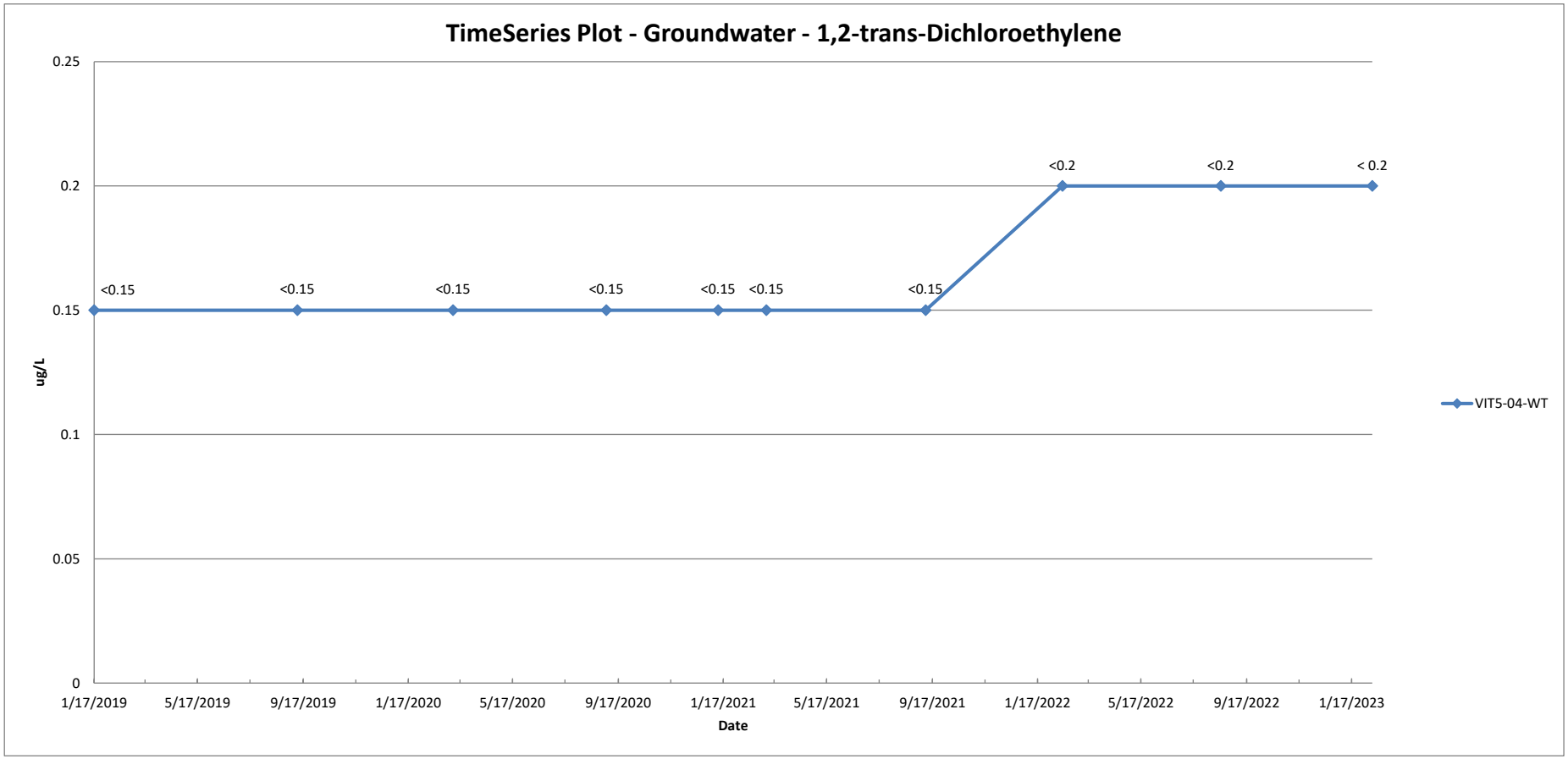
# Appendix E

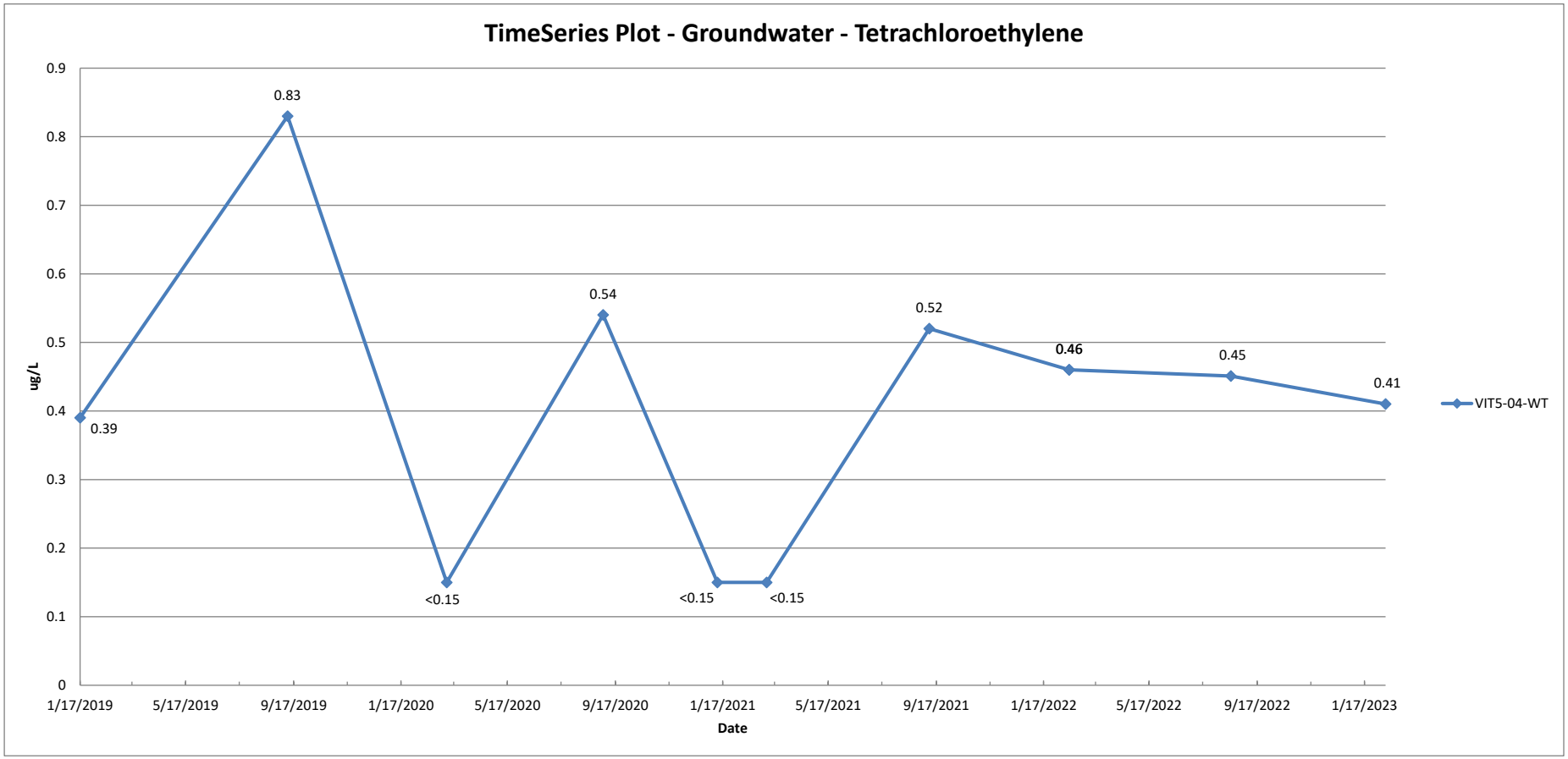

TimeSeries Plot - Groundwater - 1,1,1-Trichloroethane
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.0
ug/L
6.2
5.1
4.5
7.0
5.5
4.3
3.8
4.8
3.7
4.7
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT

