Phase II Environmental Site Assessment

Former L&M Service
925 Massachusetts Avenue
Lunenburg, Massachusetts

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Prepared for:

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1. Executive Summary

This report documents findings from the Phase II Environmental Site Assessment (Phase II) that BETA Group, Inc. (BETA) has prepared for the former L&M Service property at 925 Massachusetts Avenue in Lunenburg, Massachusetts (the Site, see Figure 1) on behalf of the Montachusett Regional Planning Commission (MRPC). This property consists of 0.191 acres of land located approximately 400 feet west of the Lunenburg Center. The Town has initiated a tax-taking foreclosure from the current owner, L&M Service Center, Inc., which should be completed in 2020. An abandoned gasoline and automotive service station that formerly operated as Kelly's Citgo Service Station occupies the Site. This facility sold gasoline and conducted automotive repair at the Site. Reports indicate that Site has been a gasoline/repair station since circa 1918

Records indicate two 10,000-gallon gasoline underground storage tanks (USTs), one 4,000-gallon diesel fuel UST, and one 500-gallon fuel oil UST exist at the Site. It is BETA's understanding that these tanks are currently empty. Records also indicate that three gasoline USTs and one waste oil UST were removed from the Site in the 1980s. The Site is listed as a release site (Tier ID) with the Massachusetts Department of Environmental Protection (MassDEP) under release tracking number 2-16390. Historic environmental investigations have focused on petroleum associated with USTs at the Site. However, plans and reports indicate that the Site also conducted automotive repair which could have involved the generation of hazardous waste. Historic plans indicate floor drains and a hydraulic lift were located in the garage building and an on-site septic system existed west of the site building. These features could involve hazardous materials and provide routes of entry into the subsurface.

The purpose of the project is to investigate whether the identified environmental concerns have impacted the environmental integrity of the site. The most likely future use of the Site is re-occupancy of the current Site building.

Preparation

Prior to implementation of the field work for this investigation, BETA prepared a site-specific Quality Assurance Project Plan (QAPP) Addendum, marked out boring locations in the field, contacted Dig Safe, and prepared a project-specific Health and Safety Plan.

Geophysical Survey

Hager GeoScience, Inc. (HGI) conducted a geophysical survey at the Site using ground penetrating radar (GPR), precision utility locating (PUL), and electromagnetic (EM) methods. HGI identified two 10,000-gallon USTs, one 4,000-gallon UST, and one 500-gallon UST at the Site. HGI also identified the septic tank and leach field in the western portion of the and an anomaly in the eastern portion of the Site (south of the garage building) that could be a UST or a holding tank for the garage drain system.

Soil Borings

BETA oversaw the advancement of ten soil borings at the Site. Soil samples were submitted from each of these borings for laboratory analysis of Volatile Organic Compounds (VOCs) by EPA Methods 5035/8260, the thirteen Priority Pollutant Metals (PP13) by various EPA methods, Extractable Petroleum Hydrocarbons (EPH) with target Polynuclear Aromatic Hydrocarbons (PAHs) by the MassDEP Methodology, Volatile Petroleum Hydrocarbons (VPH) with target VOCs by the MassDEP Methodology, and Polychlorinated Biphenyls (PCBs) by EPA Method 8082.

Groundwater

During advancement of the soil borings, BETA oversaw the installation of five new monitoring wells. After developing the wells, BETA collected groundwater samples from the new monitoring wells. These samples were submitted for laboratory analysis of VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.

Hazardous Building Material Investigation

Smith & Wessel Associates, Inc. (SWA) conducted a Hazardous Materials Survey at the Site to identify hazardous materials that would require special handling and/or disposal. The survey included the assessment for the presence of asbestos, a lead based paint survey; surface wipe sampling, a visual mold evaluation; and the cataloging of oils and hazardous materials located within the building.

Findings and Conclusions

Section 9.0 includes the findings and conclusions of this investigation.

2. Previous Reports

BETA reviewed a February 15, 2020 "Phase I Environmental Site Assessment" by Mark W. Popham, R.S. and a February 14, 1997 "Level 2 Environmental Assessment" by ENSTRAT Strategic Environmental Solutions (ENSTRAT). BETA also reviewed correspondence to the former owner from MassDEP. The following summarizes pertinent information from these reports.

February 14, 2020 "Phase I Environmental Site Assessment"

Mr. Popham conducted a Phase I Environmental Site Assessment (ESA) of the Site on behalf of the Town of Lunenburg. Based on our review of this report, although an assessment was conducted, it does not appear to meet the standards set by ASTM (E1527-13) or EPA (All Appropriate Inquiry). Mr. Popham presented a summary of the previous investigations at the Site (see below) and noted the presence of underground storage tanks (USTs), monitoring wells, a septic system, floor drains, and hydraulic lifts at the Site. He also discussed the use of the Site for automotive repair and the various non-compliance issues the previous Site owner had with MassDEP. Mr. Popham concluded, "Based on the available information presented herein, it is my professional opinion that the property 925 Massachusetts Avenue presents environmental conditions that warrant a recommendation that a Phase 2 Environmental Site Assessment be performed at the site in a timely manner to mitigate the potential for adverse impacts to public health/safety and/or the local environment from the site's prior long-term use as a petroleum storage/distribution facility and automotive service center with a documented record of questionable environmental regulatory compliance."

February 14, 1997 "Level 2 Environmental Assessment"

ENSTRAT conducted their assessment for Fleet Bank following the completion of a "Level 1 Environmental Site Assessment" (this report was not available for review by BETA). ENSTRAT oversaw the advancement of ten (10) soil borings at the Site with the installation of five (5) monitoring wells. Laboratory analysis of soil samples identified naphthalene and gasoline range petroleum above the MassDEP standards in samples from two of the borings and diesel range petroleum above the MassDEP standards in samples from five of the borings. Laboratory analysis of groundwater identified xylenes in a sample from one of the wells above the MassDEP standards. ENSTRAT identified groundwater to be approximately 6 to 13 feet below grade with a northeasterly flow direction. ENSTRAT did not provide recommendations in their report.

MassDEP Correspondence

The MassDEP website lists the release notification date as September 12, 2006. MassDEP's online records include an October 12, 2006 "Notice of Responsibility" (NOR) and a January 26, 2009 "Notice of Noncompliance" (NON) issued to Mr. Michael Morin of L&M Service Center, Inc. for failing to take appropriate response actions at the Site. Based on these documents, MassDEP listed the Site as a release site with Release Tracking Number 2-0016390 based on the results of ENSTRAT's 1997 assessment. The NOR required the Site owner to conduct appropriate response actions at the Site in accordance with the 310 CMR 40.0000. The NON cited the Site owner for not taking any actions at the Site. Based on MassDEP's online records, no actions have been taken at the Site since the issuance of the NON. The Site is classified as Tier ID.

3. Preparation

3.1 Quality Assurance Project Plan

Prior to initiating the field work at the Site, BETA developed a Site Specific Quality Assurance Project Plan (QAPP) Addendum to BETA's previously approved Generic QAPP. The QAPP addendum was prepared in accordance with guidance provided by the U.S. Environmental Protection Agency (EPA) Region 1 under its Brownfields program included additions to the Generic QAPP to address groundwater and soil quality and hazardous building material sampling at the Site. The QAPP addendum was based on guidelines set forth in Generic Quality Assurance Project Plans, and Site-Specific QAPP Addenda, March 2009. BETA submitted the QAPP Addendum to EPA for approval May 1, 2020. After addressing several rounds of comments and questions, the QAPP Addendum was approved on July 8, 2020. Appendix B contains a copy of the approved QAPP Addendum.

3.2 Site Preparation

BETA conducted the following activities in preparation for the implementation of the field work for this investigation:

- Marked out the proposed boring locations in the field for utility locations purposes;
- At least 72 hours prior to the start of the drilling activities, notified "Digsafe" and the Town of Lunenburg to mark utilities in the vicinity of the proposed boring locations;
- Re-located borings that conflicted with existing utilities; and,
- Prepared a project-specific Health and Safety Plan (HASP) prior to the commencement of field work. The HASP addressed potential hazards to health, safety, public welfare, and the environment which could arise during the investigation. A copy of the HASP is included in Appendix I.

4. Geophysical Investigation

4.1 Field Investigation

On July 10, 2020, Hager GeoScience, Inc. (HGI) conducted the geophysical survey using ground penetrating radar (GPR), precision utility locating (PUL), and electromagnetic (EM) methods. HGI set up a grid in the field to survey the areas where underground storage tanks (USTs), septic system components, and drainage systems were suspected to be located. The survey area consisted of areas where historic documentation and/or surface features (fill ports, manholes, vent pipes, etc.) indicated the likely presence of underground storage tanks (USTs), drainage structures, and septic system components. Appendix C contains a copy of HGI's report.

4.2 Results

HGI identified two 10,000-gallon USTs in the western portion of the Site, one 4,000-gallon UST in the southern portion of the Site, and one 500-gallon UST in the northern portion of the Site (west of the Site building). Please note that HGI's report identifies the larger tanks as 8,000-gallon USTs; however, historic reports identify them as 10,000-gallon USTs. HGI also identified several piping runs connecting the tanks to the pump island in the southern portion of the tank.

HGI identified the septic tank and leach field in the western portion of the Site (west of the Site building and east of the two 10,000-gallon USTs). HGI's EM survey determined that these features are not constructed of metal.

HGI also identified an anomaly in the eastern portion of the Site (south of the garage building) that could be a UST or a holding tank for the garage drain system.

HGI's report includes several figures depicting the identified subsurface features.

5. Soil Borings

5.1 Soil Borings

On August 6, 2020, BETA oversaw the advancement of eight (8) soil borings at the Site (see below for boring locations). Drilling activities were completed by Technical Drilling Services, Inc. (TDS) of Sterling, Massachusetts using a track-mounted Geoprobe drilling unit. Five of the borings were completed as monitoring wells. Soil samples were collected at each boring location during drilling operations using a core sampler from grade to a depth of approximately ten feet below grade. Soil boring logs are included in Appendix D. Soil boring locations are depicted on Figure 2.

Soil borings were advanced in the following locations:

- B-101: East of the Site building.
- B-102: In the northern portion of the Site, north of the on-site septic system.
- B-103: North of the Site building.
- B-104: In the southern portion of the Site, south of the on-site septic system and east of the gasoline USTs.
- B-105: South of the Site building, near the floor drain holding tank and pump island.
- B -106: In the northern portion of the Site, north of the 500-gallon fuel oil UST.
- B -107: Near the southwest corner of the Site building and the pump island.
- B -108: In the northwest corner of the Site.

Soil samples were collected and field screened for the presence of total volatile organic compounds (TVOCs) using a MiniRAE photoionization detector (PID) with an 10.6 eV lamp calibrated to measure TVOCs as benzene in parts per million by volume (ppm_v). Headspace readings for the soil samples from the borings ranged from 0.0 ppm_v to 960.2 ppm_v. The PID reading of 960.2 ppm_v was measured in a soil sample from B-102 from a depth of ten to fifteen feet below ground surface. In general, soil at the Site consists of fine to coarse grained silty sand with some gravel. PID readings for each soil sample are shown on the soil boring logs in Appendix D.

5.2 Soil Classification

Since residential properties exist within 500 feet of the project area, BETA has compared the soil results to MassDEP's RCS-1 reportable concentrations for purposes of identifying contaminated soil. Future risk characterization of the Site may identify differing exposures and should compare results to MassDEP's cleanup standards.

5.3 Soil Sampling and Analytical Data

BETA submitted the following soil samples from the soil borings to Alpha Analytical, Inc. (Alpha) for laboratory analysis:

- B-101 (15-18 feet): Volatile Organic Compounds (VOCs) by EPA Methods 5035/8260, the thirteen Priority Pollutant Metals (PP13) by various EPA methods, Extractable Petroleum Hydrocarbons (EPH) with target Polynuclear Aromatic Hydrocarbons (PAHs) by the MassDEP Methodology, Volatile Petroleum Hydrocarbons (VPH) with target VOCs by the MassDEP Methodology, and Polychlorinated Biphenyls (PCBs) by EPA Method 8082.
- B-102 (13-15 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-103 (13-15 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-104 (10-12 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-105 (12.5-17.5 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-106 (12.5-15 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-107 (8-10 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.
- B-108 (15-17.5 feet): VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082.

Table 1 summarizes the detected compounds from these analyses and Appendix E contains the laboratory certificates of analysis. The following summarizes the detected compounds that exceeded the RCS-1 concentrations:

- $C_{19} - C_{36}$ aliphatics were detected above the RCS-1 standard (3,000 mg/Kg) in samples B-101 15-18 (5,540 mg/kg), B-107 8-10 (21,200 mg/kg), and B-103 13-15 (3,130 mg/kg). The concentraton of $C_{19} - C_{36}$ aliphatics in the B-107 8-10 sample was also above the MassDEP's Upper Concentration Limit of 20,000 mg/kg;
- $C_{11} - C_{22}$ aromatics were detected above the RCS-1 standard (1,000 mg/Kg) in samples B-107 8-10 (6,620 mg/kg), and B-103 13-15 (1,060 mg/kg);

- 2-Methylnaphthalene was detected above the RCS-1 standard (0.7 mg/Kg) in samples DUP (1.96 mg/kg), B-106 12.5-15 (0.972 mg/kg), and B-102 13-15 (15.6 mg/kg). Due to sample dilution, several other samples had reporting limits for this compound above the RCS-1 standard;
- PCBs were detected above the RCS-1 standard (1 mg/kg) in the B-103 13-15 sample (3.98 mg/kg);
- Arsenic was detected above the RCS-1 standard (20 mg/Kg) in the B-107 8-10 sample (49.6 mg/Kg);
- Lead was detected above the RCS-1 standard (200 mg/Kg) in the B-107 8-10 sample (477 mg/Kg);
- Methyl tert butyl ether was detected above the RCS-1 standard (0.1 mg/Kg) in samples B-107 8-10 (0.288 mg/kg), B-103 13-15 (0.144 mg/kg), and B-106 12.5-15 (0.14 and 0.203 mg/kg);
- Naphthalene was detected above the RCS-1 standard (4 mg/Kg) in samples B-105 12.5-17.5 (17.2 and 19 mg/kg), DUP (13.9 and 12 mg/kg), and B-102 13-15 (47.8 and 63 mg/kg);
- 1,3,5-Trimethylbenzene was detected above the RCS-1 standard (10 mg/Kg) in samples B-105 12.5-17.5 (29 mg/kg), DUP (15 mg/kg), and B-102 13-15 (72 mg/kg);
- $C_9 – C_{10}$ aromatics were detected above the RCS-1 standard (100 mg/Kg) in samples B-105 12.5-17.5 (416 mg/kg), DUP (293 mg/kg), and B-102 13-15 (1,220 mg/kg); and
- $C_5 – C_8$ aliphatics were detected above the RCS-1 standard (100 mg/Kg) in samples B-105 12.5-17.5 (207 mg/kg) and B-102 13-15 (467 mg/kg).

BETA submitted quality assurance/quality control (QA/QC) samples to Alpha for laboratory analysis. BETA submitted trip blanks for VOC analysis at a rate of one per cooler during field activities. Alpha did not detect any compounds above the laboratory reporting limit in the trip blank samples. BETA submitted two field duplicates during field activities. The following summarizes the results from the duplicate samples:

- DUP (from sample B-105) was submitted for VOCs by EPA Methods 5035/8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082. The relative percent difference was calculated for detected compounds and ranged from 0.16% to 123%. Some of the RPDs were outside the acceptable range for comparable data; however, creating a true duplicate sample from soil samples is difficult.

Although some of these RPDs are outside the acceptable range, as discussed below, the usability of the data has not been adversely affected.

5.4 Data Quality

BETA conducted a Modified Tier II Data Validation in accordance with the provisions of the QAPP and EPA guidance. The data validation included a review of the laboratory standard protocols such as method blanks, equipment blanks, trip blanks, matrix spikes, laboratory control samples, surrogate samples, and duplicate samples. Based on the Tier II data review, the data for the Site is usable for the intended purpose of site characterization. A copy of the Modified Tier II Data Validation report is included in Appendix I.

6. Groundwater Monitoring Wells

6.1 Groundwater Monitoring Wells

During advancement of the soil borings on August 6, 2020, BETA oversaw the installation of five monitoring wells. Some of ENSTRAT's wells exist at the Site but were not deemed usable due to lack of surficial covers. These five borings were completed as 2-inch diameter groundwater monitoring wells. Monitoring wells were installed in the following locations:

- MW-101: East of the Site building.
- MW-102: In the northern portion of the Site, north of the on-site septic system.
- MW-103: North of the Site building.
- MW-104: In the southern portion of the Site, south of the on-site septic system and east of the gasoline USTs.
- MW-105: South of the Site building, near the floor drain holding tank and pump island.

The depth of the new monitoring wells was approximately 20 feet below the ground surface at each location. The monitoring wells were completed using 2-inch schedule 40 PVC material. An appropriate amount of 0.010 inch slotted screen and riser material, sand and bentonite were used to complete each well. The new wells were completed with a flush-mounted roadbox and cemented in place. Soil boring and monitoring well logs are included as Appendix D. Monitoring well and soil boring locations are depicted on Figure 2.

6.2 Groundwater Monitoring Well Development

On August 14, 2020, the depth to groundwater was gauged in the five new monitoring wells. A peristaltic pump was used to over pump these wells to complete well development. In accordance with state and federal protocols, the monitoring wells were developed to remove fine silt and sand from the well and to ensure a proper connection between the well and the surrounding aquifer prior to the collection of groundwater samples.

6.3 Groundwater Classification

BETA obtained a copy of the Priority Resource Map for the project area from the MassDEP website (see Figure 3). Based on this map, the project area is not within a Current Drinking Water Source Area or a Potential Drinking Water Source Area. Additionally, the entire project area is served by municipal water, is not located within an aquifer protection district, and no known private drinking water wells are known to exist. Thus, BETA compared the results to RCGW-2 standards to identify any possible reportable. Future risk characterization of the Site may identify differing exposures and should compare results to MassDEP's cleanup standards.

6.4 Groundwater Sampling

On August 21, 2020, the depth to groundwater was gauged in each of the new monitoring wells and samples were collected from each well. Depths ranged from 13.25 to 19.16 feet below grade. Groundwater flow is to the northeast. Samples were collected using low-flow methodology. A summary of the groundwater sampling data and the depth to groundwater elevations are included in Table 3.

BETA submitted the following groundwater samples from the monitoring wells to Alpha for laboratory analysis:

- MW-101: VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082;
- MW-102: VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082;
- MW-103: VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082;
- MW-104: VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082;
- MW-105: VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082;

Table 2 summarizes the detected compounds from these analyses and Appendix G contains the laboratory certificates of analysis. As can be seen in Table 2, the only compound detected above the MassDEP RCGW-2 reportable concentrations was the concentration of total lead in the sample from MW-105. This sample contained 0.025 milligrams per liter (mg/L) of lead which was above the MassDEP RCGW-2 and Method 1 GW-3 standard of 0.01 mg/L.

BETA submitted QA/QC samples to Alpha for laboratory analysis. BETA submitted trip blanks for VOC analysis at a rate of one per cooler during field activities. Alpha did not detect any compounds above the laboratory reporting limit in the trip blank sample. BETA collected an equipment blank to ensure proper decontamination each day. Th equipment blank was submitted to Alpha for laboratory analysis of VOCs. Alpha did not detect any compounds above the laboratory reporting limit in the equipment blank sample. Table 2 also summarizes these results.

BETA submitted one field duplicate during field activities. The following summarizes the results from this duplicate sample:

- DUP (from sample MW-104) was submitted for analysis of VOCs by EPA Method 8260, the PP13 metals by various EPA methods, EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, and PCBs by EPA Method 8082. The relative percent difference was calculated for detected compounds and ranged from 0% to 20%. The RPDs were within the acceptable range for comparable data.

6.5 Data Quality

BETA conducted a Modified Tier II Data Validation in accordance with the provisions of the QAPP and EPA guidance. The data validation included a review of the laboratory standard protocols such as method blanks, equipment blanks, trip blanks, matrix spikes, laboratory control samples, surrogate samples, and duplicate samples. Based on the Tier II data review, the data for the Site is usable for the intended purpose of site characterization. A copy of the Modified Tier II Data Validation report is included in Appendix F.

7. Hazardous Materials Survey

7.1 Hazardous Materials Survey

BETA contracted Smith & Wessel Associates, Inc. (SWA) to conduct a hazardous materials survey at the Site. The survey included assessment for the presence of asbestos-containing material (ACM), lead-based paint, surface wipe sampling, a visual mold evaluation, and cataloging of oil and hazardous materials located within the Site building. A copy of the Hazardous Materials Survey is located in Appendix H.

7.2 Asbestos Containing Material

On August 3, 2020, SWA collected bulk samples of suspect ACM from within the Site building. Thirty-nine (39) bulk samples of suspect ACM were collected and included plaster, gypsum board, seam sealant, floor tiles, ceiling tiles, cove base, various adhesives, door and window glazing, shingles, tar roofing, and textured paint. Samples were submitted to EMSL Analytical, Inc. (EMSL) in Woburn, Massachusetts for polarized light microscopy (PLM) analysis by EPA Method 600. ESML identified asbestos in gray and beige metal wall panel seam sealant, white 9-inch by 9-inch floor tile, and black rolled tar mop roof. SWA identified these three materials as non-friable ACMs. Laboratory certificates are included in SWA's report in Appendix H.

7.3 Lead Based Paint Survey

On August 3, 2020, SWA analyzed representative surfaces for lead based paint using an XRF. The survey identified concentrations of lead in red paint on the wood block trim on the roof, green paint on the metal roof cupola, and white paint on an exterior bathroom door. The lead content in these three painted surfaces ranged from 2.5 to 3.9 mg/cm^2. The Massachusetts Lead Law defines a lead content of greater than 1.2 mg/cm^2 as a dangerous level of lead.

7.4 Polychlorinated Biphenyls

SWA identified fluorescent light ballasts throughout the interior of the Site building. Ballasts manufactured prior to 1979 may contain PCBs and would also require disposal. SWA also noted two one-gallon electric panel expansion tanks in the mechanical room. These tanks are suspected to contain PCB-containing transformer oil.

SWA collected samples of glazing, caulking, and seam sealant and submitted them to New England Testing Laboratory, Inc. (NETLab) for laboratory analysis of PCBs. NETLab did not identify PCBs above the laboratory method detection limits in the submitted samples.

7.5 Oil and Hazardous/Universal Waste

SWA identified fluorescent light bulbs and ballasts throughout the interior of the Site building. Fluorescent light bulbs may contain mercury and lead and have special disposal requirements. Ballasts manufactured prior to 1979 may contain PCBs and would also require disposal. SWA also noted five transformers throughout the Site. BETA identified two 55-gallon drums of waste oil and approximately one dozen containers of anti-freeze in the Site building.

8. Evaluation

8.1 Findings

The following summarizes the findings of this Phase II ESA:

Geophysical Survey

HGI identified two 10,000-gallon USTs, one 4,000-gallon UST, and one 500-gallon UST at the Site. HGI also identified the septic tank and leach field in the western portion of the and an anomaly in the eastern portion of the Site (south of the garage building) that could be a UST or a holding tank for the garage drain system.

Soil Borings

BETA oversaw the advancement of ten soil borings at the Site. Soil samples from each of these borings were submitted for laboratory analysis. The laboratory detected identified fractions of EPH, PAHs, PCBs, arsenic, lead, VOCs, and fractions of VPH that exceed the MassDEP RCS-1 reportable concentrations. Six of the eight borings have at least one exceedance of a MassDEP RCS-1 standard.

Groundwater

The laboratory identified total lead in Site groundwater above the RCGW-2 reportable concentration. Despite using low-flow sampling techniques, turbidity in some of the groundwater samples was elevated.

Hazardous Building Material Investigation

The Hazardous Materials Survey performed by SWA identified non-friable asbestos materials (sealants, floor tile, and roofing), lead-based paint on several exterior surfaces, light ballasts and transformers that may contain PCBs, and fluorescent light bulbs that may contain mercury. SWA and BETA identified other hazardous materials in the Site building including two 55-gallon drums of waste oil and approximately one dozen containers of anti-freeze.

8.2 Conclusions

BETA performed a Phase II ESA in conformance with the scope and limitations submitted to the Town of Lunenburg for the property at 925 Massachusetts Avenue in Lunenburg, Massachusetts. Any exceptions to, or deletions from, the scope are described in Appendix A. The following summarizes our conclusions:

- The geophysical survey confirmed the presence of USTs, piping, a septic system, and a drainage system at the Site;

- Soil sampling identified concentrations of EPH, PAHs, PCBs, metals, VOCs, and VPH above the MassDEP's RCS-1 reportable. The likely sources of these contaminants are the USTs, the septic system, and the floor drain system;
- Groundwater sampling identified one concentration of total lead above the RCGW-2 reportable concentration;
- A Hazardous Materials Survey conducted by SWA identified lead-based paint and ACM inside the Site building. SWA and BETA identified other hazardous materials in the Site building including fluorescent light bulbs and ballasts, two 55-gallon drums of waste oil, and approximately one dozen containers of anti-freeze.

8.3 Recommendations

Since the Town does not yet own the Site, the Release Tracking Number for the Site and non-compliance issues at the Site are not associated with the Town. Upon obtaining title to the Site, BETA recommends contacting MassDEP to discuss the regulatory status of the Site and a plan to move forward with appropriate response actions.

Based on the concentrations of the contaminants identified in soil and groundwater, BETA recommends reporting these results to the MassDEP within 120 days of the Town obtaining title to the Site. The presence of these contaminants could pose a risk to future Site occupants. Upon reporting to MassDEP, a plan should be developed to further assess soil and groundwater, remove the USTs and other subsurface structures, and response actions should be implemented to address risks for future Site occupants. If the Site building is to be re-occupied, indoor air testing may also be appropriate to assess the risk from petroleum and VOCs in soil.

Prior to re-occupancy of the Site building, hazardous building materials (lead-based paint, ACM, lights and ballasts, and containers of hazardous waste) should be abated/removed prior to re-occupancy of the Site building.

9. List of Acronyms

ACM	Asbestos Containing Materials
AST	Aboveground Storage Tank
ASTM	American Society of Testing and Materials
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generator
CORRACTS	Corrective Action Tracking System
MASSDEP	Massachusetts Department of Energy and Environmental Protection
DPW	Department of Public Works
EDR	Environmental First Search Report
ETPH	Extractable Total Petroleum Hydrocarbons
ERNS	Emergency Response Notification System
ESA	Phase I Environmental Site Assessment
FINDS	Facility Index System
GEN	Generators
HWS	Hazardous Waste Sites
IRA	Immediate Response Action
Kg	Kilogram
LBP	Lead Based Paint
Lbs	Pounds
LPG	Liquid Petroleum Gas
LTBI	Locations To Be Investigated
LUST	Leaking Underground Storage Tank
MSL	Mean Sea Level
NLR	No Longer Regulated
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OHM	Oil and/or Hazardous Material
PBS	Petroleum Bulk Storage
PCB	Polychlorinated Biphenyls
pCi/L	PicoCuries per liter
Ppb	Parts per billion
RAATS	RCRA Administrative Action Tracking System

RCRA	Resource Conservation and Recovery Act
RCRIS	Resource Conservation and Recovery Information System
REC	Recognized Environmental Conditions
SF	Square feet
SQG	Small Quantity Generator
SPILLS	State Spills List
STATE	State Sites
SVOC	Semi-volatile Organic Compound
SWL	Solid Waste Landfills
TPH	Total Petroleum Hydrocarbons
TPH-DRO	Total Petroleum Hydrocarbons – Diesel Range Organics
TRIS	Toxic Release Inventory System
TSD	Transportation, Storage, Disposal Facility
USEPA/EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

Tables

Table 1
Soil Analytical Results
925 Massachusetts Avenue, Lunenburg, Massachusetts

LOCATION	B-101 15-18		B-105 12.5-17.5		DUP		B-107 8-10		B-104 10-12		B-103 13-15		B-106 12.5-15		B-102 13-15		B-108 15-17.5		TRIP BLANK		MassDEP
SAMPLING DATE	8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		RCS-1
Extractable Petroleum Hydrocarbons, milligrams per kilogram (mg/Kg)																					
C9-C18 Aliphatics	**160**		**15.8**		**43.1**		**672**		7.51	U	**70.4**		**118**		**606**		7.05	U	-		1,000
C19-C36 Aliphatics	**5,540**		**23**		**38**		**21,200**		7.51	U	**3,130**		**2320**		**1740**		7.05	U	-		3,000
C11-C22 Aromatics, Adjusted	**568**		**18.7**		**33.2**		**6,620**		7.51	U	**1,060**		**292**		**366**		7.05	U	-		1,000
Naphthalene	**2.06**		**1.5**		0.357	U	7.18	U	0.375	U	2.04	U	**1.41**		0.752	U	0.352	U	-		4
2-Methylnaphthalene	1.93	U	**0.54**		**1.96**		7.18	U	0.375	U	2.04	U	**0.972**		**15.6**		0.352	U	-		0.7
Pyrene	1.93	U	0.374	U	0.357	U	**7.26**		0.375	U	2.04	U	0.813	U	0.752	U	0.352	U	-		1,000
General Chemistry																					
Solids, Total	85.5		88.8		90.3		90.6		87.7		81.3		79.3		85.3		90.9		-		NE
Polychlorinated Biphenyls, mg/Kg																					
Aroclor 1248	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	0.802	U	0.0415	U	**0.2**		0.0358	U	-		1
Aroclor 1254	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	0.802	U	0.0415	U	**0.105**		0.0358	U	-		1
Aroclor 1260	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	**3.98**		**0.155**	P	**0.132**		0.0358	U	-		1
PCBs, Total	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	**3.98**		**0.155**		**0.437**		0.0358	U	-		1
Total Metals, mg/Kg																					
Antimony	2.28	U	2.22	U	2.16	U	**9.01**		2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		20
Arsenic	**11.3**		**6.19**		**6.18**		**49.6**		**7.91**		**10.8**		**14.5**		**6.26**		**7.08**		-		20
Beryllium	**0.511**		**0.484**		**0.509**		**0.364**		**0.986**		**0.394**		**0.573**		**0.602**		**0.634**		-		90
Cadmium	0.456	U	0.444	U	0.432	U	**1.57**		0.448	U	**2**		0.485	U	0.453	U	0.426	U	-		70
Chromium	**26.3**		**35.1**		**33.6**		**20.8**		**47.8**		**26.1**		**31.1**		**31.5**		**22.7**		-		100
Copper	**8.32**		**9.45**		**10.3**		**982**		**14.8**		**23.8**		**5.8**		**7.6**		**7.94**		-		1,000
Lead	**31.1**		**12.9**		**11.3**		**477**		**5.68**		**169**		**108**		**40.4**		**3.66**		-		200
Mercury	0.085	U	0.082	U	0.08	U	**2.92**		0.083	U	0.089	U	0.092	U	0.087	U	0.08	U	-		20
Nickel	**15.8**		**22.6**		**20.2**		**17.4**		**31.4**		**15.1**		**14.1**		**17.4**		**15.8**		-		600
Selenium	2.28	U	2.22	U	2.16	U	**11.5**		2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		400
Silver	0.456	U	0.444	U	0.432	U	0.428	U	0.448	U	0.487	U	0.485	U	0.453	U	0.426	U	-		100
Thallium	2.28	U	2.22	U	2.16	U	2.14	U	2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		8
Zinc	**48.1**		**48.2**		**39.6**		**501**		**38.5**		**60.9**		**34.6**		**39.6**		**21.6**		-		1,000
Volatile Organic Compounds, mg/Kg																					
Benzene	0.028	U	0.12	U	0.063	U	**0.55**		0.00039	U	**0.0052**		**0.32**		0.61	U	0.00038	U	0.0005	U	2
Toluene	0.057	U	0.24	U	0.13	U	**0.52**		0.00079	U	**0.019**		0.057	U	1.2	U	0.00075	U	0.001	U	30
Ethylbenzene	0.057	U	**10**		**7.5**		**0.7**		0.00079	U	**0.0015**		**0.11**		**3.7**		0.00075	U	**0.0035**		40
Trichloroethene	0.028	U	0.12	U	0.063	U	0.026	U	0.00039	U	0.00054	U	0.029	U	0.61	U	0.00038	U	**0.00052**		0.3
Methyl tert butyl ether	0.11	U	0.48	U	0.25	U	0.1	U	0.0016	U	0.034		**0.14**		2.4	U	0.0015	U	0.002	U	0.1
p/m-Xylene	**0.17**		**67**		**55**		**2.6**		0.0016	U	0.019		**12**		**61**		0.0015	U	**0.016**		100
o-Xylene	**0.15**		**12**		**8.1**		**1**		0.00079	U	0.0023		**0.068**		1.2	U	0.00075	U	**0.002**		100
Xylenes, Total	**0.32**		**79**		**63**		**3.6**		0.00079	U	0.021		**12**		**61**		0.00075	U	**0.018**		100
Acetone	0.57	U	2.4	U	1.3	U	**0.77**		**0.031**		**0.18**		0.57	U	12	U	0.019	U	0.025	U	6
Methyl ethyl ketone	0.57	U	2.4	U	1.3	U	0.53	U	0.0079	U	**0.04**		0.57	U	12	U	0.0075	U	0.01	U	4
n-Butylbenzene	**0.17**		**4.4**		**3.1**		**0.098**		0.00079	U	0.0011	U	**0.17**		**21**		0.00075	U	0.001	U	NE
sec-Butylbenzene	**0.066**		**1.5**		**1.3**		**0.089**		0.00079	U	0.0011	U	**0.14**		**8.2**		0.00075	U	0.001	U	NE
Isopropylbenzene	**0.062**		**3.3**		**1.9**		**0.11**		0.00079	U	0.0011	U	**0.79**		**10**		0.00075	U	0.001	U	1,000
p-Isopropyltoluene	**0.07**		**0.94**		**0.63**		**0.15**		0.00079	U	0.0011	U	**0.12**		**5.7**		0.00075	U	0.001	U	100
Naphthalene	0.23	U	**19**		**12**		**0.88**		0.0032	U	0.0043	U	**1.4**		**63**		0.003	U	0.004	U	4
n-Propylbenzene	**0.19**		**11**		**7.1**		**0.22**		0.00079	U	0.0011	U	**1.9**		**38**		0.00075	U	0.0013		100
1,3,5-Trimethylbenzene	**0.43**		**29**		**15**		**1.1**		0.0016	U	0.0022	U	**2**		**72**		0.0015	U	0.002	U	10
1,2,4-Trimethylbenzene	**1.2**		**92**		**75**		**2.2**		0.0016	U	**0.011**		**14**		**350**		0.0015	U	0.0031		1,000
Volatile Petroleum Hydrocarbons, mg/Kg																					
C9-C10 Aromatics	**45.8**		**416**		**293**		**35.8**		4.68	U	**9.13**		**36.9**		**1,220**		4.4	U	-		100
C5-C8 Aliphatics, Adjusted	**7.32**		**207**		**99.4**		**35.7**		4.68	U	7.22	U	**16.2**		**467**		4.4	U	-		100
C9-C12 Aliphatics, Adjusted	**6.19**		**109**		**73.5**		**11.1**		4.68	U	7.22	U	5.74	U	**290**		4.4	U	-		1,000
Benzene	0.114	U	**0.745**		0.405	U	**0.643**		0.094	U	**0.171**		**0.414**		1.22	U	0.088	U	-		2
Toluene	0.114	U	0.478	U	0.405	U	**0.572**		0.094	U	**1.03**		0.115	U	1.22	U	0.088	U	-		30
Ethylbenzene	0.114	U	**14.1**		**9.7**		**0.862**		0.094	U	0.144	U	0.115	U	1.22	U	0.088	U	-		40
p/m-Xylene	**0.149**		**57.7**		**45.2**		**2.7**		0.094	U	**1.34**		**10.8**		**51.4**		0.088	U	-		100
o-Xylene	**0.225**		**11.3**		**7.4**		**1.05**		0.094	U	**0.148**		0.115	U	**9.07**		0.088	U	-		100
Methyl tert butyl ether	0.057	U	0.239	U	0.202	U	**0.288**		0.047	U	**0.144**		**0.203**		0.608	U	0.044	U	-		0.1
Naphthalene	**0.366**		**17.2**		**13.8**		**0.71**		0.187	U	**0.386**		**1.28**		**47.8**		0.176	U	-		4

Notes
BOLD - compound detected
BOLD and Shaded - compound detected above regulatory standard
U - Not detected above listed detection limit.
NE - Standard not established

Table 2
Groundwater Analytical Results
925 Massachusetts Avenue, Lunenburg, Massachusetts

LOCATION	MW-101	MW-105	MW-104	MW-103	MW-102	DUP	EQUIP BLANK	TRIP BLANK	MassDEP
SAMPLING DATE	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/18/2020	RCGW-2
Extractable Petroleum Hydrocarbons, mg/L									
C9-C18 Aliphatics	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	5
C19-C36 Aliphatics	**0.499**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	50
C11-C22 Aromatics, Adjusted	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	5
Naphthalene	0.01 U	0.01 U	0.01 U	**0.0305**	**0.0431**	0.01 U	-	-	0.7
Polychlorinated Biphenyls, mg/L									
Aroclor 1260	0.00025 U	0.00025 U	0.00025 U	**0.000407**	0.00025 U	0.00025 U	-	-	0.005
PCBs, Total	ND	ND	ND	**0.000407**	ND	ND	-	-	0.005
Total Metals, mg/L									
Antimony	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	-	-	8
Arsenic	**0.0074**	**0.019**	**0.0077**	**0.0229**	**0.0218**	**0.0063**	-	-	0.9
Beryllium	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	-	0.2
Cadmium	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	-	-	0.004
Chromium	**0.042**	**0.088**	0.01 U	**0.018**	0.01 U	0.01 U	-	-	0.3
Copper	**0.016**	**0.037**	0.01 U	**0.011**	0.01 U	0.01 U	-	-	100
Lead	0.01 U	**0.025**	0.01 U	0.01 U	0.01 U	0.01 U	-	-	0.01
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	-	-	0.02
Nickel	**0.032**	**0.066**	**0.04**	0.025 U	0.025 U	**0.04**	-	-	0.2
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	-	-	0.1
Silver	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	-	-	0.007
Thallium	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	-	-	3
Zinc	0.05 U	**0.078**	0.05 U	0.05 U	0.05 U	0.05 U	-	-	0.8
Volatile Organic Compounds, mg/L									
Benzene	0.0005 U	0.0005 U	0.0005 U	**0.01**	**0.017**	0.0005 U	0.0005 U	0.0005 U	1
Toluene	0.001 U	0.001 U	0.001 U	**0.0036**	**0.0063**	0.001 U	0.001 U	0.001 U	40
Ethylbenzene	**0.0037**	**0.0053**	0.001 U	**0.28**	**0.69**	0.001 U	0.001 U	0.001 U	5
Methyl tert butyl ether	0.002 U	0.002 U	0.002 U	**0.0065**	**0.0056**	0.002 U	0.002 U	0.002 U	50
p/m-Xylene	**0.11**	**0.11**	**0.0097**	**1**	**2.5**	**0.0091**	0.002 U	0.002 U	3
o-Xylene	**0.04**	**0.032**	**0.0023**	**0.0094**	**0.016**	**0.0022**	0.001 U	0.001 U	3
Xylenes, Total	**0.15**	**0.14**	**0.012**	**1**	**2.5**	**0.011**	0.001 U	0.001 U	3
Acetone	**0.011**	0.005 U	0.005 U	**0.0061**	0.005 U	0.005 U	0.005 U	0.005 U	50
1,2-Dibromoethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002
n-Butylbenzene	0.002 U	0.002 U	0.002 U	0.002 U	**0.0026**	0.002 U	0.002 U	0.002 U	NE
sec-Butylbenzene	0.002 U	0.002 U	0.002 U	0.002 U	**0.0029**	0.002 U	0.002 U	0.002 U	NE
Isopropylbenzene	0.002 U	0.002 U	0.002 U	**0.017**	**0.029**	0.002 U	0.002 U	0.002 U	100
Naphthalene	**0.0071**	**0.0033**	0.002 U	**0.05**	**0.085**	0.002 U	0.002 U	0.002 U	0.7
n-Propylbenzene	0.002 U	0.002 U	0.002 U	**0.034**	**0.058**	0.002 U	0.002 U	0.002 U	10
1,3,5-Trimethylbenzene	**0.017**	**0.012**	0.002 U	**0.05**	**0.086**	0.002 U	0.002 U	0.002 U	1
1,2,4-Trimethylbenzene	**0.041**	**0.031**	**0.004**	**0.18**	**0.42**	**0.0038**	0.002 U	0.002 U	100
Volatile Petroleum Hydrocarbons, mg/L									
C9-C10 Aromatics	**0.22**	**0.101**	0.1 U	**0.634**	**1.45**	0.1 U	-	-	4
C5-C8 Aliphatics, Adjusted	0.1 U	0.1 U	0.1 U	0.4 U	1 U	0.1 U	-	-	3
C9-C12 Aliphatics, Adjusted	0.1 U	0.1 U	0.1 U	0.4 U	1 U	0.1 U	-	-	5
Benzene	0.002 U	0.002 U	0.002 U	0.008 U	0.02 U	0.002 U	-	-	1
Toluene	0.002 U	0.002 U	0.002 U	0.008 U	0.02 U	0.002 U	-	-	40
Ethylbenzene	**0.00262**	**0.00372**	0.002 U	0.298	**0.707**	0.002 U	-	-	5
p/m-Xylene	**0.118**	**0.0907**	**0.00912**	**1.16**	**2.71**	**0.01**	-	-	3
o-Xylene	**0.0415**	**0.0278**	0.002 U	0.008 U	0.02 U	**0.00223**	-	-	3
Methyl tert butyl ether	0.003 U	0.003 U	0.003 U	0.012 U	0.03 U	0.003 U	-	-	50
Naphthalene	**0.00841**	0.004 U	0.004 U	**0.0408**	**0.0942**	0.004 U	-	-	0.7

Notes
BOLD - compound detected
BOLD and Shaded - compound detected above regulatory standard
U - Not detected above listed detection limit.
NE - Standard not established

Figures

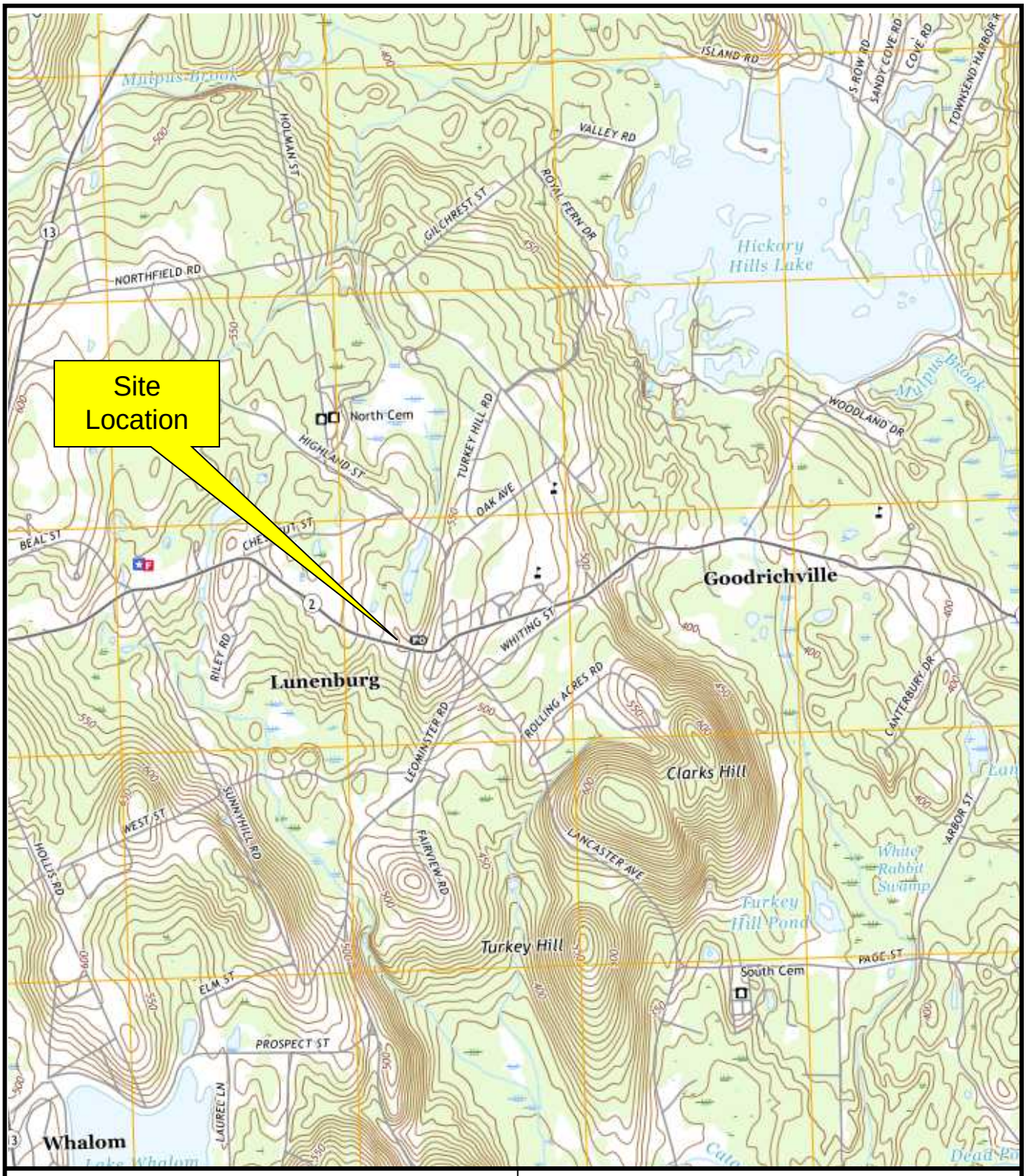


Figure 1: Site Locus

925 Massachusetts Avenue
Lunenburg, Massachusetts

www.BETA-Inc.com

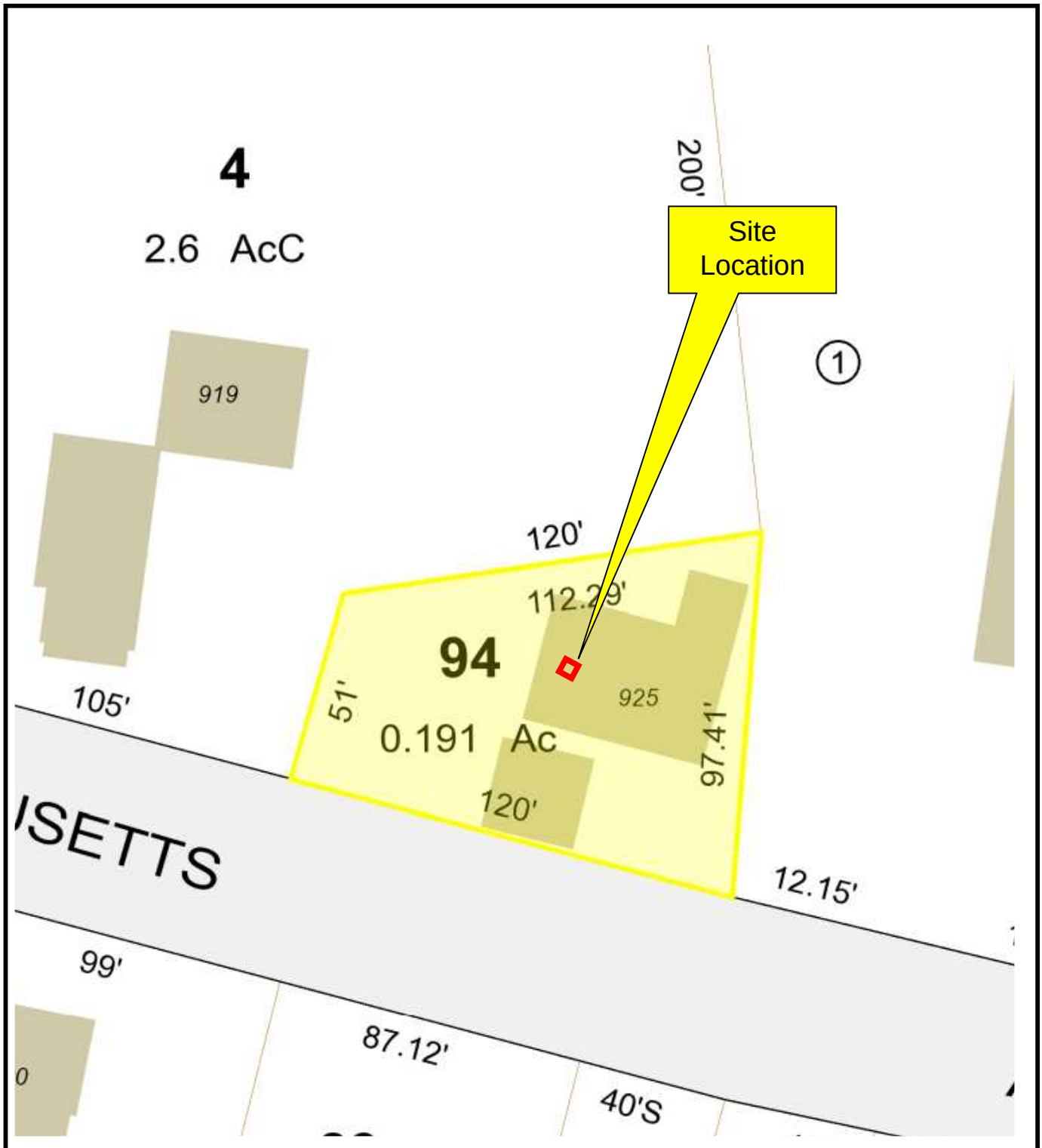
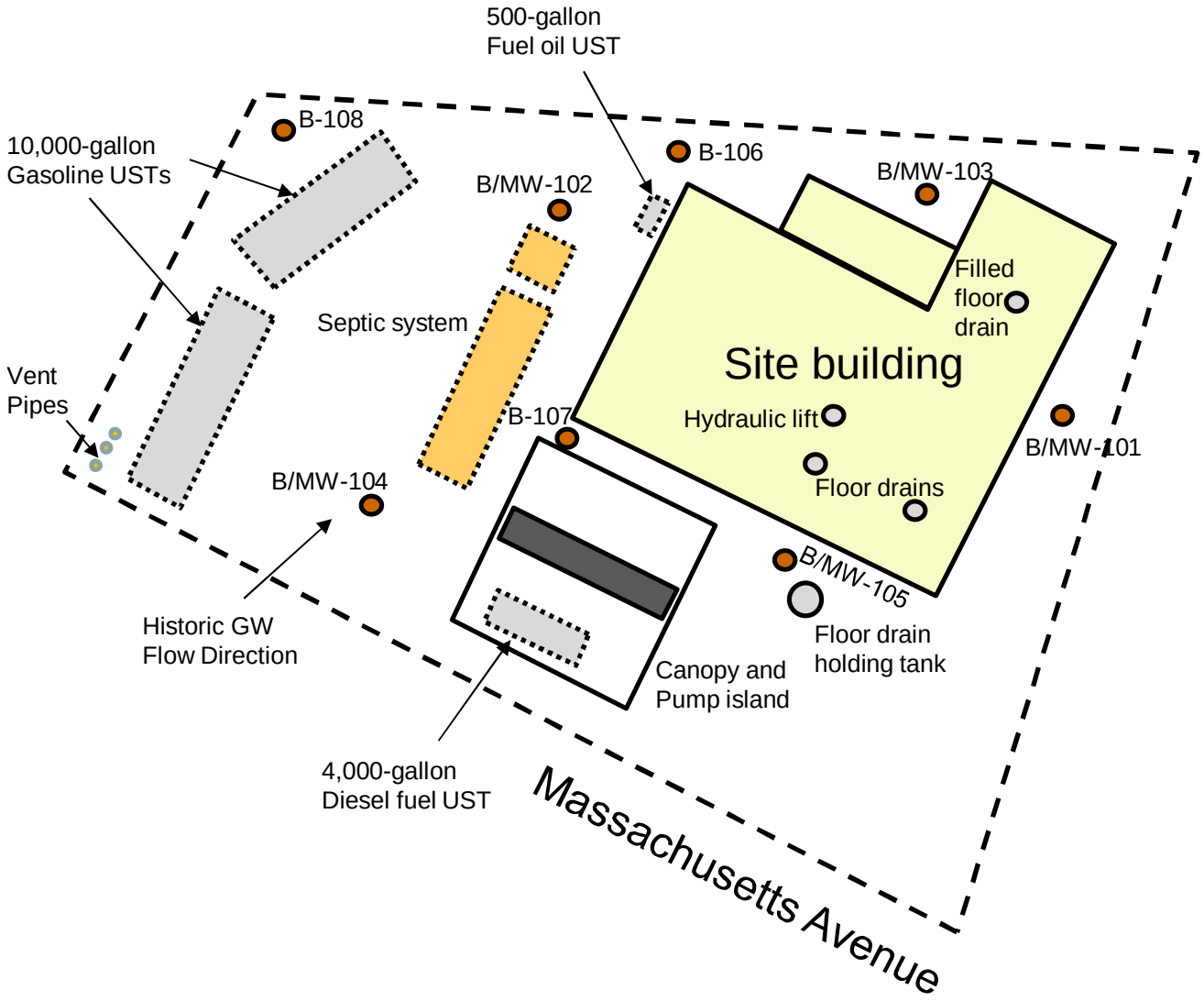


Figure 2: Assessor's Map

925 Massachusetts Avenue
Lunenburg, Massachusetts

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Base plan: 1997 Enstrat plan
Not to scale
Feature locations estimated based on historic plans and surface features

Figure 3: Site Plan

925 Massachusetts Avenue
Lunenburg, Massachusetts

N
W
E
S

BETA
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Appendix A

Limitations

The Site: 925 Massachusetts Avenue, Lunenburg, Massachusetts (Lunenburg Assessor's Parcel 071-0094-00)

- This report has been prepared for the sole and exclusive use of the Client and is subject to and issued in connection with the Agreement and the provisions thereof. Any use or reliance upon information provided in this report, without the specific written authorization of Client and BETA, shall be at the User's sole risk.
- In conducting this assessment and investigation, BETA has obtained and relied upon information from multiple sources to form certain conclusions regarding potential environmental issues at and in the vicinity of the subject property. Except as otherwise noted, no attempt has been made to verify the accuracy or completeness of such information.
- The objectives of the assessment and investigation described in this report were to assess the physical characteristics of the subject property with respect to overt evidence of past or present use, storage, and/or disposal of oil or hazardous materials, as defined in applicable state and federal environmental laws and regulations, and to gather information regarding current and past operations and environmental conditions at and in the vicinity of the subject property.
- The scope of this report does not include an assessment of the suitability of Site soil for development/construction. Please note that certain soils, particularly in urban areas, may include low levels of contaminants such as lead, metals, or ash constituents. The presence of such contaminants in soil, while not representing a "release," may result in the need for special handling at increased costs to allow for off Site soil reuse during Site development.
- No attempt has been made to assess the compliance status of any past or present Owner or Operator of the Site with any federal, state, or local laws or regulations.
- The findings, observations, and conclusions presented in this report are limited by the scope of services outlined in our Agreement, which reflects schedule and budgetary constraints imposed by Client for the current phase of environmental assessment. Furthermore, the assessment has been performed in accordance with generally accepted engineering practices and standards set forth by ASTM. No other warranty, expressed or implied, is made.
- The assessment presented in this report is based solely upon: readily-available data, visible portions of the Site, and information gathered to date. Should further environmental or other relevant information be developed at a later date, Client should bring the information to the attention of BETA as soon as possible. Based upon an evaluation, BETA may modify the report and its conclusions.
- It should be noted that the Executive Summary does not contain all the information that is found in the full report. The report should be read in its entirety to obtain a more complete understanding of the information provided and to aid in any decisions made or actions taken based on this information. This report documents the recognized environmental conditions as defined in ASTM and where appropriate other suspect environmental conditions noted on the Site and associated risks to the environment. Although the survey may not disclose all potential liabilities, a reasonable attempt has been made to do so within the scope of work.
- BETA cannot and does not warrant or guarantee that the information provided by these sources is accurate or complete. The methodologies of this assessment are not intended to produce all inclusive or comprehensive results, but rather to provide the client with information regarding overt evidence of past use storage, and/or release or threat of release of OHM the Site.

Appendix B

Quality Assurance Project Plan Addendum

Quality Assurance
Project Plan Addendum

June 24, 2020

EPA RFA # BF00A00357

Former L&M Service Station
925 Massachusetts Avenue, Lunenburg, Massachusetts

Prepared For:

Montachusett Regional Planning Commission
464 Abbot Avenue
Leominster, Massachusetts 01453

Prepared by:

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Quality Assurance Project Plan

SECTION A – PROJECT MANAGEMENT

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Quality Assurance Manager: 7/8/20

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MRPC Project Manager: John Hume Jul 8, 2020

John Hume (Date)
Planning and Development Director

EPA Project Manager: CHRISTINE LOMBARD Digitally signed by CHRISTINE LOMBARD Date: 2020.07.09 07:00:12 -04'00'

Christine Lombard (Date)
EPA Project Officer

EPA Quality Assurance Officer: Jessica Iverson 7/8/2020

Jessica Iverson (Date)
EPA Quality Assurance Officer

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FIGURES

1 Locus Plan
2 Assessor’s Map
3 Site Plan

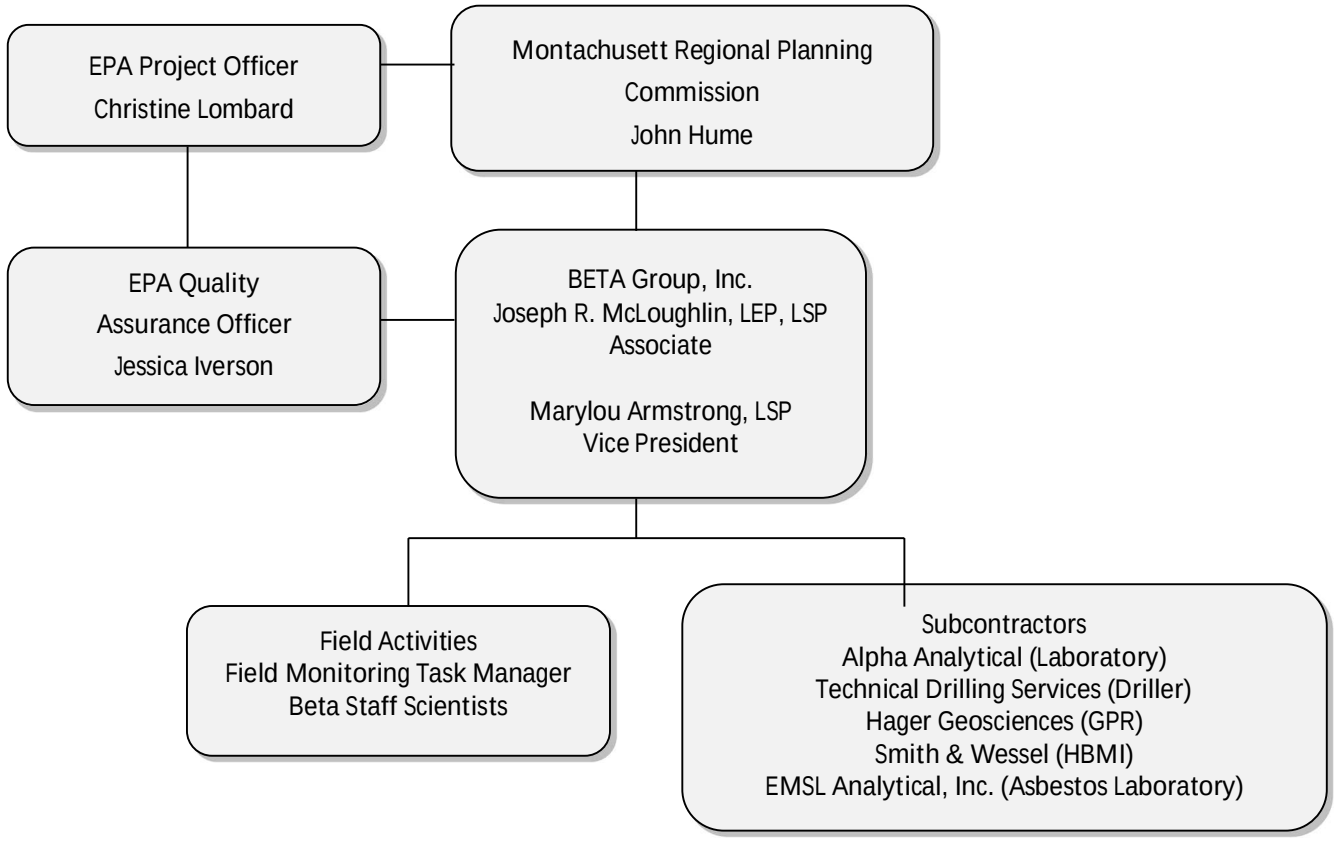
APPENDICES

A BETA Field Standard Operating Procedures
B Alpha Standard Operating Procedures
C Smith and Wessel HBMI Plan and Standard Operating Procedures

SECTION B – PROJECT ORGANIZATION AND RESPONSIBILITY

Figure B-1 below illustrates the organization structure for the assessment program.

Figure B-1: Project Organizational Structure



CONSULTANT

Joseph McLoughlin, LEP, LSP, Associate, will be responsible for the overall management of the Project Team. He will coordinate directly with the MRPC and the Town of Lunenburg. Mr. McLoughlin will also oversee the chain of custody documentation, record keeping and implementation of the quality assurance plan. He will be responsible for establishing and maintaining quality assurance (QA) guidelines for field sampling activities and sample analyses; reviewing results of quality control (QC) sample analyses; and maintaining the official, approved QAPP.

The Field Monitoring Task Manager will be responsible for overall management of the soil/groundwater sampling program, including the coordination of laboratory and drilling subcontractors. He/she will be responsible for the preparation of sample preparation bottles, collection and handling of samples, and handling and delivery to laboratories.

Field Staff

The BETA field staff will be responsible for implementing and documenting the field program in accordance with the protocols established in the QAPP and under the supervision of the Project Manager and Field Monitoring Task Manager.

Subcontractors

Alpha Analytical (Alpha), a State of Massachusetts certified laboratory will be responsible for the laboratory analysis of soil and groundwater samples.

Technical Drilling Services, Inc. (TDS) will be responsible for the advancement of soil borings using hollow-stem auger and Geoprobe drill rigs, and the installation of groundwater monitoring wells under the supervision of BETA field staff.

Smith & Wessel (S&W) will be responsible for performing a hazardous building materials investigation under the supervision of BETA field staff.

Hager Geoscience (Hager), a Woman-owned Business Enterprise, will be responsible for conducting the ground penetrating radar survey.

EMSL Analytical, Inc. (EMSL), a licensed Massachusetts laboratory that is also NVLAP accredited, will be responsible for performing asbestos analysis by polarized light microscopy (PLM).

SECTION C – PROBLEM DEFINITION

BETA Group, Inc. (BETA) has developed this Site-Specific Quality Assurance Project Plan (QAPP) Addendum in accordance with guidance provided by the U.S. Environmental Protection Agency (EPA) Region 1 under its Brownfields program. This QAPP Addendum is based on the guidelines set forth in *Generic Quality Assurance Project Plans, and Site-specific QAPP Addenda*, March 2009. It is intended for use for the project located at 925 Massachusetts Avenue, Lunenburg, Massachusetts. MRPC is utilizing Brownfields Assessment Grant (Agreement # BF00A0078) to complete this assessment.

This Site-Specific QAPP Addendum has been prepared for and submitted to the EPA for review and approval. It is understood that no work will be performed at the Site until the Addendum has been approved and that the work will be conducted in accordance with the approved QAPP Addendum. If any modifications or additions need to be made to the QAPP Addendum, they will be included as a formal revision to this document.

This property consists of 0.191 acres of land located approximately 400 feet west of the Lunenburg Center. The Town has initiated a tax-taking foreclosure from the current owner, L&M Service Center, Inc., which should be completed in 2020. An abandoned gasoline and automotive service station that formerly operated as Kelly's Citgo Service Station occupies the Site. This facility sold gasoline and conducted automotive repair at the Site. Reports indicate that Site has been a gasoline/repair station since circa 1918.

Records indicate two 10,000-gallon gasoline underground storage tanks (USTs), one 4,000-gallon diesel fuel UST, and one 500-gallon fuel oil UST exist at the Site. Records also indicate that three gasoline USTs and one waste oil UST were removed from the Site in the 1980s. The Site is listed as a release site (Tier ID) with the Massachusetts Department of Environmental Protection (MassDEP) under release tracking number 2-16390. Historic environmental investigations have focused on petroleum associated with USTs at the Site. However, plans and reports indicate that the Site also conducted automotive repair which could have involved the generation of hazardous waste. Historic plans indicate floor drains and a hydraulic lift were located in the garage building and an on-site septic system existed west of the site building. These features could involve hazardous materials and provide routes of entry into the subsurface.

Given the proximity to the center of town, the Town has submitted this Site for assessment to help facilitate redevelopment of this property. Although there are no specific development plans, the Town does not plan on retaining ownership of the property and has had inquiries about the property.

SECTION D – PROJECT DESCRIPTION/PROJECT TIMELINE

Project Purpose

BETA has been contracted by the Montachusett Regional Planning Commission (MRPC) to prepare this Site-Specific QAPP Addendum and to assess soil and groundwater quality at the site located at 925 Massachusetts Avenue in Lunenburg, Massachusetts (See Figure 1). The purpose of the project is to investigate whether the identified environmental concerns have impacted the environmental integrity of the site. The most likely future use of the Site is re-occupancy of the current Site building.

Data Quality Objectives (DQO)

The field and laboratory DQO for this investigation are designed to determine the presence and/or absence of and to the extent possible, the vertical and lateral extent of contaminants in soil and groundwater. To determine regulatory compliance, soil and groundwater concentrations will be compared to the Massachusetts Contingency Plan (MCP: 310 CMR 40.0000) reportable concentrations (RCs) and Method 1 standards.

The following tasks are proposed:

Task 1: Quality Assurance Project Plan (QAPP) Addendum

Prior to the initiation of the Site Investigation, BETA will develop this Site-Specific QAPP (QAPP Addendum) in accordance with the March 2009 "EPA New England, Region 1 Planning and Documenting Brownfields Projects – Generic Quality Assurance Project Plans and Site-Specific QAPP Addenda." BETA has an EPA-approved generic QAPP (approved in March 2020, RFA 20006) that will serve as the basis for this Site-Specific QAPP that will be submitted to the EPA for their approval.

Task 2: Initial Site Activities

BETA will conduct the following activities in preparation of the implementation of the field work for Phase II investigations:

- Pre-mark proposed boring locations in the field for utility locations purposes;
- At least seventy-two (72) hours prior to the start of the drilling activities, notify "Digsafe" and the Town of Lunenburg to mark utilities in the vicinity of the proposed boring locations; and
- Re-locate any borings that conflict with existing utilities.

BETA's Project Manager and field staff for this project have completed the 40-hour OSHA HAZWOPER training and maintain appropriate annual 8-hour refresher training. BETA will prepare a Site-specific Health and Safety Plan (HASP) in accordance with 29 CFR 1910.120 that will cover the following:

- Site description
- Chemical and physical hazards
- Health and Safety Plan responsibilities
- Excavation, trenching, and drilling safety
- First aid
- Personal protective equipment
- Site control measures
- Contingency plan

During the course of the project, the HASP will be re-evaluated and updated, if warranted by encountered site conditions.

Task 3: GPR Survey

Based on the identification of surficial features of underground storage tanks (fill ports and vent pipes), a septic system, and drainage structures, a GPR survey will be performed to locate subsurface structures including USTs. Hager will use GPR augmented with an electromagnetic metal locator to attempt to map subsurface structures including USTs exist in the southern, eastern, and western portions of the Site. This survey will be conducted prior to the advancement of soil borings to assist in locating borings in areas that will not affect subsurface structures.

Task 4: Hazardous Building Materials Investigation

Based on its age, it is possible that hazardous building materials may exist within the Site building. BETA will engage S&W to conduct a Hazardous Building Materials Investigation (HBMI). It is our understanding that the subject building is unoccupied and that limited destructive sampling will be permitted. We will, however, endeavor to minimize damage to building envelope components (i.e. windows, doors, roofing systems, etc.).

Asbestos Containing Building Materials

An audit of the building will be performed by certified Asbestos/Lead-Based Paint Inspectors for the presence of asbestos-containing materials (ACM), such as: pipe, duct and boiler insulation; floor and ceiling tiles and mastics; asphaltic roofing materials, flashing and mastics; miscellaneous interior finishes; plaster; and other suspect building materials. Asbestos bulk samples will be analyzed by polarized light microscopy with dispersion staining (PLM) at a Massachusetts-licensed laboratory. The type and percentage of asbestos in the bulk samples will be determined.

Lead Based Paint

The inspection will include field screening of surfaces for lead based paint (LBP). Painted surfaces will be screened for lead in paint concentrations using a NITON X-Ray Fluorescence (XRF) Spectrum Analyzer. Concentrations of lead in paint will be reported in milligrams per square centimeter (mg/cm^2). Total concentrations of lead will be used to help evaluate the extent of and need for segregation of building components coated with LBP. Toxicity Characteristic Leachate Procedure (TCLP) samples for waste characterization of building components coated with LBP will not be collected.

Based on the results of the testing for LBP, we will provide appropriate recommendations for handling and disposal of lead painted building components. That may include prescriptive pre-demolition methods and/or supplemental analytical testing (Toxicity Characteristic Leaching Procedure) to determine appropriate disposal options.

Polychlorinated Biphenyls (PCBs)

S&W will identify light ballasts that may contain PCBs by reading the identification marks on top of a representative sample of light ballasts. Typically, ballasts installed after 1978 do not contain PCBs and are marked as such. Based on our findings in the sample group we will make conservative assumptions as to the number of ballasts containing PCBs by extrapolating results across the site. We will also inspect for other possible sources of PCBs, such as electrical transformers, which may be present. Through visual inspection of labels and other relevant data we will attempt to confirm or deny the presence of PCBs within the examined area. No confirmatory sampling of these items for PCBs is proposed.

An initial inspection for suspect window caulk/glazing, expansion joint caulk and other sealants will be conducted to determine the potential for these materials to contain PCBs. Subsequently, samples will be collected and analyzed for PCB content via EPA's SW-846 Method 3540C/8082 SOXHLET Extraction. Based on the results, additional sampling may be required pursuant to TSCA regulatory requirements.

Mercury Components

To determine handling and disposal procedures for components that may contain mercury, S&W will quantify the number of fluorescent bulbs, switches, and thermostats assumed to contain mercury throughout the building. No confirmatory sampling or analysis for mercury is proposed.

Other Oils and Hazardous Materials

S&W will make observations for other miscellaneous hazardous materials that may be present such as batteries, solvents, aboveground storage tanks, stored drums, pigeon and or bat guano and other hazardous materials. We will prepare an inventory of such materials as identified. No confirmatory sampling and analysis are proposed.

Pre-Demolition Inspection Letter Report

Results of the HBMI will be summarized in a Letter Report for inclusion in the Phase II ESA report. The letter report will delineate the presence of regulated wastes and/or building materials, summarize the field and analytical laboratory test results, and present management plan options for the removal, segregation, handling and disposal of the regulated and hazardous wastes. The report will provide estimated quantities of each regulated and hazardous material associated with the building, along with specific requirements for management and disposal.

Task 5: Soil Borings

BETA will retain Technical Drilling Service to advance eight (8) soil borings at the Site. Five (5) of the borings will be completed as groundwater monitoring wells. BETA will oversee and direct drilling activities. The borings will be in locations anticipated to identify contamination based on the known information on the site. These locations may be modified based on findings during the investigation.

A track-mounted Geoprobe drilling unit will be used to complete the subsurface drilling activities. During the advancement of each boring, soil samples will be collected continuously from existing grade to bottom of borings. Soil borings will be terminated at the encountered water table. Borings designated for installation of overburden monitoring wells will be completed to a depth of five (5) to seven (7) feet below the water table with ten feet of well screen. Based on the proximity of surface water bodies, it is anticipated that groundwater will be encountered from approximately nine (9) to eleven (11) feet below grade.

Soil samples will be screened in the field for the presence of VOCs using headspace testing with a photoionization detector (PID). One soil sample from each boring [a total of eight (8) samples] will be submitted to Alpha for analysis of Volatile Organic Compounds (VOCs) by EPA Method 8260, Extractable Petroleum Hydrocarbons (EPH) with target polynuclear aromatic hydrocarbons (PAHs) by the MassDEP methodology, Volatile Petroleum Hydrocarbons (VPH) with target VOCs by the MassDEP methodology, polychlorinated biphenyls (PCBs) by EPA Method 8082, and the thirteen Priority Pollutant (PP) metals by various EPA methods. These analyses are proposed based on the potential sources of contamination at the Site.

Samples submitted for analyses will be selected based on field observations, PID readings, and proximity to the groundwater surface. Additional samples (duplicates, equipment blanks and trip blanks) will also be analyzed for purposes of Quality Assurance and Quality Control.

Given the nature of the Site, BETA anticipates that the completion of all drilling activities, including the installation of the groundwater monitoring wells and collection of soil samples will be completed in one (1) days. Investigation derived waste in the form of soil cuttings will be returned to the borehole.

Task 6: Groundwater Monitoring Well Development and Sampling

The five (5) new monitoring wells will be developed appropriately to remove fine silt and other particulate matter from the well to help achieve a proper hydrologic connection between the well and the surrounding aquifer, prior to the collection of groundwater samples.

The locations of the five (5) new wells and the top of well casing will be surveyed to an assumed datum and the groundwater flow direction will be determined. After the new wells are developed and allowed to come to equilibrium, groundwater samples will be collected from each of the five (5) new wells using the EPA's modified low-flow sampling protocol. Groundwater samples will be submitted to Alpha for analysis of VOCs by EPA Method 8260, EPH with target PAHs and VPH with target VOCs both by the MassDEP methodology, PCBs by EPA Method 8082A, and the 13 PP metals by various EPA methods. Additional samples (duplicates, equipment blanks and trip blanks) will also be analyzed for purposes of Quality Assurance and Quality Control.

As allowed by MassDEP and as long as it is not grossly contaminated, investigation derived waste (purge water) will be discharged to the ground surface in the immediate vicinity of each well. If grossly contaminated investigation-derived waste is encountered, this waste will be containerized for off-site disposal. The fee below does not include cost for disposal of this waste material.

Task 7: Reporting

Upon completion of field activities and receipt of laboratory analytical results, BETA will complete and submit a draft Phase II Environmental Site Assessment (ESA) report to the MRPC and EPA for review. The report will include a description of the investigatory methods used, the analytical results, identification of risks to human health and the environment, and the findings and conclusions from the investigation. Recommendations for further assessment and/or response actions will be included in the report. BETA will address comments received and issue a final report subsequent to resolution of the comments.

Project Timeline

A proposed schedule for the investigation activities is presented below. This schedule may be revised once final EPA approval of the QAPP is received. Inclement weather may also affect the proposed schedule.

Tasks	Approximate Start Date	Approximate End Date
1. Approval of QAPP/Health-and-Safety Plan/Coordination /Digsafe/Site Preparation	3/1/20	6/30/20
2. GPR Survey	7/1/20	7/15/20
3. HBMI Survey	7/1/20	7/31/20
4. Soil Boring Advancement/Soil Sampling	7/20/20	7/26/20
5. Groundwater Monitoring Well Sampling	7/29/20	8/10/20
6. Report	8/17/20	9/4/20

SECTION E – SAMPLING DESIGN AND SITE FIGURES

A Site Locus is included as Figure 1, a Lunenburg Assessor's Map is included as Figure 2, and proposed sample locations are depicted on Figure 3. The locations of sample points may be adjusted based upon the results of the GPR survey, marked utility locations, drilling refusal, property access, site observations, and/or other field constraints.

Soil Borings and Groundwater Well Installation

As shown on Figure 3, borings have been located to evaluate site conditions in areas that may be impacted by on-site sources and in areas that have not previously been investigated. On-site sources include two 10,000-gallon gasoline USTs, one 500-gallon fuel oil UST, one 4,000-gallon diesel fuel UST, an on-site septic system, hydraulic lifts, and a floor drain system. Boring locations described below have been selected to assess the Site for potential impact from these potential on-site sources. Soil samples will be collected continuously to an anticipated maximum depth of 16 feet. Groundwater has previously been encountered at depths ranging from 9 to 11 feet below ground surface. The following table summarizes the proposed borings and rationale.

Proposed Boring	Analytical Parameter	Sampling Rationale
B -101	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from gasoline USTs.
B -102	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from on-site septic system.
B -103	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from garage activities.
B -104	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	Upgradient boring.
B -105	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from drain system.
B -106	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from fuel oil UST.
B -107	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from gasoline UST and fueling island.
B -108	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	Geographical coverage.

During the advancement of soil borings, soil samples will be visually examined and screened in the field for TVOCs using the jar headspace method. At each boring, the soil sample with the highest PID readings will be submitted for analysis of VOCs which will be immediately placed in laboratory-supplied preserved vials.

Field observations (e.g., visual, olfactory, PID headspace readings) will be used to adjust and select sampling depths for EPH, VPH, PCBs, and metals. Note that the EPH analysis includes targeted PAHs (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorine, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene and pyrene. VPH analysis includes the targeted VOCs benzene, toluene, ethylbenzene, xylenes (BTEX) and naphthalene.

Soil will be returned to its place of origin (either placed inside of the boreholes or dispersed near the borehole location).

Soil results will be compared to the MassDEP RCS-1 and RCS-2 reportable concentrations listed in 310 CMR 40.1400.

Groundwater Monitoring Wells

Monitoring wells will be constructed with 2-inch diameter polyvinyl chloride (PVC) materials. The screened sections (10 feet long) will extend approximately five to seven feet below the water table to accommodate seasonal water level fluctuations. The wells will be surrounded by a sand pack and bentonite seal and will be protected at the surface with flush-mounted locking road boxes. The wells will be developed following installation using a peristaltic or bladder pump. Purge water will be discharged to the ground surface near the well.

During well development, headspace measurements of VOCs will be made on purged groundwater using a PID. If the headspace reading exceeds 10 ppm, the purge water will be drummed or containerized until the groundwater sample test results are obtained to evaluate disposal options. If the headspace VOC readings are less than 10 ppm, the water will be discharged on site. After development, the wells will be allowed to stabilize for a period of at least seven days prior to sampling.

Prior to sampling, the depth to groundwater and non-aqueous phase liquid (NAPL), if present, will be measured using a Solinst Model 122 interface probe. Groundwater samples will be collected using low-flow sampling methods. Groundwater samples will be collected from the five newly installed wells. The groundwater samples will be sent for analysis of EPH with target PAHs by the MassDEP Methodology, VPH with target VOCs by the MassDEP Methodology, VOCs by EPA Method 8260B, PP-13 metals by EPA Methods 6010, and PCBs by EPA Method 8082A. The following table summarizes the wells and proposed laboratory analysis.

Well ID	Analytical Parameter	Sampling Rationale
MW-101	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from gasoline USTs.
MW-102	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from on-site septic system.
MW-103	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from garage activities.
MW-104	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	Upgradient monitoring well.
MW-105	EPH with PAHs, VPH with VOCs, VOCs, PP-13 Metals, and PCBs	To evaluate potential impacts from drain system.

Groundwater laboratory result will be compared to the MassDEP's RCGW-2 reportable concentrations as the Site is not located in a Current or Potential Drinking Water Area (as defined in 310 CRM 40.0000 et seq.).

Quality Assurance/Quality Control

The investigation activities will be performed in accordance with applicable state and federal protocols, and BETA SOPs. Equipment calibration and quality control checks will be performed in accordance with the methodologies and frequencies indicated in Section H.

Sampling tools will be decontaminated between sampling locations and at the end of each field day in accordance with BETA established SOPs. Equipment blanks will be collected when reusable equipment is used to ensure proper decontamination at a rate of one (1) per day per piece of reusable equipment.

The laboratory samples will be stored in a cooler to maintain samples at 4°C. Field duplicates samples will be submitted with soil, sediment, surface water and groundwater analyses at a rate of 5%. Trip blanks will be collected for VOC 8260B analysis at a rate of one per cooler. BETA will also provide the laboratory with sufficient aliquots of soil at a rate of 5% per sample batch or one minimum per day (whichever is larger) to serve as laboratory matrix spike/matrix spike duplicate (MS/MSD) samples for site-specific matrix interference assessment. Sample spiking will be performed by the laboratory.

SECTION F - SAMPLING AND ANALYTICAL METHODS REQUIREMENTS

Table F-1 (next page) provides sampling and analytical method requirements.

Table F-1
Sampling and Analytical Methods Requirements

Matrix	Parameter	Number of Samples (including field QC)	Sampling Procedure (SOPs)[1]	Analytical SOP(s)[2]	Analytical Methods	Sample Containers	Sample Preservation	Maximum Holding Time Requirements
Soil	VOCs	8 + 1 dup +1 trip blank	2	-	8260B/5035A	2-40 mL Methanol preserved VOA Vials	Methanol Cool to 4ºC	14 days (Extraction)
Soil	EPH	8+1 dup	2			8 oz Glass container	Cool to 4ºC	14 Days
Soil	VPH	8+1 dup	2	-	8270D	2-40 mL Methanol preserved VOA Vials	Methanol Cool to 4ºC	14 days (Extraction)
Soil	PCBs	8+1 dup	2	-	8082A	8 oz Glass container	Cool to 4ºC	14 days (Extraction)
Soil	13 Total Metals	8 + 1 dup	2	-	6010C, 7471A	8 oz Glass container	Cool to 4ºC	Mercury - 28 days; Other metals -180 days
GW	VOCs	5 + 1 dup +1 trip blank	3	-	8260B	2 – 40 ML VOA Vials	HCl, pH<2 Cool to 4ºC	14 Days
GW	EPH	5+1 dup	3			2 – 1 L Glass containers	HCl, pH<2 Cool to 4ºC	14 Days
GW	VPH	5+1 dup	3	-	8270C	2 – 40 ML VOA Vials	HCl, pH<2 Cool to 4ºC	14 Days
GW	PCBs	5+1 dup	3	-	8082A	2 – 1 L Glass containers	$Na_2S_2O_2$ Cool to 4ºC	None
GW	13 Total Metals	5 + 1 dup	3	-	6010C, 6020, 7000A	500 mL Plastic container	HNO3, pH<2 Cool to 4ºC	6 Months
Asbestos [3]	PLM	To be determined based on HBMI	-	-	600/R-93/116	Re-sealable Plastic bag	-	Not Regulated

1 Sampling SOPs are identified on Form G-1

2 Analytical SOPs are identified on Form G-2 and will depend on laboratory used

3 Asbestos sampling SOP on Form G-3

SECTION G – METHOD AND SOP REFERENCE TABLE

The following tables include reference to field and laboratory Standard Operating Procedures (SOPs) which were included in our June 12, 2018 Generic QAPP. BETA field SOPs that were not included in the Generic QAPP, but are applicable to this project are provided in Appendix A. A revised version of the Soil Headspace Analysis SOP is also included. SOPs from Alpha are provided in Appendix B and are summarized in Table G-2. The Asbestos sampling SOP from S&W is provided in Appendix C and listed in Table G-3.

Table G-1: Field Sampling SOPs

SOP #	Document Title	Revision Number	Date
1	Field Notes	0	1/19/12
2	Soil Sample Collection	1	8/17/11
3	Low Flow Sample Collection	2	2/25/13
4	Soil Headspace Analysis	2	1/9/15
5	Equipment Decontamination	1	8/17/11
6	Water Level Measurement	0	8/17/11
7	Groundwater Monitoring Well Installation and Development	0	8/8/11

Table G-2

Laboratory SOPs – Alpha

SOP #	Analytical Method - Reference Method #	Alpha SOP
1	**Method for the Determination of Extractable Petroleum Hydrocarbons (EPH)**, Massachusetts DEP, ORS, BWSC. MADEP-EPH-04-1, Revision 1.1 May 2004	Extractable Petroleum Hydrocarbons (MA-EPH) 2.1 – March 31, 2020
2	**Method for the Determination of Volatile Petroleum Hydrocarbons (VPH)**, Massachusetts DEP, ORS, BWSC. Revision 1.1, May 2004	Volatile Petroleum Hydrocarbons (VPH) – January 14, 2020
3	**Method 8260C**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 2005. *Method 5035A*, Closed System Purge &Trap and Extraction for Volatile Organics in Soil and Waste Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, Draft, July 2002. *Method 5030B*, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, December, 1996. *Method 5030C*, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, May, 2003.	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) – April 10, 2020
4	**Method 8082** Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW – Method 8000B (Revision 2, 12/1996), 8082A (Revision 1, 02/2007). U.S. Code of Federal Regulations, Title 40 (40 CFR) Appendix B to Part 136: Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11 WSC-CAM-V A: Quality Control Requirements and Performance Standards for the Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) in Support of Response Actions under the Massachusetts Contingency Plan (Revision 1, July 1, 2010)	PCBs by Capillary Column Gas Chromatography – April 8, 2019
5	**Method 6010C SW-846**, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, February 2007. SM 2340B, Hardness by Calculation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WPCF, 21st Edition, 1997.	Inductively Coupled Plasma – Atomic Emission Spectrometry – December 20, 2018
7	**EPA 7470A** Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update II, September 1994.	Mercury in Liquid Waste – January 13, 2020
8	**EPA 7471B** Reference: SW846 Method 7471A and 7471B: Mercury in Solid Waste (Manual Cold-Vapor Technique). Third edition, Final Updates III and IV.	Mercury in Solid or Semisolid Waste – January 13, 2020
9	**Method EPA/600/R-93/116:** US EPA Method of Determination of Asbestos in Bulk Building Materials. July 1993.	PLM SOP May 30, 2017
10	**AHERA Method:** 40 CFR Part 763 Appendix A to Subpart E	TEM SOP July 24, 2018

Table G-3
Field SOPs – S&W

SOP #	Document Title	Revision Number	Date
1	Scope of Asbestos Sampling Work and Sampling Protocols	0	2/27/20

SECTION H – FIELD EQUIPMENT CALIBRATION & CORRECTIVE ACTION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION I – LABORATORY EQUIPMENT CALIBRATION & CORRECTIVE ACTION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION J – SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION K – ANALYTICAL SENSITIVITY AND PROJECT CRITERIA

The following table documents analytical method sensitivity and project criteria for methods that will be used to analyze soil and groundwater collected at the Site.

If the reporting limit is greater than the applicable standards, the sample will be re-analyzed with a lower limit of detection until the reporting limit is less than the appropriate standards. The RLs and standards are current and accurate as of the date of this plan.

Analyte	Analytical Method	Reporting Limit		Massachusetts Criteria (Reportable Concentrations)		
		Aqueous (mg/l)	Soil (mg/kg)	Soil (mg/kg)		Groundwater (mg/L)
				RCS-1	RCS-2	RCGW-2
Volatile Organic Compounds	SW-846 Method 8260B					
1,1,2-Trichlorofluoroethane (Freon 113)		0.01	0.004	NS	NS	NS
Acetone		0.005	0.025	6	50	50
Acrylonitrile		0.005	0.004	100	1,000	10
Benzene		0.0005	0.0005	2	200	2
Bromobenzene		0.0025	0.002	100	1,000	10
Bromochloromethane		0.0025	0.002	NS	NS	NS
Bromodichloromethane		0.0005	0.0005	0.1	0.1	0.006
Bromoform		0.002	0.004	0.1	1	0.7
Bromomethane		0.001	0.002	0.5	0.5	0.007
2-Butanone (MEK)		0.005	0.01	4	50	50
n-Butylbenzene		0.0005	0.001	NS	NS	NS
sec-Butylbenzene		0.0005	0.001	NS	NS	NS
tert-Butylbenzene		0.0025	0.002	100	1,000	NS
Carbon Disulfide		0.005	0.01	100	1,000	10
Carbon Tetrachloride		0.0005	0.001	5	5	0.002
Chlorobenzene		0.0005	0.0005	1	3	0.2
Chloroethane		0.001	0.002	100	1,000	10
Chloroform		0.00075	0.0015	0.3	0.3	0.05
Chloromethane		0.0025	0.004	100	1,000	10
2-Chlorotoluene (o-Chlorotoluene)		0.0025	0.002	NS	NS	NS
4-Chlorotoluene (p- Chlorotoluene)		0.0025	0.002	NS	NS	NS
1,2-Dibromo-3-chloropropane		0.0025	0.003	10	100	1
Dibromochloromethane		0.0005	0.001	0.005	0.03	0.02
1,2-Dibromoethane (EDB)		0.002	0.001	0.1	0.1	0.002
Dibromomethane		0.005	0.002	500	5,000	50
1,2-Dichlorobenzene		0.0025	0.002	9	30	2
1,3-Dichlorobenzene		0.0025	0.002	1	4	2
1,4-Dichlorobenzene		0.0025	0.002	0.7	40	2
Dichlorodifluoromethane		0.005	0.01	1,000	10,000	100
1,1-Dichloroethane		0.00075	0.001	0.4	5	1
1,2,-Dichloroethane		0.0005	0.001	0.1	0.1	0.005
1,1-Dichloroethene		0.0005	0.001	3	40	0.08
cis-1,2-Dichloroethene		0.0005	0.001	0.3	0.4	NS
trans-1,2-Dichloroethene		0.00075	0.0015	1	1	0.09
1,2-Dichloropropane		0.00175	0.001	0.1	0.1	0.003
1,3-Dichloropropane		0.0025	0.002	500	5,000	50
2,2-Dichloropropane		0.0025	0.002	NS	NS	NS
1,1-Dichloropropene		0.0025	0.0005	500	5,000	50
cis-1,3-Dichloropropene		0.0005	0.0005	0.01	0.4	0.01
trans-1,3-dichloropropene		0.0005	0.001	0.01	0.4	0.01
Ethylbenzene		0.0005	0.001	40	1,000	5
Hexachlorobutadiene		0.0005	0.004	6	90	0.001
2-Hexanone		0.005	0.01	100	1,000	10
Isopropylbenzene (Cumene)		0.0005	0.001	1,000	10,000	100
4-Isopropyltoluene		0.0005	0.001	NS	NS	NS
Methyl t-butyl ether		0.001	0.002	0.1	100	5
4-Methyl-2-pentanone (Methyl isobutyl ketone)		0.005	0.01	0.4 0	50 0	50 0
Methylene Chloride		0.003	0.005	0.1	200	10
Naphthalene		0.0025	0.004	4	40	1

Analyte	Analytical Method	Reporting Limit		Massachusetts Criteria (Reportable Concentrations)		
		Aqueous (mg/l)	Soil (mg/kg)	Soil (mg/kg)		Groundwater (mg/L)
				RCS-1	RCS-2	RCGW-2
Volatile Organic Compounds	SW-846 Method 8260B					
n-Propylbenzene		0.0005	0.001	NS	NS	NS
Styrene		0.001	0.001	3	4	0.1
1,1,1,2-Tetrachloroethane		0.0005	0.0005	0.1	0.1	0.01
1,1,2,2-Tetrachloroethane		0.0005	0.0005	0.005	0.02	0.009
Tetrachloroethene		0.0005	0.0005	1	10	0.05
Toluene		0.00075	0.001	30	1,000	40
1,2,3-Trichlorobenzene		0.0025	0.002	NS	NS	NS
1,2,4-Trichlorobenzene		0.0025	0.002	2	70	2
1,1,1-Trichloroethane		0.0005	0.0005	30	600	4
1,1,2-Trichloroethane		0.00075	0.001	0.1	2	0.9
Trichloroethene		0.0005	0.0005	0.3	2	0.03
Trichlorofluoromethane		0.0025	0.004	1,000	10,000	100
1,2,3-Trichloropropane		0.005	0.01	100	1,000	10
1,2,4-Trimethylbenzene		0.0025	0.002	NS	NS	100
1,3,5-Trimethylbenzene		0.0025	0.002	NS	NS	1
Vinyl Chloride		0.001	0.001	3	40	0.002
Xylenes		0.001	0.002	500	500	5
Tetrahydrofuran		0.005	0.004	500	5,000	50
Ethyl Ether		0.0025	0.002	100	1,000	10
Tert-amyl methyl ether		0.002	0.002	NS	NS	NS
Ethyl tert-butyl ether		0.002	0.002	NS	NS	NS
Di-isopropyl ether		0.002	0.002	100	1,000	10
Tert-Butanol / butyl alcohol		0.01	0.02	100	1,000	100
1,4-Dioxane		0.25	0.08	0.2	6	6

Analyte	Analytical Method	Reporting Limit		Massachusetts Criteria (Reportable Concentrations)		
		Aqueous (mg/l)	Soil(mg/kg)	Soil (mg/kg)		Groundwater (mg/L)
				RCS-1	RCS-2	RCGW-2
Volatile Petroleum Hydrocarbons	MassDEP Method					
C5-C8 Aliphatics		0.1	5	100	500	3
C9-C12 Aliphatics		0.1	5	1,000	3,000	5
C9-C10 Aromatics		0.1	5	100	500	4
Benzene		0.002	0.1	2	200	2
Toluene		0.002	0.1	30	1,000	40
Ethylbenzene		0.002	0.1	40	1,000	5
Xylene		0.002	0.1	300	300	5
Naphthalene		0.01	0.5	4	40	1
Methyl Tert Butyl Ether		0.003	0.05	0.1	100	5
Extractable Petroleum Hydrocarbons	MassDEP Method					
C9-C18 Aliphatics		0.1	6.67	1,000	3,000	5
C19-C36Aliphatics		0.1	6.67	3,000	5,000	50
C11-C22 Aromatics		0.1	6.67	1,000	3,000	5
Acenaphthene		0.01	0.333	1,000	3,000	50
Acenaphthylene		0.01	0.333	1	10	0.04
Anthracene		0.01	0.333	1,000	3,000	0.03
benzo(a)anthracene		0.01	0.333	7	40	0.1
benzo(a)pyrene		0.01	0.333	2	4	0.5
benzo(b)fluoranthene		0.01	0.333	7	40	0.04
benzo(g,h,i)perylene		0.01	0.333	1,000	3,000	0.02
benzo(k)fluoranthene		0.01	0.333	70	400	0.01
Chrysene		0.01	0.333	70	400	0.07
dibenzo[a,h]anthracene		0.01	0.333	0.7	4	0.04
Fluoranthene		0.01	0.333	1,000	3,000	0.2
Fluorene		0.01	0.333	1,000	3,000	0.04
indeno(123-cd)pyrene		0.01	0.333	7	40	0.1
2-methylnaphthalene		0.01	0.333	0.7	80	0.2
Naphthalene		0.01	0.333	4	40	0.1
Phenanthrene		0.01	0.333	10	1,000	10
Pyrene		0.01	0.333	1,000	3,000	0.02

Analyte	Analytical Method	Reporting Limit		Massachusetts Criteria (Reportable Concentrations)		
		Aqueous (mg/l)	Soil (mg/kg)	Soil (mg/kg)		Groundwater (mg/L)
				RCS-1	RCS-2	RCGW-2
Metals	**SW-846 6010**					
Antimony		0.05	2.0	20	30	8
Arsenic		0.005	0.4	20	20	0.9
Beryllium		0.005	0.2	90	200	0.2
Cadmium		0.005	0.4	70	100	0.004
Chromium		0.01	0.4	100	200	0.3
Copper		0.01	0.4	1,000	10,000	100
Lead		0.01	2.0	300	300	0.01
Nickel		0.025	1.0	600	1,000	0.2
Selenium		0.01	0.8	400	700	0.1
Silver		0.007	0.4	100	200	0.007
Thallium		0.02	0.8	8	60	3
Zinc		0.05	2.0	1,000	3,000	0.9
Mercury	**SW-846 Method 7470A/7471B**	0.0002	0.100	2	20	0.02
PCBs	**SW-846 8082A**					
PCBs		0.00025	0.0	1	4	0.005

SECTION L – FIELD QUALITY CONTROL

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION M – LABORATORY QUALITY CONTROL

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION N – DATA MANAGEMENT & DOCUMENTATION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION O – ASSESSMENTS AND RESPONSE ACTIONS

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION P – PROJECT REPORTS

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION Q – FIELD DATA EVALUATION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION R – LABORATORY DATA EVALUATION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

SECTION S – DATA USABILITY AND PROJECT EVALUATION

Refer to BETA's Generic QAPP dated March 25, 2020 (RFA #20006).

FIGURES

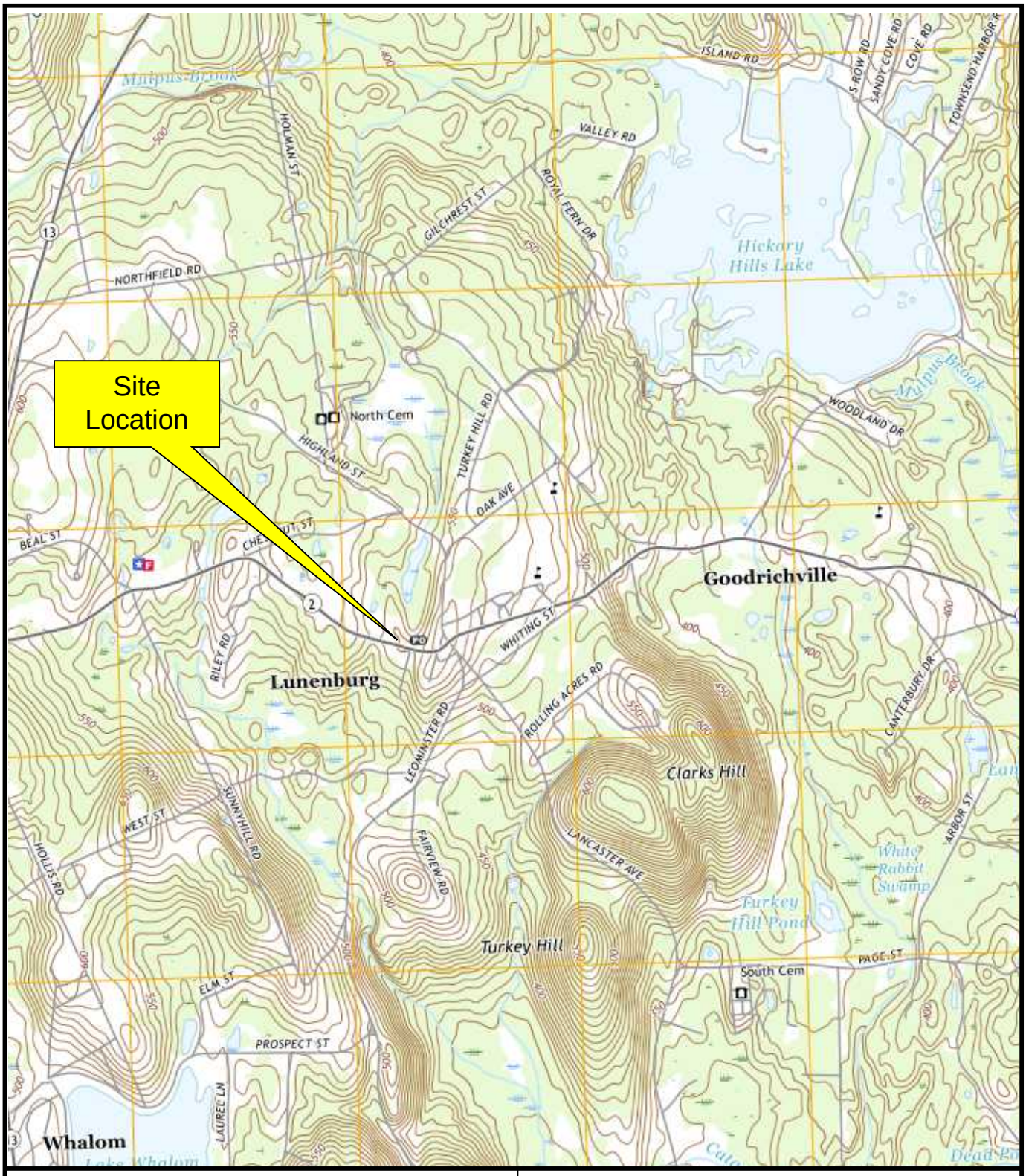


Figure 1: Site Locus

925 Massachusetts Avenue
Lunenburg, Massachusetts

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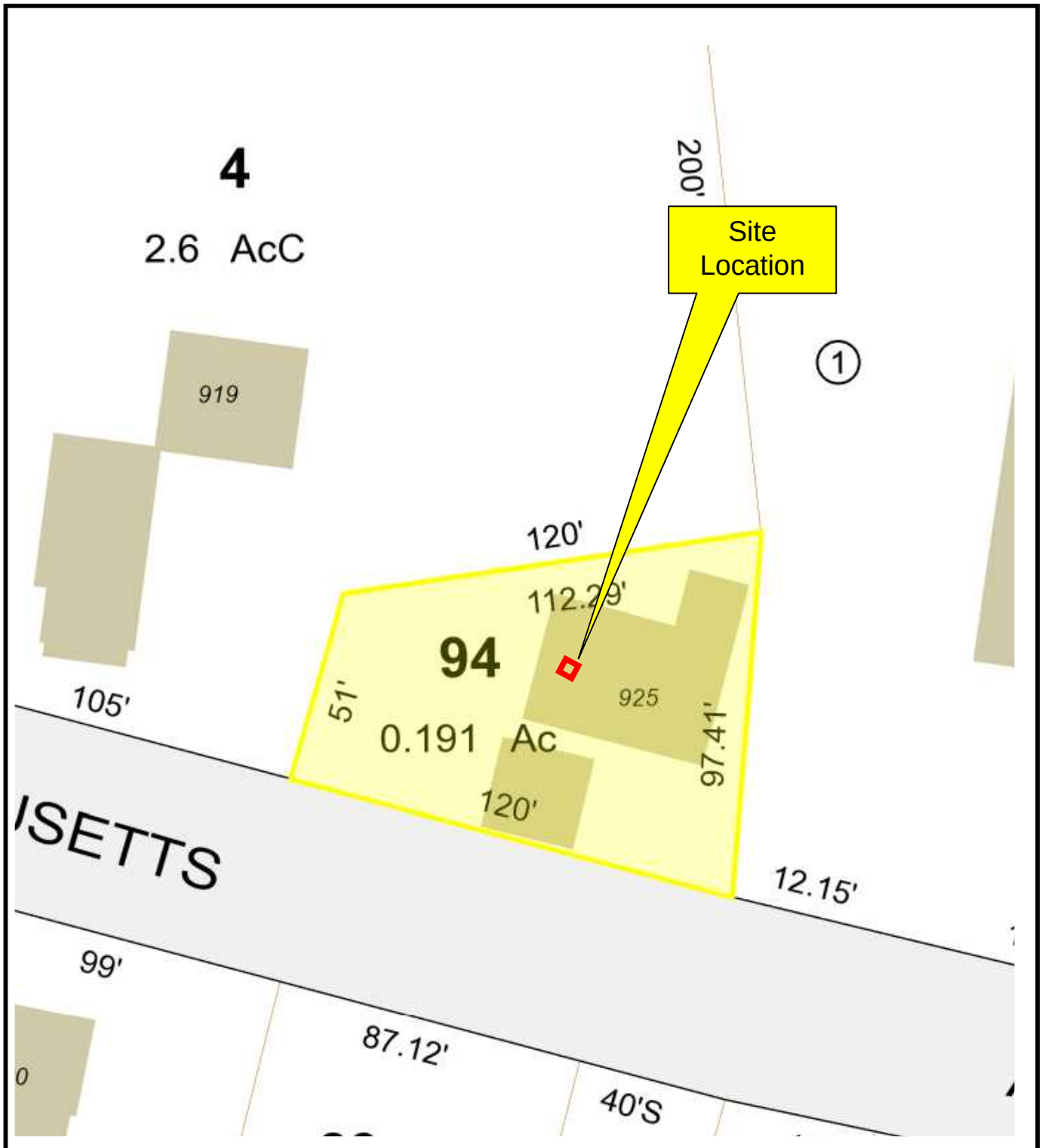
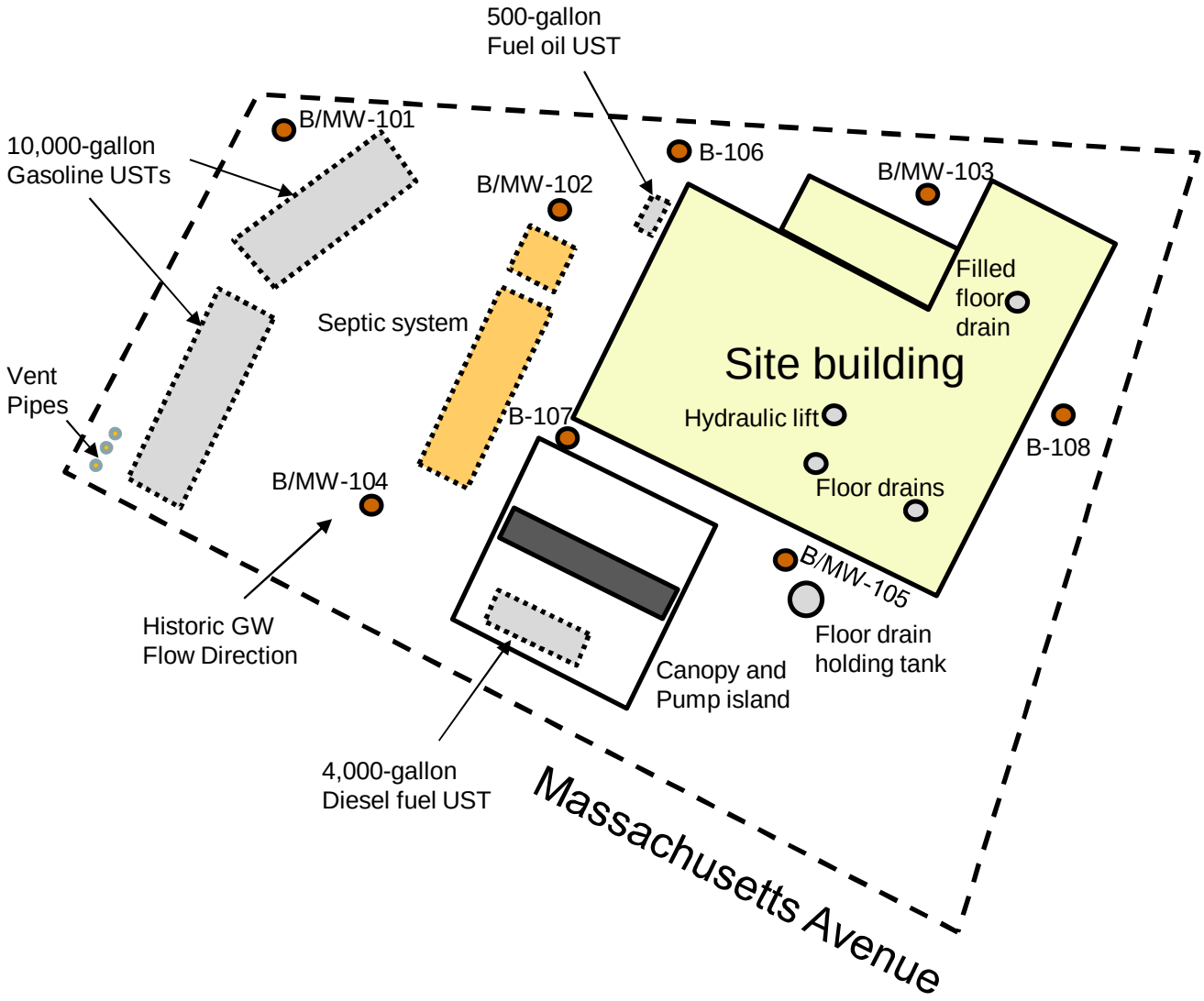


Figure 2: Assessor's Map

925 Massachusetts Avenue
Lunenburg, Massachusetts

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Base plan: 1997 Enstrat plan
Not to scale
Feature locations estimated based on historic plans and surface features

Figure 3: Site Plan

925 Massachusetts Avenue
Lunenburg, Massachusetts

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APPENDIX A

BETA FIELD STANDARD OPERATING PROCEDURES

BETA Group, Inc.
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Standard Operating Procedures

Field Notes

The purpose of this Standard Operating Procedure (SOP) is to establish a consistent method and format for documentation of field activities. Field notes are used to provide detailed information that can be used to recreate field activities. Information in these documents must be clear and complete. This procedure shall be used during all field activities, including sampling of soil, groundwater, soil vapor, landfill gas; soil borings, monitoring well installation, free product gauging, site reconnaissance, remediation, and waste handling.

Responsibility:

The field sampling personnel will be responsible for understanding and implementing guidelines set forth in this SOP. Field personnel shall confirm that all field activities have been documented at the end of each field day. Field notes shall be scanned and saved electronically in the designated project folder upon return to the office.

Required Materials:

- Field Book
- Waterproof pens
- Field forms

Methods:

This SOP specifically details the procedures for field book documentation. Other field records and forms (boring logs, sample labels, chain of custody records) are discussed in the specific SOP associated with that particular activity, and are not covered in this SOP.

Field Books:
Field personnel shall keep accurate written records of their daily activities in a bound field book that will be sufficient to recreate the project field activities without reliance on memory. The information will be recorded in chronological order, and contain detailed information on field activities, data observations, derivations from project plans, problems encountered, and actions taken in response to the problem.

In addition to documenting field activities, field books shall include the following:

- Date and time of activities
- Site location
- Purpose of site visit
- Site and weather conditions
- Personnel present, including sampling crew, facility/site personnel and representatives, and subcontractors (including site arrival and departure times)
- Sampling methodology and information
- Sample numbers or descriptions
- Sample locations (field sketches with measurements recommended)

Photographs:

Photographs are very important to document site conditions, field observations, and any circumstances encountered. For each photograph taken, the date and location should be recorded. The photograph number and direction taken should also be documented. For digital cameras, make sure that the date and time settings are set correctly before taking pictures.

Corrections:

Any corrections to the field book will be made by drawing a single line through the error, entering the correct information, and initialing and dating the change.

Documentation Archive:

All field notes will be scanned to the designated project folder as soon as possible. The field books themselves will be maintained and stored for future reference, if necessary.

August 17, 2011
Rev. 1

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Standard Operating Procedures

Soil Sample Collection

This standard operating procedure (SOP) will describe the procedures used in the collection of soil samples. It is important to obtain a representative sample and avoid cross-contamination between sampling points. Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

Sampling methods may vary depending on site conditions and equipment restrictions, and desired depth of sample.

Preparation:

Prior to field activities, a sampling plan will be established. The sampling plan will consist of sampling methods to be used, the approximate number of samples to be collected, locations and depth of samples, laboratory analysis to be performed, and a list of all required equipment and supplies.

Sampling and monitoring equipment will be decontaminated in accordance with the procedures outlined in the "Decontamination Procedures" SOP.

Sample Containers:

Precleaned containers shall be requested from the laboratory that meet the requirements in "Specifications and Guidance for Contaminant-Free Sample Containers", EPA540/R-93/051, PB93-963316, December 1992. Soil samples collected for laboratory analyses will be collected using appropriate sample containers, as provided by the receiving laboratory.

Sampling Procedures:

During soil sampling events, the following general procedures will be followed:

- Following field screening and visual/olfactory inspection, identify the soil to be collected for laboratory analyses;
- Obtain the most representative, homogeneous sample as possible. Samples will be collected using a pre-cleaned stainless steel scoop, spoon, or spade. As appropriate, soil samples will be composited in stainless steel bowls or sealable plastic bag;
- Remove all large stones from the soil sample (greater than 1/4-inch);
- Place the sample into the labeled laboratory-supplied container. Sample shall be packed as tightly as possible to remove air pockets. If collecting for VOC analysis, transfer the sample directly into an appropriate labeled sample container and secure the cap tightly. If collecting a composite sample, place the remainder of the sample in the soil jar provided by the laboratory.

- Clean threads of jar and place Teflon lid on tightly. Care shall be taken not to trap soil grains within the threads of the jar and lid;
- Label and preserve the sample as discussed in the section "Sample Handling, Documentation and Chain-of-Custody requirements";
- Discard outer protective gloves between each sample event; and
- Decontaminate samples tools as described in the section, "Decontamination Procedures".

Sample Preservation:

Samples will be collected in pre-cleaned glass containers and stored in cool conditions (approximately 4°C). After collection, samples will be promptly placed in a cooler with ice to preserve the samples; no chemical preservative will be added. Samples will be submitted on the same day of collection to a Massachusetts-certified laboratory for chemical analysis. The samples will remain refrigerated at the laboratory until analysis.

May 23, 2019
Rev. 3

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Standard Operating Procedures

Low Flow Sampling

This standard operating procedure (SOP) was established to provide a method that minimizes the impact the purging process has on the ground water chemistry during sample collection and to minimize the volume of water that is being purged and disposed. The general procedure for low flow groundwater sampling is discussed below. EPA's "Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells" is attached to this SOP.

Set Up:

1. Inspect and open monitoring well. Record the well conditions and use a water level indicator to gauge the water level within the well.
2. Choose the pump placement such that the intake to the pump should be placed at the mid-point of the length of submerged well screen. (Prior to visiting the Site, copies of well construction logs should be made and inspected for total well depth, screened interval and pervious depth to water). If sampling from a well where the screen intersects the water table elevation, be sure to sample from the mid-point of the submerged screen length:

   Examples:

   Given: Monitoring well installed 25 ft. below ground surface (bgs)
   Screened interval: 15-25 ft. bgs
   Depth to water: 20 ft bgs.
   Find: Sampling depth

   Sampling Point= (mid-point of submerged screen)=
   =(20+25)/2=22.5 ft bgs

   Given: Monitoring well: 80 ft bgs
   Screened Interval: 70-80 ft bgs
   Depth to water: 20 ft bgs
   Find: Sampling Depth

   Sampling Point = (mid-point of submerged interval)=(70+80)/2
   =75 feet bgs

Prior to Low Flow sampling, the type of pump should be chosen based on water level, well diameter, and accessibility. The following factors dictate pump choice:

- Depth to Groundwater:
  - Peristaltic pumps are effective pumps for wells with water levels down to approximately 25 feet in depth. Beyond 25 feet in depth in-line losses do not allow the pump to function. Although the pump is rated to 25 feet, care should be taken if the pump is to be relied upon beyond approximately 23 feet.
  - Bladder pumps are effective beyond 25 feet in depth to beyond 100 feet in depth.
  - Submersible pumps are rated to various depths, with variable flow rates. Certain submersible pumps cannot be operated within the "low flow" discharge rate (0.1 to 0.5 l/min).

- Well diameter:
  - Bladder pumps are available in sizes that fit within 1" and 2" diameter wells. Choose the appropriate size.
  - Peristaltic pumps remain outside the well during pumping, and ¼' tubing is placed within the well. One should use ¼" tubing regardless of well diameter.

1. Set up pump apparatus (peristaltic pump or bladder pump) in accordance with the equipment manual, measure length of new tubing for target pump depth from top of riser and mark with a permanent marker. Attach tubing to pump and/or pump controller. Lower into well, aligning mark on tubing with top of riser.

2. Attach tubing in-line flow thru cell which houses the water-quality "sonde" instrument for monitoring of water quality parameters (except for turbidity). Inflow tubing to the flow thru cell should be attached to the bottom port of the flow thru cell, while the discharge tubing from the flow thru cell will be connected to the upper port of the flow thru cell. Flow from the flow thru cell's discharge tubing should be collected in a clean 5 gallon pail for visual and olfactory inspection.

<u>Set Flow Rate to Minimize Drawdown:</u>

1. Lower water level indicator into well.

2. Note time and initial water level before starting pump. Pump should be started at a low flow rate and can be increased if turbidity and drawdown is kept to a minimum.

3. During pumping drawdown should generally be kept less than 0.3 ft. If drawdown is greater than 0.3 ft, decrease the pumping rate. If turbidity is high, check drawdown, and lower pumping rate.

4. Discharge rate from the pump should be measured using a graduated cylinder and a stopwatch, or if a graduated cylinder is not available a 40 ml vial can be substituted.

Flow Rate Example 1:
Given: Peristaltic Pump (continuously) fills three 40 ml vials per minute.
Find: Flow Rate
Flow Rate=
(Volume)/Time=((3*40ml)/(1 min))*(1 liter/1000ml)
=0.12 liters/min.

Depending on pump use, discharge may be continuous, or intermittent as in the case of the bladder pump.

Flow Rate Example 2:
Given: Bladder Pump (intermittently) fills four ml vials every 60 seconds. The pump operates with filling and discharge phases. The pump is set at 4 cycles per minute.
Find: Flow Rate
Flow Rate=
(Volume)/Time=((4*40 ml)/ (1 min))*(1 liter/1000 ml)
=0.16 liters/min.

Pump flow should generally be set to between 0.1 to 0.5 l/min. but is dependent on the aquifer.

Wait for Stabilization:

1. With no excessive drawdown, or turbidity, pump well at current rate, and record data from flow thru cell. Reading should be taken at intervals based on the theoretical retention time of the flow thru cell calculated by the flow rate, and flow thru cell volume. The flow thru cell is approximately 0.75 liters.
    - Given: 0.75 liter flow thru cell
      0.1 liter per min pumping rate
      Find: Theoretical retention time=
      =(Volume of Flow thru cell)/(Discharge rate of pump)
      =(0.75 liter)/(0.1 liter/min)=
      =7.5 minutes

   For flow rates between 0.1 liter/min and 0.5 liter/minutes readings should be taken between 7.5 and 1.5 minutes.

Stabilization is considered complete when three consecutive readings are within the following limits:

Table 1: Acceptable Limits of Variation

Parameter	Limit of Variation
Turbidity (reading taken before water enters the flow-through-cell)	10% for values greater than 5 NTU; if 3 measurements are less than 5 NTU, consider the values as stabilized.
DO	10% for values greater than 0.5 mg/L; if 3 DO values are less than 0.5 mg/L, consider the values as stabilized.
Specific Conductance	3%
Temperature	3%
pH	(+-) 0.1 unit
ORP	(+-) 10 millivolts

B. Sample Collection:

1. When stabilization has been achieved, samples should be collected directly from the pump discharge, and samples should not be collected from the flow thru cell discharge. This is achieved by detaching the flow thru cell, and sampling directly from the pump discharge.
2. Samples should be collected and preserved in agreement with standard protocols and transported under chain of custody and preserved by cold to a state certified analytical laboratory.

Adapted from:
Standard References for Monitoring Wells, The Massachusetts Department of Environmental Protection, DEP Publication #WSC-310-91

Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells. US EPA, Region 1, July 30, 1996, revised September 19, 2017.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

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Revision Page

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1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the “Monitoring Indicator Field Parameters” section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase

liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection

may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in

the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic ”tape”, pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume

cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the

minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be

changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and

continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods

(e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 µm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

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U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to

the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

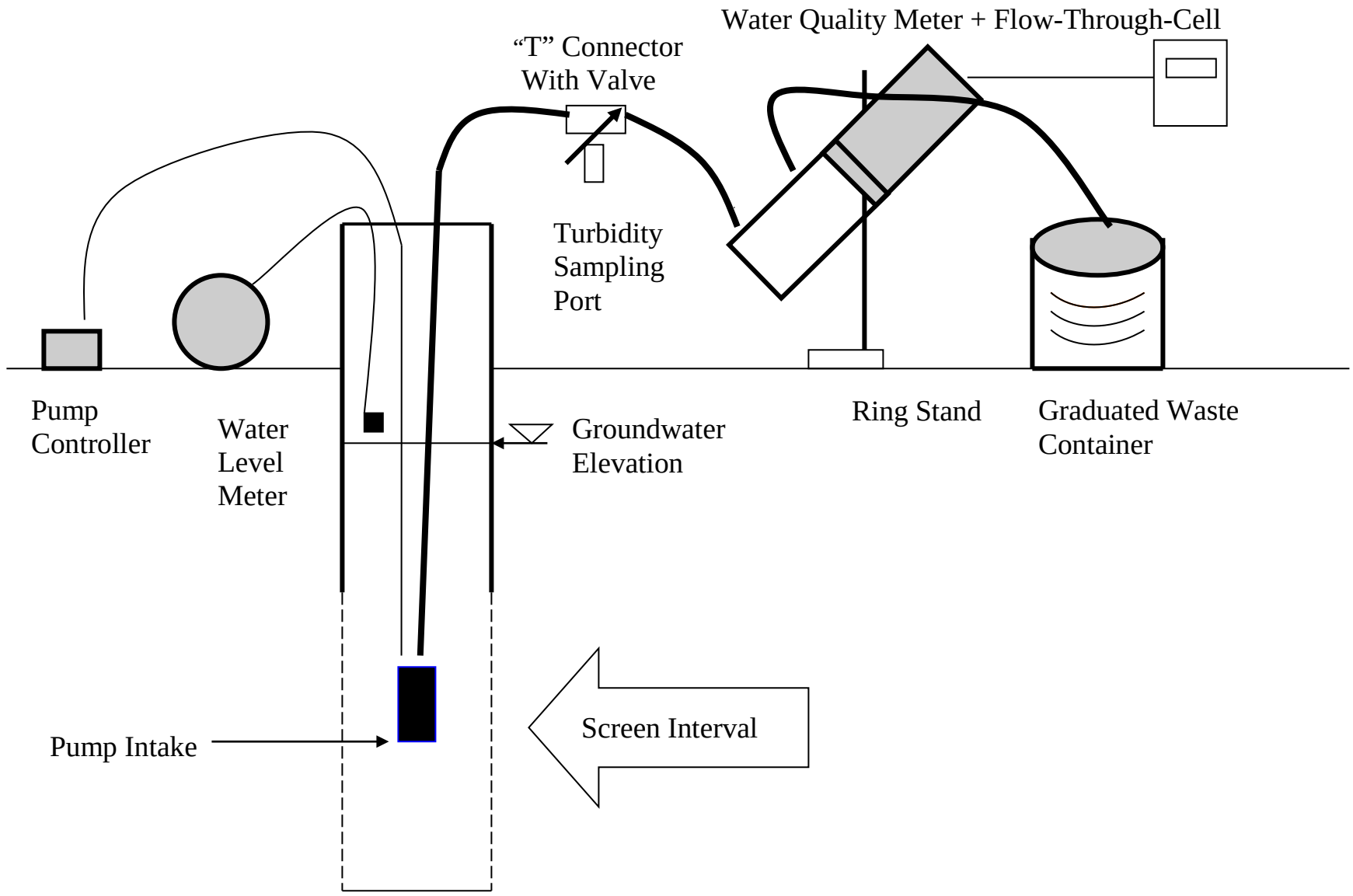
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____ Depth to _____/_____ of screen
Well Number_____ Date_____ (below MP) top bottom
Field Personnel_____ Pump Intake at (ft. below MP)_____
Sampling Organization_____ Purging Device; (pump type)_____
Identify MP_____ Total Volume Purged _____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. "C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments
Stabilization Criteria					3%	3%	±0.1	±10 mv	10%	10%	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

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Standard Operating Procedures

Soil Headspace Analysis

There are two methods that may be used to screen soil for volatile organic compounds (VOCs) in the field. Depending on the project requirements, analysis may be performed using glass jars or plastic sample bags as discussed below.

JAR HEADSPACE ANALYTICAL SCREENING PROCEDURE

The following are recommended procedures for conducting analytical screening of VOC-contaminated soils utilizing a portable Photoionization Detector (PID):

(1) Half-fill a glass jar with sample. Cover the open top with one or two sheets of clean aluminum foil and subsequently apply screw caps to tightly seal the jars. Sixteen ounce (16 oz.) (approx. 500 ml) soil or "mason" type jars are preferred; jars less than 8 oz. total capacity (approx. 250 ml), should not be used.

(2) Allow headspace development for at least 5-10 minutes. Gently shake the jar for 15 seconds both at the beginning and end of the headspace development period. Where ambient temperatures are below 32 F (0 C), headspace development should be within a heated vehicle or building.

(3) Subsequently to headspace development, remove screw lid in order to expose foil seal. Quickly puncture foil seal with instrument sampling probe, to a point about one-half of the headspace depth. Exercise care to avoid uptake of water droplets or soil particulates. As an alternative, syringe withdrawal of a headspace sample with subsequent injection to instrument probe or septum-fitted inlet is acceptable contingent upon verification of methodology accuracy using a test gas standard.

(4) Once the probe of the PID has been inserted into the air space of the jar, record the highest reading as the headspace concentration. This method should yield a maximum reading between two and five seconds upon insertion of the PID probe. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be discounted.

(5) Photoionization detectors shall be operated and calibrated to yield "total organic vapors" in parts per million (ppm). PID instruments must be operated with a 10.6 eV (+/) lamp source. Operation, maintenance, and calibration shall be performed in accordance with the manufacturer's specifications. Maintenance and calibration of the PID will generally be done by the company that it is rented from. Instrument calibration shall be

checked and if need be, adjusted no less than once every 10 analyses, or daily, whichever is greater.

(6) Instrumentation with digital (LED/LCD) displays may not be able to discern maximum headspace response unless equipped with a "maximum hold" feature or strip-chart recorder. Deviations, departures and/or additions to the above procedures should be consistent with 310 CMR 40.0017. In such cases, compelling technical justification must be presented and documented by the methodology proponent.

SAMPLE BAG HEADSPACE SCREENING PROCEDURE

(1) Fill a sample bag between half and two-thirds of the way filled with the soil sample. (At least one-third of the space within the sample bag must contain ambient air.)

(2) Allow headspace development for at least 5-10 minutes. Gently shake the sample bag for 15 seconds both at the beginning and end of the headspace development period. Where ambient temperatures are below 32 F (0 C), headspace development should be within a heated vehicle or building.

(3) Subsequently to headspace development, simply create a small opening in the seal of the sample bag and slide the probe of the PID inside of the opening. Make sure the probe of the PID is halfway between the opening and the sample. Exercise care to avoid uptake of water droplets or soil particulates.

(4) Once the probe of the PID has been inserted into the air space of the sample bag, record the highest reading as the headspace concentration. This method should yield a maximum reading between two and five seconds upon insertion of the PID probe. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be discounted.

(5) Photoionization detectors shall be operated and calibrated to yield "total organic vapors" in parts per million (ppm). PID instruments must be operated with either a 10.6 or 11.7 eV (+/) lamp source. The lamp source will be selected based on expected contaminants and the relative ionization potential associated with these contaminants. Operation, maintenance, and calibration shall be performed in accordance with the manufacturer's specifications. Maintenance and calibration of the PID will generally be done by the company that it is rented from. Instrument calibration shall be checked and if need be, adjusted no less than once every 10 analyses, or daily, whichever is greater.

(6) Instrumentation with digital (LED/LCD) displays may not be able to discern maximum headspace response unless equipped with a "maximum hold" feature or strip-chart recorder. Deviations, departures and/or additions to the above procedures should be consistent with 310 CMR 40.0017. In such cases, compelling technical justification must be presented and documented by the methodology proponent.

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Equipment Decontamination

Decontamination of field equipment is necessary to ensure the quality of samples by preventing cross-contamination. In addition, decontamination reduces health hazards and prevents the spread of contaminants off-site. The method of choice for decontamination should be that which most fully removes site contaminants from the sampling equipment with the least interference to the ultimate chemical analysis. Site and weather conditions may impose constraints upon the preferred method.

Procedures:

The general decontamination methods and compounds that can be used are as follows:

- Equipment to be utilized in the collection of samples for metals analysis should be cleaned by the following steps:

    1. Wash equipment with a non-phosphate detergent solution (e.g. Alconox) and a brush.
    2. Rinse thoroughly with tap water.
    3. Rinse with 1:1 nitric acid.
    4. Rinse the equipment thoroughly with deionized.
    5. Repeat this procedure at each location.

- Equipment to be used for collection of samples for TPH, oil identification, and oil and grease analyses should be cleaned by the following steps:

    1. Wash equipment with a non-phosphate detergent-solution (e.g. Alconox) and a brush.
    2. Rinse with tap water.
    3. Rinse thoroughly with deionized water.
    4. Repeat this at each location.

- Equipment to be used for collection of semi-volatile organics (which include base-neutral extractables, PCBs, herbicides and pesticides) should be cleaned by the following steps:

    1. Wash equipment with a non-phosphate detergent-solution (e.g. Alconox) and a brush.
    2. Rinse with tap water.
    3. Rinse with technical grade acetone.
    4. Rinse with pesticide grade hexane.

5. Rinse thoroughly with deionized water.
6. Repeat this procedure at each sampling location.

- Equipment to be used for collection of samples for volatile organics analysis should be cleaned by the following steps:

    1. Wash equipment with a non-phosphate detergent-solution (e.g. Alconox) and a brush.
    2. Rinse with tap water.
    3. Rinse thoroughly with deionized water.
    4. Repeat this procedure at each location.

- Steam cleaning is another acceptable technique for field decontamination.

More than one method or compound may be used in series for a particular site. In extreme cases, disposable equipment is recommended over decontamination. This is because the level of effort and costs required to adequately clean the equipment and dispose of the cleaning solutions may not be warranted.

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Standard Operating Procedures

Water Level Measurement

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water in an open borehole, cased borehole, monitoring well or piezometer. Groundwater level measurements in monitoring wells will be obtained using an EnviroSupply and Service Inc. water level meter, Model 101. This model uses a two-conductor, battery-powered water level indicator.

Preparation:

Review site-specific planning documents to obtain the following information.

1. The identification number of the well or wells to be monitored;
2. The locations of the wells as shown on a site map;
3. Records listing the most recent water level measurements for the well (if available);
4. Well access requirements
5. Reference point information
6. The types of equipment needed to perform the scheduled monitoring activity;
7. Calibration requirements for the equipment (if applicable); and
8. Health and safety considerations

Procedure:

Prior to obtaining a water level measurement in a given well, the well condition shall be inspected.

1. Note the date, time of day, well elevation (top of casing) and well condition in the field notes. Any signs of vandalism or deterioration will also be recorded.
2. Make sure the water level meter is functioning properly and is in good condition. The water level meter must be decontaminated prior to use at each location, and operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan.
3. If possible, start at the wells that are least contaminated and proceed to the wells that contain higher levels of contaminates based on available information.
4. Remove locking well cap.
5. Remove expandable inner cap.
6. If required, screen the headspace of the well with a photoionization detector (PID) immediately after opening the well. Record the PID reading in the field notes.
7. Measure the distance from reference point on the well to the water surface, noting the point of reference in the field notes.
8. Measure the total depth of the well and record in log book.
9. Remove all equipment and replace the expandable inner cap and outer well cap.
10. Decontaminate all equipment and store for transport.

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Standard Operating Procedures

Soil Gas Sampling

Soil gas sampling is completed to determine if subsurface contaminants of concern are likely to impact indoor air quality. These samples can be used to establish the geographical extent, chemical characteristics, and relative levels of contamination in the sub slab area. Soil gas samples are most often collected near sites where volatiles are known to be present in the soil and/or groundwater. Collection of soil gas samples can determine the potential for impact to the indoor air of a building from volatile chemicals, without the issue of cross contamination from chemicals that may exist within the building itself.

It is recommended that sub-slab soil gas samples be collected from the airspace immediately below a building's basement or slab. Soil gas directly beneath a slab or basement is most likely to be representative of what may be entering the building. If samples cannot be obtained directly beneath the slab due to access issues, soil gas samples obtained adjacent to the building and under pavement can be used to estimate conditions beneath the building. Sampling adjacent to the building should be performed at a depth below the slab and at an angle such the soil gas under the building footprint is obtained. It should be noted that collecting data from locations adjacent to the building of interest adds an additional degree of uncertainty to the vapor intrusion assessment at the site.

Preparation:

A sampling plan must first be established for the Site. This plan should take into consideration the possibility for any preferential pathways, potential source areas, the expected contaminants of concern, and the location of sub slab utilities. The plan will also identify the number of samples, sampling containers, tubing types, and Quality Assurance/Quality Control procedures. The plan will include the type of sampling to be completed (grab samples or time elapsed) and if the sampling points will be used for multiple sampling events.

Sampling equipment will be decontaminated in accordance with the procedures outlined in SOP #5 - "Decontamination Procedures".

Sample Containers:

Summa Canisters will be used to collect sub-slab samples. These will be pre-ordered from a laboratory and fit with the appropriate regulator for a grab or timed sample. After collection, summa canisters do not need to be preserved, but should be returned to the laboratory promptly. In some cases, tedlar bags may be used for sample collection. If tedlar bags are selected, they must be protected from light and returned to the lab immediately. The holding time for a tedlar bag is 48 hours.

Equipment:

- Hammer rotary drill with drill bits or Geoprobe
- Filter sand for backfilling
- Rigid tubing (nylon, Teflon, stainless steel)
- Expendable drive point(s)
- Vacuum pump for purging
- Sealant such as bentonite clay or concrete
- Sample containers

Procedures:

1. **Drill hole into concrete slab.** This can be done with a hammer rotary drill or with the help of a drilling crew and geoprobe. The hole should be drilled completely through the slab.

2. **Place tubing or probe tip into hole.** The soil gas sampling hole can be fitted with a flush mounted PVC riser and threaded cap with gasket. Tubing is placed through the PVC. If using a geoprobe, the sampling probes, consisting of a
steel alloy steel rod tipped by an expendable steel point is driven into the ground to the target depth. The probe tools are withdrawn to release the expendable tip and allow soil gas to flow into the tool's tubing.

   can be attached to a probe tip to hold the tube in place.To reduce cross contaminating sub slab soil vapor and indoor air vapors, backfilling the intake with sand and sealing the sampling point with modeling clay or bentonite clay may be required. Low-VOC sealants are necessary, and the sealant should be allowed to solidify (15-30 minutes) before the sample is collected.

   Tubing should be selected based on the expected contaminants of concern. Certain volatile compounds may interact with certain types of tubing and thus site specific tubing may be required. Rigid tubing with little background contribution is preferred (nylon, Teflon, stainless steel). The length of tubing should be minimized to reduce purging requirements.

   Dedicated tubing will be used at each sampling location.

   Purge tubing using a vacuum or a peristaltic pump. To ensure a representative soil gas sample, a discrete volume of gas is purged to rid the tubing of atmospheric air and allow the subsurface soil gas to enter the probe tubing. The volume of gas removed is determined by the volume of tubing employed in the probe. Note: the volume of ¼" OD x 3/16" ID tubing is approximately 5.5 mL per foot.

3. **Collect sample with Summa Canister (or Tedlar Bag if applicable).** The canister pressure should be recorded from the vacuum gauge before and after the sampling event.

Remove pump from tubing and attach regulator to the end of tubing, and allow canister to fill using the vacuum of the canister. Connection fittings should be checked prior to the start of sampling. Avoid sampling at too high a flow rate or vacuum as this could create short circuiting.

4. **Seal permanent sampling points**. Depending on the purpose of the sampling event, the sampling point may be used once or continuously. If the point is going to be used for future monitoring, the hole should be sealed with concrete instead of modeling clay. Note: PVC cement can be a source of ketones and should not be used for sealing the sampling points.

5. **Protect monitoring location points**. If the sampling point is selected for long term monitoring, the tubing and seal should be protected to ensure they are not compromised for future sampling.

6. **Submit sample containers to analytical laboratory.** Samples will be properly logged on Chain – of – Custody forms and submitted promptly to the selected laboratory. The holding time for a Summa Canister analyzing for TO-15 is thirty days. Note: no preservation of the summa cans is required.

7. **Note site conditions.** Due to the nature of soil gas sampling, additional notes regarding weather conditions and site vicinity should be recorded. Specific items that should be included are:
    - Weather conditions including any recent precipitation
    - Depth and time of sample collection
    - Sub slab conditions
    - Any necessary modifications to the procedure (tubing, sealant, etc.)
    - Possible sources of contamination from adjacent properties (gas station, dry cleaner, car repair, etc.)
    - Possible sources of contamination from within the building (cleaning supplies, equipment exhaust, recent painting or renovations, etc.)

HEALTH AND SAFETY

Because the sample is being drawn from underground, and no contamination is introduced into the breathing zone, soil gas sampling usually occurs in Level D. Nevertheless, ambient air should be constantly monitored using the HNu P101 to obtain background and breathing zone readings during the sampling procedure. As long as the levels in ambient air do not rise above background, no upgrade of the level of protection is needed.

When conducting soil gas sampling, appropriate personal protective equipment [PPE (leather gloves, steel-toed shoes, Tyvek safety suit)] should be worn. Also, an underground utility search must be performed prior to sampling.

Adapted from:

Soil Gas Sampling, SOP #2042, Rev 0.0, US. EPA, April 18, 2001.
Protocol for Collecting Sub Slab Soil Gas Samples, SOP No. DR #027, MEDEP/DR, March 12, 2009.
Interim Final Vapor Intrusion Guidance, WSC#11-435, MassDEP, December 2011

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Standard Operating Procedures

Groundwater Monitoring Well Installation and Development

The objective of this SOP is to provide the methods to be used for the installation and development of groundwater monitoring wells. This method is applicable to auger-rig, air hammer and Geoprobe drilling rigs.

Preparation:

Specific well design will be Site specific and can vary with the subsurface conditions encountered. The following elements will be part of the pre-drilling planning:

- Borehole drilling method (auger, geoprobe)
- Well construction materials and diameter
- Well depth (potentially dependent on subsurface conditions)
- Screen length
- Location of bentonite seals
- Well completion and protection requirements (standpipe or roadbox)

Groundwater monitoring well installation and development will be performed in accordance with applicable well standards for the area of investigation and this SOP. For a two-inch diameter PVC monitoring well, the borehole diameter should be a minimum of four (4) inches greater than the outside diameter of the well screen or riser pipe used to construct the well to ensure there is enough room for both the filter pack and bentonite seal. Monitoring wells installed with a Geoprobe can be constructed of pre-packed filter packs, however, due to the boring size, it may not be possible to construct a filter pack.

Required Materials:

- Well casing (PVC, stainless steel, Teflon)
- Well screen
- Filter pack materials
- Seal (bentonite or cement)
- Roadbox
- Selected Drilling rig
- Appropriate personal protective equipment (PPE)

Procedures:

Prior to the start of any drilling, subsurface utilities will be notified to mark out any utilities in the area of drilling, these will include DigSafe and local utilities.

Several drilling methods are available, but this SOP covers the three (3) most likely to be used methods:

Hollow Stem Auger:

Hollow stem auger uses a continuous flight of augers (typically four feet in length) with a bit at the bottom to drill. The screw-like shape of the augers continuously brings drill cuttings to the surface. Soil sampling is completed by hammering a split-spoon sampler ahead of the augers. The well is installed inside the flight of augers. The drillers assemble the appropriate length of screen, and riser and slide the well casing into the auger. The filter pack and seal are also installed within the auger. The auger flights are removed as the well is constructed. The well is completed as per the drilling plan with either a standpipe or a road box. The amount of each material used is recorded in the field book.

Geoprobe:

The geoprobe rig can be truck or track mounted and drives hollow steel probe rods into the ground. Inside the steel roads, polyethylene sleeves are used to collect the soil samples. Typically the rods and sleeves are five (5) feet in length. The drillers assemble the appropriate length of screen, and riser and slide the well casing into the steel probe rods. The filter pack and seal are also installed within the rods. Once the well is installed, the rods are removed, and the well is completed as per the drilling plan with either a standpipe or a road box.

Air – Hammer Drilling:

A direct rotary method, known as an "air-hammer," can be used, and is typically chosen when drilling through bedrock is required. This method uses a pneumatic drill operated at the end of a drill pipe which strikes the rock while the drill pipe is slowly rotated. Cuttings are removed continuously. The drillers assemble the appropriate length of screen, and riser and slide the well casing into the drill pipe. The filter pack and seal are also installed within the drill pipe. Once the well is installed, the rods are removed, and the well is completed as per the drilling plan with either a standpipe or a road box.

Well Construction:

The monitoring well will be constructed with factory sealed and commercially available well screen and casing. Well screens and casing will typically be constructed of 2-inch diameter PVC, but may have differing diameters or use different materials such as stainless steel, or Teflon. The sand pack is added continuously as the auger flights or drill rods are removed to ensure a continuous sand pack. A weighted tape will be used to monitor the sand pack elevation relative to the auger or rod bottom. Unless otherwise specified, or required due to site conditions, the sand pack will be placed to an elevation of two feet above the top of the well screen.

A one foot (or greater) thick bentonite seal will be added above the sand pack. If the seal is placed above the water table, the pellets will be hydrated with potable water. A weighted tape

will be used to assure that the bentonite is placed at the proper elevation and at the proper thickness. The annular space from the top of the bentonite seal will be backfilled with natural materials unless other materials are specified.

Each well will be completed with either a flush mounted roadbox or standpipe, cemented into place. The cement seal shall be a minimum of one foot in diameter and tapered outward to drain water away from the well.

Field Notes:

Boring logs will be created for each boring completed. They should include: soil characteristics and density, strata changes, the presence of groundwater, depth of the boring, and well construction details such as the length of the screen and riser, and depth of the filter pack and bentonite seal. Additionally, soil samples and drill cuttings will be field screened with a PID for the presence of any volatiles; these observations will be recorded on the boring log.

Well Development:

Well development is necessary to ensure that a complete hydraulic connection is made between the well and the surrounding aquifer. Well development should begin no sooner than 48 hours after well installation. A submersible pump (typically a whaler pump) will be inserted into the well and moved up and down the well screen interval to remove fine materials from the well and filter pack. The submersible pump is used until the water is relatively clear. The minimum volume of purge water should be approximately three (3) well volumes. However, this might not be possible for wells with low recharge rates.

Drill Cuttings and Purge Water Disposal:

Drill cuttings and purge water will be field screened with a PID. The QAPP will specify a PID value for soils that can be reused or water that can be disposed onsite. Otherwise cuttings from drilling, and purge water will be containerized (based on visual and screening data) and stored pending analytical results, unless specifically addressed in the sampling plan.

Adapted from:

Standard Operating Procedures for Groundwater Monitoring Well Installation Using the Geoprobe, US EPA Region 1, June 20, 2002.

Groundwater Monitoring Well Installation and Development, SOP -07, Yerington Mine Site, June 6, 2006.

APPENDIX B

ALPHA STANDARD OPERATING PROCEDURES

Extractable Petroleum Hydrocarbons (MA-EPH) 2.1

Reference: Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Massachusetts DEP, BWSC. MADEP-EPH-19-1, Revision 2.1 December 2019.

Quality Control Requirements and Performance Standards for the ***Analysis of Extractable Petroleum Hydrocarbons (EPH)*** in Support of Response Actions under the Massachusetts Contingency Plan (MCP), Section IV B, Rev 1, July 1, 2010

1. Scope and Application

Matrices: This method is suitable for the analysis of waters, soils, sediments, wastes, sludges and non-aqueous phase liquids (NAPL).

Definitions: Refer to Alpha Analytical Quality Manual.

This method is used to measure the collective concentrations of extractable aliphatic and aromatic petroleum hydrocarbons in water and soil. Extractable aliphatic hydrocarbons are collectively quantitated within two ranges: C_9 through C_{18}, and C_{19} through C_{36}. Extractable aromatic hydrocarbons are collectively quantitated within the C_{11} – C_{22} range. These extractable aliphatic and aromatic hydrocarbon ranges correspond to a boiling point range between approximately 150 °C and 265 °C.

This method is based on a solvent extraction, silica gel solid-phase extraction/fractionation process (SPE), and gas chromatography (GC) analysis using a flame ionization detector (FID). This procedure is used by, or under the supervision of, analysts experienced in extractable organics analysis. Analysts must be skilled in the interpretation of gas chromatograms and their use as a quantitative tool. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

This method is also able to measure the individual concentrations of Target Polynuclear Aromatic Hydrocarbons (PAH) Analytes, including Diesel PAH Analytes, in water and soil. Results for these individual analytes are reported at client request. The Method Detection Limits for some of these PAH compounds in water are greater than the notification and/or cleanup standards specified in the Massachusetts Contingency Plan for sites located in drinking water resource areas. In cases where it is necessary to demonstrate compliance with these standards, the use of a GC/MS method in the SIM mode may be necessary.

The fractionation step described in this method may be eliminated to allow for the determination of a Total Petroleum Hydrocarbon (TPH) value, and/or obtain qualitative “fingerprinting” information. While TPH provides little information on the chemistry, toxicity, or environmental fate of petroleum mixtures, it may be a cost-effective screening tool in cases where relatively low concentrations of contamination are suspected.

Petroleum products suitable for evaluation by this method include kerosene, fuel oil #2, fuel oil #4, fuel oil #6, diesel fuel, jet fuel, and certain lubricating oils. This method, in and of itself, is not suitable for the evaluation of gasoline, mineral spirits, petroleum naphthas, or other petroleum products that contain a significant percentage of hydrocarbons lighter than C_9. This method, in and of itself, is also not suitable for the evaluation of petroleum products that contain a significant percentage of hydrocarbons heavier than C_{36}.

This method includes a data adjustment step to subtract the concentration of Target PAH Analytes from the concentration of C_{11} through C_{22} Aromatic Hydrocarbons. This step is taken by the laboratory, and both adjusted and unadjusted values are reported to the client.

Data generated using this method is reported using the required format.

Like all GC procedures, this method is subject to a "false positive" bias in the reporting of Target PAH Analytes, in that non-targeted hydrocarbon compounds eluting or co-eluting within a specified retention time window may be falsely identified and/or quantified as a Target or Diesel PAH Analyte. In addition, this method is subject to a "false negative" bias in the reporting of Target PAH Analytes, in that the ability to identify Target PAH Analytes at low concentrations may be inhibited if a large unresolved complex mixture is present. While cleanup procedures specified in this method to segregate aliphatic and aromatic fractions will serve to mitigate this concern, confirmatory analysis by gas chromatography/mass spectrometry (GC/MS) analysis may be performed in cases where a target PAH analyte identification is suspect.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/FID and in the interpretation of GC/FID data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

Parameter	**CAS**
C9-C18 Aliphatic Hydrocarbons	-
C19-C36 Aliphatic Hydrocarbons	-
C11-C22 Aromatic Hydrocarbons	-
Naphthalene	91-20-3
2-Methylnaphthalene	91-57-6
Acenaphthylene	208-96-8
Acenaphthene	83-32-9
Fluorene	86-73-7
Phenanthrene	85-01-8
Anthracene	120-12-7
Fluoranthene	206-44-0
Pyrene	129-00-0
Benzo(a)anthracene	56-55-3
Chrysene	218-01-9
Benzo(b)fluoranthene	205-99-2
Benzo(k)fluoranthene	207-08-9
Benzo(a)pyrene	50-32-8
Indeno(1,2,3-cd)pyrene	193-39-5
Dibenzo(a,h)Anthracene	53-70-3
Benzo(g,h,i)perylene	191-24-2

2. Summary of Method

Samples submitted for EPH analysis are extracted with methylene chloride, dried over sodium sulfate, solvent exchanged into hexane, and concentrated in a Kuderna-Danish apparatus. Sample cleanup and separation into aliphatic and aromatic fractions is conducted using commercially available silica gel cartridges. The two extracts produced are then re-concentrated to final volumes of 1mL each (i.e., an aliphatic extract and an aromatic extract). The extracts are then separately analyzed by a capillary column gas chromatograph equipped with a flame ionization detector.

Average calibration factors are determined using an aliphatic hydrocarbon standard mixture and are used to calculate the collective concentrations of C_9 through C_{18} and C_{19} through C_{36} aliphatic hydrocarbons. An average calibration factor is determined using a PAH standard mixture and is used to calculate the collective C_{11} through C_{22} aromatic hydrocarbon concentration. Calibration factors determined for individual components of the PAH standard mixture are also used to calculate individual concentrations of Target PAH Analytes

2.1 Method Modifications from Reference

None.

3. Reporting Limits

The Reporting Limits (RLs) of this method for each of the collective aliphatic and aromatic fractional ranges are typically 6.67 mg/kg in soil and 100µg/L in water. The RLs of this method for the Target PAH Analytes are typically 0.33 mg/kg in soil and 10µg/L in water. Table 1 lists our routine reporting limits.

4. Interferences

4.1 High purity reagents are used to minimize interference problems.

4.2 Only high purity gases are used in the GC system to eliminate this source of possible contamination. The air and hydrogen (carrier gas – 99.999%, and detector make-up gas) are certified by the gas supplier.

4.3 Preventive instrument maintenance is performed routinely, and whenever highly contaminated extracts are analyzed that could result in chromatographic interferences or result in degradation of system performance. Section 10.5 details the maintenance steps.

4.4 Glassware must be scrupulously cleaned. This procedure is detailed in the extraction SOPs. Store dry glassware in a clean environment.

4.5 The leaching of plasticizers and other compounds have been observed from commercially available silica gel cartridges used to fractionate EPH sample extracts. This possible source of contamination is continuously monitored and documented by analysis of Laboratory Method Blanks.

4.6 Contamination by carry-over can occur whenever high-concentration and low-concentration samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, it must be followed by the analysis of a solvent blank to check for possible carry-over. If this is not done and the sample analyzed immediately following the high-concentration sample is free from contamination, then it may be assumed that carry-over is not an issue. However, if this sample did detect analytes which were present in the unusually concentrated sample, reanalysis is required for all samples analyzed after this highly concentrated sample which detected similar analytes.

4.7 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interference will vary considerably from one source to another depending

upon the nature and diversity of the site being sampled. The silica gel SPE cleanup procedure is used to overcome many of these interferences, but some samples may require additional cleanup approaches that are beyond the scope of this method.

4.8 Certain organic contaminants mixed with petroleum product releases, including chlorinated hydrocarbons, phenols, and phthalate esters, will be quantitated as Extractable and Total Petroleum Hydrocarbons. If necessary and/or desirable, additional sample cleanup and/or analytical procedures may be employed to minimize or document the presence of such compounds.

4.9 Because of their weakly polar nature, naphthalene and substituted naphthalenes are readily fractionated into the aliphatic extract if excessive amounts of hexane are used to elute the silica gel cartridge/column. Because these compounds constitute a significant percentage of the water-soluble fraction of fuel oils, this occurrence is especially problematic in the analysis of water samples. For this reason, the method requires the evaluation of the aliphatic fraction for the presence of naphthalene and 2-methyl-naphthalene in the LCS/LCSD pair on a per batch basis. The fractionation surrogate, 2-Bromonaphthalene, is used to monitor sample-specific fractionation efficiency.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents.

5.2 All solvent and extract transfers must be handled in the vented bench area in the GC laboratory.

5.3 All stock standards, working standards, and vialed sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in two 1L amber glass jars with teflon-lined lids. Solid samples are collected in 250mL wide-mouth amber glass jars with teflon-lined lids. All containers are purchased pre-cleaned and certified from commercial vendors.

6.2 Sample Preservation

Both aqueous and solid samples are then preserved by packing in coolers with ice or ice packs, to maintain a temperature of 4 ±2 °C. Additionally, aqueous samples are preserved at the time of sampling by the addition of approximately 5mLs of 1:1 HCl. The sample pH must be less than 2.0 after addition of the acid. Upon receipt at the laboratory, the samples are transferred into sample storage refrigerators to maintain at a temperature of 4 ±2 °C.

6.3 Sample Shipping

No specific requirements.

6.4 Sample Handling

Aqueous and soil/sediment samples must be extracted within 14 days of sample collection, and be analyzed within 40 days of the extraction date. Additionally if the sample must be frozen it needs to be within 24hours after collection and then it can be extracted up to 14 days after thawing.

7. Equipment and Supplies

7.1 Gas Chromatograph, Agilent 6890A and 7890A: An analytical system complete with gas chromatograph configured for split-splitless injection and all required accessories including autosampler syringes, analytical columns, gases, and flame ionization detectors (FID). The systems used for this analysis are configured with dual injectors/dual columns for

7.2 GC Column: is listed below. Alternative columns may be used as long as the method performance criteria can be met.

RTx-5MS: Cat. #12624 from Restek or equivalent; 30m, 0.32mm, 0.25µm

7.3 Microsyringes: 10µL, 100µL, 250µL, 500µL and 1000µL

7.4 Volumetric Flasks: 10mL and 25mL, used for standard preparation

7.5 Precision liner: Cat. #AGO-4680 from Phenomenex or equivalent

7.6 Siltek FID jet: Cat. #21683, #20673 from Restek or equivalent

8. Reagents and Standards

Reagent grade or pesticide grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.

NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate) at 4 ±2 ° C in Teflon(R)-sealed containers in the dark.

8.1 Reagents

8.1.1 Reagent Water: All reagent water is from Alpha's DI treatment system, and is demonstrated to be free of interferences or contaminants

8.1.2 Solvents: Hexane, Methylene Chloride (DCM), and Acetone; pesticide grade or better. Store away from other solvents.

8.2 Stock Standard Solutions: All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. They can be replaced with different standards as long as they contain all target analytes. Stock solutions are stored per manufacturer's recommendations.

8.3 Intermediate/Working Standard Solutions

Intermediate and working standards expire 6 months from the date of preparation or on the earliest expiration date of any of the stock solution used to prepare it. Standards are stored in

the refrigerator. Standard preparation information including the analyst's initials, preparation date, expiration date and standard identifier are recorded.

8.3.1 Calibration Standards

The Aliphatic calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. The Aromatic calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with methylene chloride. Calibrations are performed at the 6 concentration levels listed in Table 2. The list of typical ampulated calibration standards:

- **ALIPHATIC WORKING STANDARD at 200µg/mL:**
    - 1-Chlorooctadecane Solution, Ultra, #IST-470-1 at 2000µg/mL
    - Fractionation Surrogate Spike Mix, Accustandard, #DRH-MA-FSS-50X at 2000µg/mL
    - Naphthalene, Accustandard, #M-502-40-10X at 2000µg/mL
    - 2-Methylnaphthalene, Accustandard, #APP-9-133-20X at 2000µg/mL
    - MA-EPH n-Hydrocarbon Standard, Absolute, #93459 at 2000µg/mL
- **AROMATIC WORKING STANDARD at 200µg/mL:**
    - Fractionation Surrogate Spike Mix, Accustandard, #DRH-MA-FSS-50X at 2000µg/mL
    - O-Terphenyl Standard, Accustandard, #DRH-006-SS at 1000µg/mL
    - Aromatic Hydrocarbon Standard, Ultra, #SMA-300-1 at 1000µg/mL

8.3.2 Second Source (ICV):

The Aliphatic and Aromatic ICV standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane and ethylene chloride accordingly. The list of typical ampulated calibration standards:

- **ALIPHATIC ICV STANDARDS at 10ug/mL**:
    - Proposed DEP(MA)-Aliphatic Hydrocarbons, Accustandard, #DRH-007S at 1000µg/mL
    - Naphthalene, Absolute, #90298 at 2000µg/mL
    - 2-Methylnaphthalene, Absolute, #90798 at 2000µg/mL
    - 1-Chlorooctadecane, Restek, #31098 at 10000µg/mL
    - MA-Fractionation Surrogate Spike Mix, Restek, #31480 at 4000µg/ml
- **AROMATIC ICV STANDARDS at 10ug/mL:**
    - Proposed DEP(MA)-PAH Mix, Accustandard, #DRH-006S at 1000ug/mL
    - MA Fractionation Surrogate Spike Mix, Restek, #31480 at 4000µg/mL
    - O-Terphenyl, Restek, #31097 at 10000µg/mL

8.3.3 Surrogate Spiking Solution

The extraction surrogates are 1-chloro-octadecane (COD) and Ortho-Terphenyl (OTP).The surrogate spiking solution is prepared by adding 10mL of MA-EPH Surrogate Spike (Absolute, Cat. #51075 at 2000µg/mL) to a 500mL volumetric flask and bringing to volume with acetone. The final concentration of the spiking solution is **40µg/mL**.

8.3.4 LCS/MS Spiking Solution

This solution is used for preparing Laboratory Control Samples (LCS) and Matrix Spikes (MS), if requested. The solution is prepared by adding 10mL of the MA-EPH Aromatic Hydrocarbons (Absolute, Cat. #50003, at 2000µg/mL, consists of the 17 PAH compounds listed in Table 1) and 10mL of the MA-EPH n-Hydrocarbon Standard (Absolute, Cat. #93459 at 2000µg/mL, consists of the 14 normal alkanes listed in Table 2) to a 200mL volumetric flask and bringing to volume with pentane. The final concentration of the spiking solution is **100µg/mL**. This solution must always be brought to room temperature prior to use.

8.3.5 Fractionation Surrogate Spiking Solution

The fractionation surrogates are 2-Fluorobiphenyl and 2-Bromonaphthalene. This solution is added to all extracted samples and QC samples prior to sample cleanup and fractionation using the silica gel cartridges. This serves as an important check on the ability of the fractionation to accurately separate the aliphatic from the aromatic compounds. The solution is prepared by adding 10mL of the MA Fractionation Surrogate Spike Mix (Restek, Cat. #31480 at 4000µg/mL) and volumetric dilution to 1000mL with hexane. The final concentration of the surrogate solution is **40µg/mL**.

8.3.6 Fractionation Check Solution

This solution is used to monitor the fractionation efficiency of the silica gel cartridge, and to establish the optimum volume of hexane needed to sufficiently elute aliphatic hydrocarbons from the cartridge without eluting the aromatic hydrocarbons prior to the methylene chloride elution. Fractionation checks are performed whenever a new lot of silica gel cartridges is received, prior to using them for actual samples.

The solution is prepared by adding 1mL of the Aromatic Hydrocarbon Standard (Ultra, Cat. #SMA-300-1 at 1000µg/mL), 1mL of the Aliphatic Hydrocarbon Standard (Ultra, Cat. #SMA-310-1 at 1000µg/mL) and 1mL of Surrogate Spiking Solution (Ultra, Cat. #ISM-580-1 at 2000µg/mL) to a 50mL volumetric flask, bringing to volume with hexane. The final concentration of the solution is **40µg/mL** for Surrogates and **20µg/mL** for aliphatic and aromatic compounds.

8.4 Hydrogen gas: From Alpha generator.

8.5 Zero Air: From Alpha generator

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Extraction blanks are performed with each extraction batch of 20 or less samples, according to the extraction SOPs.

The extraction blank must not contain any of the individual target analytes or hydrocarbon ranges above the reporting limits. If any reportable analytes are detected in the blank, the entire extraction batch is suspect.

- If concentration of contaminant in sample is <10x concentration in blank all samples associated with this blank must be re-extracted and re-analyzed. If re-extraction can

not be performed due to insufficient sample volume CS must be notified immediately.
- No corrective action is required if concentration of contaminant in sample is >10x concentration in blank or if contaminant is not detected in sample.

The surrogate recoveries must also be within the acceptance criteria listed in Section 9.7.1. If surrogate acceptance criteria are exceeded, the extraction batch must be evaluated to determine if re-extraction or re-analysis is necessary.
- If any of the surrogates in the blank are high, but blank is undetected for all target analytes, no corrective action is required.
- If any of the surrogates in the blank are low, but associated samples are undetected for all target analytes with passing surrogates, no corrective action is required.

If any of the surrogates in the blank are low and associated samples have positive hits, re-fractionation and/or re-extraction of the appropriate extracts is required.

9.2 Laboratory Control Sample (LCS)

A LCS/LCSD pair is extracted with each analytical batch of 20 samples or less. The LCS/LCSD consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCS/LCSD standards must be from a different source than that used for the initial calibration. The LCS/LCSD pair is spiked with the aliphatic and aromatic compounds.

The recovery of **alkanes, PAHs and all 3 ranges** must be between **40%-140%** except for **nonane** which must be between **30-140%**.
- If ≤10% of compounds are outside of the acceptance criteria (3 out of 35 including alkanes, PAHs and ranges), re- extraction is not required as long as recoveries are >10%.
- If >10% of compounds are above the acceptance criteria (>140%), reextraction is not required if affected compounds were not detected in associated samples.
- If any recovery criteria are not met, the extract may be re-fractionated to see if the recoveries improve. If the criteria are still not met, the entire batch must be re-extracted. If this is not possible, due to insufficient sample volume or holding time exceedances, the analyst must submit the failure on a narrative sheet for inclusion in the client report.
- The Analytical Batch Precision is determined from the Relative Percent Difference (RPD) of the concentrations (not recoveries) of LCS/LCSD pair. The **RPD** for alkanes and individual Target PAH analytes, aliphatic and aromatic hydrocarbon range concentrations must be **≤ 25 for waters and soils**.

Breakthrough of naphthalene and 2-methylnaphthalene in the aliphatic fraction is calculated. If the breakthrough is **>5%**, all associated samples and QC samples must be re-fractionated.

9.3 Initial Calibration Verification (ICV)

See Section 10.2

9.4 Continuing Calibration Verification (CCV)

See Section 10.4

9.5 Matrix Spike

A Matrix Spike and/or a Matrix Spike/Matrix Spike Duplicate pair are performed at client's request. The MS/MSD is an aliquot of actual sample spiked with the aliphatic and aromatic compounds. The recoveries in the **MS/MSD**, corrected for the concentrations found in the parent sample, must be between **40% and 140%.** If the recovery criteria are not met, but are

met in the LCS, the failure may be attributed to sample matrix effects and must be noted on a narrative sheet for inclusion in the client report. If an MS/MSD is performed, the **%RPD** must be **less than 50%** for alkanes and PAHs for results >5x the reporting limit.

9.6 Laboratory Duplicate

Upon Client request, a laboratory duplicate is extracted with each analytical batch of 20 samples or less. The duplicate is a sample aliquot split from the same container as the sample, and is extracted and analyzed separately following the same procedures. The RPDs for any hits in the samples, for hydrocarbon ranges or individual analytes (if reported) must be less than 50% when the results are greater than 5x the Reporting Limit. If the RPD criteria are not met, and all other QC criteria are met for the sample and it's duplicate, inspect the sample for possible non-homogeneity. If this is the suspected cause of the high RPD result(s) note this on a narrative sheet for inclusion in the client report. Otherwise, re-extraction of the sample and duplicate, and possibly the entire extraction batch, may be required. If RPD is greater than 50 and both results are >5x the RL you must repeat the analysis. If a Target PAH or Range is detected in one analysis at >5x the RL and not in the duplitcate analysis you must repeat the analysis.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogate

All extracted samples and associated QC are spiked with two extraction surrogates **COD** and **OTP**. Sample extracts are also spiked with the fractionation surrogates **2-bromonaphthalene and 2-fluorobiphenyl** prior to cleanup and fractionation using the silica gel cartridges. All surrogate recoveries must be between **40% and 140%**. If any surrogates fail the recovery criteria, samples may be re-fractionated and re-analyzed. If the surrogate limits are still not met, the affected samples must be re-extracted to confirm that the failure was due to sample matrix. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report; both sets of data are reported.

The only exception to this is when large amounts of extracted material co-elute with any of the surrogate compounds, resulting in false high recoveries. When this is evident by examination of the sample chromatogram, re-extraction or re-fractionation is not required. Note the cause for the high recovery on a narrative sheet for inclusion in the client report.

9.8 Method Sequence

The typical daily analytical sequence is:

- Calibration Check Standard
- Laboratory Method Blank
- Laboratory Control Sample
- Laboratory Control Sample Duplicate
- 20 or less samples
- Duplicate sample (as requested)
- Laboratory Fortified Matrix/duplicate (as requested)
- Calibration Check Standard

10. Procedure

10.1 Equipment Set-up

10.1.1 Sample Extraction

Aqueous samples are extracted at acid pH (less than pH 2) with methylene chloride using a separatory funnel (Method 3510C). See extraction SOP for details.

Solid samples are extracted with methylene chloride using Soxhlet extraction (Method 3540C) or microwave extraction (Method 3546) procedures. See appropriate extraction SOP for details.

10.1.2 Extract Fractionation

Silica gel fractionation is used for sample cleanup and separation into aliphatic and aromatic extracts. Silica gel cartridges are purchased from commercial vendors, and tested prior to use. See appropriate extraction SOP for details.

10.1.3 GC Conditions:

A dual-injector/dual-column/dual-detector approach involves the use of the columns listed in section 7.2. This allows for the simultaneous analysis of both fractions. Typical GC conditions are listed below, but may be altered as long as method performance criteria are met.

Temperature1: 35 ºC
Time1: 1.14 minutes
Ramp1: 14.05ºC/minute
Final Temperature: 320ºC
Time2: 4 minutes
Total Time: 22.99 minutes
Temperature3: 230ºC

Injector Temperature: 285ºC
FID Temperature: 350ºC
Carrier gas: Hydrogen
Carrier pressure program:
9.89 psi initial
79cm/sec 20.6psi final
Detector Air: 300mL/minute
Detector Hydrogen: 30mL/minute
Injection Volume: 1 µL

10.2 Initial Calibration

10.2.1 Prepare calibration standards using the procedures in Section 8.3.1 at the concentrations listed in Table 2. At the minimum 5 standards must be used or 6 if non-linear regression will be used.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in section 10.1.3. The same operating conditions are used for calibrations and sample analyses. Create the analytical sequence using the Agilent Chemstation data acquisition software. Record the calibration standard, unique lot number (EPH#) and analyst's initials in the analytical sequence list.

10.2.3 A 1µL injection volume of each calibration standard is typically used. Other injection volumes may be employed, provided that the analyst can demonstrate adequate sensitivity for the compounds of interest. The same injection volume must be used for calibration standards, samples and QC samples.

10.2.4 Calibration Factors

The external standard calibration technique is employed in this method. Calibration factors are determined for the individual PAH target compounds, the aromatic hydrocarbon range, and the two aliphatic hydrocarbon ranges as described below.

10.2.4.1 **Individual PAH Target Compounds**: In each standard, calculate the calibration factor for each analyte, the mean calibration factor, and the relative standard deviation (RSD) of the calibration factors. The calculations are performed automatically, using the formula listed in Alpha's Quality Manual and the CF equation below:

Calibration factor: Target PAH Analytes:

$$\textit{Calibration Factor (CF)} = \frac{\text{area of peak}}{\text{concentration injected (ng/µL)}}$$

10.2.4.2 **Hydrocarbon Ranges**: In each standard, calculate the calibration factor for each range, the mean calibration factor, and the relative standard deviation (RSD) of the calibration factors. The calculations are performed automatically, using the formulae listed in Alpha's Quality Manual.

Range Calibration Factor: Hydrocarbon Ranges:

$$\textit{Range CF} = \frac{\text{Area of Summation of Range Components}}{\text{Total concentration injected (ng/µL)}}$$

10.2.5 Initial Calibration Acceptance Criteria

If the **RSD for an analyte or range is < 25%,** then the response of the instrument for this compound is considered linear over the range and the mean calibration factor can be used to quantitate sample results.

If the **RSD for any analyte or range is > 25%**, then linearity through the origin cannot be assumed. An alternative calculation may be done by the use of linearity as long as the correlation coefficient (r) is **>0.99**. If both of these quantitation methods fail criteria for any compound in the initial calibration, then the system must be reevaluated and a new calibration curve must be analyzed.

If linear or non-linear regression is used, RL must be verified by recalculating concentration in the lowest calibration standard using the final calibration curve. Recoveries must be **70-130%.**

10.2.6 Initial Calibration Verification

The initial calibration is verified using a standard source different than that used for the initial calibration. This standard is analyzed immediately after each initial calibration. Percent recoveries must be between **80-120%** for each target analyte.

10.2.6.1 EPH retention time (Rt) windows are defined as beginning 0.1 minutes before the elution of the beginning marker compound and ending 0.1 minutes after the elution of the ending marker compound, except for n-C_{19}, which is both a beginning and ending marker compound for two different ranges.

The C_9 – C_{18} Aliphatic Hydrocarbon range ends immediately (0.1minutes) before the elution of the n-C_{19} peak. The C_{19} – C_{36} Aliphatic Hydrocarbon range begins 0.1 before the elution of the n-C_{19} peak; therefore there is no overlap of the two

ranges and the n-C_{19} peak is only included in the C_{19} – C_{36} Aliphatic Hydrocarbon range.

EPH marker compounds and windows are summarized in Table 4.

10.3 Equipment Operation and Sample Processing

10.3.1 Additional Instrument QC

10.3.1.1 All four surrogate compounds must be adequately resolved from any individual analytes in the aliphatic and aromatic standards.

10.3.1.2 The n-nonane peak must be adequately resolved from the solvent peak.

10.3.1.3 All individual compound peaks in the aliphatic standard must be adequately resolved to baseline. In the aromatic standard, baseline separation must be seen for Phenanthrene and Anthracene. Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene will not demonstrate baseline separation, and may be reported as an un-resolved mixture, unless adequate resolution is obtained. (Adequate resolution is assumed to be achieved if the height of the valley between the two peaks is less than 25% of the average height of the two peaks.)

10.3.1.4 The response ratio of C_{28} to C_{20} must be at least 0.85, to demonstrate that the system is not exhibiting mass discrimination. The response ratio for all CCVs is recorded in the instrument sequence log.

10.3.1.5 Surrogates 1-Chloro-Octadecane and o-Terphenyl must be adequately resolved from any individual components in the aliphatic and aromatic hydrocarbon standards.

10.3.1.6 Peaks for Naphthalene and n-dodecane in the aliphatic hydrocarbon fraction must be adequately resolved to allow for an accurate determination of the naphthalene concentration in the LCS/LCSD pair.

10.3.2 Sample Analysis

10.3.2.1 The same GC operating conditions used for the initial calibration must be employed for sample analyses, including sample injection volume (Section 10.1.3).

10.3.2.2 Samples are analyzed in a set referred to as an analytical sequence. The sequence begins with a mid-level calibration standard, followed by QC samples and sample extracts, and ends with a mid-level calibration standard. An instrument solvent blank(s) can be loaded in the sequence after samples that appear to have a high-concentration of petroleum hydrocarbons to prevent carryover into following samples. If any samples appear to have carryover in them from the previous sample, they are rerun. Instrument solvent blanks can not be loaded before any instrument QC such as calibration standards. Inject 1µL sample extract using the solvent flush technique. The sample and calibration standard injection volume must be equal.

10.3.2.3 Establish daily retention time windows for each analyte of interest. Use the absolute retention time for each analyte as the midpoint of the window for that day. The daily retention time window equals the midpoint ± 3 times the standard deviation determined in Section 10.2.6.1. Alternatively, the default value of 0.1 minutes may be used for daily retention time window.

10.3.2.3.1 Tentative identification of an analyte occurs when a peak from a sample extract falls within the daily retention time window. Confirmation on a second GC column or by GC/MS analysis may be necessary.

10.3.2.3.2 Validation of GC system qualitative performance must be accomplished by the analysis of midlevel standards within the analysis sequence. If any of the standards fall outside their daily retention time window, the system is out of control. In such cases, the cause of the problem must be determined and corrected. All samples analyzed after the last passing CCV must be reanalyzed.

10.3.2.4 Aliphatic and aromatic ranges of interest are determined by the collective integration of all peaks eluting between specified range “marker” compounds.

10.3.2.5 When quantifying the aliphatic and aromatic ranges the integration must be from baseline (i.e., must include the unresolved complex mixture, or “hump”, areas). For the integration of individual Target Analytes and surrogate compounds, a valley-to-valley approach should typically be used, though this approach may be modified on a case-by-case basis by an experienced analyst.

10.3.2.6 Baseline correction using a system solvent blank is only permissible for the calculation of aliphatic and aromatic hydrocarbon range concentrations in accordance with the method. However, this correction is not routinely performed by Alpha.

10.3.2.7 If the Target PAH Analytes are to be quantitated using this method and the response for an individual analyte exceeds the linear range of the system, dilute the extract with methylene chloride and reanalyze. Extracts must be diluted so that all peaks are on scale. Overlapping peaks are not always evident when peaks are off scale. Computer reproduction of chromatograms, manipulated to ensure that all peaks are on scale over a 100-fold range, is acceptable if linearity is demonstrated prior to the analysis of samples.

10.3.2.8 For non-target analytes eluting in the aliphatic, aromatic or TPH fractions, the upper linear range of the system must be defined by peak height measurement, based upon the maximum peak height documented for an aliphatic or aromatic standard within the fraction that is shown to be within the linear range of the detector.

Under circumstances that a sample dilution is required because either the concentration of one or more of the target analytes exceeds the concentration of the respective calibration standard, or any non-target peak eluting with any aliphatic or aromatic range exceeds the peak height documented for the highest range-specific calibration standard, the RL for each target analyte and/or range must be adjusted in direct proportion to the dilution factor.

10.3.2.9 When performing dilutions for target analytes over the curve, the target analyte with the highest concentration is diluted to be with 60-80% of the highest calibration standard, so that the RLs will not be unnecessarily raised for analytes not needing dilutions.

10.3.3 Data Transmission

When reporting multiple sets of data for a particular QC element or Sample, the “Arolist” file must be sent to the LIMS last in order to ensure that the C11-C22 Aromatic Adjusted Range is calculated correctly.

10.4 Continuing Calibration

10.4.1 The initial calibration curve is verified on each working day prior to the analysis of samples by the injection of the midpoint Calibration Standard. Continuing calibrations are also run throughout the analytical sequence, typically after every 20 samples or every 24 hours (whichever is more frequent) and at the end of analytical sequence. The percent difference (**%D**) for all aliphatic and aromatic analytes must be **less than or equal to 25%** except for **n-nonane**, which must be **<30.** In closing CCAL: up to four (4) compounds may exhibit a %D or % drift >25 but <40.

10.4.2 The Retention Times of each analyte are updated every time a CC is injected.

10.4.3 If the %D criteria cannot be met, inspect the gas chromatographic system to determine the cause and perform whatever maintenance is necessary before verifying calibration and proceeding with sample analysis.

10.4.4 If after maintenance the system still fails the calibration verification criteria, a new initial calibration curve must be analyzed.

10.5 Preventive Maintenance

10.5.1 Preventive Maintenance

Routine preventive maintenance must be performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and clipping several inches off of the injector end of the capillary column.

10.5.2 Additional Maintenance

Additional maintenance may be required if system performance degrades. Autosampler syringes and syringe needles must be periodically inspected, especially if erratic response or peak discrimination is seen. If the maintenance steps listed above do not improve system performance, it may be necessary to replace the GC column(s).

11. Data Evaluation, Calculations and Reporting

The concentration reported for a particular hydrocarbon range or individual target analyte in an extract is calculated using the Enviroquant data processing software. The Enviroquant methods have been configured to utilize the quantitation formulas found in Alpha's Quality Manual. Proper quantitation requires the appropriate selection of a baseline from which the peak area or height can be determined. See the Manual Integration SOP for integration guidelines.

11.1 Hydrocarbon Ranges

11.1.1 Aliphatic Fraction

11.1.1.1 Determine the total area count for all peaks eluting 0.1 minutes before n-C_9 and 0.1 minutes before the elution of n-C_{19}. It is not necessary to identify or quantitate individual aliphatic compounds within this range. The area due to the aliphatic extraction surrogate (COD) must not be included in this area.

11.1.1.2 Determine the total area count for all peaks eluting at 0.1 minutes before n-C_{19} and 0.1 minutes after the elution of n-C_{36}. It is not necessary to identify or quantitate individual aliphatic compounds within this range.

11.1.1.3 Using the average calibration factor from the initial calibration, or linear regression analysis (if used), calculate the collective concentrations of C_9 through C_{18} Aliphatic Hydrocarbons, C_{19}

through C_{36} Aliphatic Hydrocarbons, and individual concentrations of the sample surrogate, COD.

11.1.2 Aromatic Fraction

11.1.2.1 Determine the total area count for all peaks eluting 0.1 minutes before naphthalene and 0.1 minutes after benzo(g,h,i)perylene. The area due to the aromatic extraction surrogate (OTP) and the fractionation surrogates (2-Fluorobiphenyl and 2-Bromonaphthalene) must not be included in this area.

11.1.2.2 Using the average calibration factor from the initial calibration, or linear regression analysis (if used), calculate the concentrations of Unadjusted C_{11} through C_{22} Aromatic Hydrocarbons, the sample surrogate standard (OTP), and the fractionation surrogates.

11.2 Individual Aromatic Target Analytes

Determine the area for each of the individual PAH analytes found in the aromatic fraction. Using the average calibration factor from the initial calibration, or linear regression analysis (if used), calculate the concentrations of the individual analytes.

11.3 Data Manipulations

11.3.1 By definition, the collective concentration of the aromatic fraction (and/or TPH) **excludes** the individual concentrations of the Target PAH Analytes. Accordingly, a data manipulation step is necessary to adjust the collective range concentration calculated in Sections 11.1.1 and 11.1.2, to eliminate 'double counting' of analytes.

This necessary data manipulation step is taken by Alpha for inclusion on the client report. Subtract the individual concentrations of the Target or Diesel PAH Analytes from the collective concentration of Unadjusted C_{11} through C_{22} Aromatic Hydrocarbons and/or Unadjusted TPH. This calculation is performed automatically by Alpha's LIMS system.

Soil samples are reported on a dry-weight basis, utilizing formulae found in Alpha's Quality Manual. This calculation is performed automatically by Alpha's LIMS system.

The extent of data manipulations taken by the laboratory must be noted on the data reporting form.

11.3.2 Contamination of SPE Cartridges

11.3.2.1 Range integration areas may be affected by peaks identified during the injection of a Laboratory Method Blank, and determined to be attributable to the leaching of plasticizers or other contaminants from silica gel SPE cartridges. In general, this contamination affects the C_{11} – C_{22} Aromatics. **Blank correction is not permissible.**

11.3.2.2 The laboratory must report the presence of this contamination in the associated range. Optionally, the laboratory may perform GC/MS analysis of the laboratory method blank extract to demonstrate that the contaminant in question is not a C_{11} – C_{22} aromatic compound. Analysis of only the method blank is acceptable as long as the associated samples exhibit the same

contaminant peak at the same retention time. If demonstrated not to be a $C_{11} – C_{22}$ aromatic compound, the contaminant does not need to be included in the calculation of the hydrocarbon range concentration. The laboratory must provide a discussion in the case narrative if this approach is used (MADEP-EPH-19-1, section 11.2.6).

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedances, improper preservation and observed sample headspace are noted on the nonconformance report form.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument maintenance logbook.

All batch and sample specific QC criteria outlined in Section 9 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.1.1 Additional MAEPH Criteria

Analyze over three days a minimum of seven replicates reagent water and/or clean sand blanks that have been fortified with all analytes or interest. Spiking concentrations are typically 10µg/L for water, and 0.17mg/kg for soil.

13.1.1.1 Water MDLs are determined by extracting a minimum of 7 replicates of 1L reagent water blanks spiked with OTP, COD and each analyte of interest.

13.1.1.2 Soil/sediment MDLs are determined by extracting a minimum of 7 replicates of 15g sand blanks spiked with OTP, COD, and each analyte of interest.

13.1.1.3 The mean accuracy of Nonane (C9), expressed as a percentage of the true value, must be between 30% and 140%. For other analytes, excluding C36, the mean accuracy must be between 40% and 140%. For each analyte, the %RSD must be less than or equal to 25%.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

13.2.3 Additional MAEPH Criteria

13.2.3.1 Accuracy and Precision

13.2.3.1.1 Extract each replicate according to the extraction SOP, and analyze each replicate according to the procedures described in Section 10.3.2.

13.2.3.1.2 Calculate the measured concentrations of each analyte in all replicates, the mean accuracy (as percentage of true value) for each analyte, and the precision (as %RSD) of the measurements for each analyte.

13.2.3.1.3 For each analyte, excluding n-C_{36}, the mean accuracy, expressed as a percentage of the true value, must be within ± 40% of the true value for both aqueous and soil matrices. Poorer recoveries may be experienced for the n-C_{36} standard. For each analyte, the %RSD must be ± 25% for both aqueous and soil matrices. A higher %RSD is allowed for nonane if it is included in the collective calibration standard for the C_9 – C_{18} aliphatic range. Such allowable non-conformances must be documented.

13.2.3.2 Fractionation Efficiency

13.2.3.2.1 To demonstrate the initial capability of properly fractionating aliphatic and aromatic hydrocarbons in a sample, the analyst must first prepare and analyze the Fractionation Check Solution specified in Section 8.3.5.

13.2.3.2.2 To demonstrate the initial capability of properly fractionating aliphatic and aromatic hydrocarbons at least four (4) replicate FCCs must be extracted, fractionated per the appropriate extraction SOP, and analyzed. The mean % Recovery of the subject fractionation surrogates is determined.

13.2.3.2.3 For each analyte within the Fractionation Check Solution, excluding n-nonane, the % mean accuracy for four (4) replicate samples, expressed as a percentage of the mean true value, must be

between 40% - 140%. Lower recoveries are permissible for n-nonane. If recovery of n-nonane is < 30%, the source of the problem must be found and the fractionation check repeated.

13.2.3.3 Subsequent to the initial demonstration of laboratory capability, a Fractionation Check Solution is analyzed for each new lot of silica gel cartridges.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

2121 Chemical Hygiene Plan

1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

1739 Demonstration of Capability (DOC) Generation SOP

1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 1 – REPORTING LIMITS
Table 2 – ALIPHATIC HYDROCARBON STANDARD
Table 3 – LIST OF COMPOUNDS AND CALIBRATION LEVELS
Table 4 – EPH MARKER COMPOUNDS

Table 1
Reporting Limits

Parameter	Aqueous	Soil
C9-C18 Aliphatic Hydrocarbons	100 µg/L	6.67 mg/Kg
C19-C36 Aliphatic Hydrocarbons	100 µg/L	6.67 mg/Kg
C11-C22 Aromatic Hydrocarbons	100 µg/L	6.67 mg/Kg
Naphthalene	10 µg/L	0.33 mg/Kg
2-Methylnaphthalene	10 µg/L	0.33 mg/Kg
Acenaphthylene	10 µg/L	0.33 mg/Kg
Acenaphthene	10 µg/L	0.33 mg/Kg
Fluorene	10 µg/L	0.33 mg/Kg
Phenanthrene	10 µg/L	0.33 mg/Kg
Anthracene	10 µg/L	0.33 mg/Kg
Fluoranthene	10 µg/L	0.33 mg/Kg
Pyrene	10 µg/L	0.33 mg/Kg
Benzo(a)anthracene	10 µg/L	0.33 mg/Kg
Chrysene	10 µg/L	0.33 mg/Kg
Benzo(b)fluoranthene	10 µg/L	0.33 mg/Kg
Benzo(k)fluoranthene	10 µg/L	0.33 mg/Kg
Benzo(a)pyrene	10 µg/L	0.33 mg/Kg
Indeno(1,2,3-cd)pyrene	10 µg/L	0.33 mg/Kg
Dibenzo(a,h)Anthracene	10 µg/L	0.33 mg/Kg
Benzo(g,h,i)perylene	10 µg/L	0.33 mg/Kg

Table 2
Aliphatic Hydrocarbon Standard

Compound	Carbon Number	Compound	Carbon Number
n-Nonane	C_9	n-Eicosane	C_{20}
n-Decane	C_{10}	n-Docosane	C_{22}
n-Dodecane	C_{12}	n-Tetracosane	C_{24}
n-Tetradecane	C_{14}	n-Hexacosane	C_{26}
n-Hexadecane	C_{16}	n-Octacosane	C_{28}
n-Octadecane	C_{18}	n-Tricontane	C_{30}
n-Nonadecane	C_{19}	n- Hexatriacontane	C_{36}

Table 3
List of Compounds and Calibration Levels

Component	Concentration of standard analytes (µg/mL)					
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Individual Aliphatic, Aromatic and Surrogate Compounds	1	5	10	20	50	100
Total Mass C_9 – C_{18} Aliphatic Hydrocarbons, ng (6 components)	6	30	60	120	300	600
Total Mass C_{19} – C_{36} Aliphatic Hydrocarbons, ng (8 components)	8	40	80	160	400	800
Total Mass C_{11} – C_{22} Aromatic Hydrocarbons/PAHs, ng (17 components)	17	85	170	340	850	1700

Table 4
EPH Marker Compounds

Range/Hydrocarbon Standard	Beginning Marker Compound	Ending Marker Compound
C_9 – C_{18} Aliphatic Hydrocarbons	n-Nonane	Just before n-Nonadecane
C_{19} – C_{36} Aliphatic Hydrocarbons	n-Nonadecane	n-Hexatriacontane
C_{11} – C_{22} Aromatic Hydrocarbons	Naphthalene	Benzo (g,h,i) Perylene

Volatile Petroleum Hydrocarbons (VPH)

Reference Method No.: Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), Massachusetts DEP, ORS, BWSC. Revision 2.1, February 2018.

Quality Control Requirements and Performance Standards for the ***Analysis of Volatile Petroleum Hydrocarbons (VPH)*** in Support of Response Actions under the Massachusetts Contingency Plan (MCP), Section IV C, Rev 0, January, 2017

1. Scope and Application

Matrices: This method is suitable for the analysis of waters, soils, sludges, sediments, wastes and non-aqueous-phase liquids (NAPL). Water samples may be analyzed directly for volatile petroleum hydrocarbons by purge-and-trap concentration and gas chromatography. Soil/sediment samples are dispersed in methanol to dissolve the volatile organic constituents. A portion of the methanol solution is then analyzed by purge-and-trap GC.

This method is designed to measure the collective concentrations of volatile aliphatic and aromatic petroleum hydrocarbons in water and soil. Volatile aliphatic hydrocarbons are collectively quantitated within two ranges: C_5 through C_8, and C_9 through C_{12}. Volatile aromatic hydrocarbons are collectively quantitated within the C_9 to C_{10} range. These aliphatic and aromatic hydrocarbon ranges correspond to a boiling range between approximately 36ºC and 220ºC.

This method is based on a purge-and-trap, gas chromatography (GC) procedure using in-series Photoionization and Flame Ionization Detectors (PID/FID). This method should be used by, or under the supervision of, analysts experienced in the use of purge-and-trap systems and gas chromatographs. The analysts should be skilled in the interpretation of chromatograms and their use as a quantitative tool. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

This method is also able to measure the individual concentrations of the VPH Target Analytes: benzene, toluene, ethylbenzene, xylenes, naphthalene, and methyl-tert-butyl ether (MTBE). Results for these individual analytes are reported at client request.

Petroleum products suitable for evaluation by this method include gasoline, mineral spirits, and certain petroleum naphthas. This method, in and of itself, is not suitable for the evaluation of kerosene, jet fuel, heating oils, lubricating oils, and/or other petroleum products which contain a significant percentage of hydrocarbons heavier than C_{12}.

The Reporting Limits (RLs) of this method for each of the collective aliphatic and aromatic ranges are typically 5 - 10 mg/kg in soil and 100 - 150 µg/L in aqueous samples. The RLs of this method for the Target VPH Analytes are typically 0.05 to 0.25 mg/kg in soil for all compounds. In aqueous samples, the typical reporting limits are 1 to 5 µg/L for all compounds.

This method includes a data adjustment step to subtract the concentration of VPH Target Analytes from the concentration of the aliphatic range results when the individual compounds are reported (Alpha product VPH Deluxe). This step is taken by the laboratory, and both adjusted and unadjusted values are reported to the client.

Data generated using this method is reported using the format specified in the MADEP VPH method.

Like all GC procedures, this method is subject to a “false positive” bias in the reporting of Target VPH analytes, in that non-targeted hydrocarbon compounds eluting or co-eluting within a specified retention time window may be falsely identified and/or quantitated as a Target VPH analyte.

Confirmatory analysis by gas chromatography/mass spectrometry (GC/MS) analysis may be performed in cases where target analyte identification is suspect.

Regulatory Parameter List:

Parameter	CAS
C5-C8 Aliphatic Hydrocarbons	-
C9-C12 Aliphatic Hydrocarbons	-
C9-C10 Aromatic Hydrocarbons	-
Benzene	71-43-2
Toluene	108-88-3
Ethylbenzene	100-41-4
m/p-Xylenes	108-38-3/106-42-3
o-Xylene	95-47-6
Naphthalene	91-20-3
Methyl-tert-butyl ether	1634-04-4

Definitions: See Alpha Analytical Quality Manual.

♦ **Analytical Batch** is defined as a group of field samples with similar matrices, which are processed as a unit. For Quality Control purposes, if the number of samples in such a group is greater than 20, then each group of 20 samples or less is defined as a separate analytical batch.

♦ **Calibration Check Standard** is defined as a calibration standard which is analyzed daily to verify the calibration state of an instrument. The calibration check standard is prepared from the same stock solution as the initial calibration standards, and is spiked at the concentration of the Level 4 initial calibration standard.

♦ **Calibration Standards** are defined as a series of standard solutions prepared from a stock standard solution, containing known concentrations of each analyte and surrogate compound of interest.

♦ **Unadjusted C_5 through C_8 Aliphatic Hydrocarbons** are defined as all aliphatic hydrocarbon compounds, which elute on the FID chromatogram from n-pentane (C_5) to just before n-nonane (C_9).

♦ **Unadjusted C_9 through C_{12} Aliphatic Hydrocarbons** are defined as all aliphatic hydrocarbon compounds, which elute on the FID chromatogram from n-nonane (C_9) to just before naphthalene.

♦ **C_9 through C_{10} Aromatic Hydrocarbons** are defined as all aromatic hydrocarbon compounds, which elute on the PID chromatogram from just after o-xylene to just before naphthalene. Although it is an aromatic compound with 10 carbon atoms, naphthalene is excluded from this range because it is evaluated as a separate (Target) analyte.

♦ **Field Duplicates** are defined as two separate samples collected at the same time and place, under identical circumstances and managed the same throughout field and laboratory procedures. Analyses of field duplicates give a measure of the precision associated with sample collection, preservation, and storage, as well as laboratory procedures.

♦ **Target VPH Analytes** are defined as benzene, toluene, ethylbenzene, m-xylene, p-xylene, o-xylene, naphthalene, and methyl tert-butyl ether.

♦ **Adjusted C_5 through C_8 Aliphatic Hydrocarbons** are defined as all hydrocarbon compounds which elute on the FID chromatogram from n-pentane (C_5) to just before n-nonane (C_9), corrected for MTBE, Benzene, and Toluene.

♦ **Adjusted C_9 through C_{12} Aliphatic Hydrocarbons** are defined as all hydrocarbon compounds which elute on the FID chromatogram from n-nonane (C_9) to just before naphthalene, corrected for Ethylbenzene, m/p-Xylene, and o-Xylene.

♦ **Volatile Petroleum Hydrocarbons (VPH)** are defined as collective fractions of hydrocarbon compounds eluting from n-pentane to naphthalene, excluding Target VPH Analytes. VPH is comprised of C5 through C8 Aliphatic Hydrocarbons, C9 through C12 Aliphatic Hydrocarbons, and C9 through C10 Aromatic Hydrocarbons.

♦ **Volatile Petroleum Hydrocarbon (VPH) Component Standard** is defined as a 15-component mixture of the aliphatic and aromatic compounds listed in Table 2. The compounds comprising the VPH Component Standard are used to (a) define the individual retention times and chromatographic response factors for each of the Target VPH Analytes, (b) define and establish the windows for the collective aliphatic and aromatic hydrocarbon ranges of interest, and (c) determine average chromatographic response factors that can in turn be used to calculate the collective concentration of hydrocarbons within these ranges.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer.

A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the QA Officer and/or Laboratory Director on a case-by-case basis.

2. Summary of Method

Samples are analyzed using purge-and-trap sample concentration. The gas chromatograph is temperature programmed to facilitate the separation of organic compounds. Detection is achieved by a photoionization detector (PID) and flame ionization detector (FID) connected in series. Quantitation is based on comparing the PID and FID detector response of a sample to a standard comprised of aromatic and aliphatic hydrocarbons. The PID chromatogram is used to determine the individual concentrations of Target Analytes and collective concentration of aromatic hydrocarbons within the C_9 through C_{10} range. The FID chromatogram is used to determine the collective concentration of aliphatic hydrocarbons within the C_5 - C_8 and C_9 - C_{12} ranges.

2.1 Method Modifications from Reference

2.1.1 Trap

We currently use a Supelco K trap. A trap desorption efficiency study was performed using a gasoline standard. Results were acceptable within method required criteria. Results of the comparison study are kept on file by the QA department.

3. Reporting Limits

Table 1 lists our routine reporting limits.

4. Interferences

4.1 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be free from contamination under the conditions of the analysis. Running laboratory reagent blanks as described in Section 9.1 demonstrates the system is free of contamination. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system must be avoided.

4.2 Sample contamination occurs by diffusion of volatile organics through the septum seal into the sample during shipment and storage. Trip blanks are prepared from reagent water or methanol as appropriate, and are carried through sampling and subsequent storage and handling steps to serve as a check on such contamination.

4.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. To reduce carry-over, the sample syringe must be rinsed with reagent water between sample analyses. Each autosampler position is also monitored for positive hits and subsequent sample analyses are checked for potential carry-over. If carry-over is suspected, the sample is reanalyzed for confirmation. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination. For samples containing large amounts of water-soluble materials, suspended solids, high boiling compounds or high purgeable levels, it may be necessary to wash the purging device with a detergent solution, rinse it with reagent water, and then dry it in a 105°C oven between analyses. The trap and other parts of the system are subject to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4.4 The response selectivity of a photoionization detector (PID) is used in this method to differentiate aromatic hydrocarbons from aliphatic hydrocarbons. All compounds eluting on the PID chromatogram after o-xylene are identified by the method as aromatic hydrocarbons. This will lead to an overestimation of aromatic hydrocarbons within samples, as the PID will also detect certain aliphatic compounds, particularly unsaturated compounds such as alkenes. This is a limitation of the method, and the significance and implication of the overestimation will vary from sample to sample.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, standards, or solvents.

5.2 All standard preparation must be performed in the volatiles hood.

5.3 All expired standards must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be labeled properly with hazard warning labels indicating the container contents. Unopened expired standards get placed in the proper VOA lab pack area designated by the Hazardous Waste Manager.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Shipping and Handling

A summary of sample collection, preservation and holding times is provided in Table 3.

6.1 Sample Collection and Preservation

6.1.1 Aqueous Samples

Aqueous samples are collected in triplicate, without agitation and without headspace, in contaminant-free, 40mL glass VOA vials with Teflon-lined septa screw caps. The Teflon liner must contact the sample. Samples are acidified to a pH of 2.0 or less at the time of collection. This is typically accomplished by adding 3 to 4 drops (0.1 to 0.2mL) of 1:1 HCl (1 part reagent water and 1 part concentrated HCl) to a 40mL sample vial. Samples must be cooled to 4ºC immediately after collection.

The laboratory must determine the pH of all water samples. The pH measurement may be performed on leftover sample. If the pH of any sample is above 2, it must be noted on a narrative report for inclusion in the client report.

6.1.2 Soil Samples

Soil samples are collected in duplicate contaminant free 40mL VOC vials with Teflon-lined septa screwcaps. Soil samples are collected in a manner that minimizes sample handling and agitation. The use of specially designed airtight collection samplers is recommended. All sediment must be removed from the glass threads of the vial to ensure an adequate seal. Samples must be cooled to 4ºC immediately after collection.

Methanol preservation of soil samples is mandatory. Methanol (purge-and-trap grade) must be added to the sample vial before or immediately after sample collection. In lieu of the in-field preservation of samples with methanol, soil samples may be collected in specially designed, airtight sampling devices, provided that the samples are extruded and preserved in methanol with 48 hours of collection.

6.1.2.1 The desired ratio of methanol-to-soil is 1mL methanol / 1 gram soil, ± 25%. The exact weight of the soil sample and volume of methanol must be known or ascertained by the laboratory when calculating and reporting soil concentration data.

In all cases, the soil sample in the vial must be completely covered by the methanol.

6.1.2.2 An additional sample of the soil must also be obtained (without methanol) to be used for the determination of soil moisture content to allow for the calculation of the dry weight results, and to calculate the methanol dilution effect. (See Section 11.3)

6.2 Sample Shipping

A reagent water trip blank accompanies each batch of water samples.

A methanol trip blank accompanies each batch of soil samples.

6.3 Sample Handling

A chain of custody form must accompany all sampling vials and must document the date and time of sample collection and, where appropriate, the volume of methanol added. Observations of vial leakage must be so noted on the laboratory/data report sheet. Any sample received by the laboratory that is not packed in ice or cooled to 4ºC must be so noted on the sample delivery group form.

Aqueous samples must be analyzed within 14 days of collection, soil samples within 28 days of collection.

7. Equipment and Supplies

7.1 Glassware

7.1.1 VOC Vials: 40mL VOC vials with Teflon/silicone septa for soils or waters

7.1.2 Class "A" Volumetric Flasks: 10mL, 50mL, 100mL, and 1,000mL with a ground-glass stopper.

7.1.3 Pasteur Pipets: Disposable.

7.2 Analytical Balance: A top-loading balance capable of weighing to the nearest 0.01g is used for weighing soil samples and taring prepared soil VOA vials containing the methanol.

7.3 Gas Chromatograph:

7.3.1 Gas Chromatograph, Hewlett Packard 6890 (or equivalent): An analytical system complete with temperature programmable gas chromatograph and purge-and-trap concentrator. The data station must be capable of storing and reintegrating chromatographic data and must be capable of determining peak areas using a forced baseline projection.

7.3.2 Chromatographic Column: Restek RTx-502.2, 105M x 0.53mm I.D., 3.0-micron film thickness. Alternative columns may be used as long as the method performance criteria can be met.

7.3.3 Detectors: A Photoionization Detector (PID) is used in series with a Flame Ionization Detector (FID); the PID is first in the series.

7.3.4 **Purge and Trap System:** The purge-and-trap system consists of two separate pieces of equipment: a purging device (autosampler) (EST Centurion or equivalent) coupled to the desorber (concentrator) (EST Encon or equivalent).

7.3.5 Purge/carrier gas = Helium, analytical grade, (99.999%).

7.3.6 The purging device is configured with 5 mL sample purge tubes, and the helium purge gas is introduced at the bottom of the water column as finely divided bubbles

7.3.7 The trap used in the desorber is typically a Supelco "K" trap. Different traps may be used if equivalent performance is demonstrated.

7.3.8 The desorber is capable of rapidly heating the trap to 260°C. The trap is not heated above manufacturer's specifications

7.4 Data System: A computer system is interfaced to the GC for collection of data. Chemstation software is used for data acquisition, and Enviroquant software is used for data reduction and processing.

7.5 Syringes: 5mL, 10mL, and 25mL gas-tight syringe.

7.6 Microsyringes: 1µL, 5µL, 10µL, 25µL, 100µL, 250µL, 500µL, and 1,000µL.

7.7 Spatula: Stainless steel.

8. Reagents and Standards

8.1 Organic-free reagent water: Tap water passed through activated carbon. All references to "reagent water" in this SOP refer to water prepared in this manner.

8.2 Methanol: Purge and Trap grade or equivalent, demonstrated to be free of volatile analytes. Store in flammables cabinet, away from other solvents.

8.3 Stock Standards: All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. When an ampulated stock solution is opened, it is transferred to a labeled amber screw cap vial. The expiration date of the stock solution is either the vendor specified expiration date or 1 month from the date the ampule was opened, whichever is sooner. Store at -10°C to -20°C, protected from light.

8.3.1 **Primary VPH Stock Standard:** (Absolute Standards, Cat # 93624) or equivalent

Component	Concentrations, µg/mL
Pentane	50
2-Methyl pentane	50
Methyl-t-butyl-ether	50
2,2,4-Trimethylpentane	50
Benzene	50
Toluene	50
Nonane	50
Decane	50
Ethylbenzene	50

m-Xylene	50
p-Xylene	50
o-Xylene	50
1,2,4-Trimethylbenzene	50
n-Butylcyclohexane	50
Naphthalene	50
2,5-Dibromotoluene (surrogate)	50

8.3.2 Surrogate Stock Standard: 2,5-Dibromotoluene, 10,000µg/mL; Restek Cat # 30453 or equivalent.

8.3.3 LCS/LFB Standard: Contains the same compounds as Section 8.3.1 at a concentration of 50µg/mL, obtained from a second primary source.

8.3.4 Soil MS Stock Standard: VPH Matrix Spike Surrogate (revised), 500ug/mL each compound, Absolute Standard Cat# 93625 or equivalent, obtained from a second primary source.

8.3.5 Liquid MS Stock Standard: VPH Matrix Spike Surrogate (revised), 50ug/mL each compound, Restek Cat# 30605 or equivalent, obtained from a second primary source.

8.3.6 Gasoline Stock Standard: 5,000µg/mL; Ultra Scientific, (Cat # RGO-601).

8.4 Intermediate Standards: Intermediate standards are prepared volumetrically by diluting the appropriate stock standard(s) with methanol. Intermediate standards expire one month from the date of preparation, or on the earliest expiration date of any of the stock solutions used to prepare the intermediate standard. Store with limited headspace at -10°C to -20°C.

8.4.1 Surrogate standard solutions: Into a 20mL ground glass stoppered volumetric flask, add 1mL of the stock listed in Section 8.3.3. Bring to volume with methanol. The concentration of the intermediate solution is 500µg/mL. The standard is then transferred into labeled 40mL amber VOA screw cap vials and stored in the volatiles freezer at -10° C to -20°C. Record all preparation information, including preparation date, expiration date, preparer's initials, and methanol lot number in the volatiles standard prep logbook.

8.5 Initial Aqueous Calibration Standards: Initial calibration standards are prepared at the six concentrations listed in Table 2 by adding the amounts of the stock standard (from Section 8.3.1) for levels one and two listed below to a 100mL volumetric flask filled with organic-free water. Mix aqueous standards by inverting the flask three times. Discard the solution contained in the neck of the flask, and fill a 40ml amber sample vial from the standard solution contained in the expanded area of the flask. For levels three to six repeat process by adding the amounts of the stock standard listed into a 50ml volumetric flask. Aqueous standards are not stable and should be discarded after one hour.

Calibration Level	Amount of Primary VPH Stock (µL)
1	2
2	10
3	20
4	50
5	100
6	200

8.6 Initial Soil/Solid Calibration Standards: Initial calibration standards are prepared at the six concentrations listed in Table 2 by adding the amounts of the stock standard (from Section 8.3.1) for levels one and two listed below to a 100mL volumetric flask filled with organic-free water. Mix aqueous standards by inverting the flask three times. Discard the solution contained in the neck of the flask, fill a 5ml syringe with the calibration standard and add to a non-preserved 40ml amber vial. For levels three to six spike listed amounts from the table below into a 5ml syringe filled with organic free water. Add contents of syringe to a non-preserved 40ml amber vial.

Calibration Level	Amount of Primary VPH Stock (µL)
1	2
2	10
3	2
4	5
5	10
6	20

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Analyze a method blank once per analytical batch prior to sample analysis to demonstrate that the system is free of contaminants. The method blank is 4.9mL of reagent water with 100µL of methanol added to ensure that all reagents are free of contaminants. Surrogate is also added to the method blank.

The method blank must not contain any target analytes at or above the compound reporting limits. Samples may not be run until a passing blank is analyzed.

9.2 Laboratory Control Sample (LCS) or Laboratory Fortified Blank (LFB)

An LCS is analyzed with each batch of 20 or less field samples.

The LCS for soil samples consists of a 4.9mL aliquot of reagent water and 100µL of Methanol, spiked with 5.0µL of the LCS stock standard (Section 8.3.3).

The LCS for aqueous samples consists of a 5.0mL aliquot of reagent water spiked with 5µL of the LCS stock standard (Section 8.3.3).

The recovery of individual target compounds and hydrocarbon ranges must be between 70% and 130%. If any recovery criteria are not met, the cause of the failure (i.e. degraded standard or instrument problems) must be determined and corrected prior to sample analysis.

- If the recoveries are low and outside of the acceptance limits, reanalyze the LCS and associated samples.
    - If still outside of the acceptance limits recalibrate.

- If the recoveries are high and outside of the acceptance limits and the affected compound was detected in the associated samples, reanalyze the LCS and the associated samples.
    - If recoveries are still outside of the acceptance limits recalibrate.
- If the recoveries are high and sample results were nondetect, data can be reported without qualification; however, the high recoveries should be noted in the laboratory narrative.

9.2.1 Laboratory Fortified Blank Duplicate or Laboratory Control Sample Duplicate (LFBD or LCSD)

A LCSD is analyzed with each batch of 20 or less field samples.

The LCSD for soil samples consists of a 4.9mL aliquot of reagent water and 100µL of Methanol, spiked with 5.0µL of the LCS stock standard (Section 8.3.3).

The LCSD for aqueous samples consists of a 5.0mL aliquot of reagent water spiked with 5µL of the LCS stock standard (Section 8.3.3).

The recovery of individual target compounds and hydrocarbon ranges must be between 70% and 130%. The RPD for the LCS/LCSD pair must be less than or equal to 25%

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.3.5.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

A Matrix Spike and/or Matrix Spike Duplicate pair is performed at the client's request.

For a liquid sample being purged as a soil/solid, the MS/MSD consists of a 5mL aliquot of a field sample, spiked with 5µL the MS stock standard (Section 8.3.5) or LCS standard (Section 8.3.3).

For a solid sample, the MS/MSD sample vial (a separate VOA sample vial preserved with Methanol) is spiked with 75µL of the MS stock standard (Section 8.3.4) and 100µL aliquot of the Methanol is added to 4.9mL of water and purged.

For a liquid sample the MS/MSD consists of a 43ml aliquot of a field sample, spiked with 43µL the MS stock standard (Section 8.3.5).

The recovery of individual target compounds and hydrocarbon ranges in the MS/MSD, corrected for the concentrations found in the neat sample, must be between 70% and 130% and the %RPD must be <50%. If the recovery criteria are not met but are met in the LCS, the failure may be attributed to sample matrix effects and must be noted on a narrative sheet for inclusion in the client report.

9.6 Laboratory Duplicate

A duplicate sample is analyzed with each batch of 20 or less field samples at the client's request. A duplicate is a split sample, taken from the same sample container and analyzed separately under the same conditions. The %RSDs of the sample and duplicate results are calculated, and must not exceed 50%.

- If RPD exceeds 50% and the results are > 5X the RL, sample analysis must be repeated.
- If an analyte is detected in one of the runs, but not in the other, then analysis must be repeated.
- If an analyte is detected in one analysis at < 5x the RL and not detected in the duplicate analysis, the RPD is not calculable and the analysis does not have to be repeated.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

All samples and associated QC samples are spiked with the surrogate spiking solution (Section 8.4.1). The surrogate recoveries must be between 70% and 130%. If any surrogates fail the recovery criteria, the sample should be re-analyzed to determine if the failure is due to sample matrix effects. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

Exceptions are as follows:

1. When a large amount of target or non-target material is present that co-elutes with the surrogate compound, resulting in a false high recovery. When this is evident by examination of the chromatogram, re-analysis is not required. Note the cause of the high recovery on a narrative sheet for inclusion in the client report.
2. Percent moisture of a soil/sediment sample is >25% and surrogate recovery is 10% or more.
3. The surrogate recovery is high and the sample is non-detect for all target analytes and hydrocarbon ranges.

9.7.2 Additional Instrumental Quality Control

The n-pentane (C_5) and MTBE peaks must be adequately resolved from any solvent front that may be present on the FID and PID chromatograms, respectively. This is achievable using the recommended trap and purge and trap procedures. Coelution of the m- and p- xylene isomers is permissible.

9.8 Method Sequence

The sequence of analysis is as follows:

- Calibration Standards (initial) or mid-range Calibration Check Standard (daily check of initial calibration) (REQUIRED)
- Laboratory Fortified Blank or Laboratory Control Sample (REQUIRED)
- Laboratory Fortified Blank Duplicate or Laboratory Control Sample Duplicate (REQUIRED)
- Laboratory Method Blank (REQUIRED)
- Samples (up to 20 samples)
- Duplicate sample (As requested by Client)

- Laboratory Fortified Matrix/duplicate (As requested by Client)
- Closing mid-range Calibration Check Standard after 20 samples or at the end of the batch. This standard may also be used as the opening standard for a batch. (REQUIRED)

10. Procedure

10.1 Equipment Set-up

10.1.1 Instrument Set-up Conditions

Typical instrument operating conditions are listed below. Alternate conditions are allowed, as long as method performance criteria can be met.

10.1.1.1 GC Conditions

Injection port temperature:	250ºC
Column head pressure:	20psi
Carrier gas:	Helium
Carrier gas flow:	12.5mL/min.
Temperature 1:	45 °C
Hold time 1:	2 minutes
Ramp 1:	3 °C / minute
Temperature 2:	100 °C
Hold Time 2:	0 minute
Ramp 2:	8 °C / minute
Temperature 3:	160 °C
Hold Time 3:	0 minutes
Ramp 3	20 °C/ minute
Temperature 4:	230 °C
Hold Time 4:	11.6 minutes

10.1.1.2 Detector Conditions

The carrier gas flow is augmented with an additional 24mL of helium flow before entering the photoionization detector. This make-up gas is necessary to ensure optimal response from both detectors.

FID detector

Detector temperature: 250 °C
Air flow: 350 mL/minute
Hydrogen flow: 30 mL/minute

PID detector

Detector temp: 250 °C
PID lamp: 10.2 eV
Makeup gas flow: 17.5 mL/minute

10.1.1.3 Purge and Trap Conditions

Purge Time: 11 minutes
Dry purge: 4 minutes

Desorb Preheat: 225 °C
Desorb temp: 230 °C
Desorb Time: 6 minutes

Bake temp: 260 °C
Bake time: 15 minutes

10.2 Equipment Operation and Sample Processing

The same GC, Purge and Trap, and detector conditions used for the initial calibration must be employed for sample analysis. After verification of system performance by analysis of the continuing calibration standard (Section 10.4), a method blank (Section 9.1) and samples are analyzed and processed as described below.

10.2.1 Retrieve sample VOA vials from the sample bank refrigerator just prior to loading onto the Purge and Trap. Soil samples preserved with methanol must have Surrogate Standard Solution (Section 8.4.1) added to the sample and methanol and should be shaken for 1 – 2 minutes to extract the volatile components into the methanol and mix the surrogate throughout the sample. Let sample settle prior to taking methanol aliquot. Add the spike volume below;

- 75uL for the 15mL Methanol vial.
- 50uL for the 10mL Methanol vial.
- 25uL for the 5mL Methanol vial.

10.2.2 For soil samples, fill the syringe with 4.9mL of reagent water. Add the appropriate amount of the methanol (typically 100µL) to the syringe containing the reagent water.

10.2.3 Samples may be analyzed continuously for up to 24 hours from the analysis start time of the continuing calibration standard.

10.2.4 Identification of an individual analyte occurs when a peak from a sample falls within the daily retention time window (Section 10.2.5). The concentration of an identified target compound is calculated using the Enviroquant data processing software. The Target methods have been configured to utilize the quantitation formulae found in Alpha's Quality Manual.

Proper quantitation requires the appropriate selection of a baseline from which the peak area can be determined. For the integration of individual Target Analytes and surrogate compounds, a valley-to-valley approach should typically be used, though this approach may be modified on a case-by-case basis by an experienced analyst. See the Manual Integration SOP for integration guidelines.

If the response for any individual analyte exceeds the calibration range of the system, the sample must be rerun on dilution. Whenever possible, dilutions should be made to keep the concentration of the compound in the middle of the calibration curve.

10.2.5 Aliphatic and aromatic ranges of interest are determined by the collective integration of all peaks that elute between the specified range "marker" compounds (Table 4). When quantifying on a peak area basis, collective peak area integration for the fractional ranges must be from baseline (i.e. must include the unresolved complex mixture "hump" areas). This will often require the analyst to perform a manual integration. See the Manual Integration SOP for integration guidelines.