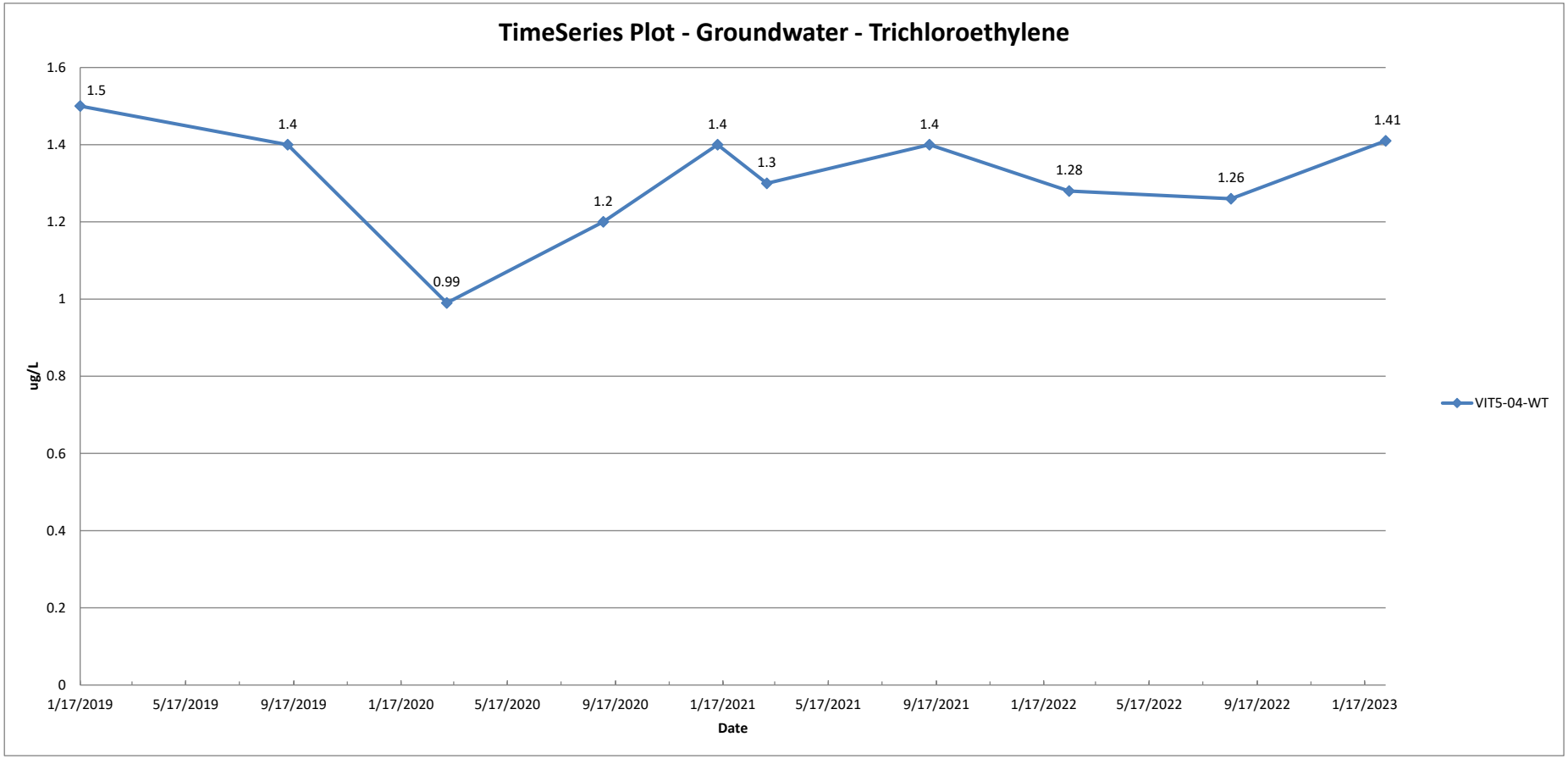

TimeSeries Plot - Groundwater - 1,1-Dichloroethane
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ug/L
1.5
1.5
0.93
1.1
1
<0.15
0.81
0.72
0.65
1.07
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT

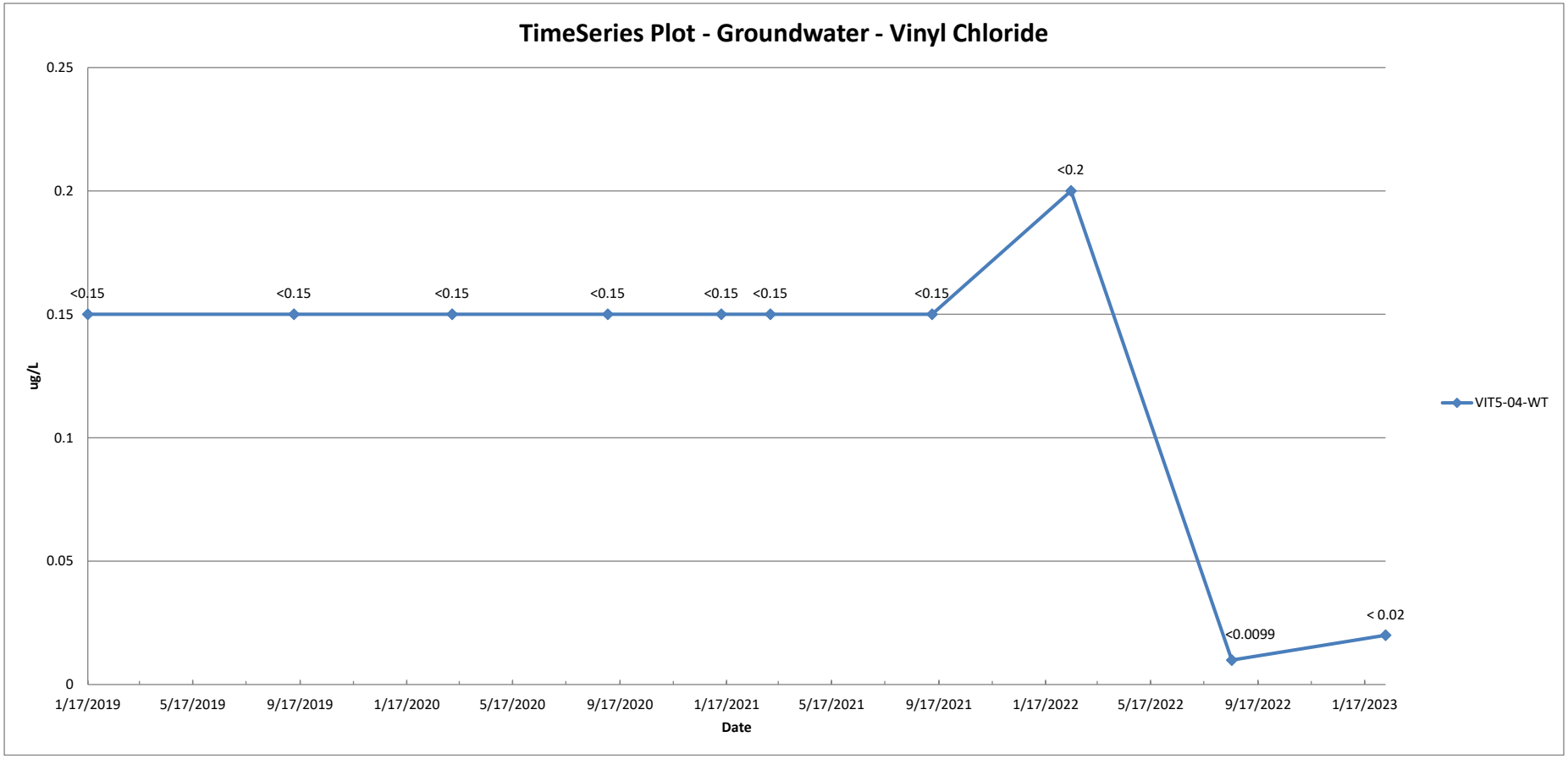

TimeSeries Plot - Groundwater - 1,1-Dichloroethylene
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.25
<0.25
<0.25
<0.25
<0.25
<0.25
<0.25
0.19 J
0.39
0.26
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT


TimeSeries Plot - Groundwater - 1,2-cis-Dichloroethylene
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.2
<0.2
0.1
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT


TimeSeries Plot - Groundwater - 1,2-trans-Dichloroethylene
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.2
<0.2
< 0.2
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT


TimeSeries Plot - Groundwater - Tetrachloroethylene
ug/L
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.83
0.54
0.52
0.46
0.45
0.41
0.39
<0.15
<0.15
<0.15
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT


TimeSeries Plot - Groundwater - Trichloroethylene
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ug/L
1.5
1.4
0.99
1.2
1.4
1.3
1.4
1.28
1.26
1.41
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT


TimeSeries Plot - Groundwater - Vinyl Chloride
0.25
0.2
0.15
0.1
0.05
0
ug/L
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.15
<0.2
<0.0099
< 0.02
1/17/2019
5/17/2019
9/17/2019
1/17/2020
5/17/2020
9/17/2020
1/17/2021
5/17/2021
9/17/2021
1/17/2022
5/17/2022
9/17/2022
1/17/2023
Date
VIT5-04-WT