For non-target analytes eluting in the aliphatic or aromatic fractions, the upper linear range of the system is defined by peak height measurement, based upon the maximum peak height documented for an aliphatic or aromatic standard within the fraction that is shown to be within the linear range of the detector.

10.3 Initial Calibration

10.3.1 Prepare a minimum of 5 calibration standards as per Section 8.5 or 8.6.

10.3.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in Section 10.1.1.1. The same operating conditions are used for calibration and sample analyses. Create the analytical sequence using the Chemstation data acquisition software.

10.3.3 Relative Response Factors

The external standard calibration technique is used.

10.3.3.1 Individual Analytes

In each calibration standard, calculate the calibration factors and the relative standard deviation (RSD) of the calibration factors for all aromatic compounds using the Enviroquant data processing software. The calculations are performed automatically, using the formulae listed in Alpha's Quality Manual.

10.3.3.2 Hydrocarbon Ranges

A collective calibration factor must also be established for each hydrocarbon range. Calculate the collective Calibration Factors (CF) for C_5-C_8 Aliphatic Hydrocarbons and C_9-C_{12} Aliphatic Hydrocarbons using the FID chromatogram. Calculate the collective CF for the C_9-C_{10} Aromatic Hydrocarbons using the PID chromatogram. The VPH marker compounds that determine the various ranges are listed in Table 4. The compounds that are included in each of the 3 ranges are listed below:

C_5-C_8 Aliphatic Hydrocarbons:

n-Pentane, 2-Methylpentane, and 2,2,4-Trimethylpentane

C_9-C_{12} Aliphatic Hydrocarbons:

n-Nonane, Decane and n-butylcyclohexane

C_9-C_{10} Aromatic Hydrocarbons:

1,2,4-Trimethylbenzene.

10.3.4 Initial Calibration Criteria

If the RSD for an individual analyte is $\leq$ 20% and $\leq$ 25% for hydrocarbon ranges, then the response for this compound is considered linear over the range and the mean calibration factor can be used to quantitate sample results. If the RSD criterion is not met for an analyte, linearity through the origin cannot be assumed. The calibration may be repeated for any compounds that fail, or a separate calibration curve may be generated for this compound and used for sample quantitation.

In order for the linear regression model to be used for quantitative purposes, r (correlation coefficient) must be ≥0.99. In addition, the resulting calibration curve from the linear regression must be verified by recalculating concentrations of the Target VPH Analytes and hydrocarbon ranges in the lowest calibration standard using the final calibration curve. Recoveries must be 70-130%. If recalculated concentrations from the lowest calibration standard are outside the 70-130% recovery range, raise the RL to the

concentration of the next highest calibration standard that exhibits acceptable recoveries when recalculated using the final calibration curve.

NOTE: Use of non-linear calibration is not allowed and is considered a significant modification.

10.3.5 ICV

After the calibration an ICV needs to be analyzed with a ±30% recovery. The ICV must be prepared from a separate source standard than used for initial and continuing calibrations. The calibration standard must be analyzed immediately following the initial calibration. The ICV should be prepared at a mid-range calibration curve concentration.

Percent recoveries must be between 70-130%. Recalibrate if >10% of all analytes are outside of criteria.

10.3.6 Retention Time Windows

The retention time windows used for identification of the individual analytes are ± 0.05 RRT (Relative Retention Time) units, based on the most recent standard run. It has been determined that these limits work well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positive results. Analyst experience also weighs heavily in the determination of positive hits. If uncertainty still exists, confirmation by GC/MS is required.

VPH retention time (Rt) windows of the aliphatic ranges are defined as beginning 0.1 minutes before the Rt of the beginning marker compound and ending 0.1 before the Rt of the ending marker compound, except for C_9, which is both a beginning and ending marker compound for two different ranges.

The C_5 – C_8 Aliphatic Hydrocarbon range ends immediately (0.01 min) before the elution of the n-pentane peak.

The C_9 – C_{12} Aliphatic Hydrocarbon range begins 0.01 min. before the elution of n-nonane..

Therefore, there is no overlap of the two ranges and the n-nonane peak is only included in the C_9 – C_{12} Aliphatic Hydrocarbon range.

The VPH retention time (Rt) window for the C_9-C_{10} Aromatic Hydrocarbons is defined as beginning 0.1 minutes after the Rt of the beginning marker compound and ending 0.1 before the Rt of the ending marker compound.

VPH marker compounds and windows are summarized in Table 4.

10.4 Continuing Calibration

Verify calibration daily, after every 20 samples or less, and at the end of the analytical sequence by analyzing a continuing calibration standard. The concentration of the continuing calibration standard is the same as the Level 4 standard from the initial calibration (Section 8.5). The %D of each response factor must be ≤20% for target VPH analytes and the surrogate, and ≤25% for hydrocarbon ranges except for n-nonane, which must be ≤30%.

10.4.1 If these criteria are not met, inspect the analytical system to determine the cause of the drift and perform necessary maintenance before verifying calibration and proceeding with sample analyses.

10.4.2 If routine maintenance does not return the instrument performance to meet the %D criteria when compared to the last initial calibration curve, then a new initial calibration must be performed.

10.4.3 Closing Mid-range Calibration Verification

Following a batch of twenty or less samples, another CCV (Section 9.3) is analyzed. If this CCV achieves the acceptance criteria specified in Section 9.3, the sample results are considered valid. If this standard fails acceptance criteria, the samples and QC samples analyzed since the last acceptable CCV must be reanalyzed.

This QC sample may also be used as the opening CCV Standard for the next analytical batch if batches are processed continuously.

10.5 Preventive Maintenance

If the response of the PID detector decreases significantly, perform a cleaning of the PID lamp per the manufacturer's instructions. If the response is still low, the PID lamp should be replaced with a new one (PID lamp life is typically 90 - 180 days).

Additional maintenance should be performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and clipping several inches off of the injector end of the capillary column. The trap used in the Purge and Trap equipment will also need periodic replacement, when system performance degrades.

11. Data Evaluation, Calculations and Reporting

11.1 Data Manipulations

By definition, the collective concentrations of aliphatic and aromatic fractions of interest **exclude** the individual concentrations of VPH Target Analytes. Accordingly, a series of data manipulation steps are necessary to adjust the collective range concentrations to eliminate "double counting" of analytes.

This necessary data manipulation step is taken by Alpha for inclusion on the client report. Subtract the individual concentrations of the Target analytes from the collective concentration of Unadjusted Aliphatic Hydrocarbon ranges. This calculation is performed automatically by Alpha's LIMS system according to the steps listed below.

11.1.1 Subtract the collective concentration of $C_9 - C_{10}$ Aromatic Hydrocarbons from the collective concentration of $C_9 - C_{12}$ Aliphatic Hydrocarbons. If this value is less than the Reporting Limit, report "Not Detected".

11.1.2 Subtract the individual concentrations of the VPH Target Analytes from the appropriate aliphatic range (i.e. $C_5 - C_8$, or $C_9 - C_{12}$ Aliphatic Hydrocarbons) in which they elute. If the individual concentrations of Target Analytes have not been quantitated, report the values as Unadjusted $C_5 - C_8$ Aliphatic Hydrocarbons and Unadjusted $C_9 - C_{12}$ Aliphatic Hydrocarbons, and indicate "Not Determined" for Adjusted $C_5 - C_8$ Aliphatic Hydrocarbons and Adjusted C9 – C_{12} Aliphatic Hydrocarbons.

The extent of data manipulations taken by the laboratory must be noted on the data reporting form.

11.2 Data Reporting Format

The purpose Alpha's reporting format is to provide data users with a succinct and complete summary of pertinent information and data, a clear indication of whether significant modifications were made to the VPH Method, and a clear affirmation on whether the QA/QC procedures and standards specified in this method were followed and achieved. While it is permissible to alter the form and presentation of the data, all of the information must be provided in a clear, concise, and succinct manner.

11.3 LIMS Data Corrections

Please note that the Laboratory Information Management System (LIMS) automatically adjusts soil sample results to account for the % Total Solids of the sample (as determined per Alpha SOP/07-38) and the methanol preservation dilution effect.

12. Contingencies for Handling Out-of-Control or Unacceptable Data

Holding time exceedance, improper preservation and observed sample headspace are noted on a project narrative report by the analyst for inclusion in the data report.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument maintenance logbook.

All batch and sample specific QC criteria outlined in Section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

The laboratory follows the procedure found in the MADEP "Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), Revision 2.1, February 2018" to determine the MDL on an annual basis. The method detection limits determined by the laboratory are on file for review.

Method performance data is on file in the laboratory QC department. Method performance data for the laboratory is compared to the MADEP VPH method criteria.

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD)

The laboratory follows the procedure to determine the MDL, and LOD as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDOC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

13.3 Initial Demonstration of Accuracy (IDA)

Prepare and analyze seven (7) replicate Laboratory Control Samples (LCSs) fortified at a concentration of 50% of the highest calibration curve standard (100µg/L for waters and 5mg/Kg for soils/sediments). An LCS must be prepared and treated exactly as a typical field sample submitted for analysis, including exposure to all glassware, equipment, solvents and reagents. An LCS for water analyses is prepared by adding 4µL of LCS spiking solution (Section 8.3.4) in purge-and-trap grade Methanol to 5mL of organic-free water (ASTM Type I reagent grade). An LCS for soil/sediment analyses is prepared by adding 6.2uL of surrogate spiking solution (Section 8.3.4) in purge-and-trap grade Methanol to 5 mL of organic-free water (ASTM Type I reagent grade) fortified with the appropriate volume of a calibration standard or appropriate reference standard (as specified above) to obtain an equivalent concentration of 50% of the highest calibration curve standard (5mg/Kg). Calculate the mean measured concentration (C_{mean}) of the replicate LCSs for VPH Target Analytes and ranges as follows:

Equation D: Calculation of C_{mean}

$$C_{mean} = \frac{(C_1 + C_2 + C_3 + ...C_n)}{n}$$

Where:

C_{mean} = Mean recovered concentration of the replicate analysis

$C_1 + C_2 + C_3 + ...C_n$ = Recovered concentrations of the replicate 1.2...n

$n = 7$

The value derived for C_{mean} must be within ± 30% of the true value or between 70µg/L and 130µg/L for waters and 3.5mg/Kg and 6.5mg/Kg for solids.

13.4 Initial Demonstration of Precision (IDP)

Using the results calculated from Section 13.3, calculate the percent relative standard deviation (%RSD) of the seven (7) replicate analyses, as indicated in the Equation E below. The %RSD must be less than or equal to 25% for both waters and solids. Higher %RSDs are allowed for n-Nonane, if included in the collective calibration standard for the C_9 through C_{12} aliphatic range. Such allowable non-conformances must be documented.

Equation E: Calculation of %RSD

$$\%RSD = \frac{S_{n-1}}{C_{mean}} \times 100$$

Where:

S_{n-1} = Sample standard deviation (n-1) of the replicate analyses

C_{mean} = mean recovered concentration of the replicate analyses

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/08-05 MDL/LOD/LOQ Generation

SOP/08-12 IDC/DOC Generation

SOP/14-01 Waste Management and Disposal SOP

16. Attachments

TABLE 1: Reporting Limits

TABLE 2: List of Compounds and Calibration Levels

TABLE 3: Holding Times and Preservation Requirements

TABLE 4: VPH Marker Compounds

TABLE 1
REPORTING LIMITS

Parameter	Aqueous	Soil
C5-C8 Aliphatic Hydrocarbons	100.00 µg/L	5.0 mg/kg
C9-C12 Aliphatic Hydrocarbons	100.00 µg/L	5.0 mg/kg
C9-C10 Aromatic Hydrocarbons	100.00 µg/L	5.0 mg/kg
Benzene	2.00 µg/L	0.10 mg/Kg
Toluene	2.00 µg/L	0.10 mg/Kg
Ethylbenzene	2.00 µg/L	0.10 mg/Kg
m/p-Xylenes	2.00 µg/L	0.10 mg/Kg
o-Xylene	2.00 µg/L	0.10 mg/Kg
Naphthalene	10.00 µg/L	0.50 mg/Kg
Methyl-tert-butyl ether	3.00 µg/L	0.05 mg/Kg

TABLE 2
LIST OF COMPOUNDS AND CALIBRATION LEVELS

Component	Concentration (µg/L)					
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Pentane	1	5	20	50	100	200
2-Methylpentane	1	5	20	50	100	200
Methyl-t-butyl ether	1	5	20	50	100	200
2,2,4-Trimethylpentane	1	5	20	50	100	200
Benzene	1	5	20	50	100	200
Toluene	1	5	20	50	100	200
Nonane	1	5	20	50	100	200
Decane	1	5	20	50	100	200
Ethylbenzene	1	5	20	50	100	200
p/m-Xylene	2	10	40	100	200	400
o-Xylene	1	5	20	50	100	200
1,2,4-Trimethylbenzene	1	5	20	50	100	200
n-Butylcyclohexane	1	5	20	50	100	200
Naphthalene	1	5	20	50	100	200
2,5-Dibromotoluene (surrogate)	1	5	20	50	100	200

TABLE 3
HOLDING TIMES AND PRESERVATION REQUIREMENTS

Matrix	Container	Preservation	Holding Time
Aqueous Samples	40mL VOC vials w/Teflon-lined septa screw caps, in triplicate	Add 3 to 4 drops of 1:1 HCl; cool to 4ºC	14 days
Soil/Sediment Samples	VOC vials w/Teflon- lined septa screw caps, in duplicate 40mL vials: add 15 g soil	1mL methanol for every gram of soil; add before or at time of sampling; cool to 4ºC	28 days

TABLE 4
VPH MARKER COMPOUNDS

Hydrocarbon Range	Beginning Marker	Ending Marker
C_5-C_8 Aliphatic Hydrocarbons (FID)	0.1 min. before n-Pentane	0.01 min. before n-Nonane
C_9-C_{12} Aliphatic Hydrocarbons (FID)	0.01 min. before n-Nonane	0.1 min. before Naphthalene *
C_9-C_{10} Aromatic Hydrocarbons (PID)	0.1 min. after o-Xylene	0.1 min. before Naphthalene

* The retention time for Dodecane (C_{12}) is approximately 2 minutes less than the retention time for naphthalene, using the column and chromatographic conditions recommended for this method. For simplicity, naphthalene is used as the ending marker for the C_9-C_{12} Aliphatic Hydrocarbon range.

Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

References: **Method 8260D**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update VI (Phase II), June 2018.

Method 5035A, SW-846, Closed System Purge & Trap and Extraction for Volatile Organics in Soil and Waste Samples. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Draft Revision I, July 2002.

Method 5030B, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, December, 1996.

Method 5030C, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, May, 2003.

1. Scope and Application

Matrices: Method 8260 is used to determine volatile organic compounds in a variety of solid waste matrices. This method is applicable to nearly all types of samples, regardless of water content, including various air sampling trapping media, ground and surface water, aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

Definitions: Refer to Alpha Analytical Quality Manual.

The compounds listed in Table 5 may be determined by this method.

There are various techniques by which these components may be introduced into the GC/MS system. Purge-and-trap, by Methods 5030C (aqueous samples) and 5035A (solid and waste oil samples), is the most commonly used technique for volatile organic analytes. However, other techniques are also appropriate and necessary for some analytes. One technique is direct injection of an aqueous sample (concentration permitting).

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Department Manager, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph/mass spectrometers and in the interpretation of mass spectra and their use as a quantitative tool. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

The volatile compounds are introduced into the gas chromatograph by the purge-and-trap method or by direct injection. The analytes are introduced to a narrow-bore capillary column for analysis. The Gas Chromatograph (GC) is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) interfaced to the GC.

Analytes eluted from the capillary column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact (or electron impact-like) spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard, comparing sample response to the calibration standards.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Table 1 lists our typical reporting limits.

4. Interferences

4.1 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be free from contamination under the conditions of the analysis. Running laboratory reagent blanks as described in Section 9.1 and 10.3 demonstrates the system is free of contamination. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system must be avoided.

4.2 Sample contamination occurs by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A trip blank or a field reagent blank prepared from reagent water and carried through the sampling and handling protocol serves as a check on such contamination.

4.2.1 Storage blanks shall be analyzed if contamination is suspect. If contamination is confirmed by positive detections in the sample storage blanks, all data from samples contained in the relative refrigerator or freezer shall be evaluated for possible contamination. If the samples contain suspected contamination, the Client Services department shall be notified in order to contact the necessary clients regarding the contamination. Samples shall be reanalyzed if so desired by the client. If suspected contamination is not confirmed by storage blanks, no further action shall be pursued concerning said blanks. It is recommended that further action be taken to determine the possible cause of suspected contamination.

4.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. Whenever a highly concentrated sample is being encountered, it should be followed by an analysis of reagent water (instrument blank) to check for potential contamination. If carry-over is suspected, then numerous instrument blanks may be required; additionally all affected samples are rerun for confirmation. In case of severe contamination, preventive maintenance of the entire system may be required.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of safety data sheets (SDS) is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The following method analytes have been tentatively classified as known or suspected human or mammalian carcinogens: benzene, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichloroethane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, chloroform, 1,2-dibromoethane, tetrachloroethene, trichloroethene, and vinyl chloride. Pure standard materials and stock standard solutions of these compounds should be handled in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, standards, or solvents.

5.2 All stock solution standard preparation must be performed in the volatiles hood. Initial calibration, continuing calibration, laboratory control sample and client sample dilutions do not need to be performed in the hood.

5.3 All expired standards must be placed into the waste bucket in the lab for future disposal. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing Methanol must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Storage, Shipping and Handling

6.1 Sample Collection and Preservation

6.1.1 Aqueous Samples

Grab samples are collected in standard 40mL amber glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two or more VOA vials should be filled per sample location. EPA Method 8260 requires that samples be acidified to eliminate the possibility of biological degradation. Unless otherwise directed for project-specific reasons, all VOA vials are delivered to the client with approximately 2 – 4 drops of 1:1 HCl added to the vial, which is sufficient to adjust the pH of the sample to < 2. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Fill the sample vial to the point of overflowing so that no headspace is contained within. Samples must be introduced into the vials gently to reduce agitation, which might drive off volatile compounds or cause loss of the HCl preservative.

Seal the bottle so that no air bubbles are in the VOA vial. If preservative has been added, shake vigorously for one minute. Invert the bottle and tap to check for air bubbles. Recollect the samples if any air bubbles are present.

Maintain the hermetic seal on the VOA vial until time of analysis.

6.1.2 Soil Samples

The recommended sampling method for soil samples is EPA 5035A. Method 5035A provides for two distinct sampling procedures, depending on the required reporting limits and suspected or known concentration levels of target analytes. These methods are referred to as the High Level and Low Level methods. Both are listed below, but depending on the samples only one of the methods may be required. If concentration levels are unknown, it is recommended that samples be collected using both procedures.

The Lab will analyze the high level sample first, followed by the low level sample if the results from the high level analysis show that the sample is clean or contains analytes at low levels. The typical reporting levels of the two methods are listed in Table 1.

6.1.2.1 High Level Soil Samples

Collect sample in a standard 40mL amber glass screw-cap vial with Teflon lined silicon septa (VOA vial). The vial is provided containing 15mL of Purge and Trap Grade methanol, and is labeled and weighed prior to addition of sample. Record the weight of the vial with methanol on the vial label. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Approximately 15g of soil is added to the vial in the field, making sure that the sample is completely covered by the methanol.

Maintain the hermetic seal on the VOA vial until the time of analysis.

An additional sample of the soil must also be obtained (without methanol) to be used for the determination of soil moisture content to allow for the calculation of the dry weight results, and to calculate the methanol dilution effect. (See Sections 11.1.2.2.2 and 11.1.2.2.3)

6.1.2.2 Low Level Soil Samples

Collect sample in a standard 40mL amber glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two samples should be taken per sample location. Vials are provided containing a magnetic stirring bar and 5 mL of either 200g/L sodium bisulfate solution or water, prepared by a certified vendor. These vials are labeled and weighed prior to addition of sample. Record the weight of the vial with the stirring bar and preservative on the vial label.

Approximately 5g of soil is added to the vial in the field, making sure that the sample is completely covered by the sodium bisulfate solution or water.

Maintain the hermetic seal on the VOA until the time of analysis.

6.2 Sample Handling and Storage

Document client specific sample handling, preservation and collection criteria in the project file. The laboratory Log-in staff documents sample temperature at the time of receipt.

Record deviations from this SOP or client specific criteria on the chain of custody form.

Record holding time exceedance, improper preservation and observed sample headspace on the nonconformance report form.

6.2.1 Aqueous Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 1 and 4 °C. Sample receiving personnel must note on the sample delivery group form when samples received at the laboratory are not within the temperature criteria. If more than one vial is received for a sample, the vials are stored in separate refrigerators. Storing the vials apart provides a useful check if laboratory contamination of a sample is suspected. Samples must be analyzed within 14 days of collection. Unpreserved samples requiring aromatic analysis must be analyzed within 7 days of collection.

6.2.2 High Level Soil Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Sample receiving personnel note on the

nonconformance report form when samples received at the laboratory are not within the temperature criteria.

6.2.3 Low Level Soil Samples

Ice or refrigerate samples preserved with water or sodium bisulfate from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Samples preserved with water are to be immediately frozen after sampling. Sample receiving personnel note on the nonconformance report form when samples received at the laboratory are not within the temperature criteria.

6.3 Sample Shipping

Samples requiring shipment to the laboratory are shipped in ice-packed coolers via an overnight delivery service in accordance with applicable Department of Transportation regulations.

7. Equipment and Supplies

7.1 Purge and Trap System (For Aqueous samples): The purge-and-trap system consists of two separate pieces of equipment: a purging device (autosampler) (TekmarAtomxXYZ, EST Centurion or equivalents) coupled to the desorber (concentrator) (EST Encon or Encon EV, or equivalents).

7.1.1 Purge gas = Helium, analytical grade (99.999%).

7.1.2 The purging device is configured with 25 mL sample purge tubes, and the helium purge gas is introduced at the bottom of the water column as finely divided bubbles

7.1.3 The trap used in the desorber is typically a Supelco “K” trap. Different traps may be used if equivalent performance is demonstrated.

7.1.4 The desorber is capable of rapidly heating the trap to 260°C. The trap is not heated above manufacturer’s specifications

7.2. Purge and Trap System (For Low Level and High Level Soil Samples): The purge and trap system consists of two separate pieces of equipment: a purging device (autosampler) (Tekmar AtomxXYZ, EST Centurion or equivalents) coupled to the desorber (concentrator) (Tekmar Velocity or Atomx, or EST Encon or Encon EV, or equivalents).

7.2.1 Purge gas = Helium, analytical grade (99.999%).

7.2.2 The autosampler purging device is a closed system, designed to accept the 40mL VOA vials. The VOA vial, containing the soil sample, water (or sodium bisulfate), and stirring bar is placed into the autosampler tray. The instrument automatically adds reagent water, internal standards, and surrogates to the unopened VOA vial. The vial is heated to 40 °C, and the helium purge gas is introduced into the aqueous portion to purge the volatile components onto the trap.

7.2.3 The trap used in the desorber is typically a Supelco “K” trap. Different traps may be used if equivalent performance is demonstrated.The desorber is capable of rapidly heating the trap to 260 °C. The trap is not heated above manufacturer specifications.

7.3 Gas Chromatography/Mass Spectrometer/Data System:

7.3.1 Gas Chromatograph, Agilent 6890/7890 or equivalent: An analytical system complete with a temperature-programmable gas chromatograph with appropriate interface for sample introduction device. The system includes all required accessories,

including syringes, analytical columns, and gases. The capillary column is directly coupled to the source of the GC/MS system.

7.3.2 Typical Gas Chromatographic Columns:

7.3.2.1 Column 1: Restek 502.2, 40 meter, 0.18mm ID, or equivalent.

7.3.2.2 Column 2: Restek RTX-VMS, 30 meter, 0.25mm ID, or equivalent

7.3.3 Mass Spectrometer, Agilent 5973/5975/5978 or equivalent: Capable of acquiring mass spectra from mass/charge (m/z) 35 to 270 at a rate fast enough to acquire at least five (but preferably 10 or more) mass spectra across each chromatographic peak of interest, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for 4-Bromofluorobenzene (BFB) which meets all of the criteria in Table 3, when 50ng of the GC/MS tuning standard (BFB) are injected through the GC. For all SIM analysis, the mass spectrometer must also be able to acquire data in a dual acquisition mode (SIM and full scan).

7.3.4 Data System: Hewlett-Packard EnviroQuant software is used for data acquisition, and allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program.

Enviroquant E.02.02 (or equivalent) is used for data processing, and allows searching of any GC/MS data file for ions of a specified m/z, and plotting such ion abundances versus time or scan-number.

The most recent version of the EPA/NIST Mass Spectral Library is loaded onto the Target / Enviroquant data system.

7.4 Wiretrol or Micro syringes: 10µL - 1,000µL.

7.5 Syringes: 5mL, 10mL, or 25mL, glass with Luerlock tip.

7.6 Balances: Top-loading**,** capable of weighing 0.01g.

7.7 Vials: 2mL, 4mL.

7.8 Disposable Pipets.

7.9 Volumetric Flasks: Class A, appropriate sizes, with ground-glass stoppers.

7.10 Eppendorf pipets.

8. Reagents and Standards

Reagent grade organic chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all organic reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

Great care must be taken to maintain the integrity of all standard solutions. Standards in methanol are stored at –10ºC or less, in amber vials with PTFE-lined screw-caps.

8.1 Organic-free Reagent Water:

All references to water in this method refer to organic-free reagent water, which is tap water passed through activated carbon and air bubbled through.

8.2 Methanol:

Purge and Trap Grade or equivalent. Store in flammables cabinet.

8.3 Stock Solutions:

All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. When an ampulated stock solution is opened, it is transferred to a labeled amber screw-cap vial with minimal headspace. The expiration date of the stock solution is either the vendor specified expiration date or 6 months from the date the ampule was opened, whichever is sooner. Typical stock standard concentrations are listed in Table 4.

8.4 Intermediate Standards: Intermediate standards are prepared volumetrically by diluting the appropriate stock standard(s) with methanol. Initial Calibration solutions expire 2 months from the date of preparation, or sooner if daily continuing calibration checks do not achieve the method acceptance criteria. If the Intermediate Standards are used as a second source to verify a valid Initial Calibration solution, there is no expiration date.

8.4.1 Internal Standard Solutions:

The internal standards are Fluorobenzene, Chlorobenzene-d_5, and 1,4-Dichlorobenzene-d_4. The intermediate IS solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of IS solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample or standard. Internal standard is added at the same concentration to all standards, samples, and QC samples.

8.4.2 Surrogate Standard Solutions:

The surrogate standards are Dibromofluoromethane, 1,2-Dichloroethane-d_4, Toluene-d_8, and 4-Bromofluorobenzene. The intermediate surrogate solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of surrogate solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample.

8.4.3 Target Compound Solutions:

The target analytes routinely reported by this method are listed in .Table 1 and 4. The intermediate target compound solutions are prepared by diluting the stock solution(s) with methanol. This set of solutions, at concentrations of 200 µg/mL, is used for preparation of the calibration standards.

8.4.4 4-Bromofluorobenzene (BFB) Tune solution:

8.4.4.1 A solution containing BFB at a concentration of 50 µg/mL is prepared by volumetrically diluting the BFB stock solution. 1 µL of this solution is direct-injected or purged into the GC/MS system to verify system performance prior to any standard or sample analysis.

8.4.4.2 BFB may be analyzed in full scan mode while standards, samples, and QC are analyzed in SIM

8.5 Calibration Standards:

There are two types of calibration standards used for this method – initial calibration standards and calibration verification standards.

8.5.1 Initial Calibration Standards:

Initial calibration standards can be prepared at the levels listed in Table 4 (other/different levels are allowed). The Initial Calibration needs to have a minimum of 5 standards, 6 if a quadratic curve fit is used. Prepare these solutions in organic-free reagent water. The standards correspond to the range of concentrations found in typical samples and do not exceed the working range of the GC/MS system. Initial calibration should be mixed from fresh stock standards and dilution standards when generating an initial calibration curve.

8.5.2 Initial Calibration Verification Standard (ICV):

The initial calibration verification standard is at the same concentration as the level 3 for liquids and level 4 for soils initial calibration standard. This standard is prepared from source materials from a second manufacturer or from a manufacturer's batch prepared independently from the batch used for calibration. A second lot# from the same manufacturer may be adequate to meet this requirement. The standard must contain all calibrated target analytes that will be reported for the project, if readily available.

8.5.3 Continuing Calibration Verification Standard:

The continuing calibration verification standard, or calibration check standard, should be analyzed near the action level of the project. Since most projects are focused on achieving low reporting limits, the continuing calibration verification standard is at the same concentrations as the level 3 for liquids and level 4 for soils initial calibration standard. This standard is run at the beginning of each analytical sequence, following the BFB tune standard, to verify system performance.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

9.1.1 Before processing any samples, the analyst must demonstrate through the analysis of a method blank (MB) or instrument blank that equipment and reagents are free from contaminants and interferences. The blank must contain the internal standards and surrogates and must be from the same source of water used for preparing the standards, QC samples and sample dilutions.

9.1.2 Analyze a matrix-specific blank, i.e. methanol samples need to have methanol in the blank; sodium bisulfate samples need to have a sodium bisulfate blank analyzed;

TCLP samples need a TCLP blank, after each ICAL and CCV, and prior to any sample analysis to demonstrate that interferences from the analytical system are under control.

9.1.3 Blanks are considered to be acceptable if target analyte concentrations are less than one half the LOQ or are less than project-specific requirements. Blanks may contain analyte concentrations greater than acceptance limits if the associated samples in the batch are unaffected (i.e., target analytes are not present in samples or sample concentrations/responses are >10X the blank).

9.1.4 If an analyte of interest is found in a sample in the batch near a concentration detected in the blank, the presence and/or concentration of that analyte should be considered suspect and may require qualification. Reanalysis is not necessary if the analyte concentration falls well below the action or regulatory limit or if the analyte is deemed not important for the project.

9.1.5 The laboratory should not subtract the results of the MB (or any blank) from those of any associated samples.

9.2 Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)

A LCS/LCSD pair is analyzed at the beginning of each analytical sequence. Since the LCS contains the same compounds at the same concentrations as the continuing calibration check standard, the same analysis is used to satisfy both QC elements. The LCS/LCSD acceptance criteria are based on in-house control limits, unless specified by project/regulation.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.5.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 11.2.

9.5 Matrix Spike/ Matrix Spike Duplicate

Upon Client Request, a matrix spike/matrix spike duplicate pair may be analyzed with each batch of 20 or less samples. The MS/MSD are sample aliquots spiked with the target compounds at the same concentration as the continuing calibration standard for water analysis and level 6 for soils. The MS/MSD acceptance criteria are based on in-house control limits. If the MS/MSD does not meet the criteria, but the LCSD does, the failure may be attributed to sample matrix. Report the MS/MSD, including a narrative sheet for inclusion with the client report.

9.6 Laboratory Duplicate

Not applicable.

9.7 Method-specific Quality Control Samples

9.7.1 Internal Standards

Area counts of the internal standard peaks in all samples and QC samples must be between 50-200% of the areas of the internal standards in the QC check standard.

If any individual percent recovery falls outside the range, that parameter has failed the acceptance criteria. For calibration standards, CCVs, LCS/LCSD or blanks the internal

standard must be within the range for data to be reported to the clients. For samples, matrix spikes and duplicates: if the data is not within the range, the sample is rerun to confirm that the failure is due to sample matrix. A nonconformance report form is completed to ensure client notification and reporting if matrix effect is confirmed.

9.7.2 Surrogates

Surrogates are added to each field sample and QC sample. The laboratory must evaluate surrogate recovery data from individual samples versus the surrogate control limits developed by the laboratory. The surrogate acceptance criteria are listed in Table 2. Since the SIM analysis is acquired in dual mode, the surrogates from the full scan are used to evaluate the entire sample (SIM and full scan).

9.8 Method Sequence

In a 12-hour period, the typical analytical sequence is as follows:

- BFB
- QC Check Standard/Laboratory Control Sample/LCSD
- Method Blank
- Samples
- MS/MSD (upon Client request, may be run any time after the Method Blank)

10. Procedure

10.1 Equipment Set-up

Typical instrument operating conditions are listed below. Alternate conditions are allowed, if method performance criteria can be met.

10.1.1 GC Conditions:

Temperature 1:	35°C	Carrier gas:	Helium, 99.999%
Hold Time 1:	4 minutes	Carrier mode:	Constant flow
Ramp 1:	6°C/minute	Carrier flow:	1 mL/minute
Temperature 2:	150°C		
Hold Time 2:	0 minutes		
Ramp 2:	8°C/minute		
Temperature 3:	220°C		
Final Time:	1 minute		

10.1.2 MS Conditions:

Mass range:	m/z of 35 – 270 amu
Scan time:	0.5 minutes/scan
Source temperature:	230°C or according to manufacturer's specifications.

10.1.3 Velocity Concentrator Purge and Trap Conditions:

Purge time:	11 minutes
Dry purge:	2 minutes

Desorb preheat:	250°C
Desorb temp:	255°C
Desorb time:	2 minutes

Bake temp: 290°C
Bake time: 10 minutes

10.1.4 Encon Concentrator Purge and Trap Conditions:

Purge time: 11 minutes
Dry purge: 1 minute

Desorb preheat: 245°C
Desorb temp: 255°C
Desorb time: 1 minute

Bake temp: 270°C
Bake time: 10 minutes

10.2 Initial Calibration

10.2.1 The initial calibration is performed at a minimum of five (5) concentration levels listed in Table 4, the low level either at or below the reporting limit. The calibration is performed using instrument conditions listed in Section 10.1.

BFB must be analyzed prior to analysis of the initial calibration standards, and must pass the criteria listed in Table 3. The mass spectrum of BFB should be acquired in the following manner:

(1) Three scans (the peak apex scan, the scan immediately preceding the apex and the scan immediately following the apex) are acquired and averaged.
(2) Background subtraction is performed using a single scan of no more than 20 scans prior to the elution of BFB.

This is done automatically with the Enviroquant software.

10.2.1.1 Low Level/High Level Soil Curve on Centurion: To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 50mL volumetric flask using a micro syringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, then gently fill a 5mL syringe with standard and transfer to a 40mL VOA vial containing a magnetic stir bar. Load the vial onto autosampler.

10.2.1.2 Aqueous/High Level Soil Curve on Solatek or Centurion: To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 100mL volumetric flask using a micro syringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, and then gently fill a 40mL VOA vial to the top. Load the vial onto the autosampler.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in Section 10.1. The same operating conditions are used for calibration and sample analyses. Create the analytical sequence using the HP Enviroquant data acquisition software.

Relative Response Factors: The internal standard calibration technique is used. In each calibration standard, calculate the relative response factor for each analyte and the relative standard deviation (RSD) of the response factors using the Enviroquant data

processing software. The response factors are calculated using the areas of the characteristic (quantitation) ion for each target analyte and internal standard. The calculations are performed automatically using the Enviroquant software, using the formulae listed in Alpha's Quality Manual.

10.2.3 Initial Calibration Criteria: The following sections outline the method acceptance criteria for an initial calibration curve. All criteria must be met for the calibration to be deemed acceptable, and for sample analysis to proceed.

10.2.3.1 Relative Standard Deviation Criteria: If the RSD for each target analyte is less than or equal to 20%, then the response for this compound is considered linear over the calibration range and the mean calibration factor can be used to quantitate sample results. If the 20% RSD criterion is not met for an analyte linear regression may be used if $\mathbf{r^2} \geq 0.990$, weighted linear with a weighting factor of 1/SD2 and r > 0.995, or quadratic fit if $\mathbf{r^2} \geq 0.990$. A minimum of six points is required and the low point of the calibration must be re-quantitated and recover within 70-130% to be deemed acceptable. The calibration must be repeated for any compounds that fail. If more than 10% of the compounds exceed the 20% RSD limit and do not achieve the minimum correlation coefficient for alternative curve fits, sample analysis cannot proceed.

10.2.3.2 Minimum Response Factors: Table 1 lists the suggested minimum response factors for the most common analytes. Each calibration level may be evaluated against the specified criteria. All analytes should be greater than or equal to 0.05, except for certain very poor purgers (1,4-Dioxane, Acrolein, ketones, alcohols and other water soluble compounds) that should meet a 0.001 response factor. If an analyte falls below 0.05 (or 0.001 for 1,4-Dioxane, Acrolein, ketones, alcohols and other water soluble compounds), then corrective action should be taken to resolve the problem before analysis can proceed.

10.2.3.2.1 Minimum response factors are required to be narrated for MCP jobs. See the MCP 8260 SOP addendum for more information.

10.2.4 Evaluation of Retention Times: The relative retention times used for identification of target analytes are +/- 0.06 RRT (Relative Retention Time) units, based on the most recent standard run. It has been determined that these limits work well, being wide enough to eliminate false-negative results while being tight enough to eliminate false positive results. Due to the selectivity of the mass spectrometer, compound identification is more definitive than when using a less selective detector.

10.2.5 Initial Calibration Verification: After each calibration and before the analysis of samples, an ICV must be analyzed at or near the midpoint of the curve. The ICV must be prepared using a different source than the Initial Calibration and must contain all target analytes. The percent recoveries must be between 70% and 130% for target analytes except for "difficult" analytes (Table 7), which must exhibit percent recoveries between 40% and 160%. Corrective action is required if greater than 10% of all analytes are outside the prescribed criteria.

10.2.5.1 The ICV used for the initial calibration can be used as the continuing calibration verification. See Section 10.4 for criteria.

10.2.6 Additional considerations for SIM analysis

10.2.6.1 SIM may be useful for applications requiring quantitation limits below the normal range of electron impact quadrupole mass spectrometry, and both are allowable options for this method. Using the primary m/z for quantitation and at least one

secondary m/z (or product ion) for confirmation, set up the descriptor windows based on their retention times. The selected m/z values should include any mass defect noted in the target analyte mass spectra acquired on the instrument, usually less than 0.2 amu. The dwell time for each ion may be automatically calculated by the instrument software or may be calculated based on the peak widths of the analytes of interest, the number of spectra needed to be acquired across each peak, and the number of concurrent ions that need to be acquired in each segment. When fewer m/z values are monitored in each segment, the acquisition time for each m/z can be increased, thereby increasing the sensitivity of the system. The total cycle time for the MS should be short enough that at least five, but preferably ten or more, spectra are acquired per chromatographic peak.

10.2.6.2 When compounds are analyzed in SIM mode, the following best practices are recommended:

10.2.6.2.1 Monitor at least two ions for each target analyte, and use the mid-point of the calibration curve to establish proper ion ratios for each compound. The ratios of primary and secondary ions are the only qualitative tools available in SIM runs (other than RT), which increases their importance in proper identification. When interferences are expected or observed in a given matrix, acquiring multiple secondary ions may aid in qualitative identification.

10.2.6.2.2 Verify that all monitored ions are correctly integrated in order to achieve proper ion ratios. Update the primary/secondary ion ratios and reference mass spectra after each ICAL using a mid-range ICAL standard.

10.3 Equipment Operation and Sample Processing

The same GC, MS, and Purge and Trap conditions used for the initial calibration must be employed for sample analysis. After verification of system performance by analysis of BFB, the continuing calibration standard and method blank, samples are analyzed and processed as described below.

10.3.1 All samples are initially screened using Tekmar 7000 Headspace Autosamplers.

10.3.2 Retrieve sample VOA vials from the sample refrigerator just prior to loading onto the purge and trap system.

10.3.3 Aqueous samples:
Load the VOA vial directly on the sampling rack. Dilutions may be prepared volumetrically and poured into VOA vials ensuring there is no headspace left in the vial. The autosampler will then sample 10mL from the VOA vial.

10.3.4 Low level soil samples:
Low level soil sample should be shaken briefly to ensure that the stir bar is loose, and will spin on the autosampler unit. Take the low level VOA vial and place directly into the rack of the autosampler unit. Surrogate and internal standards are added automatically by the autosampler prior to sample purging.

10.3.5 High level soil samples:

Shake or vortex the sample for 15 seconds, ensuring the methanol has completely penetrated the soil in the vial. Let sample settle prior to taking methanol aliquot.

10.3.5.1 Through liquid path

Load a maximum of 430µL or appropriate dilution of the methanol into a half-full VOA vial. Fill the VOA vial up to the top with water and cap with no headspace. Allow the auto-sampler to sample 10mL out of the VOA vial which would be equivalent to injecting 100µL of the methanol extract. Prepare dilutions accordingly.

10.3.5.2 Through soil path

Into a VOA vial with a stir bar added, load 4.9mL of water plus a maximum of 100 µL of methanol or appropriate dilution of methanol extract from a 5mL luerlock syringe. Cap the vial and load onto the auto-sampler.

10.3.6 Qualitative Analysis:

10.3.6.1 The qualitative identification of each compound is based on retention time and on comparison of the sample mass spectrum with the reference mass spectrum. The reference mass spectrum must be generated by the laboratory on the same GC/MS system. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.3.6.1.1 The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. The Enviroquant data system is configured to make this check.

10.3.6.1.2 The relative retention time (RRT) of the sample component is within ±0.06 RRT units of the RRT of the standard component.

10.3.6.1.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

10.3.6.1.4 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is ≤ 50% of the average of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs (i.e., m and p-xylene).

10.3.6.1.5 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.

10.3.6.1.6 Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra, and in qualitative identification of compounds. When analytes coelute (i.e., only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the coeluting compound.

10.3.6.2 For samples containing non-target analytes, a library search will be performed at client request. Compound identification will be classified as "tentative", and the concentration will be reported as an estimate as no quantitative standards are run for these compounds.

10.3.6.2.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) are present in the sample spectrum.

10.3.6.2.2 The relative intensities of the major ions should agree within ±20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%.)

10.3.6.2.3 Molecular ions present in the reference spectrum are present in the sample spectrum. If the molecular ion is not present, carefully review library matches in order to avoid misidentification.

10.3.6.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

10.3.6.2.5 Ions present in the reference spectrum but not in the sample spectrum are reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks.

10.3.6.2.6 Mass spectral library search algorithms typically assign a match factor to the peak identity based on comparison of an unknown mass spectrum to library spectra. For spectra meeting the above conditions, match factors greater than 0.85 (85%) may be considered confirming evidence. Where a known limitation in data collection is identified (e.g., the presence of an incompletely resolved spectral interference), a lower match factor may be considered confirmatory. For multiple library spectra with similar match factors (e.g., for hydrocarbons with low abundance molecular ions, or structural isomers), the tentative identification assigned to the unknown may be better represented as a more generic structure (e.g., unknown hydrocarbon, C4 benzene structural isomer).

10.3.7 Quantitative Analysis:

10.3.7.1 Quantitation of a target compound detected in a sample is performed automatically by the Enviroquant data processing software, using the formulae found in Alpha's Quality Manual. Either the average response factor or calibration curve will be used for sample quantitation, depending on how the particular analyte was processed in the initial calibration curve. If non-target compounds are to be reported, the quantitation is performed automatically by the Enviroquant software using the total area of the compound and the nearest internal standard, and assuming a relative response factor of 1.0.

10.4 Continuing Calibration

Calibration verification consists of three steps that are performed at the beginning of each 12-hour analytical shift.

10.4.1 Prior to the analysis of samples or calibration standards, inject or purge 1 µL (50 ng) of the 4-Bromofluorobenzene standard (Section 8.4.4) into the GC/MS system. The resultant mass spectra for the BFB must meet the criteria given in Table 3 before sample analysis begins.

10.4.2 The initial calibration curve for each compound of interest must be verified once every 12 hours prior to sample analysis. This is accomplished by analyzing the continuing calibration check standard (Section 8.5.3).

10.4.3 A method blank must be analyzed prior to any samples, typically immediately following the continuing calibration check standard, to ensure that the analytical system is free of contaminants. The method blank must not contain any target analytes at or above the required compound reporting limits.

10.4.4 The percent difference or drift for each target analyte must be less than or equal to 20% (30% for all SIM compounds). If greater than 20% of target analytes exceed the %D criteria corrective action must be taken prior to the analysis of samples. If less than or equal to 20% of compounds exceed the criteria, corrective action is not required.

10.4.5 The continuing calibration standard must also be evaluated for the suggested minimum response factor criteria, as specified in section 10.2.3.2

10.4.6 Internal Standard Retention Time:

The absolute retention times of the internal standards in the calibration verification standard are evaluated after data acquisition. If the absolute retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard level of the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

10.4.7 Internal Standard Response:

If the area for any of the internal standards in the calibration verification standard changes by a factor of two (50% to 200%) from that in the mid-point standard level of the most recent initial calibration sequence, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate. When corrections are made, re-analysis of samples analyzed while the system was malfunctioning is required.

10.5 Preventive Maintenance

Routine preventive maintenance should be performed on the analytical system. This includes replacement of GC septa and periodic rinsing or replacement of purge and trap tubes and sparge needles. The trap should be replaced every six months or sooner if performance criteria cannot be met. Periodic cleaning (typically twice per year) of the mass spectrometer ion

source is required. More frequent source cleaning may be needed, especially if dirty samples are analyzed.

If system performance deteriorates, additional maintenance may be required. This includes replacement of injector ports and seals, clipping several inches off of the front end of the GC column, or in extreme cases the replacement of the GC column. Flushing or replacement of purge and trap lines may be necessary if they become contaminated or develop active sites.

Perform routine preventative maintenance as described throughout this SOP. Record all maintenance in the instrument logbook.

11. Data Evaluation, Calculations and Reporting

11.1 LIMS Data Corrections

Please note that the Laboratory Information Management System (LIMS) automatically adjusts soil sample results to account for the % Total Solids of the sample (as determined per Alpha SOP/07-38) and the methanol preservation dilution effect.

11.2 Data Calculations

11.2.1 Results of Aqueous Sample Analysis:

$$Concentration\ (ug/L) = \frac{(Conc.)\ (Vp)\ (DF)}{(Vs)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
Vp = Volume purged, 10 mL is standard
Vs = Volume of sample purged
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".

11.2.2 Results of Sediment/Soil, Sludge, and Waste Analysis:

All solids including soils, sediments, and sludges must be reported on a dry-weight basis.

11.2.2.1 Low-Level Samples:

$$Concentration\ (ug/Kg) = \frac{(Conc.)\ (Vp)\ (DF)}{(W)\ (\%S)}$$

11.2.2.2 High-Level Samples:

$$Concentration\ (ug/Kg) = \frac{(Conc.)\ (Vp)\ (5000)\ (DF)}{(W)\ (Ve)\ (\%S)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".
Ve = Extract volume, mL
Vp = Volume purged, 5 mL is standard
W = Aliquot of sample (wet), g

%S = Sample % solid
5000 = Constant representing the final volume of the methanol extraction.

11.2.2.2.1 High-Level Samples Corrected for Total Water/Solvent Mixture (V_t):

Samples that are extracted prior to analysis in a water miscible solvent such as methanol are diluted by the total volume of the water/solvent mixture. The total mixture volume can only be calculated based on the sample moisture present as determined by the % moisture calculation.

$$\%\ moisture = \frac{g\ of\ sample - g\ of\ dry\ sample}{g\ of\ sample} \times 100$$

$$V_t = \frac{[mL\ of\ solvent + (\%moisture \times g\ of\ sample)]}{100} \times 1000mL/mL$$

The calculated V_t value is now added to the volume of methanol in the sample (typically 5000µL), and the corrected concentration is calculated using the equation below:

$$Corrected\ concentration\ (mg/Kg) = \frac{(Conc.)\ (V_t + methanol\ vol.)\ (Vp)\ (DF)}{(W)\ (Ve)\ (\%S)}$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

All batch and sample specific QC criteria outlined in section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 DL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

SOP/1728 Waste Management and Disposal SOP

16. Attachments

TABLE 1: 8260 REPORTING LIMITS

TABLE 2: 8260 QC ACCEPTANCE CRITERIA

TABLE 3: BFB TUNING CRITERIA

TABLE 4: STANDARD SOLUTIONS and ICAL Levels

TABLE 5: 8260D Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

TABLE 6: 8260D Quantitation Ions

TABLE 7: Difficult Analytes

Table 1

Standard Reported Detection Limits

US EPA METHOD 8260D and 5035A/8260D

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG)(1)	RDL (µg/KG) (2)
Acetone (3,4,5)	0.01	5.0	25	1250
Acrolein (5)		5.0	25	1250
Acrylonitrile (3,4)		5.0	4	200
Allyl Chloride (7)		N/A	5	250
Benzene (3,4,5)	0.2	0.5	0.5	25
Bromobenzene (3,4)		2.5	2	100
Bromochloromethane (3,4,5)	0.1	2.5	2	100
Bromodichloromethane (3,4,5)	0.300	0.5	0.5	25
Bromoform (3,4,5)	0.100	2.0	4	200
Bromomethane (3,4,5)	0.01	1.0	2	100
2-Butanone (3,4,5)	0.01	5.0	10	500
Butyl acetate (7)		N/A	5	50
n-Butylbenzene (3,4)		0.5	1	50
sec-Butylbenzene (3,4)		0.5	1	50
tert-Butylbenzene (3,4)		2.5	2	100
Carbon disulfide (3,4,5)	0.100	5.0	10	500
Carbon tetrachloride (3,4,5)	0.100	0.5	1	50
Chlorobenzene (3,4,5)	0.400	0.5	0.5	25
Chlorodifluoromethane (7)		N/A	5	250
Chloroethane (3,4,5)	0.01	1.0	2	100
2-Chloroethylvinyl ether (3)		10.0	20	1000
Chloroform (3,4,5)	0.300	0.75	1.5	75
Chloromethane (3,4,5)	0.01	2.5	4	200
o-Chlorotoluene (3,4)		2.5	2	100
Cyclohexane (5)	0.01	10	10	500
Cyclohexanone		10	20	1000
p-Chlorotoluene (3,4)		2.5	2	100
cis-Decahydronaphthalene (7)		N/A	5	250
trans-Decahydronaphthalene (7)		N/A	5	250
n-Decane (7)		N/A	5	250
Dibromochloromethane (3,4,5)	0.200	0.5	1	50
1,2-Dibromo-3-chloropropane (3,4,5)	0.01	2.5	3	150
1,2-Dibromoethane (3,4,5)	0.200	2.0	1	50
Dibromomethane (3,4)		5.0	2	100
1,2-Dichlorobenzene (3,4,5)	0.600	2.5	2	100
1,3-Dichlorobenzene (3,4,5)	0.500	2.5	2	100
1,4-Dichlorobenzene (3,4,5)	0.600	2.5	2	100
1,4-Dichlorobutane (3,4)		5.0	10	500
trans-1,4-Dichloro-2-butene (3,4)		2.5	5	250

Table 1 (continued)

Standard Reported Detection Limits

US EPA METHOD 8260D and 5035A/8260D

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG)(1)	RDL (µg/KG) (2)
Dichlorodifluoromethane (3,4,5)	0.01	5.0	10	500
1,1-Dichloroethane (3,4,5)	0.300	0.75	1	50
1,2-Dichloroethane (3,4,5)	0.07	0.5	1	50
1,1-Dichloroethene (3,4,5)	0.06	0.5	1	50
cis-1,2-Dichloroethene (3,4,5)	0.200	0.5	1	50
trans-1,2-Dichloroethene (3,4,5)	0.100	0.75	1.5	75
1,2-Dichloropropane (3,4,5)	0.200	1.75	1	50
1,3-Dichloropropane (3,4)		2.5	2	100
2,2-Dichloropropane (3,4)		2.5	2	100
1,1-Dichloropropene (3,4)		2.5	0.5	25
cis-1,3-Dichloropropene (3,4,5)	0.300	0.5	0.5	25
p-Diethylbenzene (4)		2.0	2	100
Diisopropyl Ether (6)		2.0	2	100
1,4-Dioxane (5) (non-SIM)		250.0	80	4000
trans-1,3-Dichloropropene (3,4,5)	0.300	0.5	1	50
Ethanol (7)		250.0	1000	50000
Ethyl acetate		10.0	10	500
Ethylbenzene (3,4,5)	0.400	0.5	1	50
Ethyl ether (3,4)		2.5	2	100
4-Ethyltoluene (4)		2.0	2	100
Ethyl methacrylate (3,4)		5.0	10	500
Ethyl-Tert-Butyl-Ether (6)		2.0	2	100
Freon-113 (5)	0.05	10.0	4	200
n-Heptane (7)		N/A	5	250
Hexachlorobutadiene (3,4)		0.5	4	200
Hexachloroethane (7)		N/A	5	250
Hexane		1.0	5	250
2-Hexanone (3,4,5)	0.01	5.0	10	500
Iodomethane		5.0	10	500
Isopropyl Alcohol (IPA)		100.0	100	5000
Isopropylbenzene (3,4,5)	0.400	0.5	1	50
p-Isopropyltoluene (3,4)		0.5	1	50
Limonene (7)		N/A	5	250
Methyl Acetate (5)	0.01	10.0	4	200
Methylene chloride (3,4,5)	0.01	3.0	5	250
Methyl Cyclohexane (5)	0.05	10.0	4	200
Methyl isothiocyanate (7)		N/A	5	250
Methyl Methacrylate		2.5	5	250
4-Methyl-2-pentanone (3,4,5)	0.03	5.0	10	500

Methyl-tert-butyl-ether (3,4,5)	0.100	1.0	2	100
Naphthalene (3,4)		2.5	4	200
Nitrobenzene (7)		N/A	5	250
2-Nitropropane (7)		N/A	5	250
n-Nonane (7)		N/A	5	250
n-Octane (7)		N/A	5	250
n-Butanol (5)		100.0	300	15000
n-Propylbenzene (3,4)		0.5	1	50
n-Propyl bromide		5.0	N/A	N/A
Pentachloroethane		2.0	N/A	N/A
Styrene (3,4,5)	0.200	1.0	1	50
Tert-Butyl Alcohol (5)		10.0	20	1000
Tertiary-Amyl Methyl Ether (6)		2.0	2	100
1,1,1,2-Tetrachloroethane (3,4)		0.5	0.5	25
1,2,4,5-Tetramethylbenzene (4)		2.0	2	100
1,1,2,2-Tetrachloroethane (3,4,5)	0.200	0.5	0.5	25
Tetrachloroethene (3,4,5)	0.100	0.5	0.5	25
Tetrahydrofuran (3)		5.0	4	200
Toluene (3,4,5)	0.300	0.75	1	50
1,2,3-Trichlorobenzene (3,4,5)	0.400	2.5	2	100
1,2,4-Trichlorobenzene (3,4,5)	0.400	2.5	2	100
1,3,5-Trichlorobenzene (6)		2.0	2	100
1,1,1-Trichloroethane (3,4,5)	0.05	0.5	0.5	25
1,1,2-Trichloroethane (3,4,5)	0.200	0.75	1	50
Trichloroethene (3,4,5)	0.200	0.5	0.5	25
Trichlorofluoromethane (3,4,5)	0.01	2.5	4	200
1,2,3-Trichloropropane (3,4)		5.0	10	500
1,2,4-Trimethylbenzene (3,4)		2.5	2	100
1,3,5-Trimethylbenzene (3,4)		2.5	2	100
n-Undecane (7)		N/A	5	250
Vinyl acetate (3,4)		5.0	10	500
Vinyl chloride (3,4,5)	0.01	1.0	1	50
m/p-Xylenes (3,4,5)	0.200	1.0	2	100
o-Xylene (3,4,5)	0.200	1.0	1	50
Isobutyl Alcohol		10.0	N/A	N/A
2-Butanol		25.0	N/A	N/A
4-penten-2-ol		100.0	N/A	N/A
2-methyl-2-butanol		25.0	N/A	N/A
4-methyl-2-pentanol		25.0	N/A	N/A
Chloropicrin		20.0	100	5000
Halothane		2.5	10	500
1,4-Dioxane (5) SIM		3.0	N/A	N/A
1,1,2,2-Tetrachloroethane SIM		0.1	N/A	N/A

(1) Detection Limits are for Low-level Aqueous preserved samples.

(2) Detection Limits are for High-level Methanol preserved samples.
(3) Analyte reported by standard 8260 reporting list.
(4) Analyte reported by New York TCL reporting list.
(5) Analyte reported by New Jersey TCL reporting list.
(6) Analyte reported for New Hampshire in addition to standard 8260 reporting list.
(7) Analyte only reported for New York TCL report upon client request.
(8) Note: Reporting Limits are based on standard 8260 reporting list, RL's may vary for NY and NJ reporting lists.

Table 2

QUALITY CONTROL ACCEPTANCE CRITERIA

Surrogate Spike Percent Recovery	Aqueous Limits		Soil Limits	
	Lower Control Limit	Upper Control Limit	Lower Control Limit	Upper Control Limit
1,2-Dichloroethane-d_4	70%	130%	70%	130%
4-Bromofluorobenzene	70%	130%	70%	130%
Toluene-d_8	70%	130%	70%	130%
Dibromofluoromethane	70%	130%	70%	130%

Table 3

BFB (4-BROMOFLUOROBENZENE) MASS INTENSITY CRITERIA

m/z	Required Intensity (relative abundance)
50	15 to 40% of m/z 95 (not required)
75	30 to 60% of m/z 95 (not required)
95	50 to 200% of m/z 174
96	5 to 9% of m/z 95
173	Less than 2% of m/z 174
174	50 to 200% of m/z 95
175	5 to 9% of m/z 174
176	95% to 105% of m/z 174
177	5 to 10% of m/z 176

Table 4

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Soil	Stock (µg/mL)	Level 0 (ug/kg)	Level 1 (ug/kg)	Level 1.5 (ug/kg)	Level 2 (ug/kg)	Level 3 (ug/kg)	Level 4 (ug/kg)	Level 5 (ug/kg)	Level 6 (ug/kg)	Level 7 (ug/kg)	Level 8 (ug/kg)
Fluorobenzene	2500	20	20	20	20	20	20	20	20	20	20
Dichlorodifluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorodifluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Vinyl chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Bromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Trichlorofluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Ethanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
1,1-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
Carbon disulfide	2000	0.5	1	2	4	20	40	60	100	200	300
Freon-113	2000	0.5	1	2	4	20	40	60	100	200	300
Iodomethane	2000	0.5	1	2	4	20	40	60	100	200	300
Acrolein	2000	0.5	1	2	4	20	40	60	100	200	300
Allyl chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Methylene chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Isopropyl alcohol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Acetone	2000	0.5	1	2	4	20	40	60	100	200	300
trans-1,2-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
Hexane	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl tert-butyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
tert-Butyl alcohol	2000	2.5	5	10	20	100	200	300	500	1000	1500
Diisopropyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
1,1-Dichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Halothane	2000	0.5	1	2	4	20	40	60	100	200	300
Acrylonitrile	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl tert-butyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Vinyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
cis-1,2-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
2,2-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
Bromochloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Cyclohexane	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	Stock (µg/mL)	Level 0 (ug/kg)	Level 1 (ug/kg)	Level 1.5 (ug/kg)	Level 2 (ug/kg)	Level 3 (ug/kg)	Level 4 (ug/kg)	Level 5 (ug/kg)	Level 6 (ug/kg)	Level 7 (ug/kg)	Level 8 (ug/kg)
Chloroform	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
Carbon tetrachloride	2000	0.5	1	2	4	20	40	60	100	200	300
Tetrahydrofuran	2000	0.5	1	2	4	20	40	60	100	200	300
Dibromofluoromethane	2500	20	20	20	20	20	20	20	20	20	20
1,1,1-Trichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
2-Butanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
2-Butanone	2000	0.5	1	2	4	20	40	60	100	200	300
1,1-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Heptane	2000	0.5	1	2	4	20	40	60	100	200	300
Benzene	2000	0.5	1	2	4	20	40	60	100	200	300
tert-Amyl methyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichloroethane-d4	2500	20	20	20	20	20	20	20	20	20	20
1,2-Dichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Isobutyl alcohol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
2-Methyl-2-butanol	2000	2.5	5	10	20	100	200	300	500	1000	1500
Methyl cyclohexane	2000	0.5	1	2	4	20	40	60	100	200	300
Trichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Dibromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
4-penten-2-ol	2000	2.5	5	10	20	100	200	300	500	1000	1500
2-Chloroethyl vinyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Bromodichloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl acrylate	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dioxane	2000	N/A	40	80	200	1000	2000	3000	5000	10000	15000
cis-1,3-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorobenzene-d5	2500	20	20	20	20	20	20	20	20	20	20
Octane	2000	0.5	1	2	4	20	40	60	100	200	300
Toluene-d8	2500	20	20	20	20	20	20	20	20	20	20
Toluene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Methyl-2-pentanone	2000	0.5	1	2	4	20	40	60	100	200	300
Tetrachloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
2-Nitropropane	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	Stock (µg/mL)	Level 0 (ug/kg)	Level 1 (ug/kg)	Level 1.5 (ug/kg)	Level 2 (ug/kg)	Level 3 (ug/kg)	Level 4 (ug/kg)	Level 5 (ug/kg)	Level 6 (ug/kg)	Level 7 (ug/kg)	Level 8 (ug/kg)
Chloropicrin	2000	N/A	50	N/A	100	200	300	400	500	600	700
trans-1,3-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl isothiocyanate	2000	0.5	1	2	4	20	40	60	100	200	300
4-Methyl-2-pentanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Ethyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,2-Trichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorodibromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dibromoethane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butyl Acetate	2000	0.5	1	2	4	20	40	60	100	200	300
2-Hexanone	2000	0.5	1	2	4	20	40	60	100	200	300
Nonane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Ethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,1,2-Tetrachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
p/m Xylene	2000	1	2	4	8	40	80	120	200	400	600
o Xylene	2000	1	2	4	8	40	80	120	200	400	600
Styrene	2000	1	2	4	8	40	80	120	200	400	600
1,4-Dichlorobenzene-d4	2500	20	20	20	20	20	20	20	20	20	20
Bromoform	2000	0.5	1	2	4	20	40	60	100	200	300
Butyl acrylate	2000	0.5	1	2	4	20	40	60	100	200	300
Isopropylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Bromofluorobenzene	2500	20	20	20	20	20	20	20	20	20	20
Bromobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Decane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Propylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dichlorobutane	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,2,2-Tetrachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
4-Ethyltoluene	2000	0.5	1	2	4	20	40	60	100	200	300
2-Chlorotoluene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3,5-Trimethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,3-Trichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
trans-1,4-Dichloro-2-butene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Chlorotoluene	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	Stock (µg/mL)	Level 0 (ug/kg)	Level 1 (ug/kg)	Level 1.5 (ug/kg)	Level 2 (ug/kg)	Level 3 (ug/kg)	Level 4 (ug/kg)	Level 5 (ug/kg)	Level 6 (ug/kg)	Level 7 (ug/kg)	Level 8 (ug/kg)
tert-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Pentachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4-Trimethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Limonene	2000	0.5	1	2	4	20	40	60	100	200	300
sec-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
p-Isopropyltoluene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
trans-Decahydronaphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
Undecane	2000	0.5	1	2	4	20	40	60	100	200	300
p-Diethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Hexachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
cis-Decahydronaphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4,5-Tetramethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dibromo-3-chloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
1,3,5-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Nitrobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Hexachlorobutadiene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Naphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,3-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dioxolane	2000	N/A	25	N/A	50	100	250	500	1000	1500	2000

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
Fluorobenzene	2500	10	10	10	10	10	10	10	10	10	10	10
Dichlorodifluoromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Vinyl chloride	2000	0.2	0.5	2	10	30	50	80	100	120	160	200
Bromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Trichlorofluoromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Ethanol	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Carbon disulfide	2000		0.5	2	10	30	50	80	100	120	160	200
Freon-113	2000		0.5	2	10	30	50	80	100	120	160	200
Iodomethane	2000		0.5	2	10	30	50	80	100	120	160	200
Acrolein	2000		0.5	2	10	30	50	80	100	120	160	200
Methylene chloride	2000		0.5	2	10	30	50	80	100	120	160	200
Isopropyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
Acetone	2000		0.5	2	10	30	50	80	100	120	160	200
trans-1,2-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Methyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200
Methyl tert-butyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
tert-Butyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
Diisopropyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Halothane	2000		0.5	2	10	30	50	80	100	120	160	200
Acrylonitrile	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl tert-butyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Vinyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200
cis-1,2-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
2,2-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
Bromochloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Cyclohexane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloroform	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
Carbon tetrachloride	2000	0.2	0.5	2	10	30	50	80	100	120	160	200
Tetrahydrofuran	2000		0.5	2	10	30	50	80	100	120	160	200
Dibromofluoromethane	2500	10	10	10	10	10	10	10	10	10	10	10
1,1,1-Trichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
2-Butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Butanone	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
Benzene	2000	0.2	0.5	2	10	30	50	80	100	120	160	200
tert-Amyl methyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichloroethane-d4	2500	10	10	10	10	10	10	10	10	10	10	10
1,2-Dichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Isobutyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Methyl-2-butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
Methyl cyclohexane	2000		0.5	2	10	30	50	80	100	120	160	200
Trichloroethene	2000	0.2	0.5	2	10	30	50	80	100	120	160	200
n-Butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
Dibromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
4-penten-2-ol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Chloroethyl vinyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Bromodichloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl acrylate	2000		0.25	1	5	15	25	40	50	60	80	100
Methyl methacrylate	2000		0.25	1	5	15	25	40	50	60	80	100
1,4-Dioxane	2000		100	400	500	600	1000	800	1000	1200	1600	2000
cis-1,3-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorobenzene-d5	2500	10	10	10	10	10	10	10	10	10	10	10
Toluene-d8	2500	10	10	10	10	10	10	10	10	10	10	10
Toluene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Methyl-2-pentanone	2000		0.5	2	10	30	50	80	100	120	160	200
Tetrachloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Chloropicrin	2000		30	50	80	120	200	160	400	200	320	400
trans-1,3-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Methyl-2-pentanol	2000		2.5	10	50	150	250	400	500	600	800	1000

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
Ethyl methacrylate	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,2-Trichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorodibromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dibromoethane	2000		0.5	2	10	30	50	80	100	120	160	200
2-Hexanone	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Ethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,1,2-Tetrachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
p/m Xylene	2000		1	4	20	60	100	160	200	240	320	400
o Xylene	2000		1	4	20	60	100	160	200	240	320	400
Styrene	2000		1	4	20	60	100	160	200	240	320	400
1,4-Dichlorobenzene-d4	2500	10	10	10	10	10	10	10	10	10	10	10
Bromoform	2000		0.5	2	10	30	50	80	100	120	160	200
Butyl acrylate	2000		0.25	1	5	15	25	40	50	60	80	100
Isopropylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Bromofluorobenzene	2500	10	10	10	10	10	10	10	10	10	10	10
Bromobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
n-Propylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dichlorobutane	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,2,2-Tetrachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
4-Ethyltoluene	2000		0.5	2	10	30	50	80	100	120	160	200
2-Chlorotoluene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3,5-Trimethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,3-Trichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
trans-1,4-Dichloro-2-butene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Chlorotoluene	2000		0.5	2	10	30	50	80	100	120	160	200
tert-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Pentachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
n-Butyl methacrylate	2000		0.25	1	5	15	25	40	50	60	80	100
1,2,4-Trimethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
sec-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
p-Isopropyltoluene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
p-Diethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
n-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,4,5-Tetramethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dibromo-3-chloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
1,3,5-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Hexachlorobutadiene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,4-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Naphthalene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,3-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dioxolane	2000		10	40	100	250	N/A	500	N/A	750	N/A	1000
Pentachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dioxane (SIM)	100		0.5	2	10	20	30	50	100	200	N/A	N/A
1,1,2,2-Tetrachloroethane (SIM)	100		0.05	0.1	0.2	0.5	1	2	5	10	N/A	N/A

- For Low Level Soil analysis, the calibration levels are the same in µg/Kg units.
- For High Level Soil analysis, the calibration levels are at 50x the levels listed due to sample preparation requirements.

Table 5

8260D Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

Fluorobenzene	Chlorobenzene-d5	1,4-Dichlorobenzene-d4
Dichlorodifluoromethane	Toluene-d8 (surr)	Isopropylbenzene
Chloromethane	Toluene	Bromoform
Vinyl Chloride	Ethyl Methacrylate	1,4-dichloro-2-butane
Bromomethane	Trans-1,3-dichloropropene	1,1,2,2,-tetrachloroethane
Chloroethane	1,1,2-trichloroethane	4-bromofluorobenzene (surr)
Trichlorofluoromethane	2-hexanone	1,2,3-trichloropropane
Ethyl Ether	1,3-dichloropropane	trans-1,4-dichloro-2-butene
Freon 113	Tetrachloroethene	n-propylbenzene
Acrolein	Chlorodibromomethane	Bromobenzene
Acetone	1,2-dibromoethane	4-ethyltoluene
Ethanol	Chlorobenzene	1,3,5-trimethybenzene
1,1,-dichloroethene	1,1,1,2-tetrachloroethane	2-chlorotoluene
Tert-Butyl Alcohol	Ethylbenzene	4-chorotoluene
Methyl Acetate	p/m xylene	tert-butylbenzene
Carbon Disulfide	o xylene	1,2,4-trimethylbenzene
Methylene Chloride	Styrene	sec-butylbenzene
Acrylonitrile	Octane	p-isopropyltoluene
Methyl Tert Butyl Ether	2-Nitropropane	1,3-dichlorobenzene
Halothane	Methyl isothiocyanate	1,4-dichlorobenzene
Trans-1,2-dichloroethene	n-Butyl acetate	n-butylbenzene
Diisopropyl Ether	Nonane	p-diethylbenzene
Vinyl Acetate		1,2-dichlorobenzene
1,1-dichloroethane		1,2,4,5-tetramethylbenzene
Ethyl-Tert-Butyl-Ether		1,2-dibromo-3-chloropropane
2-butanone		1,3,5-trichlorobenzene
2,2-dichloropropane		1,2,4-trichlorobenzene
Cis-1,2-dichloroethene		Hexachlorobutadiene
Chloroform		Naphthalene
Bromochloromethane		1,2,3-trichlorobenzene
Tetrahydrofuran		Cyclohexanone
Dibromofluoromethane (surr)		Nitrobenzene

1,1,1-trichloroethane		Pentachloroethane
Cyclohexane		Decane
1,1-dichloropropene		Limonene
carbon Tetrachloride		trans-Decahydronaphthalene
Tertiary-Amyl Methyl Ether		Undecane
1,2-dichloroethane-d4 (surr)		Hexachloroethane
1,2-dichloroethane		cis-Decahydronaphthalene
Benzene		
Trichloroethene		
Methyl cyclohexane		
1,2-Dichloropropane		
Bromodichloromethane		
1,4-Dioxane		
Dibromomethane		
2-Chloroethylvinyl Ether		
4-methyl-2-pentanone		
cis-1,3-Dichloropropene		
Iodomethane		
Methyl methacrylate		
n-Butanol		
Ethyl acetate		
Isopropyl alcohol (IPA)		
Hexane		
n-Propyl bromide		
Chlorodifluoromethane		
Allyl chloride		
Heptane		

Table 6

8260D Quantitation Ions

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Dichlorodifluoromethane	85	Ethyl Methacrylate	69
Chloromethane	50	Trans-1,3-dichloropropene	75
Vinyl Chloride	62	1,1,2-trichloroethane	83
Bromomethane	94	2-hexanone	43
Chloroethane	64	1,3-dichloropropane	76
Trichlorofluoromethane	101	Tetrachloroethene	166
Ethyl Ether	74	Chlorodibromomethane	129
Freon 113	101	1,2-dibromoethane	107
Acrolein	56	Chlorobenzene	112
Acetone	43	1,1,1,2-tetrachloroethane	131
1,1,-dichloroethene	96	Ethylbenzene	91
Tert-Butyl Alcohol	59	p/m xylene	106
Methyl Acetate	43	o xylene	106
Carbon Disulfide	84	Styrene	104
Methylene Chloride	76	Isopropylbenzene	105
Acrylonitrile	53	Bromoform	173
Methyl Tert Butyl Ether	73	1,4-dichloro-2-butane	55
Halothane	117	1,1,2,2,-tetrachloroethane	83
Trans-1,2-dichloroethene	96	1,2,3-trichloropropane	75
Diisopropyl Ether	45	Trans-1,4-dichloro-2-butene	53
Vinyl Acetate	43	n-propylbenzene	91
1,1-dichloroethane	63	Bromobenzene	156
Ethyl-Tert-Butyl-Ether	59	4-ethyltoluene	105
2-butanone	43	1,3,5-trimethybenzene	105
2,2-dichloropropane	77	2-chlorotoluene	91
Cis-1,2-dichloroethene	96	4-chlorotoluene	91
Chloroform	83	tert-butylbenzene	119
Bromochloromethane	128	1,2,4-trimethylbenzene	105
Tetrahydrofuran	42	sec-butylbenzene	105
1,1,1-trichloroethane	97	p-isopropyltoluene	119
Cyclohexane	56	1,3-dichlorobenzene	146
1,1-dichloropropene	75	1,4-dichlorobenzene	146
Carbon Tetrachloride	117	n-butylbenzene	91
Tertiary-Amyl Methyl Ether	73	p-diethylbenzene	119
1,2-dichloroethane	62	1,2-dichlorobenzene	146
Benzene	78	1,2,4,5-Tetramethylbenzene	119
Trichloroethene	95	1,2-Dibromo-3-chloropropane	75
Methyl Cyclohexane	83	1,3,5-Trichlorobenzene	180
1,2-Dichloropropane	63	1,2,4-Trichlorobenzene	180
Bromodichloromethane	83	Hexachlorobutadiene	225
1,4-dioxane	88	Naphthalene	128
Dibromomethane	93	1,2,3-trichlorobenzene	180
2-Chloroethylvinyl Ether	63	Ethanol	45
4-methyl-2-pentanone	58	Cyclohexanone	55
Cis-1,3-dichloropropene	75	Ethyl acetate	43

Table 6

8260D Quantitation Ions (continued)

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Toluene	92	Iodomethane	142
Methyl methacrylate	69	n-Butanol	56
Pentachloroethane	167	Isopropyl Alcohol (IPA)	45
Hexane	57	n-Propyl bromide	43
Chlorodifluoromethane	51	Iodomethane	142
Allyl chloride	76	Heptane	71
Octane	85	2-Nitropropane	41
Methyl isothiocyanate	73	n-Butyl Acetate	43
Nonane	57	Decane	57
Limonene	68	Undecane	57
trans-Decahydronaphthalene	138	cis-Decahydronaphthalene	138
Hexachloroethane	117	Nitrobenzene	77

Table 7

List of 8260 Difficult Analytes:

1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane (DBCP)
1,4-Dioxane
2-Butanone
2-chloroethylvinyl ether
2-Hexanone
2,2-dichloropropane
4-Methyl-2-pentanone
Acetone
Bromoform
Bromomethane
Carbon disulfide
Chloroethane
Chloromethane
cis-1,3-Dichloropropene
Dichlorodifluoromethane (Freon 12)
Ethanol
Iodomethane
Isobutyl Alcohol
Naphthalene
Nitrobenzene
n-butanol
Styrene
Tert-Butyl Alcohol
Trichlorofluoromethane (Freon 11)
Isopropyl Alcohol (IPA)

PCBs

By Capillary Column Gas Chromatography

Reference Methods: Method 8082A SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, 2007.

Quality Control Requirements and Performance Standards for Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) in Support of Response Action under the Massachusetts Contingency Plan (MCP), Revision No.1, July 1, 2010.

State of Connecticut, Department of Environmental Protection, RRCP, Version 2.0, July 2006.

1. Scope and Application

Method 8082A is used to determine the concentrations of Polychlorinated Biphenyls (PCBs) as Aroclors in extracts from solid and liquid matrices. This SOP details the analysis for PCBs using fused-silica, open-tubular, capillary columns with electron capture detectors (ECD).
Matrices: Extracts from solid and liquid matrices.

Definitions: See Alpha Laboratories Quality Manual Appendix A

Regulatory Parameter List: The standard compounds listed below are determined by this method.

Parameter	CAS#
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Director, or Quality Assurance Officer.
This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph (GC) and in the interpretation of gas chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability (see section 13.2).

2. Summary of Method

A measured volume or weight of sample (volumes and weights can vary but approximately 1L or 125 mls (LVI – Low Volume Initiative) for liquids, 15g to 30g for solids) is extracted using the appropriate matrix-specific sample extraction technique.

Liquid samples are extracted at neutral pH with methylene chloride using Method 3510C (separatory funnel), or other appropriate technique. See extraction SOP for details.

Solid samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet), or other appropriate technique. Solid samples may also be extracted with hexane:acetone (1:1) using Method 3546 (microwave). See extraction SOP for details.

Wipe samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet) or other appropriate technique. See extraction SOP for details.

Oil samples are diluted with hexane following the procedure outlined in the extraction SOP.

Sulfuric acid cleanup (Method 3665A), Copper cleanup (Method 3660B) and Silica Gel cleanup (Method 3630) are utilized for PCB extracts. See extraction SOP for details.

After cleanup, the extract is analyzed by injecting 1µL into a gas chromatograph equipped with narrow- or wide-bore fused silica capillary columns and electron capture (GC/ECD) detectors.

2.1 Method Modifications from Reference

Not applicable.

3. Reporting Limits

The reporting limits for this method as outlined is as follows:

- Aqueous samples: 0.25 ug/L / Aroclor (based on a 1L extraction or 125 ml LVI extraction)
- Soil Samples: 33.3 ug/kg / Aroclor (based on a 15g extraction)
- Solid of Difficult Matrices (i.e Caulking, Concrete, etc. are logged using the Alpha Low Level 8082 products): based on a 15g extraction
    - Aroclors 1016, 1221, 1232, 1242, 1254: 20 ug/kg
    - Aroclors 1248, 1260: 13.3 ug/kg
    - Aroclors 1262, 1268: 6.67 ug/kg

4. Interferences

4.1 Instrumental

4.1.1 Only high purity gases are used in the GC system to eliminate this source of possible contamination. Both the helium (carrier gas – 99.999%) and argon-methane (detector make-up gas) are certified by the gas supplier.

4.1.2 Preventive instrument maintenance is performed routinely, and whenever highly contaminated extracts are analyzed that could result in chromatographic interferences or result in degradation of system performance. Section 10.5 details the maintenance steps.

4.1.3 Glassware must be scrupulously cleaned. This procedure is detailed in the Organic Extraction Cleaning and Handling SOP/1953. Store dry glassware in a clean environment.

4.2 Parameters

4.2.1 All solvents used are pesticide grade or equivalent, and reagents are purchased as certified contaminant free. All of these materials are routinely determined to be free of interferences by analysis of extraction blanks with every extraction batch performed.

4.2.2 Certain compounds (i.e. phthalates) can be extracted from the sample matrix and be detected by the ECD that could possibly result in false positive results or complicate the data interpretation. The use of the cleanup procedures detailed in the extraction SOP minimizes these possible interferences. Analyst experience is also crucial in making compound determinations.

4.2.3 Interferences co-extracted from the samples will vary considerably from waste to waste. While a general cleanup technique is referenced or provided as part of the method, unique samples may require additional cleanup approaches to achieve desired degrees of discrimination and quantitation.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. PCBs have been tentatively classified as known or suspected human or mammalian carcinogens. Additional references to laboratory safety are available in the Chemical Hygiene Plan.
All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents.

5.2 All solvent and extract transfers must be handled in the vented bench area in the GC laboratory.

5.3 All stock standards, working standards, and vialed sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in two 1L or two 125 ml (LVI) amber glass jars with teflon-lined lids. Solid samples are collected in one 250 mL wide-mouth glass jar with a teflon-lined lid. All containers are purchased pre-cleaned and certified from commercial vendors.

6.2 Sample Preservation

Both aqueous and solid samples are then preserved by packing in coolers with ice or ice packs, to maintain a temperature of 4 ± 2° C. Upon receipt at the laboratory, the samples are transferred into sample storage refrigerators to maintain at a temperature of 4 ± 2° C.

6.3 Sample Handling

Aqueous samples must be extracted within 7 days of sample collection, solid samples within 14 days of collection. Once extracted, the samples must be analyzed within 40 days of the extraction date.

7. Equipment and Supplies

7.1 Gas Chromatograph, Agilent 6890, 7890: An analytical system complete with gas chromatograph configured for split-splitless injection and all required accessories including syringes, analytical columns, gases, electron capture detectors (ECD), and data system.

7.2 GC Columns: Alpha utilizes dual-column analyses. The dual-column approach involves either a single injection that is split between two columns that are mounted in a single gas chromatograph. Typical column pair used is listed below. Other columns may be used as long as method performance criteria can be met.

Column pair:

RTX-CLP: Cat. #11141 from Restek or equivalent; 30m, 0.32mm, 0.32µm

RTX-CLPII Cat. #11324 from Restek or equivalent; 30m, 0.32mm, 0.25µm

7.3 Guard Column: Cat. #10027 from Restek or equivalent; 5m, 0.32mm

7.4 Class "A" Volumetric Flasks: 10mL and 25mL (and other volumes), for standards preparation

7.5 Microsyringes/Wiretrol syringes: 10 µL – 1000 µL

7.6 Gooseneck splitless injecton liner, Cat #20799-214.5 from Restek or equivalent

7.7 Universal "Y" Press-tight tee split: Cat. #20406 from Restek or equivalent / **Siltek MXT Connector:** Cat. #21388 from Restek or equivalent

8. Reagents and Standards

Reagent grade or pesticide grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.
NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate) at 4 ± 2° C in Teflon(R)-sealed containers in the dark. When a Lot of standards is prepared, aliquots of that Lot are stored in individual small vials. All stock standard solutions must be replaced after one year or sooner if routine QC tests indicate a problem. All other standard solutions must be replaced after six months or sooner if routine QC indicates a problem.

8.1 n-Hexane: Pesticide quality or equivalent.

8.2 Acetone: Pesticide quality or equivalent.

8.3 Organic-free Reagent Water: All references to water in this method refer to organic-free reagent water from Alpha's RO water treatment system.

8.4 Stock Standard Solutions: All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. When an ampulated stock solution is opened, it is transferred to a labeled amber screw-cap vial. The expiration date of the stock solution is either the vendor specified expiration date, or 1 year from the date the ampule was opened, whichever is sooner.

8.5 Calibration Standards: Calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. Calibration standards expire 6 months from the date of preparation, or on the earliest expiration date of any of the stock solutions used to prepare the calibration standard. Calibrations are performed at the 6 concentration levels listed in Table 1. The list of ampulated calibration standards are obtain from **Ultra**:

- Aroclor 1016, Cat. #PP-282, at 100ug/ml
- Aroclor 1260, Cat. #PP-361, at 100ug/ml
- Aroclor 1262, Cat. #PP-371, at 100ug/ml
- Aroclor 1268, Cat. #PP-382, at 100ug/ml
- Aroclor 1221, Cat. #PP-292, at 100ug/ml
- Aroclor 1232, Cat. #PP-302, at 100ug/ml
- Aroclor 1242, Cat. #PP-312, at 100ug/ml
- Aroclor 1248, Cat. #PP-342, at 100ug/ml
- Aroclor 1254, Cat. #PP-351, at 100ug/ml

8.6 Second Source Standards: (ICV/CCAL) Continuing Calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. Continuing Calibration standards expire 6 months from the date of preparation, or on the earliest expiration date of any of the stock solutions used to prepare the standard. The list of ampulated standards are obtain from **Accustandard**:

- Aroclor 1016, Cat. #C-216S-H-10X, at 1000ug/ml
- Aroclor 1260, Cat. #C-260S-H-10X, at 1000ug/ml
- Aroclor 1262, Cat. #C-262S-H-10X, at 1000ug/ml
- Aroclor 1268, Cat. #C-268S-H-10X, at 1000ug/ml
- Aroclor 1221, Cat. #C-221S-H-10X, at 1000ug/ml
- Aroclor 1232, Cat. #C-232S-H-10X, at 1000ug/ml
- Aroclor 1242, Cat. #C-242S-H-10X, at 1000ug/ml
- Aroclor 1248, Cat. #C-248S-H-10X, at 1000ug/ml
- Aroclor 1254, Cat. #C-254S-H-10X, at 1000ug/ml

8.7 Internal Standard Solution: 1-Bromo-2-nitrobenzene (Ultra, Cat. #PPS-351) is used as the internal standard, and is added to all single-component calibration standards and sample extracts to achieve a concentration of 0.25µg/mL. For LVI, this solution is diluted 10X more, achieving a concentration of 0.025µg/mL.

8.8 Surrogate Standards: Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) are used as surrogates for Aroclor analysis. They are added to the calibration standards at the concentrations listed in Table 1, Continuing Calibration Standards and are spiked into all samples and QC samples prior to extraction.

- **ICAL Surrogates Stock:** is prepared by diluting of 500ul of Pesticides Surrogates Standard Spiking Solution (Ultra, Cat. #ISM-320-1) and 500ul of Decachlorobiphenyl (Accustandard, Cat. #CLP-032-R-01) to 20ml of Hexane to achieve concentration of TCMX at 5ug/ml and DCB at 10ug/ml. For LVI, this solution is diluted 10X more, achieving a concentration of 0.5 ug/ml for TCMX and 0.1 ug/ml for DCB.
- **CCAL Surrogates Stock:** is prepared by diluting of 1ml of TCMX&DCB (Accustandard, Cat. #CLP-032-R) and 1ml of Decachlorobiphenyl (Accustandard, Cat. #CLP-032-R-01) to 20ml of Hexane to achieve concentration of TCMX at 10ug/ml and DCB at 20ug/ml. For LVI, this solution is diluted 10X more, achieving a concentration of 1 ug/ml for TCMX and 2 ug/ml for DCB.
- **Extraction Surrogates Stock:** is prepared by diluting of 10ml of TCMX&DCB (Accustandard, Cat. #CLP-032-R) to 1000ml of Acetone to achieve concentration of TCMX and DCB at 2ug/ml. For LVI, this solution is diluted 10X more, achieving a concentration of 0.2 ug/ml for both TCMX and DCB.

8.9 LCS/MS Spiking Solutions: The LCS/MS spiking solution is prepared by diluting of 6.25ml of Arochlor 1016/1260 (Restek, Cat. #32039) to 500ml of Acetone to achieve concentration of Arochlor 1016/1260 at 12.5ug/ml. For LVI, 1.25 ml of the stock solution is diluted to 500 mls of Acetone to achieve a concentration of Aroclor 1016/1260 at 2.5 ug/ml.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A Method Blank is an aliquot of a clean reference matrix (reagent water for water samples or Ottawa sand for soil/sediment samples) that is carried through the entire analytical procedure. Extraction blanks are performed with each extraction batch of 20 or less samples, according to the extraction SOPs. The extraction blank must not contain any of the reportable analytes above the reporting limit. If any reportable analytes are detected in the blank, the entire extraction batch is suspect and re-extraction of all associated samples is required, unless the associated samples are non-detect or concentration of the analyte in the samples is 10 times greater than the concentration of this analyte in the blank. The surrogate recoveries must also be within the acceptance criteria listed in Table 2. If surrogate acceptance criteria are exceeded, the extraction batch must be evaluated to determine if re-extraction or re-analysis is necessary.

9.2 Laboratory Control Sample (LCS)

A Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD) pair is extracted with each analytical batch. The LCS/LCSD consist of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. For Aroclor analysis, the LCS/LCSD are spiked with a mixture of Aroclor 1016 and 1260. The recovery acceptance criteria are listed in Table 2. If any recovery criteria are not met, the extract may be re-analyzed. If the criteria are still not met, the **entire batch is re-extracted**, unless the recoveries are high and the associated samples are non-detect. If this is not possible, due to insufficient sample or holding time exceedances, the analyst must narrate the failure in the LIMS for inclusion in the client report.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.7.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike

Upon client request, a matrix spike and matrix spike duplicate pair are extracted and analyzed with each batch of 20 or less samples. The MS/MSD pair is extracted and analyzed for standard PCB analysis. The recovery acceptance criteria are listed in Table 2. If the recovery criteria are not met, but are met in the LCS, the failure may be attributed to sample matrix effects and must be narrated for inclusion in the client report.

9.6 Laboratory Duplicate

Upon client request, a Laboratory Duplicate is extracted and analyzed with each batch of 20 or less samples. The relative percent difference (RPD) acceptance criteria are listed in Table 2. If the RPD criteria are not met, the failure may be attributed to matrix effect and must be narrated for inclusion in the client report.

9.7 Surrogates

All extracted samples and associated QC are spiked with Extraction Surrogates Stock to achieve concentration of TCMX and DCB at 0.5ug/ml (0.2 ug/ml for LVI). The laboratory must evaluate surrogate recovery data from individual samples and QC samples versus the surrogate control limits listed in Table 2. If the surrogate limits are not met, the extract may be reanalyzed to determine if the failure was due to an instrument problem. If the criteria are still not met, the affected samples must be re-extracted to confirm that the failure was due to sample matrix, unless the surrogate recovery is high and the associated sample is non-detect. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

9.8 Method Sequence

Typical Initial calibration (each level to identified with the standard lot number)

1. Prime
2. Blank
3. Standard Level 1
4. Standard Level 2
5. Standard Level 3

6. Standard Level 4
7. Standard Level 5
8. Standard Level 6
9. Initial Calibration Verification Standard (ICV)

Repeat steps 3 – 9 as needed for each Aroclor necessary for calibration.

NOTE: If multiple calibration mixtures are analyzed, it is acceptable to analyze appropriate ICVs after all calibration standards have been injected.

Typical Daily Sequence

1.1016/1260 Continuing Calibration Standard **(identified with the standard lot number)**
2. Extraction Blank
3. Laboratory Control Sample
4. Matrix Spike / Matrix Spike Duplicate (if requested by Client)
5. Duplicate (if included with batch QC)
6. Samples up to 16
7. Repeat 1 – 6 as needed.

10. Procedure

10.1 Equipment Set-up

10.1.1 GC Conditions:

The dual-column / dual-detector approach involves the use of the columns listed in section 7.2. The columns are connected to an injection tee or dual injection GC, and separate electron capture detectors. Alpha typical GC conditions are listed below, but may be altered as long as method performance criteria are met.

Temperature1: 120 ºC	Injector temerature: 250ºC
Time1: 0 minutes	Injector mode: Pulsed Split
Ramp1: 45ºC/minute	1.4:1 split, 0.20 min pulse
Temperature2: 200ºC	Injector Flow: 5.7 ml/min split flow
Time2: 0 minutes	Detector temperature: 350ºC
Ramp2: 15ºC/minute	Carrier gas: Helium
Temperature3: 230ºC	Carrier flow: 20ml/min
Time3: 0 minutes	Carrier mode: Constant flow
Ramp3: 30ºC/minute	Makeup gas: Argon/methane (P5)
Final temperature 330ºC	Total detector flow: 55ml/min
Final time: 2 minutes	Injection Volume: 1 µL

10.2 Initial Calibration

10.2.1 Prepare calibration standards using the standards listed in Section 8.5 to achieve the concentrations from Table 1. Alternatively, a standard containing a mixture of Aroclor 1016 and Aroclor 1260 will include many of the peaks represented in the other five Aroclor mixtures. As a result, a multi-point initial calibration employing a mixture of Aroclors 1016 and 1260 at five concentrations should be sufficient to demonstrate the linearity of the detector response without the necessity of performing multi-point initial calibrations for each of the seven Aroclors. In addition, such a mixture can be used as a standard to demonstrate that a sample does not contain peaks that represent any one of the Aroclors. Single standards of each of the other seven Aroclors are required to aid the analyst in pattern recognition. Assuming that the Aroclor 1016/1260 standards have been used to demonstrate the linearity of the detector, these single standards of the remaining seven Aroclors also may be used to determine the calibration factor for each Aroclor when a linear calibration model through the origin is chosen. Prepare a standard for each of the other Aroclors. The concentrations should generally correspond to the mid-point of the linear range of the detector, but lower concentrations may be employed.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in section 10.1.1. The same operating conditions are used for calibrations and sample analyses. Create the analytical sequence using the Agilent Chemstation data acquisition software. Record the calibration standard, unique lot number (PP#) and analyst's initials in the analytical sequence list.

10.2.3 A 1µL injection volume of each calibration standard is typically used. Other injection volumes may be employed, provided that the analyst can demonstrate adequate sensitivity for the compounds of interest. The same injection volume must be used for all standards and samples.

10.2.4 Column adsorption may be a problem when the GC has not been used for a day or more or after system maintenance. The GC column may be primed (or deactivated) by injecting a PCB standard mixture approximately 20 times more concentrated than the mid-concentration standard. Inject this standard mixture prior to beginning the initial calibration or calibration verification.

Alternately, the system may be primed by baking at the final analytical temperature for approximately 30 minutes.

Several analytes may be observed in the injection just following system priming. Always run an instrument blank after system priming.

10.2.5 **Calibration Factor:** Internal standard calibration techniques are employed in this method.

10.2.5.1 Internal Standard Procedure. In each standard, calculate the response factor (RF) for each analyte, the average RF, and the relative standard deviation (RSD) of the RFs, using the Enviroquant data processing software. The calculations are performed automatically, using the formula listed in Alpha's Quality Manual.

Alternatively, standards of the other seven Aroclors are necessary for pattern recognition. When employing the traditional model of a linear calibration through the origin, these standards are also used to determine a single-point calibration factor for each Aroclor, assuming that the Aroclor 1016/1260 mixture has been

used to describe the detector response. The standards for these seven Aroclors should be analyzed before the analysis of any samples with hits above the RL. For example, an Aroclor 1254 standard should be analyzed before a sample with a hit of Aroclor 1254.

10.2.6 Initial Calibration Criteria

- If the **RSD for an analyte is < 20%**, then the response of the instrument for this compound is considered linear over the range and the mean calibration factor can be used to quantitate sample results.
- If the **RSD for any analyte is > 20%**, then linearity through the origin cannot be assumed. The mean response factor cannot be used for quantitation. An alternative calculation may be done by the use of **linear regression** or **quadratic regression** (minimum of six ICAL points are needed and regression must be weighted inversely proportional to concentration) as long as the correlation coefficient is **>0.990**. If both of these quantitation methods fail criteria for any compound in the initial calibration, then the system must be reevaluated and a new calibration curve must be analyzed. If quadratic regression is used for calibration, this must be noted in the laboratory narrative.
- **MCP requirement**: minimum of five unique peaks must be evaluated for Aroclors 1016 and 1260.
- **MCP requirement:** If linear or non-linear regression is used, RL must to be verified by recalculating concentrations in the lowest calibration standard using the final calibration curve. Recoveries must be **70-130%.**
- **MCP requirement:** Minimum of five standards (or six if non-linear regression used) must be used.

Initial Calibration Verification

An initial calibration verification standard must be run immediately after each initial calibration, near the midpoint of the curve. The standard must be prepared using a second source that is different than the source used for the initial calibration. (Standards listed in Section 8.6). The **%D** has to be within **20%** (**15% for CT RCP**) when compared to the mean response factor from the initial calibration.

10.2.7 Retention Time Window

10.2.7.1 The retention time window used for the identification of target analytes is ± 0.07 minutes. These criteria have been adopted from the EPA CLP Statement of Work (OLM04.2). It has been found that these limits work well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positives. Windows that are calculated using the procedure recommended in Method 8000 tend to be very narrow, creating the risk of false negative results.

10.2.7.2 The windows listed above are used as guidance; however the experience of the analyst weighs heavily in the interpretation of the chromatograms. For example, it has been observed that certain oil matrices can cause the retention times to shift more dramatically.

10.3 Sample Processing

The determination of PCB Aroclors is accomplished by comparing the sample chromatogram to that of the most similar Aroclor standard. The use of PCB overlays is extremely helpful, either by using hardcopies of chromatograms or by utilizing the Enviroquant software. A choice must be made as to which Aroclor is most similar and whether that standard is truly representative of the PCB in the sample. Both retention time and pattern are important when determining PCBs in a sample.

Samples that contained weathered PCB present special analytical challenges. Weathering could alter the Aroclor pattern to the extent that different peaks have to be selected for quantitation. Samples that contained more than one Aroclor present similar problems. For these samples, the Analyst may have to consider selecting the earlier eluting peaks for the lower boiling Aroclor and selecting the later eluting peaks for the higher boiling Aroclors to minimize overlapping peaks. Minimum of 3 peaks must be chosen for each Aroclor. In these instances, the Analyst may need request the assistance of someone with more expertise in determining the presence of PCB Aroclor.

If compound identification or quantitation is precluded due to interference (e.g., broad, rounded peaks or ill-defined baselines are present) cleanup of the extract may be needed. If instrument problems are suspected, rerun the extract on another instrument to determine if the problem results from analytical hardware or the sample matrix. Refer to the extraction SOPs for the procedures to be followed in sample cleanup.

The laboratory must report the ***HIGHER*** of the two results unless obvious interference is present on of the columns.

10.4 Continuing Calibration

10.4.1 Verify calibration each **12-hours** shift by injecting calibration verification standards prior to conducting any sample analyses. A calibration standard must also be injected at intervals of not less than **once every twenty injections**. A bracketing CCV is not required with the use of internal standard calibration (Method 8082A 11.6.8) with the exception of samples ran under CT RCP method. For Aroclor analysis, the calibration verification standard should be a mixture of Aroclor 1016 and 1260. The calibration verification process does not require analysis of the other Aroclor standards used for pattern recognition (Method 8082A 11.6.2). However, if the one-point calibration is used for the seven other Aroclor, a calibration standard must be analyzed before the sample for any hits.

10.4.2 The response factor (for internal standard compounds) for each analyte to be quantitated must not exceed a **± 20% difference** when compared to the initial calibration curve (**± 15% for CT RCP**). The Target data processing software automatically calculates the %D for all analytes according to the formulae in Alpha's Quality Manual. A retention time shift >30 seconds for the internal standard necessitates reanalysis of all affected samples.

10.5 Internal Standard

The use of internal standard calibration does not require that all sample results be bracketed with CCV standard. However, when internal standard calibration is used, the

retention times of internal standards and the area response of internal standards should be checked for each analysis.

10.5.1 **IS in CCAL** – The measured area of the internal standard must be no more than ± 50% different from the average area calculated during initial calibration **(-50 to 150%).**

10.5.2 **IS in samples** - The measured area of the internal standard must be no more than -50% to +100% different from the area calculated from opening CCV **(-50 to 200%)**

Retention time shifts of more than 30 sec from the retention time of the most recent calibration standard are cause for concern and must be investigated.

10.6 Preventive Maintenance

10.6.1 **Preventive Maintenance:** Routine preventive maintenance is performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and replacement of injector seals.

10.6.2 **Other Maintenance:** ECD detectors may become contaminated, requiring bake out at elevated temperatures, (no greater than 375°C) or repair by the manufacturer.

11. Data Evaluation, Calculations and Reporting

11.1 Quantitation of Aroclors

Per Method 8082A, quantitation is based on the use of a minimum of 3 of the major peaks present in the analyte, although the use of 5 of the major peaks is recommended. Each of these peaks is individually calibrated with a **minimum of five calibration points** based on average response factors. The %RSD must meet the criteria of ≤20% for the ICAL. The five major peaks are calculated as described below. After individual calculation meets criteria, the average of the peaks selected for quantitation is used to determine the final concentration.

11.1.1 Aqueous samples

$$\text{Concentration } (\mu g/L) = \frac{C \times DF \times Vf \times 1000}{Vo}$$

where:

C = Extract concentration (µg/mL), **NOTE**: ng on column = ng/injection volume = ng/uL = ug/mL

DF = Dilution factor

Vf = Final extract volume (mL)
Vo = Sample volume (mL)

11.1.2 Soil/sediment samples

$$\text{Concentration (µg/Kg, dry weight)} = \frac{C \times DF \times Vf \times 1000}{W\ (gm)} \div \%S$$

where:
C = Extract concentration (µg/mL), **NOTE**: ng on column = ng/injection volume = ng/uL = ug/mL
DF = Dilution factor
Vf = Final extract volume (mL)
W = Weight of the sample extracted (10g for high, 30g for low)
%S = Percent solids, as a decimal value

11.1.3 Reporting Results

11.1.3.1 After performing technical data review, validating that all QC criteria have been met and confirming all positive hits, the data report is sent electronically to the LIMS computer for generation of the client report. There are two levels of review of the data in the LIMS system prior to release of data. These reviews must be done by two separate individuals.

11.1.3.2 Reporting Results for PCBs in Caulk Samples

If in the screen sample Aroclor concentration as calculated above is **> 20000ppm**, the Client is contacted by a Customer Service Representative and these results are sent to the LIMS and reported to the Client.

If the sample concentration as calculated above for any Aroclor is **< 20000ppm**, the sample is sent for re-extraction by Method 3540C (Alpha SOP/1954).

11.1.3.3 Summation Rules

"TOTAL" concentrations are calculated for **ALL samples and Quality Control Samples** (i.e. LCS, MS, DUP, BLK).

TOTAL = sum of "reportable" Aroclors

Reportable- all Aroclors reported for associated project.

For dual-column analysis, Total is reported as part of column "A" data, unless all individuals are reported from "B" column. "Total" is calculated based on the associated "Report List". See Work Instruction #14335 for details.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedance and/or improper preservation are noted on the nonconformance report form.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument logbook.

All batch and sample specific QC criteria outlined in Section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written into the LIMS by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 MDL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

SOP/1728 Waste Management and Disposal SOP

16. Attachments

Table 1: STANDARD SOLUTIONS

Table 2: QC ACCEPTANCE CRITERIA

TABLE 1

STANDARD SOLUTIONS – Suggested Concentrations

STANDARD SOLUTIONS	Stock solution (ug/mL)	Level 1 (ug/mL)	Level 2 (ug/mL)	Level 3 (ug/mL)	Level 4 (ug/mL)	Level 5 (ug/mL)	Level 6 (ug/mL)	Spike Solution (ug/mL)	LCS Solution (ug/mL)
PCB									
Aroclor 1016/1260	100	0.1	0.5	1	2.5	5	10	12.5	12.5
Aroclors 1221, 1232, 1242, 1254, 1262, 1268	100	0.1	0.5	1	2.5	5	10		
LVI		0.01	0.05	0.1	0.25	0.5	1	2.5	2.5
Internal Standard									
1-Bromo-2-Nitrobenzene	5000	0.25	0.25	0.25	0.25	0.25	0.25		
LVI		0.025	0.025	0.025	0.025	0.025	0.025		
Surrogates:									
Tetrachloro-m-xylene	2.0	0.0064	0.032	0.064	0.16	0.32	0.64	2	2
Decachlorobiphenyl	2.0	0.0126	0.064	0.128	0.32	0.64	1.28	2	2
LVI – 10X less								0.2	0.2

LVI is spiked 10X lower

TABLE 2

QC ACCEPTANCE CRITERIA

	Aqueous, Soils	
Surrogate % Recovery	**Lower Control Limit**	**Upper Control Limit**
2,4,5,6-Tetrachloro-m-xylene	30%	150%
Decachlorobiphenyl	30%	150%

	Aqueous, Soils % Recovery		Duplicate and/or MSD	
MS/MSD and LCS	**Lower Control Limit**	**Upper Control Limit**	**Aqueous RPD**	**Soil RPD**
Aroclor 1016, 1260	40%	140%	30%	50%

Inductively Coupled Plasma - Atomic Emission Spectrometry

Reference Method No.: **Method 6010D** SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update V, July, 2014.

SM 2340B, Hardness by Calculation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WPCF, 21st Edition, 1997.

1. Scope and Application

Matrices: Digestates from all matrices.

Definitions: See Alpha Laboratories Quality Manual Appendix A

Inductively coupled plasma-atomic emission spectrometry (ICP-AES) determines trace elements, including metals, in solution. The method is applicable to all of the elements listed in Table 1. All matrices, excluding filtered groundwater samples but including ground water, aqueous samples, TCLP and EP extracts, industrial and organic wastes, soils, sludge, sediments, and other solid wastes, require digestion prior to analysis. Groundwater samples that have been prefiltered and acidified will not need acid digestion unless chemical interferences are suspected. Samples which are not digested are matrix matched with the standards. Refer to Metals Preparation SOPs for the appropriate digestion procedures.

Table 1 lists the elements for which this method is applicable. Detection limits, sensitivity, and the optimum and linear concentration ranges of the elements can vary with the wavelength, spectrometer, matrix and operating conditions. Table 1 lists the recommended analytical wavelengths for the elements in clean aqueous matrices. Table 3 lists the Reported Detection Limits. The reported detection limit data may be used to estimate instrument and method performance for other sample matrices. Elements other than those listed in Table 1 may be analyzed by this method if performance at the concentration levels of interest (see Section 9) is demonstrated.

Users of the method should state the data quality objectives prior to analysis and must document and have on file the required initial demonstration performance data described in the following sections prior to using the method for analysis.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is made by one of the following laboratory personnel before performing the modification: Area Supervisor, Metals Manager, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer.

Use of this method is restricted to spectroscopists who are knowledgeable in the correction of spectral, chemical, and physical interferences described in this method. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

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2. Summary of Method

Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods. When analyzing groundwater samples for dissolved constituents, acid digestion is not necessary if the samples are filtered and acid preserved prior to analysis.

This method describes multielemental determinations by ICP-AES using sequential or simultaneous optical systems and axial or radial viewing of the plasma. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices. Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. In one mode of analysis the position used must be as free as possible from spectral interference and must reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. The possibility of additional interferences named in Section 4.0 must also be recognized and appropriate corrections made; tests for their presence are described in Section 9.7. Alternatively, users may choose multivariate calibration methods. In this case, point selections for background correction are superfluous since whole spectral regions are processed.

This SOP includes the manual calculations for Total Hardness and Calcium Hardness, according to SM 2340B.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Refer to Table 3 for method Reporting Limits.

4. Interferences

4.1 Spectral

Spectral interferences are caused by background emission from continuous or recombination phenomena, stray light from the line emission of high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.

4.1.1 Background emission and stray light can usually be compensated for by subtracting the background emission determined by measurements adjacent to the analyte wavelength peak. Spectral scans of samples or single element solutions in the analyte regions may indicate when alternate wavelengths are desirable because of severe spectral interference. These scans will also show whether the most appropriate estimate of the background emission is provided by an interpolation from measurements on both sides of the wavelength peak or by measured emission on only one side. The locations selected for the measurement of background intensity will be determined by the complexity of the spectrum adjacent to the wavelength peak. The locations used for

routine measurement must be free of off-line spectral interference (interelement or molecular) or adequately corrected to reflect the same change in background intensity as occurs at the wavelength peak. For multivariate methods using whole spectral regions, background scans must be included in the correction algorithm. Off-line spectral interferences are handled by including spectra on interfering species in the algorithm.

4.1.2 To determine the appropriate location for off-line background correction, the user must scan the area on either side adjacent to the wavelength and record the apparent emission intensity from all other method analytes. This spectral information must be documented and kept on file. The location selected for background correction must be either free of off-line interelement spectral interference or a computer routine must be used for automatic correction on all determinations. If a wavelength other than the recommended wavelength is used, the analyst must determine and document both the overlapping and nearby spectral interference effects from all method analytes and common elements and provide for their automatic correction on all analyses. Tests to determine spectral interference must be done using analyte concentrations that will adequately describe the interference. Normally, 100 mg/L single element solutions are sufficient; however, for analytes such as iron that may be found at high concentration, a more appropriate test would be to use a concentration near the upper analytical range limit.

4.1.3 Spectral overlaps may be avoided by using an alternate wavelength or can be compensated by equations that correct for interelement contributions. Instruments that use equations for interelement correction require the interfering elements be analyzed at the same time as the element of interest. When operative and uncorrected, interferences will produce false positive determinations and be reported as analyte concentrations. More extensive information on interferant effects at various wavelengths and resolutions is available in reference wavelength tables and books. Users may apply interelement correction equations determined on their instruments with tested concentration ranges to compensate (off line or on line) for the effects of interfering elements. For multivariate methods using whole spectral regions, spectral interferences are handled by including spectra of the interfering elements in the algorithm. The interferences listed are only those that occur between method analytes. Only interferences of a direct overlap nature are listed. These overlaps were observed with a single instrument having a working resolution of 0.035 nm.

4.1.4 When using inter-element correction equations, the interference may be expressed as analyte concentration equivalents (i.e. false analyte concentrations) arising from 100 mg/L of the interference element. For example, assume that As is to be determined (at 193.696 nm) in a sample containing approximately 10 mg/L of Al. 100 mg/L of Al would yield a false signal for As equivalent to approximately 1.3 mg/L. Therefore, the presence of 10 mg/L of Al would result in a false signal for As equivalent to approximately 0.13 mg/L. The user is cautioned that each instrument may exhibit somewhat different levels of interference. The interference effects must be evaluated for each individual instrument since the intensities will vary.

Major known interferences are Fe, Al, Ca, Mg, V, Ni, Cu, and Cr. To minimize any of these interferences, every analyte is analyzed on each instrument at or near its linear range and corrected for these interferences. This is done on an annual basis, and data is kept on file.

4.1.5 Inter-element corrections will vary for the same emission line among instruments because of differences in resolution, as determined by the grating, the entrance and exit slit widths, and by the order of dispersion. Inter-element corrections will also vary depending upon the choice of background correction points. Selecting a background correction point where an interfering emission line may appear must be avoided when practical. Inter-element corrections that constitute a major portion of an emission signal may not yield accurate data. Users must not forget that some samples may contain uncommon elements that could contribute spectral interferences.

4.1.6 The interference effects must be evaluated for each individual instrument whether configured as a sequential or simultaneous instrument. For each instrument, intensities will vary not only with optical resolution but also with operating conditions (such as power, viewing height and argon flow rate). When using the recommended wavelengths, the analyst is required to determine and document for each wavelength the effect from referenced interferences as well as any other suspected interferences that may be specific to the instrument or matrix. The analyst is encouraged to utilize a computer routine for automatic correction on all analyses.

4.1.7 The primary wavelength for each analyte is based upon the instrument manufacturer's recommendations. An alternate wavelength is chosen if there is an indication of elevated background or overlap of another spectral wavelength. The wavelength for each analyte must be as free from interferences as possible.

4.1.8 If the correction routine is operating properly, the determined apparent analyte(s) concentration from analysis of each interference solution must fall within a specific concentration range around the calibration blank. The concentration range is calculated by multiplying the concentration of the interfering element by the value of the correction factor being tested and divided by 10. If after the subtraction of the calibration blank the apparent analyte concentration falls outside of this range in either a positive or negative direction, a change in the correction factor of more than 10% should be suspected. The cause of the change must be determined and corrected and the correction factor updated. The interference check solutions must be analyzed more than once to confirm a change has occurred. Adequate rinse time between solutions and before analysis of the calibration blank will assist in the confirmation.

4.1.9 When inter-element corrections are applied, their accuracy must be verified, daily, by analyzing the spectral interference check solution. The correction factor or multivariate correction matrices tested on a daily basis. All inter-element spectral correction factors or multivariate correction matrices are verified and updated when an instrumentation change, such as in the torch, nebulizer, injector, or plasma conditions occurs. The standard solution must be inspected to ensure that there is no contamination that may be perceived as a spectral interference.

4.1.10 When inter-element corrections are <u>not</u> used, verification of absence of interferences is required.

4.1.10.1 One method is to use a computer software routine for comparing the determinative data to limits, files for notifying the analyst when an interfering element is detected in the sample at a concentration that will produce either an apparent false positive concentration, (i.e., greater than) the analyte

instrument detection limit, or false negative analyte concentration, (i.e., less than the lower control limit of the calibration blank defined for a 99% confidence interval).

4.1.10.2 Another method is to analyze an Interference Check Solution(s) which contains similar concentrations of the major components of the samples (>10 mg/L) on a continuing basis to verify the absence of effects at the wavelengths selected. These data must be kept on file with the sample analysis data. If the check solution confirms an operative interference that is >20% of the analyte concentration, the analyte must be determined using (1) analytical and background correction wavelengths (or spectral regions) free of the interference, (2) by an alternative wavelength, or (3) by another documented test procedure.

4.2 Physical

Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. If physical interferences are present, they must be reduced by diluting the sample, using a peristaltic pump, use of an internal standard or by using a high solids nebulizer. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, affecting aerosol flow rate and causing instrumental drift. The problem can be controlled by wetting the argon prior to nebulization, using a tip washer, using a high solids nebulizer or diluting the sample. Also, it has been reported that better control of the argon flow rate, especially to the nebulizer, improves instrument performance: this may be accomplished with the use of mass flow controllers. The test described in Section 10.3.4.1 will help determine if a physical interference is present.

4.3 Chemical

Chemical interferences include molecular compound formation, ionization effects, and solute vaporization effects. Normally, these effects are not significant with the ICP technique, but if observed, can be minimized by careful selection of operating conditions (incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. Additionally, if filtered samples are found to have an organic or sulfur like odor they are processed by heating after the addition of the acids to matrix match. Chemical interferences are highly dependent on matrix type and the specific analyte element.

4.4 Memory

Memory interferences result when analytes in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the uptake tubing to the nebulizer and from the build-up of sample material in the plasma torch and spray chamber. The site where these effects occur is dependent on the element and can be minimized by flushing the system with a rinse blank between samples. The possibility of memory interferences must be recognized within an analytical run and suitable rinse times must be used to reduce them. The rinse times necessary for a particular element must be estimated prior to analysis. This may be achieved by aspirating a standard containing elements at a concentration ten times the usual amount or at the top of the linear dynamic range. The aspiration time for this sample must be the same as a normal sample analysis period, followed by analysis of the rinse blank at designated intervals. The length of time required to reduce analyte signals to within a factor of two of the method detection limit must be noted. Until the required rinse time is established, this method suggests a rinse period of at least 60 seconds between samples and standards. If memory interference is suspected, the sample must be reanalyzed after a rinse

period of sufficient length. Alternate rinse times may be established by the analyst based upon their DQOs.

4.5 Other Interferences

4.5.1 Users are advised that high salt concentrations can cause analyte signal suppressions and confuse interference tests. If the instrument does not display negative values, fortify the interference check solution with the elements of interest at 0.5 to 1 mg/L and measure the added standard concentration accordingly. Concentrations must be within 20% of the true spiked concentration or dilution of the samples will be necessary. In the absence of measurable analyte, overcorrection could go undetected if a negative value is reported as zero.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples are collected in plastic bottles.

6.2 Sample Preservation

If samples are for soluble metals analysis, filtration must take place prior to preservation with 1:1 HNO3 to a pH < 2. Soluble samples must be held at pH < 2 for at least 24 hours prior to digestion if not preserved at the time of filtration. Samples for total metals analysis are preserved with 1:1 HNO3 to a pH < 2. Samples must be pH <2 for at least 24 hours prior to digestion if not preserved at the time of collection.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples to be analyzed for soluble metals, that have not been filtered, must be filtered and preserved within 24 hours of sample collection.

Preserved samples have a hold time of 6 months, and are stored at ambient temperature.

7. Equipment and Supplies

7.1 Inductively coupled argon plasma emission spectrometer:

- **Thermo Scientific ICAP Duo 6500 (Trace7)**

7.1.1 Computer-controlled emission spectrometer with background correction.

7.1.2 Radio-frequency generator compliant with FCC regulations.

7.1.3 Optional mass flow controller for argon nebulizer gas supply.

7.1.4 Optional peristaltic pump.

7.1.5 Optional Autosampler.

7.1.6 Argon gas supply - high purity.

7.2 Volumetric flasks of suitable precision and accuracy.

7.3 Volumetric pipets of suitable precision and accuracy.

8. Standards and Reagents

Reagent semiconductor and/or trace grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration of the contamination is less than the MDL then the reagent is acceptable.

8.1 Hydrochloric acid (conc), HCl. Stored at room temperature in acid resistant cabinet. Expiration date if defined by vendor.

8.2 Hydrochloric acid (1:1), HCl. Add 500 mL concentrated HCl to 400 mL DI water and dilute to 1 liter in an appropriately sized beaker. Stored at room temperature in polypropylene bottle, expiration date if defined by vendor..

8.3 Nitric acid (conc), HNO_3. Stored at room temperature in acid resistant cabinet. Expiration date if defined by vendor.

8.4 Nitric acid (1:1), HNO_3. Add 500 mL concentrated HNO_3 to 400 mL DI water and dilute to 1 liter in an appropriately sized beaker. Stored at room temperature in polypropylene bottle, expiration date if defined by vendor..

8.5 Reagent Water. All references to water in the method refer to reagent water unless otherwise specified. Reagent water will be interference free. Refer to Chapter One for a definition of reagent water.

8.6 Standard stock solutions may be purchased or prepared from ultra- high purity grade chemicals or metals (99.99% pure or greater). All stock standards are ordered through ISO and American Association for Lab Accreditation vendors. All standards are in aqueous solutions and are generally at concentrations of 1000ppm and 10,000ppm.

8.7 Mixed calibration standard solutions

Prepare mixed calibration standard solutions by combining appropriate volumes of the stock solutions in volumetric flasks. Add the appropriate types and volumes of acids so that the standards are matrix matched with the sample digestates. Care must be taken when preparing the mixed standards to ensure that the elements are compatible and stable together. Transfer the mixed standard solutions to HDPE or polypropylene bottles for storage. Fresh mixed standards must be prepared, as needed, with the realization that concentration can change on aging as evidenced by failures in the ICV.

NOTE: If the addition of silver to the recommended acid combination results in an initial precipitation, add 15 mL of water and warm the flask until the solution clears. Cool and dilute to 100 mL with water. For this acid combination, the silver concentration must be limited to 2 mg/L. Silver under these conditions is stable in a tap-water matrix for 30 days. Higher concentrations of silver require additional HCl.
Additionally, sulfur standards are stand-alone single element standards and therefore are not to be combined in a mixed calibration standard solution.

8.8 Blanks

Three types of blanks are required for the analysis for samples. The calibration blank is used in establishing the analytical curve, and the method blank is used to identify possible contamination resulting from varying amounts of the acids used in the sample processing. The rinse blank is used to flush the system between all samples and standards.

8.8.1 The calibration blank is prepared by acidifying reagent water to the same concentrations of the acids found in the standards. Prepare a sufficient quantity to flush the system between standards and samples. The calibration blank will also be used for all initial (ICB) and continuing calibration blank (CCB) determinations (see Sections 10.2 and 10.4). Refer to Section 10.4.1.2 for acceptance criteria and/or corrective actions.

8.8.2 The method blank must contain all of the reagents in the same volumes as used in the processing of the samples. The method blank must be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis. Refer to Section 9.1 for acceptance criteria and/or corrective actions.

8.8.3 The rinse blank consists of HNO_3 (1% or 2%) (v/v) in reagent water. Prepare a sufficient quantity to flush the system between standards and samples.

8.9 The Initial Calibration Verification Standard (ICV) and the Continuing Calibration Verification Standard (CCV)

These ICV is prepared by the analyst by combining compatible elements from a standard source different than that of the calibration standard at a concentration at or near the mid-point of the calibration curve. The CCV is prepared from the same source as the calibration standards and must be at a concentration near the mid-point of the calibration curve.

8.10 Low Level of Quantification, (LLOQ)

The LLOQ is initially verified by the analysis of at least 7 replicate samples, spiked at the LLOQ and processed through all preparation and analysis steps of the method at or below the lowest calibration point. The mean recovery and relative standard deviation of these samples provide an initial statement of precision and accuracy at the LLOQ. In most cases the mean recovery should be +/- 35% of the true value and RSD should be < 20%. In-house limits may be calculated when sufficient data points exist. Monitoring recovery of LLOQ over time is useful for assessing precision and bias.

Ongoing LLOQ verification, at a minimum, is on a quarterly basis to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, method blanks. Optimally, the LLOQ should be less than the desired regulatory action levels based on the stated project-specific requirements.

8.11 Spectral Interference Check Solution

These solutions are prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. Analysts are advised that high salt concentrations can cause analyte signal suppressions and confuse interference tests.

Single element interference checks - At a minimum, single element SIC checks must be performed for the following elements: Aluminum 500mg/L; Boron 50mg/L, Barium, 50mg/L, Calcium 500mg/L; Copper 50mg/L; Iron 200mg/L; Magnesium 500mg/L; Manganese 50mg/L; Molybdenum 20mg/L; Sodium 1000mg/L; Nickel 20mg/L; Selenium 20mg/L; Silicon 200mg/L; Tin 20mg/L; Vanadium 20mg/L; Zinc 20mg/L The absolute value of the concentration observed for any unspiked analyte in the single element SIC checks must be less than two times the analytes' LLOQ.

The concentration of the SIC checks are suggested, but become the highest concentration allowed in a sample analysis, and cannot be higher than the highest established linear range. Samples with concentrations of elements higher than the SIC check must be diluted until the concentration is less than the SIC check solution. Note that reanalysis of a diluted sample is required even if the high concentration element is not required to be reported for the specific sample, since the function of the SIC check is to evaluate spectral interferences on other elements. The single element SIC checks are performed when the instrument is setup and periodically (at least once every 6 months) thereafter.

Mixed element interference check - The mixed element SIC solution is analyzed at least once per day, immediately after the initial calibration. The concentration measured for any target analytes must be less than +/- the LLOQ. If this criterion is not met then sample analysis may not proceed until the problem is corrected, or alternatively the LLOQ may be raised to twice the concentration observed in the SIC solution. The only exceptions are those elements that have been demonstrated to be contaminants in the SIC solutions These may be present up to the concentration documented plus the LLOQ.

Mixed element SIC solution: Aluminum, 500mg/L; Calcium, 500mg/L; Iron, 200mg/L; Magnesium, 500mg/L

8.12 Ongoing Low Level of Quantification, (LLOQ)

Ongoing LLOQ verification, at a minimum, is on a quarterly basis to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, method blanks. Optimally, the LLOQ should be less than the desired regulatory action levels based on the stated project-specific requirements.

8.13 Internal Standard

The internal standard consists of a multi-element solution; each internal standard covers a range of the spectrum (low, middle, or high wavelengths) and the elements within that range.

100 mg/L Ce

20 mg/L Cs

2.0 mg/L Lu

Note: The standard is used to monitor instrument fluctuations including but not limited to nebulization efficiency, plasma variations, environmental temperature changes, peristaltic pump pulsations, etc. Therefore, the solution used to start an analysis calibration cannot be added to or changed out during analysis without requiring subsequent full recalibration.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Employ a minimum of one method blank per sample batch to determine if contamination or any memory effects are occurring. A method blank is a volume of reagent water carried through the same preparation process as a sample.

The method blank results must be less than ½ of the LLOQ for all analytes of concern. If the results of the method blank exceed the RDL for any analyte, perform re-analysis of a new aliquot of the method blank.

If the results continue to exceed the RDL, proceed as follows:

If all of the samples for the analyte are non-detected, and the method blank is at or above the RDL, no action is required.

If one or more associated samples for that analyte have positive results at or above the RDL, those samples must be considered to be out of control, and are re-digested and reanalyzed.

9.2 Laboratory Control Sample (LCS)

Analyze one LCSW/SRM per sample batch. A LCS/SRM sample is a spiked volume of reagent water that is brought through the entire preparation and analytical process. The LCSW must have a % Recovery of ± 20% within the actual value or within vendor control limits (95% confidence limits) for the solid SRM.

If the LCSW or SRM % Recovery is outside the acceptable limits as stated in Table 2, or outside any vendor control limits, the LCS is rerun once. If upon reanalysis the LCS is still out

of control, the failed analytes are re-prepped and re-analyzed. Otherwise, a nonconformance report form is raised to document the exact problem and this form is then authorized by the QA/QC Director and/or the Laboratory Manager(s).

9.3 Initial Calibration Verification (ICV)

For all analytes and determinations, the laboratory must analyze an ICV (Section 8.9), and a calibration blank (ICB, Section 8.8.1), immediately following daily calibration. The results of the ICV are to agree within 10% of the expected value; if not, re-analyze once, if still failing terminate the analysis, correct the problem, and recalibrate the instrument.

9.4 Continuing Calibration Verification (CCV)

A calibration blank (CCB, Section 8.8.1) and a calibration verification standard (CCV, Section 8.9) must be analyzed after every tenth sample and at the end of the sample run. Analysis of the calibration verification (CCV) must verify that the instrument is within 10% of the calibration with the relative standard deviation < 5% from replicate (minimum of two) integrations.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The batch sheet is noted. If the standard fails again, instrument maintenance must be performed and the CCV/CCB standard is reanalyzed. If the standard passes, then all samples run after the last passing CCV/CCB pair must be re-analyzed.

If the standard fails after instrument maintenance, the instrument is recalibrated. A new ICV/ICB is performed, and all previous data after the last passing CCV/CCB is reanalyzed.

9.5 Matrix Spike

Analyze matrix spike samples at a frequency of one per matrix batch. The matrix spike is the same solution as used for the LCS (Table 4). A matrix spike sample is a sample brought through the entire sample preparation and analytical process.

9.5.1 The percent recovery is to be calculated as follows:

$$\% \text{ Recovery} = \frac{MS - S}{C} \times 100$$

where:

MS = Matrix Spike value
S = Sample value.
C = Concentration of the Spiking solution.

9.5.2 If the Matrix Spike falls outside of the limits as stated in Table 2, or outside any historical documentation for analytes of interest a post analytical spike is performed for the failed analytes. The same sample from which the MS/MSD aliquots were prepared should be spiked with a post digestion spike at a minimum level of 10 times and a maximum of 100 times the lower limit of quantitation. The acceptable % Recovery of the post analytical spike is 80-120%. A nonconformance is noted in the LIMS and approved in secondary peer review and/or by the Metals Manager.

9.5.3 If the Post Spike fails the dilution test should be performed**.** If the analyte concentration is sufficiently high (minimally, a factor of 25 above the lower limit of quantitation after dilution), an analysis of a 1:5 dilution should agree within ± 20% of the original determination. If not, then a chemical or physical interference effect should be suspected.

9.6 Laboratory Duplicate

A duplicate sample is analyzed once per matrix batch. This sample is brought through the entire sample preparation and analytical process.

9.6.1 The relative percent difference between duplicate determinations is to be calculated as follows:

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

where:

RPD = relative percent difference.
D_1 = first sample value.
D_2 = second sample value (replicate).

9.6.2 If the Duplicate falls outside of the limits as stated in Table 2, or outside any historical documentation and the concentrations of the failing analytes are less than 5x the RL or a matrix interference is found a nonconformance is noted in the LIMS and approved in secondary peer review and/or by the Metals Manager.

9.7 Method-specific Quality Control Samples

9.7.1 Spectra Interference Check Standard

A mixed check solution is analyzed once daily (section 8.11). One solution (SIC) has only elevated concentrations of Fe, Al, Ca, Mg to ensure no interferences occur. The concentrations of the analytes of interest must have an absolute value of the LLOQ. This solution is analyzed at the beginning of the first analytical run of the day.

The high level interferences are not evaluated for recovery. If the SIC fails take corrective action which may include re-evaluation of the inter-element correction values (IECs) after running single element SIC. The instrument calibration routine must then be performed and confirmed by the ICV/ICB pair and the SIC re-analyzed before proceeding with analysis. Otherwise, the nonconformance issue is raised to the Department Supervisor and/or the QA Department.

9.7.2 Internal Standard

The internal standards are added prior to the nebulizer and corrects for intensity differences in the instrument response between the standard's and sample's matrix. They are monitored for any variation in response during the sample analyses and used to ratio the sample response to the internal standard response of the calibration blank. The ratio is applied to compensate for instrument conditions in the plasma or nebulization caused by the matrix. The internal standard is monitored for 50-150% recovery or laboratory generated control ranges difference from the calibration blank IS response to ensure the proper functioning of the internal standard introduction system and matrix interferences. If an injection falls outside of this acceptance range the sample or QC check is rerun once to check for an introduction error.

If a sample continues to fail it's to be run on successive increasing dilutions until the internal standards associated with the elements of interest are within range. If a

QC check fails on the single rerun the analysis is stopped, the root cause investigated, corrected and the instrument re-calibrated/verified. The analysis begins again with all samples that were run after the last acceptable CCV/CCB pair.

9.7.3 LDR Check Solution: A multiple element or single element solution run at a point above the highest calibration standard under the same calibration used to quantify the associated sample data. The LDR check must be within +/-10% of the true value of each element of interest to be considered valid.

9.8 Method Sequence

- Calibration of instrument
- Initial Calibration Verification Standard
- Initial Calibration Blank
- Mixed SIC Solution
- Continuing Calibration Verification Standard
- Continuing Calibration Blank
- 10 samples
- Continuing Calibration Verification Standard
- Continuing Calibration Blank
- 10 Samples
- Continuing Calibration Verification Standard
- Continuing Calibration Blank

10. Procedure

10.1 Equipment Set-up

10.1.1 Sample Preparation

Preliminary treatment of most matrices is necessary because of the complexity and variability of sample matrices. Groundwater samples which have been prefiltered and acidified will not need acid digestion. Samples which are not digested must be matrix matched with the standards.

10.1.2 Instrument Set-Up

Set up the instrument with proper operating parameters established as detailed below. The instrument must be allowed to become thermally stable before beginning (usually requiring at least 30 minutes of operation prior to calibration).

Startup Procedures

For iCAP Duo 6500

- Turn on power to the chiller
- Click on ThermoSpec Icon; enter analyst initials in login screen
- Click on Plasma icon to start instrument
- Allow to warm up for 30 minutes
- Enter analytical workgroup number (obtained from LIMS) globally under the Instrument menu by selecting Tools, then Options, then Analyst.

- Click on the Sequence tab and enter the sequence by selecting New Autosampler Table, Add Sequence, Add # of spaces.
- Enter the sample locations and IDs
- Press Run Auto-Session button (►) in menu bar.

10.1.2.1 Specific wavelengths are listed in Table 1. Other wavelengths may be substituted if they can provide the needed sensitivity and are corrected for spectral interference. The instrument and operating conditions utilized for determination must be capable of providing data of acceptable quality to the program and data user.

Operating conditions for axial plasma will vary from 1100 – 1500 watts forward power, 15-19 Liters/min argon coolant flow, 0.5 – 0.7 L/min argon nebulizer flow, 140 – 200 rpm pump rate and a default 1 minute preflush time and 10 second measurement time is recommended for all simultaneous instruments.

10.1.2.2 The plasma operating conditions need to be optimized prior to use of the instrument. This routine is not required on a daily basis, but only when first setting up a new instrument or following a change in operating conditions. The following procedure is recommended or follow manufacturer's recommendations. The purpose of plasma optimization is to provide a maximum signal to background ratio for some of the least sensitive elements in the analytical array. The use of a mass flow controller to regulate the nebulizer gas flow or source optimization software greatly facilitates the procedure.

10.1.2.2.1 The Thermo ICP's typically use a Meinhard Nebulizer. The nebulizer flow for each instrument is 1.0 +/- 0.2 mL/min.

10.1.2.2.2 The 6500 Duo instruments automatically perform a wavelength check at start up without user interaction.

10.1.2.2.3 The instrument operating condition finally selected as being optimum must provide the lowest reliable instrument detection limits and method detection limits.

10.1.2.2.4 If either the instrument operating conditions, such as incident power or nebulizer gas flow rate are changed, or a new torch injector tube with a different orifice internal diameter is installed, the plasma and argon pressures must be reoptimized.

10.1.2.2.5 After completing the initial optimization of operating conditions, but before analyzing samples, the laboratory must establish and initially verify an interelement spectral interference correction routine to be used during sample analysis. A general description concerning spectral interference and the analytical requirements for background correction in particular are discussed in the section on interferences. Criteria for determining an interelement spectral interference is an apparent positive or negative concentration for the analyte that falls within ± ½ LLOQ. The upper control limit is the analyte instrument detection limit. Once established, the entire routine is periodically verified every six months. In between that time, IEC's are done on a need be basis per analyte. Only a portion of the

correction routine must be verified more frequently or on a daily basis. Initial and periodic verification of the routine must be kept on file. Special cases where continual verification is required are described elsewhere.

10.1.2.3 Sensitivity, instrumental detection limit, precision, linear dynamic range, and interference effects must be established for each individual analyte line on each particular instrument. All measurements must be within the instrument linear range where the correction equations are valid.

10.1.2.3.1 Method detection limits must be established for all wavelengths utilized for each type of matrix commonly analyzed. The matrix used for the MDL calculation must contain analytes of known concentrations within 3-5 times the anticipated detection limit.

10.1.2.3.2 Determination of limits using reagent water MDLs represent a best case situation and do not represent possible matrix effects of real world samples.

10.1.2.3.3 If additional confirmation is desired, reanalyze the seven replicate aliquots on two more non-consecutive days and again calculate the method detection limit values for each day. An average of the three values for each analyte may provide for a more appropriate estimate.

10.1.2.3.4 The upper limit of the linear dynamic range must be established for each wavelength utilized by determining the signal responses with 10% of the true value of each element from a concentration standard at the upper limit of the range run on the same calibration as required by the sample responses above the calibration range. The range which may be used for the analysis of samples must be no more than 90% of the resulting data. Determined analyte concentrations that are above the upper range limit must be diluted and reanalyzed. The analyst must also be aware that if an inter-element correction from an analyte above the linear range exists, a second analyte where the inter-element correction has been applied may be inaccurately reported.

NOTE: Many of the alkali and alkaline earth metals have non-linear response curves due to ionization and self-absorption effects. These curves may be used if the instrument allows; however the effective range must be checked and the second order curve fit must have a correlation coefficient of 0.995 or better. Third order fits are not acceptable. These curves are much more sensitive to changes in operating conditions than the linear lines and must be checked whenever there have been moderate equipment changes.

10.1.2.4 The analyst must (1) verify that the instrument configuration and operating conditions satisfy the analytical requirements and (2) maintain quality control data confirming instrument performance and analytical results.

10.2 Initial Calibration

Calibrate the instrument according to the instrument manufacturer's recommended procedures, using the typical mixed calibration standard solutions described in Section 8.7. Flush the system with the calibration blank (Section 8.8.1) between each standard or as the manufacturer

recommends. (Use the average intensity of multiple exposures for both standardization and sample analysis to reduce random error.) The calibration curve consists of a calibration blank, RL standard and a high level standard. Calibration curve verification is accomplished through the analysis of the ICV, ICB and SIC standards.

10.3 Equipment Operation and Sample Processing

10.3.1 For all analytes and determinations, the laboratory must analyze an ICV (Section 8.9), and a calibration blank (ICB, Section 8.8.1), immediately following daily calibration.

A calibration blank (CCB, Section 8.8.1) and a calibration verification standard (CCV, Section 8.9) must be analyzed after every tenth sample and at the end of the sample run. Analysis of the calibration verification (CCV) must verify that the instrument is within 10% of the calibration with the relative standard deviation < 5% from replicate (minimum of three) integrations.

If the calibration cannot be verified within the specified limits, the sample analysis must be discontinued, the cause determined and the instrument recalibrated. All samples following the last acceptable ICV/ICB, or CCV/CCB must be reanalyzed. The analysis data for the calibration blank, check standard, and ICV or CCV must be kept on file with the sample analysis data.

10.3.2 Rinse the system with the rinse blank solution (Section 8.8.3) before the analysis of each sample. The suggested default rinse time is one minute. Each ICP instrument may establish a reduction in this rinse time through a suitable demonstration.

10.3.3 Dilute and reanalyze samples that exceed the linear range or use a calibrated alternate, less sensitive line for which quality control data is already established.

10.3.4 If less than acceptable accuracy and precision data are generated a series of tests are performed prior to reporting concentration data for analyte elements. At a minimum, these tests should be performed with each batch of samples prepared/analyzed with corresponding unacceptable data quality results. These tests, as outlined in Sections 10.3.5 and 10.3.6, will ensure that neither positive nor negative interferences are operating on any of the analyte elements to distort the accuracy of the reported values.

10.3.5 **Post Digestion Spike Addition:** If the sample concentrations are insufficient to perform a dilution test a post digestion spike added to a portion of a prepared sample, or its dilution for the elements failing the matrix spike recoveries must be run, recovery limits equal to 75% to 125% of the known spike value. If the spike is not recovered within the specified limits If the post-digestion recovery fails to meet the acceptance criteria, the sample results must be reported as estimated values

10.3.6 **Dilution Test:** If the analyte concentration is sufficiently high (minimally, a factor of 25 above the lower limit of quantitation after dilution), an analysis of a 1:5 dilution must agree within ± 20% of the original determination. Elements that fail the dilution test are reported as estimated values.

10.3.7 **CAUTION:** If spectral overlap is suspected, use of computerized compensation, an alternate wavelength, or comparison with an alternate method is recommended.

10.4 Continuing Calibration

10.4.1 Check calibration with an ICV following the initial calibration (Section 8.9). Verify calibration with the Continuing Calibration Verification (CCV) Standard (Section 8.9) at the end of the initial calibration sequence (ICV, ICB), after every ten samples, and at the

end of an analytical run. Use a calibration blank (Section 8.8.1) immediately following daily calibration, after every 10 samples and at the end of the analytical run.

10.4.1.1 The results of the ICV are to agree within 10% of the expected value, and CCVs are to agree within 10% of the expected value; if not, terminate the analysis, correct the problem, and recalibrate the instrument. Each may be rerun once to confirm or cure the initial failure.

10.4.1.2 The results of the calibration blank should be below ½ of LLOQ or RL (whichever is lower). If not, repeat the analysis and if the failure is repeated terminate the analysis, correct the problem, recalibrate, and reanalyze the previous 10 samples. If the blank is less than 1/10 the concentration of the action level of interest, and no sample is within ten percent of the action limit, analyses need not be rerun and recalibration need not be performed before continuation of the run.

10.4.2 Verify the inter-element and background correction factors at the beginning of each analytical run. Do this by analyzing the SIC (Section 8.10). Results must be less than +/- LLOQ for all non-spiked elements.

10.4.3 When low-level sensitivity is required, a check standard at the requested limit of quantitation is analyzed to confirm the reported detection limit (RDL). This is performed on a project-by-project basis.

10.5 Preventive Maintenance

Whenever instrument maintenance is performed, it is noted in the instrument's Maintenance Logbook.

10.5.1 Daily

Inspect the nebulizer pump tubing from the Autosampler to the Nebulizer. Replace if necessary.

10.5.2 Monthly or as needed

Remove the torch, "shot glass", nebulizer and spray chamber. Clean each with 10% Nitric Acid and rinse with tap water. Coat the inside of the spray chamber and shot glass with concentrated Sulfuric Acid and soak for one hour, then rinse well with DI water. Soak the torch and nebulizer in aqua regia overnight, then rinse with DI water.

10.5.3 Every 6 months

Preventive Maintenance is performed by the Vendor or in-house personnel as follows:

- check the cooling system
- flush/refill the chiller with distilled water and antibacterial conditioner
- clean the instrument to regain intensity
- clean/replace air filters.

11. Data Evaluation, Calculations and Reporting

11.1 If dilutions were performed, the appropriate factors must be applied to sample values. All results must be reported with up to three significant figures.

11.2 Soil samples

Soil samples are calculated as follows:

$$\mathbf{A} = \frac{\text{Sample weight (grams)}}{\text{Final Volume (mL)}}$$

$$\mathbf{B}\ (\text{concentration in mg/Kg}) = \frac{\text{Concentration of analyte (mg/L)}}{\mathbf{A}}$$

11.2.1 Dry weight correction

The LIMS calculates the dry weight correction, however it is calculated as follows:

$$\text{Final concentration in mg/Kg dry weight} = \frac{\mathbf{B}}{\%\ \text{Solids}}$$

11.3 Liquid samples

Liquid samples are calculated as follows:

$$\text{Dilution Factor} = \frac{\text{Final Volume (mL)}}{\text{Sample Volume (mL)}}$$

$$\text{Final concentration in mg/L} = \text{Concentration of analyte (mg/L)} \times \text{Dilution Factor}$$

11.4 Calculations for Hardness

The method for determining hardness is to compute it from the results of separate determinations of Calcium and Magnesium on aqueous samples.

11.4.1 Total Hardness

Total Hardness, mg equivalent $CaCO_3$/L = [2.497 (Ca, mg/L)] + [4.118 (Mg, mg/L)]

11.4.2 Calcium Hardness

Calcium Hardness, mg equivalent $CaCO_3$/L = [2.497 (Ca, mg/L)]

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Also refer to Section 9 for Quality Control and acceptance criteria.

If the SIC is outside of the recovery window, then the standard is reanalyzed. If the standard failure continues, the IECs for the element/elements in question are reviewed and recalculated if necessary.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The raw data is noted. If the standard fails again, the problem must be found and corrected and the instrument is recalibrated. The ICV/ICB standard is reanalyzed and all previous data that had failed back to the previous passing CCV/CCB is reanalyzed.

The reanalysis procedure outline above is also conducted for a failing LCS or Method Blank; they may be rerun alone on the new or any subsequent passing bracket. The LCS or Method Blank do not qualify a bracket of samples but the batch run itself.

If the Matrix Spike does not meet acceptance criteria, a dilution test is performed. If the levels of the native sample is inadequate (see section 10.3.6) The RPD must be within 20% of the true value of the native sample. If the dilution test fails or the concentrations in the native sample are inadequate, the post spike is analyzed and evaluated (section 10.3.5). If these criteria are met, then the Matrix Spike data is reported, with the post spike narrated on the final report. If the post spike fails the data is reported as estimated.

If sample Duplicates are outside of the acceptance criteria, the analyst examines the sample for homogeneity. If the sample is not homogenous, this is narrated on the final report. Clean, homogenous samples are reanalyzed and if still outside of the acceptance limits, redigested and reanalyzed.

Sample nonconformance regarding a Matrix Spike recovery or a duplicate %RSD is narrated on the final report along with the corrective action(s) taken.

The mixed element SIC solution is analyzed at least once per day, immediately after the initial calibration. The concentration measured for any target analytes must be less than +/- the LLOQ. If this criterion is not met then sample analysis may not proceed until the problem is corrected, instrument is recalibrated, verified with the ICV/ICB and the SIC is then re-analyzed. Alternatively, the LLOQ may be raised to twice the concentration observed in the SIC solution if approved by the Department Manger or QA Department and the level is below the regulatory action limit or project specific requirements. The only exceptions are those elements that have been demonstrated to be contaminants in the SIC solutions These may be present up to the concentration documented plus the LLOQ. If failure continues notify the Department Supervisor or Manager.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05 unless supersede within this SOP. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP #1732 MDL/LOD/LOQ Generation

SOP# 1739 IDC/DOC Generation

SOP# 1728 Waste Management and Disposal

16. Attachments

TABLE 1: Element Wavelengths

TABLE 2: Precision and Accuracy Acceptance Criteria

TABLE 3: Reporting Limits

TABLE 1
ELEMENT WAVELENGTHS

Element	6500 Duo wavelength (nm)
Pb	220.3
Se	196.0
Sb	206.8
As	189.0
Ba	455.4
Be	313.0
Cd	214.4
Co	228.6
Cu	324.7
Cr	267.7
Fe	259.9
Mn	257.6
Mo	202.0
Ni	231.6
Ag	328.0
Tl	190.8
V	292.4
Zn	206.2
Al	396.1
Ca	315.8
Mg	279.0
B	208.9
Si	212.9
Sn	189.9
Sr	421.5
Ti	334.9
Bi	223.0
Na	589.5
K	766.4
S	180.7

TABLE 2
PRECISION AND ACCURACY ACCEPTANCE CRITERIA

	% Recovery LCS		Aqueous % Recovery MS		Soil % Recovery SRM *		Duplicate	
Element	**Lower Control Limit**	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**	**Aqueous %RPD**	**Soil %RPD**
Aluminum	80	120	75	125	29	171	20	20
Antimony	80	120	75	125	4	196	20	20
Arsenic	80	120	75	125	81	119	20	20
Barium	80	120	75	125	83	118	20	20
Beryllium	80	120	75	125	83	117	20	20
Boron	80	120	75	125	70	129	20	20
Cadmium	80	120	75	125	82	117	20	20
Calcium	80	120	75	125	83	117	20	20
Chromium	80	120	75	125	80	119	20	20
Cobalt	80	120	75	125	83	117	20	20
Copper	80	120	75	125	83	117	20	20
Iron	80	120	75	125	51	150	20	20
Lead	80	120	75	125	80	120	20	20
Magnesium	80	120	75	125	74	126	20	20
Manganese	80	120	75	125	83	117	20	20
Molybdenum	80	120	75	125	81	119	20	20
Nickel	80	120	75	125	82	117	20	20
Potassium	80	120	75	125	74	126	20	20
Sulfur	80	120	75	125	NA	NA	20	20
Selenium	80	120	75	125	80	120	20	20
Silica (SiO_2)	80	120	75	125	NA	NA	20	20
Silver	80	120	75	125	66	134	20	20
Sodium	80	120	75	125	74	127	20	20
Strontium	80	120	75	125	80	120	20	20
Thallium	80	120	75	125	79	120	20	20
Tin	80	120	75	125	69	131	20	20
Titanium	80	120	75	125	82	118	20	20
Vanadium	80	120	75	125	79	121	20	20
Zinc	80	120	75	125	82	119	20	20

** Ranges of the SRM are presented as an example of a typical SRM; actual limits may vary by lot provided by the vendor.

TABLE 3
REPORTING LIMITS

Element	Aqueous (mg/L)	Soil (mg/Kg)
ALUMINUM	0.10	4.0
ANTIMONY	0.05	2.0
ARSENIC	0.005	0.40
BARIUM	0.01	0.40
BERYLLIUM	0.005	0.20
BORON	0.03	1.2
CADMIUM	0.005	0.40
CALCIUM	0.10	4.0
CHROMIUM	0.01	0.40
COBALT	0.02	0.80
COPPER	0.01	0.40
IRON	0.05	2.0
LEAD	0.01	2.0
MAGNESIUM	0.10	4.0
MANGANESE	0.01	0.40
MOLYBDENUM	0.05	2.0
NICKEL	0.025	1.0
POTASSIUM	2.5	100
SULFUR	0.25	10
SELENIUM	0.01	0.80
SILICA	0.50	20
SILVER	0.007	0.40
SODIUM	2.0	80
STRONTIUM	0.01	2.0
THALLIUM	0.02	0.80
TIN	0.05	4.0
TITANIUM	0.01	0.40
VANADIUM	0.01	0.40
ZINC	0.05	2.0

TABLE 4
LCS and Matrix Spike

Analyte	Liquid Concentration (mg/L)	Soil Concentration * (MS spike only) (mg/Kg)
Antimony	0.5	160
Arsenic	0.12	160
Barium	2.00	160
Beryllium	0.05	80
Cadmium	0.051	80
Chromium	0.20	160
Copper	0.25	160
Lead	0.51	160
Nickel	0.50	160
Selenium	0.12	160
Silver	0.05	40
Thallium	0.12	160
Zinc	0.50	160
Iron	1.00	800
Manganese	0.50	160
Calcium	10.0	800
Magnesium	10.0	800
Potassium	10.0	800
Sodium	10.0	800
Silica	1.0	800
Aluminum	2.00	800
Cobalt	0.50	160
Vanadium	0.50	160
Boron	1.0	NA
Molybdenum	1.0	NA
Titanium	1.0	NA

*MS spike of a solid based on 1.25g and a final volume of 50 mL.

Note: Solids LCS is an SRM with certified value provided by the vendor on a lot basis.

Mercury in Liquid Waste

(Automated Cold-Vapor Technique)

Reference Method No.: **EPA 7470A**

Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update II, September 1994.

1. Scope and Application

Matrices: Method 7470 is a cold-vapor atomic absorption procedure approved for determining the concentration of mercury in mobility-procedure extracts, aqueous wastes, and ground waters. (Method 7470 can also be used for analyzing certain solid and sludge-type wastes; however, Method 7471 is usually the method of choice for these waste types.) All samples must be subjected to an appropriate dissolution step prior to analysis.

Definitions: See Alpha Laboratories Quality Manual Appendix A.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Mercury Analyzer and in the interpretation of Mercury data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

Prior to analysis, the liquid samples must be prepared according to the procedure discussed in this method.

Method 7470, a cold-vapor atomic absorption technique, is based on the absorption of radiation at 253.7-nm by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

2.1 Method Modifications from Reference

2.1.1 A smaller sample sized is prepared, and therefore proportionately less reagent volumes are used.

2.1.2 The original method does not address the automated instrument procedure.

3. Reporting Limits

The typical reporting limit for Mercury is 0.0002mg/L. This satisfies Massachusetts, GW1 and GW 2 criteria. Connecticut mobility criteria for SPLP is 0.0004mg/L, Rhode Island is 0.002mg/L, and the Drinking Water reporting limit is 0.0002mg/L.

4. Interferences

Potassium permanganate is added to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide as sodium sulfide do not interfere with the recovery of added inorganic mercury from reagent water.

Copper has also been reported to interfere; however, copper concentrations as high as 10 mg/L had no effect on recovery of mercury from spiked samples.

Seawaters, brines, and industrial effluents high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253.7 nm. Care must therefore be taken to ensure that free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine sulfate reagent (25 mL). Both inorganic and organic mercury spikes have been quantitatively recovered from seawater by using this technique.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

Mercury compounds are highly toxic if swallowed, inhaled, or absorbed through the skin. Analysis is conducted under a laboratory exhaust hood. The analyst must wear chemical resistant gloves when handling concentrated mercury standards.

The acidification of samples containing reactive materials may result in the release of toxic gases, such as cyanides or sulfides. Therefore, the acidification of samples is to be conducted under a laboratory exhaust hood.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples are collected in either glass or plastic containers.

6.2 Sample Preservation

Samples are preserved with HNO_3 to a pH of <2.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples are stored under refrigeration at 4 ± 2°C and analyzed as soon as possible after collection. The samples have a 28-day holding time from the time of collection.

7. Equipment and Supplies

Instrumentation:

Perkin Elmer FIMS 100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. The PE FIMS is designed specifically for the measurement of mercury using the cold-vapor technique with BOC (background offset correction) performed by a survey scan prior to each sample introduction. PE S10 autosampler is coupled to the instrument.

Cetac M-6100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. This instrument employs a reference cell off-set correction and full automation through the CETAC software. A Cetac ASX-260 autosampler is coupled to the instrument.

Nippon Instrument model# RA-4300A analyzer with integrated 80 position autosampler:

The instrument adds a stannous chloride (II) solution to the sample post digestion, the divalent mercury ion (Hg2+) is reduced to zero-valent metallic mercury and turns into mercury gas by bubbling. Hg2++SnCl2 → Hg0 ↑
After removing the acid mist and water vapor generated by bubbling with an electronic cooling unit, the instrument measures the absorbance of mercury at 253.7 nm absorption wavelength. It measures the known mercury amount, creates a calibration curve, and then calculates the mercury amount from the absorbance.

7.1 Graduated cylinder: Rinse once with 50% HNO_3 and then rinse with reagent water prior to use.

7.2 Volumetric Flasks, Class A, various volumes: Rinse once with 50% HNO_3 and then rinse with reagent water prior to use.

7.3 Heating Block: Environmental Express HotBlock, 48 position capacity, able to maintain 95˚C +/-3.

7.4 50 mL Digestion Tubes: Polypropylene, graduated.

7.5 50 mL Digestion Tube Rack: 48 position, racklock

7.6 Pump tubing: Environmental Express, three stop and two in various IDs.

7.7 PTFE membranes: Whatman TE37 disks.

7.8 Dilution vials: 20mL capacity, used to prepare analytical dilutions.

7.9 Low Dust Laboratory Wipes

7.10 Compressed Air

7.11 Whatman 41 filter paper or equivalent

8. Reagents and Standards

8.1 Reagent Water: Reagent water is DI water shown to be interference free. All references to water in this method will refer to reagent water unless otherwise specified.

8.2 Sulfuric acid (H_2SO_4), concentrated: Reagent grade. Store at room temperature in an appropriately designated acid cabinet.

8.3 Hydrochloric acid, concentrated: Trace Metal grade. Store at room temperature in an appropriately designated acid cabinet.

8.4 Carrier, Hydrochloric Acid, 3%: This is the ***carrier*** for the Instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl (Section 8.3). Bring to volume with reagent water. Store at room temperature, prepare daily as needed.

8.5 Reductant, Stannous Chloride in 3% HCl: This is the ***reductant*** for the Instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl and 11g $SnCl_2 \cdot 2H_20$. Mix to dissolve the solid and bring to volume with reagent water. Store at room temperature, prepare daily as needed.

8.6 Nitric acid (HNO_3), concentrated: Trace metal grade of low mercury content. If a high reagent blank is obtained, it may be necessary to distill the nitric acid. Store at room temperature in an appropriately designated acid cabinet.

8.7 Sodium chloride-hydroxylamine hydrochloride solution: Dissolve 12 g of sodium chloride and 12 g of hydroxylamine hydrochloride in reagent water and dilute to 100mL. Store at room temperature. Expires one month from date of preparation.

8.8 Potassium permanganate, mercury-free, 5% solution (w/v): Dissolve 5 g of potassium permanganate in 100 mL of reagent water. Store at room temperature. Expires one month from date of preparation.

8.9 Potassium persulfate, 5% solution (w/v): Dissolve 5 g of potassium persulfate in 100 mL of reagent water. Store at room temperature. Expires one month from date of preparation.

8.10 Mercury Stock Standard, 1000ppm: Purchased from a commercial source with a certificate of analysis. Purchase three different sources. Store at room temperature. Expires upon manufacturer's specification.

8.11 Mercury Stock Calibration Standard, 10ppm: To a 100mL volumetric flask, add 5mL of concentrated HNO_3, 2.5mL of concentrated H_2SO_4 and 1000ppm Mercury Stock Standard (Section 8.10, use one source). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.12 Mercury Working Calibration Standard / Matrix Spike Solution, 0.1ppm: To a 100mL volumetric flask, add 5mL of concentrated HNO_3, 2.5mL of concentrated H_2SO_4 and 1mL of 10ppm Mercury Stock Standard (Section 8.11). Bring to volume with reagent water. Store at room temperature. Make fresh daily.

8.13 Mercury Calibration Standards: All calibration standards are prepared daily.

8.13.1 0 ppm Calibration Standard: Add 10 mL of reagent water to a polypropylene digestion vessel. This aliquot may be used for the CCB. Another separate aliquot is prepared in the same manner for use as the ICB and diluent for sample dilutions.

8.13.2 **0.0002ppm Calibration Standard:** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 0.05 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.13.3 **0.001ppm Calibration Standard:** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 0.25 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.13.4 **0.002ppm Calibration Standard** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 0.5 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.13.5 **0.005ppm Calibration Standard/Continuing Calibration Verification Standard:** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 1.25 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.13.6 **0.010ppm Calibration Standard / Post Analytical Spike Solution:** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 2.5 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.13.7 **0.020ppm Calibration Standard / Post Analytical Spike Solution:** Add 10 mL of reagent water to a polypropylene digestion vessel. Pipet 5.0 mL of 0.1ppm Mercury Working Stock (Section 8.12) to the digestion vessel. Bring to a final volume of 25 mL.

8.14 Mercury Stock LCS Standard, 10ppm: To a 100mL volumetric flask add 25mL of reagent water and 5mL of concentrated HNO_3 (Section 8.6). Add 1mL of 1000ppm Mercury Stock Standard (Section 8.10). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.15 Mercury Working LCS Standard, 0.1ppm: To a 100mL volumetric flask add 25mL of reagent water and 5mL concentrated HNO_3 (Section 8.6). Add 1mL of 10ppm Stock LCS Standard (Section 8.14). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.16 Mercury LCS Standard, 0.001ppm: Prepare daily with each batch of samples. To a 50mL digestion vessel add 10mL of reagent water Add 0.25 mL of 0.1ppm Working LCS Standard (Section 8.15). Bring to a final volume of 25mL and carry through entire digestion process as in Section 10.1.1.

8.17 Mercury Stock ICV Standard, 10ppm: To a 100mL volumetric flask add 25mL of reagent water and 5mL of concentrated HNO_3 (Section 8.6). Add 1mL of 1000ppm Mercury Stock Standard (Section 8.10-use alternate source than that used for both the calibration standards and the LCS Stock Standard). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.18 Mercury Working ICV Standard, 0.3ppm: To a 100mL volumetric flask add 25mL of reagent water and 5mL of concentrated HNO_3 (Section 8.6). Add 3mL of 10ppm Stock ICV Standard (Section 8.5). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.19 Mercury ICV Standard, 0.003ppm: Prepare daily with each batch of samples. To a 25mL digestion vessel add 10mL of reagent water. Add 0.25mL of 0.3ppm Working ICV Standard (Section 8.18). Bring to a 25mL final volume with reagent water and carry through entire digestion process as in Section 10.1.1..

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

The ICB, CCB, and Method Blank: A 25mL aliquot of 0ppm calibration standard brought through the preparation procedure as outlined in Section 10.1.1 . Blank results must be <RL. See Section 12.1 for corrective action. An ICB is analyzed after the initial calibration or re-calibration. The CCB is analyzed at every 10 sample injection interval. Method Blank is analyzed once per batch of samples; batch consists of 20 samples.

9.2 Laboratory Control Samples (LCS)

The LCS Standard consists of a 0.001ppm Mercury LCS Standard (Section 8.16). This standard is brought through the preparation procedure as outlined in Section 10.1.1. The LCS Standard must be recovered within ± 20% of the true value. See Section 12.3 for corrective action. The LCS Standard is analyzed once per batch of samples. A batch consists of 20 samples.

9.3 Initial Calibration verification (ICV)

The ICV Standard consists of a 25mL aliquot of 0.003ppm Mercury ICV Standard (Section 8.19). The ICV must be recovered within 10% of the true value. See Section 12.2 for corrective action.

9.4 Continuing Calibration Verification (CCV)

The CCV Standard consists of a 0.010ppm calibration standard (Section 8.13.3). The CCV must be recovered within 20% of the true value. See Section 12.2 for corrective action.

9.5 Matrix Spike

A matrix spike is analyzed once per batch of samples. A batch consists of 20 samples for monitoring wells, surface waters, influents and effluents. Prepare the matrix spike at 0.005ppm by adding 1.25mL of 0.1ppm Mercury Stock Standard (Section 8.3) to 25mL of the selected QC sample. The final concentration of the matrix spike is 0.005mg/L.

The matrix spike sample is brought through the preparation procedure as outlined in Section 10.1. A matrix spike is analyzed once per batch of samples. A batch consists of 20 samples for monitoring wells and surface waters. The recovery of the matrix spike must be between 75 – 125% (using the calculation in Section 11.2).

If the recovery of the matrix spike is out of range, a post-analytical spike is analyzed. Prepare the post analytical spike by adding 5mL of 0.010ppm Calibration Standard / Post Analytical Spike Solution (Section 8.1.6) and 5mL of the sample digestate to a 50mL centrifuge tube for a final concentration of 0.005mg/L. Analyze the post spike as outlined in Section 10.3.5.

Calculate the post spike concentration as follows:

Post Analytical Spike Sample Concentration (mg/L) =

[Sample Concentration (mg/L) x (0.5)] + 0.005mg/L

The percent recovery of the post-analytical spike must be between 75 – 125%. See Section 12.4 for corrective action.

9.6 Laboratory Duplicate

A sample is analyzed in duplicate once per batch of samples. A batch consists of 20 samples for monitoring wells and surface waters. The RPD between the sample and its duplicate must be 20% or less (using the calculation in Section 11.3), See Section 12.5 for corrective action.

9.7 Method-specific Quality Control Samples

Not applicable.

9.8 Method Sequence

- Calibration Blank
- 0.0002 ppm Calibration Standard
- 0.0005 ppm Calibration Standard
- 0.001 ppm Calibration Standard
- 0.002 ppm Calibration Standard
- 0.010 ppm Calibration Standard
- 0.020 ppm Calibration Standard
- ICV
- ICB
- Ten analytical samples
- CCV
- CCB
- Ten analytical samples
- CCV
- CCB
- Etc.

10. Procedure

10.1 Equipment Set-up

10.1.1 Preparation and Digestion

Samples, Standards and All Batch QC

Transfer 25mL of well-homogenized sample (or an aliquot of the sample diluted to 25mL with reagent water) or standards (Sections 8.13.1 through 8.13.7, 8.16 and 8.19) to a 50mL centrifuge tube.

Add 1.25mL of concentrated H_2SO_4 (Section 8.2), 0.625mL of concentrated HNO_3 (Section 8.6), Add 3.75mL of Potassium Permanganate Solution, shake and add additional portions of potassium permanganate solution (if necessary) to all samples and QC, until the purple color persists for at least 15 min. (Section 8.8). Add 2mL of Potassium Persulfate Solution (Section 8.9), and heat samples for 2 hours in a 95°C +/-3

heating block. Cool, and add 1.5mL of Sodium Chloride-Hydroxylamine hydrochloride solution (Section 8.7).
Filter the sample if needed to remove any sediment or particulate.

Analyze samples and the digested calibration standards (Sections 8.13.1 through 8.13.7) are used in Section 9.2 to generate a calibration curve.

10.2 Initial Calibration

Construct a calibration curve by plotting the absorbances of prepared standards (Section 10.1.1) versus micrograms of mercury. Determine the peak height of the unknown from the absorbance maxima on the spectrometer, and read the mercury value from the standard curve. (See Section 11.)

The curve correlation coefficient (cc) must be greater than or equal to 0.995 in order for the curve to be linear. If the correlation coefficient is less than 0.995, find and correct the problem. When the problem has been corrected, re-analyze either the previous standards or new standards. When the curve has generated an acceptable cc then the analysis can continue with the ICV/ICB.

10.3 Equipment Operation and Sample Processing

Sample and standard analysis:

10.3.1 Instrument Setup

10.3.1.1 Turn the instrument on. The autosampler will initialize itself.

10.3.1.2 Choose the instrument software from the desktop menu. The autosampler will initialize again.

FIMS 100 NOTE: The instrument must be turned on before the application is started. Otherwise, an error message will result.

10.3.1.3 Enter the appropriate fields for sample identification, and data storage.

10.3.1.4 Fill the carrier and reductant bottles.

10.3.1.4.1 The Carrier is 3% HCl (Section 8.6).

10.3.1.4.2 The Reductant is 1.1% $SnCl_2$ in 3% HCl (Section 8.5).

10.3.1.5 Allow the instrument to warm up while clearing samples. Samples that are cloudy or with particulate present after clearing must be filtered through Whatman 41 filter paper (Section 7.11) before analysis.

10.3.1.6 Place carrier uptake line and reductant uptake line.

10.3.1.7 Load carrier and reductant lines into pump magazines

10.3.1.8 Load the two waste lines into the pump magazines below the roller.

10.3.1.9 Lock the magazines into place.

FIMS100 only:

10.3.1.10 Remove the cap from the liquid/vapor separator and wipe dry with a Lab Wipe (Section 7.9). Compressed air (Section 7.10) through the vapor transfer line to dry it out.

10.3.1.11 Place a PTFE membrane (Section 7.7), rough side up, in the liquid/vapor separator; replace the cap and reattach the vapor transfer line to the sample absorption cell.

10.3.1.12 Adjust the gas flow by turning the black knob below the air flow meter to obtain a reading of just over 50.

10.3.2 Calibration and Sample Analysis

10.3.2.1 The instrument will now run the calibration standards; verify a CC of 0.995 or better before proceeding with the ICV and ICB. Ten analytical samples, a CCV and CCB, ten analytical samples, CCV, CCB, etc. The CCBs and CCVs must be recovered within the proper ranges (Sections 9.4 and 9.1.3) for analysis to continue.

10.3.2.2 If the sample result is beyond 90% of the concentration of the highest point on the calibration curve or LDR study used to establish the linear range, dilute the sample extract with a portion of one of the prepared blanks (ICB, CCB or PBS) to produce an analytical result that is within the range.

10.3.3 Instrument Shut Down

10.3.3.1 When analysis is complete place reagent uptake lines in a beaker of reagent water.

10.3.3.1.1 Continue to run the pumps for several minutes to flush reagents out of the lines.

10.3.3.1.2 Continue to run the pumps for several minutes to flush reagents out of the lines.

10.3.3.2 Pull the reagent uptake lines out of the reagent water beaker to allow the pump to draw air through the lines.

10.3.3.3 Unlock the top and bottom pump magazines and remove tubing from the magazines.

10.3.3.4 Exit from the software application.

10.3.3.4.1 Dump the samples and instrument waste in the Metals/WetChem waste drum located in the transfer room.

10.4 Continuing Calibration

Continuing calibration verification samples are analyzed after every 10 samples in the sample run, as outlined in Section 10.3.5.

10.5 Preventative Maintenance

Preventative maintenance is conducted per the manufacturer's instructions. All preventative maintenance is recorded in the Instrument Maintenance Logbook.

11. Data Evaluation, Calculations and Reporting

11.1 Calculate Mercury concentration

Calculate Mercury concentration from the daily calibration curve. The curve is generated utilizing a straight-line equation defined as:

$$A = k_1 + k_2C$$

Where:

A = Average peak height of the sample/standard integrations
C = Sample/Standard Concentration, µg/L
k_1 = y-intercept
k2 = slope

The instrument will plot peak height against concentration (µg/L). The result is generated in µg/L . This value is divided by 1000 to convert the units to mg/L. If the sample is diluted (DF), the result is multiplied by the DF to generate the final result.

Result, mg/L = (concentration, µg/L) x (1mg/1000µg) x (DF)

11.2 Matrix Spike Calculation

Calculate percent recovery for the Matrix Spike corrected for concentrations measured in the unfortified sample. Percent recovery is calculated using the following equation:

$$\% \text{ Recovery} = \frac{(Cm - C)}{s} \times 100$$

Where:

Cm = measured Mercury in the fortified sample
C = measured native mercury sample concentration
S = concentration equivalent of spike added to sample

11.3 Relative Percent Difference (RPD) Calculation

Calculate the Relative Percent Difference (RPD) for each Duplicate of the initial quantitated concentration (IC) and duplicate quantitated concentration (Dc) using the following formula:

$$RPD = \frac{|(IC - Dc)|}{\{(IC + Dc) / 2\}} \times 100$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Method Blank Failure: When a prep blank mercury level constitutes 10% or more of analyte level determined for any sample in the batch, or is greater than 2.2x the MDL value (whichever is greater), the associated samples in the batch must be redigested (Section 10.1).

For method blanks that have concentrations greater than the RL, the data is rejected and the associated samples sent back for redigestion unless the associated sample concentrations are greater than 10x the blank concentration. In this case the blank is narrated and the results are reported without qualification.

12.2 ICV / CCV Failure: If the ICV %Recovery is outside of acceptance criteria, the ICV is reinjected. If the %Recovery is outside the acceptance criteria, the analysis is terminated until the problem is found and corrected. If the CCV %Recovery is outside of acceptance criteria, the CCV is reinjected. If the % Recovery is still outside the acceptance criteria, all samples analyzed since the last acceptable CCV must be reanalyzed following correction of the problem.

12.3 LCS Failure: If the LCS is not recovered within acceptance criteria, the LCS is reinjected. If the % Recovery is still outside the acceptance criteria, either recalibrate and rerun or the associated batch and another LCS must be redigested (Section 10.1).

12.4 Matrix Spike / Post Digestion Spike Failure: If the recovery of the matrix spike is outside of the acceptance criteria, a post digestion spike is performed (Section 9.54). If the post digestion spike is outside of 75 – 125%, a narrative must be included with the data. (Section 10.1).

12.5 Duplicate Failure: If the RPD between the sample and its duplicate is greater than 20%, visually evaluate the sample matrix. If the matrix appears problematic, the sample digestate may be diluted and reanalyzed, or a narrative included with the data to explain the matrix problem.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 DL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

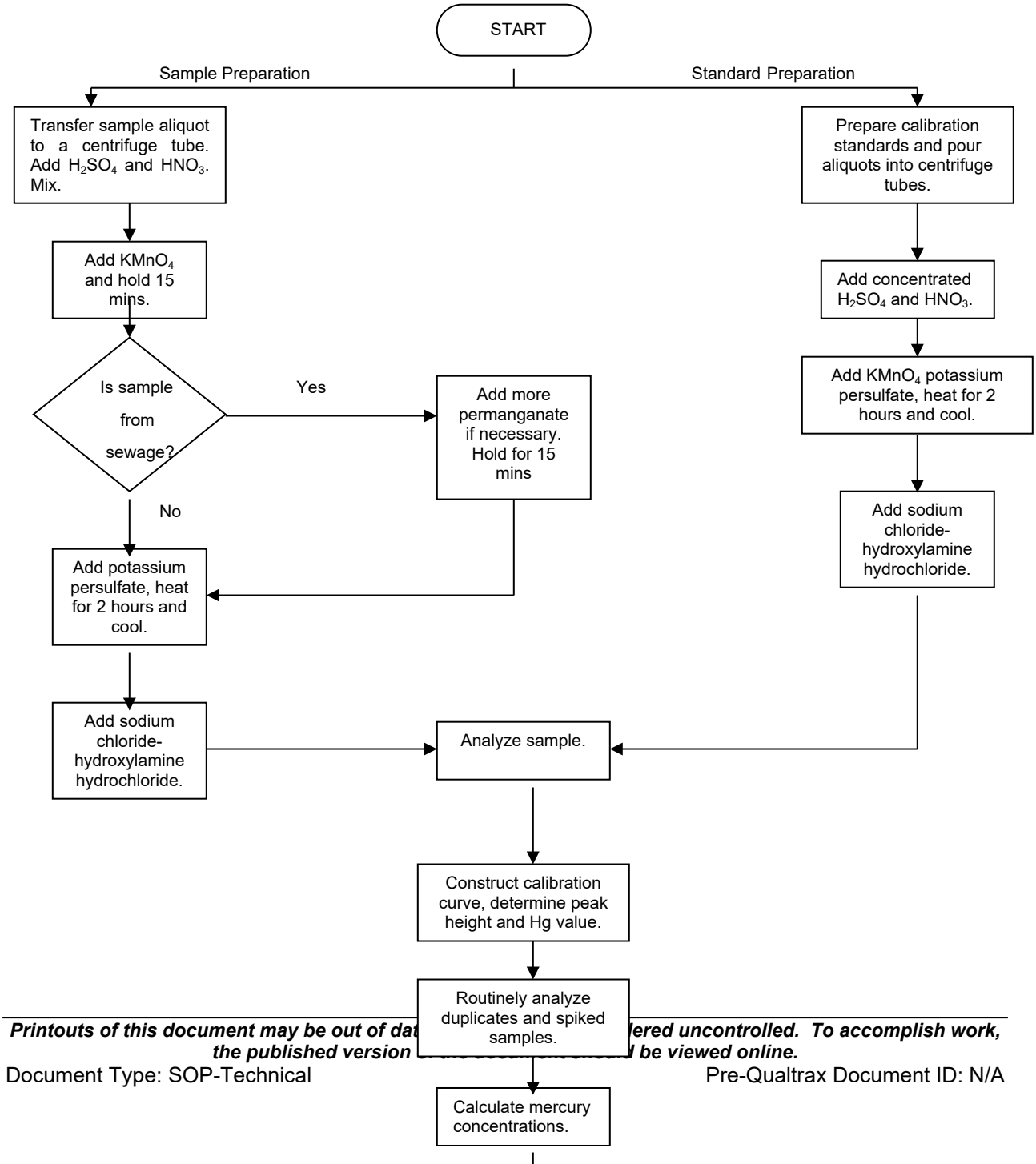
SOP/1797 Waste Management and Disposal SOP

16. Attachments

Figure 1: Method 7470A Flow Chart

Figure 1

Method 7470A Flow Chart



END

Mercury in Solid or Semisolid Waste
(Manual Cold-Vapor Technique)

Reference Method No.: **EPA 7471B**

Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, February 2007.

1. Scope and Application

Matrices: Method 7471 is approved for measuring total mercury (organic and inorganic) in soils, sediments, bottom deposits, and sludge-type materials. All samples must be subjected to an appropriate dissolution step prior to analysis. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix.

Definitions: Refer to Alpha Analytical Quality Manual.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Mercury Analyzer and in the interpretation of Mercury data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability..

2. Summary of Method

Prior to analysis, the solid or semi-solid samples must be prepared according to the procedures discussed in this method.

Method 7471, a cold-vapor atomic absorption method, is based on the absorption of radiation at the 253.7-nm wavelength by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

2.1 Method Modifications from Reference

Alpha analyzes only one 0.3g aliquot of sample. The original method does not address the automated instrument procedure. A reduced volume of sample is digested in disposable digestion tubes on a hot block digestor.

3. Reporting Limits

The reporting limit for this method is 0.08mg/Kg.

4. Interferences

Potassium permanganate is added to eliminate possible interference from sulfide. Concentrations as high as 20 mg/Kg of sulfide, as sodium sulfide, do not interfere with the recovery of added inorganic mercury in reagent water.

Copper has also been reported to interfere; however, copper concentrations as high as 10 mg/Kg had no effect on recovery of mercury from spiked samples.

Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253 nm. Care must therefore be taken to ensure that free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine sulfate reagent (25 mL).

Certain volatile organic materials that absorb at this wavelength may also cause interference. A preliminary run without reagents should determine if this type of interference is present.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

Because mercury vapor is toxic, precaution must be taken to avoid its inhalation.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples may be collected in plastic or glass containers.

6.2 Sample Preservation

None.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples are stored under refrigeration at 4°C and analyzed as soon as possible after collection. The samples have a 28-day holding time from the time of collection.

7. Equipment and Supplies

7.1 Instrumentation:

Perkin Elmer FIMS 100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. The PE FIMS is designed specifically

for the measurement of mercury using the cold-vapor technique with BOC (background offset correction) performed by a survey scan prior to each sample introduction. PE S10 autosampler is coupled to the instrument.

Cetac M-6100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. This instrument employs a reference cell off-set correction and full automation through the CETAC software. A Cetac ASX-260 autosampler is coupled to the instrument.

Nippon Instrument model# RA-4300A analyzer with integrated 80 position autosampler:

The instrument adds a stannous chloride (II) solution to the sample post digestion, the divalent mercury ion (Hg2+) is reduced to zero-valent metallic mercury and turns into mercury gas by bubbling. $Hg2{+}{+}SnCl2 \rightarrow Hg0 \uparrow$

After removing the acid mist and water vapor generated by bubbling with an electronic cooling unit, the instrument measures the absorbance of mercury at 253.7 nm absorption wavelength. It measures the known mercury amount, creates a calibration curve, and then calculates the mercury amount from the absorbance.

7.2 Hot Block Digestor: Environmental Express, 54 position, capable of maintaining a temperature of 95°C +/-3°C.

7.3 Graduated cylinder. Rinse once with 50% Nitric Acid, then rinse with reagent water prior to use.

7.4 Volumetric Flasks, Class A, various volumes. Rinse once with 50% Nitric Acid, then rinse with reagent water prior to use.

7.5 Polypropylene Digestion Vessels: 50 mL volume, with plastic screw caps

7.6 Pump Tubing: Environmental Express, three stop and two stop tubing in various IDs.

7.7 PTFE membranes: Pall TF1000 disks

7.8 Dilution vials: 20mL capacity, used when making analytical dilutions.

7.9 Laboratory Wipes

7.10 Compressed Air

7.11 Whatman 41 or equivalent filter paper

7.12 Eppendorf pipets: Accurate means to make trace standards

8. Reagents and Standards

8.1 Reagent Water: Reagent water is DI water shown to be interference free. All references to water in this method refer to reagent water unless otherwise specified.

8.2 Aqua regia: Prepare immediately before use by carefully adding three volumes of concentrated HCl to one volume of concentrated HNO_3.

8.3 Concentrated Nitric Acid, (HNO_3): Trace grade. Store at room temperature in the appropriately marked acid cabinet.

8.4 Concentrated Hydrochloric Acid, (HCl): Trace grade. Store at room temperature in the appropriately marked acid cabinet.

8.5 Reductant, Stannous Chloride in 3% HCl: This is the ***reductant*** for the Instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl and 11g $SnCl_2 \cdot 2H_20$. Mix to dissolve the solid and bring to volume with reagent water. Store at room temperature, prepare as needed.

8.6 Carrier, Hydrochloric Acid, 3%: This is the ***carrier*** for the instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl (Section 8.4). Bring to volume with reagent water. Store at room temperature, prepare as needed.

8.7 Potassium permanganate, mercury-free, 5% solution (w/v): Dissolve 5 g of potassium permanganate in 100 mL of reagent water. Store at room temperature.

8.8 Sodium chloride-hydroxylamine hydrochloride solution: Dissolve 12 g of sodium chloride and 12 g of hydroxylamine hydrochloride in reagent water and dilute to 100 mL. Store at room temperature.

8.9 Mercury stock solution, 1000ppm: This solution is purchased commercially prepared with a certificate of analysis. Three solutions are purchased, each from a different source. Store at room temperature. Expires according to manufacturer's specifications.

8.9.1 10ppm Mercury Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 1000ppm Mercury Stock Solution (Section 8.9). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.1.1 0.1ppm Mercury Working Stock / Matrix Spike Solution: To a 500mL volumetric flask, add 5mL of concentrated HNO_3 and 5 mL of 10ppm Mercury Stock Standard (Section 8.9.1). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.9.2 10ppm Mercury ICV Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of Mercury Stock Solution (Section 8.9, from an alternate source than that used in Section 8.9.1). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.2.1 0.3ppm Mercury ICV Working Stock: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 3.0mL of 10ppm Hg ICV Stock Standard (Section 8.9.2). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.9.3 10ppm Mercury LCS Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 1000ppm Mercury Stock Solution (Section 8.9, from an alternate source than that used in Sections 8.9.1 and 8.9.2). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.3.1 0.1ppm Mercury LCS Working Stock: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 10ppm Mercury LCS Stock Standard (Section

8.9.3). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.10 SRM: Purchased from ERA in 300-500g lots.

9. Quality Control and Data Assessment

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

The Method Blank consists of the 0ppm standard as prepared in Section 10.1.2.1.1. Analyze one Method Blank per analytical batch of twenty samples or less. The Method Blank must be less than the Reporting Limit (RL). See Section 12.1 for corrective action.

9.1.1 PBS

A preparation blank is analyzed once per batch of twenty samples or less. It is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The PBS must be recovered within ± 0.2 µg/L.

9.1.2 ICB

The ICB is analyzed after the ICV, and is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The ICB must be recovered within ± 0.2 µg/L.

9.1.3 CCB

The CCB is analyzed after the CCV. It is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The CCB must be recovered within ± 0.2 µg/L.

9.2 Laboratory Control Sample (LCS)

The LCS is analyzed once per each analytical batch of twenty samples or less. It is prepared in the same manner as in Section 10.1.2.3. The LCS must be recovered within 80 – 120% of the true value. See Section 12.3 for corrective action.

9.3 Initial Calibration Verification (ICV)

The ICV is analyzed after the calibration curve. It is prepared in the manner specified in Section 10.1.2.2. The ICV must be recovered within ± 10% of the true value. See Section 12.2 for corrective action.

9.4 Continuing Calibration Verification (CCV)

The CCV is analyzed after every ten analytical samples. It is prepared in the same manner as the 5.0ppb calibration standard (Section 10.1.2.1.5). The CCV must be recovered within 20% of the true value. See Section 12.2 for corrective action.

9.5 Matrix Spike

Analyze one matrix spike per twenty or less analytical samples. The recovery of the matrix spike must be between 80 – 120%. Calculate percent recovery using Section 11.2.

If the recovery of the matrix spike is out of range, a post-analytical spike is analyzed. Prepare the post analytical spike by adding 5mL of 0.010ppm Calibration Standard (Section

10.1.2.1.6) and 5mL of the sample digestate to a 50mL centrifuge tube for a final concentration of 0.005mg/L. Analyze the post spike as outlined in Section 10.3.

Calculate the post spike concentration as follows:

Post Analytical Spike Sample Concentration (mg/L) =

[Sample Concentration (mg/L) x (0.5)] + 0.005mg/L

The percent recovery of the post-analytical spike must be between 75 – 125%.

See Section 12.4 for corrective action.

9.6 Laboratory Duplicate

Analyze one sample in duplicate per twenty or less analytical samples. The RPD between the sample and its duplicate must be ≤ 20% (as calculated in Section 11.3). See Section 12.5 for corrective action.

9.7 Method-specific Quality Control Samples

None

9.8 Method Sequence

- Sample preparation
- Sample digestion
- Standards preparation:
  - Calibration standards
  - ICV standard
  - LCS standard
- Standards digestion
- Analysis of calibration standards
- Generation of calibration curve
- Analysis of samples and standards:
  - ICV
  - ICB
  - analytical samples
  - CCV
  - CCB
  - analytical samples
  - CCV
  - CCB
  - etc.

10. Procedure

10.1 Equipment Set-Up

10.1.1 Sample preparation: Weigh a 0.3-g portion of untreated and homogenized sample and place in the bottom of a polypropylene digestion vessel. Record the weight in the laboratory notebook. NOTE: When preparing the batch, include one sample duplicate aliquot to be prepared in the same manner.

Add 2.5 mL of reagent water and 2.5 mL of aqua regia (Section 8.2). Heat 2 min on a hot block at 95°C +/-3°C. Cool; then add 15 mL reagent water, and 7.5 mL potassium permanganate solution (Section 8.7) to the digestion vessel. Wait 15 minutes to be sure the potassium permanganate is not exhausted (purple color disappears), if it does add additional potassium permanganate to all samples and QC until stable. Mix thoroughly and place in the hot block for 30 min at 95°C +/-3°C. Cool and add 3 mL of sodium chloride-hydroxylamine hydrochloride (Section 8.8) to reduce the excess permanganate.

CAUTION: Perform this addition under a hood, as Cl_2 could be evolved.

Bring up to a final volume of 50 mL with reagent water. Continue as described under Section 10.3.1.

10.1.2 Standard preparation: Standard preparation is performed each time samples are digested.

10.1.2.1 Calibration Standards

10.1.2.1.1 0 ppb: Add 10mL of reagent water to a polypropylene digestion vessel. This aliquot may be used for the CCB. Another separate aliquot is prepared for use as the ICB and the diluent for any samples with concentration greater than 90% the highest calibration standard used to determine the linear range.

10.1.2.1.2 0.5ppb: Add 10 mL of reagent water to a polypropylene digestion vessel. Using a volumetric pipet, add 0.25 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vesel.

10.1.2.1.3 1.0ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 0.5 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.4 2.0ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 1.0mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.5 5.0ppb/CCV: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 2.5 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.6 10ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.Using a volumetric pipet, add 5.0 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.7 20ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.Using a volumetric pipet, add 10.0 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.2 ICV Standard, 3.0ppb: This standard is used for calibration verification.

Add 10.0 mL of reagent water to a digestion vessel. Using a volumetric pipet, add 0.5 mL of 0.3ppm Mercury Working Stock (Section 8.9.2.1) to the digestion vessel. Digest the ICV Standard as in Section 10.1.3.

10.1.2.3 LCS Standard, 1.0ppb: This standard is prepared and analyzed with each analytical batch.

Add 5.0mL of reagent water to a digestion vessel. Add 0.15g of SRM (Section 8.10). Digest the LCS Standard as in Section 10.1.3.

10.1.2.4 Matrix Spike, 0.001mg/L: Weigh two aliquots of the sample designated to be the batch matrix spike.

Add 10.0 mL of the reagent water to the digestion vessel containing the weighed sample aliquot. Add a 0.5 mL aliquot of 0.1ppm Mercury LCS Working Stock (Section 8.9.3.1). Digest the MS as in Section 10.1.3.

10.1.3 Standard Digestion:

To each standard (Sections 10.1.2.1 through 10.1.2.3), add 2.5 mL of reagent water and 2.5 mL of aqua regia (Section 8.2) and heat 2 min on the hot block at 95°C +/- 3°C. Allow the standard to cool; add 15 mL reagent water and 7.5 mL of $KMnO_4$ solution (Section 8.7) to each bottle and return to the hot block for 30 min. Cool and add 3 mL of sodium chloride-hydroxylamine hydrochloride solution (Section 8.8) to reduce the excess permanganate. Bring up to final volume of 50 mL with reagent water, continue as described in Section 10.3.3.

Note: Alternate volumes of standards may be made base on need as long as they are made with the same proportions as describe above.

10.2 Initial Calibration

Construct a calibration curve by plotting the absorbances of prepared standards (Section 10.1.2) versus micrograms of mercury. (See Section 11.1.) Determine the peak height of the unknown from the absorbance maxima on the spectrometer, and read the mercury value from the standard curve.

The curve correlation coefficient (cc) must be greater than or equal to 0.995 in order for the curve to be linear. If the correlation coefficient is less than 0.995, find and correct the problem. When the problem has been corrected, re-analyze either the previous standards or new standards. When the curve has generated an acceptable cc, then the analysis can continue with the ICV/ICB.

Analyze an Initial Calibration Verification Standard (ICV) (Section 9.3), an Initial Calibration Blank sample (ICB) (Section 9.1.2) at the start of the analytical run. The results for the ICV must be within 10% of the true value. If results are outside this range, refer to Section 12.2 for corrective action.

10.3 Equipment Operation and Sample Processing

10.3.1 Instrument Setup

10.3.1.1 Turn the instrument on. The autosampler will initialize itself.

10.3.1.2 Choose the instrument software from the desktop menu. The autosampler will initialize again.

FIMS 100 NOTE: The instrument must be turned on before the application is started. Otherwise, an error message will result.

10.3.1.3 Enter the appropriate fields for sample identification, and data storage.

10.3.1.4 Fill the carrier and reductant bottles.

10.3.1.4.1 The Carrier is 3% HCl (Section 8.6).

10.3.1.4.2 The Reductant is 1.1% $SnCl_2$ in 3% HCl (Section 8.5).

10.3.1.5 Allow the instrument to warm up while clearing samples. Samples that are cloudy or with particulate present after clearing must be filtered through Whatman 41 filter paper (Section 7.11) before analysis.

10.3.1.6 Place carrier uptake line and reductant uptake line.

10.3.1.7 Load carrier and reductant lines into pump magazines

10.3.1.8 Load the two waste lines into the pump magazines below the roller.

10.3.1.9 Lock the magazines into place.

FIMS100 only:

10.3.1.10 Remove the cap from the liquid/vapor separator and wipe dry with a Lab Wipe (Section 7.9). Compressed air (Section 7.10) through the vapor transfer line to dry it out.

10.3.1.11 Place a PTFE membrane (Section 7.7), rough side up, in the liquid/vapor separator; replace the cap and reattach the vapor transfer line to the sample absorption cell.

10.3.1.12 Adjust the gas flow by turning the black knob below the air flow meter to obtain a reading of just over 50.

10.3.2 Calibration and Sample Analysis

10.3.2.1 The instrument will now run the calibration standards; verify a CC of 0.995 or better before proceeding with the ICV and ICB. Ten analytical samples, a CCV and CCB, ten analytical samples, CCV, CCB, etc. The CCBs and CCVs must be recovered within the proper ranges (Sections 9.4 and 9.1.3) for analysis to continue.

10.3.2.2 If the sample result is beyond 90% of the concentration of the highest point on the calibration curve or LDR study used to establish the linear range, dilute the sample extract with a portion of one of the prepared blanks (ICB, CCB or PBS) to produce an analytical result that is within the range.

10.3.3 Instrument Shut Down

10.3.3.1 When analysis is complete place reagent uptake lines in a beaker of DI water.

10.3.3.1.1 Continue to run the pumps for several minutes to flush reagents out of the lines.

10.3.3.1.2 Continue to run the pumps for several more minutes to flush the lines thoroughly with DI water.

10.3.3.2 Pull the reagent uptake lines out of the DI water beaker to allow the pump to draw air completely through the lines.

10.3.3.3 Unlock the top and bottom pump magazines and remove tubing from the magazines.

10.3.3.4 Exit from the software application.

Note: This procedure must be followed every time the instrument is shut down to prevent water or reagents from being draw back into the instrument which can cause severe damage.

10.3.3.4.1 Dump the samples and instrument waste in the Metals/WetChem waste drum located in the transfer room only after all data has been processed through final review and package generation.

10.4 Continuing Calibration

After every 10 samples, analyze a Continuing Calibration Verification Standard (CCV), and a Continuing Calibration Blank sample (CCB). Determine the concentrations from the calibration curve. The results for the CCV must be within 20% of the true value.

10.5 Preventive Maintenance

Preventative maintenance is conducted per the manufacturer's instructions. All preventative maintenance is recorded in the Instrument Maintenance Logbook.

11. Data Evaluation, Calculations and Reporting

11.1 Calculate Mercury Concentration From the Daily Calibration Curve

The curve is generated utilizing a straight-line equation defined as:

$$A = k_1 + k_2C$$

Where:

A = Average peak height of the sample/standard integrations
C = Sample/Standard Concentration, µg/L
k_1 = y-intercept
k2 = slope

The instrument will plot peak height against concentration (µg/L). The result is generated in µg/L. This value is divided by 1000 to convert the units to mg/L. The mg/L units are converted to mg/Kg by multiplying by L/Kg. A dilution factor (DF) is applied if necessary. The Result is then divided by the % Total Solids prior to release to the client.

$$\text{Result, mg/Kg} = (\text{concentration, µg/L}) \times (1\text{mg}/1000\mu\text{g}) \times (\text{DF}) \times (\text{L/Kg})$$

Where:

$$\text{L/Kg} = \frac{\text{Final volume of digestate, in L}}{\text{Weight of original sample, in Kg}}$$

11.2 Calculate Percent Recovery for the Matrix Spike corrected for concentrations measured in the unfortified sample. Percent recovery is calculated using the following equation:

$$\%\ \text{Recovery} = \frac{(Cm - C)}{s} \times 100$$

Where:

Cm = measured Mercury in the fortified sample
C = measured native mercury sample concentration
S = concentration equivalent of spike added to sample

11.3 Calculate the Relative Percent Difference (RPD) for each Duplicate of the initial quantitated concentration (IC) and duplicate quantitated concentration (Dc) using the following formula:

$$RPD = \frac{|(IC - Dc)|}{\{(IC + Dc) / 2\}} \times 100$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Method Blank Failure

When a prep blank mercury concentration is ≥10% of the mercury concentration determined for any associated sample, or is greater than 2.2x the MDL value (whichever is greater), the entire batch associated with the prep blank must be redigested.

12.2 ICV / CCV Failure

If the ICV %Recovery is outside of acceptance criteria, analysis is terminated until the problem is found and corrected. If the CCV %Recovery is outside of acceptance criteria, all samples analyzed since the last acceptable CCV must be reanalyzed following correction of the problem.

12.3 LCS Failure

If the LCS is not recovered within acceptance criteria, the associated batch and another LCS must be redigested (Section 10.1).

12.4 Matrix Spike/Post Digestion Spike Failure

If the recovery of the matrix spike is outside of the acceptance criteria of 80 – 120%, a post digestion spike is performed (Section 9.5). If the post digestion spike is beyond 75 – 125%, the sample and its spike are redigested (Section 10.1).

12.5 Duplicate Failure

If the RPD between the sample and its duplicate is greater than 20%, visually evaluate the sample matrix. If the sample matrix appears clean, the sample and its duplicate are removed from the batch and redigested (Section 10.1). If the matrix appears problematic, the sample digestate may be diluted and reanalyzed, or a narrative included with the data to explain the matrix problem.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 DL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

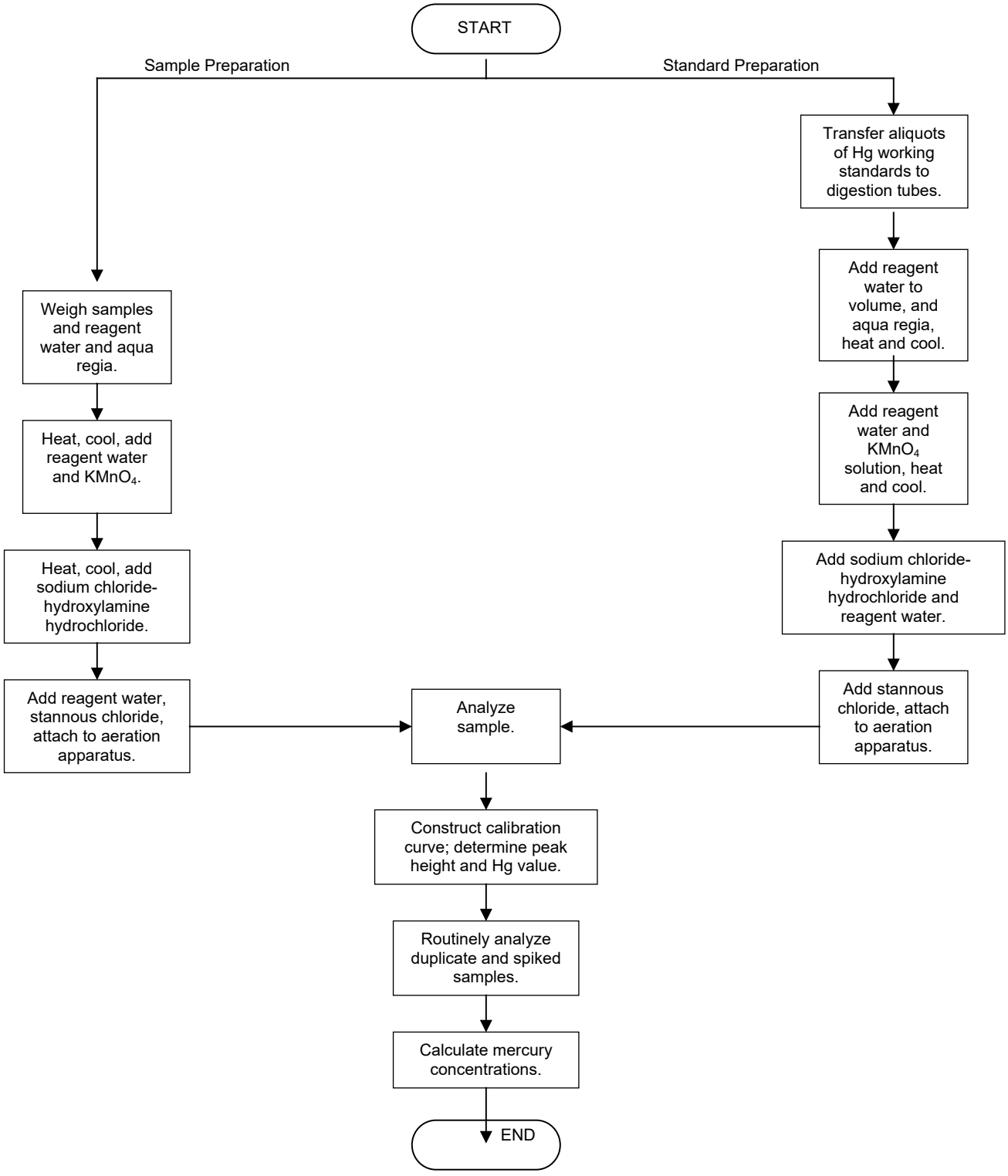
SOP/1797 Waste Management and Disposal SOP

16. Attachments

FIGURE 1: Flow Chart for Method 7471B

Figure 1

Method 7471B Flow Chart



APPENDIX C

SMITH AND WESSEL HBMI PLAN AND
STANDARD OPERATING PROCEDURES

SMITH & WESSEL ASSOCIATES, INC.
HAZARDOUS BUILDING MATERIALS AND AIR QUALITY SPECIALISTS

PROPOSAL FOR HAZARDOUS BUILDING MATERIALS CONSULTING SERVICES

Former Citgo Service Station
925 Massachusetts Avenue
Lunenburg, Massachusetts



Prepared for:

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Project 20118

February 27, 2020

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INTRODUCTION

Smith & Wessel Associates, Inc. (SWA) provides expert consulting services in all matters relating to the indoor environment, with specific attention to potentially hazardous building materials and indoor air quality. SWA is dedicated to offering information that is accurate, reliable, timely, and confidential within a framework that gives equal and top priority to safety and cost effectiveness. We are pleased to submit this proposal for SWA to provide hazardous building materials consulting services to Beta Group, Inc. (Beta) for the former Citgo Service Station located at 925 Massachusetts Avenue, in Lunenburg Massachusetts.

In anticipation of the structure being demolished, SWA's services will include the identification of asbestos containing building materials (ACBM), lead-based paint (LBP), polychlorinated biphenyls (PCBs) and mercury containing components throughout the building and gas pump island. In addition, SWA will make recommendations for the abatement or other appropriate control of the identified potentially hazardous materials, generate comprehensive reports, and estimate associated abatement and/or control costs.

1. SCOPE OF WORK

Asbestos Inspection Phase

The inspection for suspect ACBM will be conducted by SWA's experienced and accredited Asbestos Inspectors. Before beginning the on-site inspection process, we will review existing and available drawings and building specifications for original construction information pertaining to the installation of suspect ACBM if they are made available. In this way, we may be able to identify the type and location of some of the suspect ACBM in and on the structures, thereby reducing sampling and analysis, saving both time, and associated sampling costs. SWA will inspect for suspect roof materials and provide a temporary repair against future leaks if necessary.

In general, we will make observations for both friable (easily crumbled, crushed, or pulverized by hand) and nonfriable suspect ACBM within the pump station, including the following:

- thermal system insulation, such as pipe, boiler, tank, and duct insulation;
- surfacing materials, such as fireproofing, acoustical and decorative plasters, or other coatings applied by spray or trowel; and
- miscellaneous materials, such as floor and ceiling tiles, mastics, and blown-in insulation.

Not all building materials will be considered to be suspect ACBM. Certain materials, such as fiberglass (pink or yellow), brick, concrete, wood, glass, and rubber can be identified as non-suspect ACBM by visual inspection. Also, friable materials that are known to have been installed after 1980 will not be considered suspect. If documentation

is available indicating that nonfriable materials do not contain asbestos, these materials also will not be considered to be suspect ACBM. We will refer to all such documentation in our report. By classifying certain materials as non-suspect, we can minimize sampling and the associated costs of analyzing the materials.

As necessary, we shall collect additional bulk samples of those suspect materials that were not adequately addressed in any of the existing documentation. SWA's sampling protocol is based upon our prior experience and the following EPA guidance documents:

- *The Asbestos Hazard Emergency Response Act*, 40 CFR Part 763
- *Asbestos in Buildings: A Simplified Sampling Scheme for Friable Surfacing Materials*, (EPA Document 560/5-85-030a, October, 1985)
- *Asbestos Exposure Assessment in Buildings, Inspection Manual* (Yellow Book)
- *Guidance for Controlling Asbestos-Containing Materials in Buildings* (EPA Document 560/5-85-024)

To determine the asbestos content of suspect materials, we shall collect representative bulk samples using the following protocol:

- For thermal system insulation, a minimum of three samples of each type, except for small patched areas (less than six square feet), in which case at least one sample will be collected;
- For surfacing materials, a minimum of three samples of each type of material present in quantities less than 1,000 square feet, a minimum of five samples of each type of material present in quantities 1,000 square feet to 5,000 square feet, and seven samples for homogeneous areas greater than 5,000 square feet; and
- For miscellaneous materials, at least one sample of each type of material present in quantities less than 500 square feet, and a minimum of two samples of each type of material present in quantities equal to or greater than 500 square feet.

While adhering to strict safety precautions, we will collect samples of those materials that are readily accessible and can be sampled with minimum damage to existing finishes. The samples that we collect will be as small as reasonably feasible in order to obtain a representative portion of the substrate.

Bulk samples will be analyzed by a licensed asbestos analytical laboratory. The analytical method used will be Polarized Light Microscopy (PLM) in accordance with the method described in 40 CFR Part 763, Subpart F, Appendix A. This method is sensitive to the presence of asbestos fibers, typically at less than one percent of the sample composition. In instances where multiple samples of a similar homogeneous material are collected, the laboratory will be directed to analyze each sample of the material until a positive result is obtained (i.e. a sample containing greater than 1% asbestos) so as to

avoid the additional costs of repetitive analysis while at the same time retaining analytical quality.

Although PLM is the method accepted by the EPA for detecting the presence of asbestos in bulk samples, it is not consistently reliable in detecting asbestos in floor tiles and in some other types of organically bound materials. Therefore, if less than one percent asbestos is detected in a floor tile for example, confirmatory analysis using Transmission Electron Microscopy (TEM) will be recommended.

Lead Inspection

To identify lead-based paints (LBP), we will conduct an investigation of the interior and exterior of the pump stations to identify the lead content of paints on walls, ceilings, windows, and doors, including casings, baseboard, facades, and so forth. Testing for LBP will be conducted using a portable X-Ray fluorescence analyzer (XRFA) which uses a radioactive source to excite the electrons of lead atoms (if present) in paint. As the lead atom electrons return to their normal state, they emit x-rays that are measured by the XRFA. These data are then processed and the results converted to milligrams of lead per square centimeter of sampled surface area.

PCBs Inspection

SWA's investigation for PCBs will include visual inspections for ballasts associated with fluorescent light fixtures and other sources throughout the pump station. SWA will inspect the affixed labels on representative fluorescent light fixture ballasts for the "No PCB" wording. SWA will also inspect for other possible sources such as electrical transformers and capacitors. Typically, ballasts installed after 1978 do not contain PCBs and are marked as such. No sampling for PCBs in ballasts or transformers is proposed.

However, SWA will collect samples of suspect caulking, glazing, paints and or suspect sealants to be analyzed for PCBs via Soxhlet Extraction using EPA Method SW-846 8082.

Mercury Containing Components Inspection

SWA will make observations for mercury containing components such as fluorescent light bulbs, mercury tubes in heat regulating thermostats throughout the pump station. Our inspection for mercury components will be limited to visual assessments, inventory of materials and providing cost estimates for removal and proper packaging for disposal or recycling. No testing is proposed.

Report Preparation

On the basis of the information gathered during the inspections, we will provide a final report detailing our findings and appropriate recommendations regarding hazardous materials identified at the sites. The report will include an inventory of ACBM, LBP, PCBs and mercury containing components, regulatory guidance, the result of our assessment of hazards, and recommendations for abatement and control of those hazards.

Exclusions

While SWA endeavors to conduct a thorough, comprehensive inspection, some exclusions are warranted. Our inspection will include building areas only; no assessment of soil, debris, subterranean areas, inaccessible crawl spaces, interior of equipment, or inaccessible tunnels or trenches will be attempted. Because the structures will be demolished, SWA will conduct intrusive investigations throughout as practical using hand tools only.

SWA will sample the roof system and provide a temporary repair at all sample locations as necessary. SWA does not warrantee against future leaks and shall not be held liable for water damage as a result of a repair failing. If a more permanent repair is necessary, SWA can contract a professional Roof Contractor. We have not included this cost in our base scope, but have carried a line item in our Unit Cost section. If requested, SWA can remove select bricks to look behind façade, but would not be responsible for repairs.

While SWA will follow industry standards during the inspection, we do not warrant that all suspect hazardous building materials will be identified in or on the pump station and we shall not be held liable related to abatement costs related to hazardous materials that are either not discovered or not appropriately characterized. This is due in part to inherent problems with every building inspection, such as, but not limited to:

- seemingly homogeneous materials that are not in fact homogeneous;
- seemingly representative locations that are not in fact representative,
- layered materials that are not uniformly present or are isolated;
- materials that are present in an isolated and limited quantity;
- materials that may be accessible but were not recognized as hazardous; and
- materials that are present in locations that are unsafe or otherwise difficult to access.

During the course of future renovation/demolition work, it is likely that additional hazardous materials or materials suspected of being hazardous will be identified. Such materials should be assumed to be hazardous unless appropriate evaluation or sampling and analysis demonstrate otherwise. Contracts, specifications and plans should advise contractors to conduct controlled demolition work and stop immediately should any hazardous building materials be encountered during the course of their work.

Standard Operating Procedures

Inspection Scope of Work and Methodology

Asbestos Inspection

The inspection for suspect ACBM will be conducted by SWA's accredited Asbestos Inspectors. Prior to initiating the on-site inspection process, SWA will review existing drawings and building specifications made available to us for original construction information pertaining to the installation of suspect ACBM. In this way, SWA may be able to identify the type and location of some of the suspect ACBM in the buildings, thereby reducing sampling and analysis and saving both time and associated sampling costs. Any reference material used to assist in the investigation of the facility will be clearly referenced in the report, but will not be used as a substitute for SWA's inspection protocols. As practical, using hand tools, SWA will conduct intrusive investigation techniques to inspect for suspect ACBM that may be hidden in wall cavities, above suspended ceilings and like areas.

In general, SWA will make observations for both friable (easily crumbled, crushed, or pulverized by hand) and nonfriable suspect ACBM within the building, including the following materials:

- thermal system insulation, such as pipe, boiler, tank, and duct insulation;
- surfacing materials, such as fireproofing, acoustical and decorative plasters, or other coatings applied by spray or trowel; and
- miscellaneous materials, such as floor and ceiling tiles, mastics, roofing materials, and blown-in insulation.

Not all building materials will be considered to be suspect ACBM. Certain materials, such as fiberglass (pink or yellow), brick, concrete, wood, glass, and rubber can visually be identified as non-suspect ACBM. Also, friable materials that are known to have been installed after 1980 will not be considered suspect. If documentation is made available indicating that nonfriable materials do not contain asbestos, these materials also will not be considered to be suspect ACBM. SWA will refer to such available documentation in the report. By classifying certain materials as non-suspect, we can minimize sampling and the associated costs of analyzing the materials.

As necessary, SWA shall collect additional bulk samples of those suspect materials that were not adequately addressed in any of the existing documentation.

Asbestos Sampling Protocol

To determine the asbestos content of suspect materials, SWA will collect representative bulk samples using the following protocol:

- For thermal system insulation, a minimum of three samples of each type, except for small patched areas (less than six square feet), in which case at least one sample will be collected;
- For surfacing materials, a minimum of three samples of each type of material present in quantities less than 1,000 square feet, a minimum of five samples of each type of material present in quantities

1,000 square feet to 5,000 square feet, and seven samples for homogeneous areas greater than 5,000 square feet; and

- For miscellaneous materials, at least one sample of each type of material present in quantities less than 500 square feet, and a minimum of two samples of each type of material present in quantities equal to or greater than 500 square feet.

While adhering to strict safety precautions, SWA will collect samples of those materials that are readily accessible and can be sampled without extensive damage to existing finishes. The samples collected will be as small as reasonably feasible in order to obtain a representative portion of the substrate. If SWA will be collecting samples from the roof in order to evaluate the types of roofing materials present and their asbestos content, a professional roofer will be utilized to cut and patch the associated locations on the roof.

Bulk samples will be analyzed by a licensed asbestos analytical laboratory. The analytical method used will be Polarized Light Microscopy (PLM) in accordance with the method described in 40 CFR Part 763, Subpart F, Appendix A. This method is sensitive to the presence of asbestos fibers, typically at less than one percent of the sample composition. In instances where multiple samples of a similar homogeneous material are collected, the laboratory will be directed to analyze each sample of the material until each sample is analyzed or a positive result is obtained (i.e. a sample containing greater than 1% asbestos) so as to avoid the additional costs of repetitive analysis while at the same time retaining analytical quality.

Although PLM is the method accepted by the EPA for detecting the presence of asbestos in bulk samples, it is not consistently reliable in detecting asbestos in floor tiles and in some other types of organically bound materials. Therefore, if less than one percent asbestos is detected in these materials, confirmatory analysis using Transmission Electron Microscopy (TEM) will be recommended.

Lead Paint Inspection

To identify LBP, SWA will conduct an investigation of the equipment and building components that will be impacted by the project in order to identify their lead content. Testing for LBP will be conducted using a portable NITON XLp-303a X-Ray fluorescence analyzer (XRFA) which uses a radioactive source to excite the electrons of lead atoms (if present) in paint. As the lead atom electrons return to their normal state, they emit x-rays that are measured by the XRFA. These data are then processed and the results converted to milligrams of lead per square centimeter of sampled surface area.

To verify calibration, before and after each use SWA will check readings on standards for surface lead of 0.01 mg/cm2 and 1.04 mg/cm2 and buried lead at 0.01 mg/cm2 and 3.58 mg/cm2. Based on the results of the testing for LBP utilizing the XRF, SWA will provide appropriate recommendations for handling and management of wastes and possibly for further testing for LBP chip analysis and/or TCLP analysis.

PCB Inspection

Devices Potentially containing PCBs

SWA's investigation for PCBs will be visual only. SWA will identify light ballasts that may contain PCBs by reading the identification marks on top of a representative sample of light ballasts. Typically, ballasts installed after 1978 do not contain PCBs and are marked as such. Based on the findings in the sample

group, conservative assumptions will be made as to the number of ballasts containing PCBs by extrapolating results across the site.

SWA will also inspect for other possible sources of PCBs, such as electrical transformers, which may be present, if they will be impacted by the work of the project. Through visual inspection of labels and other relevant data we will attempt to confirm or deny the presence of PCBs within the examined area. No confirmatory sampling is proposed.

Building Materials potentially containing PCBs

SWA's Environmental Technicians will inspect for suspect caulking and sealants only in locations that may be impacted by the work of the project. SWA will collect representative samples of the aforementioned materials to be submitted to a qualified laboratory via proper chain of custody for analysis. SWA will collect samples of suspect caulking measuring approximately 25 grams to be analyzed by a qualified laboratory utilizing EPA's SW-846 Method 3540C 8082 SOXHLET Extraction. Any materials containing PCBs equal or greater than 50 ppm are regulated under the Toxic Substance Control Act and the PCB regulation found at 40 CFR Part 761.

Substrates abutting caulking, such as concrete and brick, as well as surficial soils beneath windows, could potentially have become contaminated with PCBs, if present in caulking material. Following an evaluation of the PCB analysis in caulk, an additional assessment program to evaluate these substrates may be necessary.

Mercury Inspection

To determine handling and disposal procedures for components that may contain mercury, SWA will quantify the number of fluorescent bulbs, switches, and thermostats assumed to contain mercury throughout the buildings. No confirmatory sampling or analysis for mercury is proposed.

Exclusions

While SWA endeavors to conduct a thorough, comprehensive inspection, some exclusion is warranted. SWA's inspection will include building areas only; no assessment of soil, debris, subterranean areas, and inaccessible crawl spaces, interior of equipment, or inaccessible tunnels or trenches will be attempted. Further, spaces behind wall partitions and above suspended or fixed ceilings, inaccessible crawl spaces, interior of equipment, within fire doors, under new windows, and inaccessible tunnels or trenches will only be subject to limited inspection. Additional limitations may impact our ability to inspect all locations such as poor lighting, height constraints, unusual building features, occupancy, and stored materials. SWA will not inspect for hidden materials.

SWA cannot warrant the complete identification and proper characterization of all roof materials. Often, roofing materials were put down in layers and may include several types, although this may not be apparent upon visual inspection and limited sampling. SWA will collect samples and make assumptions pertaining to roofing materials based on sampling results and observation, but our findings should not be construed to be definitive pertaining to the extent of materials present. Only upon removal of the entire roofing system will the exact nature of roofing materials be known. SWA will contract a professional Roof Contractor to assist with the sampling of roof materials and make the appropriate repair of sample locations against future leaks.

While SWA will follow industry standards during the inspection, we do not warrant that all suspect hazardous building materials will be identified in or on the building within the inspection areas and we shall not be held liable related to abatement costs related to hazardous materials that are either not discovered or not appropriately characterized. This is due in part to inherent problems with every building inspection, such as, but not limited to:

- seemingly homogeneous materials that are not in fact homogeneous,
- seemingly representative locations that are not in fact representative,
- layered materials that are not uniformly present or are isolated,
- materials that are present in an isolated and limited quantity,
- materials that were accessible but that were not recognized as being hazardous or potentially hazardous,
- materials that are present in locations that are unsafe or otherwise difficult to access.

During the course of future demolition work, it is possible that additional hazardous materials or materials suspected of being hazardous will be identified. Such materials should be assumed to be hazardous unless appropriate evaluation or sampling and analysis demonstrate otherwise. Contracts, specifications and plans should advise contractors to conduct controlled demolition work and stop immediately should any hazardous building materials be encountered during the course of their work.

POLYCHLORINATED BIPHENYLS (PCBs) by GAS CHROMATOGRAPHY

(Method SW846 8082A)

Approved:

Tod Kopyscinski
Laboratory Director

Katherine Allen
QA Officer

NON-CONTROLLED COPY

Revision Number: 12

Change Record

Revision	Date	Responsible Person	Description of Change
Original	05/05/2003	J. Beane/ S. Kocot	Original, including MCP Data Enhancement Criteria and NELAP format
1	01/13/2004	D.Damboragian	QC criteria updates, for AZ audit
2	8/31/2005	E. Denson	2004 Arizona audit requirements
3	10/27/2005	J. Beane	Updates to extraction and GC parameters
4	11/16/2006	D.Damboragian	Addition of PCB wipe extraction procedure
5	11/12/2008	F.Derose	Updates to extraction and GC parameters
6	10/14/09	F.Derose	Updates
7	4/13/2011	JB	Updates from Annual SOP review: Sec. 9.0 (Instrument Set-up updated), Sec. 6.0 (Reagents section updated), Sec 8.0 updated, and Sec 17.0 (ref. addition)
8	06/19/2012	KFA	Updates from annual review: Sec's 1.0, 2.0, 4.0, 6.18, 11.0, 12.2.5 (Inclusion of PCB Wipes) and Sec 17.10 (new MA MCP rev). Sec 5.24 & Sec 8.3.7 rinse twice with hexane added, Sec 6.10 helium removed, Sec 8.5.3 to 8.5.5 removed and reference to see SOP Florisil Clean-up added.
9	09/19/2013	KFA/CWB	Updates from 2012 annual SOP review: Section 8.3.2 (note added on how to handle sediment on the bottom of sample container), Section 9.1 (deletion of ECD#2) and Section 17.0 (deletion of 5890 reference and addition of Buchi turbovap). Updated section 8.3.9 with new numbering. Added section 8.3.10 to include Buchi Syncore Concentrator. Updated section 8.4.1.
10	03/23/2016	CWB	Removed all Turbo Vap references. Updated Section 9.1 (added Instrument ECD 10), updated column information
11	08/31/2017	KFA	Update from annual internal audit: Sec 9.1 (delete ECD#8 and column 1 is 0.5um df), Sec 12.2.1 (20% ICAL RSD not 15% and 100ug/L ICV not 50ug/L), Sec 12.2.2 (0.03min is default), Sec 12.2.3 (MCP 20% not 15% for CCV), and Sec 12.2.8 (reworded conf. criteria).
12	03/12/2019	Charles Balicki/PJG	Updates from Annual SOP Review: Section 1.0 added 10 ug/L for caulking, paint, and micro extraction waters. Section 3.0 replaced florisil column cleanup with Enhanced Florisil cleanup. Section 4.0 Updated MCP Data Enhancement: removed aqueous samples/no residual chlorine, added "PCB", and changed -10°C to 4°C. Sections 6.17, 6.18, 6.19 Updated volume amounts. Section 8.3.3 changed 1000ug/l to 2000 ug/L. Section 9.1 changed model numbers for column 1 and column 2. Section 11.0 added "^{2}" to Wipe sample concentration formula. Section 12.2.1 changed from 5 point to 6 point. Section 12.2.2 changed default standard deviation from 0.3 to 0.03 minutes. Update for new calibration: Sec 6.16.

Distribution/Training List

See Employee Training Record File for signed training statements for trained users.

1.0 SCOPE AND APPLICATION

Method 8082 is used to determine the concentrations of polychlorinated biphenyls (PCBs) as Aroclors in extracts from solid, wipes and aqueous matrices. Open-tubular, capillary columns are employed with electron capture detectors (ECD). When compared to packed columns, these fused-silica, open-tubular columns offer improved resolution, better selectivity, increased sensitivity, and faster analysis. The target compounds may be determined by either a single- or dual-column analysis system. The method also may be applied to other matrices such as oils and wipe samples, if appropriate sample extraction procedures are employed. The following analytes can be determined by this method:

PCB-1016	PCB-1254
PCB-1221	PCB-1260
PCB-1232	PCB-1262
PCB-1242	PCB-1268
PCB-1248	

Reporting Limit = 20 ug/L (off of the instrument), 10 µg/L for caulking, paint, and micro-extraction waters, <0.1 mg/Kg and <0.2 ug/L (calculated).

MA CAM RL's = 0.25ug/L and 0.1 mg/kg

2.0 SUMMARY OF METHOD

A measured volume, weight of sample (approximately 1-Liter for liquids, 10 grams for soils; 0.200 grams for paint; 0.500 grams for caulking; 2.0 grams for product solid), or one wipe is extracted using the appropriate matrix-specific sample extraction technique (e.g. Microwave -3546 or ASE -3545 or Soxhlet -3540C or Liq-Liq 3510C). Aqueous samples are extracted at pH 5-9 with methylene chloride, solid and wipe samples are extracted with 1:1 Acetone:Hexane. Extracts for PCB analysis are subjected to a sulfuric acid clean-up, which will remove many single component organochlorine or organophosphorus pesticides. Therefore, Method 8082 is not applicable to the analysis of such compounds. Instead, use Method 8081. After clean-up, the extract is analyzed by injecting an aliquot into a gas chromatograph with a narrow bore fused silica capillary column and electron capture detector (GC/ECD).

3.0 INTERFERENCES

3.1 Interferences co-extracted from the samples will vary from matrix-to-matrix.

- 3.1.1 Contaminated solvents, reagents, or sample processing hardware.
- 3.1.2 Contaminated GC carrier gas, parts, column surfaces, or detector surfaces.
- 3.1.3 Compounds extracted from the sample matrix to which the detector will respond.
- 3.1.4 Co-elution of target analytes.
- 3.1.5 Clean-up procedures include: Advanced Florisil clean-up, Florisil cartridge clean-up, TBA clean-up (for sulfur interferences: used for either PCBs or pesticides), and sulfuric acid clean-up (only performed for PCBs, never for pesticides).

3.2 Interferences by phthalate esters can pose a major problem in PCB determination. Common flexible plastics contain varying amounts of phthalates. These phthalates are easily extracted or leached from such materials during laboratory operations. For this reason, avoid the use of plastics in the laboratory.

3.3 Cross-contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Glassware must be scrupulously cleaned.

NOTE: Oven-drying of glassware used for PCB analysis can increase contamination because PCBs are readily volatilized in the oven and spread to other glassware. Therefore, exercise caution, and do not dry glassware from samples containing high concentrations of PCBs with glassware that may be used for trace analyses.

3.4 Subtracting blank values from sample results is not permitted.

4.0 SAMPLE PRESERVATION/STORAGE/HOLDING TIME

Sample Matrix	Container	Preservation	Holding Time
Aqueous*	1-Liter amber glass bottle with Teflon-lined screw cap	Cool to 4°C **	CT = Extract within 7 days of collection; analyze extracts within 40 days following extraction MA = Extract within 1 year and 40 days from extraction to analysis. For states following SW846 guidelines = all matrices no holding times stated.
Soils/Sediments	8-16 oz wide-mouthed amber glass jar with Teflon-lined screw cap	Cool to 4°C **	CT = Extract within 14 days of collection; analyze extracts within 40 days following extraction MA = Extract within 1 year and 40 days from extraction to analysis. For states following SW846 guidelines = all matrices no holding times stated.
Concentrated Waste Samples	125-mL wide-mouth glass with Teflon-lined cap	None Required **	CT = Extract within 14 days of collection; analyze extracts within 40 days following extraction MA = Extract within 1 year and 40 days from extraction to analysis. For states following SW846 guidelines = all matrices no holding times stated.
Wipe sample media (gauze pads)	2-8 oz wide-mouthed amber glass jar with Teflon-lined screw cap	Hexane on media prior to sampling	Extract within 14 days of collection; analyze extracts within 40 days following extraction

* For aqueous samples with a chlorine residual, add 1-3 mL 10% sodium thiosulfate to sampling container prior to filling.
**** MCP Data Enhancement**: Store PCB sample extracts at -4°C, protect from sunlight, and store in sealed vials (screw-cap or crimp-cap vials) with un-pierced PTFE-lined septa.

5.0 EQUIPMENT & SUPPLIES

5.1 Capillary column, gas chromatograph with splitless injector, auto injector, ECD and data system.
5.2 Sample containers - amber glass jars, with Teflon-lined screw caps.
5.3 Buchi Syncore Concentrator and glassware
5.4 Ebulator or boiling chips
5.5 Graduated cylinder - 1-Liter, glass
5.6 Volumetric glassware
5.7 Micro syringes
5.8 Pipettes - 1-mL, volumetric, class A
5.9 Vials, 2-mL snap top
5.10 Water bath
5.11 Filter paper: Grade 413, 11cm
5.12 Glass funnels
5.13 Pasteur pipettes
5.14 Florisil sep packs
5.15 Separatory funnel: 2-Liter
5.16 pH paper
5.17 300-mL BOD bottles
5.18 4-mL screw top vials
5.19 60-mL extraction vials
5.20 10-mL N-EVAP concentrator tubes
5.21 Microwave - CEM – w/ temperature program capable of $\pm$ 2.5° C
5.22 Microwave Vessels – Teflon
5.23 Vials, 12-mL amber vials with Teflon lined caps
Note: All glassware must be rinsed at least twice with methylene chloride and twice with Hexane.

6.0 REAGENTS & STANDARDS

6.1 Reagent Water: deionized water
6.2 Methylene Chloride: pesticide quality
6.3 Hexane: pesticide quality
6.4 Isooctane (2,2,4-Trimethyl Pentane): pesticide quality
6.5 Acetone: pesticide quality
6.6 Sodium Sulfate: ACS grade, granular, anhydrous, baked at 400°C for 4 hours
6.7 Glass Wool: pesticide quality
6.8 Nitrogen: Ultra High Purity
6.9 Sulfuric Acid (concentrated): ACS grade
6.10 Hydrogen: Ultra High Purity
6.11 Sodium Thiosulfate: ACS grade, granular
6.12 Stock Standards: Purchased as certified solutions from Ultra Scientific (or equivalent), 100 ug/mL in either methanol or hexane
Aroclor - 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268
6.13 2-Propanol: Pesticide quality or equivalent
6.14 Tetrabutylammonium hydrogen sulfate: sulfite reagent
6.15 Sodium sulfite: pesticide quality
6.16 Working Stock, 1 ug/mL (1000 ppb): add 500 uL of PCB 1260 and PCB 1016 stock solution [Ultra Scientific (or equivalent) 100ug/mL] and 250 uL of Pesticide Surrogate Mix [Restek (or equivalent) 200 ug/mL] to final volume of 50 mLs in isooctane. Prepared fresh for each new curve; expiration = 6 months. Expiration date to be written on vial.

Dilution	Working Stock (mLs)	Isooctane (mLs)	Final Conc. (ug/L)
2x	20	20	500
5x	8	32	200
10x	4	36	100
20x	2	38	50
50x	0.8	39.2	20
100x	0.4	39.6	10
200x	0.2	39.8	5*

*In surrogate curve only

6.17 Soil Spiking Stock, 2000µg/L: add 1mL of 1000µg/mL of Aroclor 1016/1260 Mix, to a final volume of 500mL with acetone. Spiking standards are obtained from a different source than calibration standards.

6.18 Water and Wipe Spiking Stock, 500 µg/L: add 0.25mL of 1000µg/mL of Aroclor 1016/1260 Mix, to a final volume of 500 mL with acetone. Spiking standards are obtained from a different source than calibration standards.

6.19 Surrogate Standard, 2000 ug/L: add 5 mL of Restek (or equivalent) stock (200 ug/mL in Acetone) to a final volume of 500 mL with Acetone.

7.0 SAFETY

See Material Safety Data Sheets (MSDSs) and Con-Test Chemical Hygiene Plan.

PCBs are absorbed through the skin. Exercise extreme caution when working with concentrated solutions or samples containing or suspected to contain PCBs. Nitrile gloves of sufficient thickness to be impervious to PCBs should be used.

If skin contamination occurs the material should be wiped off immediately and the skin washed with soap and water. Water alone is not sufficient. Contaminated clothing should be removed quickly and disposed of as recommended. Organic solvents should NOT be used to wash the skin.

8.0 SAMPLE EXTRACTION

8.1 Microwave Extraction (Soils and Wipes) – Method 3546 (refer to Microwave Method 3546 SOP)

8.2 Soxhlet Extraction (Soils, Wipes, TO-10A) – Method 3540C (refer to Soxhlet Method 3540C SOP)

8.3 Water Extraction Method SW-846 3510C

8.3.1 The pH of all samples is checked with pH paper at the time of log-in. The pH must be between5-9. If the pH is not in the proper range, adjust accordingly with either 1N NaOH or 1:1 H_2SO_4. Record the volume of acid or base used.

8.3.2 To measure the volume of sample, draw a line on the sample container at the meniscus of the sample. Transfer the entire sample to a separatory funnel. Rinse the sample container with the first 60 mL aliquot of methylene chloride and transfer to the separatory funnel. At a later time, place water in the sample container so the meniscus is up to the line drawn. Measure this volume in a graduated cylinder to the nearest 5 mLs and record. If one liter of sample is not available, record amount of sample used and bring up to one liter with DI water.

Note: If sediment covers the entire bottom of the sample container, be sure to decant sample, rinse container with solvent and decant solvent into separatory funnel leaving sediment in sample container.

8.3.3 Add 1.0 mL of 2,4,5,6-Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) at 2000 ug/L surrogate standard to all samples, spikes and blanks.

8.3.4 Add 1 mL of spike standard to all LFBs ("lab spikes") and matrix spikes. True value = 500 ug/L (50 ug/L off of the instrument). 1016/1260 is used per method. Alternate Aroclors may be warranted based on site specific conditions.

8.3.5 Add 60 mLs of methylene chloride to the separatory funnel. Stopper and shake vigorously for 2 minutes with periodic venting to release excess pressure. Allow the organic layer (bottom layer) to separate from the water phase for a minimum of 10 minutes. If an emulsion exists between layers, the analyst must employ mechanical techniques such as swirling, stirring, and centrifugation, to complete phase separation.

8.3.6 Pass the solvent layer through a glass funnel, lined with filter paper containing anhydrous sodium sulfate into a BOD bottle. Repeat extraction two more times using fresh solvent and combine the three solvent extracts. After the third extraction, pass additional methylene chloride through the sodium sulfate (collecting it in the BOD bottle) to rinse it.

8.3.7 Prepare the evaporation cells by rinsing them twice with methylene chloride and twice with Hexane.

8.3.8 Transfer the extracted samples from the BOD bottles into the rinsed evaporation cells. After adding the sample to the cell, rinse the BOD bottle once with methylene chloride and add that rinseate to the sample.

8.4 Buchi Syncore Concentrator

8.4.1 First the vacuum pump, Syncore platform, and chiller must be turned on. To do so flip the green toggle buttons to the “on” position. Next push the green start button next to the screen on the vacuum pump to turn the chiller on.

Note: The Syncore platform should be set to 55°C.

Note: The chiller’s on/off status is indicated by the snowflake symbol on the vacuum pump screen. When the snowflake is back-lit with a black square, the chiller is on.

8.4.2 Check each individual cell on the Syncore platform so that it reflects the correct concentration glassware being used. If 1.0 ml concentration tubes are used then

each cell should have a small orange O-ring at its lowest point. When using 3.0 ml concentration tubes remove the orange O-ring.

Note: Check each individual cell to see if DI water needs to be added to each cell so that the bottom black ring is submerged.

8.4.3 When placing live samples in the Syncore Concentrator, do so one at a time. Remove the sample Id sticker from the glassware before placing the sample in the Syncore Platform. Place the sticker on the sample position grid in order to indicate which sample is in which cell on the Syncore Concentrator.

8.4.4 All samples should have relatively the same volume. Add the appropriate solvent to samples when necessary in order to maintain uniform sample volume.

Note: Maximum sample volume should be below the top heating plate when the Syncore concentrator is running at full speed.

Note: Concentration time will vary based on the program selected and the type of solvent used.

Note: In order to select a desired program select "menu" on the screen attached to the vacuum pump. Scroll down to "programs" and hit the right arrow button. Continue to scroll down to "open" and use the black knob to select the desired program then hit OK.

Finally, check that the word "gradient" is present in the top left box of the vacuum pump screen. If it is not there go to "menu", "mode", then use the black knob to select "gradient and hit OK.

8.4.5 When starting the Syncore Concentrator place the vacuum plate on top of the concentration tubes and secure firmly using the hand screws. Double check that the correct program is selected for the samples being concentrated. Turn the large black RPM control knob on the Syncore platform to 250. Bring samples to the appropriate final volumes, after sample program on Syncore concentrator has finished.

8.4.6 After samples have been concentrated, empty the solvent collection vessels attached to the condenser. Do so as needed and at the end of each shift.

8.5 Sample Extract Clean-Up

8.5.1 An acid clean-up is performed on all PCB samples and their corresponding QC. Never do an acid clean-up on the same sample aliquot that is to be analyzed for pesticides. Pipette approximately 2 mLs of sample extract into a 4-mL screw cap vial that contains about 1 mL of sulfuric acid. Cap the vial and vortex for approximately 30 seconds. Allow the layer to separate then pipette off about 1- mL of sample and transfer to a labeled crimp top vial.

TBA Clean-up

8.5.2 Sulfur is removed by Method 3660B; Tetrabutylammonium (TBA) sulfite reagent. Prepare reagent by dissolving 3.39g Tetrabutylammonium hydrogen sulfate in 100 mL organic-free reagent water. To remove impurities, extract this solution three times with 20 mL portions of hexane. Discard the hexane extracts, and add 25g sodium sulfite to the water solution. Store the resulting solution, which is saturated with sodium sulfite, in an amber bottle with a PTFE-lined screw cap. This solution can be stored at room temperature for at least one month.

8.5.2.1 Transfer 1.0mL of sample extract to a 10mL clear vial with a PTFE-lined screw cap.

8.5.2.2 Add 1.0mL TBA sulfite reagent and 2mL 2-propanol, cap vial, and shake for 1 min. If the sample is colorless or if the initial color is unchanged, and if clear crystals (precipitated sodium sulfite) are observed, sufficient sodium sulfite is present.

8.5.2.3 Add 5mL organic free reagent water and shake for a least 1 min. Allow sample to stand for 5-10 min. Transfer the hexane layer (top) to a 1mL auto sampler vial.

****Florisil Clean-up- Refer to SOP Florsil Clean-Up Method SW-846 3620C****

9.0 PROCEDURE - INSTRUMENT ANALYSIS

9.1 Instrument Set-Up: **HP 6890 (ECD 1 #US10135015)**
HP 6890 (ECD 3 #CN10426061)
HP 7890 (ECD 4 #10715067)
HP 7890 (ECD 5 #10805007)
HP 7890 (ECD 9 #11321159)
HP 7890 (ECD 10 #CN1341002)

Oven

Initial Temp: 125°C Maximum Temp: 330°C
Initial Time: 0.25 min Equilibration time: 0.50min
Ramps:

#	Rate	Final temp	Final time
1	30.00	200	0.00
2	20.00	260	0.00
3	45.00	320	2.00
4	0.0 (off)		

Post temp: 0°C
Post time: 0.00min
Run time: 9.08min

Front Inlet

Initial Temp: 210°C (On)
Pressure: 13.89 psi (On)
Purge flow: 12.5 mL/min
Purge time: 1.00 min
Total Flow: 25.0 mL/min

Gas type: Hydrogen

Column 1
Model Number: RTX-CL Pesticides: 11139
340ºC 30m x 0.32mmID x 0.5um df

Column 2
Model Number: RTX-CL Pesticides 2: 11324
340ºC 30m x 0.32mmID x .25um df

Front Detector	**Back Detector**
Temperature: 320ºC	Temperature: 320ºC
Combined Flow: 60.0 mL/min	Combined Flow: 60.0 mL/min
Make-up Gas Type: Nitrogen	Make-up Gas Type: Nitrogen

10.0 Sample Analysis

Analyze samples by GC along with solvent blanks, calibration standards, method blanks (extracted blanks) and all appropriate quality control samples.

Sample extracts are generally injected by an auto sampler. If an auto sampler stalls, lab analysts will restart the analysis using two blanks and an acceptable continuing calibration verification standard.

All Aroclor standards must be run for pattern recognition before running samples. Patterns are established before any sample analysis at the beginning of a sequence.

Aroclors are identified based on retention time and PCB pattern matching. All samples are analyzed on a confirmation to verify the correct aroclor is identified. Retention times must fall within established windows on both columns.

11.0 CALCULATIONS

$$\text{Soil concentration, mg/Kg} = \frac{\text{ug/L (from instrument) x (final prep volume, L)}}{\text{initial sample weight, g}}$$

$$\text{Water concentration, ug/L} = \frac{\text{ug/L (from instrument) x (final prep volume, L)}}{\text{initial sample volume, L}}$$

Wipe sample concentration, Total ug = ug/L (from instrument) X (final prep volume, L)

$$\text{ug/area} = \frac{\text{Total ug}}{\text{Area Wiped}} \quad \text{ex. ug/100 cm}^2 \text{ or ug/ft}^2$$

12.0 QUALITY CONTROL

12.1 Definitions

For definitions and explanations of quality control measures, refer to the Con-Test Analytical Quality Control Manual.

12.2 Quality Control Measures & Acceptance Criteria

12.2.1 Calibration Curve

A 6-point calibration curve is used to calibrate the system. The curve must contain Aroclors 1016 and 1260. The low standard must be ≤RL. The average response factor over the working range must be ≤20%. or ("r" should be ≥0.99). The curve must be verified with an independent standard (ICV) prior to sample analysis, (100ug/L). All other Aroclors will also be quantitated from a six-point calibration curve.

If a peak is not properly integrated by the data system, manual integration may be necessary. Manual integrations must comply with the Con-Test SOP on Chromatographic Integration Procedures. The integration of the peaks for the samples and quality control samples must be as consistent as possible with the integration used with the initial calibration. All manual integrations must be documented. In particular, the chromatogram must be expanded to clearly show the specific peak being integrated. A “before” integration is printed, showing the software integration, or lack thereof. An “after” integration showing the action taken by the analyst is printed. The analyst initials and dates both records and they are included with the rest of the documentation for that data file.

The method file used by the data system for the initial calibration should be named with a unique identifier for initial calibration. The initial calibration method file includes a “C” as a suffix to denote that it is the original file. When the retention times change for target compounds due to daily instrument maintenance, the original file is copied to (saved as) a new file with the “C” suffix removed. The method file without the “C” suffix indicates that the retention times have been changed from the initial calibration. The original initial calibration method file with the “C” as a suffix must not be changed.

If the initial calibration does not meet the acceptability criteria, it may not be used for quantitative analyses. Investigate the cause of the problem and perform instrument maintenance if necessary. Then repeat the initial calibration.

12.2.2 Retention Time Windows

Retention time windows will be determined by calculating the mean and standard deviation of the absolute retention times of the surrogate compounds and three (minimum) to five major peaks for each Aroclor.

For the Aroclors, each selected peak will be characteristic of that Aroclor, will be at least 25% of the height of the largest Aroclor peak, and will

include at least one peak that is unique to that Aroclor. The retention times used for these calculations should be taken from three injections of the Aroclor standards made over a 72-hour period.

If the standard deviation of the retention times for any peak is 0.000, a default standard deviation of 0.03 minutes may be used. The width of the retention time window for each surrogate and Aroclor peak will be ±3 times the standard deviation of the mean absolute retention time established during the 72-hour period.

12.2.3 Continuing Calibration Check (Calibration Check Standard)

Performed every 12 hours and after no more than 20 samples, and at the end of the analytical sequence. Must be at the mid-point of the curve and contain at least Aroclors 1016 and 1260. For samples run by CT RCP / 8000B protocols, % RSD must be within 15% of the initial calibration. For samples run by MA MCP and 8000C/D protocols % RSD must be $\leq$ 20%. An Aroclor hit in a sample must have calibration verified with a one-point standard of that Aroclor within 12 hours.

The calibration check standard must meet the acceptance criteria before any samples are run. If the calibration check does not meet the acceptance criteria, corrective action is required including instrument maintenance. If the calibration check still fails the acceptance criteria, a new initial calibration is required.

12.2.4 Method Blank

Analyzed on each working day to demonstrate that no contamination is present. The method blank is matrix specific, and extracted with every batch of 20 samples or less. The target compounds and ranges must be $\leq$RL.

12.2.5 Laboratory Control Samples (LCS) / Quality Control Check Samples

Matrix-specific LCS/LCSD's are extracted and analyzed with every batch of 20 samples or less. The concentration should be between the low and mid-level standard, and must contain at least Aroclors 1016 and 1260. Percent recoveries must fall within control limits. Percent recoveries must be 40-140 %R to meet MCP Data Enhancement and RCP criteria. RPD between LCS and LCSD is <20% for waters and <30% for soils.

Water prep:	1 mL of appropriate 500 ppb spike to a final volume of 10 mL. True value = 50 ug/L off of the instrument.
Soil/Solid prep:	Add 1-mL of Spike 2000ppb to 10 grams of sample, to a final volume of 10 mL. True value = 200 ug/Kg = 200µg/L off of the instrument.
Wipe prep:	Add 1-mL of 500 ppb spike to a final volume of 10 mL. True Value = 50 ug/L off the instrument

12.2.6 Matrix Spikes/Matrix Spike Duplicates

A matrix-specific MS/MSD is extracted and analyzed with every batch of 20 samples or less. It must contain at least Aroclors 1016 and 1260. Percent

recoveries must fall within control limits established from historical data. Percent recoveries must be 40-140 %R and MSRPD must be ≤50%

12.2.7 Surrogates

Surrogates are added to all blanks, standards, samples, and spikes. Analyze a minimum of two, one that elutes at the beginning of the run and one that elutes at the end of the run (TCMX and DCB). Percent recoveries must fall within control limits established from historical data. Percent recoveries must be 30-150%R in order to meet MCP Data Enhancement and RCP criteria. If the %R is outside of control limits on both columns for the same surrogate, re-extract the sample. If both surrogates are outside limits on one column only, then report any sample results from column within control criteria. If a surrogate is diluted to a concentration below that of the lowest calibration standard, no corrective action, aside from narration, is necessary.

12.2.8 Confirmation

Confirm any hits on a second dissimilar column; report the higher of the two results, unless obvious interference is present on one of the columns, or there were QC outliers on one of the columns. RPD between primary and confirmatory column should be ≤40%. All QA/QC parameters (e.g. calibrations, LCSs, etc) must be met on the 2° column as well. For samples the higher of the two results is reported unless requested by client or obvious interference is present from one of the columns.

13.0 DATA PROCESSING

13.1 GC files

A file naming convention is used that allows differentiation between updates to the calibration file performed to adjust target retention times for the changes brought about by daily chromatographic maintenance (no file suffix) and updates due to analysis of a new calibration curve (addition of a “C” suffix to the file identifier)

13.1.1 PCBs

13.2 Reporting Package

The reporting package that is delivered to clients will consist of the sample results, the surrogate recovery results and any matrix spikes, blanks, duplicates and lab fortified blanks that pertain to the clients’ samples.

MCP Data Enhancement and RCP projects will include required deliverables plus a case narrative and appropriate checklists.

13.3 Data Filing

13.3.1 Data to be filed in File Boxes labeled as Pest/PCB (date range)

- All raw data

13.3.2 Data to be filed in Laboratory log books

-Records for all types of spike solutions

13.3.3 Backup electronic data filed on DVD

14.0 CORRECTIVE ACTIONS/CONTINGENCIES OF HANDLING OUT-OF-CONTROL DATA

14.1 Refer to Con-Test Quality Assurance Manual.
14.2 Refer to Con-Test Corrective Actions SOP

15.0 POLLUTION PREVENTION

Pollution prevention encompasses any technique that reduces or eliminates the quantity and or eliminates the quantity and or toxicity of waste at the point of generation. Many opportunities for pollution prevention exist in laboratory operation. Whenever feasible, laboratory personal should use pollution prevention techniques to address waste generation. When it is not feasible to reduce wastes at the source, recycling is recommended as the next best option. Standards should be prepared in volumes consistent with laboratory use to minimize the volume of expired standards to be disposed.

16.0 WASTE MANAGEMENT

It is the laboratory's responsibility to comply with all federal, state, and local regulations governing the waste management, particularly the hazardous waste identification rules and land disposal restrictions, and to protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations.

Any PCB containing samples with over 2.0 ppm are labeled and stored separately for disposal. Used standards are accumulated as a lab-pack and sent out to be disposed properly by a waste management company.

17.0 REFERENCES

17.1 EPA, Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, SW- 846, Rev.7, December 2007, Method 8082 ,Method 3545, and Method 3546 Rev 0 February 2007.

17.2 EPA, Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, SW- 846, Rev.1, February 2007, Method 8082A.

17.3 Con-Test Analytical Chemical Hygiene Plan.

17.4 Con-Test Analytical Quality Assurance Manual.

17.5 Syncore Application Guide for Buchi Turbo Vap Concentrator, Version A, January 2012.

17.6 HP 6890 Series Gas Chromatograph Operating Manual, Edition 1, January 1990.

17.7 Agilent Technologies 7890 Series II Gas Chromatography Operating Manual, Online

17.8 Dionex ASE 200, Accelerated Solvent Extractor Operator's Manual, February 1996; Doc # 031149-02.

17.9 MA DEP, MCP Data Enhancement Program, "Quality Control Requirements and Performance Standards for the Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) in Support of Response Actions under the Massachusetts Contingency Plan (MCP)", Rev 1, July 1, 2010.

17.10 Contest document entitled, "Laboratory-Generated Control Limits".

17.11 Con-Test SOP on Procedures for Implementing Corrective Actions

17.12 Con-Test SOP on Chromatographic Integration Procedures

17.13 Con-Test SOP on method 3546.

17.14 Connecticut DEP, Reasonable Confidence Protocol, Method 8082, Ver.2.0 July 2006

17.15 USEPA – "Determinative Chromatographic Separations", SW846, 3rd edition, March 2003, Method 8000C.

17.16 USEPA - – "Determinative Chromatographic Separations", SW846, 2nd edition, December 1996, Method 8000B.

17.17 Con-Test SOP on method 3540C – Soxhlet Extraction

METHOD 3540c
Soxhlet Extraction Procedure for Polychlorinated Biphenyls

Approved: Tod Kopyscinski _____ Katherine F. Allen _____

Tod Kopyscinski
Laboratory Director

Katherine F. Allen
QA Officer

Revision Number: 4

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Change Record

Revision	Date	Responsible Person	Description of Change
Original	3/30/09	F.Derose	Original SOP
1	3/26/2013	Katherine Allen	Updates from annual SOP review: Sec 1.1, 5.3, and 5.4 (addition of fluted filter paper), Sec 2.3 + 5.10 (100 not 500 ml RBF), added sec 2.23 (fluted folding paper), sec 2.9 (deletion of glass wool), sec 2.11+ 6.0(replace sand with sodium sulfate), Sec. 3.0 (updated glassware washing procedure), Sec 5.1 (add 5g for prod/solid and 0.5g for caulking), sec 5.14 (add 12ml vial), sec 5.2 (record lot of NaSO4), deletion of 6.1.5 (LFB) and sec 9.0 (addition of new MCP).
2	03/23/2015	Charles Balicki	Update from annual SOP review: Addition of BUCHI to Sec 2.0, 5.0, and 9.0, and Sec 5.1 (addition of paint).
3	03/15/2017	Katherine Allen	Update from annual Internal audit: Sec 1.4 (20+/-4 hours added), Sec 2.0 (delete Cellulose ext. thimble and Turbovap and add N-EVAP and Dishwasher), Sec 3.0 (ref the Glassware SOP),Sec 3.8 (2:1 hexane:acetone added), Sec 3.9 (dishwasher added), Sec 5.0 (add 1.0ml for spikes, replace water with chiller, add note to put assembly # on bench-sheet, added to cover samples, reworded section, took out cellulose ext. thimble, and remove Turbovap), Sec 5.17.3.1 (add 55c for 55min)
4	1/18/2018	Brianna McLaughlin	Updates from 2017 NY audit: Sec 2.0 (filter paper has lot number which gets documented), Addition of Reagents Section 2.25 and 2.26 as well as note of documentation needed for reagent Section 2.23. Addition of section 5.1.1 (to refer to handling of non-soil samples prior to extraction -shredding of caulk samples).

Distribution/Training List

See Employee Training Record File for signed training statements for trained users.

1.0 SUMMARY OF METHOD

Method 3540C is a procedure for the extraction of organic compounds from soils, clays, sediments, sludge's, PUF's, wipes, and solid wastes. The Soxhlet extraction process ensures intimate contact of the sample matrix with the extraction solvent. This method is restricted to use by or under the supervision of a trained analyst.

1.1 The solid sample is mixed with anhydrous sodium sulfate, placed in fluted filter paper, and extracted using an appropriate solvent in a Soxhlet extractor.
1.2 The appropriate surrogate and or matrix spike is added to the Soxhlet extractor.
1.3 The appropriate solvent system is added to the round bottom flask. 1:1 Hexane/Acetone. (PCB, PEST).
1.4 Attach the flask to the extractor and extract the sample for 20 +/- 4 hours at 4 – 6 cycles/hour.
1.5 Extract is cooled, dried with anhydrous sodium sulfate, rinsed and is then concentrated and as needed, exchanged into a solvent compatible with its method.

2.0 EQUIPMENT & SUPPLIES

2.1 **Cooled Condenser**: AMK 34/45 #EX01A or equivalent

2.2 **Soxhlet Extractor**: AMK 34/45 #EX01B or equivalent

2.3 **125mL Round Bottom Flask:** AMK #EX01C or equivalent

2.4 **Heating Mantle**: Type "VF" laboratory heating mantle or equivalent

2.5 **Heating Mantle Controller**: Glass-Co #PL3122 or equivalent – regulates temperature control of the mantle.

2.6 **Sodium Sulfate**: ACS Grade, Anhydrous (12-60 mesh)

2.7 **Boiling Chips**: Approximately 10/40 mesh or equivalent

2.8 **Analytical balance**: Capable of weighing to 0.1g, 0.01g (product solid), or 0.001g (paint/caulking)

2.9 **Methylene Chloride**: pesticide quality or equivalent

2.10 **Hexane**: pesticide quality or equivalent

2.11 **Acetone**: pesticide quality or equivalent

2.12 **N-evap Concentrator**

2.13 **Buchi Concentrator Tubes**

2.14 **Buchi Syncore Concentrator Unit**

2.15 **Filter paper**: Whatman No. 41 or equivalent with documented lot number on bench sheet

2.18 **Stock Standards**: Purchased as certified solutions from Ultra Scientific ("or equivalent")

2.19 **Gas Tight Syringes**

2.20 **Vials** – 12ml glass vial with screw top, 2ml crimp top, or 4ml screw top vials.

2.21 **Pasteur Pipettes**: 9inches

2.22 **Disposable Pour-Boat Weighing Dish:** VWR Cat:12577-055 or equivalent

2.23 **Folded Smooth Fluted Filter Paper –** 15.0 cm Grade 313 with documented lot number on bench sheet

2.24 **Dishwasher**

2.25 **PCB Free Gauze Wipe-** When Applicable to matrix of samples. Lot number must be documented on bench sheet.

2.26 **PCB Free Caulking-** When applicable to matrix of samples. Lot number must be documented on bench sheet.

3.0 GLASWARE CLEANING (Also refer to Glassware Cleaning SOP)

3.1 Prepare 2-3% soap solution by adding approximately 10 mLs of Liquinox cleaning soap to 500 mL soap dispenser. Bring to volume with deionized water.

3.2 Add a sufficient amount of soap to glassware and scrub three times using a glassware cleaning brush.

*Note: If not cleaning glassware immediately, it is good to fill a basin tub with hot soapy water to let glassware soak in until cleaning.

3.3 Thoroughly rinse three times with tap water. Take care to rinse off any soap remaining on glass surface at this time.

3.4 Rinse three times with deionized water.

3.5 Place glassware in oven and bake at 103°C until dry. (Teflon or plastic equipment is left on Versi-Dry soaker to air dry).

3.6 Carefully remove dried glassware using appropriate oven mitts and let cool to room temperature.

3.7 If glassware is to be used immediately after washing, Acetone may be used to dry glassware. If Acetone is used to dry glassware, allow to dry in hood. **Do not place in oven – Explosion may result.**

3.8 Prior to use for extraction, glassware must be rinsed with methylene chloride two times followed by 2:1 Hexane:Acetone.

3.9 When available, analysts may use dishwasher. The pre-rinsed glassware should be loaded into the dishwasher. Alcojet soap should be added to dispenser and closed. Run dishwasher on a 0ne-hour quick wash setting.

4.0 SAFETY

See Material Safety Data Sheets (MSDSs) and Con-Test Chemical Hygiene Plan.

Protective gear must always be worn when handling glassware and samples.

Polychlorinated biphenyls have been tentatively classified as known or suspected carcinogens. Then analyst must review the Material Safety Data Sheets (MSDS) for PCBs and all reagents used in the procedure before handling them.

5.0 PROCEDURE FOR EXTRACTION OF SOIL

5.1 Weigh out 10g of soil, 2g for product/solid, 0.500 g caulking, 0.200g paint sample into disposable pour-boat weighing dish.

5.1.1 Note: Per method, product/solid/caulking/paint samples must be cut and or shredded prior to extraction.

5.2 Blend in anhydrous sodium sulfate (make sure sample is free-flowing).

5.3 Place sample in fluted filter paper. The extractor must cycle continuously for the duration of the extraction period.

5.4 Add approximetly 100mL of 70:30 mixture of Hexane/Acetone to a 125mL round bottom flask. Add 2-5 boiling chips. Attach a Soxhlet Extractor on top of the round bottom flask; make sure to slightly twist – ensuring a tight connection.

5.5 Transfer the sample label from the weigh boat onto the round bottom flask. Place the corresponding fluted filter paper into the Soxhlet extractor. Check Soxhlet setup for any cracks or chips which may leak solvent or cause samples to burn out.

5.6 Add 1.0mL of surrogate standard to all samples and QC.

5.7 Add 1.0mL of spike to all LFB's (lab spikes) and MS/D (matrix spikes and duplicates).

5.8 Place the round bottom flask with attached Soxhlet extractor onto a heating mantle and clamp into position. Then, attach condenser unit; make sure to slightly twist – ensuring a tight connection. Turn on chiller to cool the condensers. Chiller should reach at least 8-10°C prior to starting extraction. Note extractor and bulb numbers for each sample on the bench-sheet for tracking purposes.

5.9 Turn on corresponding thermostats. The setting is predetermined during each year's cycle verification testing to achieve 4-6 cycles per hour. At this time, double check Soxhlet for any cracks or chips which may leak solvent or burn out.

5.10 The samples should be extracted for a minimum of 16 hours (20 ± 4 hours). Once the sample has finished extracting, turn the heating mantle off and allow samples to cool to room temperature. Once cool, disengage condenser unit and flush the remaining solvent from the Soxhlet extractor by tipping the Soxhlet. Disengage the Soxhlet extractor from the flask and pour remaining solvent into the bulb and put extractor aside. Using a pair of long-handled tweezers, pull the filter out of the Soxhlet and place in a hood for total solvent evaporation. Repeat for all other samples. Be sure to cover samples while sitting waiting to be concentrated.

5.11 Prepare a glass funnel lined with filter paper and fill half way with sodium sulfate. Saturate sodium sulfate with hexane. Pass the extract through the funnel into a clean Buchi tube. Rinse the 125mL Flask with ~10mLs of fresh solvent and pass it through the funnel. Rinse the funnel with hexane.

5.12 **How to Use the Buchi Syncore Concentrator (In reference to 3510, 3546, and 3540c methods)**

5.12.1 **How to prep a Buchi Syncore in order to concentrate samples for waters and soils.**

Note: Prior to concentrating samples, allow the cooling plate to stabilize to its appropriate temperature.

5.12.2 Chiller should read between 8°C and 10°C before using.

5.12.3 Add at least ¼ inch of de-ionized water to each cell in the concentration platform.
Note: Avoid filling a cell so much that excess DI spills out.

5.12.4 Each day fill the cold-water bath that chills the solvent collection vessel. Run coolant line through the cold-water bath and add ice when necessary.

5.12.5 Before starting, check that the secondary containment solvent vessels are empty! **It is extremely important that this be checked throughout the day!!**

Note: It is important that all of the concentration glassware has the same dimensions. Glassware of different heights can adversely affect sample concentration rates in the Buchi.

5.13 Sample Concentration (Soils)

5.13.1 Refer to section 5.12.1 for prepping the Syncore concentrator before working on samples.

5.13.2 Target sample volume after drying through sodium sulfate should be ~50 mL to avoid the sample going above the level of the cooling plate.

5.13.3 Pour the dried sample into a Buchi Concentration tube. Start the Syncore Concentrator using the following programs where applicable:

5.13.3.1 For **3540c**, use program **"SOX 70/30 HEX/ACE" program. Temperature is set to 55ºC for 55 minutes.**

Note:
Immediately upon completion of a given program, adjust rotation to 0, hit stop on the vacuum pump and then hit start again to restart the chiller. If this is not done, five minutes after a program stops, the chiller will automatically turn off. The result of which may be losing the samples that are being concentrated.

5.18 Using a Pasteur pipette and bulb, transfer the sample extract into a 12mL screw top vial. Rinse the Buchi tube with ~1mL hexane and transfer to vial. Repeat two more times. Bring to a final volume of 10mL with Hexane. Vials are either brought directly to an analyst or placed in freezer. The extraction technician will document rack number on

bench-sheet so the analyst knows where to find the extracts. The extraction technician then changes status in Element to prepared.

6.0 QUALITY CONTROL

6.1 Definitions

For definitions and explanations of quality control measures, refer to the Con-Test Analytical Quality Control Manual.

6.1.1 Method Blank

Analyzed on each working day to demonstrate that no contamination is present. The method blank is matrix specific, and extracted with every batch of 20 samples or less. Sodium Sulfate is used for the solid matrix.

6.1.2 Laboratory Control Sample (LCS) (BS) / Quality Control Check Samples

A matrix-specific LCS is analyzed with every batch of 20 samples or less. Prepared from a different stock than that of the calibration curve. The concentration should be between the low and mid-level standard. Sodium Sulfate is used for the solid matrix.

6.1.3 Matrix Spikes/Matrix Spike Duplicates

A matrix-specific MS/MSD pair is analyzed every batch of 20 samples or less.

6.1.4 Matrix duplicates

Analyze a sample duplicate every 20 samples (when enough aliquot is provided) if requested by client.

6.1.5 Surrogates

Surrogates are added to all blanks, standards, samples, and spikes.

7.0 POLLUTION PREVENTION

Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Many opportunities for pollution prevention exist in laboratory operation. EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address waste generation. When it is not feasible to reduce wastes at the source, the Agency recommends recycling as the next best option.

8.0 WASTE MANAGEMENT

It is the laboratory's responsibility to comply with all federal, state, and local regulations governing the waste management, particularly the hazardous waste identification rules and land disposal restrictions, and to protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations.

9.0 REFERENCES

7.1 EPA, Method 3540C "Soxhlet Extraction"

7.2 Con-Test Analytical Chemical Hygiene Plan.

7.3 Con-Test Analytical Quality Assurance Manual.

7.4 Buchi Syncore Concentrator Manual

7.5 MA DEP, MCP Data Enhancement Program, "Quality Assurance and Quality Control Requirements for SW-846 Method 8082, Polychlorinated Biphenyl's (PCBs) by Gas Chromatography (GC) for the Massachusetts Contingency Plan (MCP)", Rev. 3, May 2003.

7.6 Con-Test SOP on Procedures for Implementing Corrective Actions

7.7 CT RCP, RCP Recommended Reasonable Confidence Program, "Quality Assurance and Quality Control Requirements Polychlorinated Biphenyls by Method 8082, SW-846", Version 2, July 2006.

7.8 MA DEP. MCP Data Enhancement Program, "Quality Control Requirements and Performance Standards for the Analysis of PCB's by GC in Support of Response Actions under the MCP", Rev 1, July 1, 2010.

Qualifications & Financial Stability Statement 2013

Con-Test Analytical Laboratory is a full service environmental testing laboratory which performs chemical and microbiological analysis on a wide variety of sample matrices including drinking water, groundwater, surface water, wastewater, soil, sediment, sludge, hazardous waste and air. Thousands of projects have been completed in soil and groundwater contamination, hazardous material classification, landfill monitoring wells, wastewater and stormwater discharge, total constituent analysis, lead based paint, industrial hygiene monitoring, air quality, microbiology, soil gas, vapor intrusion, odor analysis and indoor air quality. The laboratory is skilled and experts at PCBanalysis including soxhlet extractions and homologue/congener analysis.

In business since 1986 and privately owned since 1996, Con-Test is staffed with highly experienced core management individuals and technically competent and experienced laboratory personnel. The laboratory's management team has collectively greater than seventy five years of environmental laboratory experience. The lead analysts and department supervisors have greater than ten years of environmental laboratory experience.

Con-Test provides quality analytical services, balancing response and prompt turnaround with precise and reliable analysis. Con-Test holds certifications in Massachusetts, Connecticut, Rhode Island, New Hampshire, New York, Vermont, Virginia, North Carolina as well as NELAC and NJ (air only), FL (air only) and American Industrial Hygiene Association (AIHA)/ISO 17025 accreditation. In addition, Con-Test is certified by the Commonwealth of Massachusetts as a WBE/DBE and NY WBE, NC WBE and RI WBE/DBE. Con-Test participates in performance evaluation sample programs as well as Proficiency Analytical Testing (PAT) administered by the AIHA and consistently participates in NELAP proficiencies and audits through the State of New York.

The Con-Test Laboratory is an established laboratory which realizes the need for remaining on the cutting edge of environmental technology. Automation of systems to the greatest extent possible is a primary objective of the laboratory. Current applications and systems are continually being expanded and updated whenever possible to achieve unrivaled quality and information turnaround. Con-Test believes that the use of state of the art instrumentation, including data management systems is imperative in maintaining needed efficiency and effectiveness of services. The laboratory is equipped with the latest instrumentation including gas chromatographs (GC), GC Mass Spectra (GC/MS), Lachat Auto Ion Analyzer, Inductively Coupled Plasma-Atomic Emission Spectrometers (ICAP), Atomic Absorption Spectrometers (AAS), Automated Mercury Analyzer, ICP Mass Spectra (ICP/MS) Accelerated Solvent Extractor (ASE), HPLC and a Laboratory Information Management System (LIMS). The air laboratory is similarly equipped with state of the art instrumentation including: Entech Dynamic Dilution System, Air Concentrator and Autosamplers for a high degree of automation and rapid turnaround of data. This instrumentation is crucial to reproducibility, data integrity, multiple sample processing and keeping costs down.

The laboratory's Quality Assurance program ensures accuracy of data from testing methodologies to provide a high level of confidence in test results.

The laboratory has served the environmental industry for over twenty five years. Con-Test Analytical Laboratory currently serves a diverse range of clients in an even broader range of analytical services. Seventy eight percent of this client base are environmental engineers and consultants. Fifty percent of these are located in Massachusetts. Thousands of projects to date have been completed in support of MCP, RCP initiatives. The laboratory is financially solvent and has obtained revenue growth over the last fourteen years.

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

March 20, 2013

LAB ID: 10899
MR. MICHAEL ERICKSON
CON-TEST ENVIRONMENTAL LAB
39 SPRUCE ST
EAST LONGMEADOW, MA 01028

Dear Mr. Erickson:

Your laboratory's scores for the Environmental Laboratory Approval Program (ELAP) Non-Potable Water/Solid &Chemical Materials/Air & Emissions Chemistry Proficiency Test are enclosed.

ELAP validates the fitness for use of each sample/analyte used in it's PT studies. After the study close date samples/analytes are evaluated again for stability in conjunction with historic pass/fail rates. The evaluation procedures used to establish the assigned value are discussed in the ELAP Certification Manual Item 300. Metrological traceability and measurement uncertainty for value assignment is established using a Type B approach as described in the U.S. Guide to the Expression of Uncertainty in Measurement (ANSI/NCSL Z540-2-1997). All analytes were determined to be fit for use as PT materials for this study.

The assigned value is the 'made to' value for the analyte. The mean for scoring is either the predicted mean from the FoPT Tables or the participant consensus mean. The acceptance limits are centered on the mean for scoring and calculated as plus/minus three times the standard deviation or the fixed percentage, as denoted using the % symbol, stated in the report. In some cases, the acceptance limits are manually adjusted to conform with the FoPT table footnotes 4 through 6. In these cases, the standard deviation cannot be used to set the acceptance limits.

From the sample reporting instructions, step 3, provided in the sample shipment package(s); participants are reminded to use the appropriate FoPT PTRLs for "Less Than" reporting of non detects and detections below the PTRL.

The statistical procedures used to establish study means, standard deviations and acceptance limits are described in the ELAP Certification Manual Item 330.

The PT Program does not limit the usage of proficiency test reports by individuals or organizations. The PT Program only distributes PT reports to the participant and any organization selected by the participant for distribution.

Summary statistics by method, as well as, assigned value uncertainties may be requested by contacting the PT Program. Also, please provide us with your feedback on any issues related to the PT Program, including the current study. Direct any comments, requests, feedback, or questions to us at dehspt@health.state.ny.us.

Sincerely,

Dan Dickinson

Daniel Dickinson, PT Program Coordinator
NYS DOH - Wadsworth Center
PO BOX 509, Albany NY 12201-0509
Phone: (518) 473-3383, Fax: (518) 473-8117

WADSWORTH CENTER
NEW YORK STATE DEPARTMENT OF HEALTH

TNI-EL-V3-2009 Proficiency Test Compliant Report

Lab Id: 10899
EPA Lab Code: MA00100

CON-TEST ENVIRONMENTAL LAB
39 SPRUCE ST
EAST LONGMEADOW, MA 01028
(413) 525-2332
Director: MR. MICHAEL ERICKSON

Shipment Date : 15-Jan-2013
Closing Date : 28-Feb-2013
Score Date : 18-Mar-2013

NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Air and Emissions Lead									
Lead, Total	ug/strip	6019	NIOSH 7300		655.	646	65.2	450 - 842	Satisfactory
Analyte Code: 1075					1/29/13	679		*32 passed out of 34 reported results.*	
Sample: Non Potable Water Benzidines									
3,3 -Dichlorobenzidine	ug/L	6015	EPA 625		67.8	68.1	17.7	15.1 - 121	Satisfactory
Analyte Code: 5945					2/16/13	76.2		*42 passed out of 42 reported results.*	
Benzidine	ug/L	6015	EPA 625		874.	520	264	46.0 - 1310	Satisfactory
Analyte Code: 5595					2/16/13	456		*41 passed out of 41 reported results.*	
Sample: Non Potable Water Color									
Color	Color	6056	SM 18-21 2120B (01)		20.0	17.2	3.08	7.94 - 26.4	Satisfactory
Analyte Code: 1605					2/14/13	17.5		*38 passed out of 41 reported results.*	
Sample: Non Potable Water Demand									
Biochemical Oxygen Demand	mg/L	6001	SM 18-21 5210B (01)		58.8	55.5	9.22	27.9 - 83.2	Satisfactory
Analyte Code: 1530					1/30/13	87.7		*108 passed out of 110 reported results.*	
Carbonaceous BOD	mg/L	6001	SM 18-21 5210B (01)		52.2	47.9	8.8	21.4 - 74.3	Satisfactory
Analyte Code: 1555					1/30/13	87.7		*78 passed out of 79 reported results.*	
Chemical Oxygen Demand	mg/L	6001	EPA 410.4 Rev. 2.0		90.3	85.8	6.68	65.8 - 106	Satisfactory
Analyte Code: 1565					1/30/13	89.7		*57 passed out of 58 reported results.*	
Organic Carbon, Total	mg/L	6001	SM 18-21 5310B (00)		34.2	35.2	1.91	29.5 - 41.0	Satisfactory
Analyte Code: 2040					2/8/13	35.4		*37 passed out of 40 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Solid and Hazardous Waste Diesel Range Organics									
Diesel Range Organics	mg/kg	6053	EPA 8015C		1400.	1650	324	678 - 2620	Satisfactory
Analyte Code: 9369					2/11/13	2368		*21 passed out of 22 reported results.*	
Sample: Solid and Hazardous Waste Gasoline Range Organics									
Gasoline Range Organics	mg/kg	6055	EPA 8015C		640.	653	199	95.7 - 1250	Satisfactory
Analyte Code: 9408					1/29/13	957		*19 passed out of 19 reported results.*	
Sample: Non Potable Water Chlorophenoxy Acid Pesticides (Herbicides)									
2,4,5-T	ug/L	6018	EPA 8151A		7.23	6.28	1.81	0.858 - 11.7	Satisfactory
Analyte Code: 8655					2/27/13	8.02		*20 passed out of 21 reported results.*	
2,4-D	ug/L	6018	EPA 8151A		3.09	3.63	1.36	0.47 - 7.70	Satisfactory
Analyte Code: 8545					2/27/13	4.68		*23 passed out of 24 reported results.*	
Dicamba	ug/L	6018	EPA 8151A		7.03	6.5	1.91	0.849 - 12.2	Satisfactory
Analyte Code: 8595					2/27/13	8.49		*16 passed out of 16 reported results.*	
2,4,5-TP (Silvex)	ug/L	6018	EPA 8151A		4.39	4.22	1.17	.70 - 7.74	Satisfactory
Analyte Code: 8650					2/27/13	5.27		*22 passed out of 23 reported results.*	
Sample: Non Potable Water Inorganic Nutrients									
Ammonia (as N)	mg/L	6007	SM 18 4500-NH3 C		14.5	13.9	1.16	10.4 - 17.4	Satisfactory
Analyte Code: 1515					1/28/13	14.0		*88 passed out of 92 reported results.*	
Nitrate (as N)	mg/L	6007	SM 18-21 4500-NO3 F (00)		23.9	23.9	1.71	18.8 - 29.1	Satisfactory
Analyte Code: 1810					1/28/13	24.1		*85 passed out of 86 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Inorganic Nutrients									
Orthophosphate (as P)	mg/L	6007	SM 18-21 4500-P E		1.80	2.01	0.134	1.61 - 2.41	Satisfactory
Analyte Code: 1870					1/29/13	2.00		*71 passed out of 76 reported results.*	
Sample: Non Potable Water Surfactants									
Surfactants (as MBAS)	mg/L	6043	SM 18-21 5540C (00)		0.286	0.306	0.0444	0.173 - 0.439	Satisfactory
Analyte Code: 2025					2/14/13	0.3		*23 passed out of 28 reported results.*	
Sample: Non Potable Water Metals I and II									
Silver, Total	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	219.	221	10.7	189 - 253	Satisfactory
Analyte Code: 1150					1/29/13	221		*90 passed out of 94 reported results.*	
Silver, Total	ug/L	6011A	EPA 200.7 Rev. 4.4		193.	221	10.7	189 - 253	Satisfactory
Analyte Code: 1150					1/29/13	221		*90 passed out of 94 reported results.*	
Aluminum, Total	ug/L	6011A	EPA 200.7 Rev. 4.4		2540.	2540	144	2110 - 2970	Satisfactory
Analyte Code: 1000					1/29/13	2560		*68 passed out of 69 reported results.*	
Arsenic, Total	ug/L	6011A	EPA 200.7 Rev. 4.4		467.	463	25.8	386 - 540	Satisfactory
Analyte Code: 1010					1/30/13	461		*91 passed out of 93 reported results.*	
Arsenic, Total	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	443.	463	25.8	386 - 540	Satisfactory
Analyte Code: 1010					1/29/13	461		*91 passed out of 93 reported results.*	
Barium, Total	ug/L	6011A	EPA 200.7 Rev. 4.4		685.	677	29.4	589 - 766	Satisfactory
Analyte Code: 1015					1/29/13	679		*77 passed out of 79 reported results.*	
Barium, Total	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	672.	677	29.4	589 - 766	Satisfactory
Analyte Code: 1015					1/29/13	679		*77 passed out of 79 reported results.*	

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Shipment Date : 15-Jan-2013
Closing Date : 28-Feb-2013
Score Date : 18-Mar-2013

NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Metals I and II									
Beryllium, Total **Analyte Code: 1020**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	890. 1/30/13	890 899	41.6	765 - 1020 *77 passed out of 79 reported results.*	Satisfactory
Beryllium, Total **Analyte Code: 1020**	ug/L	6011A	EPA 200.7 Rev. 4.4		938. 1/29/13	890 899	41.6	765 - 1020 *77 passed out of 79 reported results.*	Satisfactory
Boron, Total **Analyte Code: 1025**	ug/L	6011A	EPA 200.7 Rev. 4.4		1190. 1/29/13	1250 1260	72.5	1030 - 1470 *34 passed out of 35 reported results.*	Satisfactory
Cadmium, Total **Analyte Code: 1030**	ug/L	6011A	EPA 200.7 Rev. 4.4		367. 1/29/13	378 380	18	324 - 432 *99 passed out of 101 reported results.*	Satisfactory
Cadmium, Total **Analyte Code: 1030**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	364. 1/29/13	378 380	18	324 - 432 *99 passed out of 101 reported results.*	Satisfactory
Cobalt, Total **Analyte Code: 1050**	ug/L	6011A	EPA 200.7 Rev. 4.4		965. 1/29/13	961 961	38.5	846 - 1080 *63 passed out of 66 reported results.*	Satisfactory
Cobalt, Total **Analyte Code: 1050**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	934. 1/29/13	961 961	38.5	846 - 1080 *63 passed out of 66 reported results.*	Satisfactory
Chromium, Total **Analyte Code: 1040**	ug/L	6011A	EPA 200.7 Rev. 4.4		177. 1/29/13	180 180	8.36	155 - 205 *88 passed out of 91 reported results.*	Satisfactory
Chromium, Total **Analyte Code: 1040**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	178. 1/29/13	180 180	8.36	155 - 205 *88 passed out of 91 reported results.*	Satisfactory
Copper, Total **Analyte Code: 1055**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	463. 1/29/13	481 480	15.4	432 - 528 *88 passed out of 96 reported results.*	Satisfactory
Copper, Total **Analyte Code: 1055**	ug/L	6011A	EPA 200.7 Rev. 4.4		477. 1/29/13	481 480	15.4	432 - 528 *88 passed out of 96 reported results.*	Satisfactory
Iron, Total **Analyte Code: 1070**	ug/L	6011A	EPA 200.7 Rev. 4.4		437. 1/29/13	424 420	18.4	368 - 479 *60 passed out of 65 reported results.*	Satisfactory

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TNI-EL-V3-2009 Proficiency Test Compliant Report

Lab Id: 10899
EPA Lab Code: MA00100

CON-TEST ENVIRONMENTAL LAB
39 SPRUCE ST
EAST LONGMEADOW, MA 01028
(413) 525-2332
Director: MR. MICHAEL ERICKSON

Shipment Date : 15-Jan-2013
Closing Date : 28-Feb-2013
Score Date : 18-Mar-2013

NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Metals I and II									
Manganese, Total **Analyte Code: 1090**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	2660. 1/29/13	2570 2560	90.2	2300 - 2840 *74 passed out of 79 reported results.*	Satisfactory
Manganese, Total **Analyte Code: 1090**	ug/L	6011A	EPA 200.7 Rev. 4.4		2620. 1/29/13	2570 2560	90.2	2300 - 2840 *74 passed out of 79 reported results.*	Satisfactory
Nickel, Total **Analyte Code: 1105**	ug/L	6011A	EPA 200.7 Rev. 4.4		2940. 1/29/13	2960 2930	99.6	2640 - 3260 *91 passed out of 93 reported results.*	Satisfactory
Nickel, Total **Analyte Code: 1105**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	2870. 1/29/13	2960 2930	99.6	2640 - 3260 *91 passed out of 93 reported results.*	Satisfactory
Lead, Total **Analyte Code: 1075**	ug/L	6011A	EPA 200.7 Rev. 4.4		241. 1/29/13	240 240	11.6	205 - 274 *101 passed out of 106 reported results.*	Satisfactory
Lead, Total **Analyte Code: 1075**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	237. 1/29/13	240 240	11.6	205 - 274 *101 passed out of 106 reported results.*	Satisfactory
Antimony, Total **Analyte Code: 1005**	ug/L	6011A	EPA 200.7 Rev. 4.4		945. 1/29/13	842 882	71.9	626 - 1060 *78 passed out of 81 reported results.*	Satisfactory
Antimony, Total **Analyte Code: 1005**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	862. 1/29/13	842 882	71.9	626 - 1060 *78 passed out of 81 reported results.*	Satisfactory
Selenium, Total **Analyte Code: 1140**	ug/L	6011A	EPA 200.7 Rev. 4.4		778. 1/29/13	762 781	47.4	620 - 904 *87 passed out of 88 reported results.*	Satisfactory
Selenium, Total **Analyte Code: 1140**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	790. 1/29/13	762 781	47.4	620 - 904 *87 passed out of 88 reported results.*	Satisfactory
Thallium, Total **Analyte Code: 1165**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	229. 1/29/13	227 229	20	167 - 287 *76 passed out of 77 reported results.*	Satisfactory
Thallium, Total **Analyte Code: 1165**	ug/L	6011A	EPA 200.7 Rev. 4.4		226. 1/29/13	227 229	20	167 - 287 *76 passed out of 77 reported results.*	Satisfactory

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Metals I and II									
Vanadium, Total **Analyte Code: 1185**	ug/L	6011A	EPA 200.7 Rev. 4.4		1880. 1/29/13	1870 1880	75.4	1650 - 2100 *62 passed out of 65 reported results.*	Satisfactory
Vanadium, Total **Analyte Code: 1185**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	1940. 1/29/13	1870 1880	75.4	1650 - 2100 *62 passed out of 65 reported results.*	Satisfactory
Zinc, Total **Analyte Code: 1190**	ug/L	6011A	EPA 200.8 Rev. 5.4	EPA 3005A	585. 1/29/13	564 561	27.6	481 - 647 *89 passed out of 93 reported results.*	Satisfactory
Zinc, Total **Analyte Code: 1190**	ug/L	6011A	EPA 200.7 Rev. 4.4		557. 1/29/13	564 561	27.6	481 - 647 *89 passed out of 93 reported results.*	Satisfactory
Sample: Non Potable Water Metals III									
Mercury, Total **Analyte Code: 1095**	ug/L	6011B	EPA 245.1 Rev. 3.0		22.3 2/4/13	21.6 22.0	2.69	13.5 - 29.7 *63 passed out of 64 reported results.*	Satisfactory
Molybdenum, Total **Analyte Code: 1100**	ug/L	6011B	EPA 200.8 Rev. 5.4	EPA 3005A	539. 2/4/13	536 539	26.1	458 - 615 *65 passed out of 69 reported results.*	Satisfactory
Molybdenum, Total **Analyte Code: 1100**	ug/L	6011B	EPA 200.7 Rev. 4.4		550. 2/5/13	536 539	26.1	458 - 615 *65 passed out of 69 reported results.*	Satisfactory
Tin, Total **Analyte Code: 1175**	ug/L	6011B	EPA 200.7 Rev. 4.4		3040. 2/4/13	2730 2720	194	2140 - 3310 *33 passed out of 34 reported results.*	Satisfactory
Titanium, Total **Analyte Code: 1180**	ug/L	6011B	EPA 200.7 Rev. 4.4		317. 2/4/13	298 300	13.2	258 - 337 *27 passed out of 28 reported results.*	Satisfactory

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Minerals									
Chloride	mg/L	6008	SM 18-21 4500-Cl- B (97)		59.8	57.9	2.95	49.1 - 66.8	Satisfactory
Analyte Code: 1575					1/25/13	57.7		*85 passed out of 87 reported results.*	
Sulfate (as SO4)	mg/L	6008	ASTM D516-90 02 & 07		83.9	105	5.46	88.1 - 121	**Unsatisfactory <==**
Analyte Code: 2000					1/23/13	106		*63 passed out of 66 reported results.*	
Sample: Non Potable Water Minerals II									
Calcium, Total	mg/L	6037	EPA 200.7 Rev. 4.4		44.7	46.6	1.87	41.0 - 52.2	Satisfactory
Analyte Code: 1035					1/29/13	46.0		*53 passed out of 57 reported results.*	
Calcium Hardness as CaCO3	mg/L	6037	EPA 200.7 Rev. 4.4		110.	117	4.67	103 - 131	Satisfactory
Analyte Code: 1550					1/29/13	115		*33 passed out of 36 reported results.*	
Potassium, Total	mg/L	6037	EPA 200.7 Rev. 4.4		29.6	30.1	1.81	24.6 - 35.5	Satisfactory
Analyte Code: 1125					1/30/13	29.8		*53 passed out of 55 reported results.*	
Magnesium, Total	mg/L	6037	EPA 200.7 Rev. 4.4		26.0	28.3	1.37	24.2 - 32.4	Satisfactory
Analyte Code: 1085					1/29/13	28.2		*56 passed out of 58 reported results.*	
Sodium, Total	mg/L	6037	EPA 200.7 Rev. 4.4		63.1	66.8	3.32	56.8 - 76.7	Satisfactory
Analyte Code: 1155					1/29/13	66.9		*50 passed out of 58 reported results.*	
Hardness, Total (CaCO3)	mg/L	6037	SM 18-21 2340C (97)		228.	226	8.12	202 - 264	Satisfactory
Analyte Code: 1755					1/22/13	231		*54 passed out of 58 reported results.*	
Sample: Non Potable Water Nitrite									
Nitrite as N	mg/L	6041	SM 18-21 4500-NO2 B (00)		2.84	3.13	0.157	2.66 - 3.60	Satisfactory
Analyte Code: 1840					1/23/13	3.13		*74 passed out of 79 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Nitrosamines									
N-Nitrosodimethylamine	ug/L	6014	EPA 625		78.9	79.5	31.3	15.0 - 174	Satisfactory
Analyte Code: 6530					2/16/13	148		*36 passed out of 36 reported results.*	
N-Nitrosodiphenylamine	ug/L	6014	EPA 625		241.	148	34.4	44.7 - 251	Satisfactory
Analyte Code: 6535					2/16/13	188		*41 passed out of 41 reported results.*	
N-Nitrosodi-n-propylamine	ug/L	6014	EPA 625		68.8	52.5	11.7	17.5 - 87.5	Satisfactory
Analyte Code: 6545					2/16/13	65.7		*42 passed out of 42 reported results.*	
Sample: Non Potable Water Acid extractables									
2,4,5-Trichlorophenol	ug/L	6035	EPA 625		70.6	61.5	11.5	27.2 - 95.9	Satisfactory
Analyte Code: 6835					2/16/13	73.2		*41 passed out of 41 reported results.*	
2,4,6-Trichlorophenol	ug/L	6035	EPA 625		60.4	50.3	10.1	19.9 - 80.7	Satisfactory
Analyte Code: 6840					2/16/13	62.3		*44 passed out of 44 reported results.*	
2,4-Dichlorophenol	ug/L	6035	EPA 625		119.	101	19.6	42.3 - 160	Satisfactory
Analyte Code: 6000					2/16/13	130		*44 passed out of 44 reported results.*	
2,4-Dimethylphenol	ug/L	6035	EPA 625		177.	140	32.9	41.5 - 239	Satisfactory
Analyte Code: 6130					2/16/13	183		*44 passed out of 44 reported results.*	
2,4-Dinitrophenol	ug/L	6035	EPA 625		< 10.0				Satisfactory
Analyte Code: 6175					2/16/13	< 10.0		*39 passed out of 44 reported results.*	
2-Chlorophenol	ug/L	6035	EPA 625		106.	109	22.8	40.1 - 177	Satisfactory
Analyte Code: 5800					2/16/13	141		*44 passed out of 44 reported results.*	
2-Methyl-4,6-dinitrophenol	ug/L	6035	EPA 625		132.	152	30.2	61.2 - 242	Satisfactory
Analyte Code: 6360					2/16/13	169		*43 passed out of 43 reported results.*	
2-Nitrophenol	ug/L	6035	EPA 625		98.2	82.7	18.7	26.6 - 139	Satisfactory
Analyte Code: 6490					2/16/13	107		*44 passed out of 44 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Acid extractables									
4-Chloro-3-methylphenol	ug/L	6035	EPA 625		78.7	68.4	12.4	31.3 - 105	Satisfactory
Analyte Code: 5700					2/16/13	82.0		*44 passed out of 44 reported results.*	
4-Nitrophenol	ug/L	6035	EPA 625		76.6	84.0	40.1	15.2 - 204	Satisfactory
Analyte Code: 6500					2/16/13	152		*42 passed out of 43 reported results.*	
Phenol	ug/L	6035	EPA 625		61.4	111	51.4	20.0 - 266	Satisfactory
Analyte Code: 6625					2/16/13	199		*44 passed out of 44 reported results.*	
Pentachlorophenol	ug/L	6035	EPA 625		88.3	79.2	18.3	24.4 - 134	Satisfactory
Analyte Code: 6605					2/16/13	97.0		*42 passed out of 44 reported results.*	
Sample: Non Potable Water Total Alkalinity									
Alkalinity	mg/L	6006	SM 18-21 2320B (97)		23.0	23.6	1.7	18.5 - 28.7	Satisfactory
Analyte Code: 1505					1/24/13	22.8		*63 passed out of 64 reported results.*	
Sample: Non Potable Water Base/Neutrals									
1,2,4-Trichlorobenzene	ug/L	6036	EPA 625		75.7	71.4	16.4	22.1 - 121	Satisfactory
Analyte Code: 5155					2/16/13	101		*43 passed out of 43 reported results.*	
2,4-Dinitrotoluene	ug/L	6036	EPA 625		123.	112	19.7	52.8 - 171	Satisfactory
Analyte Code: 6185					2/16/13	140		*41 passed out of 42 reported results.*	
2,6-Dinitrotoluene	ug/L	6036	EPA 625		< 6.70				Satisfactory
Analyte Code: 6190					2/16/13	< 6.7		*31 passed out of 42 reported results.*	
2-Chloronaphthalene	ug/L	6036	EPA 625		139.	135	26.6	55.4 - 215	Satisfactory
Analyte Code: 5795					2/16/13	179		*44 passed out of 44 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Base/Neutrals									
4-Chlorophenylphenyl ether	ug/L	6036	EPA 625		39.6	34.6	6.24	15.9 - 53.3	Satisfactory
Analyte Code: 5825					2/16/13	41.2		*39 passed out of 42 reported results.*	
2-Methylnaphthalene	ug/L	6036	EPA 8270D		91.2	80.6	18.8	24.2 - 137	Satisfactory
Analyte Code: 6385					2/16/13	120		*25 passed out of 26 reported results.*	
4-Bromophenylphenyl ether	ug/L	6036	EPA 625		72.7	61.3	12.3	24.4 - 98.3	Satisfactory
Analyte Code: 5660					2/16/13	72.8		*41 passed out of 42 reported results.*	
Acenaphthene	ug/L	6036	EPA 625		< 5.60				Satisfactory
Analyte Code: 5500					2/16/13	< 5.6		*33 passed out of 43 reported results.*	
Anthracene	ug/L	6036	EPA 625		137.	128	21.1	64.9 - 192	Satisfactory
Analyte Code: 5555					2/16/13	155		*43 passed out of 43 reported results.*	
Acenaphthylene	ug/L	6036	EPA 625		56.8	52.4	9.02	25.3 - 79.4	Satisfactory
Analyte Code: 5505					2/16/13	64.7		*42 passed out of 43 reported results.*	
Bis(2-chloroethyl)ether	ug/L	6036	EPA 625		136.	128	27.4	46.0 - 211	Satisfactory
Analyte Code: 5765					2/16/13	175		*42 passed out of 42 reported results.*	
Bis(2-chloroethoxy)methane	ug/L	6036	EPA 625		162.	142	23.5	71.4 - 212	Satisfactory
Analyte Code: 5760					2/16/13	180		*42 passed out of 42 reported results.*	
Bis(2-chloroisopropyl)ether	ug/L	6036	EPA 625		< 9.60				Satisfactory
Analyte Code: 5780					2/16/13	< 9.6		*31 passed out of 42 reported results.*	
Bis(2-ethylhexyl)phthalate	ug/L	6036	EPA 625		26.7	24.7	5.44	8.41 - 41.0	Satisfactory
Analyte Code: 6065					2/16/13	26.1		*44 passed out of 44 reported results.*	
Benzo(a)anthracene	ug/L	6036	EPA 625		< 3.90				Satisfactory
Analyte Code: 5575					2/16/13	< 3.9		*26 passed out of 43 reported results.*	
Benzo(a)pyrene	ug/L	6036	EPA 625		65.9	57.0	11.8	21.6 - 92.4	Satisfactory
Analyte Code: 5580					2/16/13	72.6		*43 passed out of 43 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Base/Neutrals									
Benzo(b)fluoranthene	ug/L	6036	EPA 625		74.6	67.1	12.6	29.4 - 105	Satisfactory
Analyte Code: 5585					2/16/13	78.1		*43 passed out of 43 reported results.*	
Benzo(g,h,i)perylene	ug/L	6036	EPA 625		113.	91.1	16.7	41.2 - 141	Satisfactory
Analyte Code: 5590					2/16/13	105		*42 passed out of 43 reported results.*	
Benzo(k)fluoranthene	ug/L	6036	EPA 625		109.	95.7	22.4	28.7 - 163	Satisfactory
Analyte Code: 5600					2/16/13	114		*43 passed out of 43 reported results.*	
Benzyl butyl phthalate	ug/L	6036	EPA 625		79.3	75.7	19.9	16.0 - 135	Satisfactory
Analyte Code: 5670					2/16/13	93.8		*44 passed out of 44 reported results.*	
Chrysene	ug/L	6036	EPA 625		< 5.20				Satisfactory
Analyte Code: 5855					2/16/13	< 5.2		*33 passed out of 43 reported results.*	
Dibenzo(a,h)anthracene	ug/L	6036	EPA 625		< 4.90				Satisfactory
Analyte Code: 5895					2/16/13	< 4.9		*25 passed out of 43 reported results.*	
Di-n-butyl phthalate	ug/L	6036	EPA 625		< 14.0				Satisfactory
Analyte Code: 5925					2/16/13	< 14.0		*43 passed out of 44 reported results.*	
Dibenzofuran	ug/L	6036	EPA 8270D		< 11.0				Satisfactory
Analyte Code: 5905					2/16/13	< 11.0		*26 passed out of 26 reported results.*	
Diethyl phthalate	ug/L	6036	EPA 625		65.5	71.2	18.4	16.1 - 126	Satisfactory
Analyte Code: 6070					2/16/13	90.6		*44 passed out of 44 reported results.*	
Dimethyl phthalate	ug/L	6036	EPA 625		< 10.0				Satisfactory
Analyte Code: 6135					2/16/13	< 10.0		*44 passed out of 44 reported results.*	
Di-n-octyl phthalate	ug/L	6036	EPA 625		< 14.0				Satisfactory
Analyte Code: 6200					2/16/13	< 14.0		*44 passed out of 44 reported results.*	
Fluoranthene	ug/L	6036	EPA 625		< 14.0				Satisfactory
Analyte Code: 6265					2/16/13	< 14.0		*43 passed out of 43 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Base/Neutrals									
Fluorene	ug/L	6036	EPA 625		131.	108	16.3	59.2 - 157	Satisfactory
Analyte Code: 6270					2/16/13	134		*41 passed out of 42 reported results.*	
Hexachlorobenzene	ug/L	6036	EPA 625		94.5	80.9	12.9	42.3 - 119	Satisfactory
Analyte Code: 6275					2/16/13	97.3		*47 passed out of 47 reported results.*	
Hexachlorobutadiene	ug/L	6036	EPA 625		69.7	66.1	18.2	11.5 - 121	Satisfactory
Analyte Code: 4835					2/16/13	101		*44 passed out of 44 reported results.*	
Hexachloroethane	ug/L	6036	EPA 625		108.	114	31.7	18.8 - 209	Satisfactory
Analyte Code: 4840					2/16/13	180		*43 passed out of 43 reported results.*	
Hexachlorocyclopentadiene	ug/L	6036	EPA 625		73.9	88.8	35.1	15.0 - 194	Satisfactory
Analyte Code: 6285					2/16/13	150		*44 passed out of 44 reported results.*	
Indeno(1,2,3-c,d)pyrene	ug/L	6036	EPA 625		98.9	58.2	12.7	20.0 - 96.4	**Unsatisfactory <==**
Analyte Code: 6315					2/16/13	74.6		*41 passed out of 43 reported results.*	
Isophorone	ug/L	6036	EPA 625		< 13.0				Satisfactory
Analyte Code: 6320					2/16/13	< 13.0		*41 passed out of 42 reported results.*	
Naphthalene	ug/L	6036	EPA 625		< 10.0				Satisfactory
Analyte Code: 5005					2/16/13	< 10.0		*42 passed out of 43 reported results.*	
Nitrobenzene	ug/L	6036	EPA 625		96.5	88.5	17.4	36.1 - 141	Satisfactory
Analyte Code: 5015					2/16/13	116		*41 passed out of 42 reported results.*	
Phenanthrene	ug/L	6036	EPA 625		< 15.0				Satisfactory
Analyte Code: 6615					2/16/13	< 15.0		*41 passed out of 43 reported results.*	
Pyrene	ug/L	6036	EPA 625		40.5	34.8	7.37	12.7 - 56.9	Satisfactory
Analyte Code: 6665					2/16/13	39.2		*43 passed out of 43 reported results.*	
1,2-Dichlorobenzene	ug/L	6036	EPA 8270D		83.7	81.9	22	15.8 - 148	Satisfactory
Analyte Code: 4610					2/16/13	125		*29 passed out of 29 reported results.*	

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CON-TEST ENVIRONMENTAL LAB
39 SPRUCE ST
EAST LONGMEADOW, MA 01028
(413) 525-2332
Director: MR. MICHAEL ERICKSON

Shipment Date : 15-Jan-2013
Closing Date : 28-Feb-2013
Score Date : 18-Mar-2013

NYSDOH Wadsworth Center is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Base/Neutrals									
1,3 Dichlorobenzene	ug/L	6036	EPA 8270D		< 4.50				Satisfactory
Analyte Code: 4615					2/16/13	< 4.5		*16 passed out of 29 reported results.*	
1,4-Dichlorobenzene	ug/L	6036	EPA 8270D		46.4	46.3	13.5	7.08 - 86.6	Satisfactory
Analyte Code: 4620					2/16/13	70.8		*29 passed out of 29 reported results.*	
Sample: Non Potable Water Chlordane									
Chlordane Total	ug/L	6016	EPA 608		11.7	12.0	2.35	4.95 - 19.1	Satisfactory
Analyte Code: 7250					2/14/13	13.2		*40 passed out of 41 reported results.*	
Sample: Non Potable Water Total Cyanide									
Cyanide, Total	mg/L	6012	SM 18-21 4500-CN E (99)		0.479	0.564	0.0753	0.338 - 0.79	Satisfactory
Analyte Code: 1645					1/30/13	0.563		*62 passed out of 63 reported results.*	
Sample: Non Potable Water Chromium VI									
Chromium VI	ug/L	6032	SM 18-19 3500-Cr D		736.	765	45.7	628 - 902	Satisfactory
Analyte Code: 1045					2/1/13	768		*44 passed out of 49 reported results.*	
Sample: Non Potable Water DRO									
Diesel Range Organics (DRO)	ug/L	6062	EPA 8015C	EPA 3510C	3100.	3140	685	1080 - 5190	Satisfactory
Analyte Code: 9369					1/29/13	4152		*10 passed out of 10 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water GRO									
Gasline Range Organics (GRO)	ug/L	6061	EPA 8015C		2860.	3800	806	1380 - 6220	Satisfactory
Analyte Code: 9408					1/29/13	3566		*11 passed out of 11 reported results.*	
Sample: Non Potable Water Low Level PAHs									
Acenaphthlene	ug/L	6048	EPA 8270C SIM		13.3	11.9	2.26	5.15 - 18.7	Satisfactory
Analyte Code: 5500					2/4/13	15.5		*10 passed out of 10 reported results.*	
Acenaphthylene	ug/L	6048	EPA 8270C SIM		15.6	13.9	2.06	7.68 - 20.1	Satisfactory
Analyte Code: 5505					2/4/13	17.6		*10 passed out of 10 reported results.*	
Anthracene	ug/L	6048	EPA 8270C SIM		4.37	4.01	0.85	1.46 - 6.55	Satisfactory
Analyte Code: 5555					2/4/13	4.89		*10 passed out of 10 reported results.*	
Benzo(a)anthracene	ug/L	6048	EPA 8270C SIM		3.74	3.64	0.296	2.76 - 4.53	Satisfactory
Analyte Code: 5575					2/4/13	4.07		*11 passed out of 11 reported results.*	
Benzo(a)pyrene	ug/L	6048	EPA 8270C SIM		2.38	2.15	0.337	1.14 - 3.16	Satisfactory
Analyte Code: 5580					2/4/13	2.67		*11 passed out of 11 reported results.*	
Benzo(b)fluoranthene	ug/L	6048	EPA 8270C SIM		2.65	2.46	0.356	1.39 - 3.53	Satisfactory
Analyte Code: 5585					2/4/13	2.93		*11 passed out of 11 reported results.*	
Benzo(g,h,i)perylene	ug/L	6048	EPA 8270C SIM		2.28	2.09	0.44	0.773 - 3.42	Satisfactory
Analyte Code: 5590					2/4/13	2.63		*10 passed out of 10 reported results.*	
Benzo(k)fluoranthene	ug/L	6048	EPA 8270C SIM		3.32	3.47	0.495	1.99 - 4.96	Satisfactory
Analyte Code: 5600					2/4/13	3.89		*11 passed out of 11 reported results.*	
Chrysene	ug/L	6048	EPA 8270C SIM		1.35	1.38	0.185	0.827 - 1.93	Satisfactory
Analyte Code: 5855					2/4/13	1.54		*10 passed out of 10 reported results.*	
Dibenzo(a,h)anthracene	ug/L	6048	EPA 8270C SIM		1.49	1.45	0.293	0.57 - 2.33	Satisfactory
Analyte Code: 5895					2/4/13	1.75		*11 passed out of 11 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Low Level PAHs									
Fluoranthene	ug/L	6048	EPA 8270C SIM		3.65	3.58	0.454	2.21 - 4.94	Satisfactory
Analyte Code: 6265					2/4/13	4.15		*10 passed out of 10 reported results.*	
Fluorene	ug/L	6048	EPA 8270C SIM		1.87	1.78	0.317	0.827 - 2.73	Satisfactory
Analyte Code: 6270					2/4/13	2.2		*10 passed out of 10 reported results.*	
Indeno(1,2,3-cd)pyrene	ug/L	6048	EPA 8270C SIM		2.64	2.47	0.412	1.24 - 3.71	Satisfactory
Analyte Code: 6315					2/4/13	2.93		*11 passed out of 11 reported results.*	
Naphthalene	ug/L	6048	EPA 8270C SIM		2.94	3.02	0.583	1.27 - 4.77	Satisfactory
Analyte Code: 5005					2/4/13	4.02		*10 passed out of 10 reported results.*	
Phenanthene	ug/L	6048	EPA 8270C SIM		3.30	3.38	0.454	2.01 - 4.74	Satisfactory
Analyte Code: 6615					2/4/13	4.02		*10 passed out of 10 reported results.*	
Pyrene	ug/L	6048	EPA 8270C SIM		2.58	2.48	0.304	1.57 - 3.39	Satisfactory
Analyte Code: 6665					2/4/13	2.88		*10 passed out of 10 reported results.*	
Sample: Non Potable Water Toxaphene									
Toxaphene	ug/L	6033	EPA 608		29.7	28.0	10.5	3.30 - 59.4	Satisfactory
Analyte Code: 8250					2/15/13	32.8		*41 passed out of 41 reported results.*	
Sample: Non Potable Water Oil and Grease									
Oil and Grease Total Recoverable	mg/L	6010	EPA 1664A		67.7	64.7	5.86	47.2 - 82.3	Satisfactory
Analyte Code: 1860					2/6/13	69.3		*51 passed out of 53 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Organic Nutrients									
Kjeldahl Nitrogen, Total	mg/L	6004	SM 19-21 4500 NH3-C (97)	SM 18-21 4500-N Org B or C (97)	16.2	16.6	1.78	11.2 - 21.9	Satisfactory
Analyte Code: 1795					1/29/13	17.0		*60 passed out of 64 reported results.*	
Phosphorus, Total	mg/L	6004	SM 18-21 4500-P E		3.44	3.13	0.203	2.52 - 3.74	Satisfactory
Analyte Code: 1910					1/31/13	3.1		*87 passed out of 88 reported results.*	
Sample: Solid and Hazardous Waste Lead in Paint									
Lead in Paint	%	6021	EPA 6010C	EPA 3050B	5.22	5.21	0.292	4.13% - 6.09%	Satisfactory
Analyte Code:					1/30/13	4.59		*50 passed out of 54 reported results.*	
Sample: Non Potable Water Polychlorinated Biphenyls									
PCB-1016	ug/L	6038	EPA 608		< 1.40				Satisfactory
Analyte Code: 8880					2/14/13	< 1.4		*46 passed out of 47 reported results.*	
PCB-1221	ug/L	6038	EPA 608		9.49	9.46	2.45	2.11 - 16.8	Satisfactory
Analyte Code: 8885					2/14/13	11.7		*45 passed out of 47 reported results.*	
PCB-1232	ug/L	6038	EPA 608		< 0.61				Satisfactory
Analyte Code: 8890					2/14/13	< 0.61		*40 passed out of 47 reported results.*	
PCB-1242	ug/L	6038	EPA 608		< 1.40				Satisfactory
Analyte Code: 8895					2/14/13	< 1.4		*45 passed out of 47 reported results.*	
PCB-1248	ug/L	6038	EPA 608		< 0.60				Satisfactory
Analyte Code: 8900					2/14/13	< 0.6		*42 passed out of 48 reported results.*	
PCB-1254	ug/L	6038	EPA 608		< 0.64				Satisfactory
Analyte Code: 8905					2/14/13	< 0.64		*41 passed out of 47 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Polychlorinated Biphenyls									
PCB-1260	ug/L	6038	EPA 608		< 0.62				Satisfactory
Analyte Code: 8910					2/14/13	< 0.62		*41 passed out of 47 reported results.*	
Sample: Non Potable Water Chlorinated Hydrocarbon Pesticides									
4,4-DDD	ug/L	6017	EPA 608		6.58	6.27	1.23	2.57 - 9.97	Satisfactory
Analyte Code: 7355					2/15/13	6.99		*41 passed out of 41 reported results.*	
4,4-DDE	ug/L	6017	EPA 608		6.55	5.93	0.966	3.03 - 8.82	Satisfactory
Analyte Code: 7360					2/15/13	6.82		*41 passed out of 42 reported results.*	
4,4-DDT	ug/L	6017	EPA 608		< 0.38				Satisfactory
Analyte Code: 7365					2/15/13	< 0.38		*37 passed out of 41 reported results.*	
alpha-BHC	ug/L	6017	EPA 608		12.5	12.6	2.07	6.41 - 18.8	Satisfactory
Analyte Code: 7110					2/15/13	14.0		*40 passed out of 41 reported results.*	
Aldrin	ug/L	6017	EPA 608		12.7	11.4	2.52	3.86 - 19.0	Satisfactory
Analyte Code: 7025					2/15/13	13.8		*41 passed out of 41 reported results.*	
beta-BHC	ug/L	6017	EPA 608		11.5	11.5	2.02	5.49 - 17.6	Satisfactory
Analyte Code: 7115					2/15/13	13.1		*41 passed out of 41 reported results.*	
delta-BHC	ug/L	6017	EPA 608		4.38	5.16	1.01	2.13 - 8.19	Satisfactory
Analyte Code: 7105					2/15/13	5.86		*40 passed out of 40 reported results.*	
Dieldrin	ug/L	6017	EPA 608		8.35	7.93	1.24	4.20 - 11.6	Satisfactory
Analyte Code: 7470					2/15/13	8.57		*41 passed out of 41 reported results.*	
Endrin aldehyde	ug/L	6017	EPA 608		< 0.93				Satisfactory
Analyte Code: 7530					2/15/13	< 0.93		*39 passed out of 40 reported results.*	
Endrin	ug/L	6017	EPA 608		< 0.85				Satisfactory
Analyte Code: 7540					2/15/13	< 0.85		*42 passed out of 42 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Chlorinated Hydrocarbon Pesticides									
Endosulfan I	ug/L	6017	EPA 608		13.8	13.9	3.01	4.85 - 22.9	Satisfactory
Analyte Code: 7510					2/15/13	15.6		*40 passed out of 40 reported results.*	
Endosulfan II	ug/L	6017	EPA 608		5.25	4.95	0.991	1.98 - 7.92	Satisfactory
Analyte Code: 7515					2/15/13	5.79		*39 passed out of 39 reported results.*	
Endosulfan sulfate	ug/L	6017	EPA 608		6.50	7.05	1.39	2.88 - 11.2	Satisfactory
Analyte Code: 7520					2/15/13	7.69		*40 passed out of 40 reported results.*	
Heptachlor	ug/L	6017	EPA 608		4.82	4.57	0.941	1.75 - 7.39	Satisfactory
Analyte Code: 7685					2/15/13	5.4		*42 passed out of 42 reported results.*	
Heptachlor epoxide	ug/L	6017	EPA 608		6.39	6.7	1.06	3.53 - 9.88	Satisfactory
Analyte Code: 7690					2/15/13	7.08		*42 passed out of 42 reported results.*	
Lindane	ug/L	6017	EPA 608		6.21	6.06	1.1	2.77 - 9.36	Satisfactory
Analyte Code: 7120					2/15/13	6.78		*42 passed out of 42 reported results.*	
Methoxychlor	ug/L	6017	EPA 608		2.58	2.86	0.723	0.689 - 5.03	Satisfactory
Analyte Code: 7810					2/15/13	3.02		*39 passed out of 39 reported results.*	
Sample: Non Potable Water Phenols									
Phenols	mg/L	6009	EPA 420.1 Rev. 1978		2.27	2.3	0.341	1.27 - 3.32	Satisfactory
Analyte Code: 1905					2/4/13	3.47		*46 passed out of 47 reported results.*	
Sample: Non Potable Water Purgeables									
1,1,1-Trichloroethane	ug/L	6013	EPA 624		< 6.50				Satisfactory
Analyte Code: 5160					2/13/13	< 6.5		*52 passed out of 53 reported results.*	

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Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Purgeables									
1,1,2,2-Tetrachloroethane	ug/L	6013	EPA 624		115.	126	17.6	73.6 - 179	Satisfactory
Analyte Code: 5110					2/13/13	124		*52 passed out of 52 reported results.*	
1,1,2-Trichloroethane	ug/L	6013	EPA 624		72.2	73.6	7.45	51.3 - 96.0	Satisfactory
Analyte Code: 5165					2/13/13	74.0		*52 passed out of 52 reported results.*	
1,1-Dichloroethane	ug/L	6013	EPA 624		< 6.40				Satisfactory
Analyte Code: 4630					2/13/13	< 6.4		*51 passed out of 52 reported results.*	
1,1-Dichloroethene	ug/L	6013	EPA 624		60.1	65.5	10.4	34.3 - 96.6	Satisfactory
Analyte Code: 4640					2/13/13	66.6		*52 passed out of 52 reported results.*	
1,2-Dichloroethane	ug/L	6013	EPA 624		103.	101	10.3	70.2 - 132	Satisfactory
Analyte Code: 4635					2/13/13	101		*51 passed out of 52 reported results.*	
1,2-Dichlorobenzene	ug/L	6013	EPA 624		102.	97.7	9.76	68.4 - 127	Satisfactory
Analyte Code: 4610					2/13/13	98.1		*59 passed out of 60 reported results.*	
1,2-Dichlorobenzene	ug/L	6013	EPA 602		96.1	97.7	9.76	68.4 - 127	Satisfactory
Analyte Code: 4610					2/22/13	98.1		*59 passed out of 60 reported results.*	
cis-1,2-Dichloroethene	ug/L	6013	EPA 8260C		< 7.00				Satisfactory
Analyte Code: 4645					2/13/13	< 7.00		*38 passed out of 39 reported results.*	
1,2-Dichloropropane	ug/L	6013	EPA 624		59.2	60.3	6.78	40.0 - 80.7	Satisfactory
Analyte Code: 4655					2/13/13	61.1		*52 passed out of 52 reported results.*	
1,3-Dichlorobenzene	ug/L	6013	EPA 624		82.0	76.7	7.75	53.5 - 100	Satisfactory
Analyte Code: 4615					2/13/13	78.6		*58 passed out of 59 reported results.*	
1,3-Dichlorobenzene	ug/L	6013	EPA 602		79.1	76.7	7.75	53.5 - 100	Satisfactory
Analyte Code: 4615					2/22/13	78.6		*58 passed out of 59 reported results.*	
1,4-Dichlorobenzene	ug/L	6013	EPA 602		< 4.90				Satisfactory
Analyte Code: 4620					2/22/13	< 4.9		*45 passed out of 59 reported results.*	

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Shipment: 360 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Test Method	Prep Method	Result/ Analysis Date	Mean/ Assigned Value	Standard Deviation/ Fixed %	Acceptance Limits	Score
Sample: Non Potable Water Purgeables									
1,4-Dichlorobenzene	ug/L	6013	EPA 624		< 4.90				Satisfactory
Analyte Code: 4620					2/13/13	< 4.9		*45 passed out of 59 reported results.*	
Benzene	ug/L	6013	EPA 602		37.9	37.8	3.62	26.9 - 48.7	Satisfactory
Analyte Code: 4375					2/22/13	37.9		*53 passed out of 57 reported results.*	
Benzene	ug/L	6013	EPA 624		36.2	37.8	3.62	26.9 - 48.7	Satisfactory
Analyte Code: 4375					2/13/13	37.9		*53 passed out of 57 reported results.*	
Bromodichloromethane	ug/L	6013	EPA 624		< 5.00				Satisfactory
Analyte Code: 4395					2/13/13	< 5.00		*51 passed out of 52 reported results.*	
Bromoform	ug/L	6013	EPA 624		< 5.60				Satisfactory
Analyte Code: 4400					2/13/13	< 5.6		*52 passed out of 52 reported results.*	
cis-1,3-Dichloropropene	ug/L	6013	EPA 624		90.5	94.3	9.63	65.4 - 123	Satisfactory
Analyte Code: 4680					2/13/13	97.7		*51 passed out of 52 reported results.*	
Carbon tetrachloride	ug/L	6013	EPA 624		114.	98.0	14	55.9 - 140	Satisfactory
Analyte Code: 4455					2/13/13	103		*50 passed out of 52 reported results.*	
Bromomethane	ug/L	6013	EPA 624		18.2	45.2	7.76	18.0 - 72.0	Satisfactory
Analyte Code: 4950					2/13/13	45.0	60%	*47 passed out of 50 reported results.*	
Chloromethane	ug/L	6013	EPA 624		28.4	36.7	7.5	13.6 - 54.4	Satisfactory
Analyte Code: 4960					2/13/13	34.0	60%	*50 passed out of 51 reported results.*	
Trichlorofluoromethane	ug/L	6013	EPA 624		< 8.00				Satisfactory
Analyte Code: 5175					2/13/13	< 8.00		*50 passed out of 52 reported results.*	
Chlorobenzene	ug/L	6013	EPA 602		< 7.10				Satisfactory
Analyte Code: 4475					2/22/13	< 7.1		*59 passed out of 60 reported results.*	
Chlorobenzene	ug/L	6013	EPA 624		< 7.10				Satisfactory
Analyte Code: 4475					2/13/13	< 7.1		*59 passed out of 60 reported results.*	



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EMSL Analytical, Inc. Management

EMSL Analytical S.O.P.

PLM SOP

EPA 600/R-93/116, EPA 600/M4/82/020, EPA 400 Point Count, EPA 1000 Point Count, EPA PLM NOB, NYSDOH ELAP 198.1 & 198.6, NIOSH 9002, IRSST 244

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1.0 Method Description

1.1 Applicable Matrix

This method is applicable to friable, non-friable and non-friable organically bound building materials. Sample should be of sufficient quantity to ensure reliable quantitation through the use of multiple preparations.

1.2 Scope and Application

This procedure should be used to determine the asbestos content of bulk building materials, and includes procedures for various prep techniques and quantitation methods. Due to the procedure's use of multiple preps and repreps, as well as numerous preparation options, bulk building materials are specified due to their inherent gross homogeneity that cannot be assumed in debris or other non-manufactured materials. Various accreditation agencies may require only specific parts of this procedure and exclude others. This procedure, in its entirety, can be viewed as a set of tools to handle a wide range of materials.

1.3 Summary of Method

Samples are initially examined under low magnification using stereo microscopy. Initial observations note gross material appearance (homogeneity, fibrous/non-fibrous) and physical characteristics (color, texture, friable/non-friable). Preparation using various techniques, including, but not limited to, pinch mounts and gravimetric reduction, followed by analysis by polarized light microscopy (PLM) are used for the positive identification of suspect fibers and quantitation. Positive identification of asbestos requires the determination of optical property characteristics of the six types of regulated asbestos: chrysotile, amosite (grunerite), crocidolite (riebeckite), anthophyllite, tremolite and actinolite asbestos. Quantitation follows using calibrated visual estimation or, depending on the method used, one of a number of point counting techniques. Final results are generated incorporating gravimetric preparation data, when applicable. This procedure will generate aerial percentages, or in the case when combined with gravimetric reduction, a combined area/weight percentage.

1.4 Detection Limit

Under normal conditions, the practical detection limit for this method is <1 percent. Detection limits can vary with sample type, amount of sample analyzed or method of preparation and quantitation used. For example, the 1,000 point count method can detect values down to <0.1%. Similarly, when EPA 600/R-93/116 is combined with gravimetric reduction, the preparation will lower the detection limit of this procedure. This detection limit is based on the limits as referenced in the documented methodologies. When a detection limit of <1% is appropriate for an analysis, the results are reported as “less than” one percent (<1%) if the asbestos concentration is below the detection limit.

2.0 Interferences

Interferences for this method include, but are not limited, to:

2.1 Non-regulated asbestos minerals such as the two polymorphs of chrysotile; lizardite and antigorite

2.2 Non-regulated amphiboles such as winchite and richterite, and pyroxenes

2.3 Cleavage fragments of the regulated asbestos types which may at times have aspect ratios similar to the true asbestiform varieties

2.4 Clay minerals that can have similar morphology to asbestos such as sepiolite and palygorskite

2.5 All non-asbestos particulate, fibrous or not, which can partially or wholly obscure asbestos fibers

2.6 Coatings applied during sample manufacturing, or while the building material application was in place, may obscure the optical properties of fibers.

3.0 Definitions

3.1 **Asbestiform:** A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility. Asbestiform morphology is characterized by high mean aspect ratio (generally >20:1 for fibers > 5 µm) and thin fibril widths (usually < 0.5µm).

3.2 **Asbestos:** A collective mineralogical term encompassing the asbestiform varieties of various minerals that are typically hydrated silicates. Regulated asbestos refers to 6 specific asbestiform minerals belonging to two classes of silicate minerals.

3.2.1 Serpentine Asbestos: Only one serpentine mineral is classified as a regulated asbestos variety. Serpentine asbestos is typically less dense and more flexible than amphibole varieties.

3.2.1.1 **Chrysotile:** A serpentine, layered mineral that forms long, silky fibrils and bundles. Chrysotile is the most prevalent of all regulated asbestos varieties in the US.

3.2.2 **Amphibole Asbestos:** Double chain silicates that are typically more rigid than chrysotile and are all members of a solid solution series. Of the amphibole varieties, amosite is the most prevalent in the US.

3.2.2.1 Actinolite: An amphibole solid solution member in the series of the Tremolite – Actinolite – Ferro-Actinolite

3.2.2.2 Amosite: Mineralogically known as grunerite, it is an amphibole solid solution mineral. The trade name "AMOSITE" is rooted the terminology "amosa" describing Asbestos Mines of South Africa.

3.2.2.3 Anthophyllite: Amphibole silicate solid solution end member

3.2.2.4 Crocidolite: Mineralogically known as riebeckite; it is an amphibole solid solution mineral

3.2.2.5 Tremolite: An amphibole solid solution end member in the series of Tremolite – Actinolite – Ferro-Actinolite

3.3 **Calibrated Visual Estimate:** An estimation of concentration of asbestos in a sample as compared to the other sample components. The concentration estimate based on, and calibrated for, samples with known quantities of asbestos. This may be actual samples, permanent mounts, or pictures.

3.4 **Crossed Polarizers:** The normal condition of the polarized light microscope when the polarizer (sub stage polar) and the analyzer (post stage polar) are set so their privileged directions are perpendicular to each other

3.5 **Dispersion Staining:** An optical means of imparting apparent or virtual color to transparent substances by the use of stops in the objective back focal plane; it is used to determine refractive indices.

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3.6 **Extinction:** The condition in which an anisotropic substance appears dark when observed between crossed polars. This occurs when the vibration directions in the specimen are parallel to the vibration directions in the polarizer and analyzer. Extinction may be complete or incomplete; common types include parallel, oblique, symmetrical and undulose.

3.7 **Fiber:** With reference to asbestiform morphology, a structure consisting of one or more fibrils

3.8 **Fibril:** The individual unit structure of fibers

3.9 **Fiber Color:** The color of the fiber in plane polarized light

3.10 **Fibrous**: The description of a bulk building material describing the presence of fibers, asbestos or non-asbestos, in the bulk sample

3.11 **Plane Polarized Light:** Light that is transmitted through a sub stage polarizer only. The analyzer and compensator are not in the light path.

3.12 **Pleochroism** : The change in color or hue of colored anisotropic substance when rotated relative to the vibration direction of plane polarized light

3.13 **Point Count:** Quantitation technique in which a series of points are randomly superimposed on the sample's field of views. The material that lies under the point(s) is classified and counted. The points are totaled and percentages generated.

3.14 **Polarized Light:** Light that passes through a polarizer is reduced to only the light that has the same radial direction, vibration direction as the polar it passes though. Polarized light is light that has only one known vibration direction.

3.15 **Refractive Index:** The ratio of the velocity of light in a vacuum relative to the velocity of light in a medium. It is expressed as n and varies with wavelength and temperature.

3.16 **Refractive Index Liquid:** A liquid of known refractive index used to determine the refractive index of unknown particles through comparison

3.17 **Sign of Elongation:** Referring to the location of the high and low refractive indices in an elongated anisotropic substance, a specimen is described as positive when the higher refractive index is lenthwise (length slow), and as negative when the lower refractive index is lengthwise (length fast).

3.18 **Strength of Birefringence:** The numerical difference between the maximum and minimum refractive indices of an anisotropic substance

4.0 Safety

All personnel performing preparation and/or analysis of samples must be familiar with the EMSL Chemical Hygiene and Safety Plan. Specific hazards and precautions associated with this analysis include:

4.1 **Asbestos**

4.1.1 Prudent measures must be taken to prevent any possible airborne asbestos fiber release from occurring during sample handling.

4.1.2 Ensure that work stations and surrounding floors are clutter free and dust free.

4.1.3 All handling of samples, including gravimetrically reduced samples, should take place in a safety hood.

4.1.4 All intermediate preparation steps (acid dissolution, slide preparation, etc.), should also take place in a safety hood.

4.1.5 After an analyst completes work for the day or shift, or as needed, the HEPA hood, the surrounding work surfaces and floors in the immediate vicinity below the work area should be cleaned as follows:

4.1.5.1 The hood and all surfaces (including floor) should be vacuumed with a HEPA filtration equipped vacuum.

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4.1.5.2 The hood and all surfaces (including floors) should be wiped down with either disinfecting wipes or for the floor areas a *"Swiffer"* type, handled floor cleaner that utilizes disposable, wet cleaning pads.

4.2 Muffle Furnace

4.2.1 The muffle furnace should be vented out of the building due to organic vapors generated during the ashing process.

4.2.2 Care should be used, and appropriate safety clothing worn, during handling of samples in the muffle furnace due to high temperatures (485 ± 5ºC).

4.3 Solvent Dissolution

4.3.1 Solvent (including acid) dissolution should only take place under a safety fume hood.

4.3.2 Acid is a corrosive; proper clothing should be worn.

4.3.3 Exposure to all solvents should be avoided; proper safety precautions should be taken at all times.

5.0 Equipment and Supplies

5.1 Centrifuge and tubes (optional)

5.2 Cover slips, glass

Note 1: Ideal cover slip thickness is matched to the objectives of a particular microscope. This information is inscribed on the objectives with a number such as 0.17.

Note 2: For NYS Methods 198.1 & 198.6, cover glass used must be 22mm x 22mm.

5.3 Crucibles with tops

5.4 Filtration apparatus including:

- **5.4.1** Vacuum pump
- **5.4.2** Tubing
- **5.4.3** Vacuum flask
- **5.4.4** Rubber stoppers appropriate for frits of filtration setup

5.5 Filtration setups including:

- **5.5.1** 47mm disposable filtration funnels w/ supports and frits
- **5.5.2** 47mm absorbent pads

5.6 Forceps

5.7 Fume safety hood capable of ≥75lfpm

5.8 HEPA filtered safety hood capable of ≥75lfpm

5.9 Microscope slides, glass, 3” x 1”

5.10 Mortar and pestles, agate or porcelain

5.11 Muffle furnace capable of 485ºC

5.12 Petri dishes, 47mm disposable

5.13 Polycarbonate filters, 47mm, 0.4µm pore size

5.14 Polarized Light Microscope including:

- **5.14.1** 360º rotating stage
- **5.14.2** Analyzer (post stage polar)
- **5.14.3** Central stop dispersion objective
- **5.14.4** Eyepiece reticule - crosshair
- **5.14.5** Eyepiece reticule - point array such as Chalkley (Optional)
- **5.14.6** Gypsum retardation compensator plate, 530-550nm
- **5.14.7** Light source
- **5.14.8** Objective lenses, 10x-20x-40x

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5.14.9 Oculars 10x
5.14.10 Polarizer (sub stage polar)
5.14.11 Port for retardation plate
5.14.12 Sub stage Condenser
5.14.13 Sub stage field iris
5.15 Probes and other prep tools
5.16 Scalpel handles and blades
5.17 Stereomicroscope up to approx. 45X magnification
5.18 Thermometer capable of ambient room temperature displayed in ^{o}C
5.19 Weigh boats and drying tins
5.20 Wylie mill (optional)

6.0 Reagents and Standards

All reagents should be ACS Reagent Grade or better.

6.1 Acetone
6.2 Calibrated Refractive Index Glass Beads such as Cargille M-25 set (M-7 is still acceptable if already on-site)
6.3 Hydrochloric Acid – dilute for slides preps and concentrated (12N) for NOB prep
6.4 Tetrahydrofuran
6.5 Alcohol
6.6 NIST standard asbestos (1866/1866a and 1867)
6.7 HSL 037 Asbestos Reference Set
6.8 Non-Asbestos standards
6.9 Refractive Index Liquids
6.9.1 N_D = 1.550, 1.625 and 1.680 for common use
6.9.2 N_D = 1.490 - 1.720 in 0.005 increments or less
6.10 Water (Labs should use 0.1µm filtered water for Method ELAP 198.6)

7.0 Sample Collection, Preservation, Shipment and Storage

7.1 Samples are collected in a manner which produces no fiber release. Samples are commonly collected using a strong 'Ziplock' bag.
7.2 Only one sample per bag should be submitted.
7.3 No preservation is required.
7.4 Bulk samples are not to be shipped or stored with air samples.
7.5 Samples are retained in an easily retrievable manner for a minimum of 60 days.

8.0 Calibration and Standardization

Each major component of the method is calibrated and/or standardized including the analyst. Examples follow:

8.1 GEN-FM-410 Balance Calibration Verification Worksheet is used to record the analytical balance checks daily, or on next use, using 2 weights over a range that represents the normal use of the balance.
8.2 The muffle furnace is calibrated quarterly at 3 points over the range of normal temperature use; recorded utilizing ASB-FM-2 Muffle Furnace Calibration workbook.
8.3 The PLM analyst is calibrated as follows; details are listed in EMSL's Quality Management System Manual, Module A:

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8.3.1 Using past proficiency samples and samples of known quantity, analyst precision and accuracy are tracked, monitored and recorded in ASB-TMP-202 PLM QC Reference workbook.

8.3.2 Analysts calibrate their visual estimates using standards (8.3.1 above).

8.4 The polarized light microscope is aligned daily or prior to first use. Please follow the alignment procedures outlined in PLM Microscope Alignment SOP, utilizing form ASB-FM-200 PLM Calibration.

8.4.1 Daily Contamination Check

8.4.1.1 In the PLM hood, with a clean mortar and pestle, place a small portion of reagent grade salt (or other non-fibrous, isotropic, confirmed negative friable material) in the mortar.

8.4.1.2 Crush the material using the pestle.

8.4.1.3 Place a small portion of the salt on a clean slide and place a small drop of all liquids to be used during the day's analyses on the slide.

8.4.1.4 Mix the crushed material, using sequentially all tools that will be used for prepping that day, and place a cover slip on the prep.

8.4.1.5 Scan the entire area under the cover slip.

8.4.1.6 Check the Daily Contamination Check column of form ASB-FM-200.

8.4.1.6.1 If any contamination is found, please follow the flowchart in 17.5 and document where the contamination was found. Mark the column with the location of the contamination Tools (a), Reagent Grade Salt (b), RI Oils (c), Work Surfaces (d), Slides (e), Cover Slips (f), Mortar & Pestle (g). If the contamination was not reproduced, please mark the record with an (h).

8.4.1.7 *Additionally*: After every 20 uses of any homogenization equipment (i.e. mortar and pestle) run a negative material (as described in 8.4.6.1) prep to monitor contamination of the homogenization equipment. It is not necessary to use all tools and liquids for this step, just what is necessary to produce the prep.

8.5 Refractive Index Liquid Calibration

8.5.1 Refractive index liquids are calibrated to an accuracy of ± 0.004.

8.5.2 Refractive index calibrations are corrected for temperatures other than 25ºC.

8.5.3 Refractive Index liquids are calibrated at least upon:

8.5.3.1 Initial opening of the bottle and

8.5.3.2 Additionally, all refractive index liquids, including small bottle Cargille sets, are calibrated upon next use if the last calibration has been 3 months ago or longer.

8.5.3.3 For analysis of samples by the NIOSH 9002 method, refractive index liquids, including small bottle Cargille sets, must be calibrated before next use if the last calibration has not been within the last week.

8.5.4 Refractive Index liquids are calibrated using EMSL's RI Liquid Calibration SOP and recorded in ASB-FM-205 RI Oil Calibration.

8.6 Dispersion Staining Color Verification

8.6.1 At least monthly, the dispersion staining colors of NIST 1866 Amosite or HSL Amosite are obtained and recorded to verify the microscope's ability to produce dispersion staining colors.

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8.6.2 After microscope alignment (following Section 8.4 above), place a permanent mount of NIST 1866 Amosite or HSL Amosite in a 1.680 refractive index medium on the microscope stage.

8.6.3 Follow section 9.6.7.1 to obtain dispersion staining colors from the amosite prep.

8.6.4 Translate the observed dispersion staining colors to wavelengths, following step 9.6.7.1.4.

8.6.5 Record the wavelengths corresponding to the parallel and perpendicular directions of the amosite fiber on the ASB-FM-200 PLM Calibration record for the microscope used.

8.7 Daily Reference Sample

8.7.1 A reference sample is submitted to each analyst on a daily basis. This sample should be submitted blindly so the analyst does not know the identity of the sample and recorded on a QC bench sheet. The reference sample library should consist of old proficiency, round robin and real time samples where the target asbestos concentration(s) is/are known.

8.7.2 Measuring Accuracy: To measure and judge accuracy, the analysis must fall within the acceptable limits before analysis may proceed. If the sample falls out of the limits;

8.7.2.1 A Corrective Action Response (CAR) must be initiated.

8.7.2.2 Another reference slide in the same asbestos concentration range must be analyzed acceptably before analysis may proceed.

8.7.2.3 The CAR does not need to be closed before analysis may proceed.

8.7.3 Measuring Precision: Precision is measured by maintaining a spreadsheet log of all analyses of each reference sample per analyst.

8.7.3.1 The most recent 20 analyses of each asbestos range are considered for this measurement, and the pooled data is used to calculate the Average Accuracy Coefficient in ASB-TMP-202 PLM QC Reference Workbook.

9.0 Procedure

9.1 Sample Receipt

9.1.1 Upon receipt of samples, check that the sample information on the Chain of Custody (COC) matches the information on the samples and other paperwork. Any discrepancies must be resolved before proceeding.

9.1.2 If the samples do not have a COC, then one is completed at the time of log in. Have the client fill out the necessary information completely.

9.1.3 Information required on the Chain of Custody includes:

9.1.3.1 Client name, address, telephone number, contact person, fax #, e-mail

9.1.3.2 Project number/ name, state where samples were taken

9.1.3.3 Number of samples sent and sample IDs

9.1.3.4 Type of analysis requested

9.1.3.5 Sample volumes or areas if applicable

9.1.3.6 Turn-around time; “RUSH” is not acceptable.

9.1.3.7 A date and signature of the person relinuishing the samples

9.1.3.8 All samples MUST be accounted for with the proper sample IDs.

9.1.3.9 All samples MUST be sealed, properly bagged and undamaged.

9.1.4 All sample sets must be clocked in at the time of receipt and signed and dated by an EMSL employee. If the lab does not have a clock for sample receipt, the receiving employee should record the time of receipt also.

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9.1.5 Check to see if the samples match the COC and if the containers are open, damaged, or contaminated. If the samples are damaged or if the COC does not match, notify the client.

9.2 Sample Log In

If all of the above criteria for sample receiving are met, then the samples can be logged into Sample Master (LIMS) as per the Sample Master SOP.

9.2.1 This process will assign a unique EMSL order number for the project, as well as labels with the order number to be affixed to the sample bags

9.2.2 Sample Master generates an Internal Chain of Custody, and if needed, the appropriate bench sheets for the analysis.

9.3 Macroscopic Observation

9.3.1 Regardless of the requested analytical method, all samples are observed both using the naked eye, and using a stereomicroscope prior to further processing. Direct data entry is used to record analytical data into iL@B.

9.3.2 In a HEPA and/or fume hood, remove the sample from the sample container ("Zip-lock bag," jar, etc.) and set it on a clean piece of scrap paper or paper towel.

9.3.3 Using a stereomicroscope, when necessary, record observations pertaining to the sample including:

9.3.3.1 Sample Color - the sample color of the hand specimen

9.3.3.2 Homogeneity - whether the sample is homogenous or heterogeneous with respect to discernable sample layers. If there is more than one discreet sample layer observed, each layer is analyzed and reported as a separate sample. Compositing, except in the following circumstances is not done:

9.3.3.2.1 Joint compound / Drywall system - are allowed to be composited only if the joint compound is part of the wall system (used for joint and holes only) and not a separate application /layer. This information would only be available to the field sampling entity.

9.3.3.2.2 The sample layers are inseparable to the point that it would be impossible to separate the layers without substantial contamination between the layers

9.3.3.2.3 When the client requests samples to be composited, but only when accompanied by a report / sample comment indicating the client requested this non-compliant procedure

9.3.3.3 Determine if fibers are visible in the sample hand specimen and the percentage of suspect asbestos fibers present as viewed through the stereoscope.

9.3.3.4 Any other observation that may be helpful in analysis is also recorded.

9.3.4 When samples are to be separated into layers, an aliquot is added to the sample ID in iL@B or Sample Master and additional worksheets (if needed) are generated. These layers will have a unique EMSL lab sample ID for tracking purposes.

9.4 Preliminary Fiber Identification (excluding NYSELAP 198.6)

All prep work should take place in a HEPA / fume hood. Samples proceeding directly with gravimetric reduction (NYS ELAP 198.6, EPA PLM NOB, client's request, etc.) may proceed directly to Section 9.5. Preliminary fiber identification may be better performed on the final residue after gravimetric reduction.

Note: For those labs adhering to NYS 198.6 - following the NYS ELAP regulations, fibers

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protruding from the matrix may be removed for PLM analysis. If the fibers are identified as asbestos, the client may be notified that the NOB contains and unquantifiable amount of asbestos. However, analysis must continue with a full gravimetric reduction in order to determine the specific percentages.

9.4.1 When possible, fibers observed in the previous macroscopic observation step are mounted in an appropriate RI liquid and identified as part of the qualitative analysis of the sample.

9.4.2 Using clean tools (forceps, probes, scalpel, etc.), isolate a fiber and remove it from the sample; place the fiber on a clean microscope slide.

9.4.3 Place a drop or two of an appropriate RI liquid on top of the fiber. The appropriate RI liquid is determined by the suspect fiber identification. If the fiber is suspected to be:

9.4.3.1 Chrysotile - use 1.550 RI liquid

9.4.3.2 Amphibole - use 1.680 RI liquid

9.4.3.3 Non-Asbestos - use 1.550 RI liquid

9.4.4 Using prep tools, immerse and modify (chop, cut up, etc.) the fibers to disperse them in the RI liquid. Place a cover slip on the fiber prep and tap gently with a pencil eraser or other tool to expel any remaining air bubbles under the cover slip.

9.4.5 Mount the slide on the PLM stage, and following the steps in Section 9.6, Fiber Identification, determine if the fiber's identity was consistent with the suspected identification.

9.4.6 After observation of the fiber's optical properties, determine if the fiber was indeed the suspected fiber type.

9.4.6.1 If the fiber was consistent with the suspected identification, record all required optical properties (as specified in Section 9.6) on the analytical worksheet. Repeat steps 9.4.2 to 9.4.5 until all fibers present in the sample have been identified.

9.4.6.2 If the fiber was not consistent with the suspected fiber type, but the optical properties of the fiber were able to be measured, leading to a positive identification of another fiber type, record all required optical properties (as specified in Section 9.6) on the analytical worksheet. Repeat steps 9.4.2 to 9.4.5 until all fibers present in the sample have been identified.

9.4.6.3 If the fiber's optical properties were not able to be measured satisfactorily because the RI liquid chosen in step 9.4.3 was not conducive to obtaining the optical properties, return to step 9.4.3 and remount more of the suspect fibers in another liquid. Suspected amphibole fibers that are not identified as amosite or crocidolite, but remain suspected amphiboles, should be mounted in 1.625 RI liquid. Repeat steps 9.4.2 to 9.4.5 until all fibers present in the sample have been identified.

9.4.6.4 If the fiber's optical properties were not able to be measured satisfactorily due to interferences of matrix, coatings, etc., an alternate prep technique (such as gravimetric reduction) may be necessary. Alternate prep techniques are discussed in Section 9.5. Solvent washing (acetone, RI liquid, etc.) may be required to clean fibers or bundles sufficiently prior to identification. Fresh RI liquid must be used after the cleaning for identification.

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9.4.7 It may be advantageous sometimes to remove coatings or binding materials prior to fiber identification. In these cases, the use of a dilute Sodium Metaphosphate solution (approximately 10g/L) and water is recommended to wash and rinse suspected asbestos particles prior to identification.

9.5 Alternate / Specialized Preparations - Gravimetric Reduction

A full gravimetric reduction is required by NYS ELAP 198.6, and as requested by the client (i.e. EPA PLM NOB). Certain material may require parts or all of this procedure for correct identification and quantitation of the sample. Preparation steps where the sample is outside of a sealed container (zip lock bag, crucible with top, etc.), should take place in either a safety or fume hood. All steps that involve the use of acid should take place in a fume hood.

9.5.1 Place the samples into the order noted on the COC, initial the EMSL internal chain of custody in the space "Prepped By" and date. All personnel involved in the prep process should add their initials and appropriate date here.

9.5.2 For each sample, assign a clean, pre-weighed crucible and a pre-weighed petri dish with a 0.4µm PC filter. Record the weight of the empty crucible and petri dish in iL@B Gravimetric Data Entry corresponding to the sample in locations A and D, respectively.

9.5.3 Label the petri dish with the EMSL order ID and sample number, or optionally, the EMSL order ID and client sample number, and the crucible ID or crucible location in the tray/rack. Mount each filter in a filtration funnel setup and store with the labeled petri dish.

9.5.4 Following steps in Section 9.3 above, and after stereoscopic examination, record the following sample observations in iL@B:

9.5.4.1 Sample color

9.5.4.2 Whether the sample is homogeneous or heterogeneous

9.5.4.3 Whether the sample is fibrous or non-fibrous

9.5.5 Always separate layers (i.e. floor tile and mastic, etc.) and prepare separately, if possible, without significant cross contamination.

9.5.6 If the client requests sample layers to be combined:

9.5.6.1 Verify that the client's request is in writing or otherwise documented.

9.5.6.2 Combine layers during preparation, prior to gravimetric reduction.

9.5.6.3 Sample a representative amount of each layer when combining layers.

9.5.6.4 Note this clearly on the analytical bench sheet. **This must be commented on the final report.**

9.5.7 Remove between 100 to 500 mg of sample and place into the crucible. The sub-sample should be taken so that it represents the overall composition of the sample and is treated in such a way (shaving of tiles, crushing, etc.) to maximize the surface area of the material being placed in the crucible.

9.5.8 If the sample does not consist of at least 100mg of material, this is considered to be "Insufficient Sample" and should not be processed. It can sometimes be difficult to acquire this much mastic from the back of a tile but it is crucial for accurate results. Comment in IL@B or change status to indicate that there was **"**Insufficient Sample." The client may be contacted and asked to submit more sample. However, if the client requests, we will process the sample "as is" provided the following:

9.5.8.1 There is at least 20mg of sample to process and

9.5.8.2 The sample result on the report is noted, "Sample below method recommended minimum weight; analyzed at client's request."

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9.5.9 Weigh the crucible in the analytical balance and record the weight of the crucible and unashed sample on the corresponding analytical bench sheet in location B.

9.5.10 Place the crucible in a labeled rack or tray; this may be a specialized crucible rack or simply a 'muffin tin.' A crucible map is filled out for each of the trays and the tray ID, and sample numbers are filled in on the map. Samples are placed in the rack or tin beginning at the top left and proceeding across and down (as if reading a book). Alternately, crucibles may be labeled with special marking ink and the individual crucible IDs used to track location. Labeling in this manner requires crucibles to be baked at extremely high temperatures before use.

9.5.11 Repeat this process (steps 9.5.2 to 9.5.10) for all samples to be processed.

9.5.12 Place the crucibles into a pre-heated muffle furnace at 485 ± 5ºC for 12 hours. *(Note: In general, 12 hours is a good starting point, but for smaller sample sets and samples of amenable matrix compositions, shorter ashing times may be possible. NYS ELAP item 198.6 suggests anywhere between 1-12 hours for the mass to stabilize, and EPA 600/R-93/116 offers six hours at 450ºC is usually sufficient. In practice, 4 hours is insufficient for most roofing and some other types of samples. The ashing time is dependent on available sample surface area as a result of the sample preparation techniques used.)*

9.5.13 Remove samples from the furnace and allow cooling to room temperature. Re-weigh the crucible with sample and record this weight on the analytical bench sheet in location C.

Note: *For NYS ELAP Labs, the samples should be allowed to cool to room temperature in a desiccator.*

9.5.14 In the fume hood, arrange the crucibles and filtration funnel setups that were loaded with the pre-weighed filters, in sample order. Add approximately 0.5 ml of water to each crucible and grind the sample in the crucible using the flat end of a clean pestle. After grinding, rinse the pestle with a minimum of water to wash any remaining sample on the pestle back into the crucible.

9.5.15 Carefully add 2-5 ml of concentrated HCl (12N) to the crucible so that any reaction does not overflow the crucible.

9.5.15.1 It can be beneficial to perform additional grinding or breaking up of clumps and chunks with a disposable applicator stick or clean glass stirring rod while the sample is reacting with the acid to maximize the surface area exposed to the acid, and to therefore maximize the reaction. Additional acid should be added (1 or 2 ml at a time) until no visible sign of effervescing is apparent. This ensures a complete reaction and maximum matrix removal.

9.5.15.2 Allow the sample and acid to react for 2-10 minutes, or longer (up to 15 minutes max) if needed, in order to achieve a complete reaction.

9.5.15.3 NYS Certified Labs should maintain the acid treatment for a full 15 minutes.

9.5.15.4 Prolonged exposure of chrysotile fiber to acid (approximately > 20 minutes) may result in fiber damage that will adversely affect the ability to identify these fibers.

9.5.16 Add de-ionized fiber free water to the crucible and filter through the associated pre-weighed funnel setup. Rinse the crucible with water and filter all rinsate through the filter to ensure the entire sample has been transferred. Rinse the sides of the funnel with squirt bottle of de-ionized water so that no sample is left on the funnel walls when the filter is removed.

9.5.17 Remove the filter from the funnel setup and place it in its associated labeled petri dish.

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Allow the filter to dry in the petri dish in a drying oven or slide warmer for 15 minutes at about 40-60 °C. Check for dryness by inspecting the petri dish cover for condensation.

9.5.18 Once dry, remove from the heat sources and allow to cool to room temperature. Re-weigh the petri dish and record the weight on the analytical bench sheet in location E.

9.5.19 Perform calculations on the analytical bench sheets to determine the weight of the original sub-sample (W1), weight of the post-ash residue (W2), and the weight of the post-acid residue (W3). Also, the calculations for percent organics, percent acid soluble and final residue should be performed. See Section 10, Calculations for details.

9.6 Fiber Identification

9.6.1 Suspect fibers classified as asbestos must be identified using the following properties:

9.6.1.1 Morphology
9.6.1.2 Sign of Elongation
9.6.1.3 Fiber Color
9.6.1.4 Pleochroism
9.6.1.5 Extinction
9.6.1.6 Refractive Index
9.6.1.7 Birefringence

9.6.2 For suspect fibers classified as non-asbestos, at least one of the above properties must be measured and recorded that would fall outside of normal asbestos classification ranges.

9.6.3 Morphology

9.6.3.1 The morphology of suspect fibers should be such that fibrocity is evident from its morphology. This may include the value of aspect ratio and three dimensional aspects of morphology that may not be readily noticeable at first.

9.6.3.2 Suspect Chrysotile will have morphology that is generally silky and wavy. Chrysotile fibrils are never visible under light microscopy and all chrysotile under the PLM are bundles. Larger bundles may exhibit large waves and/or kink bands. The ends of bundles may be splayed; portions of extremely long bundles may split and rejoin at a later point in the bundle.

9.6.3.3 Suspect Amphiboles will have morphology that is straighter and more rod-like than chrysotile. The end of amphibole bundles may have broom-like properties with a small amount of splaying. Very long amphibole asbestos will show curvature and bending, but with more rigidity than chrysotile.

9.6.3.4 For EPA 600/R-93/116 and NYS ELAP 198.1 & 198.6, Asbestiform Morphology is generally recognized by the following:

9.6.3.4.1 Mean aspect ratio from 20:1 to ≥100:1
9.6.3.4.2 Thin fibrils, usually < 0.5µm in width
9.6.3.4.3 Two or more of the following:
9.6.3.4.3.1 Parallel fibers occurring in bundles
9.6.3.4.3.2 Bundles displaying splayed ends
9.6.3.4.3.3 Matted masses of individual fibrils
9.6.3.4.3.4 Fibers showing curvature

***Note**: (From EPA 600/R-93/116 Appendix A. Glossary of Terms, Asbestiform Morphology (last paragraph) also applying to NYSDOH ELAP 198.1 & 198.6."These characteristics refer to the population of fibers as observed in a bulk sample. It is*

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not unusual to observe occasional particles having aspect ratios of 10:1 or less, but it is unlikely that the asbestos component(s) would be dominated by particles (individual fibers) having aspect ratios of <20:1 for fibers longer than 5µm. If a sample contains a fibrous component of which most of the fibers have aspect ratios of <20:1 and that do not display the additional asbestiform characteristics, by definition, the component should not be considered asbestos."

9.6.3.5 For NIOSH 9002 asbestos fiber aspect ratios are:

9.6.3.5.1 Typically >10:1 for fibers found to be chrysotile, amosite and/or crocidolite

9.6.3.5.2 Typically <10:1 for fibers found to be anthophyllite or actinolite/tremolite

9.6.3.6 For IRSST 244 and EPA 600/M4-82-020 (Interim Method), the minimum fiber aspect ratio for counting fibers is 3:1 or greater, which may include cleavage fragments.

9.6.3.7 Other morphological types (bladed, acicular, etc.) may at first appear to be fibrous, but careful examination will show the morphology to be other than fibrous (thinning thickness across the width of bladed particles, tapered ends on acicular particles).

9.6.4 Sign of Elongation

9.6.4.1 While viewing the fiber, the sign of elongation of a fiber may be observed in crossed polarized light.

9.6.4.2 Insert the first order red 1 plate (530nm – 550nm) into the microscope's accessory port (at 45º to the analyzer and polarizer). The slow component direction of the first order red 1 plate should be in the NE-SW orientation. (The compensator has a label on it indicating the slow component direction.)

9.6.4.3 When the fiber exhibits a blue color in the NE-SW orientation and yellow in the NW-SE orientation, the sign of elongation is positive. For these fibers, the refractive index of the fiber parallel to the elongation ($n\parallel$) is greater than the refractive index perpendicular to the elongation ($n\perp$). Chrysotile, amosite, anthophyllite, tremolite and actinolite have positive signs of elongation.

9.6.4.4 When the fiber exhibits a yellow color in the NE-SW orientation and blue in the NW-SE orientation, the sign of elongation is negative. For these fibers, the refractive index of the fiber parallel to the elongation ($n\parallel$) is less than the refractive index perpendicular to the elongation ($n\perp$). Crocidolite has a negative sign of elongation.

9.6.4.5 Isotropic fibers (fibers in which $n\parallel$ and $n\perp$ are equal) do not exhibit colors while being viewed with the red one plate, but remain colorless. They will exhibit the same color as the background area of the slide.

9.6.5 Fiber Color / Pleochroism

9.6.5.1 Fiber color is the color that the anisotropic fiber exhibits in plane polarized light. That is light that is polarized with a sub stage polarizer but without the analyzer or red 1 plate in place during fiber viewing. Pleochroism is when the anisotropic fiber will change color while rotated on the PLM stage.

9.6.5.2 While viewing the fiber, observe the fiber color present. Many fibers are clear (colorless) in plane polarized light.

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9.6.5.3 Rotate the stage slowly 360º until the fiber has returned to its original orientation. Observe if the fiber exhibited pleochroism and the colors present along with their orientations (parallel or perpendicular to the fiber length).

9.6.6 Extinction

9.6.6.1 When the fiber (anisotropic) coincides with the privileged vibration directions of the polarizer and analyzer (in crossed polar orientation), the fiber will appear dark. When rotating the fiber from other orientations to, and through one, where the axes coincide with the polar/analyzer privileged directions, the fibers will first be light and then appear dark, and then light again. This is called extinction because it appears that a light within the fiber has been extinguished. An anisotropic fiber will have 4 extinctions during a 360º rotation.

9.6.6.2 Extinction angles are measured by rotating the fiber so that fiber length is parallel to one of the crosshairs and noting the angular reading on the stage.

9.6.6.3 Next, rotate the stage until the fiber comes to extinction. By convention, the smaller of the two angles is reported. The reported extinction is always <45º; if the extinction is >45º, return to the original angular measurement and rotate the stage in the opposite direction. Note the angular reading of the stage. The difference in the two angular readings is the extinction angle.

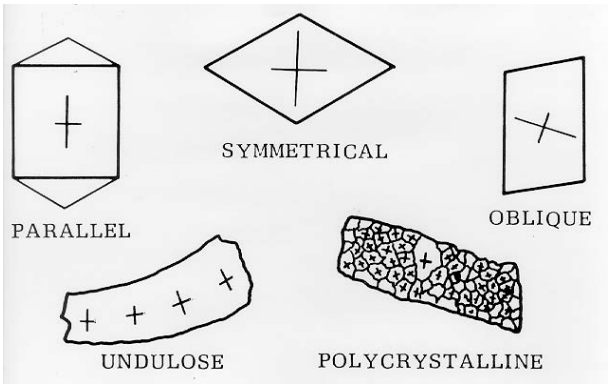
9.6.6.4 Extinctions may be classified as follows:

9.6.6.4.1 Parallel extinction is when a fiber goes extinct when the fiber is parallel to the vibration directions of the polarizer and analyzer. Chrysotile and anthophyllite have parallel extinction. Amosite and crocidolite often exhibit parallel extinction due to twinning.

9.6.6.4.2 Oblique or inclined extinction is when a fiber goes extinct at an angle greater than 0°, but less than 45° of the fiber's elongation being parallel to the vibration direction of the polarizer and analyzer. All of the monoclinic amphibole asbestos varieties possess inclined extinction, however, due to twinning, amosite and crocidolite rarely exhibit inclined extinction and usually present parallel extinction.

9.6.6.4.3 Symmetrical extinction is when the extinctions bisect the prominent interfacial angles.

9.6.6.4.4 Undulose extinction may occur in a curved particle. It is truly a parallel extinction at any given point, but due to the curve, the extinction band has the effect of fanning across the fiber as it is rotated. Chrysotile may show good undulose extinction.



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9.6.7 Refractive Index

Refractive index may be measured either using dispersion staining or Becke lines. Practically, dispersion staining is used for most samples for its speed and ease of use. Dispersion staining determinations can usually be made from a single prep (provided the correct RI liquid was selected) as opposed to Becke line determination that may need to use multiple (up to 5 or more) preps from different RI liquids. Dispersion staining will be outlined following Rapidly and Accurately Determining RIs of Asbestos Fibers by Using Dispersion Staining Method - Dr. Su 2010.

9.6.7.1 Dispersion Staining (Central Stop)

9.6.7.1.1 Mount the suspect fiber in the appropriate RI liquid for the suspected asbestos type (see Section 9.4.3 to 9.4.6). RI liquid selections to keep in mind for fiber identification are:

9.6.7.1.1.1 1.550 for suspect chrysotile

9.6.7.1.1.2 1.680 for amosite (optionally 1.700)

9.6.7.1.1.3 1.680 for crocidolite (optionally 1.700)

9.6.7.1.1.4 1.625 for anthophyllite, actinolite, tremolite (1.620 optional)

9.6.7.1.2 Using the dispersion staining objective (central stop), bring the fiber to the center of the field of view and focus on the fiber. If inserted, remove the red 1 compensator plate. Decrease the illumination of the microscope and close the sub stage condenser diaphragm so it is just as big as the central stop as viewed through the Bertrand lens.

9.6.7.1.3 Remove the Bertrand lens and the analyzer; view the fiber. Increase the illumination as needed and/or adjust the sub stage condenser diaphragm to yield the fullest, most vibrant colors.

9.6.7.1.4 Rotate the stage fully through 360º, then stop at the perpendicular fiber direction. Using a wavelength color chart for central stop dispersion staining (McCrone or other), translate the observed dispersion color to its corresponding wavelength from this chart. DS colors should be obtained on several fibers. Repeat this process for the fiber in the parallel direction. The longer (higher) wavelength for alpha, and shorter wavelength for gamma, should be used for conversion to a refractive index in the following steps.

9.6.7.1.5 Using the applicable chart corresponding to the suspect asbestos type and RI liquid used, as available in Dr. Su 2010, look up the corresponding refractive index for the fiber's perpendicular orientation DS color wavelength and the ambient room temperature at the time of DS color observation. For wavelengths between listings and/or temperatures, extrapolate the RI for the non-listed wavelength. Repeat for the RI of the fibers parallel orientation.

9.6.7.2 Becke Line

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9.6.7.2.1 Mount the suspect fiber in the appropriate RI liquid for the suspected asbestos type (see Sections 9.4.3 to 9.4.6).

9.6.7.2.2 View the fiber using an objective that magnifies the fiber so it is large enough to be easily viewed in the center of the field of view. In general, the 20x objective is adequate, but if they provide better viewing, the 10x or 40x objectives may also be used. Center the fiber in the field of view, remove the red 1 compensator (if present), and remove the analyzer and focus.

9.6.7.2.3 While observing the fiber, rotate the fine focus knob back and forth and notice the bright shadow or halo, emanating near the fiber. This is a Becke line.

9.6.7.2.4 Orient the fiber in the perpendicular orientation, and with continued movement, notice if the halo appears to move out of, or into, the fiber during the fine focus rotation. When the stage is lowered, the Becke line will move into the media that has the higher refractive index.

9.6.7.2.5 Note the RI liquid used and whether the fiber was > or < the liquid in this perpendicular orientation.

9.6.7.2.6 Change the fiber orientation to parallel and repeat step 9.6.7.2.4. Note the RI liquid used and whether the fiber was > or < the liquid in this parallel orientation.

9.6.7.2.7 At this point, we have only determined whether the fiber is > or < than the liquid in both orientations. Next, it is necessary to make additional preps of suspect fibers. The RI liquid used for these preps is not predetermined; it is based on the results from our Becke line determination from the original prep. It may be helpful at this time to address only one orientation at a time. In this manner, choose an orientation (perpendicular or parallel is not important; this will be the first orientation) to perform RI determination using Becke lines, and only measure this orientation until the determination is complete. After this determination is done, the second orientation can be measured and further preps made for the second orientation. Also, Becke line determination will require the use of many other RI liquids besides the typically used common liquids. The use of small bottled Cargille liquid sets will be necessary, and it should be noted that each liquid must be calibrated prior to use if the last calibration for the particular liquid was more than three (3) months prior; weekly if performing NIOSH 9002 analysis. RI liquid calibration should be done following EMSL's RI Calibration SOP.

9.6.7.2.8 In the first orientation, if the fiber was < than the liquid, prep another suspect fiber in a liquid that is lower than the original liquid; otherwise choose a higher liquid. The amount of relief (the amount that the fiber "stands out" in the prep) should indicate what range of liquid to use. The more the fiber stands

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out, the farther away from the original liquid the new liquid should be.

9.6.7.2.9 Orient the fiber in the first orientation and focus back and forth. Notice the direction of the Becke line movement when the stage is lowered. Note whether the fiber is > or < than the liquid.

9.6.7.2.10 Repeat steps 9.6.7.2.8 and 9.6.7.2.9 until the fiber in the first orientation matches an RI liquid or has been bracketed by two RI liquids. The Cargille RI liquid sets from 1.460 to 1.700 are in 0.004 RI increments, and from 1.700 to 1.720 are in 0.005 RI increments.

9.6.7.2.10.1 If the fiber matches the RI liquid exactly, the Becke line halo will split into two colors, orange and sky-blue. The orange color enters the fiber and the sky-blue color enters the RI liquid.

9.6.7.2.10.2 If the fiber doesn't match one of the two RI liquids that bracket it, then report the average of the two RI liquids that bracket it if the intensity of the dispersed Becke line is equal for both RI liquids.

9.6.7.2.10.3 If the intensity of the dispersed Becke line is less intensive with one of the bracketed RI liquids than the other, then report the RI of the fiber which is closer to the more intensive dispersed Becke line RI liquid. Example, bracketing RI liquids are 1.692 and 1.696. If the dispersed Becke line is more intensive with 1.692, then the reported RI of the fiber should be 1.693.

9.6.7.2.11 Repeat steps 9.6.7.2.8 to 9.6.7.2.10, substituting the second orientation for the first orientation.

9.6.8 Strength of Birefringence

9.6.8.1 The strength of the Birefringence is defined as the difference between the highest and lowest refractive index of an anisotropic particle.

9.6.8.2 The highest refractive index is always γ for biaxial minerals regardless of $\parallel$ or $\perp$ orientation.

9.6.8.3 Subtract $n\gamma - n\alpha$ to determine the strength of the birefringence.

9.6.9 Classification

9.6.9.1 All characteristics should fall within the known acceptable limits for regulated asbestos species. These references may be found in Section 16 of this SOP. Known regulated asbestos varieties are:

9.6.9.1.1 Chrysotile
9.6.9.1.2 Amosite (Grunerite)
9.6.9.1.3 Crocidolite (Riebeckite)
9.6.9.1.4 Anthophyllite
9.6.9.1.5 Actinolite
9.6.9.1.6 Tremolite

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9.6.9.2 If any one of the characteristics falls outside of, or is inconsistent with a suspected asbestos type, the fiber must be characterized as non-asbestos.

Note: *Through many processes, asbestos may be altered during its life as a building material. Some of these processes may alter some of the physical characteristics and properties of the fibers in building material samples. Even if the fiber is suspected to have at one time been a regulated asbestos variety, if at the time of analysis the fiber's properties have been altered to such an extent that one, some or all of them fall outside accepted ranges, the fiber may not be categorized as a regulated asbestos variety for the purpose of analytical reporting.*

Please see 'EMSL Policy Statement, Heat or Otherwise Altered Asbestos,' for suggestions on how to deal with altered asbestos. Please note this may result in the report containing the following disclaimer, "Numerous fibers were found with optical properties outside the acceptable limits for regulated asbestos. These fibers are possibly altered asbestos fibers and were not included in the asbestos sample concentrations."

9.7 Slide / Sub Sample Preparation

The following sections outline possible prep procedures. There are numerous different ways to prepare samples for analysis and other procedures that, while not outlined here, are not excluded from use.

9.7.1 Homogenization

9.7.1.1 Samples that are not homogenized already should be homogenized before sub sample preparation. A number of homogenization procedures are available, including, forceps, scalpel, probes, mills and mortar and pestle.

9.7.1.2 The object of homogenization is to alter the sample so all areas are represented, representatively, in the sub sample preps.

9.7.1.3 Mortar and pestle are the most useful for cementitous samples in both homogenization and grain size reduction, to help cover slips sit parallel to the slide. A representative sub-sample may be placed in the mortar and crushed with the pestle until it is of substantially uniform distribution and grain size.

9.7.1.4 Another process of homogenization may be milling. If available at the lab, this may be used and it takes the use of a mortar and pestle a step further.

9.7.1.5 Additionally, probes, forceps and scalpels may be used to rip, tear and cut portions of sample, and they continually work the portions until the sub sample is homogeneous in nature.

Note: *When grinding samples that contain amphibole minerals or vermiculite, care should be taken during analysis. Non-asbestiform amphiboles may be ground into cleavage fragments that are >3:1 in aspect ratio. One way to distinguish these fragments from asbestiform amphiboles is by using their morphological properties to determine the presence or absence of asbestiform habit in the fiber population. Asbestos mineral species that do not exhibit asbestiform habit are not considered regulated asbestos. Grinding of vermiculite may produce vermiculite fibers (scrolls) that may appear to look similar morphologically to chrysotile, but which may be distinguished on the basis of their optical properties.*

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9.7.2 Pinch Mount

9.7.2.1 After homogenization (if required) the sample should be of uniform grain size and distribution. A 'pinch' from multiple areas of the sample may be taken and combined with a drop or two of 1.550 liquid on a clean glass microscope slide. Fiber identification has already been performed, so unless other liquids are necessary for fiber distinction, 1.550 liquid is used for sample prep.

9.7.2.2 Disperse the sample in the liquid with a clean scalpel blade, tweezers or metal probes. Further reduce the sample grain size, if necessary.

9.7.2.3 Once the sample has become completely and evenly dispersed in the liquid, place a cover slip on top of the sample. Lightly tap the top of the cover slip with the back of the scalple handle or pencil eraser to help even the prep out.

9.7.2.4 If there are air pockets under the cover slip that do not go away with tapping, additional liquid may be added at the side of the cover slip. Capillary action should wick the liquid under the cover slip filling the air pockets. Once again, as in step 9.7.2.3, lightly tap the cover slip to disperse the new liquid throughout the prep.

9.7.3 Melting

9.7.3.1 The sample may contain significant organically bound matrix. If this is the case, the best path for preparation is full gravimetric reduction (see Section 9.5 above).

9.7.3.2 If this is not an option, the organically bound matrix may be melted, and the encumbered material may be freed for analysis.

9.7.3.3 It is most likely that homogenization may not be effective on these types of samples (floor tiles, mastics, caulks, roofing, etc.). It is imperative however, to fully sample all portions of the hand sample to account for any sample compositional differences within the material. In general, this is dependent on the material.

9.7.3.3.1 Floor tiles should be broken to reveal a fresh edge and cross scraped. Place a small portion of the scrapings on a clean slide.

9.7.3.3.2 Mastics and caulks may be assumed to be fairly homogeneous, but if available, fresh surfaces should still be chosen for sampling. The material chosen should be placed on a clean slide.

9.7.3.3.3 For separable roofing material, as with all samples, individual layers are prepared and analyzed separately. Various areas of the layer should be selected in representative amounts to their presence in the sample. The sample must both (a) be sufficient in size and quantity to adequately represent the sample during analysis and (b) not be of overloading quantity so the prep is unreadable due to excess material on the slide.

9.7.3.3.4 Inseparable roofing may contain many layers (layered, rolled roofing) however, due to the nature of the matrix (thick and sticky binding material) separation may not always be accomplished without significant contamination. In this case, the sample should be representatively sampled throughout all materials. These samples are possibly the most challenging material to prepare representatively, and as above, care should be taken so the sample prep will both (a) be sufficient in size and

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quantity to adequately represent the sample during analysis and (b) not be of overloading quantity so the prep cannot be analyzed due to excess material on the slide. Sampled material should be placed on a clean microscope slide. (A comment about layers should be placed on the report.)

9.7.3.4 Smearing a small amount of mastic on a slide prior to adding RI liquid may expose fibers to be examined.

9.7.3.5 Place a drop or two of liquid on the samples and disperse the sample in the liquid with a clean scalpel blade.

9.7.3.6 Place a cover slip on the sample, and with the back of an eraser, push the cover slip both downward and laterally around, to both even the cover slip so it lays flat, and to distribute the material under the cover slip.

9.7.3.7 Place the slide on a slide warmer / hot plate inside the hood and allow it to sit for a minute or two, until the organically bound material has been melted slightly. The temperature of the slide warmer should be only warm enough to melt the matrix. Excess heat will cause the liquid to boil and should be avoided.

Note: *If suspect fibers were not able to be identified previously, care should be used in letting the sample/liquid cool to room temperature before RI determinations are made. Dissolved mastic/tar will change the refractive index of the RI liquid in which the fiber is mounted. If discoloration of the liquid is noted, it may be "wicked" out from under the cover slip with a piece of paper towel. Fresh liquid can then be drawn under the cover slip by capillary action.*

9.7.3.8 Once the matrix material has melted and cooled slightly, rub the sample between the cover slip and slide to help the hidden particles free themselves from the organic binder.

9.7.4 Dissolve

9.7.4.1 Samples containing high percentages of carbonates or other acid soluble material may cause sample components to be obscured and difficult to work with. After homogenization, one way to quickly remove this component is by using a low concentration acid (≤ 2N) solution to dissolve the acid soluble fraction of the sample before observation. Two cautions are necessary for this process:

9.7.4.1.1 If suspect material is found, quantitation must include gravimetric reduction to determine the percent of acid soluble material removed prior to quantitation.

9.7.4.1.2 Use of acid must take place in a vented hood.

9.7.4.2 Acid removal of soluble material may take place in two ways: with the use of gravimetric tracking, or without. If gravimetric tracking is to be used, refer to the procedure outlined in Section 9.5 of this method, skipping steps 9.5.11 and 9.5.12, then proceed with fiber identification (9.6) and prepping via pinch mount (9.7.2).

9.7.4.3 The removal of acid soluble matrix material without gravimetric tracking should be considered qualitative, at best. This is, however, a good tool to guard against false negatives. To remove acid soluble matrix material without gravimetric reduction, take a pinch or two of sample and place it on a clean microscope slide.

9.7.4.4 Place a drop or two of diluted acid (≤2N) on the sample and mix the sample

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and acid.

9.7.4.5 Allow the reaction to come to completion, without further bubbling, then place a cover slip on the preparation. It should be noted even when there is no further noticeable reaction, there may in fact be a slight reaction progressing. This will be evident after the cover slip has been placed on the sample if the preparation develops numerous and enlargening air bubble/pockets. If this is the case, prepare another slide, and allow the reaction to proceed further before a cover slip is placed on the slide.

9.7.4.6 **It is absolutely necessary to place a cover slip on the preparation before observation.** Failure to do so will subject the microscope to acid vapors and cause corrosion of the objectives, stage, etc. This will be considered purposeful damage of company property, and is in fact very poor lab practice, and use of acid in this manner is forbidden.

9.7.4.7 The slide is now ready for qualitative evaluation.

9.7.5 Open Flame

Note: *Special care must be taken when sample is placed into an open flame because the chemicals used during sample preparation are flammable. Great care must be also taken not to alter the asbestos during open flame preparation, especially Crocidolite, which can alter at a much lower temperature compared to the other regulated asbestos types. Another consideration is the fibrous composition cannot be based on this preparation because you do not know how much of the material was burned away. Fibrous percentage(s) must still be based on an unaltered sample preparation.*

9.7.5.1 Samples containing a high concentration of organic fibers may benefit from this preparation.

9.7.5.2 The exposure of the sample to an open flame can be conducted multiple ways. The two most common are placing a portion of the sample in a metal tin pan, or pinching a portion of the sample with metal tweezers. Either way, you expose the sample portion to the open flame, then prepare and analyze the residue ashed material.

9.7.5.3 Please make sure you prepare an unaltered preparation of the sample so you identify and quantify the fibers burned away during this procedure.

9.8 Quantitation

9.8.1 Quantitation may take place using a number of methods as required by particular methods or by the client. Some analytical methods may be combined with gravimetric reduction; the quantitation methods available are:

9.8.1.1 Calibrated Visual Estimate

9.8.1.2 EPA 400 Point Count

9.8.1.3 EPA 1000 Point Count

9.8.1.4 EPA PLM NOB may utilize either calibrated visual estimate or one of the EPA Point Count procedures above.

9.8.1.5 NYS Stratified Point Count

9.8.1.6 NYSDOH ELAP 198.6 utilizes NYS Stratified Point Count

9.8.1.7 NIOSH 9002 Estimation Reported as a Range

9.8.1.8 IRSST 244 Calibrated Visual Estimate using predefined ranges

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Note: *For any quantitation method, when samples of problematic matrices are determined to be <1%, and approach or are near the 1% level, further / alternative analysis may be recommend when other technologies and/or procedures are likely to produce more accurate results.*

9.8.2 Identification of fibrous components should already have been completed in Sections 9.4 and 9.6, above. If new fibrous species are encountered, all required criteria in Section 9.6 must be met.

9.8.3 Calibrated Visual Estimate

9.8.3.1 For calibrated visual estimate, scan the entire area under the cover slip on the slide prepared in Section 9.7 above. Scanning should be done with a combination of 10x-20x-40x objectives as dictated by the sample. Higher magnifications are appropriate for finer grained samples difficult to see at lower magnification. Lower magnification may be more appropriate for large grain sizes. The objective is to see good representation of the sample in any given field of view. The process of switching back and forth between objectives is encouraged; however, the entire slide should be scanned in its entirety at least once using one magnification.

9.8.3.2 Observe the slide and determine the percentage of the regulated asbestos portion of the sample to the rest of the sample, both fibrous and non-fibrous. It may be helpful to keep in mind these relative ratios when doing this:

9.8.3.2.1 Fibrous to non-fibrous components

9.8.3.2.2 Regulated asbestos to other fibrous components

9.8.3.2.3 Do not take empty space into account.

9.8.3.2.4 Refer to any standards you may need (daily reference slides, old proficiencies, manufactured predetermined asbestos containing samples, drawings, point counted percentages, etc.) where the percentage of target fibers is known. Refer to samples with the same asbestos type(s) present in the sample.

9.8.3.3 Once you have completed observation of the first slide, return to step 9.7 and prepare another slide; repeat steps 9.8.3.1 to 9.8.3.2, above.

9.8.3.4 Repeat step 9.8.3.3 until you have completed estimation of the sample using at least (more if you feel it necessary) three (3) slide preps of the sample. If you are unsure of the final sample quantitation, more preparations may be processed.

Note: For friable samples and ashed residues, this will ensure the equivalent of at least 1000 non-empty points have been observed, and will ensure an analytical sensitivity of ≤ 0.1% for None Detected samples.

9.8.3.4.1 Estimated percentage of total asbestos (all types) in the sample

9.8.3.4.2 Estimated percentage of each asbestos component

9.8.3.4.3 Estimated percentage of each non-asbestos fibrous component

9.8.3.4.4 Estimated percentage of each non-fibrous component (if categorized)

9.8.4 EPA 400 Pt. Ct.

9.8.4.1 Point counting is a petrographic technique in which a single point (cross hairs) or a point array (Chalkley for example) is/are superimposed on the sample.

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9.8.4.2 Slides prepared for point counting should be preferably only 1 layer thick of sample. The sample should be disperse enough so overlapping areas of the slide are rare, but the slide is still mostly covered with sample.

9.8.4.3 Point counting should be done at a magnification that is dictated by fiber visibility. Higher magnifications are appropriate for finer grained samples difficult to see at lower magnification. Lower magnification may be more appropriate for large grain sizes. The objective is to see good representation of the sample in any given field of view.

9.8.4.4 The sample is moved to a random field of view and the area that is directly below each point or points is counted as a point. Only points superimposed on a particle (non-empty point) are counted. Points that fall over an unoccupied area (empty point) should not be counted; the closest particle identity is not used in place of empty points.

9.8.4.5 Each non-empty point is classified as a regulated asbestos point or a non-asbestos particle. Categories of non-asbestos particles may be subcategorized during the point count (i.e. as cellulose, fiberglass, matrix, etc.) but it is not necessary to point count non-asbestos fiber types; their quantity may be estimated.

9.8.4.6 Points that are superimposed over two individual particle types (i.e. asbestos and non-asbestos) should be counted as 1 point for each particle type.

9.8.4.7 When a point(s) are superimposed on an area that has several overlapping particles, the slide should be moved to another field.

9.8.4.8 After the point / all points in a field of view are counted, move to the next random field of view. This should be done dependent on the type of reticule in use:

9.8.4.8.1 Cross-hair: when using a crosshair reticule, new fields should be selected along multiple parallel traverses of the sample preparation

9.8.4.8.2 Point Array: when using a point array reticule, new fields should be selected on the basis of sampling as much of preparation as possible

9.8.4.9 If asbestos is encountered, but does not happen to be counted as a point, its presence should be noted.

9.8.4.10 Point counting should continue until 400 non-empty points are counted. These should be evenly spread over a minimum of two (2) preps to a maximum of 8 preps. Once the required number of counts has been tallied from the first prep, return to step 9.7 and prepare and analyze additional slides as needed until 400 points have been reached.

9.8.4.10.1 EPA 600/R-93/116 is the most recent method for the identification of asbestos in bulk building materials and stipulates the requirements stated above in Section 9.8.4.10.

9.8.4.10.2 EPA 600/M4-82-020 was the interim method prior to EPA 600/M-82-020. If this method is being used, the point count must take place using 8 slide preparations.

9.8.4.11 While point counting inherently assumes the presence of asbestos, a point count may be performed on a negative sample to demonstrate compliance with a desired analytical sensitivity. In this manner, 400 points are counted as

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outlined above in step 9.8.4.1 to 9.8.4.10, however, a minimum of 3 preparations must be point counted and scanned in their entirety as outlined in Section 9.8.3 to demonstrate a None Detected result.

9.8.5 EPA 1000 Pt. Ct.

9.8.5.1 When it is desirable, either by agency regulation, or by client request, to provide a lower analytical sensitivity, the number of points counted during a point count (as described in Section 9.8.4 above) can be increased. This is effective in increasing the accuracy of results under 1% and can also meet depressed action limits (i.e. 0.1% asbestos).

9.8.5.2 Slides prepared for point counting should be preferably only 1 layer thick of sample. The sample should be disperse enough so overlapping areas of the slide are rare, but the slide is still mostly covered with sample.

9.8.5.3 Point counting should be done at a magnification that is dictated by fiber visibility. Higher magnifications are appropriate for finer grained samples that are difficult to see at lower magnification. Lower magnification may be more appropriate for large grain sizes. The objective is to be able to see good representation of the sample in any given field of view.

9.8.5.4 The sample is moved to a random field of view and the area directly below each point or points is counted as a point. Only points superimposed on a particle (non-empty point) are counted. Points that fall on / are superimposed over an unoccupied area (empty point) should not be counted; the closest particle identity is not used in place of empty points.

9.8.5.5 Each non-empty point is classified as a regulated asbestos point or a non-asbestos particle. Categories of non-asbestos particles may be subcategorized during the point count (i.e. as cellulose, fiberglass, matrix, etc.) but it is not necessary to point count non-asbestos fiber types; their quantity may be estimated.

9.8.5.6 Points superimposed over two individual particle types (i.e. asbestos and non-asbestos) should be counted as 1 point for each particle type.

9.8.5.7 When a point(s) are superimposed on an area that has several overlapping particles, the slide should be moved to another field.

9.8.5.8 After the point / all points in a field of view are counted, move to the next random field of view. This should be done dependent on the type of reticule in use:

9.8.5.8.1 Cross-hair: when using a crosshair reticule, new fields should be selected along multiple parallel traverses of the sample preparation

9.8.5.8.2 Point Array: when using a point array reticule, new fields should be selected on the basis of sampling as much of preparation as possible

9.8.5.9 If asbestos is encountered, but does not happen to be counted as a point, its presence should be noted.

9.8.5.10 Point counting should continue until 1000 non-empty points are counted. These should be evenly spread over a minimum of 5 preps to a maximum of 20. Once the required number of counts has been tallied from the first prep, return to step 9.7 and prepare and analyze additional slides as needed until 1000

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points have been reached. Additional preps (beyond 5) may provide better accuracy and representation of the entire sample, especially when performing extended point counts.

9.8.5.10.1 EPA 600/R-93/116 is the most recent method for the identification of asbestos in bulk building materials and stipulates the requirements stated above in Section 9.8.5.10.

9.8.5.10.2 EPA 600/M4-82-020 was the interim method prior to EPA 600/R-93/116. This method requires 400 points be counted and cannot be used for the 1000 point count.

9.8.5.11 While point counting inherently assumes the presence of asbestos, a point count may be performed on a negative sample to demonstrate compliance with a desired analytical sensitivity. In this manner, 1000 points are counted as outlined above in step 9.8.5.1 to 9.8.5.10, however, a minimum of 3 preparations must be point counted and scanned in their entirety as outlined in Section 9.8.3 to demonstrate a None Detected result.

9.8.6 NYS DOH ELAP Stratified Point Count

9.8.6.1 While similar to EPA point counting, NYS DOH ELAP's specified method of point counting (often referred to as Stratified or NYS Stratified Point Counting) differs in significant ways. While the precision of NYS Stratified point count is lower than traditional 400 point counting at higher concentrations, it is important to realize, at levels at 1% or below, 400 points are counted using this scheme. Differences include:

9.8.6.1.1 Point counting must be performed at 100x, although other magnifications may be used to clarify fibers; counting must be conducted at 100x.

9.8.6.1.2 4 to 8+ preparations are required for analysis.

9.8.6.1.3 The scanning negative option for None Detected samples requires 4 preparations.

9.8.6.1.4 The point counting procedure utilizes a "positive stop" form of point counting.

9.8.6.2 Point counting is a petrographic technique in which a single point (crosshair) or a point array (Chalkley for example) is/are superimposed on the sample. Initially, 4 preparations should be prepared for analysis. Slides prepared for point counting should be preferably only 1 layer thick of sample. The sample should be disperse enough so overlapping areas of the slide are rare, but the slide is still mostly covered with sample.

9.8.6.3 Point counting should be done at a 100x magnification. During the point count it may be advantageous to switch to other magnifications for better visualization / characterization; however it is necessary to return to 100x for counting.

9.8.6.4 The slide (initially, the first slide) is scanned to determine its gross composition and compatibility for point counting. A random field of view is selected and the microscope (if not already there) is at 100x. Point counting may use either a crosshair reticule or point array (Chalkley) reticule. During point counting, each slide is counted until the following

9.8.6.4.1 The first asbestos point is counted or

9.8.6.4.2 50 non-empty points have been counted, regardless

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9.8.6.4.3 No more than 1 asbestos point many be counted per preparation.

9.8.6.4.4 If the sample is judged to have no asbestos in it, the entire area of the sample prep should be scanned at 100x. If at any time asbestos is encountered, scanning should stop and point count commence. All preparations, regardless of which preparation the asbestos was encountered on, are to be point counted.

Note: *If a crosshair reticule is chosen, count the point under the reticule crosshairs and move to a new, random field of view. If a point array reticule is chosen, counting should commence at the same point in every field of view. The Chalkley array has a total of 25 points in the reticule as well as a crosshair. The crosshair should be ignored, and one of the points should be picked to be the first counted each time. A systematic path should then be used to traverse the points in the Chalkley array and the same path used for every field of view during the analysis.*

9.8.6.5 Only points superimposed on a particle (non-empty point) are counted. Points that fall on / are superimposed over an unoccupied area (empty point) should not be counted; the closest particle identity is not used in place of empty points.

9.8.6.6 Each non-empty point is classified as a regulated asbestos point or a non-asbestos particle. Categories of non-asbestos particles may be subcategorized during the point count (i.e. as cellulose, fiberglass, matrix, rtc.) but it is not necessary to point count non-asbestos fiber types; their quantity may be estimated.

9.8.6.7 Points that are superimposed over two individual particle types (i.e. asbestos and non-asbestos) should be counted as 1 point for each particle type.

9.8.6.8 When a point(s) are superimposed on an area that has several overlapping particles, the slide should be moved to another field.

9.8.6.9 After the point / all points in a field of view are counted, move to the next field of view. The next field of view should be selected at random, with the analyst looking away temporarily while moving the slide.

9.8.6.10 If asbestos is encountered, but does not happen to be counted as a point, its presence should be noted.

9.8.6.11 The remaining three (3) slides should be processed using steps 9.8.6.4 through 9.8.6.10.

9.8.6.12 After completion of point counting all four preps, and if the point count has yielded 4 asbestos points, the point count is complete.

9.8.6.13 If less than 4 asbestos points have been counted after the first four preps are processed, additional preps should be prepped following Section 9.7, and point counted following steps 9.8.6.4 through 9.8.6.10. Preps should be made and point counting should continue until either:

9.8.6.13.1 4 asbestos points are counted or

9.8.6.13.2 400 non-empty points are counted or

9.8.6.13.3 No asbestos is encountered and the areas under 4 cover slip preparations are completely scanned at 100x.

9.8.6.14 After conditions in step 9.8.6.13 are met, the point count is finished.

9.8.7 NIOSH 9002

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9.8.7.1 Scan the entire area under the cover sliped slide prepared in Section 9.7. Scanning should be done with a combination of 4x-10x-20x-40x objectives as dictated by the sample. Higher magnifications are appropriate for finer grained samples difficult to see at lower magnification. Lower magnification may be more appropriate for large grain sizes. The objective is to see good representation of the sample in any given field of view. The process of switching back and forth between objectives is encouraged, however, the entire slide should be scanned in its entirety at least once using one magnification.

9.8.7.2 Observe the slide and determine the percentage of the regulated asbestos portion of the sample to the rest of the sample, both fibrous and non-fibrous. Use Figure #1 in NIOSH 9002 (also included in Section 16) as an aid in determining the estimate. It may be helpful to keep in mind the following relative ratios when doing this:

9.8.7.2.1 Fibrous to non-fibrous components

9.8.7.2.2 Regulated asbestos to other fibrous components

9.8.7.2.3 Do not take empty space into account.

9.8.7.2.4 Refer to any standards you may need (daily reference slides, old proficiencies, manufactured predetermined asbestos containing samples, drawings, point counted percentages, etc.) where the percentage of target fibers is known. Refer to samples with the same asbestos type(s) that are present in the sample.

9.8.7.3 Once you have completed observation of the first slide, return to step 9.7 and prepare another slide, and repeat Sections 9.8.7.1 to 9.8.7.2 above.

9.8.7.4 Repeat step 9.8.7.3 until you have complete estimation of the sample using at least (more if you feel it necessary) three (3) slide preps of the sample. If you are unsure of the final sample quantitation, more preparations may be processed. Once multiple preparations have been evaluated, estimate a final microscopic asbestos content for the sample.

9.8.7.5 Combine your microscopic estimation in step 9.8.7.4 with the macroscopic fiber estimations in Section 9.3 to produce final sample estimated concentrations. The final concentration should be a range that reflects the analyst's precision, and by utilizing Fig. 1 in NIOSH 9002.

9.8.7.5.1 Estimated percentage range of total asbestos (all types) in the sample

9.8.7.5.2 Estimated percentage range of each asbestos component

9.8.7.5.3 Estimated percentage of each non-asbestos fibrous component

9.8.7.5.4 Estimated percentage of each non-fibrous component (if categorized)

9.8.8 IRSST 244

9.8.8.1 Scan the entire area under the cover slip slide prepared in Section 9.7. Scanning should be done with a combination of 4x-10x-20x-40x objectives as dictated by the sample. Higher magnifications are appropriate for finer grained samples difficult to see at lower magnification. Lower magnification may be more appropriate for large grain sizes. The object is to be able to see good representation of the sample in any given field of view. The process of switching back and forth between objectives is encouraged; however, the

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entire slide should be scanned in its entirety at least once using one magnification.

9.8.8.2 Prepare 5 additional preparations (Section 9.7) and repeat step 9.8.8.1.

9.8.8.3 If, after the scanning and analysis of all 6 preparations, and taking the original stereoscopic observations into account:

9.8.8.4 The estimated asbestos concentration in the sample is 1% or greater, the sample is reported as a percentage above 1%, and analysis is terminated.

9.8.8.5 Either no asbestos fibers are present, or the estimated asbestos concentration in the sample is <1%, 3 additional preparations should be made and scanned for asbestos content.

9.8.8.6 If after the observation of all 9 sample preps there are no asbestos fibers seen in the any of the preps, report the sample as None Detected. Floor tile samples should be forwarded for analysis via NYS TEM 198.4 NOB.

9.8.8.7 If after the observation of all 9 sample preps there are ≤ 4 asbestos fibers detected, report the sample as TRACE. Floor tile samples should be forwarded for analysis via NYS TEM 198.4 NOB.

9.8.8.8 If after the observation of all 9 sample preps there are asbestos fibers seen in many if not all preps, and at least 5 individual asbestos fibers are observed, report the sample as <1%.

Note: *Floor tiles that are found to be None Detected or Trace (≤ 4 asbestos fibers detected in 9 preps) are required to be analyzed via NYS method TEM 198.4 NOB. For TEM analysis of these samples, the lab should consider all fibers ≥3:1 in aspect ratio, which may include cleavage fragments, to be considered asbestos. If the sample will be forwarded to a 3rd party lab (EMSL lab or otherwise) the receiving lab must be informed of this method modification for NYS TEM 198.4. (The lab must be NYS ELAP certified for the analysis.)*

It is also optional that other samples that would benefit from gravimetric matrix modification and TEM analysis be forwarded at the client's request.

9.9 Data Recording

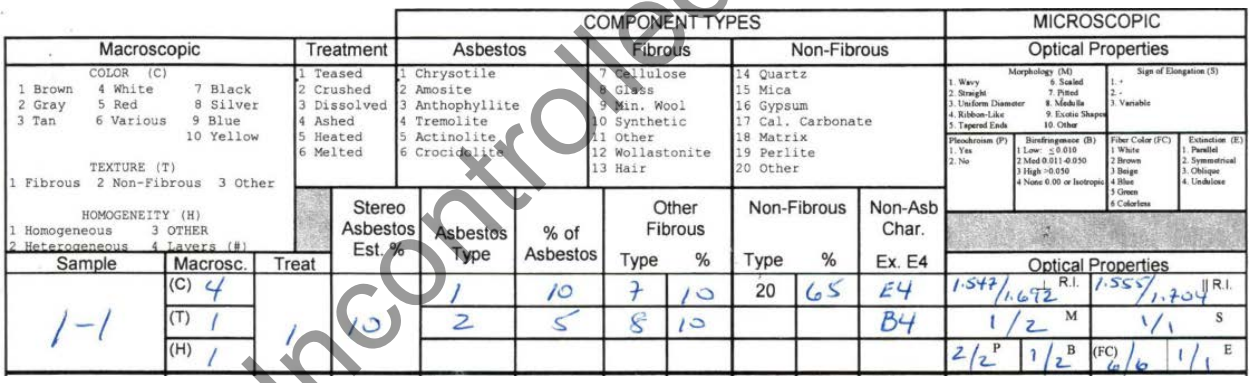
9.9.1 Following method requirements, specific information is collected and recorded during analysis. Information is recorded on EMSL's PLM worksheet, or in EMSL's Direct Data entry database interface, "iLab." For information on the use of "iLab", please see EMSL's Asbestos DDE Manual on elink.

Regardless of the method of recording used, all information detailed below is required to be recorded. The microscopist observes and documents macroscopic and microscopic characteristics, concentrations of materials, optical properties and any other pertinent information. Along with the analyst's signature, date of analysis and temperature (in °C), the information recorded includes:

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Macroscopic Characteristics	Sample Treatment	Component Types	Microscopic Characteristics
Color	Teased	Asbestos	Morphology
Texture (fibrous, non-fibrous, other)	Crushed	Other fibrous	Sign of Elongation
Homogeneity	Dissolved	Non-fibrous	Pleochroism
	Ashed		Birefringence
	Heated/Melted		Fiber Color
			Refractive Index
			Extinction

9.9.2 At least the first 4 fibers of asbestos in each sample shall be positively identified, if possible, by each of these microscopic parameters. When more than one asbestos type is identified in a sample, at least 4 fibers of each asbestos type, if possible, must be positively identified. Many of EMSL's worksheets are designed to utilize codes in order to conserve space and make data entry more efficient; these codes are also available for use in direct data entry in iL@B. The following is an example of the header of the PLM analytical worksheet and the codes are listed below. If a component is not explicitly listed in the codes, an option of "Other" is available for recording purposes. The material should still be correctly identified and properties recorded:



Macroscopic			Treatment	COMPONENT TYPES: Asbestos			Fibrous		Non-Fibrous			MICROSCOPIC: Optical Properties
COLOR (C) 1 Brown 4 White 7 Black 2 Gray 5 Red 8 Silver 3 Tan 6 Various 9 Blue 10 Yellow TEXTURE (T) 1 Fibrous 2 Non-Fibrous 3 Other HOMOGENEITY (H) 1 Homogeneous 3 OTHER 2 Heterogeneous 4 Layers (#)			1 Teased 2 Crushed 3 Dissolved 4 Ashed 5 Heated 6 Melted	1 Chrysotile 2 Amosite 3 Anthophyllite 4 Tremolite 5 Actinolite 6 Crocidolite			7 Cellulose 8 Glass 9 Min. Wool 10 Synthetic 11 Other 12 Wollastonite 13 Hair		14 Quartz 15 Mica 16 Gypsum 17 Cal. Carbonate 18 Matrix 19 Perlite 20 Other			Morphology (M) / Sign of Elongation (S) / Pleochroism (P) / Birefringence (B) / Fiber Color (FC) / Extinction (E)
Sample	Macrosc.	Treat		Stereo Asbestos Est. %	Asbestos Type	% of Asbestos	Other Fibrous Type	%	Non-Fibrous Type	%	Non-Asb Char. Ex. E4	Optical Properties
1-1	(C) 4	1		10	1	10	7	10	20	65	E4	1.547/1.672 ⊥ R.I. 1.555/1.704 ∥ R.I.
	(T) 1				2	5	8	10			B4	1/2 M 1/1 S
	(H) 1											2/2 P 1/2 B (FC) 6/6 1/1 E

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Optical Property codes can be seen more clearly here:

Morphology (M)		Sign of Elongation (S)		
1. Wavy	6. Scaled	1. +		
2. Straight	7. Pitted	2. -		
3. Uniform Diameter	8. Medulla	3. Variable		
4. Ribbon-Like	9. Exotic Shapes			
5. Tapered Ends	10. Other			
Pleochroism (P)	Birefringenece (B)	Fiber Color (FC)	Extinction (E)	
1. Yes	1 Low: ≤ 0.010	1 White	1. Parallel	
2. No	2 Med 0.011-0.050	2 Brown	2. Symmetrical	
	3 High >0.050	3 Beige	3. Oblique	
	4 None 0.00 or Isotropic	4 Blue	4. Undulose	
		5 Green		
		6 Colorless		

9.9.3 Worksheets are completed by inserting the appropriate code for each observation. In the example above the sample 1-1 was:

9.9.3.1 White (C=4)
9.9.3.2 Fibrous (T=1)
9.9.3.3 Homogeneous (H=1)
9.9.3.4 Teased (Treat=1)
9.9.3.5 Contained approximately 10% suspect asbestos by steremicroscope
9.9.3.6 Contained 10 % chrysotile (Asbestos Type=1, 10%)
9.9.3.6 and 5% amosite (Asbestos Type=2, 5%)
9.9.3.7 10% cellulose (Other Fibrous=7, 10%)
9.9.3.8 and 75% other non-fibrous material (Non-Fibrous=20, 75%)
9.9.3.9 The distinguishing characteristic for the non-asbestos fiber detected (cellulose) was undulose extinction (Non-Asb Char.=E4).
9.9.3.10 The distinguishing characteristic for the non-asbestos fiber detected (glass) was isotropic (Non-Asb Char = B4).

Note: *For sample analyzed using NIOSH 9002, asbestos concentrations should be recorded as a range.*

9.9.4 The optical properties are filled out similarly and for the purposes of filling out the PLM analytical bench sheet when more than one asbestos type is encountered, the Optical Properties may be recorded as follows:

9.9.4.1 Each sample space/block on the worksheet allows for the listing of up to 3 asbestos types on three distinct lines within the space.
9.9.4.2 List each asbestos type and percent, in order of decreasing quantity, on the lines within the sample.
9.9.4.3 In the Optical Properties section of the worksheet, separate each box in the section using a slash or slashes. This will mark individual sections of each box for entry of optical properties of each asbestos type (i.e. if there are 2 asbestos types, each box will be divided into two spaces to allow for recording of two sets of

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optical properties).

9.9.4.4 The first (leftmost) section of each Optical Properties box is for the first asbestos type, the next section is for the second asbestos type and so on. In this example, chrysotile is the first asbestos type (asbestos type #1) and amosite is the second (asbestos type #2). The optical properties for chrysotile are the first or leftmost property in each box. In this case, the ⊥ Refractive Index (RI) for chrysotile is 1.547 and the ⊥ RI for amosite is 1.692.

Asbestos Type	% of Asbestos
1	10
2	5

Optical Properties					
1.547 / 1.692 ⊥ R.I.		1.555 / 1.709 ∥ RI.			
1 / 2 M		1 / 1 S			
2 / P 2	1 / B 2	(FC) 6 / 6	1 / 1 E		

9.9.5 The full set of properties for chrysotile above is:

9.9.5.1 Refractive Index is ⊥ RI=1.547, ll RI=1.555

9.9.5.2 Fiber morphology is wavy (M=1)

9.9.5.3 Sign of elongation is positive (S=1)

9.9.5.4 No pleochroism observed (P=2)

9.9.5.5 Birefringence is low (B=1)

9.9.5.6 Fiber color in plane polarized light is clear (FC=6)

9.9.5.7 Extinction is parallel (E=1)

10.0 Calculations

All calculations are where:

%A - Percent asbestos
%Ave- Percent asbestos visual estimate
%Apt- Percent asbestos from point count
a - Asbestos points counted
n - Total (asbestos + non-asbestos) points counted
W1 - Weight of unashed sample
W2 - Weight of post-ash sample
W3 - Weight of final (post-ash, post-acid) sample
O - % Organics of sample
AS - % Acid soluble material of sample
R - % Non-organic, non-soluble of sample

10.1 Percentage Asbestos Concentrations

10.1.1 Point Count (EPA 400 & 1000 and NYSDOH ELAP Stratified 198.1)

$$\%Apt = (a/n)\cdot 100$$

10.1.2 NOB

10.1.2.1 EPA NOB

$$\%A = (\%Ave \cdot R)/100$$

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10.1.2.2 NYSDOH 198.6

$$\%A = (\%Apt \cdot R)/100$$

10.2 Gravimetric Reduction Calculation

10.2.1 The percent of organics removed in the ashing proces is calculated as:

$$O = [(W1 - W2)/W1] \cdot 100$$

10.2.2 The percent of acid soluble material removed in the acid dissolution is calculated as:

$$AC = [(W2 - W3)/W1] \cdot 100$$

10.2.3 The Final Residue is the percent of non-organic, non-soluble material in the sample is calculated as:

$$R = (W3/W1) \cdot 100$$

11.0 Reporting

11.1 *A note on the use of the term "trace:" Except for the IRSST 244 Method, it is EMSL policy not to use the term 'trace' when reporting sample results, as this terminology is ill-defined and ambiguous. When applying the point count technique, the New York State Environmental Laboratory Approval Program (NYSELAP) methods refer to the term 'trace' where asbestos is observed in the sample slide, but is not directly under a point. EMSL reports <1 % in these cases.*

11.2 *A note for sample results at 1%: In these instances, additional analytical effort should be applied. This should include additional preps for estimation, sampling more areas of the sample, observation by a second analyst, counting more points during point counts, or other means to determine whether the sample may be greater or less than 1%.*

11.3 Certain specific reporting criteria must be taken into account when reporting asbestos concentrations in this SOP. The following items are included in the final report (on EMSL letterhead) to the client:

11.3.1 EPA 600

11.3.1.1 Asbestos concentrations should be reported to the nearest whole integer.

11.3.1.2 Concentrations below 1% are reported as <1%.

11.3.1.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.2 EPA 400 Point Count

11.3.2.1 Asbestos concentrations are reported to the nearest ¼ percent (1/400 points), including concentrations below 1%. If EPA 600/M4/92/020 is being used, results below 1% should be reported as <1%.

11.3.2.2 Samples in which asbestos is encountered but not landed on during point counting are reported as <0.25%.

11.3.2.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.3 EPA 1000 Point Count

11.3.3.1 Asbestos concentrations are reported to the nearest tenth ($^{1}/_{10}$) percent (1/1000 points), including concentrations below 1%.

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11.3.3.2 Samples in which asbestos is encountered but not landed on during point counting are reported as <0.1%.

11.3.3.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.4 EPA NOB

11.3.4.1 Asbestos concentrations are reported to two significant figures, to a lower boundary of 0.25%.

11.3.4.2 Concentrations below 0.25% are reported as <0.25%.

11.3.4.3 Sample in which no asbestos was encountered are reported as "None Detected."

11.3.4.4 Reporting of “Insufficient Residue” samples:

11.3.4.4.1 This designation is regardless of actual residue weights and typically would be utilized for final residue percentages around or below 1%.

11.3.4.4.2 When the preparation of slide preparations from the final residue yields noticeably low loading background particulate, but does not possess sufficient material to be able to reliably make a confident qualitative or quantitative determination or

11.3.4.4.3 The absense of said low loading background particulate indicates there is no appreciable particulate loading transferred from the sample filter, indicating the possibility only transferred material was actual filter.

11.3.4.4.4 This may be determined by noticing if, in fact, there is a particulate loading of approximately <1% of total area, or there is no loading at all on the prepared slides.

11.3.4.4.5 Report the sample using the designation “Insufficient Residue” as well as the sample’s gravimetric breakdown (% organics, % carbonate and final residue %) in a sample comment.

11.3.5 NYS 198.1

11.3.5.1 Asbestos concentrations should be reported to 2 significant figures.

11.3.5.2 For asbestos concentration below 1%, including samples in which asbestos was noted but not counted during point counting, report as <1%.

11.3.5.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.6 Sample Reported using NYSDOH ELAP 198.6:

11.3.6.1 Asbestos concentrations should be reported to 2 significant figures.

11.3.6.2 Total asbestos results (for samples containing more than one (1) asbestos type) are also reported.

11.3.6.3 For asbestos concentration below 1%, including samples in which asbestos was noted but not counted during point counting, report as <1%.

11.3.6.4 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.6.5 Samples reported as None Detected or ≤1% should be analysed by NYS 198.4 (TEM NOB).

11.3.6.6 Samples where no asbestos is detected, or at levels ≤1%, are reported with the additional comment of "Inconclusive" as per 198.6.

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11.3.6.7 Reporting of "Insufficient Residue" samples:

11.3.6.7.1 This designation is regardless of actual residue weights and typically would be utilized for final residue percentages around or below 1%.

11.3.6.7.2 When the preparation of slide preparations from the final residue yields noticeably low loading background particulate, but does not possess sufficient material to be able to reliably make a confident qualitative or quantitative determination or

11.3.6.7.3 The absence of said low loading background particulate indicates that there is no appreciable particulate loading that has been transferred from the sample filter, indicating the possibility that the only transferred material was actual filter.

11.3.6.7.4 This may be determined by noticing if in fact there is a particulate loading of approximately <1% of total area, or there is no loading at all on the prepared slides.

11.3.6.7.5 Report the sample using the designation "Insufficient Residue" as well as the sample's gravimetric breakdown (% organics, % carbonate and final residue %) in a sample comment.

11.3.6.8 If asbestos was identified during preliminary stereomicroscopic observation, and the sample was eventually found to be None Detected or calculated to be ≤1% asbestos by NYSDOH ELAP 198.4, report the sample as "Conflicting Results - additional sampling and analysis needed."
Note: According to this procedure in Section 9.4 above, fiber identification during preliminary stereomicroscopic observation is ***not performed****.*

11.3.7 NIOSH 9002

11.3.7.1 Asbestos concentrations should be reported as a range representing the analyst's precision.

11.3.7.2 Concentrations below 1% are reported as <1%.

11.3.7.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.8 IRSST 244

11.3.8.1 Asbestos concentration ≥1% is reported as a discreet percentage with reference to defined ranges as listed in the IRSST 244 method. The report will include a listing of these ranges for client reference.

11.3.8.2 Concentrations below 1% are reported as either;

11.3.8.2.1 <1% for samples where >4 asbestos fibers were identified

11.3.8.2.2 Trace for sample in which ≤ 4 asbestos fibers were identified

11.3.8.3 Samples in which no asbestos was encountered are reported as "None Detected."

11.3.9 Alternative reports: There may exist alternative reports (i.e. NY 3 in 1, NJ 5 in 1, Ontario report, etc.), that are meant to summarize multiple analysis methodologies in one summary. In these cases, the composite report may not include all required information as detailed in this section, and should only be issued as a supplement to the individual reports for each analytical method. Uncertainty may also be reported at client request as

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an alternate report and is calculated from EMSL's Uncertainty Worksheet – Asbestos Excel spreadsheet. This may be done as follows:

Note: Separate uncertainties for multiple concentration ranges are recommended.

11.3.9.1 The uncertainty range (at a 95% confidence level) for a result is defined as the reported result $\pm 2S_r$, where S_r = S/mean.

11.3.9.2 S_r values are typically derived using either relative percent difference (RPD) data from quality control samples, or recovery data from standard reference materials (SRMs). In the latter case, the mean shall be the reference value (or 100% if using mean recovery), and thus S_r = S.

PLM Example

If the standard deviation (S) for a population of NVLAP PT data is 10.0% (calculated using % recovery data relative to the reference value), and the mean recovery is 90.0%, the relative standard deviation (S_r) is equal to 10.0% since S_r = S. Thus, in this example, the uncertainty range for a client result of 10% shall be reported as 10% (not corrected for bias) ± 2% ($2S_r$ = 20%, thus $2S_r$ x 10% = 2%) with a probable negative bias of 1%.

11.3.9.3 Note the reported result is not corrected for bias for any client sample. Rather, bias (available only when S_r is derived from SRM data) must be reported as a separate value.

11.3.9.4 When applied to a specific client result, both uncertainty and bias shall be provided in the appropriate units.

11.3.9.5 Alternatively, at the request of the client, the uncertainty, confidence level and bias may simply be provided to the client as the derived percentage values without application to a specific result.

11.4 As a service for our Canadian Clients, a special report format is provided. For this report, a statement as to the analytical sensitivity for None Detected samples will be included. This statement will correspond to Section 9.8.3.4 above.

11.5 Identification of each asbestos type in the sample

11.6 Asbestos concentration in % asbestos of each asbestos type in the sample (upper and lower estimates should be reported for samples following NIOSH 9002)

11.7 Identification of non-asbestos fibers encountered

11.8 Percentage of each non-asbestos fiber type identified

11.9 Percentage, and optionally identification, of matrix material in the sample

11.10 Sample appearance (color, homogeneity, texture)

11.11 Sample description or location of the sample in the field

11.12 Client and lab sample numbers

11.13 Client identification and contact information

11.14 EMSL order ID

11.15 Client project information (if supplied)

11.16 Analysis date, report date and date received

11.17 Signature of lab manager

11.18 Report comments

11.19 Lab accreditations

12.0 Method Performance

12.1 MDL

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12.1.1 EPA 600/R-93/116, EPA 600/M4-82-020, NYSDOH ELAP 198.1 & 198.6, NIOSH 9002, and PLM IRSST 244 method detection limits are < 1%.

12.1.2 EPA 400 Point Count Method detection limit is < 0.25%.

12.1.3 EPA 1000 Point Count Method detection limit is < 0.1%.

12.1.4 EPA NOB method detection limit is dependent on the gravimetric reduction component of the analysis; in theory it could be as low as 0.1% x 1% CVE.

12.2 DOCs

Demonstrations of Capability are required for each analytical method.

12.3 PTs

12.3.1 Proficiency tests are available from NVLAP and NYS ELAP for EPA 600/R-93/116 (with or without EPA point counts and gravimetry components) and NYSDOH 198.1.

12.3.2 All analysts are required to participate in each round of testing either before or after results have been submitted.

12.4 Accuracy

12.4.1 EPA 600/R-93/116 by visual estimate or 400 point count would expect precision and accuracy to be 0-3% at the 1% range. Gravimetry may increase the accuracy of these levels.

12.4.2 NYSDOH ELAP 198.1 only offers that point counting is usually more accurate than visual estimate, and by 198.6, the results are negatively biased as compared to TEM, with the possibility of false negatives.

12.4.3 Not determined for NIOSH 9002

12.5 Precision

12.5.1 EPA 600/R-93/116 by visual estimate or 400 point count would expect precision and accuracy to be 0-3% at the 1% range. Gravimetry may increase these levels.

12.5.2 NYSDOH ELAP 198.1 produces Sr values of 25% or less for concentration of 1 to 3%, and 24 to 45% for concentration of 5 to 7%. ELAP 198.6 applied to VAT samples in the 15 to 30% range (determined via TEM) produced Sr values of 60 to 100%.

12.5.3 Not determined for NIOSH 9002

13.0 Quality Control

13.1 All QC data is entered on the most current version of QC Bench Sheet PLM or Chatfield NOB, and must be maintained and available for easy reference and inspection.

13.2 Blanks

13.2.1 Known negative materials are prepared, using all prep equipment and RI liquids, at a rate of 1 per 100 samples, or at least daily.

13.2.2 Known negative materials are prepared and processed with at least every 20 used of all homogenization equipment (i.e. mortar and pestle, etc.).

13.2.3 For samples involving gravimetric preparation, known negative material is processed, including gravimetric reduction at a rate of 1 per every 20 samples, and at least 1 with every batch of samples processed.

13.3 Sample Re-analysis QC: The selection of samples for re-analysis should be semi-random in nature, and focus more on positive and difficult samples. Our goal, when possible, given we are limited in the portion of our sample population that contain asbestos and are <10%, is to achieve a rate of 30% of our total re-analysis QC samples having asbestos contents of 1-10%.

13.3.1 7% Inter-analyst QC analysis

13.3.2 2% Intra-analyst QC analysis

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13.4 1% Standard analysis

13.4.1 NYS ELAP certified labs must perform point count analysis of the daily reference samples.

Note: *NIOSH 9002 requires analysis of 5% known quantitative standards.*

13.5 0.5% Inter-laboratory analyses performed quarterly following ASB-SOP-2-Asbestos Inter-Lab Sample Exchange

13.6 The selection of QC samples should be semi random and as blind as possible, so the QC analyst does not know the sample identity or result before analysis. One suggested scenario for selecting and submitting QC samples is as follows:

13.6.1 For each batch of samples, the original analyst should determine the number of QC samples to be selected for QC. This is 2% (approximately 1/50) for intra-analyst analysis and 7% (approximately 1/15 sample) for inter-analyst analysis.

13.6.2 Small jobs may be combined to use as a sample pool, but it is important to keep in mind not every batch of samples needs to have QC samples chosen from it.

13.6.3 The original analyst will select the inter-analyst QC samples to be used and record the EMSL order ID and the sample numbers to be reanalyzed on a separate, blank analytical worksheet.

13.6.4 These samples are then submitted, along with the worksheet, to the QC analyst for reanalysis.

13.6.5 The original analyst also inputs the Date, Order ID, Sample ID, Original Analyst Initials and Original Sample Results in the PLM QC spreadsheet.

13.6.6 After the inter-analyst QC samples have been analyzed, the QC analyst will input the QC results in the corresponding rows of the PLM QC spreadsheet as started by the original analyst.

13.6.7 The QC analyst will then pick the required amount of intra-analyst QC samples, and as in step 13.7.3 above, record the EMSL Order ID and the sample numbers to be reanalyzed on a separate, blank analytical worksheet.

13.6.8 The QC analyst will also input the Date, Order ID, Sample ID, Original Analyst Initials and Original Sample Results in the PLM QC spreadsheet.

13.6.9 These samples are then submitted, along with the blank worksheet, to the Original analyst for QC analysis.

13.6.10 After reanalysis by the original analyst, the results are entered in the PLM QC spreadsheet.

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14.0 Data Assessment

14.1 Acceptance Criteria for QC Measures

These are addressed in EMSL's QMS Manual, Module A.

14.1.1 If a sample falls outside the acceptable limits it needs to be reconciled with participating analysts and/or a third analyst, when necessary.

14.1.2 The Pass/Fail criteria for inter-analyst QC and formula for R (variance) is:

Pass $-1 \leq R \leq 1$
Fail $R < -1$ or $R > 1$

$$R = \frac{(A-B)}{((A+B)/2)}$$ where A = analysis 1 and B = analysis 2

14.1.3 The Pass/Fail criteria for intra-analyst QC and formula for R (variance) is:

Pass R ≤ 1
Fail R > 1

$$R = \frac{|A-B|}{((A+B)/2)}$$ where A = analysis 1 and B = analysis 2

14.1.4 Standard analysis is tabulated for precision and accuracy.

14.2 Corrective Actions

These policies are addressed fully in EMSL's QMS Manual.

14.2.1 All corrective actions should look for the root cause of the error.

14.2.2 All out of control or unacceptable data must be brought to the attention of the laboratory manager.

14.2.3 The laboratory manager is responsible for generating a corrective action including an investigation of calibration procedures, a review of analytical technique and investigation of training policies and compliance.

14.2.4 Corrective actions will be reported to the QA Department by means of the Quarterly Management Report and Monthly Asbestos QC Report or sooner, when appropriate.

14.3 Contingencies for Handling Out-of-Control or Unacceptable Data

Any quality control requirements not met must have an explanation to their nonconformance.

14.4

15.0 Method Validation

15.1 EMSL Analytical uses analytical methods published or approved by regulatory authorities or consensus standard development agencies. Additional method validation is not required. Quality control data is evaluated on regular basis to ensure effectiveness of the procedure.

16.0 Pollution Prevention / Waste Management

16.1 Pollution Prevention

EMSL Analytical makes all efforts to reduce the volume and toxicity of the waste generated by the laboratory. An effort to manage procurement of hazardous materials has been implemented in order to avoid over ordering. Hazardous waste is classified for proper disposal.

16.2 Waste Management

The waste generated during prep and analysis will be disposed of following safety procedures outlined in the chemical hygiene and safety plan.

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17.0 Tables, Diagrams, Flowcharts, and Validation Data

17.1 CHEMICAL FORMULAS FOR TYPICAL ASBESTOS MINERALS

Mineral	*Chemical Formula*
Chrysotile	$Mg_3Si_2O_5(OH)_4$
Amosite	Approx $Mg_{2.8}Fe_{4.2}Si_8O_{22}(OH)_2$
Crocidolite	$Na_2Fe^{2+}{}_3Fe^{3+}{}_2Si_8O_{22}(OH)_2$
Anthophyllite	$Mg_7Fe_0Si_8O_{22}(OH)_2$- $Mg_6Fe_1Si_8O_{22}(OH)_2$
Tremolite	$Mg_5Fe_0Ca_2Si_8O_{22}(OH)_2$- $Mg_{4.5}Fe_{0.5}Ca_2Si_8O_{22}(OH)_2$
Actinolite	$Mg_{4.5}Fe_{0.5}Ca_2Si_8O_{22}(OH)_2$- $Mg_{2.5}Fe_{2.5}Ca_2Si_8O_{22}(OH)_2$

17.2 ASBESTOS AND ANALOG NON-ASBESTIFORM VARIETIES

Asbestos	*Non-Asbestos Analog*
Chrysotile	Antigorite-Lizardite
Crocidolite	Riebeckite
Amosite	Cummingtonite-Grunerite
Asbestiform Anthophyllite	Anthophyllite
Asbestiform Tremolite	Tremolite
Asbestiform Actinolite	Actinolite

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17.3 OPTICAL PROPERTIES OF ASBESTOS FIBERS

As summarized from EPA 600/R-93/116 and ELAP 198.1

Mineral	Morphology, Color	Refractive Indices α	Refractive Indices γ[1]	Birefringence	Extinction	Sign of Elongation
Chrysotile (asbestiform) serpentine	Wavy fibers. Fiber bodies have splayed ends and "kinks." Aspect ratio typically > 10:1, Colorless	1.493-1.559	1.517-1.567	0.004 - 0.017	Parallel / Undulose	+ (length slow)
Amosite (asbestiform grunerite)	Straight to curved, rigid fibers moderately flexible. Aspect ratio typically > 10:1. Colorless to tan / brown, nonpleochroic or weakly so. Opaque inclusions may be present. Easily splayed ends.	1.657-1.686	1.696-1.729	0.021 - 0.054	Usually Parallel / Infrequently ~2º	+ (length slow)
Crocidolite (asbestiform riebeckite)	Straight to curved, flexible and rigid fibers, some kink bands, splayed ends. Thick fibers and bundles common, blue to dark blue in color. Pleochroic. Aspect ratio typically > 10:1.	1.654-1.701	1.668-1.717	0.003 - 0.022	Usually Parallel	- (length fast)
Anthophyllite	Straight to curved fibers and bundles, usually stiff, ends splayed to blunt. Aspect ratios typically >10:1, cleavage fragments may be present with aspect ratios < 10:1. Colorless to tan/ light brown	1.596-1.694	1.615 - 1.722	0.013 - 0.028	Parallel	+ (length slow)
Tremolite	Straight to curved fibers and bundles, usually stiff, large bundles may have splayed ends. Aspect ratio > 10:1, cleavage fragments may be present as single crystals with aspect ratios < 10:1. Colorless to pale green (rarely).	1.599-1.628	1.625-1.655	0.017 - 0.028	Parallel and oblique / inclined up to 21º	+ (length slow)
Actinolite	Straight to curved fibers and bundles, usually stiff, large bundles may have splayed ends. Aspect ratio > 10:1, cleavage fragments may be present as single crystals with aspect ratios < 10:1. Colorless to pale green. Pleochroic.	1.600-1.668	1.625-1.688	0.017 - 0.028	Parallel and oblique / inclined up to 21º	+ (length slow)

[1] γ is the parallel orientation for all asbestos minerals except in crocidolite γ is ⊥.

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17.4 Expected Dispersion Staining Colors Using Central Stop Lens

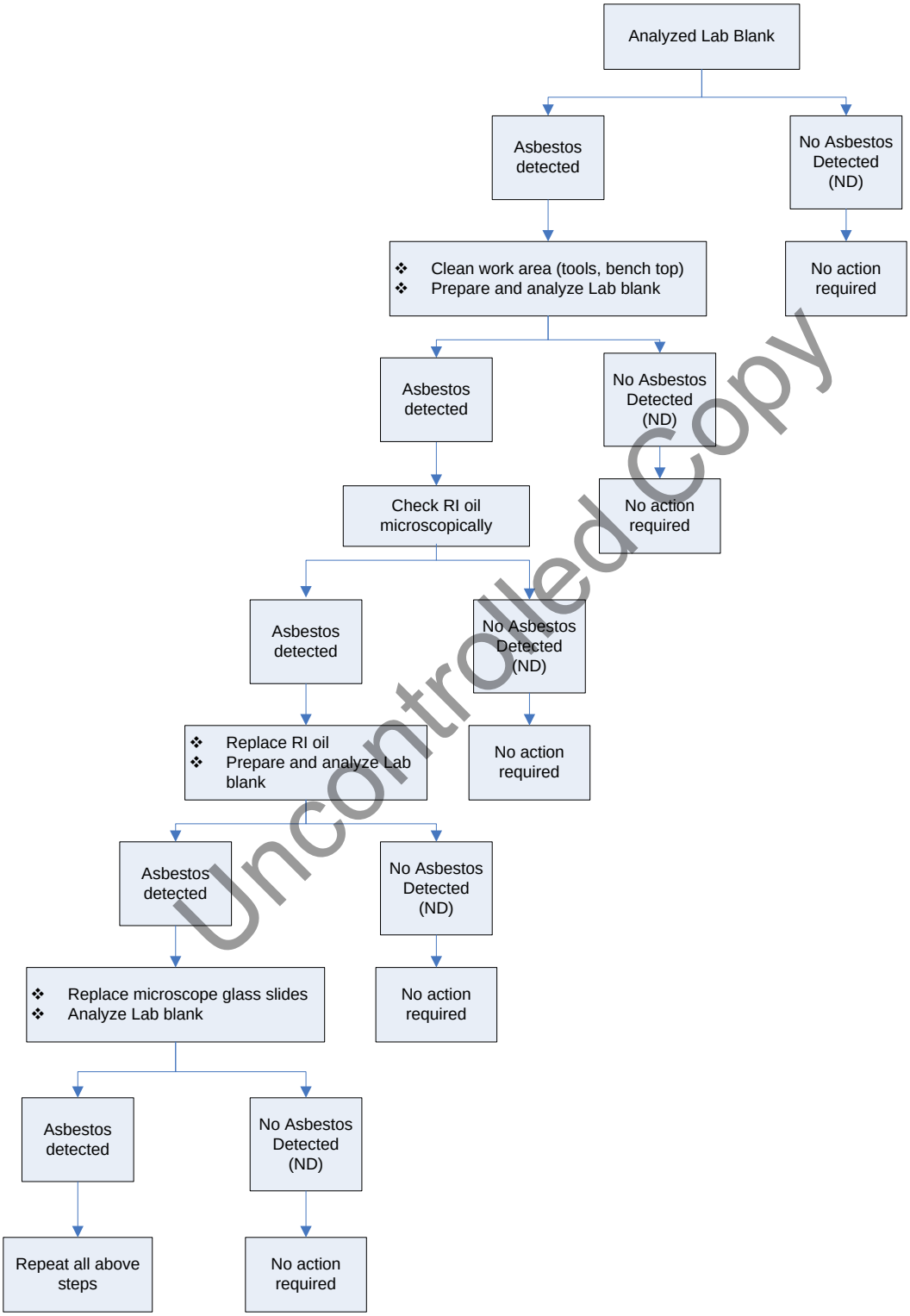
As summarized from (1) EPA 600/R-93/116, (2) NIOSH 9002, (3) McCrone Asbestos Identification and (4) EMSL Corporate.

CENTRAL STOP DISPERSION STAINING COLORS

MINERAL	RI LIQUID	Reference	‖ (parallel)	⊥ (perpendicular)
Chrysotile	1.550[HD]	1	magenta to light blue-green	blue-green to pale blue
		2	blue-magenta	blue
		3	magenta	blue
“Amosite”	1.680	1	yellow to magenta	blue-magenta to light blue
		2	gold	blue
		3	golden yellow	blue
"Crocidolite"	1.680	1	yellow to magenta	pale yellow to golden yellow
		2	yellow	pale yellow
		3	golden yellow	pale yellow
	1.700	2	blue-magenta	red-magenta
Anthophyllite	1.605[HD]	1	pale yellow to yellow	golden yellow to light blue-green
		2	gold to golden magenta	blue
		3	yellow	blue-magenta
	1.620 [HD]	2	golden yellow	blue-green
		4	golden yellow	pale blue
	1.625[HD]	4	red yellow	light blue
Tremolite	1.605 [HD]	1	pale yellow to yellow	golden yellow to light blue-green
		2	yellow	pale blue
		3	yellow to pale yellow	blue, magenta
	1.620[HD]	4	golden yellow	dark blue
	1.625[HD]	4	magenta red	light blue
Actinolite	1.605 [HD]	1	pale yellow	pale yellow to golden yellow
		2	pale yellow	yellow
		3	pale yellow	yellow to pale yellow
	1.620[HD]	4	yellow	light blue
	1.625$_{HD}$	4	golden yellow	light blue
	1.630[HD]	1	yellow to magenta	golden yellow to blue

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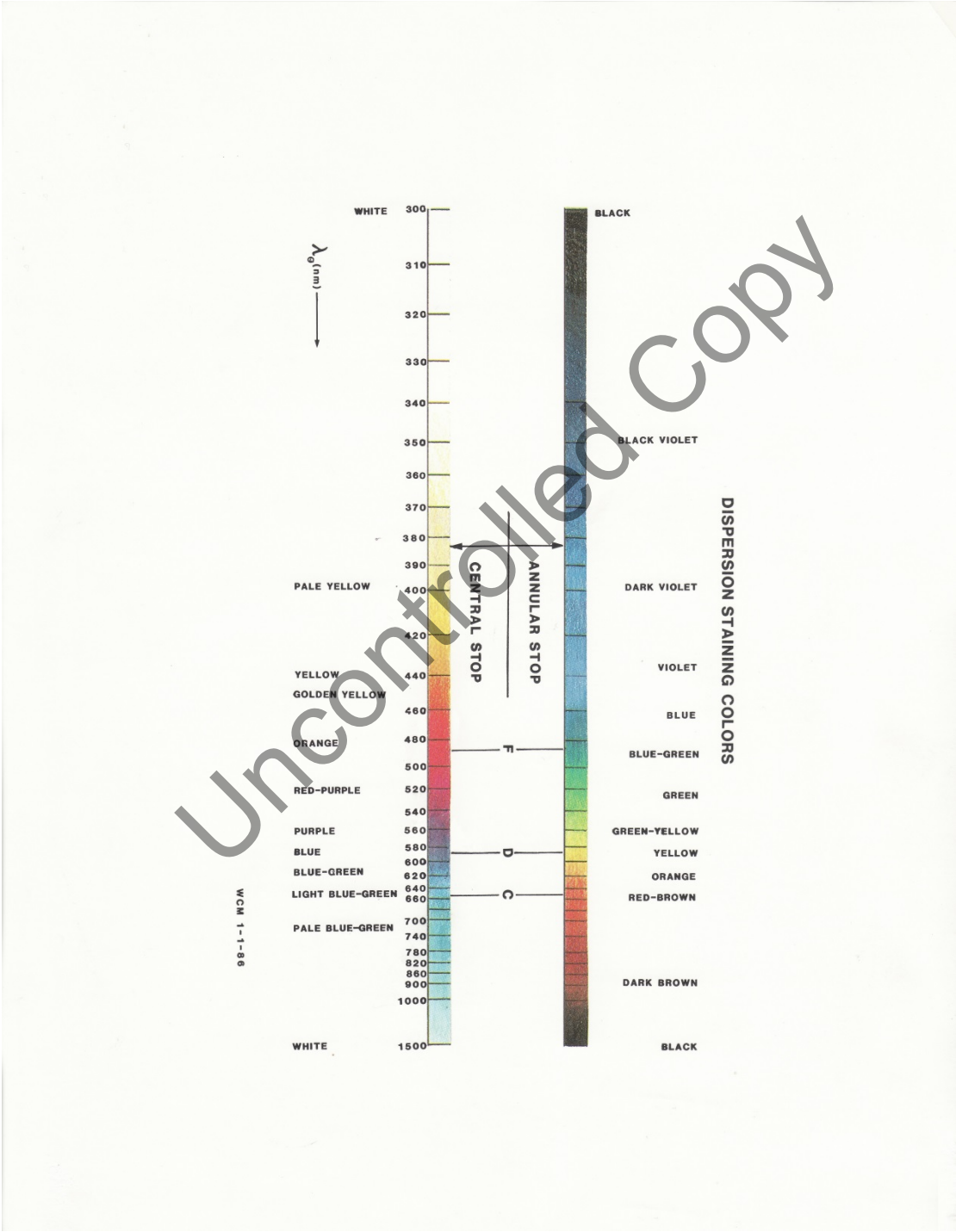
17.5 Contamination Flowchart



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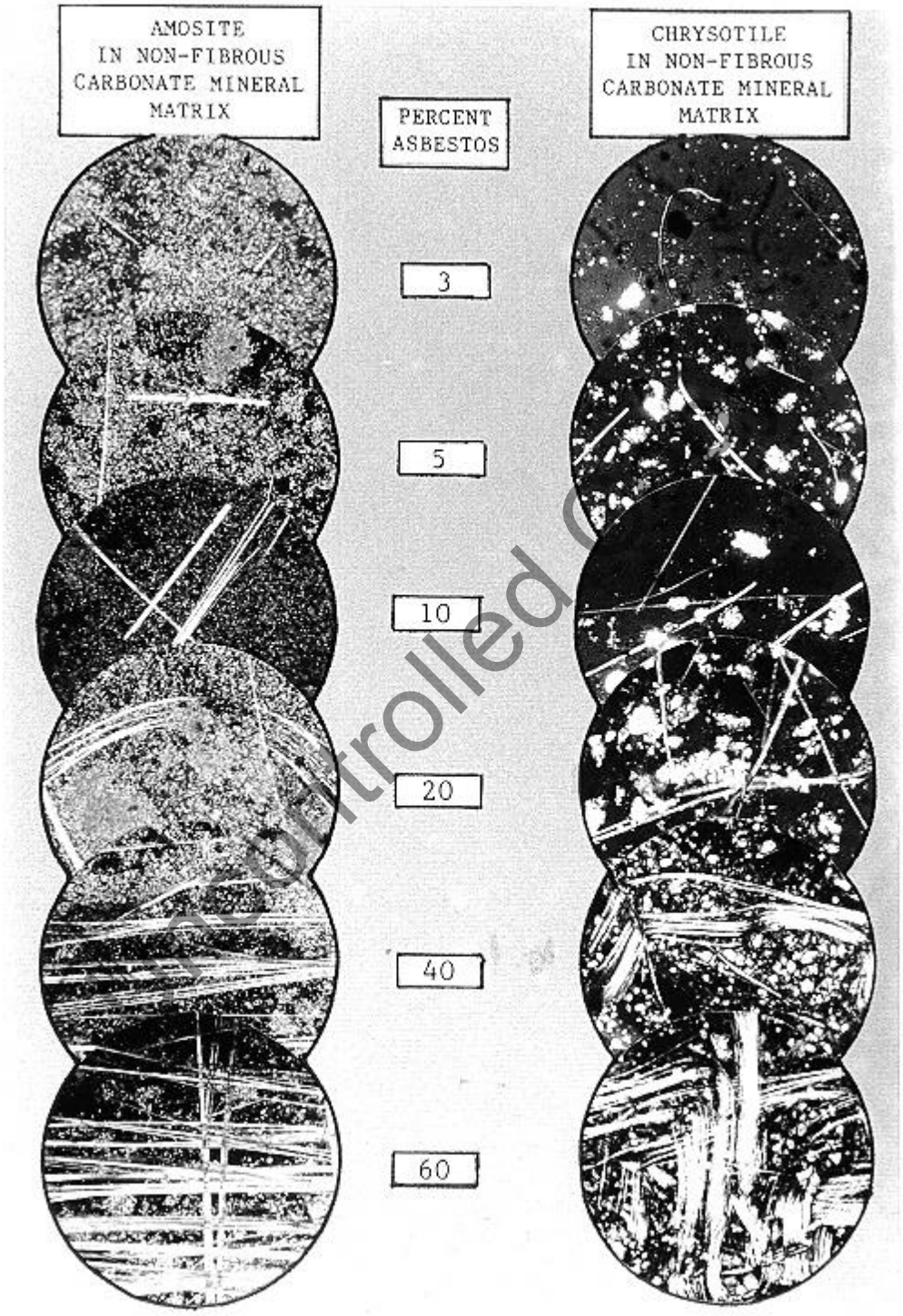
17.6 Dispersion Staining Colors / Wavelength Charts

Note: *This chart is presented as an example. Due to variations in the chart scan coloring, and monitor to monitor differences, actual color / wavelength determinations should be made using hard copies of charts available in the lab.*



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17.7 Asbestos Concentration Chart for NIOSH 9002



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17.8 Dispersed Becke line Chart by Prof. F. Donald Bloss (1999)

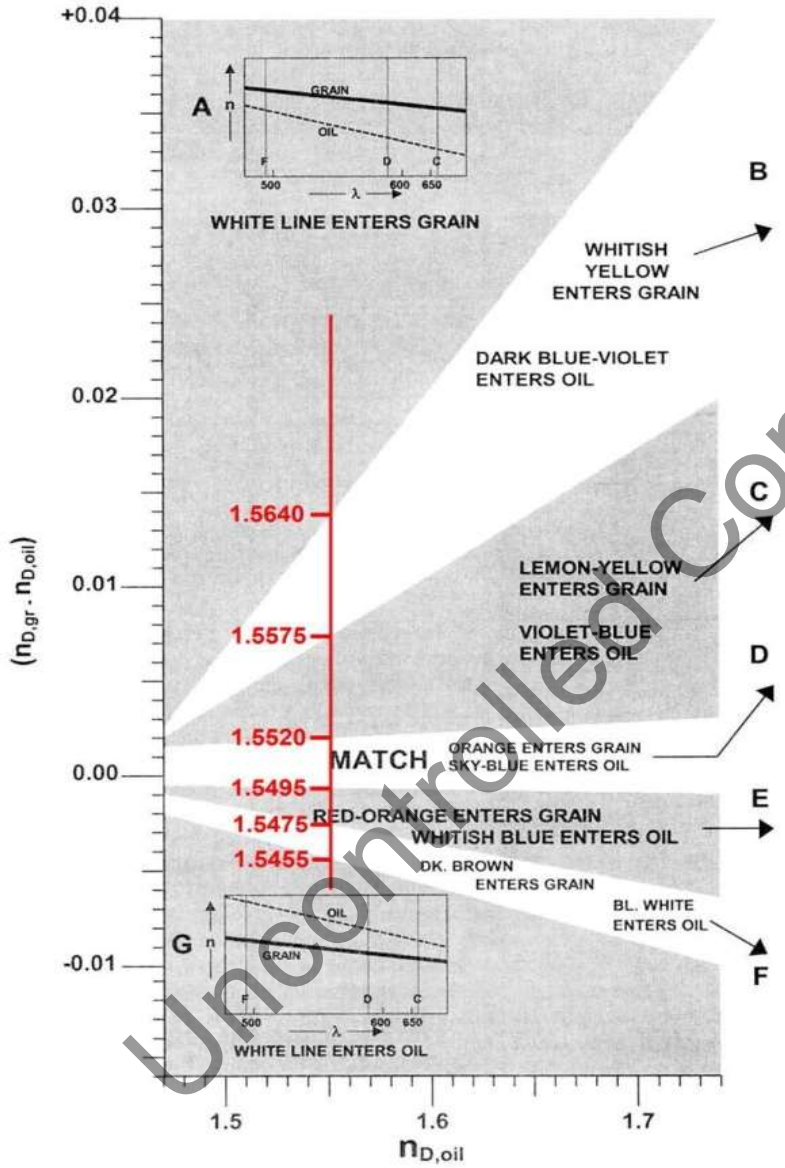


Figure 5-9. Use of the colors observed for the Becke lines or oblique illumination shadows to determine the amount by which n_D for the solid exceeds n_D for the liquid (if Cargille Series A or B liquids are being used). The Becke line movements are those observed when the objective is raised upward from sharp focus. The color observed depends upon the wavelength (λ_m) where—as shown to the right—the dispersion curves of liquid and solid intersect within the visible range. To correct the colors cited to your own perceptions of color, observe grains of salt (n_D = 1.544) mounted in liquids for which n_D equals 1.570, 1.560, 1.550, 1.544, 1.540, and 1.530. [Figure continued on facing page.]

OPTICAL CRYSTALLOGRAPHY. By F. Donald Bloss. Mineralogical Society of America (Monograph Series, Publication No. 5), 1999, Washington, D.C. 239 p

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17.9 Table of Optical Properties of Non-asbestos Fibers

Non-asbestos fiber	Morphology	Birefringence	Extinction	Sign of Elongation
Cellulose (Paper fibers)	Ribbon-like, Tapered ends	High: >0.5	**Undulose**	+
Glass	Uniform diameter	**None 0.00 Isotropic***	---	---
Mineral Wool	Exotic Shapes	**None 0.00 Isotropic***	---	---
Synthetic (Poly)	**Uniform Diameter** or Shredded	Moderate to **High**	Variable (by fiber type)	---
Hair	**Medulla, Scaled**	Moderate	Parallel	+
Wollastonite	Needles & Blades	Moderate to Low	Parallel and Oblique	**Variable**

*When possible, please use underlined optical properties during identification of non-asbestos fibers.

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18.0 References

18.1 EMSL QMS Manual
18.2 EMSL Chemical Hygiene and Safety Plan
18.3 Less is Better-Guide to Minimizing Waste in Laboratories prepared by the Task Force on Laboratory Environment, Health and Safety-American Chemical Society, 2002
18.4 Method for the Determination of Asbestos in Bulk Building Materials EPA 600/R-93/116
18.5 Interim Method for the Determination of Asbestos in Bulk Insulation Samples EPA 600/M4/82/020
18.6 PLM Methods for Identifying and Quantitating Asbestos in Bulk Samples NYSDOH ELAP 198.1
18.7 PLM Methods for Identifying and Quantitating Asbestos in Non-Friable Organically Bound Bulk Samples NYSDOH ELAP 198.6
18.8 Asbestos (bulk) by PLM NIOSH 9002
18.9 Asbestos Identification McCrone Institute
18.10 NVLAP Handbook 150-3 2006 Edition, and Checklist Bulk Asbestos Analysis 150-3 2011 Edition
18.11 Asbestos NESHAP (1990 Point Counting)
18.12 Asbestos NESHAP Clarification (40 CFR Part 61 Jan-5-1994 & Dec-19-1995 Analysis of Multi-Layered Systems)
18.13 EPA Asbestos Sampling Bulletin (September 30, 1994)
18.14 Rapidly and Accurately Determining RI of Asbestos Fibers by Dispersion Staining, Dr. Su (2010)
18.15 Characterization of fibres found in dust and bulk materials IRSST Analytical Method 244

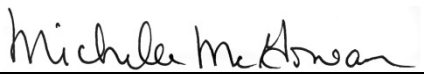
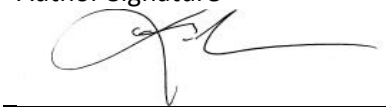
19.0 Revision History

Rev 12.11 1/18/2017
Rev 12.12 2/6/2017
Rev 12.13 3/28/2017

Rev #	Date	Revision	Initials
12.14	5/30/2017	Changes to sections 8.1, 8.2, 8.3.1, 8.4, 8.4.1.6, 8.5.4, 8.7.1, 8.7.3.1, 9.3.1, 9.3.3, 9.3.4, 9.5.2, 9.5.4, 9.9.2, 13.1, and 13.5, adding appropriate forms to record required information. Added Section 8.4.1.6.1 detailing the procedure for documenting contamination in the daily check. Added recommended disclaimer to section 9.6.9.2	MM

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Authorizing Signatures

Michelle McGowan		5/30/2017
Author (print)	Author Signature	Date
Ken Najuch		5/30/2017
Reviewer (print)	Reviewer Signature	Date
Ed Cahill		6/1/2017
Corporate Approval (print)	Corporate Approval Signature	Date

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Document Review and Acknowledgement Form

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Laboratory Staff Acknowledgement

My signature below signifies that I have read, understood, and have had the opportunity to ask questions regarding the entire contents of this document. I agree to fully comply with, implement, and enforce all requirements, procedures, and protocols specified in this document and any supporting reference materials or methodologies.

Print Name	Signature	Date

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Acknowledged by:

Lab Manager/QA Officer (Print Name)	Signature	Date



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EMSL Analytical, Inc. Management

EMSL Analytical S.O.P.

-----TEM AHERA Method
40 CFR Part 763 Appendix A to Subpart E-----

[ASB-SOP-400]

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1.0 Method Description

1.1 Applicable Matrix

This method is appropriate for air samples only.

1.2 Scope and Application

This method is for the determination of asbestos concentrations in air samples by Transmission Electron Microscopy (TEM). Although originally developed as a means for final clearance after asbestos abatement, it is also used for baseline studies or ambient air testing. Samples are prepared in the lab via a direct prep method. Analysis is performed at approximately 20,000X magnification. Asbestos structures are identified by a combination of morphology, elemental chemistry via Energy Dispersive X-Ray Analysis (EDXA), and Selected Area Electron Diffraction (SAED). 70 structures/mm^2 is the Pass/Fail criteria, but strictly speaking, this limit is applicable only when air samples are collected (aggressively) post remediation, and in groups of at least 13 samples (5 in the work area, 5 outside of the work area, 2 field blanks, and a sealed blank). Alternately, compliance may be determined by comparing the inside and outside sample results using a statistical comparison called a Z-Test.

1.3 Summary of Method

This method is for the determination of asbestos concentrations in air samples by transmission electron microscopy (TEM). Samples are collected on a membrane filter, prepped via a direct prep method and analyzed with an electron microscope at 20,000X magnification, capable of Energy Dispersive X-Ray Analysis (EDXA).

1.4 Detection Limit

The detection limit for this method has historically been set at the 99% Confidence Limit of the blank contamination level, 70s/mm^2.

1.5 Analytical Sensitivity

The method prescribes sufficient analytical effort to reach an analytical sensitivity of 0.005 structures per cubic centimeter of air. The limit of detection can be lowered by collecting a larger initial volume of air, or by analyzing additional surface area of the filter (grid openings).

2.0 Interferences

Interferences for this method include, but are not limited, to:

2.1 Non-regulated asbestos minerals, such as the two polymorphs of Chrysotile, Lizardite and Antigorite

2.2 Non-regulated amphiboles such as winchite and richterite

2.3 Cleavage fragments of the regulated asbestos types, which may at times have aspect ratios similar to the true asbestiform varieties

2.4 Clay minerals that can have similar morphology to asbestos, such as sepiolite and pallygorskite

2.5 All non-asbestos particulate, fibrous or not, which can partially or wholly obscure asbestos fibers

3.0 Definitions

3.1 **Analytical Sensitivity:** The airborne concentration represented by each structure counted under the electron microscope. The air volume collected and the proportion of the filter examined determine the analytical sensitivity.

3.2 **Asbestos:** Generic term for a group of hydrated mineral silicates

3.3 **Aspect Ratio:** The ratio of the length to the width of a particle. Minimum aspect ratio for this method is equal to or greater than 5:1.

3.4 **Bundle:** A structure composed of 3 or more fibers in a parallel arrangement, with each fiber lying less than one fiber diameter apart

3.5 **Cluster:** A structure with fibers in a random arrangement, such that all fibers are intermixed, and not a single fiber is isolated from the group; groupings must have more than 2 intersections

3.6 **EDXA:** Energy dispersive X-ray analysis

3.7 **Fiber:** A structure having a minimum length of 0.5 µm, and an aspect ratio of 5:1 or greater, with substantially parallel sides

3.8 **Grid:** An open structure for the mounting of the sample to aid in its examination in the TEM

3.9 **Grid Opening (GO):** One opening of the grid. For this method, the area of the grid opening must be known.

3.10 **Matrix:** A fiber or fibers with one free end and the other end embedded or hidden by particulate. The exposed fiber must meet the fiber definition.

3.11 **MCE Filters:** Mixed cellulose ester filter

3.12 **PC Filters:** Polycarbonate filters

3.13 **SAED:** Selected area electron diffraction

3.14 **Structure:** A microscopic bundle, cluster, fiber or matrix which may contain asbestos

3.15 **TEM:** Transmission Electron Microscopy

4.0 Safety

All personnel performing preparation and/or analysis of samples must be familiar with the EMSL Chemical Hygiene and Safety Plan. Specific hazards and precautions associated with this analysis include:

4.1 Asbestos

4.1.1 Prudent measures must be taken to prevent any possible airborne asbestos fiber release from occurring during sample handling.

4.1.2 Any filter handling performed prior to the acetone collapse step should be performed under the safety hood.

4.2 Acetone

4.2.1 Keep away from heat, sparks, and flame.

4.2.2 Avoid breathing vapors; use with adequate ventilation.

4.2.3 Avoid contact with eyes.

4.2.4 Prevent prolonged or repeated contact with skin.

4.3 Carbon Spark

4.3.1 Shield eyes from the glow of the spark during the carbon coating process with welder's type goggles or similar protection.

4.4 Oxygen

4.4.1 The oxygen used with the plasma asher is an explosion hazard. Use only vacuum pumps filled with non-hydrocarbon (Fomblin) oil.

4.4.2 Keep Oxygen tank strapped to wall at all times.

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5.0 Equipment and Supplies

5.1 0.45 micron MCE or 0.4 micron PC filters
5.2 Glass Petri dishes
5.3 Glass microscope slides
5.4 Low temperature plasma asher
5.5 Vacuum evaporator (carbon coater)
5.6 Graphite or carbon rods
5.7 HEPA laminar flow hood
5.8 Acetone vapor generator
5.9 Grids
5.10 Fine forceps
5.11 Grid clips and grid storage boxes
5.12 Jaffe wick or sponge
5.13 Kimwipes or alternative paper
5.14 Transmission Electron Microscope with the following capabilities:
- **5.14.1** 100 Kev
- **5.14.2** Fine probe size <250 nm
- **5.14.3** Elemental Chemistry via X-Ray Detector

6.0 Reagents and Standards

6.1 Acetone, reagent grade or better
6.2 Di-Methyl Formamide (DMF)
6.3 Glacial Acetic Acid
6.4 NIST SRM 1876b
6.5 NIST SRM 2063
6.6 Albite standard
6.7 Aluminum coated Copper grid standard
6.8 Gold coated grid standard
6.9 Magnification (cross grating replica) calibration standard
6.10 NIST traceable asbestos on grids
6.11 Non-asbestos standards on grids

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7.0 Sample Collection, Preservation, Shipment and Storage

7.1 Air samples are collected at no more than 10 liters/minute onto 0.45 micron Mixed Cellulose Ester (MCE) filters, (0.4 micron Polycarbonate (PC) filters can also be used), with an additional 5.0 µm pore size backing filter. The method minimum volume for 25 mm cassettes is 560L.
7.2 When used in a post removal situation, the sampling strategy is typically as follows:
- **7.2.1** 5 samples (or more) inside the work area
- **7.2.2** 5 samples (or more) outside the work area
- **7.2.3** 1 Field Blank opened briefly at the entrance to the work area
- **7.2.4** 1 Field Blank opened briefly outside the work area
- **7.2.5** 1 Sealed Blank (unopened)

7.3 Typically, ≥1200 liter samples are collected; in these cases, the inside screening test may be used to determine compliance. In these cases, passing is considered to be an arithmetic mean ≤70 s/mm^2 for the sample set's inside samples. If <1200 liters are collected, then the 70 structure/mm^2 PASS/FAIL

rule cannot be applied. If this is the case, then all (13 minimum) samples must be analyzed, and a statistical Z test used to determine PASS/FAIL.

7.4 No sample preservation is needed and samples can be stored indefinitely prior to analysis.

7.5 Samples are best transported to the lab by hand. When mailing, try to package samples carefully to minimize disturbance and possible dislocation of particulate from the filter surface. Use packing materials that will minimize static charge. Sample should not be packaged with bulk asbestos samples.

7.6 All air cassettes must be retained in an easily retrievable manner for a minimum of 60 days.

7.7 Samples prepped to grid (both the grid bar and the extra grid), and the field blanks prepped to slide, must be retained for a minimum of 3 years.

8.0 Calibration and Standardization

8.1 Each major component of the method is calibrated and/or standardized, including the analyst. Examples follow:

8.1.1 Sample collection vacuum pumps are calibrated at the beginning and end of a sampling event (with the sample cassette in line) using a rotometer.

8.1.2 The rotometer, in turn, needs to be calibrated to a primary standard periodically. (Rotometer use and calibration is the responsibility of the sample collection entity).

8.1.3 The electron microscope is calibrated with various standards for

8.1.3.1 Exact screen magnification at 20,000X

8.1.3.2 Exact film magnification at 20,000X

8.1.3.3 Spot size (must be less than 250 nm)

8.1.4 The X-Ray system attached to the electron microscope is calibrated with various standards for:

8.1.4.1 Proper location of Al and Cu peaks

8.1.4.2 Resolution <175 eV at the Mn peak

8.1.4.3 Relative sensitivity (K Factors) determined for various elements

9.0 Procedure

9.1 Sample Receipt

9.1.1 Upon receipt of samples, check that the sample information on the Chain of Custody (COC) matches the information on the samples and other paperwork. Any discrepancies must be resolved before proceeding.

9.1.2 If the samples do not have a COC, then one is completed at time of log in. Have the client fill out the necessary information completely.

9.1.3 Information required on the Chain of Custody includes:

9.1.3.1 Client name, address, telephone number, contact person, fax number

9.1.3.2 Project number/ name, state where samples where taken

9.1.3.3 Number of samples sent and sample IDs

9.1.3.4 Type of analysis requested

9.1.3.5 Sample volumes or areas if applicable

9.1.3.6 Turn around time. “RUSH” is not acceptable.

9.1.3.7 A date and signature of the person relinquishing the samples

9.1.3.8 All samples MUST be accounted for with the proper sample IDs.

9.1.4 All samples MUST be sealed, properly bagged and undamaged.

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9.1.5 All samples must be clocked in at the time of receipt and signed and dated by an EMSL employee. If the lab does not have a clock for sample receipt, the receiving employee should record the time of receipt also.

9.1.6 Check to see if the samples match the COC and if the cassettes are open, damaged, or contaminated. If samples are delivered in the same container or bag as bulk asbestos material, samples must be rejected. If the samples are damaged or if the COC does not match, notify the client.

9.2 Sample Log-In

If all of the above criteria for sample receiving are met, then the sample can be logged into Sample Master (LIMS) as per the Sample Master SOP.

9.2.1 This process will assign a unique EMSL order number for the project as well as unique lab sample IDs.

9.2.2 The LIMS will create appropriate bench sheets for the type of analysis requested and an Internal Chain of Custody.

9.3 Sample Preparation

AHERA samples may be collected on MCE filters (0.45 micron or less pore size) or Polycarbonate (PC) filters (0.4 micron or less pore size). Cassettes should also have a 5.0 µm pore size backing filter. The sample filters are prepared using one of the direct transfer techniques outlined in the Direct Prep of Sample Filters SOP. A minimum of 3 grids per sample are prepped and stored.

9.4 Grid Storage

9.4.1 Grids are stored and location recorded following section 7.4 of EMSL's TEM Grid Clip Loading SOP.

9.4.2 All AHERA grid clips and grid boxes (analyzed preps and backup grids not mounted on clips), are stored for 3 years.

9.5 Sample Preparation Acceptance

9.5.1 Remove the first sample grid clip from the box and insert it into the TEM.

9.5.2 Bring the TEM to a magnification of 300 to 500x and inspect the grids to determine if all of the following conditions are being met.

9.5.2.1 More than 50% of the grid must be covered with replica.

9.5.2.2 Grids must have at least 50% intact grid openings.

9.5.2.3 Grids must not have more than 50% opaque area due to incomplete filter dissolution.

9.5.2.4 Total grid area must have <50% overlapping or folded replica.

9.5.2.5 At least 20 grid openings with <5% holes and <5% opaque area due to incomplete dissolution

9.5.2.6 Grid openings must not have rips or overlapping folds.

9.5.2.7 Reject grid openings that have greater than 25% particulate loading or an obvious non-uniform particulate distribution. The AHERA method states an overload criteria of 25% particulate loading. NVLAP (2002) lowered that threshold to 10% particulate. Unless specifically directed otherwise by the client, EMSL will apply a 10% overload criterion to all AHERA samples.

9.5.2.8 Two grids are analyzed per sample. (The grid location on the clip and the individual grid openings analyzed for each grid are recorded on the bench sheet).

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9.6 AHERA Analysis Protocol

9.6.1 ***Note:*** *Steps 9.6.1 - 9.6.4 apply only to JEOL scopes using EMSL's multi-grid grid clips; for single grid scopes insert a grid and start at step 9.6.5.*

At a magnification of 100x, first locate and center the 1st grid to be analyzed using both the specimen selector (located on the left side of the TEM column on top of the left translator where it enters the column) and the specimen selector knob located on the specimen arm (see diagram below).

9.6.2 The first grid should be located on screen as the grid to the extreme left of the grid bar as viewed in Low Mag.

9.6.3 The specimen locator on the scope should be used to find the first grid, but only the specimen selector knob located on the specimen arm (long clip arms only) needs to be employed to move from grid to grid. (Detailed instruction on the use of both long and short slips and their associated sample arms can be found in EMSL's Grid Clip SOP).

9.6.4 Initially, no matter which grid is to be analyzed, you will need to locate grid number 1 and



then proceed to the grid of interest (if not grid 1). As analysis proceeds from grid to grid, you can simply proceed in the same direction (at 100x) to the next grid.

9.6.5 On grid number 1, locate and orient an intact grid opening on the middle of the screen with the left and right stage controls.

9.6.6 Increase magnification to ~20,000X, taking care to remain in the chosen grid opening; then verify the sample for eucentric height. (Once achieved, eucentric height simply needs to be maintained during the course of analysis.) The required working magnification is 15,000x to 20,000x.

9.6.7 Record both the Grid ID (i.e. B4 for 4th grid on grid bar B) and the Grid Opening Identification (i.e. C5) on the sample worksheet.

9.6.8 Move to the upper left corner of the grid square and begin traversing the grid, using only one directional control.

9.6.9 Once the opposite grid bar has been reached, move over/down one field of view using the other directional control (approximately one large circle width ≈ 5µm) and proceed scanning with the original directional controller in the opposite direction.

9.6.10 If a countable fibrous structure has been located, check its morphology against the morphologies for each asbestos type.

9.6.11 The Minimum Fiber criteria for countable structures is

9.6.11.1 Aspect ratio of ≥ 5:1

9.6.11.2 Must be ≥0.5µm length

9.6.12 If morphology is consistent with asbestiform fibers, proceed to SAED analysis. For information regarding the differentiation of asbestos fibers from asbestos look-a-likes please refer to Section 16.4 "Differentiating Non-asbestos Fibers from Regulated Asbestos."

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9.6.13 Obtain a diffraction pattern for the sample and record diffraction information on the sample worksheet. See SAED SOP for detailed information on obtaining diffraction patterns. Determine if the pattern is consistent with a known asbestos type;

9.6.13.1 For chrysotile, a 5.3Å layer line spacing and correct orientation of the (002), (020), (110), (130) and (200) spots and streaks is required (see 16.2).

9.6.13.2 For amphiboles, the pattern must at minimum exhibit a 5.3Å layer line spacing, or alternately be consistent with a known Zone Axis pattern (measurements and indexing required for zone determinations).

9.6.14 SAED identification from step 9.6.13 above is required for:

9.6.14.1 All structures that would cause the sample to exceed 70 structure / mm^2 (generally the 1st 4) that are identified as chrysotile. SAED may be used alone to identify all chrysotile structures.

9.6.14.2 All structures that would cause the sample to exceed 70 structure / mm^2 (generally the 1st 4) that are identified as an amphibole asbestos type

9.6.15 Record at least 1 pattern of each type of asbestos identified in every set of samples (typically 5 samples). If more than 5 samples are submitted in the batch, at least 1 SAED micrograph of each asbestos type should be taken for every 5 samples in the batch.

9.6.16 If the diffraction pattern from step 9.6.14 above is consistent with asbestos, proceed to EDXA, if required. EDXA identification is;

9.6.16.1 Not required for any chrysotile structures, but may be used along with SAED identification for the first 4 chrysotile structures, and alone for chrysotile structures after the first 4 structures have been identified

9.6.16.2 Required for all structures identified as amphibole asbestos

9.6.17 Obtain an EDXA spectrum of the fiber / structure by following the procedures outlined in the EDXA SOP, Sections 9.5.1 & 9.13, and compare it to the spectra for the asbestos types.

9.6.18 Print out or save to disc any spectra used to make an identification of asbestos.

9.6.19 If the morphology, diffraction, and EDX information match that of an asbestos type, record the asbestos structure as one of the following (see data recording in step 9.7 for all required recording information):

9.6.19.1 Fiber: A single fibril not connected to any non-fibrous debris

9.6.19.2 Bundle: Any group of three or more fibers lying parallel and with less than a single fiber diameter between them

9.6.19.3 Cluster: A group of three or more fibers or bundles randomly oriented with three or more intersections

9.6.19.4 Matrix: A bundle or fiber with one end free and the other end covered by or imbedded in a matrix material

9.6.20 If the structure is determined to be non-asbestos, record only the structure number and identification information.

9.6.21 Continue scanning the grid opening using the procedure in 9.6.9 until the entire grid opening has been scanned. Take care not to count any structures twice or to miss any area of the grid opening.

9.6.22 If no fibrous structures have been located, record “ND” for that grid opening.

9.6.23 Return to step 9.6.5 and choose more grid openings. Continue until the stopping criteria have been reached (step 9.6.24, below). Do not analyze adjacent grid openings; grid openings selected should be split evenly between a minimum of 2 grid preps.

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9.6.24 Stopping Rules:
- **9.6.24.1** Analyze the number of grid openings required to reach an analytical sensitivity of ≤0.005 s/cc.
- **9.6.24.2** Analysis may stop if > 50 structures in a minimum of 4 grid openings are counted; the final grid opening must be finished.
- **9.6.24.3** Analysis may be stopped if at least 50 structures are counted in any one grid opening; the grid opening does not need to be finished.

9.6.25 Once all required grid openings for a sample have been completed, continue analysis of all samples in the batch.

9.6.26 Once all samples in a batch have been analyzed, analyze any required lab blanks associated with the lab order. See steps 13.2 and 14.1.6 for lab blank analysis requirements and acceptability.

9.6.27 Analyze blank samples until a minimum analytical sensitivity of <15 s/mm^2 is reached. Analysis of a minimum of 10 grid openings is required. Grid openings should be chosen evenly over 2 grid preparations.

9.7 Data Recording

9.7.1 Information is recorded on EMSL's TEM AHERA worksheet, or in EMSL's Direct Data entry database interface "iLab." For information on the use of "iLab" please see EMSL's Asbestos DDE Manual. Regardless of the method of recording used, all information detailed below is required to be recorded.

9.7.2 Analyst Name and Date of Analysis

9.7.3 TEM Scope ID and Magnification used for analysis

9.7.4 Grid Lot & Grid Particulate Loading

9.7.5 Grid Location; Grid Box ID and Grid ID(s) (Row and Column)

9.7.6 Grid Opening ID
- **9.7.6.1** Grid ID (Row and Column)
- **9.7.6.2** Grid Opening ID

9.7.7 Structure number(s)

9.7.8 For structures identified as asbestos, the following information is recorded.
- **9.7.8.1** Asbestos type
- **9.7.8.2** Sizing of structure
  - **9.7.8.2.1** Record length in the "Length" column (on hardcopy benchsheet input the length in the correct column; ≥0.5µm to <5µm or ≥5.0µm).
  - **9.7.8.2.2** Record width in the "Width" column.
  - **9.7.8.2.3** Sizes ≥1µm should be recorded to 1 decimal place.
  - **9.7.8.2.4** Sizes <1µm should be recorded to 2 decimal places.
- **9.7.8.3** The structure type; Fiber, Bundle, Cluster or Matrix
- **9.7.8.4** Whether or not an SAED pattern consistent w/ asbestos was achieved
- **9.7.8.5** The SAED Negative number for the structure, if one was recorded
- **9.7.8.6** If performed, the elements present in the EDXA spectrum from the structure
- **9.7.8.7** A sketch of the structure
- **9.7.8.8** Any comments regarding the structure deemed pertinent for follow up analysis

9.7.9 For grid openings containing non-asbestos structures,
- **9.7.9.1** Record the number of non-asbestos structures encountered.
- **9.7.9.2** Record one element of the fiber identification in structure comment or EDXA fields that lead to the fiber identification being non-asbestos.

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9.7.10 For grid openings containing no asbestos or non-asbestos structures, record "ND" to indicate no structures were detected.

9.7.11 Input any pertinent "Internal Comments" or a "Sample Comment" for the sample. *Note: "Sample Comments" will appear on the report.*

10.0 Calculations

10.1 Examples of the calculations programmed into the LIMS database Sample Master are displayed below.

10.2 Variables include, but are not limited to, the volume and GOA (grid opening area) which is calculated with every batch of grids.

10.3 Area Analyzed = (GOA x NO)

10.4 Structures /mm^2 = (N / AA) For Analytical Sensitivity in Structures/mm^2 N=1

10.5 Structures /cc = $\frac{385 \times N}{(V \times AA \times 1000)}$ For Analytical Sensitivity in Structures/cc N=1

Where:

EFA = Effective filter area of a 25mm cassette = 385mm^2
GOA = Grid opening area (0.00635mm^2)
N = Number of structures (If N=0 then default to 1 structure)
AA = Area analyzed (0.06985mm^2)
NO = Number of openings analyzed (11)
n = Number of Samples

10.6 Z Test

$$Z = \frac{\overline{Y}_i - \overline{Y}_o}{0.8(1/n_i + 1/n_o)^{0.5}}$$ *The Site passes if Z ≤ 1.65*

Where:

Y_i = the mean of the natural logarithms of the inside samples concentration str/cc
Y_o =the mean of the natural logarithms of the outside samples concentration str/cc
n_i = the number of inside samples
n_o = the number of outside samples

When no asbestos is detected for any given sample, use ½ of the analytical sensitivity in str/cc for that sample, in this formula.

11.0 Reporting

The following items are included in the final report (on EMSL letterhead) to the client:

11.1 Asbestos concentration in structures/mm^2

11.2 Asbestos concentration in structures/cc

11.3 Analytical sensitivity of the analysis in structure/cc

11.4 Number of asbestos structures detected

11.4.1 That are ≥ 0.5 µm to < 5.0 µm and

11.4.2 That are ≥ 5.0 µm

11.5 Number of non-asbestos fibers encountered

11.6 The type(s) of asbestos detected in the sample

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11.7 Area of filter analyzed in mm^2
11.8 Volume of air collected by the client
11.9 Location of the sample in the field (if supplied)
11.10 Client and Lab sample numbers
11.11 Client identification and contact information
11.12 EMSL Order ID
11.13 Client Project information (if supplied)
11.14 Sampling (if supplied), analysis and report date
11.15 Signature of Lab Manager
11.16 Report comments
11.17 Lab accreditations
11.18 Copy of bench sheets must be included
11.19 Reporting Uncertainty to Clients

11.19.1 Refer to the Excel spreadsheet: **GEN-FM-203 Uncertainty – Asbestos** to input the reported result. The worksheet will provide the uncertainty range and probable bias to report to the client.

11.19.2 The uncertainty range (at a 95% confidence level) for a result is defined as the reported result $\pm 2S_r$, where S_r = S/mean. S_r values are typically derived using either relative percent difference (RPD) data from quality control samples, or recovery data from standard reference materials (SRMs). In the latter case, the mean shall be the reference value (or 100% if using mean recovery), and thus S_r = S.

11.19.3 TEM Example

If the standard deviation (S) for a population of Standard data (NIST 1876b or substitute) is 10.0% (calculated using % recovery data relative to the reference value), and the mean recovery is 90.0%, the relative standard deviation (S_r) is equal to 10.0% since S_r = S. Thus, in this example, the uncertainty range for a client result of 0.010 s/cc shall be reported as 0.010 s/cc (not corrected for bias) ± 0.002 s/cc ($2S_r$ = 20%, thus $2S_r$ x 0.010 f/cc = 0.002 s/cc) with a probable negative bias of 0.001 s/cc.

11.19.4 Note that the reported result is not corrected for bias for any client sample. Rather, bias (available only when S_r is derived from SRM data) must be reported as a separate value. When applied to a specific client result, both uncertainty and bias shall be provided in the appropriate units. Alternatively, at the request of the client, the uncertainty, confidence level and bias may simply be provided to the client as the derived percentage values, without application to a specific result.

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12.0 Method Performance

Method performance data can be found in the method, 40CFR Part 763 Appendix A to Subpart E-Interim Transmission Electron Microscopy Analytical Methods

12.1 **MDL:** The detection limit for this method has historically been set at the 99% Confidence Limit of the blank contamination level, $70s/mm^2$.
12.2 **DOCs:** Demonstrations of Capability are required for each analytical method.
12.3 **PTs:** Proficiency tests for this method exist both from NVLAP and from NY State ELAP.
12.4 **Accuracy:** Since it is not possible to create a standard with a known structures /sq. mm., the exact accuracy of the method cannot be determined. EMSL uses analysis of past proficiencies as an indicator.
12.5 **Precision:** Inter and Intra Analyst precision is determined each month as part of EMSL's

regular QC reporting.

13.0 Quality Control

13.1 All QC data must be maintained and available for easy reference and inspection.

13.2 Blanks

13.2.1 Laboratory Blanks:

13.2.1.1 At least 1 lab blank is prepped with each batch of samples to a minimum of 10% (10%).

13.2.1.2 For MCE filters, at least 1 laboratory blank is analyzed for every 100 samples (1%).

13.2.1.3 For PC filters, at least 1 laboratory blank is analyzed for every 25 samples (4%).

13.2.1.4 For those laboratories accredited to the TNI Standard or by NYS ELAP, the frequency is 1 for every 20 samples (5%) analyzed, regardless of filter type.

13.2.1.5 The laboratory blank is always analyzed when the mean result of a sample set exceeds 70 str/mm^2.

13.2.2 Client Submitted Blanks (Field / Sealed) are prepped to slide unless analysis is requested by the client.

13.3 Sample Reanalysis - Same Grid Opening QC

13.3.1 4% inter-analyst reanalysis of the same grid openings

13.3.2 2% intra-analyst reanalysis of the same grid openings

13.4 Sample Reanalysis - Different Grid Opening QC

13.4.1 1% reanalysis of different grid openings on the same preps (replicate according to NELAC). Analysis should be split relatively evenly between inter- and intra- analyst QC.

13.4.2 1% re-prep analysis of samples on different filter preparations (duplicate according to NELAC). Analysis should be split relatively evenly between inter- and intra- analyst QC.

13.5 Yearly analysis of Standard Reference Material 1876b (or alternative)

13.6 1% Verified analysis

13.7 0.5% Inter-laboratory analysis

14.0 Data Assessment

14.1 Acceptance Criteria for QC Measures

These are addressed in EMSL's Quality Management System Manual, Module A.

14.1.1 For all analytical QC, if a sample falls outside the acceptable limits, it needs to be reconciled with participating analysts and/or a third analyst when necessary.

14.1.2 Same Grid Opening QC

14.1.2.1 For <u>all</u> same grid opening QC analysis, structure number as well as fiber and sketch information must be compared to determine the "Confirmed Result," so they are amenable to verified analysis evaluation by Turner and Steel NISTIR 5351 as defined in Section 14.1.4 below.

14.1.2.2 The Pass/Fail criteria for the Same Grid Opening QC analyses of AHERA samples are as follows:

< 5 Structures = +/- 1 structure
5 - 20 Structures = +/- 2 structures
> 20 Structures = +/- 3 structure

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14.1.2.3 In addition, the R value is calculated and plotted on control charts where:

$$R = \frac{|A-B|}{(A+B)/2}$$

Where; A=analysis 1 and B = analysis 2

14.1.3 Different Grid Opening QC

14.1.3.1 The Pass/Fail criteria for the analyses of different grid openings on the same grid preps (replicate according to NELAC):

$$|A - B| \leq 1.5 \times PSD$$

where: A - the original result
B - the re-analysis result
PSD - the Poisson Standard Deviation of the two analyses

14.1.3.2 The Pass/Fail criteria for the analyses of samples on different filter preparations (duplicate according to NELAC):

$$|A - B| \leq 2.0 \times PSD$$

where: A - the original result
B - the re-analysis result
PSD - the Poisson Standard Deviation of the two analyses

14.1.4 Verified QC: Analysts must maintain cumulative statistics for verified QC performed according to NISTIR 5351 meeting the following criteria:

14.1.4.1 ≥ 80% True Positive structures

14.1.4.2 ≤ 20% False Negative structures

14.1.4.3 ≤ 10% False Positive structures

14.1.5 Standard Analysis: Each analyst must meet the following acceptable criteria for analysis of the 1876b (or substitute verified quantitative standard); analysis results must be between 110% of the sample's 95% upper confidence limit and 80% of the sample's 95% lower confidence limit.

14.1.6 Criteria for the maximum allowable contamination levels for laboratory blanks are:

14.1.6.1 MCE Blanks: a cumulative average of <5 s/mm^2, as well as any single preparation of <15 s/mm^2

14.1.6.2 PC Blanks: a cumulative average of 18 s/mm^2, as well as any single preparation of 53 s/mm^2

14.2 Corrective Actions

These policies are addressed fully in EMSL's Quality Management System Manual, Section 4.11.

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14.2.1 All corrective actions should look for the root cause of the error.

14.2.2 All out of control or unacceptable data must be brought to the attention of the laboratory manager.

14.2.3 The laboratory manager is responsible for generating a corrective action, including an investigation of calibration procedures, a review of analytical technique and investigation of training policies and compliance.

14.2.4 Corrective actions will be reported to the QA Department by means of the Quarterly Management Report or sooner, when appropriate.

14.3 Contingencies for Handling Out-of-Control or Unacceptable Data

Any quality control requirements not met must have an explanation to their non-conformance.

15.0 Pollution Prevention / Waste Management

15.1 Pollution Prevention

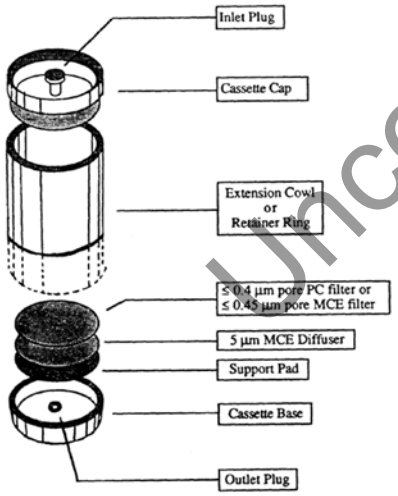
EMSL Analytical makes all efforts to reduce the volume and toxicity of the waste generated by the laboratory. An effort to manage procurement of hazardous materials has been implemented in order to avoid over ordering. Hazardous waste is classified for proper disposal.

15.2 Waste Management

The waste generated during prep and analysis will be disposed of following safety procedures outlined in EMSL's Chemical Hygiene and Safety Plan. All records pertaining to waste shall be kept, including the waste manifest.

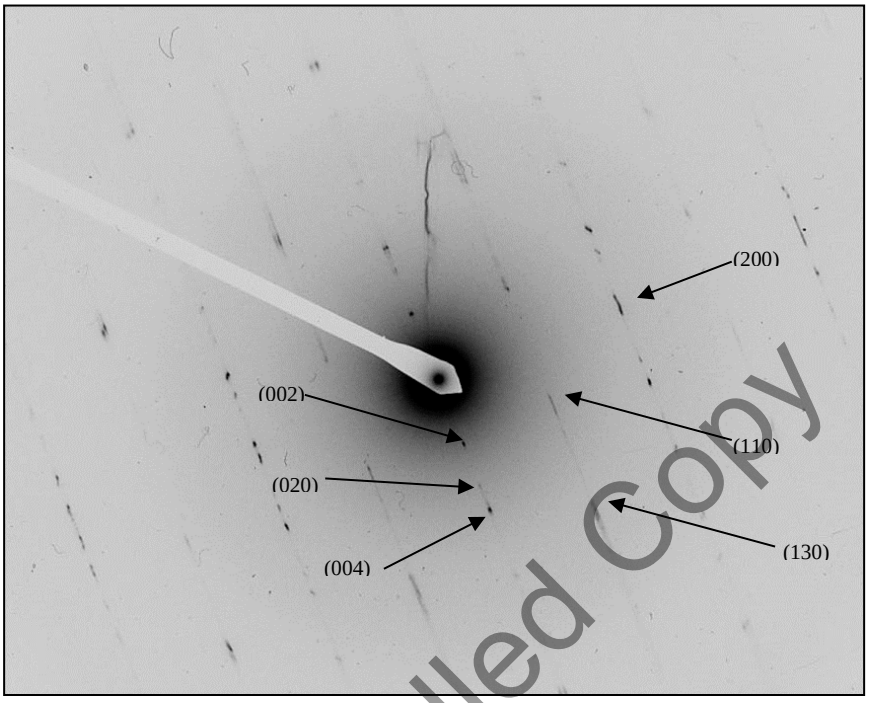
16.0 Tables, Diagrams, Flowcharts, and Validation Data

16.1 Diagram of 25mm sampling cassette



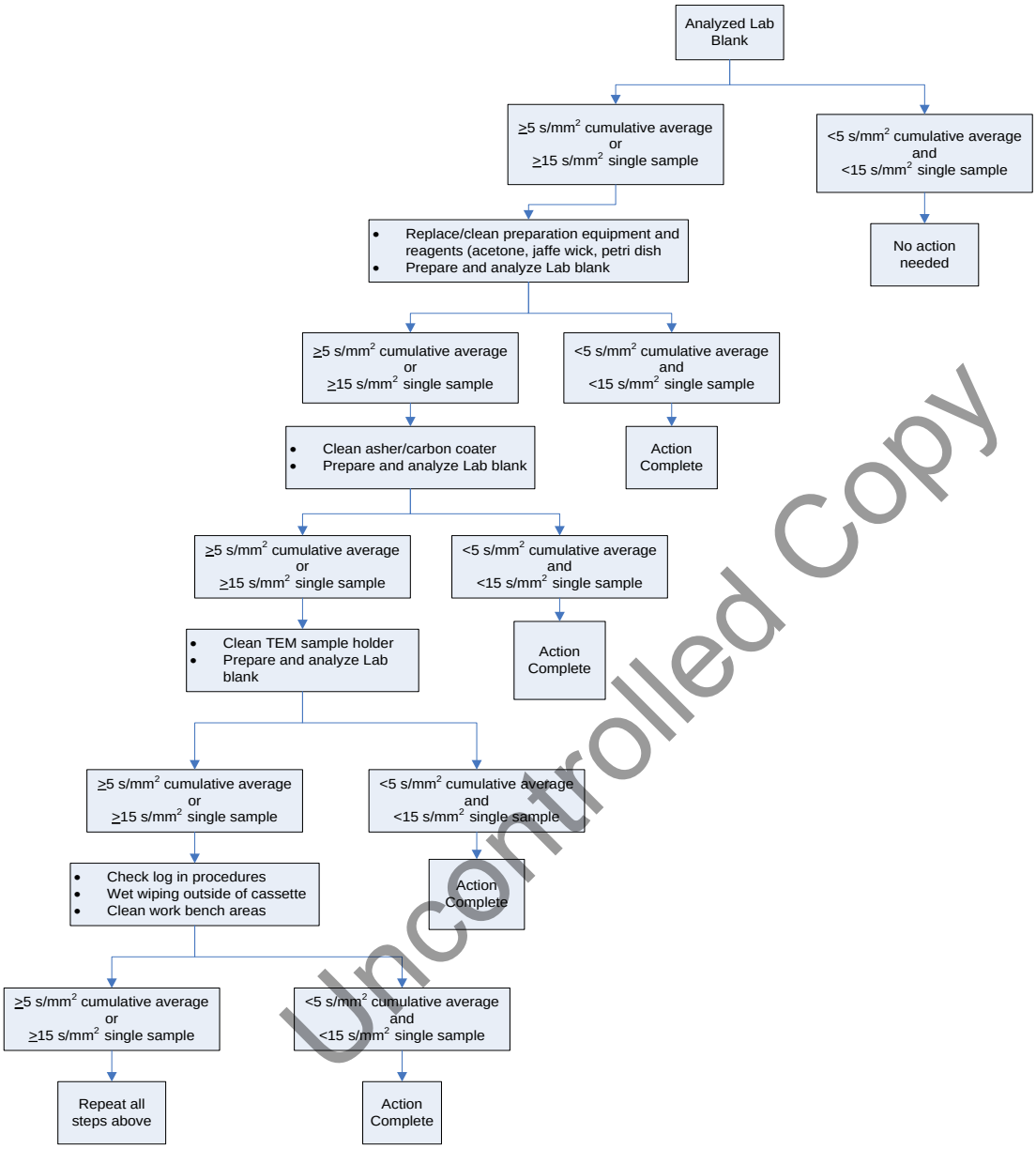
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16.2 Example Chrysotile SAED Pattern



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16.3 Contamination Flowchart for TEM AHERA Air Samples



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16.4 Differentiation of Non-Asbestos Fibers From Regulated Asbestos by TEM

Pyroxenes: Pyroxenes have the general formula $XY(Si,Al)_2O_6$ (where X represents calcium, sodium, iron^{+2} and magnesium and more rarely zinc, manganese and lithium and Y represents ions of smaller size, such as chromium, aluminium, iron^{+3}, magnesium, manganese, scandium, titanium, vanadium and even iron^{+2}). These are differentiated from regulated asbestos by the presence of aluminum. Regulated asbestos types do not have aluminum in them.

Horneblende: The general formula can be given as $(Ca,Na)_{2–3}(Mg,Fe,Al)_5(Al,Si)_8O_{22}(OH,F)_2$. These are differentiated from regulated asbestos by the presence of aluminum. Regulated asbestos types do not have aluminum in them.

Wollastonite: The general formula is $CaSiO_3$. These are differentiated from regulated asbestos because iron and/or magnesium are not present.

Halloysite: The general formula is $Al_2Si_2O_5(OH)_4$. These are differentiated from regulated asbestos by the presence of aluminum. Regulated asbestos types do not have aluminum in them.

Palygorskite: The general formula is $(Mg,Al)_2Si_4O_{10}(OH)\cdot4(H_2O)$. These are differentiated from regulated asbestos by the presence of aluminum. Regulated asbestos types do not have aluminum in them.

Sepiolite: The general formula is $Mg_4Si_6O_{15}(OH)_2\cdot6H_2O$. These fibers do not have a streaked SAED pattern similar to Chrysotile and chemically will have lower Mg content compared to chrysotile EDXA spectra.

Antigorite: The general formula is $(Mg, Fe)_3Si_2O_5(OH)_4$. Differentiated from Chrysotile based on morphology. Morphology of antigorite resembles regulated amphibole morphology. EDXA spectrum doesn't match any of the regulated amphiboles.

Lizardite: The general formula is $Mg_3Si_2O_5(OH)_4$. Differentiated from Chrysotile based on morphology and SAED. Lizardite scroll fibers do not have a well defined central core found in chrysotile fibers. They either do not have a visible core or have a tapered central core. Lizardiite does not have the distinctive chrysotile SAED pattern.

Talc: The general formula is $Mg_3Si_4O_{10}(OH)_2$. Differentiated from Chrysotile based on morphology. Morphology of Talc resembles regulated amphibole morphology. EDXA spectrum is similar to the end member Anthophyllite EDXA Spectra (having no Fe), but Talc does not exhibit the characteristic 5.3Å layer line spacing present in the amphiboles.

Vermiculite: The general formula is $(Mg,Fe{+}{+},Al)_3(Al,Si)_4O_{10}(OH)_2\bullet4(H2O)$. These are differentiated from regulated asbestos by the presence of aluminum. Regulated asbestos types do not have aluminum in them.

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17.0 References

17.1 Federal Register 40 CFR Part 763 Appendix A to Subpart E Interim Transmission Electron Microscopy
17.2 NVLAP 150-13 Handbook and Checklist
17.3 Less is Better-Guide to Minimizing Waste in Laboratories prepared by the Task Force on Laboratory Environment, Health and Safety-American Chemical Society 2002
17.4 EMSL QMS Manual
17.5 EMSL Chemical Hygiene and Safety Plan

18.0 Revision History

Revision #	Date	Revision	Initials
16	7/10/2018	Modified 9.5 Sample Preparation Acceptance Section to correspond more clearly with the NIST Handbook 150-13 Checklist	KN
15.1	6/14/2016	Modified Sections 9.6.5 and 9.6.6 to address sample eucentric position prior to analysis. Changed the definition of Detection Limit in Sections 1.4 and 12.1; added Section 1.5 for Analytical Sensitivity.	KN
15	2/05/2015	Changed formulas in Section 14.1.3 to evaluate the difference of the 2 analyses instead of the difference from the mean of the 2 analyses.	KN

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Authorizing Signatures

Ken Najuch		7/10/2018
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Ed Cahill	Ed Cahill	7/10/2018
QA Reviewer (print)	Reviewer Signature	Date
Ed Cahill	Ed Cahill	7/10/2018
Corporate Approval (print)	Corporate Approval Signature	Date

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EMSL Analytical, Inc. Management

EMSL Analytical S.O.P.

Toxicity Characteristic Leaching Procedure (TCLP) and Determination of RCRA Metals

[SW-846 Methods 1311 / 3010 / 7470 / 7000 / 6010]

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1.0 Method Description

1.1 Applicable Matrix: This method is applicable to the mobility of the RCRA (8) metals present in liquid, solid, and multiphasic wastes.

Element	US EPA Allowable Limits (mg/L)	CASRN	Element	US EPA Allowable Limits (mg/L)	CASRN
Arsenic **(As)**	5.0	7440-38-2	Lead **(Pb)**	5.0	7439-92-1
Barium **(Ba)**	100.0	7440-39-3	Mercury **(Hg)**	0.2	7439-97-6
Cadmium **(Cd)**	1.0	7440-43-9	Selenium **(Se)**	1.0	7782-49-2
Chromium **(Cr)**	5.0	7440-47-3	Silver **(Ag)**	5.0	7440-22-4

1.2 Scope and Application

1.2.1 This method is based upon the extraction of waste with 20 mL of an acetic acid buffer per gram of sample. **Note:** Steps in this method related to leachate generation are derived from EPA SW-846 Method 1311, which is considered a Method-Defined Parameter (MDP) under the EPA Method Innovation Rule (MIR); see 40 CFR Part 260 {260.11 (c) (3) (v)}.

1.2.1.1 For waste characteristization of toxicity, variances (e.g., minimum sample weight, particle size reduction) to leachate generation are not allowed. A minimum customer sample size of 110g is required for preliminary evaluation and leachate generation.

1.2.1.2 Any such variance to leachate generation steps must be noted on the customer report, regardless of the intended use of the analytical data.

1.2.2 The following analytes may be evaluated by this method (EPA SW-846 method references provided for each category):

1.2.2.1 Lead (Pb) only – Methods 1311 / 3010 / 7000 (FLAA)

1.2.2.2 Mercury (Hg) only – Methods 1311 / 7470 (CVAA)

1.2.2.3 All RCRA metals (excluding Hg) – Methods 1311 / 3010 / 6010 (ICP-OES)

1.3 Summary of Method: A representative sample of the waste undergoes a preliminary analysis to determine its particle size, alkalinity, and percent solids contents.

1.3.1 If the sample contains no liquid phase, the sample is subdivided, if necessary, and extracted with 20 times its weight of extraction fluid (acetic acid or an acetate buffer) for 18 ± 2 hours in a LDPE vessel rotated at 30 ± 2 rpm. The resulting extract is analyzed for TCLP metals.

1.3.2 If the sample contains less than 0.5% solids, it is filtered; the filtrate is considered the TCLP extract and is analyzed for TCLP metals.

1.3.3 If the sample is multiphasic, but contains greater than or equal to 0.5% solids, a representative sample is filtered under pressure to separate the phases. The filtrate is retained separately and the solid phase is subdivided, if necessary, then extracted as described in 1.3.1.

1.3.3.1 If the original filtrate and extract from 1.3.3 are compatible (e.g., multiple phases will not result upon combination) the combined liquid is defined as the TCLP extract.

1.3.3.2 If incompatible, the two phases are analyzed separately, and the results are combined mathematically to give a volume-weighted average concentration.

1.4 Holding Times

1.4.1 Samples for TCLP mercury analysis must be extracted within 28 days of the collection date and analyzed within 28 days of the extraction date.

1.4.2 Samples for other TCLP metals must be extracted within 180 days of the collection date and analyzed within 180 days of extraction date.

1.4.3 No preservative is added to the raw sample. Samples may be refrigerated at 0°C to 6°C; if irreversible sample change, such as formation of a precipitate occurs as a result, then the entire sample, including the precipitate, shall undergo extraction.

1.4.4 Extracts for the determination of TCLP metals shall be preserved with concentrated nitric acid to a pH less than 2. If a precipitate forms that remains after acidification, the extract for metals must be stored at 0°C to 6°C without preservation.

1.5 Detection Limit

1.5.1 The reporting limit for each analyte in this method, unless stated otherwise, is equal to the lowest calibration standard utilized, and can be validated by a method detection limit study.

1.5.2 See Section 1.1 for the current EPA regulatory limits.

2.0 Interferences

2.1 General

2.1.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences to sample analysis. All these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks. Specific selection of reagents by distillation in all-glass systems may be necessary. Refer to each SW-846 method referenced for specific guidance on quality control procedures, and to SW-846 Chapter Three for general guidance on the cleaning of glassware. Also refer to the preparative methods for discussion on interferences.

2.1.2 The presence of high dissolved solids in the sample may result in physical interferences.

2.1.3 Solutions should be monitored for viscosity differences that may alter the aspiration rate.

2.1.4 All metals are not equally stable in solution. Digestates should be analyzed as soon as possible after preparation.

2.2 Flame Atomic Absorption (FLAA) Spectrometry

2.2.1 Chemical interferences may be caused by lack of atomic absorption in the flame when the flame is not sufficiently hot to dissociate the molecules. One way to prevent this is to add some salts (i.e., lanthanum chloride). Chemical interferences may also be eliminated by complexiметric separation of the metal from the interfering material.

2.2.2 Ionization interferences occur when the flame temperature is sufficiently high to generate the removal of an electron from a neutral atom, giving a positively charged ion. This type of interference can generally be controlled by the addition, to both standard and sample solutions, of a large excess (1,000 mg/L) of an easily ionized element such as K, Na, Li or Cs.

2.2.3 Spectral interference can occur when an absorbing wavelength of an interfering element present in the sample falls within the width of that line of the element of interest. The results of the determination will be erroneously high. In some cases, this interference can be reduced by narrowing the slit width.

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2.3 Cold-Vapor Atomic Absorption (CVAA) Spectrometry

2.3.1 Potassium permanganate may be added to eliminate possible mercury interference from sulfide. Concentrations as high as 20 mg/kg of sulfide, as sodium sulfide, do not interfere with the recovery of added inorganic mercury from reagent water.

2.3.2 Copper has also been reported to interfere; however, copper concentrations as high as 10.0 mg/kg had no effect on recovery of mercury from spiked samples.

2.3.3 Samples high in chlorides may require additional permanganate, because chlorides are converted to free chlorine (which also absorbs radiation of 254 nm) during the oxidation step. Samples may be allowed to stand for at least one hour under a hood (without active purging) to remove the chlorine.

2.4 Inductively-Coupled Plasma Optical Emission Spectrometry (ICP-OES)

2.4.1 Spectral interferences are caused by: (1) overlap (direct or indirect) of a spectral line from another element; (2) unresolved overlap of molecular band spectra; (3) background contribution from continuous or recombination phenomena; and (4) stray light from the line emission of high-concentration elements. Background contribution and stray light can usually be compensated for by single point background correction. Direct spectral overlap can be compensated for by quantitative correction for the interfering element, while indirect spectral overlap may be compensated with multivariate algorithm models. Unresolved overlap requires selection of an alternate wavelength. See IH-TD-451 ICP-OES Training for determination of background correction points, inter-element correction (IEC) factors and Multicomponent Spectral Fitting (MSF) models for the PE Optima 8000.

2.5 Glassware Cleaning

2.5.1 The filter apparatus is rinsed in a bath of dilute (5-10% HNO_3) followed by a rise in ASTM Type II water (ASTM D1193).

2.5.2 All other non-disposable materials (e.g., LDPE bottles) used in this method are thoroughly washed with hot water and a non-phosphate detergent.

2.5.3 The glassware is thoroughly rinsed with tap water, followed by three rinses with DI water.

2.5.4 The glassware is air-dried or dried in an oven set at 95°C ± 5°C and allowed to bake out for at least 20 minutes. **Note:** Volumetric glassware is not oven dried, only air-dried.

3.0 Definitions

3.1 Calibration Blank (ICB/CCB): The calibration blank is prepared from reagent water (analyte free) with matrix-matched reagents, and checks for instrument drift and carryover contamination.

3.2 Calibration Standard: A solution prepared from the dilution of stock standard solutions. The calibration standards are used to calibrate the instrument response to analyte concentration and create a curve correlating absorbance/emission vs. concentration.

3.3 Continuing Calibration Verification Standard (CCV): A standard solution (or set of solutions) used to verify freedom from excessive instrumental drift. The concentration is to be near the mid-range of the linear curve and checked every 10 samples.

3.4 Instrument Detection Limit (IDL): The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of ten replicate measurements of the calibration blank signal at the same wavelength

3.5 Laboratory Control Sample (LCS): The LCS is a blank leachate spiked with known concentrations of target analytes (liquid spike). The LCS is prepared and analyzed in the same manner as the original client sample leachate. The purpose of the LCS is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate measurements.

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3.6 **Linear Dynamic Range (LDR):** The concentration range over which the instrument response to an analyte is near linear

3.7 **Lower Limit of Quantitation Check (LLQC):** An LLQC sample, also referred to as a reporting limit verification sample (RLVS), is a matrix-based check sample that is carried through the entire preparation and analytical procedure. The LLQC is typically prepared at the same concentrations as the lowest standard from the calibration curve.

3.8 **Matrix Spike (MS):** A matrix spike consists of a client sample leachate spiked with known concentrations of target analytes (liquid spike). The MS is prepared and analyzed in the same manner as the original client sample leachate.

3.9 **Matrix Spike Duplicate (MSD):** A matrix spike duplicate consists of a client sample leachate spiked with known concentrations of target analytes (liquid spike). The MSD is prepared and analyzed in the same manner as the original client sample.

3.10 **Method Blank:** The method blank is a blank leachate (extraction fluid #1, #2, or DI water) which contains all reagents and is subject to all preparation steps. The method blank shall be processed along with samples. These blanks will be useful in determining if samples are being contaminated.

3.11 **Method Detection Limit (MDL):** The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence the analyte concentration is greater than zero

3.12 **Reporting Limit (RL):** The minimum analyte concentration reported for samples being analyzed

3.13 **Stock Standard Solution:** A concentrated solution containing the method analyte prepared in the laboratory, using reference materials purchased from an ISO Guide 34 manufacturer

4.0 Safety

4.1 All personnel performing preparation and/or analysis of samples must be familiar with the EMSL Chemical Hygiene and Safety Plan (EMSL SAF-SOP-2).

5.0 Equipment and Supplies

5.1 Flame Atomic Absorption (FLAA) Spectrometer: Perkin Elmer PinAAcle 900, AAnalyst 400, or equivalent; double beam instrument with a grating monochromator, photomultiplier detector, adjustable slits and a wavelength range of 190 to 800 nm

5.1.1 Burner head: Single slot 10 cm by 0.065 cm

5.1.2 Lead hollow cathode lamp (HCL) or electrodeless discharge lamp (EDL)

5.2 Cold-Vapor Atomic Absorption (CVAA) Spectrometer: Perkin Elmer FIMS-100, or equivalent;

5.2.1 Low pressure mercury lamp, photocell detector with maximum sensitivity at 254 nm

5.2.2 FIMS-cell, with an inner diameter of 4 mm and an optical path length of 260 mm. The cell is heated to about 50°C to prevent the formation of condensation.

5.2.3 Pumps, magazines (for holding pump tubes), pump tubing, flow-injection valve, sample loops, carrier gas system, manifold, gas/liquid separator, and connectors

5.2.4 Scrubber kit: Use of mercury scrubber with special filter traps mercury vapor from the FIMS system (eliminates the need for an exhaust vent). Replace filter every six months or more frequently as needed; treat used mercury filters as hazardous waste and dispose of properly.

5.3 Inductively-Coupled Plasma Optical Emission Spectrometer (ICP-OES): Perkin Elmer Optima 8000, 8300, or equivalent;

5.3.1 Radio-frequency generator compliant with FCC regulations

5.3.2 Dual backside-illuminated charge-coupled device (DBI-CCD) solid state detector, or equivalent

5.3.3 Mass flow controller for argon nebulizer and purge gas supply

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5.3.4 Nebulizer, e.g. cross-flow, concentric, parallel path
5.3.5 Spray chamber, e.g. Scott, cyclonic
5.3.6 Peristaltic pump
5.3.7 Auto sampler, PE S-10, or equivalent

5.4 Fume hood, capable of minimum 75 cfm face velocity
5.5 Drying oven, capable of maintaining 100°C ± 20°C
5.6 Digestion apparatus:
5.6.1 Hotblock™ capable of maintaining 95°C ± 5°C, with 50 mL digestion tubes/caps and 41 mm watch glasses, or
5.6.2 Hot plate with adjustable temperature capable of maintaining 95°C ± 5°C. Other glassware includes 250 mL glass beakers or flasks, watch glasses (ribbed) and glass rods.
5.7 PTFT plunger/filtration system **and** cotton balls
5.8 Analytical balance(s) capable of
5.8.1 weighing sample/container (> 100 g for extraction) and accurate to within ± 0.1 g
5.8.2 weighing sample/solids (< 100 g) and accurate to within ± 0.01 g
5.9 Reference and Working weight sets (to verify bracketed weight range of interest) **Note:** To meet all applicable state, TNI and program standards, Class 1 certification is required for both weight types.
5.10 Thermometer or thermocouple, NIST traceable, calibrated within 0-200°C range
5.11 Thermometer, minimum-maximum, target ambient temperature range 21°C to 25°C
5.12 High volume pipette; 1000-5000 µL Eppendorf adjustable pipette, or equivalent of appropriate range
5.13 Medium volume pipette; 100-1000 µL Eppendorf adjustable pipette, or equivalent of appropriate range
5.14 Low volume pipette; 10-100 µL Eppendorf adjustable pipette, or equivalent of appropriate range
5.15 Eppendorf disposable pipette tips
5.16 Volumetric flasks, Class "A"
5.17 Bottle top acid dispenser(s)
5.18 Disposable transfer pipettes
5.19 Wash bottles
5.20 Spatulas, stainless steel
5.21 pH meter and electrode, capable of two-decimal readability and calibration with a minimum of 2 buffer solutions bracketing the applicable pH range of samples/extraction fluids
5.22 Magnetic stir plate and stir bars
5.23 Miscellanous tools for particle size reduction such as, but not limited to:
5.23.1 bench vice, hammer, saws, tin snips, scissors, etc.
5.23.2 associated cleaning supplies (e.g., wipes)
5.24 Rotary Agitator: Analytical Testing Corp., Model DC-20B (12-position), or equivalent. Must be capable of rotating the extraction vessels in an end-over-end fashion at 30 ± 2 rpm.
5.25 Extraction vessel: Analytical Testing Corp., RA-202 (PE), or equivalent; wide mouth, 2L capacity
5.26 Filtration equipment/consumables:
5.26.1 **Pressure filtration**: Environmental Express (EE) PF000-2, 2.2L PTFE coated, or equivalent. Use EE FG77142MM acid washed glass fiber filters, 142mm, 0.7 µm, or equivalent. Hose or tubing for nitrogen/air should be rated to a minimum of 50 PSI.
5.26.2 **Vacuum filtration (low solids content):** Positive displacement pump, Tygon or polyethylene tubing. The filtration device shall have a minimum internal volume of 300 mL (e.g., VWR 28198-865, or non-sterile equivalent) and accommodate a minimum 47mm diameter glass fiber filter (acid washed) with a 0.7 µm pore size (EE FG77047MM, or equivalent).
5.27 Erlenmeyer flask (e.g., 4L) with gradations (for generating batches of extraction fluids)

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6.0 Reagents and Standards

6.1 Reagent (deionized) water, ASTM type II water (ASTM D1193). Use reagent (DI) water for preparing all reagents and calibration standards.

6.2 Nitric Acid (HNO_3), concentrated (70%, 15.8N), ACS Grade, or equivalent

6.3 HNO_3, 1N: Dilute 63.3 mL of concentrated nitric acid with DI water in a 1L volumetric flask.

6.4 Hydrochloric acid (HCl), concentrated (36%, 11.65N), ACS Grade, or equivalent

6.5 HCl, 1N: Dilute 85.8 mL of concentrated HCl to volume with DI water in a 1L volumetric flask.

6.6 Sodium hydroxide (NaOH), ACS Grade, or equivalent

6.7 Sodium hydroxide, 1N: Dissolve 40g of NaOH in 500 mL reagent water; allow to cool to ambient temperature and dilute to volume with reagent water in a 1 L volumetric flask.

6.8 Acetic acid, glacial, ACS Grade

6.9 pH buffers, NIST traceable: pH 2, pH 4, pH 7, pH 10 (pH 4 buffer useable for electrode storage)

6.10 **Extraction fluid #1**: For a 4L batch, add 22.8 mL of glacial acetic acid to 2000 mL of reagent water in a 4L Erlenmeyer flask; add 257 mL of 1.0 N sodium hydroxide solution, dilute to volume and mix. Using a pH meter, check the pH and adjust, if necessary, to 4.93 ± 0.05 by adding acetic acid or 1N sodium hydroxide solution. If the extraction fluid has been stored for more than one day, check the pH. If it is out of the specified range, discard. In any case, discard 3 months after preparation.

6.11 **Extraction fluid #2**: For a 4L batch, dilute 22.8 mL of glacial acetic acid to 3800 mL of reagent water in a 4L Erlenmeyer flask, dilute to volume with reagent water and mix. Using a pH meter, measure the solution pH, which should be 2.88 ± 0.05. If the pH is not within specifications, discard the buffer and remake. Include the pH of the solution on the bottle label. Discard 3 months after preparation.

6.12 Instrument Calibration/Verification Standards

6.12.1 **Source 1:** Calibration Standards (purchased from an ISO Guide 34 accredited reference material provider); single-element or custom mixes. Note: Both Source 1 and Source 2 standards may be utilized for spiking QC samples or preparation of QC spiking solutions.

6.12.2 **Source 2:** Initial Calibration Verification (ICV); the ICV shall be made from a stock solution having a different manufacturer lot identification than the calibration standards.

6.12.3 **Single-Element Standards:** For preparing calibration/verification standards, spiking solutions or ICP interference check standards, single element standards (1000 ppm, in nitric acid) are available (in sets of 2 x 25 mL bottles) from SCP Science as described below:

Element	SCP Item #	Element	SCP Item #	Element	SCP Item #
Arsenic **(As)**	140-051-330	Lead **(Pb)**	140-051-820	Aluminum **(Al)**	140-051-130
Barium **(Ba)**	140-051-560	Selenium **(Se)**	140-051-340	Calcium **(Ca)**	140-051-200
Cadmium **(Cd)**	140-051-480	Silver **(Ag)**	140-051-470	Iron **(Fe)**	140-051-260
Chromium **(Cr)**	140-051-240	Mercury **(Hg)**	140-051-800	Magnesium **(Mg)**	140-051-120

6.13 **FLAA-Specific Reagents and Supplies**

6.13.1 Acetylene gas supply, AA grade or equivalent

6.13.2 Air supply from compressed air line

6.13.3 Source 1 and Source 2 Calibration and Verification standards

6.14 **CVAA-Specific Reagents and Supplies** (Note: Prepare proportionately in smaller volumes, as needed)

6.14.1 Argon gas supply, high purity (may use same source as for ICP-OES plasma)

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6.14.2 Sulfuric Acid, concentrated, ACS Grade

6.14.3 Potassium permanganate ($KMnO_4$), mercury-free: Prepare a 5% solution (w/v) by dissolving 100g of $KMnO_4$ in 2.0L of reagent water.

6.14.4 Potassium persulfate ($K_2S_2O_8$), ACS Grade: Prepare a 5% (w/v) solution by dissolving 100g of $K_2S_2O_8$ in 2.0L of reagent water.

6.14.5 Sodium Chloride-Hydroxylamine-Hydrochloride solution: Dissolve 240g of sodium chloride (NaCl) and 240g of hydroxylamine-hydrochloride in 2.0 L of reagent water.

6.14.6 Stannous Chloride ($SnCl_2$), ACS Grade: Prepare a 1.1% $SnCl_2$ solution by adding 30 mL of concentrated HCl to ~500 mL of DI water in a 1 L flask. Transfer 11 g of $SnCl_2$ to the flask, dissolve and dilute to volume with DI water. Prepare fresh daily.

6.14.7 3% (v/v) HCl solution: Add 60 mL of concentrated HCl to 2.0L of DI water and mix**.**

6.14.8 Source 1 and Source 2 Calibration and Verification standards

6.15 ICP-Specific Reagents and Supplies

6.15.1 Argon gas supply, high purity

6.15.2 Source 1 and Source 2 Calibration and Verification standards, single element standards

7.0 Sample Collection, Preservation, Shipment and Storage

7.1 Holding time for sample extraction is 6 months, except for mercury which is 28 days.

7.2 Holding time for extract analysis is 6 months, except for mercury which is 28 days.

7.3 If not analyzed immediately after extraction, all extracts/filtrates for analysis of metals must be preserved with nitric acid to pH < 2. If precipitation occurs upon acidification, the remaining extract shall not be acidified, and the extract shall be analyzed as soon as possible.

7.4 Sample Receiving: Upon sample receipt, check the information on the Chain of Custody (COC) matches the information on the samples and other paperwork. Any discrepancies must be resolved before proceeding. If the samples do not have a COC, then one is completed at time of log-in. The client shall fill out the following necessary information:

7.4.1 Client name, address, phone number, email, contact person, etc.

7.4.2 Client project description or project number (should include state where samples were taken)

7.4.3 Number of samples submitted, date and time of delivery

7.4.4 Type of analysis requested and turnaround time requested

7.4.5 Sample locations/descriptions

7.4.6 Date/initials of the customer submitting samples and EMSL employee receiving the samples

7.5 Sample Log-In

7.5.1 If all of the above criteria for sample receiving are met, then the sample(s) can be logged into Sample Master (LIMS) as per the Sample Master SOP. This process with assign a unique EMSL order number for the project, as well as unique lab sample IDs.

7.5.2 The LIMS will create an Internal Chain of Custody.

8.0 Instrument Calibration and Standardization

8.1 FLAA Instrument Calibration

8.1.1 Turn on the instrument for initialization. Install and align the lead lamp; apply the proper current for the HCL/EDL and allow it to warm up and stabilize (approx. 10-20 minutes).

8.1.2 Check the position and alignment of the burner head. Instrument Parameters:

8.1.2.1 Lead HCL or EDL current – see manufacturer's specifications

8.1.2.2 Wavelength of 283.3 nm

8.1.2.3 Slit of 0.7 (nm)

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8.1.2.4 Run an oxidizing fuel (fuel lean)

8.1.3 Check the compressed air supply and the acetylene supply. Turn on the air and acetylene to the specified value and ignite burner according to manufacturer's instructions.

8.1.4 Let the burner stabilize for a few minutes. Aspirate a blank containing acid/matrix-matched DI water. Zero the instrument according to the manufacturer's instructions.

8.1.5 Prepare a calibration blank and five calibration standards in graduated amounts within the range of 0.4 mg/L to 20.0 mg/L. The calibration standards should be prepared using the same type of acid(s) at a concentration near that of the prepared samples.

8.1.5.1 Example preparation: Add 0.20, 0.50, 2.5, 5.0, and 10.0 mL of 1000 ppm lead standard into separate 500 mL volumetric flasks using Eppendorf pipettes. Add 25.0 mL of concentrated HNO_3 to each flask and dilute to 500 mL with DI water; mix thoroughly. The final concentrations are 0.40, 1.0, 5.0, 10.0 and 20.0 mg/L.

8.1.6 To achieve a 5.0 mg/L concentration for the LCS(D)/MS(D), 0.25 mL of the 1000 ppm Source 1 or Source 2 lead standard may be added to a 50 mL aliquot of blank extraction fluid or sample extract. Alternatively, a separate spiking solution may be prepared (e.g., 1.0 mL of a 250 ppm solution) to achieve the same target concentration.

8.1.7 Auto-zero the instrument using the calibration blank, then analyze the standards and record the readings. The calibration curve is prepared from the average response of triplicate readings from each standard. Acceptance criteria shall be established for each instrument based upon historical performance.

8.1.7.1 The relative standard deviation (RSD) between triplicate readings of each calibration standard shall be ≤20%; for higher concentration standards, ≤ 5-10% criteria are typical. If the AA instrument configuration prevents the required multi-point calibration, calibrate according to instrument manufacturer's recommendations, and analyze the remaining standards immediately after calibration.

8.1.7.2 Results for each standard shall be no more than ±20% of the true value; for higher concentration standards, ± 5-10% criteria are typical. Provide each standard's calculated concentration to show this criterion has been met.

8.1.7.3 The correlation coefficient of the calibration curve shall be ≥ 0.995.

8.1.7.4 The slope (absorbance/ppm) of the calibration curve should be ≥ 0.008.

Note: If the above criteria are not met, re-calibration is necessary. The calibration curve may be forced through zero if the above criteria are met.

8.1.8 After the FLAA system has been calibrated and prior to sample analysis, analyze the Initial Calibration Verification (ICV) standard and the Initial Calibration Blank (ICB*)*. The ICV solution is prepared from a source different than that used for the standard curve, and shall be near the regulatory limit. The ICV acceptance limit is + 10% of its true value. When measurements exceed the control limits, the analysis must be terminated, the problem corrected, the instrument recalibrated and the calibration re-verified.

8.1.8.1 Example preparation: Add 1.0 mL of lead stock standard of 1000 ppm (from a second source) using an Eppendorf pipette. Add 12.5 mL of concentrated HNO_3 and 12.5 mL of concentrated HCl into a 500 mL volumetric flask, and dilute to a volume of 500 mL with DI water. Mix thoroughly. The final concentration is equal to 2.0 mg/L.

8.1.9 Acceptance criteria shall be posted near the instrument. These criteria should include those listed above, as well as the following:

8.1.9.1 Minimum absorbance criteria for the lowest concentration calibration standard

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8.1.9.2 Minimum/maximum absorbance criteria for the highest concentration calibration standard (linearity check)
8.1.9.3 Maximum allowable concentration values (absolute value) for the ICB/CCB
8.1.9.4 Minimum/maximum allowable values for the ICV/CCV

8.2 CVAA Instrument Calibration

8.2.1 Turn on the instrument and allow time to warm up (approx. 30-45 minutes). **C**heck the argon supply and set the flow to 75-100 mL/min.

8.2.2 Prepare fresh 1.1% $SnCl_2$ reductant solution (in 3% HCl); fill instrument reservoirs with reductant and carrier (3% HCl) solutions.

8.2.3 Prepare the 10 PPM (mg/L) Intermediate Calibration Standard:

8.2.3.1 Add approximately 50 mL of DI water to a 100 mL Class A volumetric flask; add 2.0 mL of HNO_3 and mix.

8.2.3.2 Add 1.0 mL of the 1000 PPM Source 1 stock standard; dilute to the mark with DI water and mix. **Note:** Expiration is 28 days, but should not exceed the expiration date of the standard from which it was prepared.

8.2.4 Prepare the 0.04 PPM (mg/L) Working Calibration Standard.

8.2.4.1 Prepare by filling a 100 mL class A volumetric flask with approximately 50 mL of DI water; then add 2 mL of HNO_3 and mix.

8.2.4.2 Add 0.40 mL of the 10 PPM intermediate calibration standard and dilute to the mark with DI water and mix. **Note:** Expiration is 28 days, but should not exceed the expiration date of the standard from which it was prepared**.**

8.2.4.3 Prepare calibration standards using the spike volumes shown below.

Calibration Standards Table

Standard	Working Calibration Stnd., mg/L	Vol. Spiked (mL)	Final Vol., mL	Hg, Conc., µg/L
Cal. Blk.	NA	0.0	40	0.0
#1	0.04	0.2	40	0.20
#2	0.04	0.5	40	0.50
#3	0.04	1.0	40	1.0
#4	0.04	2.0	40	2.0
#5	0.04	5.0	40	5.0
LCS(D)/MS(D) Spike	0.04	2.0	40	2.0

8.2.5 **LCS(D)/MS(D) Spike:** Using the working calibration standard solution (0.04 mg/L) or a separate solution prepared in the same way, add 2.0 mL to each 4.0 mL aliquot of blank extraction fluid (LCS/LCSD) or customer sample extract (MS/MSD).

8.2.6 Follow steps 9.7.3 – 9.7.11 for digestion of the calibration blank and calibration standards. Auto-zero the instrument using the calibration blank, then analyze the standards and record the readings. The calibration curve is prepared from the average response of triplicate readings from each standard. Calibration acceptance criteria shall be established for each instrument based upon historical performance.

8.2.6.1 The relative standard deviation (RSD) between triplicate readings of each calibration standard shall be ≤20%; for higher concentration standards, ≤ 5-10% criteria are

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typical. If the CVAA instrument configuration prevents the required multi-point calibration, calibrate according to instrument manufacturer's recommendations, and analyze the remaining standards immediately after calibration.

8.2.6.2 Results for each standard shall be no more than ±20% of the true value; for higher concentration standards, ± 5-10% criteria are typical. Provide each standard's calculated concentration to show this criterion has been met.

8.2.6.3 The correlation coefficient of the calibration curve shall be $\geq$ 0.995.

8.2.6.4 The slope of the calibration curve (aborbance/ppb) should be $\geq$ 0.015.

8.2.6.5 If the above criteria are not met, re-calibration is necessary. The calibration curve may be forced through zero if the above criteria are met.

8.2.7 After the CVAA system has been calibrated, and prior to sample analysis, analyze the Initial Calibration Verification (ICV) standard and the Initial Calibration Blank (ICB*).* The ICV solution is prepared from a source different than that used for the standard curve, and shall be near the regulatory limit. The ICV acceptance limit is $\pm$ 10% of its true value. When measurements exceed the control limits, the analysis must be terminated, the problem corrected, the instrument recalibrated and the calibration re-verified.

8.2.7.1 **20 mg/L Intermediate ICV Standard**: Add approximately 50 mL of DI water to a 100 mL Class A volumetric flask; add 2.0 mL of HNO_3 and mix.

8.2.7.2 Add 2.0 mL of the 1000 PPM Source 2 stock standard and dilute to the mark with DI water and mix. **Note:** Expiration is 28 days, but should not exceed the expiration date of the reference standard from which it was prepared.

8.2.7.3 **0.20 mg/L Working ICV Standard**: Add approximately 50 mL of DI water to a 100 mL Class A volumetric flask; add 2.0 mL of HNO_3 and mix**.**

8.2.7.4 Add 1.0 mL of the 20 mg/L intermediate ICV standard and dilute to the mark with DI water and mix. **Note:** Expiration is 28 days, but should not exceed the expiration date of the reference standard from which it was prepared**.**

8.2.7.5 Using a Working ICV Standard spike volume of 0.40 mL, prepare the ICV standard. The final concentration is 2.0 µg/L. Follow steps in Section 9 for digestion of the initial calibration blank (ICB) and ICV prior to instrumental analysis.

8.2.8 Acceptance criteria shall be posted near the instrument. These criteria should include those listed above, as well as the following:

8.2.8.1 Minimum absorbance criteria for the lowest concentration calibration standard (sensitivity check)

8.2.8.2 Minimum/maximum absorbance criteria for the highest concentration calibration standard (linearity check)

8.2.8.3 Maximum allowable concentration values (absolute value) for the ICB/CCB

8.2.8.4 Minimum/maximum allowable values for the ICV/CCV

8.3 ICP-OES Instrument Calibration: Turn on the instrument and allow time to warm up. **C**heck the argon supply, shear gas and chillller. The instrument must be calibrated daily and each time the instrument is initialized. Stock custom mix standards (Source 1 and 2) are shown below.

8.3.1 EMSL-BL-ICP Mix 1A (5% HNO_3 / 0.1% HF / trace tartaric acid): Analyte-Specific **(Source 1)** stock standards, purchased from an ISO Guide 34 accredited reference material provider (RMP). Source 1 standards are used to prepare calibration standards, the LLQC and the CCV standards. Single-element standards or custom mixes such as those listed below may be purchased to generate specific concentration combinations (see Table 1).

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8.3.2 EMSL-BL-ICP Mix 2A (5% HNO_3 / 0.1% HF / trace tartaric acid): Analyte-Specific **(Source 2)** Stock Standards. Source 2 standards are used to prepare the initial calibration verification standard (ICV) which is used to verify the calibration curve (Source 1). It shall be purchased from an ISO Guide 34 accredited reference material provider (RMP). Source 2 standards, either single element or custom mixes such as those listed below, can be from the same RMP as Source 1, so long as they are from a different lot number of the Source 1 standard.

Source 1 and Source 2 Analyte Concentrations

Concentration (ppm)	Analyte(s)
20	Ag
50	Cd, Cr, Pb
100	As, Se
250	Ba
500	Al, Ca, Fe
1000	Mg

Note: Since Source 1 and Source 2 (above) are identical in concentration, but have unique lot numbers, they may be used interchangeably to prepare either calibration standards or the ICV, but not both.

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8.3.3 Calibration Standards: A minimum of three standards and a calibration blank are used to calibrate the instrument. They are prepared in Class A volumetric flasks, using single-element standards or customer mixes such as those described above. **Note:** Higher concentration standards (e.g., Cal Std. #4 and Cal Std. #5, below, may be utilized for linearity checks as needed. All standards must contain the same acids and approximate concentrations as those in the prepared samples; for the examples below, the acid matrix is 3% HNO_3 and 5% HCl. Prior to preparing mixed standards, each individual element should be analyzed separately to determine possible spectral interference or the presence of impurities. Care should be taken when preparing the mixed standards to ensure the elements are compatible and stable together. For this acid combination, the silver concentration should be limited to 2 mg/L and is stable in a water matrix for 30 days. Higher concentrations of silver require additional HCl.

8.3.3.1 **Cal Blank (ICB/CCB):** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 3.0 mL HNO_3 and 5.0 mL HCl; dilute to volume with DI water.

8.3.3.2 **Cal Std. #1:** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 0.040 mL of Cal Mix A, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.3.3 **Cal Std. #2:** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 0.080 mL of Cal Mix A, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.3.4 **Cal Std. #3:** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 0.40 mL of Cal Mix A, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.3.5 **Cal Std. #4:** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 2.0 mL of Cal Mix A, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.3.6 **Cal Std. #5:** Into a 100 mL Class A volumetric flask, add ~50 mL of DI water, then add 10.0 mL of Cal Mix A, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.4 Spectral Interference Check (SIC) Standard: Single-element standards or custom mixes such as those shown below may be purchased with specific concentration combinations:

EMSL-BL SIC Mix 1, SCP # 600-054-530 (5% HNO_3)

Concentration (ppm)	Analyte(s)
2000	Fe
5000	Al, Ca, Mg

8.3.5 SIC solutions contain known concentrations of potentially interfering elements that will provide an adequate test of the correction factors. Daily analysis of one SIC solution, consisting of "major" interferents (Fe, Al, Ca, Mg), is required. Other SIC solutions containing secondary interferents, with or without the major interferents, may optionally be analyzed. The SIC solution must be successfully analyzed at the beginning and end of each analytical sequence; example preparations are provided below.

8.3.5.1 In a 100 mL volumetric flask, combine 10.0 mL EMSL-BL ICP SIC Mix 1, 3.0 mL HNO_3 and 5.0 mL HCl. Dilute to volume with DI water.

8.3.6 Instrument Performance Checks: Instrument performance is established by analyzing and verifying an ICV and ICB immediately following the calibration. Instrument performance is maintained and verified to be free from excessive instrumental drift by analyzing a CCV and CCB every ten samples, and at the end of the analytical run. Prepare as follows:

8.3.6.1 ICB/CCB; same as calibration blank

8.3.6.2 ICV standard: In a 100 mL Class A volumetric flask, add 0.40 mL of Cal Mix A (Source 1 or Source 2, whichever one not used to prepare calibration standards), 3.0 mL HNO_3 and 5.0 mL HCl; dilute to volume with DI water. The ICV must be prepared from a source independent of that used to prepare the calibration standards.

8.3.6.3 CCV standard: In a 250 mL Class A volumetric flask, add 1.0 mL of Cal Mix A (Source 1 or Source 2), 7.5 mL HNO_3 and 12.5 mL HCl; dilute to volume with DI water. The CCV concentration is identical to Calibration Standard #3.

8.3.7 Internal Standard (ISTD): The Stock Internal Standard (e.g., Indium at 10,000 mg/L) shall be purchased from an ISO Guide 34 accredited reference material provider (RMP). If used, the ISTD concentration should be sufficient for optimum precision, but not so high as to alter the salt concentration of the matrix. **Example:** To prepare a 500 mg/L standard (for direct addition to standards and sample solutions), add 50.0 mL of stock standard to a 1000 mL volumetric flask; for acid matrix-matching, add 30 mL HNO_3 and 50 mL HCl and dilute to mark with DI water. **Note:** When aspirating the internal standard separately from other solutions, the calculated value (as above) is the actual concentration, not the effective concentration estimated from tubing sizes.

8.3.8 LCS(D)/MS(D) Spiking Solution: Using custom mixes or single element standards obtained from an ISO Guide 34 accredited reference material provider (RMP), an example preparation of the spiking solution is provided:

8.3.8.1 Into a 100 mL Class A volumetric flask, add ~10 mL of DI water, then 5.0 mL HNO_3. Add 12.5 mL each of 1000 ppm As, Ba, Cd, Cr, Pb, Se. Add 5.0 mL of 1000 ppm Ag and dilute to volume with DI water. Protect standard from light during storage.

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Table 1 – Example* Settings for Calibration, Verification and SIC Standards (all concentrations in mg/L)

Element	λ (nm)	Viewing Align.	Std. #1	Std. #2	Std. #3/CCV	Std. #4	Std. #5	ICV	SIC	LCS/MS (1)
Aluminum	396.153	AA	0.20	0.40	2.0	10.0	50.0	2.0	500.0	
Arsenic	188.979	A	0.040	0.080	0.40	2.0	10.0	0.40		5.0
Barium	493.408	AR	0.10	0.40	1.0	5.0	25.0	1.0		5.0
Cadmium	228.802	A	0.020	0.040	0.20	1.0	5.0	0.20		5.0
Calcium	317.933	R	0.20	0.40	2.0	10.0	50.0	2.0	500.0	
Chromium	267.716	A	0.020	0.040	0.20	1.0	5.0	0.20		5.0
Iron	259.939	AA	0.20	0.40	2.0	10.0	50.0	2.0	200.0	
Lead	220.353	A	0.020	0.040	0.20	1.0	5.0	0.20		5.0
Magnesium	279.077	R	0.40	0.80	4.0	20.0	100.0	4.0	500.0	
Selenium	196.026	A	0.040	0.080	0.40	2.0	10.0	0.40		5.0
Silver	328.068	A	0.008	0.016	0.080	0.40	2.0	0.20		2.0

(1) contration based upon 2.0 mL LCS(D)/MS(D) spiking solution and a final prepared volume of 50 mL.

* Other wavelengths, alignments and concentrations may be substituted if they can provide the needed sensitivity, and are corrected for spectral interferences.

Alignment/Viewing
A = Axial
R = Radial
AA = Attenuated Axial (e.g., 1:40 emission intensity relative to un-attenuated axial viewing for the Optima 8000)
AR = Attenuated Radial (e.g., 1:20 emission intensity relative to un-attenuated radial viewing for the Optima 8000)

8.3.9 Auto-zero the instrument using the calibration blank, then analyze the standards and record the readings. The calibration curve is prepared from the average response of triplicate readings from each standard. Acceptance criteria shall be established for each instrument based upon historical performance.

8.3.9.1 The relative standard deviation (RSD) between triplicate readings of each calibration standard should be ≤20% for low concentration standards; for higher concentration standards, ≤ 5-10% criteria are more typical. If the instrument configuration prevents the required multi-point calibration, calibrate according to instrument manufacturer's recommendations, and analyze the remaining standards immediately after calibration.

8.3.9.2 Results for each individual standard calculated from the calibration curve should be no more than ±20% of the true value for low concentration standards; for higher concentration standards, ± 5-10% criteria are more typical. Provide each standard's calculated concentration to show this criterion has been met.

8.3.9.3 The correlation coefficient of the calibration curve should be ≥ 0.998.

8.3.9.4 The slope (emission intensity/ppm) of the calibration curve will vary widely per analyte; minimum values should be established that meet all other criteria.

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Note: If the above criteria are not met, re-calibration is necessary. The calibration curve may be forced through zero if the above criteria are met.

8.3.10 Acceptance criteria shall be posted near the instrument. These criteria should include those listed above, as well as the following:

8.3.10.1 Minimum/maximum emission intensity criteria for the lowest concentration calibration standard (sensitivity check)

8.3.10.2 Minimum/maximum emission intensity criteria for the highest concentration calibration standard (linearity check)

8.3.10.3 Maximum allowable concentration values (absolute value) for the ICB/CCB

8.3.10.4 Minimum/maximum allowable values for the ICV/CCV

9.0 Procedure

Note: All samples received are prepared in batches of 20 samples or fewer per matrix (see Section 17.0 for example run sequences for all matrices).

9.1 Determination of solids content

9.1.1 A percent solid is defined as the fraction of a waste sample from which no liquid may be expressed by an applied pressure of 50 psi.

9.1.2 If the sample will obviously yield no filtrate when subjected to pressure through a 0.7 µm glass membrane filter under pressure, proceed to determine particle size.

9.1.3 If the sample is liquid or multiphasic, it must be filtered through a 0.7 µm glass membrane filter under pressure, as follows:

9.1.3.1 Pre-weigh the membrane filter and screen and the filtrate receiving vessel (e.g. a screw-cap bottle). Record the values in the notebook.

9.1.3.2 Assemble the filtration device: Install O-rings, screen, and then membrane filter onto the base; seat the body, aligning the screws holds; install thumb screws tightly.

9.1.3.3 Pour a representative subsample (at least 100 g) of the waste into the filter. Install the lid, close the pressure relief valve, and hook up nitrogen. Position the tared receiving vessel beneath the assembly.

9.1.3.4 Allow the sample to filter by gravity. When the filtration has ceased for 2 minutes, pressurize the vessel gradually to 10 psi with nitrogen gas or compressed air. Proceed until liquid flow through the filtration apparatus has ceased for 2 minutes, and the flow of nitrogen gas is observed; then increase the pressure in increments of 10 psi to a final pressure of 50 psi. When liquid flow ceases for 2 minutes, stop the filtration, disconnect the nitrogen source, and depressurize the vessel.

9.1.3.5 The filtrate is defined as the liquid phase of the sample. The portion of the sample left in the filtration assembly is defined as the solid phase. Determine the weight of the liquid phase by subtracting the container weight from the total weight of the filtrate and container. Calculate the percent solid as follows:

$$\text{Weight \% Wet Solids} = \frac{(A-B)\times 100}{A}$$

Where: A = weight of the subsample
B = weight of the liquid phase (filtrate)

9.1.3.6 If any sample is entrained on the filter paper, the weight % dry solids must be calculated using the following formula:

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$$\text{Weight \% Dry Solids} = \frac{(C-D)\times 10}{A}$$

Where: A = weight of the subsample
C = weight of dry waste + filter/screen
D = weight of the filter/screen

9.2 Determination of particle size

9.2.1 If the percent solids is >0.5 %, determine whether particle size reduction is required.

9.2.2 The surface area or particle size must conform to one of the following criteria:

9.2.2.1 The sample particles must be smaller than 1 cm in its narrowest dimensions (must be able to pass through a 9.5 mm sieve).

9.2.2.2 For a filamentous material (paper, cloth, etc.) the surface area of the material must be ≥ 3.1 cm^2 per gram.

9.2.3 If the surface area is smaller, or particle size larger than described above, the sample must be cut, crushed, or ground to meet the appropriate criteria. In the event the criteria cannot reasonably be met, a report notation is required (see 1.2.1.2).

9.3 Determination of the appropriate extraction fluid

9.3.1 If the percent dry solid is ≥ 0.5%, the type of leaching solution must be determined. For the extraction of TCLP non-volatile samples:

9.3.1.1 Weigh 5.0 gm of subsample into a 250 mL beaker. If necessary, reduce particle size or surface area.

9.3.1.2 Add 96.5 mL of deionized water and a stir bar; cover with a watch glass and stir vigorously for 5 minutes.

9.3.1.3 Measure the solution pH using a meter and electrode. If the pH is ≤ 5.0, extraction fluid #1 is to be used.

9.3.1.4 If the pH is > 5.0, add 3.5 mL 1N HCl solution, mix, cover with a watch glass, and heat to 50°C for 10 minutes.

9.3.1.5 Cool to room temperature; measure and record the pH. If it is <5.0, use extraction fluid #1; if it is >5.0, use extraction fluid #2. **Note:** The heating cycle is a critical step. After the sample has been heated, it must be cooled to room temperature. The pH must be measured immediately after the sample has reached room temperature. If the solid waste does not remain in contact with the acidic solution under specified time and temperature conditions, an erroneous pH may be measured.

9.4 Extraction procedure for TCLP metal analysis

9.4.1 Determination of sample size

9.4.1.1 If the sample of TCLP analysis contains <0.5% dry solids, the sample is filtered through a 0.7 µm filter. The filtrate is defined as the TCLP extract, and it is analyzed directly. Discard the solids. Be sure to filter sufficient sample for acid digestion.

9.4.1.2 If the sample is 100% solids, weigh 100g and proceed to the extraction step.

9.4.1.2.1 Filter a weighed amount of sample that will produce a minimum amount of 100 grams of solids. Use a 0.7 µm filter to perform this operation.

9.4.1.2.2 Collect the liquid phase in a bottle or Tedlar bag, and store in the refrigerator at 0°C to 6°C for later use.

9.4.1.2.3 Proceed to extraction with the solid material.

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9.4.1.3 If particle size reduction is needed, decrease size until waste solids will pass through a 9.5 mm (3/8") sieve.

9.4.2 Determination of extraction fluid weight

9.4.2.1 The following formula is used to compute the required weight of extraction fluid:

$$\text{wt of ext fluid} = 20 \times \frac{\%\ \text{solids}}{100} \times \text{weight of waste filtered}$$

9.4.2.2 The amount of extraction fluid required per extraction is always 20 times the weight of wet filtered solids used in the extraction.

9.4.3 Extraction

9.4.3.1 Quantitatively transfer the solids to an extraction vessel. Include the filter used to separate the phases if the sample was multiphasic.

9.4.3.2 Add the appropriate amount of the proper extraction fluid to the extraction vessel.

9.4.3.3 Close the extraction vessel and secure in a rotary agitator. Rotate at 30 ± 2 rpm for 18 ± 2 hours. The ambient room temperature shall be maintained at 23 ± 2°C.

9.4.3.4 After rotation is complete, filter an adequate volume of the slurry through a 0.7 µm glass fiber filter. If metals are to be measured, pre-rinse the filtration apparatus with dilute nitric acid followed by reagent water. Discard all solids and collect the filtrate.

9.4.4 Combination of leachates

9.4.4.1 If no filtrate was collected initially, proceed with digestion of the leachate.

9.4.4.2 Remove a small portion of initial filtrate and the TCLP leachate. Pour both into a small beaker or other vessel to check for miscibility.

9.4.4.2.1 If the filtrate and leachate are miscible, combine; this is now the extract.

9.4.4.2.2 If not miscible, analyze each liquid separately, and combine results mathematically according to the volume ratio of the original phases.

9.4.5 Immediately after the TCLP extract is produced, record the pH of the extract. For immiscible liquids, record the pH of each.

9.5 Digestion of Leachates – Lead (Pb) Only (FLAA Analysis)

9.5.1 Transfer 50 mL of well-mixed leachate into a 250 mL beaker or 50 mL digestion tube. Add 2.5 mL of concentrated HNO_3 and cover with a ribbed watch glass.

9.5.2 Digest (reflux) at approximately 95°C for 2 hours; do not allow to boil.

9.5.3 Remove beaker/tubes and cool; if a beaker was used, transfer the digested sample to a 50 mL digestion tube. Dilute to 50 mL with deionized water.

9.5.4 Filter, centrifuge, or allow solids to settle. Samples are ready for FLAA analysis with acid matrix matched calibration standards (approximately 5% HNO_3).

9.6 FLAA Instrumental Analysis: See Section 8.1 for instrument calibration. See LMBL-SOP-51 for using the MetalsDirect interface between instrument software and the EMSL LIMS (SMXP):

9.6.1 Login samples to SMXP using the applicable test/method code.

9.6.2 Build an SMXP QC batch containing one or more logged-in customer orders.

9.6.3 Export an SMXP sample information file (SIF) to the instrument, and import data back into SMXP. Intermediate data files are stored in designated folders.

9.6.4 After data validation and approval, review all QC data. Comments regarding QC failures must be addressed before issuance of client reports.

9.6.5 It is recommended a procedure (local controlled document) be maintained in each laboratory which outlines the interface for each instrument configuration.

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9.7 Digestion of Leachates – Mercury (CVAA)

9.7.1 Transfer 4.0 mL of well-mixed sample into a 50 mL digestion tube (note that a 4.0 mL aliquot of leachate will be equivalent to a 10X dilution relative to the calibration standards).

9.7.2 Bring the sample to a volume of 40.0 mL with reagent water.

9.7.3 Add 2.0 mL of concentrated sulfuric acid (H_2SO_4).

9.7.4 Add 1.0 mL of concentrated nitric acid (HNO_3).

9.7.5 Add 6.0 mL of 5% potassium permanganate ($KMnO_4$) solution. Add additional portions of permanganate solution (if necessary) until purple color persists for at least 15 minutes.

9.7.6 Add 3.2 mL of 5% potassium persulfate ($K_2S_2O_8$) solution.

9.7.7 Cover with a ribbed watch glass. Allow to digest at 95 $\pm$ 5°C for 2 hours.

9.7.8 Remove the tubes and allow to cool to ambient temperature.

9.7.9 Add 2.4 mL of NaCl-hydroxylamine·HCl solution; mix to reduce (discolor) excess $KMnO_4$.

9.7.10 Dilute to 50 mL with DI water; mix thoroughly.

9.7.11 Filter, centrifuge or allow solids to settle. Samples are ready for CVAA analysis.

9.8 CVAA Instrumental Analysis: See Section 8.2 for instrument calibration. See LMBL-SOP-52 for using the MetalsDirect interface between instrument software and the EMSL LIMS (SMXP):

9.8.1 Login samples to SMXP using the applicable test/method code.

9.8.2 Build an SMXP QC batch containing one or more logged-in customer orders.

9.8.3 Export an SMXP sample information file (SIF) to the instrument, and import data back into SMXP. Intermediate data files are stored in designated folders.

9.8.4 After data validation and approval, review all QC data. Comments regarding QC failures must be addressed before issuance of client reports.

9.8.5 It is recommended a procedure (local controlled document) be maintained in each laboratory which outlines the interface for each instrument configuration.

9.9 Digestion of Leachates – ICP Metals

9.9.1 Transfer 10 mL of well-mixed leachate into a beaker or 50 mL digestion tube. If the sample does not contain significant solids, organic matter, or excessive levels of analytes/interferents and a lower reporting limit is requested, a larger aliquot volume may be considered.

9.9.2 Add 1.5 mL of conc. HNO_3 and cover with a ribbed watch glass; digest for 2 hours.

9.9.3 Repeat 9.9.2, if necessary, until solution is light in color.

9.9.4 Add 5 mL (1:1) HCl and digest at 95°C for 15 minutes while covered with the ribbed watch glass.

9.9.5 Remove samples and allow to cool.

9.9.6 Add ISTD (optional), carefully dilute each sample to 50 mL, cap and mix thoroughly.

9.9.7 Filter, centrifuge, or allow solids to settle. Samples are ready for ICP-OES analysis with acid matrix matched calibration standards (approximately 3% HNO_3 and 5% HCl).

9.10 ICP Instrumental Analysis: See Section 8.3 for instrument calibration. See LMBL-SOP-53 for data processing using the MetalsDirect interface between instrument software and the EMSL LIMS (SMXP); for PE instruments, the primary steps are described below:

9.10.1 Login samples to SMXP using the applicable test/method code.

9.10.2 Build an SMXP QC batch containing one or more logged-in customer orders.

9.10.3 Export an SMXP sample information file (SIF) to the instrument, and import data back into SMXP. Intermediate data files are stored in designated folders (Note: IRIS ICP-OES software does not utilize intermediate files).

9.10.4 After data validation and approval, review all QC data. Comments regarding QC failures must be addressed before issuance of client reports.

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9.10.5 It is recommended a procedure (local controlled document) be maintained in each laboratory which outlines the interface for each instrument configuration.

10.0 Calculations

10.1 **For all applications**, calculate LCS or LCSD recovery as follows:

$$\text{LCS(D)}, \%\ \text{Recovery} = \frac{\text{SSR}}{\text{SA}} \times 100$$

Where: SSR = spiked sample result, total µg, from conc. (mg/L) x final vol. (mL)
SA = spike added, µg

10.2 **For lead by FLAA**, calculate MS (or MSD) recovery as follows:

$$\text{MS}, \%\ \text{Recovery} = \frac{\text{SSR}-\text{SR}}{\text{SA}} \times 100$$

Where: SSR = spiked sample result, mg/L
SR = original sample result, mg/L, of sample being spiked
SA = spike added, mg/L

10.3 **For mercury by CVAA**, calculate MS (or MSD) recovery as follows:

$$\text{MS}, \%\ \text{Recovery} = \frac{\text{SSR}-\text{SR}}{\text{SA}} \times 100$$

Where: SSR = spiked sample result, µg/L
SR* = original sample result, µg/L, of sample being spiked
SA = spike added, µg/L

* **NOTE:** **Use the concentration derived from analysis of the extract aliquot prior to application of the 10X dilution factor (4 mL aliquot diluted to 40 mL).**

10.4 **For each ICP-OES RCRA metal**, calculate MS (or MSD) recovery as follows:

$$\text{MS}, \%\ \text{Recovery} = \frac{\text{SSR}-\text{SR}}{\text{SA}} \times 100$$

Where: SSR = spiked sample result, mg/L
SR* = original sample result, mg/L, of sample being spiked
SA = spike added, mg/L

* **NOTE:** **Use the concentration derived from analysis of the extract aliquot prior to application of the 5X dilution factor (10 mL aliquot diluted to 50 mL).**

10.5 Calculate Relative Percent Recovery (RPD) as follows:

$$\text{RPD} = \frac{|\text{S}-\text{D}|}{(\text{S}+\text{D})/2} \times 100$$

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Where: S = original value (LCS or MS)
D = duplicate value (LCSD or MSD)

11.0 Reporting

11.1 Initial filtrate versus TCLP leachate

11.1.1 Two liquids are generated when a multiphasic waste is analyzed; the initial filtrate and the leachate. If the filtrate is miscible with the leachate, the two solutions are mixed prior to analysis. If the two solutions are not miscible, they are analyzed separately, and the results are combined mathematically.

11.1.2 The mathematical calculations are performed via the following equation if the TCLP filtrate and extract are not miscible.

$$\text{Final Analyte Calculation} = \frac{V_1C_1+V_2C_2}{V_1C_2}$$

Where:

V_1=the volume of the first phase (liquid) (L)
C_1=the conc. of the analyte of concern in the first phase (mg/L)
V_2=the volume of the second phase (dry) (L)
C_2=the conc. of the analyte of the concern in the second phase (mg/L)

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12.0 Method Performance: Method reliability is ensured and reinforced through various assessment criteria, including, but not limited to, the following:

12.1 Lower Limit of Quantitation (LLOQ): Initially, LLOQs must be established by preparing and analyzing fortified matrix reference material; see each individual preparatory method for details regarding sample weights and volumes. LLOQ study and LLQC requirements are as follows:

12.1.1 Seven (7) replicate spikes of the leachate matrix (often referred to lower limit of quantitation checks, or LLQCs) are prepared at the expected LLOQ. Typically, the lowest-level calibration standard will be prepared at the same concentrations as the LLQC.

12.1.2 The LLOQ values for each analyte should be within ±35% of the target value.

12.1.3 The standard deviation (S) of the set of (7) data points should be ≤ 20%.

12.1.4 LLOQs must be established for all wavelengths utilized for Extraction Fluid #1, for each preparation method used, and for each instrument. These limits are considered the lowest reliable laboratory reporting concentrations for each analyte in each matrix.

12.1.5 A set of (7) LLQC samples should be evaluated when any major method or instrument changes occur that would affect the sensitivity.

12.1.6 The spiking solution ID, concentration, and volume used is recorded on the LLOQ spreadsheet.

12.1.7 The analysis of an LLQC is an analytical batch requirement for this method**.**

12.2 Control Limits: Acceptable control limits are defined in the Quality Control section. Values which fall outside those limits represent non-conformities that may require root cause analysis and corrective action. All non-conformities should be noted on applicable customer reports.

12.3 Trend Analysis

12.3.1 Upon review of routine LCS recovery data, statistically-significant trends may be observed. Each laboratory should provide applicable definitions of a trend; examples include

12.3.1.1 Seven (7) consecutive data points on either side of the mean

12.3.1.2 For any group of (3) data points, two data points outside the warning limits (±2S)

12.3.1.3 For any group of (5) data points, four data points outside ±1S

12.3.2 Frequency of evaluation of trends will vary as a function of matrix and frequency of analysis. Trend analysis should be conducted in "real time," often daily, to avoid missing a trend. Each laboratory should define how trend analysis is conducted, and such definition may be included in an approved addendum to this SOP. See "Standard Methods for the Examination of Water and Wastewater," Section 1020B for guidance regarding definitions.

12.4 DOCs

12.4.1 Initial Demonstrations of Capability

12.4.1.1 Prior to approval to conduct sample analysis, each analyst must prepare and analyze applicable QC samples for initial demonstration of capability. The analyst should perform a minimum of five (5) sets of LCS/LCSD; see QMS Module J for precision and accuracy requirements. All analytical data, dates/times of analysis and data review are recorded and maintained with training records. Refer to the QMS Manual for additional information on the completion of DOCs.

12.4.2 Continuing Demonstrations of Capability

12.4.2.1 During any 6-month period an analyst conducts analyses for any matrix, the analyst must demonstrate ongoing capability. This is typically done with proficiency testing (PT) samples and/or routine QC samples (LCS/LCSD, MS/MSD).

12.5 Proficiency Testing

12.5.1 Proficiency Testing (PT) samples are a means of evaluating laboratory method-specific performance, through analysis of unknown samples provided by an external source. If available, PTs are typically administered and completed semiannually per analyte or analyte group. In order to maintain proficiency for a given field of testing (FoT), the laboratory must maintain a passing score for each analyte. However, failure for any individual PT sample requires corrective action, including root cause analysis.

12.6 Calibration of Accessory Equipment and Consumables

12.6.1 The reliability of this procedure is also dependent upon calibration of equipment other than spectrometers. This equipment shall include adjustable pipettes, thermometers, balances and consumables. See Module J of the Quality Management System (QMS) manual and relevant procedures and spreadsheets.

12.7 Linear Dynamic Range

12.7.1 Annually, or more frequently if there is a significant change in instrument response, the linear dynamic range of the instrument must be documented.

12.7.2 By default, the linear dynamic range (LDR) is that bracketed by the lowest and highest concentration for a calibration curve meeting the requirements set forth in Section 8.0. The upper limit of the acceptable quantitation range may, under certain conditions (e.g., ICP-OES calibration), exceed the concentration of the highest calibration standard. To determine the maximum acceptable quantitation concentration, analyze one or more standard solution(s) prepared from the Source 1 stock standard, and at a concentration above the concentration of the highest calibration standard. For any concentration above the normal calibration curve, that concentration may be considered within the LDR under the following conditions:

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12.7.2.1 Within the past 12 months, the calculated value (against the normal calibration curve) for a standard at that concentration is within ± 10% of its true value.

12.7.2.2 The daily calibration curve slope, calculated from the highest calibration standard, is ≤ 110% of the slope value when the linear dynamic range was determined.

12.7.2.3 All analyses must fall within the linear dynamic range. Dilutions of sample solutions should be made using acid concentrations similar to the original preparation.

13.0 Quality Control

13.1 See Section 8.0 for additional instrument QC criteria. All QC data must be maintained and available for easy reference and inspection.

13.2 Each QC batch must include a Method Blank, an LLQC, an LCS, a matrix spike (MS) and a matrix spike duplicate (MSD). The batch may not include more than twenty samples. All QC samples originate from blank Extraction Fluid #1 or leachate; no spikes are performed prior to leachate generation.

13.3 Calibration Blank (ICB/CCB): To confirm lack of carryover, an initial calibration blank (ICB) must be analyzed after each initial calibration verification (ICV) standard, and a continuing calibration blank (CCB) must be analyzed after each continuing calibration verification (CCV) standard.

13.3.1 If the absolute value of the ICB/CCB is less than the LLOQ, analysis may continue.

13.3.2 If the absolute value of the ICB is greater than the LLOQ, a second analysis of the ICB may be performed. In the event the second analysis fails the criterion, the instrument must be recalibrated or auto-zeroed followed by a passing ICV/ICB.

13.3.3 If the absolute value of the CCB is greater than the LLOQ, a second analysis of the CCB may be performed. In the event the second analysis fails the criterion, the instrument must be auto-zeroed, followed by a passing ICV/ICB and the proceeding samples (10 or less) reanalyzed.

13.3.4 Even when the CCB passes the criterion, an auto-zero function may be performed after analysis of the calibration blank at the discretion of the analyst. However, each auto-zero function requires verification with a passing ICV/ICB.

13.3.5 If an auto-zero function does not follow analysis of a passing CCB, all preceding samples back to the last passing CCB must be reanalyzed following verification with the ICV/ICB.

13.4 Method Blank: The laboratory must analyze at least one Method Blank with each batch of samples. Using the applicable extraction fluid or deionized water, the method blank shall be carried throughout the entire sample preparation and analytical process for each parameter reported. The absolute value of the analyte concentration in the blank should be no greater than the MDL, but is acceptable if the absolute value is not more than the LLOQ. If the method blank fails this criterion, reanalyze the blank once. If the blank still does not meet the criterion, then corrective action must be taken prior to the release of data, which may include re-preparation and reanalysis of all samples following the last acceptable prepared blank, along with the appropriate QC samples. **Note:** In the event a sample cannot be re-prepared/reanalyzed, the client should be contacted to discuss any potential impact of the method/matrix blank failures upon the sample results. Blank failures must be noted on the final report. Sample results are not corrected for the blank value.

13.5 Lower Limit of Quantitation Check (LLQC): Each day samples are prepared, a matrix-spiked sample at a concentration equal to the reporting limit (LLOQ) must be prepared and subsequently analyzed in order to demonstrate acceptable recovery of the analyte. The acceptance criteria for spike recovery shall be ± 35% of the target value.

13.6 Laboratory Control Sample (LCS): The frequency of the laboratory control sample must be at least 5% for each matrix analyzed. Laboratory Control Samples (LCS) must be matrix-based, and must be

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analyzed using the same sample preparations, analytical methods and QA/QC procedures employed for the samples received. The LCS material may be obtained from commercial vendors. One LCS must be prepared and analyzed for every batch of samples. The acceptance criteria for LCS recovery shall be ± 20% of the target value.

13.7 Laboratory Control Sample Duplicate (LCSD): In the event a matrix spike duplicate (MSD, below) is not practical, an LCSD may be substituted for precision QC purposes. If analyzed, the frequency of the LCSD must be at least 5% for each matrix analyzed. The LCSD must be matrix-based, and must be analyzed using the same sample preparations, analytical methods and QA/QC procedures employed for the samples received. The LCSD material may be obtained from commercial vendors. If substituted for the MSD, one LCSD must be prepared and analyzed for every batch of samples. A control limit of ≤25% for Relative Percent Difference shall be used for original and duplicate sample values.

13.8 Matrix Spike (MS): Matrix spike samples should be processed in the same manner as the original client sample. Frequency of MS analysis should be 5% of all samples. A control limit of 75-125% for percent recovery shall be used to evaluate any matrix impact upon accuracy.

13.9 Matrix Spike Duplicate (MSD): Matrix spike duplicate samples should be processed in the same manner as the original client sample. Frequency of MSD analysis should be 5% of all samples. A control limit of ≤25% for Relative Percent Difference shall be used for original and duplicate sample values. The percent difference data will be used by the laboratory to evaluate the long-term precision of the methods for each parameter.

14.0 Data Assessment

14.1 Out-of-Compliance (OOC) Events, Non-Conformities (NC) and Corrective Actions (CA) with Root Cause Analysis (RCA): By definition, all out-of-compliance (OOC) events need evaluation. However, it is only when the reason for the OOC is unknown or the known result of a lab error (prep error, instrument problem, insufficient procedure, etc.) that it becomes a non-conformity (NC) that requires root cause analysis (RCA) and corrective action (CA).

14.2 Performance indicators such as trends are not considered OOC, and therefore do not require initiation of a Non-Conformity/Correction Action Report (NC/CAR). If any individual data point included in the trend is an OOC, then that isolated event moves to RCA/CA, although observance of the trend itself should only be recorded as a preventive action (PA).

14.3 Each OOC requires initiation of a NC/CAR and description of the OOC. If the reason for the OOC is known and is not within the control of the laboratory (and thus could not be corrected) and can be scientifically justified as part of the evaluation, the OOC is not a NC and does not move to RCA/CA.

14.4 Corrections: Any QC requirements not met must have an explanation to their nonconformance.

14.4.1 If any quality control failure is determined by the quality control coordinator to potentially impact the integrity of the data, the final report must include the following disclaimer, **"A quality control sample result for these samples did not meet acceptance criteria."** If more than three quality control requirements are not met, the entire QC batch cannot be reported, and the client notified. If the quality control failure can be demonstrated to have no significant effect upon the integrity of the analytical results, no report disclaimer is required.

14.5 Contingencies for Handling Out-of-control or Unacceptable Data:

14.5.1 Subsampling stratified waste is challenging. Therefore, the analyst should consider calculating percent solids from the same sample container used for the TCLP extraction instead of compositing all the sample containers. This is often the largest error in the TCLP leaching process. The laboratory must consider the amount of each phase present in each

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bottle and adjust the calculations accordingly. Therefore, estimate and record the number of phases, appearance, and volume of each sample phase before starting analysis.

14.5.2 The particle size of multiphasic material may be difficult to assess. The lab should identify procedures to classify multiphasic samples which are not amenable to size measurement.

14.5.3 Five grams of sample are usually used to determine the appropriate TCLP leaching fluid. If there is not enough volume of any individual phase, less material may be used. However, the ratio of reagent water and acid to sample must be maintained if smaller samples are used.

14.5.4 The pH of the filtrate should be recorded. This provides useful information when validating field or laboratory duplicates.

14.5.5 The filtrate volume should also be measured. This information will be needed if the multiple phases must be mathematically combined.

14.5.6 After generating the TCLP extract, the pH of the extract should be recorded. If the filtrate and TCLP extract are mixed, record the pH of the mixture, as well as the original TCLP extract and filtrate. The TCLP extract or filtrate/ extract mixture should be aliquoted for each analysis. Matrix spikes for all subsequent analyses must be added at this time.

14.5.7 The metals aliquot should be preserved to pH <2 with nitric acid. Adjust the pH of a small portion of the TCLP extract or mixture prior to adjusting the entire metals aliquot. If a precipitate forms, do not adjust the pH of the sample extract. If nitric acid is not added, the sample should be analyzed as soon as possible after TCLP extraction.

15.0 Method Validation

15.1 When modifications to this SOP are considered, the validation process first requires such modifications be reviewed at both the laboratory and corporate level for technical viability, and the SOP, in its entirety, is suitable for its intended use within the guidelines set forth by ISO/IEC 17025. In order for validation of the method inclusive of those modifications to be finalized, creation of an amendment/addendum document and corporate approval of that document is required. When the modifications are deemed, upon corporate review, to constitute a change in methodology, the steps outlined in the EMSL Corporate SOP "Validation of Methods and Method Modifications" shall be conducted, and requirements set forth in those sections shall be met prior to implementation. Depending upon the significance and probable impact of the modification, compilation of supporting data from other analyst-based efforts, such as independent test runs, proficiency testing samples, and round robin samples in the method validation package, may be required.

15.2 If this procedure is utilized for other metals, a detailed amendment must be submitted for corporate approval that fulfills the requirements described above. **Note:** Policy requirements for all analytes are outlined in EMSL QMS Module J "Environmental Chemistry Metals."

16.0 Pollution Prevention / Waste Management

16.1 Pollution Prevention

EMSL Analytical makes all efforts to reduce the volume and toxicity of the waste generated by the laboratory. An effort to manage procurement of hazardous materials has been implemented in order to avoid over ordering. Hazardous waste is classified for proper disposal.

16.2 Waste Management

The waste generated during prep and analysis will be disposed of following safety procedures outlined in the chemical hygiene plan (EMSL SAF-SOP-2). Digests from analysis will be disposed of in accordance with applicable federal, state and local requirements. Any drum containing hazardous

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waste must be properly identified with a hazardous waste sticker when placed into service. A reputable waste hauler will remove full drums from the site within a reasonable timeframe. All records pertaining to waste shall be kept, including the waste manifest.

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17.0 Tables, Diagrams, Flowcharts, and Validation Data

17.1 Example Instrument Run Sequence for Analysis – TCLP Digestates

Digested Spl. #		**Comment**
	Calibration Blank	
	Standard 1	Stock source 1
	Standard 2	Stock source 1
	Standard 3	Stock source 1
	Standard 4	Stock source 1
	Standard 5	Stock source 1
	ICV- (Initial Calibration Verification)	Stock source 2 (separate from cal stnds)
	ICB- (Initial Calibration Blank)	can be the same as the CCB
	LLOQ	equivalent to Cal Standard #1
	SIC (Al, Ca, Mg, Fe)	**ICP-OES only**
1	Method Blank	Prepared with blank leachate
2	LLQC	Prepared with blank leachate
3	Laboratory Control Sample (LCS)	Prepared with blank leachate
4	Client Spl 1	
5	Client Spl 1 Matrix Spike (MS)	Note diluted extract for CVAA / ICP-OES
6	Client Spl 1 Matrix Spike Duplicate (MSD)	Note diluted extract for CVAA / ICP-OES
7	Client Spl 2	
8	Client Spl 3	
9	Client Spl 4	
10	Client Spl 5	
	CCV	may be prepared from Source 1 or 2
	CCB	can be the same as the ICB
11	Client Spl 6	
12	Client Spl 7	
13	Client Spl 8	
14	Client Spl 9	
15	Client Spl 10	
16	Client Spl 11	
17	Client Spl 12	
18	Client Spl 13	
19	Client Spl 14	
20	Client Spl 15	
	CCV	may be prepared from Source 1 or 2
	CCB	can be the same as the ICB
21	Client Spl 16	
22	Client Spl 17	
23	Client Spl 18	
24	Client Spl 19	
25	Client Spl 20	maximum 20 client samples per batch
	CCV	may be prepared from Source 1 or 2
	CCB	can be the same as the ICB
	SIC (Al, Ca, Mg, Fe)	**ICP-OES only**

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18.0 References

18.1 EPA SW-846 Method 1311, "Toxicity Characteristic Leaching Procedure," Revision 0, July 1992.

18.2 EPA SW-846 Method 3010A, "Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy," Revision 1, July 1992.

18.3 EPA SW-846 Method 7000B, "Flame Atomic Absorption Spectrophotometry," Revision 2, February 2007.

18.4 EPA SW-846 Method 7470A, "Mercury in Liquid Waste," Revision 1, September 1994.

18.5 EPA SW-846 Method 6010C, "Inductively Coupled Plasma-Atomic Emission Spectrometry," Revision 3, February 2007.

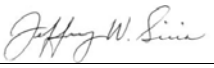
18.6 Less is Better- Guide to Minimizing Waste in Laboratories prepared by the Task Force on Laboratory Environment, Health and Safety- American Chemical Society 2002.

19.0 Revision History

Revision #	Date	Revision	Initials
2	8/14/2018	Language added to Section 1.2.1.1 to emphasize the specific quantity of sample that must be submitted by the customer in order to achieve preliminary evaluation and leachate generation.	JWS
1	5/24/2017	Minor editorial changes were made throughout this document. References throughout to "0.6-0.8 µm" were changed to "0.7 µm." References throughout to "4°C" were changed to "0°C to 6°C." Language was added to Section 1.2.1 emphasizing requirements for waste characterization and customer report comments regarding variances to leachate generation steps. Language was added in Sections 3.10 and 13.4 to emphasize the method blank is determined by the extraction fluid utilized. Various additions and supplementary language was added to Section 5 regarding equipment and supplies. Language was added to Sections 5.26.2 and 9.4.3.4 to emphasize the entire leachate does not have to be filtered. Language was added to Section 7.0 to note separate holding times for sample extraction and analysis of the extract, as well as the requirement for preserving extracts/filtrates. Section 8.3.2 was modified to reflect the barium (Ba) concentration in the custom mixes was increased from 100 ppm to 250 ppm; Table 1 concentrations (8.3.8) were modified accordingly. Section 8.3.3 language was modified to emphasize higher concentration calibration standards may be utilized for linearity checks as needed, rather than for inclusion in the calibration curve.	JWS
0	3/27/2017	Initial issue	JWS

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Authorizing Signatures

Jeffrey W. Siria		8/14/2018
Author (print)	Author Signature	Date
Susan Harding		8/14/2018
Reviewer (print)	Reviewer Signature	Date
Susan Harding		8/14/2018
Corporate Approval (print)	Corporate Approval Signature	Date

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Document Review and Acknowledgement Form

Instructions: Ensure all personnel in laboratory affected by this document read and acknowledge receipt of document. Once completed, page shall be retained on file along with personnel training.

Laboratory Staff Acknowledgement

My signature below signifies that I have read, understood, and have had the opportunity to ask questions regarding the entire contents of this document. I agree to fully comply with, implement, and enforce all requirements, procedures, and protocols specified in this document and any supporting reference materials or methodologies.

Print Name	Signature	Date

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Acknowledged by:

Lab Manager/QA Officer (Print Name)	Signature	Date

Performance Characteristic Sheet

EFFECTIVE DATE: **September 24, 2004** **EDITION NO.: 1**

MANUFACTURER AND MODEL:

Make: *Niton LLC*
Tested Model: *XLp 300*
Source: ^{109}Cd
Note: This PCS is also applicable to the equivalent model variations indicated below, for the Lead-in-Paint K+L variable reading time mode, in the XLi and XLp series:

XLi 300A, XLi 301A, XLi 302A and XLi 303A.
XLp 300A, XLp 301A, XLp 302A and XLp 303A.
XLi 700A, XLi 701A, XLi 702A and XLi 703A.
XLp 700A, XLp 701A, XLp 702A, and XLp 703A.

Note: The XLi and XLp versions refer to the shape of the handle part of the instrument. The differences in the model numbers reflect other modes available, in addition to Lead-in-Paint modes. The manufacturer states that specifications for these instruments are identical for the source, detector, and detector electronics relative to the Lead-in-Paint mode.

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Lead-in-Paint K+L variable reading time mode.

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

SUBSTRATE CORRECTION:

For XRF results using Lead-in-Paint K+L variable reading time mode, substrate correction is <u>not</u> needed for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

INCONCLUSIVE RANGE OR THRESHOLD:

K+L MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted in August 2004 on 133 testing combinations. The instruments that were used to perform the testing had new sources; one instrument's was installed in November 2003 with 40 mCi initial strength, and the other's was installed June 2004 with 40 mCi initial strength.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Substrate correction is not needed for brick, concrete, drywall, metal, plaster or wood when using Lead-in-Paint K+L variable reading time mode, the normal operating mode for these instruments. If substrate correction is desired, refer to Chapter 7 of the HUD Guidelines for guidance on correcting XRF results for substrate bias.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use the K+L variable time mode readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten re-test XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

For the Lead-in-Paint K+L variable reading time mode, the instrument continues to read until it is moved away from the testing surface, terminated by the user, or the instrument software indicates the reading is complete. The following table provides testing time information for this testing mode. The times have been adjusted for source decay, normalized to the initial source strengths as noted above. Source strength and type of substrate will affect actual testing times. At the time of testing, the instruments had source strengths of 26.6 and 36.6 mCi.

Testing Times Using K+L Reading Mode (Seconds)

	All Data			Median for laboratory-measured lead levels (mg/cm^2)		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 ≤ Pb<1.0	1.0 ≤ Pb
Wood Drywall	4	11	19	11	15	11
Metal	4	12	18	9	12	14
Brick Concrete Plaster	8	16	22	15	18	16

CLASSIFICATION RESULTS:

XRF results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold.

DOCUMENTATION:

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

Smith & Wessel Associates

LEAD-BASED PAINTS TESTING FORM

Site: **Page of**

Date: **Project #:**

Floor/Location	Substrate	Color/Component	Result	Quantity

Smith & Wessel Associates, Inc.

Project No._____ Location_____
Date Collected_____ Inspector_____

Field Sample #	Location	Component/Percentage	
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____
		1._____%____	6._____%____
		2._____%____	7._____%____
		3._____%____	8._____%____
		4._____%____	9._____%____
		5._____%____	10._____%____

Chain of Custody

Relinquished by (signature)	Date/Time	Received by	Date/Time	Total number of samples _____
				Requested analysis _ **Lead TCLP Testing**
				Comments:

Smith & Wessel Associates, Inc.

Daily Construction Report

Site:	**Project #:**
Project Monitor:	**Client:**
Contact:	**Date:**
Contractor:	**Supervisor:**

TIME	CONSTRUCTION NOTES

Summary of abatement work accomplished, including type and quantity of ACM abated in each work area:

SMITH & WESSEL ASSOCIATES, INC.

Project # _____ Page ____ of ____

Date: _____

Site: _____

Sample #	Material Description			
	Color	Size	Type of Material	
	white green black yellow blue orange red beige brown cream gray tan other _____	9"x9" 12"x12" 1'x2' 2'x2' 2'x4' other _____	pipe insulation ceiling tile fireproofing cement board fitting insulation cement plaster textured plaster baseboard tank insulation floor tile linoleum mastic duct insulation caulking glazing roofing felt boiler insulation gypsum board / jt. compound tar flashing other _____	

Location Description		Location Description		Location Description	
Floor	Area	Floor	Area	Floor	Area
basement	boiler room	basement	boiler room	basement	boiler room
1st floor	mech. room	1st floor	mech. room	1st floor	mech. room
2nd floor	bathroom	2nd floor	bathroom	2nd floor	bathroom
3rd floor	hallway	3rd floor	hallway	3rd floor	hallway
4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	
_____		_____		_____	

Sample #	Material Description			
	Color	Size	Type of Material	
	white green black yellow blue orange red beige brown cream gray tan other _____	9"x9" 12"x12" 1'x2' 2'x2' 2'x4' other _____	pipe insulation ceiling tile fireproofing cement board fitting insulation cement plaster textured plaster baseboard tank insulation floor tile linoleum mastic duct insulation caulking glazing roofing felt boiler insulation gypsum board / jt. compound tar flashing other _____	

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3rd floor	hallway	3rd floor	hallway	3rd floor	hallway
4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	
_____		_____		_____	

Chain-of-custody

Relinquished by _____ Date _____ Time _____ Analysis requested: _____

Received by _____ Date _____ Time _____ Turnaround time: _____

Comments _____Stop at first positive_____ Total # of samples _____

SMITH & WESSEL ASSOCIATES, INC. Project: Page ____ of ____

Site:

Sample #	Material Description			
	Color	Size	Type of Material	
	white green black yellow blue tan red beige brown gray other _____	9"x9" 12"x12" 1'x2' 2'x2' 2'x4' other _____	pipe insulation ceiling tile fireproofing cement board fitting insulation cement plaster textured plaster baseboard tank insulation floor tile linoleum mastic duct insulation caulking glazing roofing felt boiler insulation gypsum board / jt. compound tar flashing other _____	

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4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	

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other _____	_____	other _____	_____	other _____	_____
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3rd floor	hallway	3rd floor	hallway	3rd floor	hallway
4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	

SMITH & WESSEL ASSOCIATES, INC. Project: Page ____ of ____

Site:

Sample #	Material Description			
	Color	Size	Type of Material	
	white green black yellow blue tan red beige brown gray other _____	9"x9" 12"x12" 1'x2' 2'x2' 2'x4' other _____	pipe insulation ceiling tile fireproofing cement board fitting insulation cement plaster textured plaster baseboard tank insulation floor tile linoleum mastic duct insulation caulking glazing roofing felt boiler insulation gypsum board / jt. compound tar flashing other _____	

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4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	

Sample #	Material Description			
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3rd floor	hallway	3rd floor	hallway	3rd floor	hallway
4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	

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2nd floor	bathroom	2nd floor	bathroom	2nd floor	bathroom
3rd floor	hallway	3rd floor	hallway	3rd floor	hallway
4th floor	room _____	4th floor	room _____	4th floor	room _____
other _____	_____	other _____	_____	other _____	_____
comment _____		comment _____		comment _____	

Appendix C

Geophysical Investigation Report

HAGER GEOSCIENCE, INC.

GEOPHYSICAL SURVEY FOR SUBSURFACE STRUCTURES 925 MASSACHUSETTS AVENUE LUNENBURG, MA

July 31st, 2020
File 2020035

Prepared for:
BETA Group, Inc.
701 George Washington Highway
Lincoln, RI 02865

EDWOSB CERTIFICATION AWARD
U.S. Women's Chamber of Commerce
EDWOSB Federal
Certified Economically Disadvantaged Women-Owned Small Business

1.0 INTRODUCTION

This report details the results of a geophysical survey conducted by Hager GeoScience, Inc. (HGI) for BETA Group, Inc., (BETA) at 925 Massachusetts Avenue in Lunenburg, Massachusetts. The site is a former gas station with several known USTs and septic and drain systems. The objective of the survey was to locate these underground structures so that planned well installation will not encounter them.

2.0 DATA ACQUISITION

HGI personnel performed the survey on July 10th, 2020, using ground penetrating radar (GPR), precision utility locating (PUL) and electromagnetic (EM) methods. Scott Nee from BETA met the crew on site to delineate the area of interest.

HGI personnel used spray paint and fiberglass tapes to lay out a single survey grid. The locations of the GPR and EM traverses and observed surface features are shown on Plate 1, an AutoCAD Map3D 2020 plot created from the HGI field notes and taped measurements. HGI used its Sokkia GRX3 Rover GPS system to locate the survey grid and surface features, which provided subfoot accuracy in the Massachusetts state plane coordinate system (MA83F).

Plates 2 through 4 show the results of the survey. Appendix A contains a general discussion of the geophysical methods and their limitations.

2.1 GPR Survey

A Geophysical Survey Systems, Inc. (GSSI) SIR-4000 digital GPR acquisition system with a 350-MHz center frequency antenna was used to collect GPR data along orthogonal traverses spaced 2.5 feet apart. A survey wheel encoder provided horizontal distance control. Data were displayed in real time on the system's color monitor to allow for quality control while being simultaneously recorded on its hard drive.

The signal-to-noise ratio of the GPR data was variable across the grids, with signal penetration generally reaching 8 to 10 feet below ground surface.

Table 1 below shows the pertinent parameters used for the GPR data collection.

Table 1. GPR Survey Acquisition Parameters

Antenna Frequency (MHz)	Range (ns)	Survey Mode	Scan Rate (per sec)	Scan Rate (per ft)	Sample Rate (samples)	Effective Signal Depth (ft)
350	120	Wheel	100	28	512	8-10

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2.2 EM Survey

HGI collected EM data using a Geonics EM-61-MK2 (EM61) high-powered time domain metal detector, which uses a single transmitting coil to induce secondary time-varying magnetic fields in metallic objects. Two receiving coils detect this secondary magnetic field, which is measured in millivolts (mV). EM data were collected along north-south traverses spaced 5 feet apart. The EM survey parameters are described in Table 2.

Table 2. EM Data Acquisition Parameters

EM61 Mode	Readings/s	Wheel Inc.	GPS Input	NMEA Data
Wheel	N/A	0.64	No	N/A

2.3 Precision Utility Locating

HGI used Dynatel and Radiodetection RD8100TL TX10 precision utility locators (PUL) in conjunction with the GPR method to provide real-time utility locating. Where utilities were physically accessible (e.g., hydrant), the Radiodetection transmitter box was directly coupled with them in order to propagate a current with a unique frequency along the conductive conduit or utility. A receiver wand was then used to identify the location of the connected utility. The PUL unit was also used in passive mode to detect live electric currents. The site was swept for utilities without surface expressions using the Dynatel.

3.0 DATA REDUCTION AND ANALYSIS

3.1 GPR Survey

After completing the GPR survey, the data were downloaded to an office PC, where they were archived, processed, and analyzed using GSSI's RADAN® 7. Prior to analysis, the raw GPR data required processing to reduce the detrimental effects of site-specific noise associated with interfering background frequency signals and reflections from surface and subsurface structures. The processed records were then used to construct 3D models of the surveyed areas. 3D models are useful for viewing the spatial qualities of the data and identifying subtle spatial features that may not be apparent in individual 2D records. The 3D models were sliced horizontally and vertically to observe patterns of GPR anomalies present in the radar data.

Each 2D record was also individually evaluated for possible anomalies. Preliminary interpretations based on analysis of the individual 2D records were plotted and evaluated in a spatial context using the 3D model. Conversely, spatial anomalies observed in the 3D model were re-examined on the individual records to ensure that all possible anomalies were evaluated. The interpreted individual GPR targets were then exported to AutoCAD, where trends and areal anomalies were identified.

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3.2 EM Survey

Upon return to the HGI office, the EM data were downloaded and reduced using TRACKMAKER61MK2® and DAT61MK2® software, which was used to adjust for survey geometry and latency during data collection.

The readings taken by the EM61 are relative to a "normalized" value calibrated on site, and the values are in millivolts (mV). High-conductivity anomalies (yellow to red) are typically associated with metal structures, metal debris, or iron-rich soils.

Filled color contour plots for the EM61 data were prepared using Golden Software's Surfer for Windows V12® with a kriging interpolation method. The EM61 is capable of observing the electromagnetic response at various times or "time gates," which can provide useful information on the nature of a target. The first time gate response was found to be the most informative and was exported from Surfer into AutoCAD as a .dxf file, then saved as an AutoCAD drawing.

4.0 RESULTS AND CONCLUSIONS

Plates 1 through 4 show the survey coverage and interpreted results of HGI's geophysical survey at 925 Massachusetts Avenue. The plates' contents are as follows:

- Plate 1: GPR and EM Survey Site Map
- Plate 2: GPR Interpretation Map
- Plate 3: EM Interpretation Map
- Plate 4: GPR and EM Composite Map

The plates show that HGI's geophysical survey detected the key features indicated as present on the site map provided by BETA, with generally good correlation between the GPR and EM data sets. The four high confidence USTs shown on the plates correspond to the 8,000 gallon gasoline, 4,000 gallon diesel, and 500 gallon fuel oil tanks on the BETA plan. A possible additional UST was detected east of the Unknown Manhole (Plates 2-4), which based on its location may be the floor drain holding tank. Plate 4, the composite GPR and EM map, also shows that because of their low EM response, the leach field (as expected) but also the interpreted septic tank, both located with GPR (Plate 2) are not composed of metal.

As Plates 2 and 4 show, HGI's survey also located numerous utilities, most of them associated with the USTs. Since some of these lines lead to the pump island and may thus contain product, they should be avoided in BETA's drilling program. In addition, as the focus of HGI's investigation was subsurface structures and not a full-scale utility survey, it is important to note that not all utilities present at the site may be shown on the plates.

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APPENDIX A: THE GEOPHYSICAL METHODS

A.1 Ground Penetrating Radar (GPR)

A.1.1 Description of the Method. The principle of ground penetrating radar (GPR) is the same as that used by police radar, except that GPR transmits electromagnetic energy into the ground. The energy is reflected back to the surface from interfaces between materials with contrasting electrical (dielectric and conductivity) and physical properties. The greater the contrast between two materials in the subsurface, the stronger the reflection observed on the GPR record. The depth of GPR signal penetration depends on the properties of the subsurface materials and the frequency of the antenna used to collect radar data. The lower the antenna frequency, the greater the signal penetration, but the lower the signal resolution.

A.1.2 Data Collection. HGI collects GPR data using a Geophysical Survey Systems (GSSI) SIR 2, 20, 2000, 3000 or 4000 ground penetrating radar system. Data are digitally recorded on the internal hard drive or flash memory of the GPR system. System controls allow the GPR operator to filter out noise, attributed to coupling noise caused by conductive soil conditions, spurious noise caused by local EMF fields, and internal system noise. For shallow surveys, we use antennas with center frequencies ranging from 2000- to 400-megahertz (MHz). For deeper penetration, we use lower frequency antennas ranging from 300 MHz to 15 MHz, depending on the anticipated target depth and the degree of signal penetration. All of these antenna configurations can collect data in continuous mode, distance mode, or as discrete point measurements using signal-stacking techniques. Since there is a trade-off between signal penetration and resolution, test data are sometimes collected using antennas at several different frequencies, with the highest frequency antenna that produces the highest quality data used. In some cases, data are collected with several antenna frequencies.

The horizontal scale of the GPR record shows distance along the survey traverse. In the continuous data collection mode, the horizontal scale on each GPR record is determined by the antenna speed along the surface. When a survey wheel is used, the GPR system records data with a fixed number of traces per unit distance. The GPR record is automatically marked at specified distance intervals along the survey line. The vertical scale of the radar record is determined by the velocity of the transmitted signal in the media under study and the range setting, or recording time window of the GPR system. The recording time interval, or range, represents the maximum two-way travel time in which data are recorded. The conversion of the two-way travel time of the transmitted signals to depth is determined by the propagation velocity of the GPR signal, which is site (media) specific. When little or no information is available about the makeup of subsurface materials, we estimate propagation velocities from handbook values and experience at similar sites or by CDP velocity surveys with a bi-static antenna.

A.1.3 Data Processing. After completion of data collection, the GPR data are transferred to a PC for review and processing using RADAN® software. When appropriate, we prepare 3D models of GPR data, which can be sliced in the X, Y, and Z directions.

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The size, shape, and amplitude of GPR reflections are used to interpret GPR data. Objects such as metallic UST's and utilities produce reflections with high amplitude and distinctive hyperbolic shapes. Clay, concrete pipes, boulders and other in-situ features may produce radar signatures of similar shape but lower amplitude. The boundaries between saturated and unsaturated materials such as sand and clay, bedrock and overburden, generally also produce strong reflections.

A.1.4 Limitations of the Method. GPR signal penetration is site-specific. It is determined by the dielectric properties of local soil and fill materials. GPR signals propagate well in resistive materials such as sand and gravel; however, soils containing clay, ash- or cinder-laden fill or fill saturated with brackish or otherwise electrically conductive groundwater cause GPR signal attenuation and loss of target resolution. Concrete containing rebar or wire mesh also inhibits signal penetration.

The interpreted depths of objects detected using GPR are based on on-site calibration, handbook values, and/or estimated GPR signal propagation velocities from similar sites. GPR velocities and depth estimates may vary if the medium under investigation or soil water content is not uniform throughout the site.

Utilities are interpreted on the basis of reflections of similar size and depth that exhibit a linear trend; however GPR cannot unambiguously determine that all such reflectors are related. Fiberglass USTs or utilities composed of plastic or clay may be difficult to detect if situated in soils with similar electromagnetic properties, or if situated in fill with other reflecting targets that generate "clutter" or signal scattering and thus obscure other deeper reflectors. Objects buried beneath reinforced concrete pads or slabs may also be difficult, but possible, to detect.

As a rule of thumb, GPR can resolve utilities with a diameter of 1" per foot of depth (i.e., a 1"-diameter utility can be detected to a burial depth of 1 foot).

Changes in the speed at which the GPR antenna is moved along the surface causes slight variations in the horizontal scale of the recorded traverse. Distance interpolation may be performed to minimize the error in interpreted object positions. The variation in the horizontal scale of the GPR record may be controlled, to a certain extent, with a distance encoder or survey wheel. The GPR antenna produces a cone-shaped signal pattern that emanates approximately 45 degrees from horizontal front and back of the antenna. Therefore, buried objects may be detected before the antenna is located directly over them. GPR anomalies may appear larger than actual target dimensions.

GPR interpretation is more subjective than other geophysical methods. The interpretive method is based on the identification of reflection patterns that do not uniquely identify a subsurface target. Borings, test pits, site utility plans and other ground-truth are recommended to verify the interpreted GPR results.

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A.2 EM Time Domain Metal Detection

A.2.1 Description of the Method. The time domain electromagnetic system includes a single transmitter coil and two receiver coils. A primary magnetic field, generated by an alternating current supplied to the transmitter coil, induces eddy currents in nearby metallic objects. These induced eddy currents decay at a rate dependent on the characteristics of the anomaly, which in turn produces a secondary magnetic field with the same rate of decay. The decay over time of the secondary magnetic field generates a signal within each of the two receiving coils, thereby confirming the presence of metal.

We collect EM time domain data using a Geonics EM61-MK2 high power system. The EM61-MK2 is a "coil over coil" system in which each coil measures 1x0.5 meters. Data can be collected in auto, wheel, or manual modes depending on the nature of the survey.

The Geonics EM61-MK2 data logging system consists of an Allegro field PC, EM61MK2 data-logging program, and a cable to connect the Allegro to the EM61 instrument. The EM61MK2 program acquires and records survey data from the EM61 under the control of the operator. For in-field quality control and initial anomaly identification, the Allegro field PC also provides a real-time visual display of the data in mV. Field information such as survey line number, starting station, increments, and comments are also recorded.

A.2.2 Data Analysis and Interpretation. Common applications of the time domain metal detector include the detection of environmental hazards such as drum and underground storage tanks (USTs), utilities and infrastructure, construction and industrial waste, and unexploded ordnance (UXO).

Depending on the nature of the target (size, depth, magnetic susceptibility), the signal it produces falls within an expected voltage reading. At sites free of metal objects and other cultural interference, USTs due to their size, shape, and composition tend to produce readings several thousands of mV higher than the non-ferrous background. This significant contrast with the background makes for rapid data analysis and detection of USTs and other large targets. However, if the target is small and/or has a weak signal response, such as that produced by many UXOs, significant time is required to process and analyze the data.

A.2.3 Limitations of the Method. EM voltage readings are influenced by proximity to surface metal objects such as fences, vehicles, reinforced concrete, or buildings that may produce spurious signals unrelated to the presence of buried metal targets.

Subsurface environments containing high concentrations of ferrous materials can decrease the contrast between the background signal and that produced by a UST, making their detection more complex. Also, larger buried pieces of metal, such as scrap metal or buried metal debris may produce signals similar to those of USTs and thus produce false positives.

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Borings, test pits, site utility plans and other ground-truth are recommended to verify the interpreted EM results.

A.3 Precision Utility Locating (PUL)

A.3.1 Description of the Method. HGI uses a Radiodetection RD8100TL TX10 cable locator for utility location. The locator is a two-part system consisting of a signal transmitter and receiver. In active mode using the transmitter, utilities are traced by inducing a variety of signals onto exposed portions of conduits and piping. Alternatively, in the absence of convenient exposures, signals can be induced onto the lines by placing the transmitter on the ground above the suspected utility location. The receiver can also be used without the transmitter as a magnetic locator or to detect signal emissions (e.g., 60 Hertz for electric lines) at specific frequencies.

A.3.2 Limitations of the Method. Mapping subsurface objects, pipes, and utilities using a locator depends on recognizing physical phenomena at the ground surface. These phenomena can be electromagnetic waves or magnetic fields that are interpreted as being caused by subsurface objects. These waves or fields, however, can be attenuated and/or distorted by factors including soil moisture, steel reinforced concrete, and proximity to other surface and subsurface utilities. It has been found that vertical depth resolution beyond 5 feet below grade is questionable.

A.4 RTK GNSS Global Positioning System (GPS)

A.4.1 Description of the Method. The RTK GPS system consists of either a base (reference) receiver and a roving receiver or a roving receiver that connects to state-wide or commercially-available continuously-broadcasting networks. If a base receiver is used, it remains stationary during a survey and is mounted on a tribrach and tripod. The rover receiver is used to record points remotely and can be mounted on a staff, vehicle, or other object. The reference receiver and network base stations provide real-time corrections to the rover over a radio connection. The system can produce accuracy on a centimeter scale, but the level of accuracy depends on factors that include the geometry of the transmitting satellites and the receivers' view of the horizons. (e.g., the density of buildings and trees). The data can be collected as quickly as 5 Hz or 5 readings per second.

A.4.2 Data Collection and Processing. We perform our GPS surveys using a Sokkia GRX3 Rover GPS system. Once the system connects to a broadcasting network, data points can be collected with survey-grade (centimeter-scale) precision. When GPS points are being collected at a site where the fixed solution is constantly lost and gained, points are checked multiple times for precision. All data points are saved to a Leica field computer. The GPS data are automatically corrected during collection to fit the real world coordinates.

A.4.3 Limitations of the Method. The quality of the GPS signal is site-specific. The base and rover receiver need to have clear views of the horizon and good satellite geometry to achieve the highest level of accuracy and precision. Although a fixed solution can be achieved in wooded environments or sites with taller buildings, it may take more time to achieve the solutions, the fixed solution may be lost frequently when moving the rover, and in some cases the fixed solution may

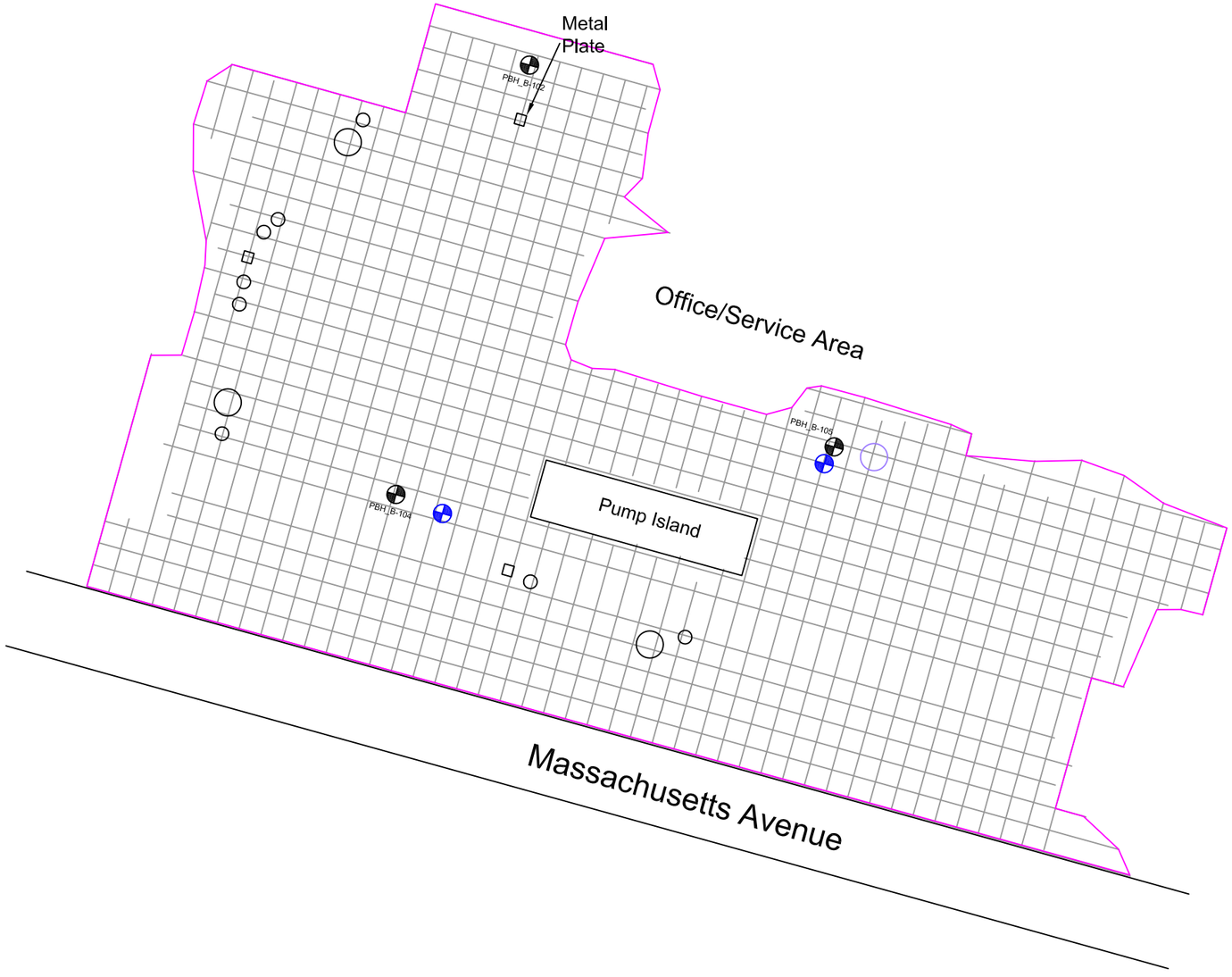
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be wrong. Each of these situations requires longer to locate data points accurately and precisely. When the point is too close to a building, beneath a building overhang, under a tree, or obscured by some other object, a fixed solution may not be possible.

If a base station is used and is set up over an unknown point, the survey data location may be several tens of meters from the real world location. The data points will have survey grade precision relative to the location of the base station and other data points, but will have a real world accuracy discrepancy. This can be corrected using the National Oceanic and Atmospheric Administration's (NOAA) Online Positioning User Service (OPUS). Corrections are not necessary when using data streamed from a broadcasting network.

HGI does not guarantee to produce a surveyor-quality map from its GPS data, as this is not its profession. If survey-level accuracy is critical for a project, we recommend hiring professional surveyors for that purpose.

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Legend

- GPR-Survey Extent
- GPR Traverse
- HGI-Located Sump
- HGI-Located UST Manhole
- HGI-Located Unknown Manhole
- HGI-Located Proposed Borehole
- HGI-Located Monitoring Well

0 15 30 Feet

PLATE 1

JULY 2020 | FILE 2020035

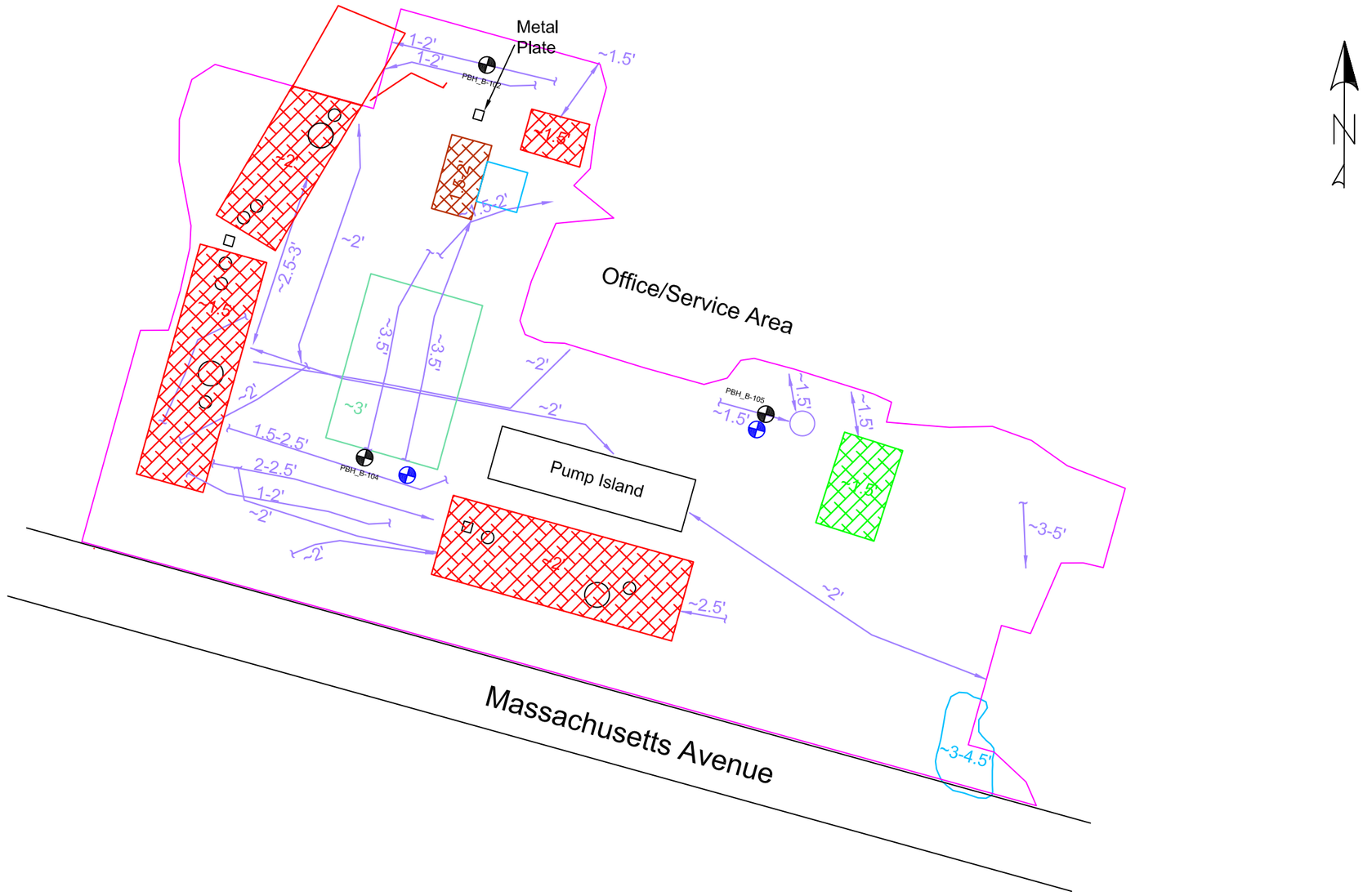
GPR and EM Survey Site Map
Geophysical Survey for Subsurface Structures
925 Massachusetts Avenue
Lunenburg, MA

Hager GeoScience, Inc.
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

NOT ALL SUBSURFACE FEATURES MAY BE DEPICTED ON THIS MAP

NOTE:

1.) The base map was created from the HGI field notes, GPS, grid marks, PUL, GPR, and EM interpretations.



Legend

- GPR-Survey Extent
- 3' GPR-Identified Linear Anomaly and Approx. Depth
- GPR-Identified High Conf. UST
- GPR-Identified Med. Conf. UST
- GPR-Identified Septic Tank
- GPR-Identified Leach Field
- GPR-Identified Anomalous Zone
- PUL-Identified Electric
- PUL-Identified Linear Anomaly
- HGI-Located Sump
- HGI-Located UST Manhole
- HGI-Located Unknown Manhole
- HGI-Located Proposed Borehole
- HGI-Located Monitoring Well

0 15 30 Feet

PLATE 2

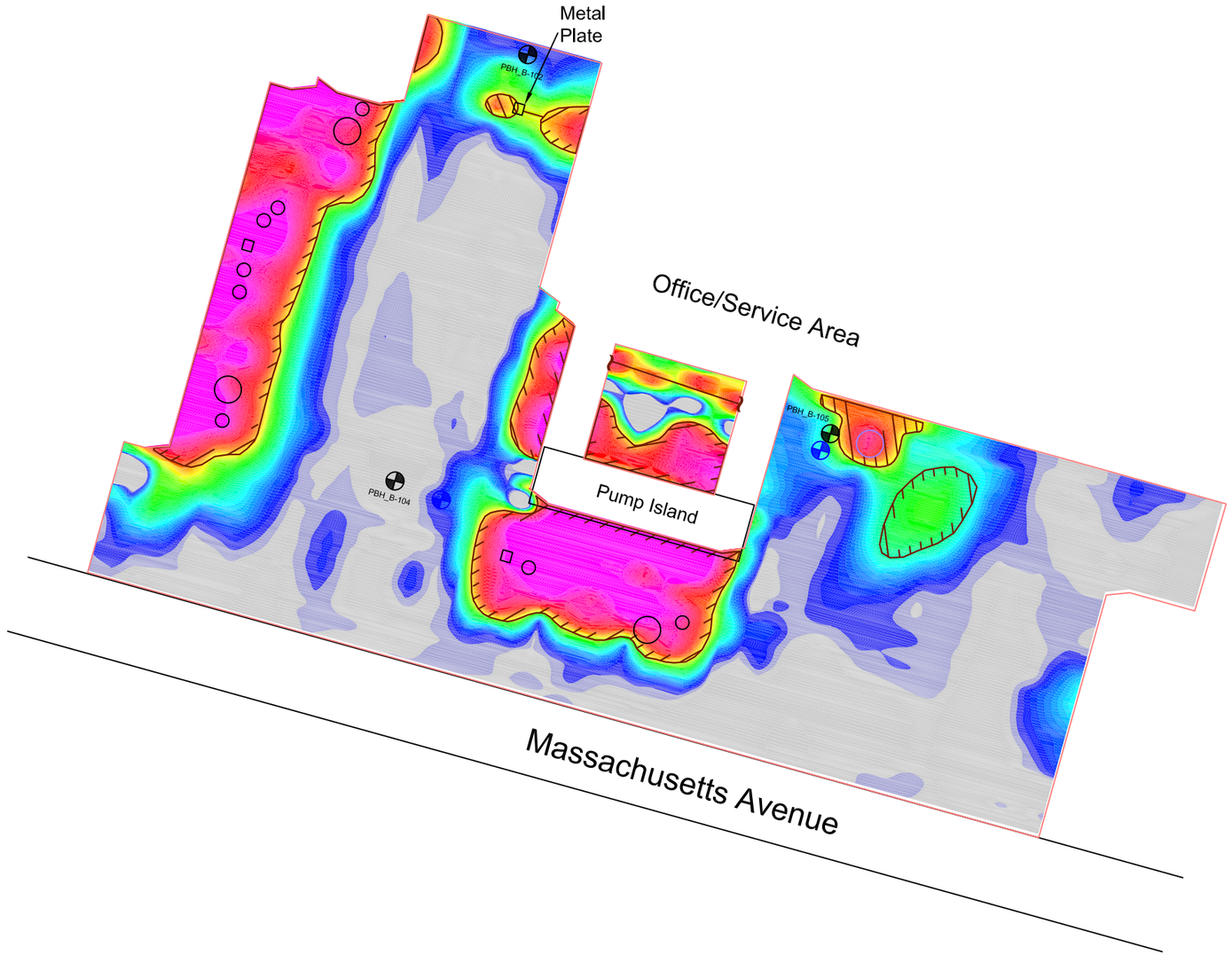
JULY 2020 | FILE 2020035

GPR Interpretation Map
Geophysical Survey for Subsurface Structures
925 Massachusetts Avenue
Lunenburg, MA

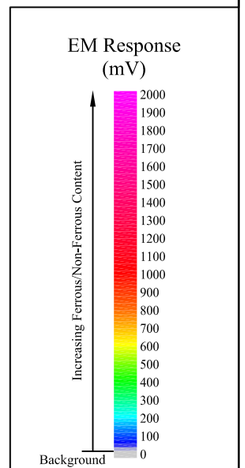
Hager GeoScience, Inc.
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

NOT ALL SUBSURFACE FEATURES MAY BE DEPICTED ON THIS MAP

NOTES:
1.) The base map was created from the HGI field notes, GPS, grid marks, PUL, GPR, and EM interpretations.
2.) The "~" symbol indicates the termination of a utility or linear anomaly or the inability of the geophysical tool to trace it farther.
3.) An arrow ending a feature indicates the possible continuation of that feature beyond the surveyed limits or into an object (i.e., tank or manhole).
4.) Values listed with GPR- and PUL-identified features are depths in feet; depths of GPR-identified features are based on GPR two way travel time velocity conversions and are approximate.
5.) PUL-identified utilities showing no depths are the result of inconclusive findings at the time of the survey.
6.) GPR-identified utilities are categorized based on their proximity to PUL markings and/or surface features (e.g., manholes, catch basins, hydrants, etc.).
7.) The "GPR-Identified - Anomalous Zone" category represents anomalous areas with geometry and/or signal strength that stands out from the background GPR signal. These can have causes ranging from changes in the soil/fill to buried debris.
8.) HGI recommends a minimum buffer of 2 to 3 feet on either side of utility centerlines and around anomaly extents as indicated on the map due to utility dimensions and inaccuracies from grid creation, data collection, and survey locating. We recommend a larger buffer for electric lines, and further that they be turned off prior to excavating. Drilling and/or excavating should proceed with caution.







Legend

- EM-Survey Extent
- EM-Identified Linear Anomaly
- EM-Identified Anomaly
- HGI-Located Sump
- HGI-Located UST Manhole
- HGI-Located Unknown Manhole
- HGI-Located Proposed Borehole
- HGI-Located Monitoring Well

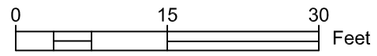


PLATE 3

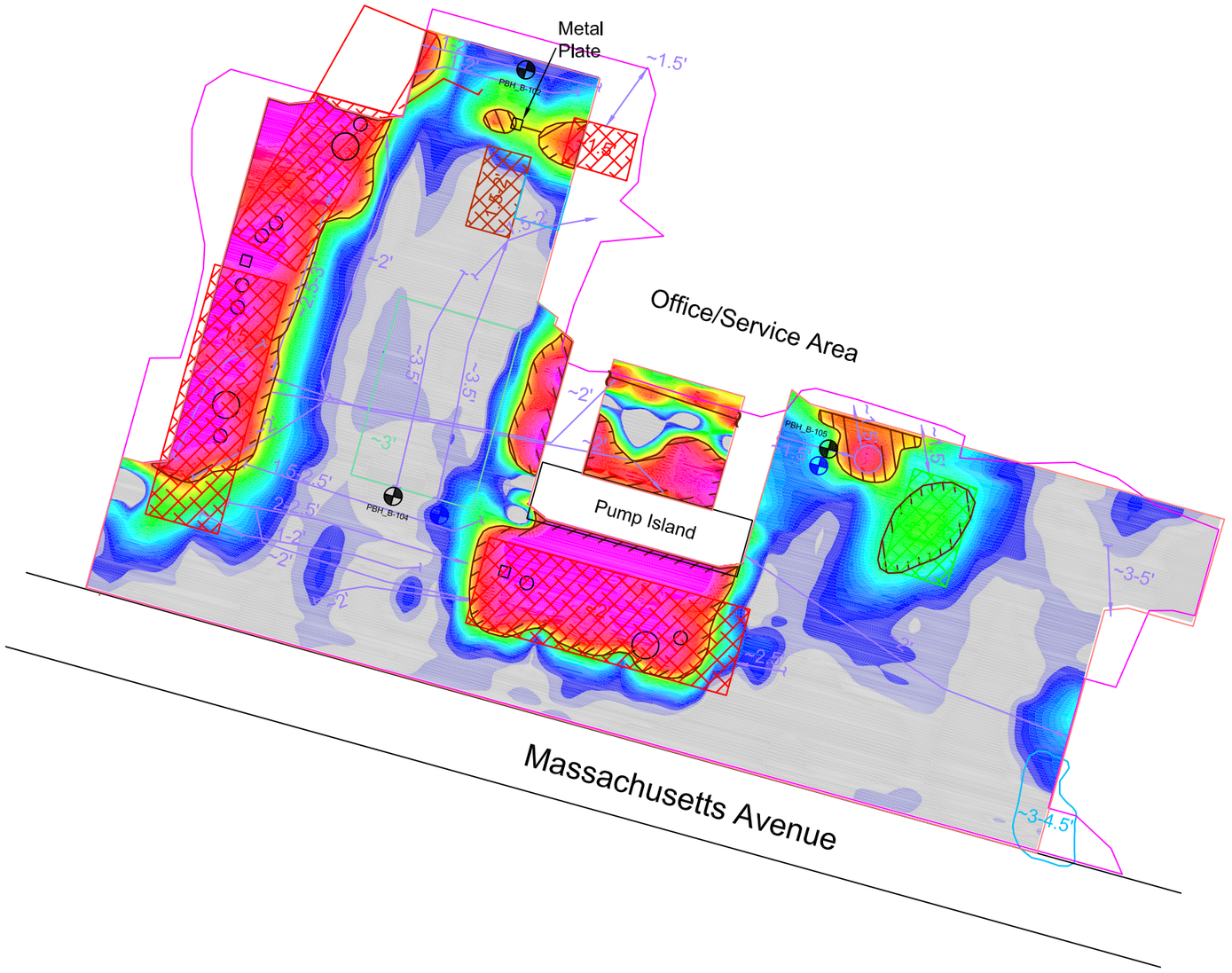
JULY 2020 | FILE 2020035

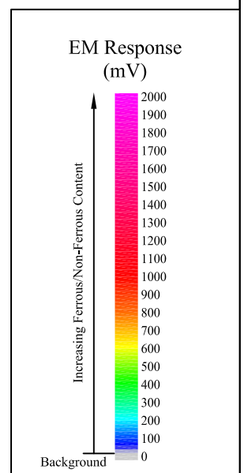
EM Interpretation Map
Geophysical Survey for Subsurface Structures
925 Massachusetts Avenue
Lunenburg, MA

NOTES:
1.) The base map was created from the HGI field notes, GPS, grid marks, PUL, GPR, and EM interpretations.
2.) The "~" symbol indicates the termination of a linear anomaly or the inability of the geophysical tool to trace it farther.
3.)The "EM-Identified - Anomaly" category indicates an area with electromagnetic response above the background level for the site. Common sources of EM anomalies include non-native material and buried metallic objects.
4.) HGI recommends a minimum buffer of 2 to 3 feet on either side of utility centerlines and around anomaly extents shown on the map due to utility dimensions and inaccuracies from grid creation, data collection, and survey locating. We recommend a larger buffer for electric lines, and further that they be turned off prior to excavating. Drilling and/or excavating should proceed with caution.

Hager GeoScience, Inc.
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

NOT ALL SUBSURFACE FEATURES MAY BE DEPICTED ON THIS MAP





Legend

- EM-Survey Extent
- EM-Identified Linear Anomaly
- EM-Identified Anomaly
- GPR-Survey Extent
- 3' GPR-Identified Linear Anomaly and Approx. Depth
- GPR-Identified High Conf. UST
- GPR-Identified Med. Conf. UST
- GPR-Identified Septic Tank
- GPR-Identified Leach Field
- GPR-Identified Anomalous Zone
- PUL-Identified Electric
- PUL-Identified Linear Anomaly
- HGI-Located Sump
- HGI-Located UST Manhole
- HGI-Located Unknown Manhole
- HGI-Located Proposed Borehole
- HGI-Located Monitoring Well

N

0 15 30 Feet

PLATE 4

JULY 2020 | FILE 2020035

GPR and EM Composite Map
Geophysical Survey for Subsurface Structures
925 Massachusetts Avenue
Lunenburg, MA

Hager GeoScience, Inc.
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

NOT ALL SUBSURFACE FEATURES MAY BE DEPICTED ON THIS MAP

NOTES:
1.) The base map was created from the HGI field notes, GPS, grid marks, PUL, GPR, and EM interpretations.
2.) The "~" symbol indicates the termination of a utility or the inability of the geophysical tool to resolve that utility.
3.) An arrow ending a feature indicates the possible continuation of that feature beyond the surveyed limits or into an object (i.e., tank or manhole).
4.) Values listed with GPR- and PUL-identified features are depths in feet; depths of GPR-identified features are based on GPR two way travel time velocity conversions and are approximate.
5.) PUL-identified utilities showing no depths are the result of inconclusive findings at the time of the survey.
6.) GPR-identified utilities are categorized based on their proximity to PUL markings and/or surface features (e.g., manholes, catch basins, hydrants, etc.).
7.) The "GPR-Identified - Anomalous Zone" category represents anomalous areas with geometry and/or signal strength that stands out from the background GPR signal. These can have causes ranging from changes in the soil/fill to buried debris.
8.)The "EM-Identified - Anomaly" category indicates an area with electromagnetic response above the background level for the site. Common sources of EM anomalies include non-native material and buried metallic objects.
9.) HGI recommends a minimum buffer of 2 to 3 feet on either side of utility centerlines and around anomaly extents as indicated on the map due to utility dimensions and inaccuracies from grid creation, data collection, and survey locating. We recommend a larger buffer for electric lines, and further that they be turned off prior to excavating. Drilling and/or excavating should proceed with caution.

Appendix D

Soil Boring and Monitoring Well Logs

BETA Group, Inc.
Engineers • Planners • Landscape Architects • Scientists

SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-101
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: ____

DEPTH	STABILIZATION TIME
~16'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							4" black coarse grained sand w/organics, gravel (SP)			
5.0	0-5						30" tan fine grained sand w/gravel (SP)		60/34	0.1
							30" tan fine grained sand w/gravel (SP)			
10.0	5-10						6" tan coarse grained sand w/gravel (SP)		60/36	0.1
							14" gray coarse grained sand w/gravel (SP)			
							8" gray coarse grained sand w/roots (SP)			
							8" gray coarse grained sand (SP)			
							6" rock fragments			
15.0	10-15						4" gray fine grained sand w/petro odor (SP)		60/48	2.6
						▽				
								B-101		
								15-18'		
							5" brown fine grained sand w/silts, petro odor (SM)			
							11" gray silt w/iron staining, petro odor (ML)			
20.0	15-20						15" gray silt w/petro odor (ML)		60/31	31.4
							Boring terminated			

Notes: Sample B-101 15-18' collected for lab analysis. Monitoring well MW-101 set, screened interval 10-20'.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-102
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: ____

DEPTH	STABILIZATION TIME
~14'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							3" asphalt			
5.0	0-5						49" tan/gray fine grained sand w/gravel (SP)		60/52	0.2
							25" tan fine grained sand w/gravel (SP)			
10.0	5-10						35" black fine grained sand w/gravel (SP)		60/60	2.4
						▽				
							38" tan fine grained sand w/gravel, brick (SP)	B-102		
15.0	10-15						22" gravel w/sand, silts (GP)	13-15'	60/60	960.2
							5" gray fine grained sand w/gravel (SP)			
20.0	15-20						55" gray silt (ML)		60/60	3
							Boring terminated			

Notes: Sample B-102 13-15' collected for lab analysis. Monitoring well MW-102 set, screened interval 10-20'.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-103
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: X

DEPTH	STABILIZATION TIME

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							2" black fine grained sand w/organics (SP) 9" tan fine grained sand w/gravel (SP)			
5.0	0-5						11" gravel w/sand (GP)		60/22	0.0
							9" brown fine grained sand w/gravel (SP) 4" rock fragments 16" brown fine grained sand w/brick, gravel (SP)			
10.0	5-10						12" gray fine grained sand w/gravel (SP)		60/41	0.0
							26" gray fine grained sand w/gravel (SP) 2" red coarse grained sand (SP)	B-103		
15.0	10-15						10" black fine grained sand w/petro odor (SP)	13-15'	60/38	6.2
							26" tan fine grained sand (SP) 6" rock fragments w/silt			
20.0	15-20						26" gray silt (ML)		60/58	0.0
							Boring terminated			

Notes: Sample B-103 13-15' collected for lab analysis. Monitoring well MW-103 set, screened interval 10-20'.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-104
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED:

DEPTH	STABILIZATION TIME
~13'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							4" asphalt 12" gray coarse grained sand w/gravel (SP) 4" rock fragments 2" gray coarse grained sand w/gravel (SP)			
5.0	0-5						12" gravel w/sand (GP)		60/34	0.0
							23" gravel w/sand (GP) 2" crushed brick w/sand 12" gray fine grained sand (SP) 2" rock fragments			
10.0	5-10						10" gray fine grained sand (SP)		60/49	0.0
						▽		B-104 10-12'		
15.0	10-15						60" gray silt (ML)		60/60	0.2
							33" gravel w/sand (GP)			
20.0	15-20						22" gray silt (ML)		60/55	0.0
							Boring terminated			

Notes: Sample B-104 10-12' collected for lab analysis. Monitoring well MW-104 set, screened interval 5-20'.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-105
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: ____

DEPTH	STABILIZATION TIME
~17'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							3" concrete			
							6" gray coarse grained sand w/gravel (SP)			
5.0	0-5						30" tan fine grained sand w/iron staining (SP)		60/39	0.0
							4" brown coarse grained sand w/gravel (SP)			
							32" tan fine grained sand w/iron staining (SP)			
10.0	5-10						6" brown fine grained sand w/iron staining (SP)		60/42	0.0
							4" tan fine grained sand (SP)			
							8" brown fine grained sand w/iron staining (SP)			
15.0	10-15						16" gray silt w/petro odor (ML)		60/28	539.2
						▽		B-105		
								12.5-17.5'		
							6" brown fine grained sand w/gravel (SP)			
							11" black fine grained sand w/silts (SM)			
							20" brown fine grained sand w/silts, gravel (SM)			
20.0	15-20						4" gray/brown silt (ML)		60/41	60.4
							Boring terminated			

Notes: Sample B-105 12.5-17.5' collected for lab analysis. Monitoring well MW-105 set, screened interval 5-20'.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-106
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: X

DEPTH	STABILIZATION TIME

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							2" black coarse grained sand w/organics (SP)			
5.0	0-5						38" tan fine grained sand w/gravel (SP)		60/40	0.0
							18" tan fine grained sand w/gravel (SP)			
							4" rock fragments			
							2" tan fine grained sand w/gravel (SP)			
10.0	5-10						12" black fine grained sand w/petro odor (SP)		60/36	17.4
							9" gray fine grained sand w/gravel (SP)			
							20" black coarse grained sand w/gravel (SP)	B-106		
15.0	10-15						12" gray fine grained sand w/silt, gravel (SM)	12.5-15'	60/41	70.3
20.0	15-20						60" gray silt (ML)		60/60	4.6
							Boring terminated			

Notes: Sample B-106 12.5-15' collected for lab analysis.

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SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-107
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: ____

DEPTH	STABILIZATION TIME
~12'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							6" concrete			
							8" tan fine grained sand w/gravel (SP)			
							22" brown fine grained sand w/gravel (SP)			
5.0	0-5						7" tan fine grained sand (SP)		60/43	0.2
							4" brown fine grained sand w/gravel (SP)			
							29" gray fine grained sand (SP)	B-107		
							8" tan fine grained sand (SP)	8-10'		
							8" gray fine grained sand (SP)			
10.0	5-10						6" black coarse grained sand w/petro odor (SP)		60/55	59.8
						▽				
							10" tan fine grained sand (SP)			
							8" tan fine grained sand w/gravel, silt (SP)			
							4" rock fragments			
15.0	10-15						38" gray silt (ML)		60/60	5.0
							13" gray coarse grained sand w/gravel (SP)			
20.0	15-20						39" gray silt (ML)		60/52	8.9
							Boring terminated			

Notes: Sample B-107 8-10' collected for lab analysis.

BETA Group, Inc.
Engineers • Planners • Landscape Architects • Scientists

SOIL BORING REPORT

PROJECT:	6893	BORING NO.	B-108
LOCATION:	Lunenburg, MA	PAGE 1 OF	1
DRILLING CO:	TDS	DATE STARTED:	8/6/2020
EQUIPMENT:	Geoprobe	DATE FINISHED:	8/6/2020
DRILLED BY:	TDS	SURFACE ELEVATION:	unknown
INSPECTED BY:	Scott Nee		

GROUNDWATER OBSERVATIONS

NOT ENCOUNTERED: ____

DEPTH	STABILIZATION TIME
~18'	

	CASING	SAMPLER	CORE BARREL
TYPE:			
SIZE ID:			
HAMMER WT:			
HAMMER FALL:			

SAMPLE DATA

DEPTH (ft)	SAMPLING DEPTH FROM - TO	HAMMER BLOWS ON SAMPLER (inches) 0-6	6-12	12-18	18-24	STRATA CHANGE (ft)	LITHOLOGY (Description of materials)	SAMPLE ID	PEN/ RECOV (in./in.)	HNU (ppm_v) Lamp 10.6 eV.
							3" black coarse grained sand w/organics (SP)			
5.0	0-5						36" tan/gray fine grained sand w/gravel		60/39	0.0
							10" gray fine grained sand w/gravel (SP)			
							40" tan fine grained sand (SP)			
10.0	5-10						4" gray coarse grained sand w/gravel (SP)		60/54	0.0
							8" tan fine grained sand w/gravel (SP)			
							33" brown fine grained sand w/silt (SM)			
15.0	10-15						19" gray fine grained sand w/silt, gravel (SM)		60/60	0.1
								B-108		
								15-17.5		
						▽				
							20" tan fine grained sand w/gravel (SP)			
20.0	15-20						21" tan silt (ML)		60/41	2.8
							Boring terminated			

Notes: Sample B-108 15-17.5' collected for lab analysis.

Appendix E

Soil Boring Laboratory Certificates of Analysis

ANALYTICAL REPORT

Lab Number:	L2033722
Client:	Beta Group, Inc. 701 George Washington Highway Lincoln, RI 02865
ATTN:	Joe McLoughlin
Phone:	(401) 333-2382
Project Name:	LUNENBURG
Project Number:	6893
Report Date:	08/25/20

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Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2033722-01	B-101 15-18	SOIL	LUNENBURG, MA	08/06/20 09:00	08/19/20
L2033722-02	B-105 12.5-17.5	SOIL	LUNENBURG, MA	08/06/20 09:50	08/19/20
L2033722-03	DUP	SOIL	LUNENBURG, MA	08/06/20 10:15	08/19/20
L2033722-04	B-107 8-10	SOIL	LUNENBURG, MA	08/06/20 10:45	08/19/20
L2033722-05	B-104 10-12	SOIL	LUNENBURG, MA	08/06/20 11:30	08/19/20
L2033722-06	B-103 13-15	SOIL	LUNENBURG, MA	08/06/20 13:00	08/19/20
L2033722-07	B-106 12.5-15	SOIL	LUNENBURG, MA	08/06/20 13:45	08/19/20
L2033722-08	B-102 13-15	SOIL	LUNENBURG, MA	08/06/20 14:10	08/19/20
L2033722-09	B-108 15-17.5	SOIL	LUNENBURG, MA	08/06/20 15:05	08/19/20
L2033722-10	TRIP BLANK	SOIL	LUNENBURG, MA	08/06/20 00:00	08/19/20
L2033722-11	EQUIP BLANK	WATER	LUNENBURG, MA	08/06/20 08:00	08/19/20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

MADEP MCP Response Action Analytical Report Certification

This form provides certifications for all samples performed by MCP methods. Please refer to the Sample Results and Container Information sections of this report for specification of MCP methods used for each analysis. The following questions pertain only to MCP Analytical Methods.

An affirmative response to questions A through F is required for "Presumptive Certainty" status		
A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	YES
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	YES
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	YES
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?"	YES
E a.	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	YES
E b.	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	N/A
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	YES

A response to questions G, H and I is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	NO
H	Were all QC performance standards specified in the CAM protocol(s) achieved?	NO
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	NO

For any questions answered "No", please refer to the case narrative section on the following page(s).

Please note that sample matrix information is located in the Sample Results section of this report.

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Project Number:	6893	**Report Date:**	08/25/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

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Case Narrative (continued)

MCP Related Narratives

Sample Receipt

The samples were received at the laboratory below the required temperature range. The samples were transported to the laboratory in a cooler with ice and were not received frozen.

Volatile Organics

L2033722-10: The Low Level Trip Blank has a result for ethylbenzene, trichloroethene, p/m-xylene, o-xylene, total xylenes, n-propylbenzene, and 1,2,4-trimethylbenzene present above the reporting limit. The sample was verified as being labeled correctly by the laboratory and the previous analysis showed there was no potential for carry over.

The initial calibration, associated with L2033722-01 through -10, utilized a quadratic fit for styrene.

In reference to question G:

L2033722-01 through -04, -07, -08, and -10 High Level: One or more of the target analytes did not achieve the requested CAM reporting limits.

In reference to question H:

The initial calibration, associated with L2033722-11, did not meet the method required minimum response factor on the lowest calibration standard for 1,4-dioxane (0.0065), as well as the average response factor for 1,4-dioxane.

The initial calibration, associated with L2033722-01 through -10, did not meet the method required minimum response factor on the lowest calibration standard for 2-hexanone (0.0647), 1,2-dibromo-3-chloropropane (0.0410), and 1,4-dioxane (0.0009), as well as the average response factor for 2-hexanone and 1,4-dioxane.

The continuing calibration standards, associated with L2033722-01 through -11, are outside the acceptance criteria for several compounds; however, they are within overall method allowances. A copy of the continuing calibration standards is included as an addendum to this report.

VPH

L2033722-02, -05, -07, and -09: The sample was outside the recommended 1:1 methanol:soil ratio, due to

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Case Narrative (continued)

the amount of soil provided in the sample vial.
In reference to question G:
L2033722-02, -03, and -08: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-02: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (146%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (138%). The results of the original analysis are reported.
L2033722-03: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (137%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (153%). The results of the original analysis are reported.
L2033722-07: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (143%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (154%). The results of the second analysis are reported.
L2033722-08: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-fid (67%); however, re-analysis achieved similar results: 2,5-dibromotoluene-fid (61%). The results of the original analysis are reported.

EPH
WG1400704: An MS/MSD, performed on L2033722-01, was not analyzed because the dilution required by the native sample would have caused the spike compounds to be diluted below the range of calibration.
In reference to question G:
L2033722-01, -04, and -06: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-03: The surrogate recoveries were outside the acceptance criteria for chloro-octadecane (25%) and o-terphenyl (20%); however, the criteria was achieved upon re-extraction outside of holding time. The results

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Case Narrative (continued)

of both extractions are reported; however, all associated compounds are considered to have a potential bias.
L2033722-04: The surrogate recoveries are below the acceptance criteria for chloro-octadecane (0%) and o-terphenyl (0%) due to the dilution required to quantitate the sample. Re-extraction was not required; therefore, the results of the original analysis are reported.

PCBs
L2033722-01 and -04: The sample has elevated detection limits due to the dilution required by the sample matrix.
In reference to question G:
L2033722-01, -04, and -06: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-04 and -06: The surrogate recoveries are below the acceptance criteria for 2,4,5,6-tetrachloro-m-xylene (0%) and decachlorobiphenyl (0%) due to the dilution required to quantitate the sample. Re-extraction was not required; therefore, the results of the original analysis are reported.

Total Metals
In reference to question H:
The WG1400770-4 MS recoveries, performed on L2033722-01, are outside the acceptance criteria for arsenic (56%), chromium (66%), lead (66%), nickel (74%), thallium (64%) and zinc (60%). Re-analysis of the MS yielded unacceptable recoveries for arsenic, chromium, lead, nickel, thallium and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable; therefore, no further action was taken.
The WG1400770-5 MSD recoveries, performed on L2033722-01, are outside the acceptance criteria for arsenic (68%), thallium (72%) and zinc (73%). Re-analysis of the MSD yielded unacceptable recoveries for arsenic, thallium and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable; therefore, no further action was taken.
In reference to question I:

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Case Narrative (continued)

All samples were analyzed for a subset of MCP analytes per client request.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Michelle M. Morris

Title: Technical Director/Representative

Date: 08/25/20

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
MCP Volatile Organics by EPA 5035 High - Westborough Lab								
8260C	Batch QC	WG1400899-4	Hexachlorobutadiene	LCSD	25	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	Naphthalene	LCSD	28	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	1,2,3-Trichlorobenzene	LCSD	26	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	1,2,4-Trichlorobenzene	LCSD	26	20	01-04,07-08,10	non-directional bias
MCP Volatile Organics by EPA 5035 Low - Westborough Lab								
8260C	Batch QC	WG1400902-4	Hexachlorobutadiene	LCSD	25	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	Naphthalene	LCSD	28	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	1,2,3-Trichlorobenzene	LCSD	26	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	1,2,4-Trichlorobenzene	LCSD	26	20	09-10	non-directional bias
Extractable Petroleum Hydrocarbons - Westborough Lab								
EPH-19-2.1	DUP	L2033722-03	Chloro-Octadecane	Surrogate	25	40-140	-	potential low bias
EPH-19-2.1	DUP	L2033722-03	o-Terphenyl	Surrogate	20	40-140	-	potential low bias
EPH-19-2.1	B-107 8-10	L2033722-04 D	Chloro-Octadecane	Surrogate	0	40-140	-	- - not applicable - -
EPH-19-2.1	B-107 8-10	L2033722-04 D	o-Terphenyl	Surrogate	0	40-140	-	- - not applicable - -
Volatile Petroleum Hydrocarbons - Westborough Lab								
VPH-18-2.1	B-105 12.5-17.5	L2033722-02 D	2,5-Dibromotoluene-PID	Surrogate	146	70-130	-	potential high bias
VPH-18-2.1	DUP	L2033722-03 D	2,5-Dibromotoluene-PID	Surrogate	137	70-130	-	potential high bias
VPH-18-2.1	B-104 10-12	L2033722-05	2,5-Dibromotoluene-PID	Surrogate	158	70-130	-	potential high bias
VPH-18-2.1	B-104 10-12	L2033722-05	2,5-Dibromotoluene-FID	Surrogate	145	70-130	-	potential high bias
VPH-18-2.1	B-106 12.5-15	L2033722-07	2,5-Dibromotoluene-PID	Surrogate	143	70-130	-	potential high bias
VPH-18-2.1	B-102 13-15	L2033722-08 D	2,5-Dibromotoluene-FID	Surrogate	67	70-130	-	potential low bias
VPH-18-2.1	B-108 15-17.5	L2033722-09	2,5-Dibromotoluene-PID	Surrogate	143	70-130	-	potential high bias
MCP Polychlorinated Biphenyls - Westborough Lab								
8082A	B-107 8-10	L2033722-04 D	2,4,5,6-Tetrachloro-m-xylene (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-107 8-10	L2033722-04 D	2,4,5,6-Tetrachloro-m-xylene (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-107 8-10	L2033722-04 D	Decachlorobiphenyl (A)	Surrogate	0	30-150	-	- - not applicable - -

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
8082A	B-107 8-10	L2033722-04 D	Decachlorobiphenyl (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	2,4,5,6-Tetrachloro-m-xylene (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	2,4,5,6-Tetrachloro-m-xylene (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	Decachlorobiphenyl (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	Decachlorobiphenyl (B)	Surrogate	0	30-150	-	- - not applicable - -
MCP Total Metals - Mansfield Lab								
6010D	Batch QC (L2033722-01)	WG1400770-4	Arsenic, Total	MS	56	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Chromium, Total	MS	66	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Lead, Total	MS	66	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Nickel, Total	MS	74	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Thallium, Total	MS	64	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Zinc, Total	MS	60	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Arsenic, Total	MSD	68	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Thallium, Total	MSD	72	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Zinc, Total	MSD	73	75-125	01-09	potential low bias

ORGANICS

VOLATILES

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 22:13
Analyst: JC
Percent Solids: 86%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	280	--	1
1,1-Dichloroethane	ND		ug/kg	57	--	1
Chloroform	ND		ug/kg	86	--	1
Carbon tetrachloride	ND		ug/kg	57	--	1
1,2-Dichloropropane	ND		ug/kg	57	--	1
Dibromochloromethane	ND		ug/kg	57	--	1
1,1,2-Trichloroethane	ND		ug/kg	57	--	1
Tetrachloroethene	ND		ug/kg	28	--	1
Chlorobenzene	ND		ug/kg	28	--	1
Trichlorofluoromethane	ND		ug/kg	230	--	1
1,2-Dichloroethane	ND		ug/kg	57	--	1
1,1,1-Trichloroethane	ND		ug/kg	28	--	1
Bromodichloromethane	ND		ug/kg	28	--	1
trans-1,3-Dichloropropene	ND		ug/kg	57	--	1
cis-1,3-Dichloropropene	ND		ug/kg	28	--	1
1,3-Dichloropropene, Total	ND		ug/kg	28	--	1
1,1-Dichloropropene	ND		ug/kg	28	--	1
Bromoform	ND		ug/kg	230	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	28	--	1
Benzene	ND		ug/kg	28	--	1
Toluene	ND		ug/kg	57	--	1
Ethylbenzene	ND		ug/kg	57	--	1
Chloromethane	ND		ug/kg	230	--	1
Bromomethane	ND		ug/kg	110	--	1
Vinyl chloride	ND		ug/kg	57	--	1
Chloroethane	ND		ug/kg	110	--	1
1,1-Dichloroethene	ND		ug/kg	57	--	1
trans-1,2-Dichloroethene	ND		ug/kg	86	--	1

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Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 Date Collected: 08/06/20 09:00

Client ID: B-101 15-18 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	28	--	1
1,2-Dichlorobenzene	ND		ug/kg	110	--	1
1,3-Dichlorobenzene	ND		ug/kg	110	--	1
1,4-Dichlorobenzene	ND		ug/kg	110	--	1
Methyl tert butyl ether	ND		ug/kg	110	--	1
p/m-Xylene	170		ug/kg	110	--	1
o-Xylene	150		ug/kg	57	--	1
Xylenes, Total	320		ug/kg	57	--	1
cis-1,2-Dichloroethene	ND		ug/kg	57	--	1
1,2-Dichloroethene, Total	ND		ug/kg	57	--	1
Dibromomethane	ND		ug/kg	110	--	1
1,2,3-Trichloropropane	ND		ug/kg	110	--	1
Styrene	ND		ug/kg	57	--	1
Dichlorodifluoromethane	ND		ug/kg	570	--	1
Acetone	ND		ug/kg	570	--	1
Carbon disulfide	ND		ug/kg	570	--	1
Methyl ethyl ketone	ND		ug/kg	570	--	1
Methyl isobutyl ketone	ND		ug/kg	570	--	1
2-Hexanone	ND		ug/kg	570	--	1
Bromochloromethane	ND		ug/kg	110	--	1
Tetrahydrofuran	ND		ug/kg	230	--	1
2,2-Dichloropropane	ND		ug/kg	110	--	1
1,2-Dibromoethane	ND		ug/kg	57	--	1
1,3-Dichloropropane	ND		ug/kg	110	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	28	--	1
Bromobenzene	ND		ug/kg	110	--	1
n-Butylbenzene	170		ug/kg	57	--	1
sec-Butylbenzene	66		ug/kg	57	--	1
tert-Butylbenzene	ND		ug/kg	110	--	1
o-Chlorotoluene	ND		ug/kg	110	--	1
p-Chlorotoluene	ND		ug/kg	110	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	170	--	1
Hexachlorobutadiene	ND		ug/kg	230	--	1
Isopropylbenzene	62		ug/kg	57	--	1
p-Isopropyltoluene	70		ug/kg	57	--	1
Naphthalene	ND		ug/kg	230	--	1
n-Propylbenzene	190		ug/kg	57	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 Date Collected: 08/06/20 09:00

Client ID: B-101 15-18 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	110	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	110	--	1
1,3,5-Trimethylbenzene	430		ug/kg	110	--	1
1,2,4-Trimethylbenzene	1200		ug/kg	110	--	1
Diethyl ether	ND		ug/kg	110	--	1
Diisopropyl Ether	ND		ug/kg	110	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	110	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	110	--	1
1,4-Dioxane	ND		ug/kg	4600	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	93		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50
Client ID: B-105 12.5-17.5 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 13:58
Analyst: AD
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	1200	--	5
1,1-Dichloroethane	ND		ug/kg	240	--	5
Chloroform	ND		ug/kg	360	--	5
Carbon tetrachloride	ND		ug/kg	240	--	5
1,2-Dichloropropane	ND		ug/kg	240	--	5
Dibromochloromethane	ND		ug/kg	240	--	5
1,1,2-Trichloroethane	ND		ug/kg	240	--	5
Tetrachloroethene	ND		ug/kg	120	--	5
Chlorobenzene	ND		ug/kg	120	--	5
Trichlorofluoromethane	ND		ug/kg	960	--	5
1,2-Dichloroethane	ND		ug/kg	240	--	5
1,1,1-Trichloroethane	ND		ug/kg	120	--	5
Bromodichloromethane	ND		ug/kg	120	--	5
trans-1,3-Dichloropropene	ND		ug/kg	240	--	5
cis-1,3-Dichloropropene	ND		ug/kg	120	--	5
1,3-Dichloropropene, Total	ND		ug/kg	120	--	5
1,1-Dichloropropene	ND		ug/kg	120	--	5
Bromoform	ND		ug/kg	960	--	5
1,1,2,2-Tetrachloroethane	ND		ug/kg	120	--	5
Benzene	ND		ug/kg	120	--	5
Toluene	ND		ug/kg	240	--	5
Ethylbenzene	10000		ug/kg	240	--	5
Chloromethane	ND		ug/kg	960	--	5
Bromomethane	ND		ug/kg	480	--	5
Vinyl chloride	ND		ug/kg	240	--	5
Chloroethane	ND		ug/kg	480	--	5
1,1-Dichloroethene	ND		ug/kg	240	--	5
trans-1,2-Dichloroethene	ND		ug/kg	360	--	5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	120	--	5
1,2-Dichlorobenzene	ND		ug/kg	480	--	5
1,3-Dichlorobenzene	ND		ug/kg	480	--	5
1,4-Dichlorobenzene	ND		ug/kg	480	--	5
Methyl tert butyl ether	ND		ug/kg	480	--	5
p/m-Xylene	67000		ug/kg	480	--	5
o-Xylene	12000		ug/kg	240	--	5
Xylenes, Total	79000		ug/kg	240	--	5
cis-1,2-Dichloroethene	ND		ug/kg	240	--	5
1,2-Dichloroethene, Total	ND		ug/kg	240	--	5
Dibromomethane	ND		ug/kg	480	--	5
1,2,3-Trichloropropane	ND		ug/kg	480	--	5
Styrene	ND		ug/kg	240	--	5
Dichlorodifluoromethane	ND		ug/kg	2400	--	5
Acetone	ND		ug/kg	2400	--	5
Carbon disulfide	ND		ug/kg	2400	--	5
Methyl ethyl ketone	ND		ug/kg	2400	--	5
Methyl isobutyl ketone	ND		ug/kg	2400	--	5
2-Hexanone	ND		ug/kg	2400	--	5
Bromochloromethane	ND		ug/kg	480	--	5
Tetrahydrofuran	ND		ug/kg	960	--	5
2,2-Dichloropropane	ND		ug/kg	480	--	5
1,2-Dibromoethane	ND		ug/kg	240	--	5
1,3-Dichloropropane	ND		ug/kg	480	--	5
1,1,1,2-Tetrachloroethane	ND		ug/kg	120	--	5
Bromobenzene	ND		ug/kg	480	--	5
n-Butylbenzene	4400		ug/kg	240	--	5
sec-Butylbenzene	1500		ug/kg	240	--	5
tert-Butylbenzene	ND		ug/kg	480	--	5
o-Chlorotoluene	ND		ug/kg	480	--	5
p-Chlorotoluene	ND		ug/kg	480	--	5
1,2-Dibromo-3-chloropropane	ND		ug/kg	720	--	5
Hexachlorobutadiene	ND		ug/kg	960	--	5
Isopropylbenzene	3300		ug/kg	240	--	5
p-Isopropyltoluene	940		ug/kg	240	--	5
Naphthalene	19000		ug/kg	960	--	5
n-Propylbenzene	11000		ug/kg	240	--	5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	480	--	5
1,2,4-Trichlorobenzene	ND		ug/kg	480	--	5
1,3,5-Trimethylbenzene	29000		ug/kg	480	--	5
1,2,4-Trimethylbenzene	96000	E	ug/kg	480	--	5
Diethyl ether	ND		ug/kg	480	--	5
Diisopropyl Ether	ND		ug/kg	480	--	5
Ethyl-Tert-Butyl-Ether	ND		ug/kg	480	--	5
Tertiary-Amyl Methyl Ether	ND		ug/kg	480	--	5
1,4-Dioxane	ND		ug/kg	19000	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	86		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	119		70-130
Dibromofluoromethane	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 22:39
Analyst: JC
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	92000		ug/kg	960	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	107		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15
Client ID: DUP Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 12:32
Analyst: JC
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	630	--	2.5
1,1-Dichloroethane	ND		ug/kg	130	--	2.5
Chloroform	ND		ug/kg	190	--	2.5
Carbon tetrachloride	ND		ug/kg	130	--	2.5
1,2-Dichloropropane	ND		ug/kg	130	--	2.5
Dibromochloromethane	ND		ug/kg	130	--	2.5
1,1,2-Trichloroethane	ND		ug/kg	130	--	2.5
Tetrachloroethene	ND		ug/kg	63	--	2.5
Chlorobenzene	ND		ug/kg	63	--	2.5
Trichlorofluoromethane	ND		ug/kg	510	--	2.5
1,2-Dichloroethane	ND		ug/kg	130	--	2.5
1,1,1-Trichloroethane	ND		ug/kg	63	--	2.5
Bromodichloromethane	ND		ug/kg	63	--	2.5
trans-1,3-Dichloropropene	ND		ug/kg	130	--	2.5
cis-1,3-Dichloropropene	ND		ug/kg	63	--	2.5
1,3-Dichloropropene, Total	ND		ug/kg	63	--	2.5
1,1-Dichloropropene	ND		ug/kg	63	--	2.5
Bromoform	ND		ug/kg	510	--	2.5
1,1,2,2-Tetrachloroethane	ND		ug/kg	63	--	2.5
Benzene	ND		ug/kg	63	--	2.5
Toluene	ND		ug/kg	130	--	2.5
Ethylbenzene	7500		ug/kg	130	--	2.5
Chloromethane	ND		ug/kg	510	--	2.5
Bromomethane	ND		ug/kg	250	--	2.5
Vinyl chloride	ND		ug/kg	130	--	2.5
Chloroethane	ND		ug/kg	250	--	2.5
1,1-Dichloroethene	ND		ug/kg	130	--	2.5
trans-1,2-Dichloroethene	ND		ug/kg	190	--	2.5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15

Client ID: DUP Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	63	--	2.5
1,2-Dichlorobenzene	ND		ug/kg	250	--	2.5
1,3-Dichlorobenzene	ND		ug/kg	250	--	2.5
1,4-Dichlorobenzene	ND		ug/kg	250	--	2.5
Methyl tert butyl ether	ND		ug/kg	250	--	2.5
p/m-Xylene	55000		ug/kg	250	--	2.5
o-Xylene	8100		ug/kg	130	--	2.5
Xylenes, Total	63000		ug/kg	130	--	2.5
cis-1,2-Dichloroethene	ND		ug/kg	130	--	2.5
1,2-Dichloroethene, Total	ND		ug/kg	130	--	2.5
Dibromomethane	ND		ug/kg	250	--	2.5
1,2,3-Trichloropropane	ND		ug/kg	250	--	2.5
Styrene	ND		ug/kg	130	--	2.5
Dichlorodifluoromethane	ND		ug/kg	1300	--	2.5
Acetone	ND		ug/kg	1300	--	2.5
Carbon disulfide	ND		ug/kg	1300	--	2.5
Methyl ethyl ketone	ND		ug/kg	1300	--	2.5
Methyl isobutyl ketone	ND		ug/kg	1300	--	2.5
2-Hexanone	ND		ug/kg	1300	--	2.5
Bromochloromethane	ND		ug/kg	250	--	2.5
Tetrahydrofuran	ND		ug/kg	510	--	2.5
2,2-Dichloropropane	ND		ug/kg	250	--	2.5
1,2-Dibromoethane	ND		ug/kg	130	--	2.5
1,3-Dichloropropane	ND		ug/kg	250	--	2.5
1,1,1,2-Tetrachloroethane	ND		ug/kg	63	--	2.5
Bromobenzene	ND		ug/kg	250	--	2.5
n-Butylbenzene	3100		ug/kg	130	--	2.5
sec-Butylbenzene	1300		ug/kg	130	--	2.5
tert-Butylbenzene	ND		ug/kg	250	--	2.5
o-Chlorotoluene	ND		ug/kg	250	--	2.5
p-Chlorotoluene	ND		ug/kg	250	--	2.5
1,2-Dibromo-3-chloropropane	ND		ug/kg	380	--	2.5
Hexachlorobutadiene	ND		ug/kg	510	--	2.5
Isopropylbenzene	1900		ug/kg	130	--	2.5
p-Isopropyltoluene	630		ug/kg	130	--	2.5
Naphthalene	12000		ug/kg	510	--	2.5
n-Propylbenzene	7100		ug/kg	130	--	2.5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15

Client ID: DUP Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	250	--	2.5
1,2,4-Trichlorobenzene	ND		ug/kg	250	--	2.5
1,3,5-Trimethylbenzene	15000		ug/kg	250	--	2.5
1,2,4-Trimethylbenzene	80000	E	ug/kg	250	--	2.5
Diethyl ether	ND		ug/kg	250	--	2.5
Diisopropyl Ether	ND		ug/kg	250	--	2.5
Ethyl-Tert-Butyl-Ether	ND		ug/kg	250	--	2.5
Tertiary-Amyl Methyl Ether	ND		ug/kg	250	--	2.5
1,4-Dioxane	ND		ug/kg	10000	--	2.5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	96		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:05
Analyst: JC
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	75000		ug/kg	510	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	102		70-130
Dibromofluoromethane	94		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45
Client ID: B-107 8-10 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:32
Analyst: JC
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	260	--	1
1,1-Dichloroethane	ND		ug/kg	53	--	1
Chloroform	ND		ug/kg	79	--	1
Carbon tetrachloride	ND		ug/kg	53	--	1
1,2-Dichloropropane	ND		ug/kg	53	--	1
Dibromochloromethane	ND		ug/kg	53	--	1
1,1,2-Trichloroethane	ND		ug/kg	53	--	1
Tetrachloroethene	ND		ug/kg	26	--	1
Chlorobenzene	ND		ug/kg	26	--	1
Trichlorofluoromethane	ND		ug/kg	210	--	1
1,2-Dichloroethane	ND		ug/kg	53	--	1
1,1,1-Trichloroethane	ND		ug/kg	26	--	1
Bromodichloromethane	ND		ug/kg	26	--	1
trans-1,3-Dichloropropene	ND		ug/kg	53	--	1
cis-1,3-Dichloropropene	ND		ug/kg	26	--	1
1,3-Dichloropropene, Total	ND		ug/kg	26	--	1
1,1-Dichloropropene	ND		ug/kg	26	--	1
Bromoform	ND		ug/kg	210	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	26	--	1
Benzene	550		ug/kg	26	--	1
Toluene	520		ug/kg	53	--	1
Ethylbenzene	700		ug/kg	53	--	1
Chloromethane	ND		ug/kg	210	--	1
Bromomethane	ND		ug/kg	100	--	1
Vinyl chloride	ND		ug/kg	53	--	1
Chloroethane	ND		ug/kg	100	--	1
1,1-Dichloroethene	ND		ug/kg	53	--	1
trans-1,2-Dichloroethene	ND		ug/kg	79	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45

Client ID: B-107 8-10 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	26	--	1
1,2-Dichlorobenzene	ND		ug/kg	100	--	1
1,3-Dichlorobenzene	ND		ug/kg	100	--	1
1,4-Dichlorobenzene	ND		ug/kg	100	--	1
Methyl tert butyl ether	ND		ug/kg	100	--	1
p/m-Xylene	2600		ug/kg	100	--	1
o-Xylene	1000		ug/kg	53	--	1
Xylenes, Total	3600		ug/kg	53	--	1
cis-1,2-Dichloroethene	ND		ug/kg	53	--	1
1,2-Dichloroethene, Total	ND		ug/kg	53	--	1
Dibromomethane	ND		ug/kg	100	--	1
1,2,3-Trichloropropane	ND		ug/kg	100	--	1
Styrene	ND		ug/kg	53	--	1
Dichlorodifluoromethane	ND		ug/kg	530	--	1
Acetone	770		ug/kg	530	--	1
Carbon disulfide	ND		ug/kg	530	--	1
Methyl ethyl ketone	ND		ug/kg	530	--	1
Methyl isobutyl ketone	ND		ug/kg	530	--	1
2-Hexanone	ND		ug/kg	530	--	1
Bromochloromethane	ND		ug/kg	100	--	1
Tetrahydrofuran	ND		ug/kg	210	--	1
2,2-Dichloropropane	ND		ug/kg	100	--	1
1,2-Dibromoethane	ND		ug/kg	53	--	1
1,3-Dichloropropane	ND		ug/kg	100	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	26	--	1
Bromobenzene	ND		ug/kg	100	--	1
n-Butylbenzene	98		ug/kg	53	--	1
sec-Butylbenzene	89		ug/kg	53	--	1
tert-Butylbenzene	ND		ug/kg	100	--	1
o-Chlorotoluene	ND		ug/kg	100	--	1
p-Chlorotoluene	ND		ug/kg	100	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	160	--	1
Hexachlorobutadiene	ND		ug/kg	210	--	1
Isopropylbenzene	110		ug/kg	53	--	1
p-Isopropyltoluene	150		ug/kg	53	--	1
Naphthalene	880		ug/kg	210	--	1
n-Propylbenzene	220		ug/kg	53	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45

Client ID: B-107 8-10 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	100	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	100	--	1
1,3,5-Trimethylbenzene	1100		ug/kg	100	--	1
1,2,4-Trimethylbenzene	2200		ug/kg	100	--	1
Diethyl ether	ND		ug/kg	100	--	1
Diisopropyl Ether	ND		ug/kg	100	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--	1
1,4-Dioxane	ND		ug/kg	4200	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	91		70-130
4-Bromofluorobenzene	115		70-130
Dibromofluoromethane	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:44
Analyst: JC
Percent Solids: 88%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.9	--	1
1,1-Dichloroethane	ND		ug/kg	0.79	--	1
Chloroform	ND		ug/kg	1.2	--	1
Carbon tetrachloride	ND		ug/kg	0.79	--	1
1,2-Dichloropropane	ND		ug/kg	0.79	--	1
Dibromochloromethane	ND		ug/kg	0.79	--	1
1,1,2-Trichloroethane	ND		ug/kg	0.79	--	1
Tetrachloroethene	ND		ug/kg	0.39	--	1
Chlorobenzene	ND		ug/kg	0.39	--	1
Trichlorofluoromethane	ND		ug/kg	3.2	--	1
1,2-Dichloroethane	ND		ug/kg	0.79	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.39	--	1
Bromodichloromethane	ND		ug/kg	0.39	--	1
trans-1,3-Dichloropropene	ND		ug/kg	0.79	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.39	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.39	--	1
1,1-Dichloropropene	ND		ug/kg	0.39	--	1
Bromoform	ND		ug/kg	3.2	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.39	--	1
Benzene	ND		ug/kg	0.39	--	1
Toluene	ND		ug/kg	0.79	--	1
Ethylbenzene	ND		ug/kg	0.79	--	1
Chloromethane	ND		ug/kg	3.2	--	1
Bromomethane	ND		ug/kg	1.6	--	1
Vinyl chloride	ND		ug/kg	0.79	--	1
Chloroethane	ND		ug/kg	1.6	--	1
1,1-Dichloroethene	ND		ug/kg	0.79	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.2	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.39	--	1
1,2-Dichlorobenzene	ND		ug/kg	1.6	--	1
1,3-Dichlorobenzene	ND		ug/kg	1.6	--	1
1,4-Dichlorobenzene	ND		ug/kg	1.6	--	1
Methyl tert butyl ether	ND		ug/kg	1.6	--	1
p/m-Xylene	ND		ug/kg	1.6	--	1
o-Xylene	ND		ug/kg	0.79	--	1
Xylenes, Total	ND		ug/kg	0.79	--	1
cis-1,2-Dichloroethene	ND		ug/kg	0.79	--	1
1,2-Dichloroethene, Total	ND		ug/kg	0.79	--	1
Dibromomethane	ND		ug/kg	1.6	--	1
1,2,3-Trichloropropane	ND		ug/kg	1.6	--	1
Styrene	ND		ug/kg	0.79	--	1
Dichlorodifluoromethane	ND		ug/kg	7.9	--	1
Acetone	31		ug/kg	20	--	1
Carbon disulfide	ND		ug/kg	7.9	--	1
Methyl ethyl ketone	ND		ug/kg	7.9	--	1
Methyl isobutyl ketone	ND		ug/kg	7.9	--	1
2-Hexanone	ND		ug/kg	7.9	--	1
Bromochloromethane	ND		ug/kg	1.6	--	1
Tetrahydrofuran	ND		ug/kg	3.2	--	1
2,2-Dichloropropane	ND		ug/kg	1.6	--	1
1,2-Dibromoethane	ND		ug/kg	0.79	--	1
1,3-Dichloropropane	ND		ug/kg	1.6	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.39	--	1
Bromobenzene	ND		ug/kg	1.6	--	1
n-Butylbenzene	ND		ug/kg	0.79	--	1
sec-Butylbenzene	ND		ug/kg	0.79	--	1
tert-Butylbenzene	ND		ug/kg	1.6	--	1
o-Chlorotoluene	ND		ug/kg	1.6	--	1
p-Chlorotoluene	ND		ug/kg	1.6	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.4	--	1
Hexachlorobutadiene	ND		ug/kg	3.2	--	1
Isopropylbenzene	ND		ug/kg	0.79	--	1
p-Isopropyltoluene	ND		ug/kg	0.79	--	1
Naphthalene	ND		ug/kg	3.2	--	1
n-Propylbenzene	ND		ug/kg	0.79	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	1.6	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.6	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.6	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.6	--	1
Diethyl ether	ND		ug/kg	1.6	--	1
Diisopropyl Ether	ND		ug/kg	1.6	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	1.6	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	1.6	--	1
1,4-Dioxane	ND		ug/kg	63	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	114		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 08:10
Analyst: JC
Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.4	--	1
1,1-Dichloroethane	ND		ug/kg	1.1	--	1
Chloroform	ND		ug/kg	1.6	--	1
Carbon tetrachloride	ND		ug/kg	1.1	--	1
1,2-Dichloropropane	ND		ug/kg	1.1	--	1
Dibromochloromethane	ND		ug/kg	1.1	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.1	--	1
Tetrachloroethene	ND		ug/kg	0.54	--	1
Chlorobenzene	ND		ug/kg	0.54	--	1
Trichlorofluoromethane	ND		ug/kg	4.3	--	1
1,2-Dichloroethane	ND		ug/kg	1.1	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.54	--	1
Bromodichloromethane	ND		ug/kg	0.54	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.1	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.54	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.54	--	1
1,1-Dichloropropene	ND		ug/kg	0.54	--	1
Bromoform	ND		ug/kg	4.3	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.54	--	1
Benzene	5.2		ug/kg	0.54	--	1
Toluene	19		ug/kg	1.1	--	1
Ethylbenzene	1.5		ug/kg	1.1	--	1
Chloromethane	ND		ug/kg	4.3	--	1
Bromomethane	ND		ug/kg	2.2	--	1
Vinyl chloride	ND		ug/kg	1.1	--	1
Chloroethane	ND		ug/kg	2.2	--	1
1,1-Dichloroethene	ND		ug/kg	1.1	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.6	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 Date Collected: 08/06/20 13:00

Client ID: B-103 13-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.54	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.2	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.2	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.2	--	1
Methyl tert butyl ether	34		ug/kg	2.2	--	1
p/m-Xylene	19		ug/kg	2.2	--	1
o-Xylene	2.3		ug/kg	1.1	--	1
Xylenes, Total	21		ug/kg	1.1	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.1	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.1	--	1
Dibromomethane	ND		ug/kg	2.2	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.2	--	1
Styrene	ND		ug/kg	1.1	--	1
Dichlorodifluoromethane	ND		ug/kg	11	--	1
Acetone	180		ug/kg	27	--	1
Carbon disulfide	ND		ug/kg	11	--	1
Methyl ethyl ketone	40		ug/kg	11	--	1
Methyl isobutyl ketone	ND		ug/kg	11	--	1
2-Hexanone	ND		ug/kg	11	--	1
Bromochloromethane	ND		ug/kg	2.2	--	1
Tetrahydrofuran	ND		ug/kg	4.3	--	1
2,2-Dichloropropane	ND		ug/kg	2.2	--	1
1,2-Dibromoethane	ND		ug/kg	1.1	--	1
1,3-Dichloropropane	ND		ug/kg	2.2	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.54	--	1
Bromobenzene	ND		ug/kg	2.2	--	1
n-Butylbenzene	ND		ug/kg	1.1	--	1
sec-Butylbenzene	ND		ug/kg	1.1	--	1
tert-Butylbenzene	ND		ug/kg	2.2	--	1
o-Chlorotoluene	ND		ug/kg	2.2	--	1
p-Chlorotoluene	ND		ug/kg	2.2	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.2	--	1
Hexachlorobutadiene	ND		ug/kg	4.3	--	1
Isopropylbenzene	ND		ug/kg	1.1	--	1
p-Isopropyltoluene	ND		ug/kg	1.1	--	1
Naphthalene	ND		ug/kg	4.3	--	1
n-Propylbenzene	ND		ug/kg	1.1	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.2	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.2	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.2	--	1
1,2,4-Trimethylbenzene	11		ug/kg	2.2	--	1
Diethyl ether	ND		ug/kg	2.2	--	1
Diisopropyl Ether	ND		ug/kg	2.2	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.2	--	1
Tertiary-Amyl Methyl Ether	3.8		ug/kg	2.2	--	1
1,4-Dioxane	ND		ug/kg	86	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	103		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 Date Collected: 08/06/20 13:45
Client ID: B-106 12.5-15 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:58
Analyst: JC
Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	290	--	1
1,1-Dichloroethane	ND		ug/kg	57	--	1
Chloroform	ND		ug/kg	86	--	1
Carbon tetrachloride	ND		ug/kg	57	--	1
1,2-Dichloropropane	ND		ug/kg	57	--	1
Dibromochloromethane	ND		ug/kg	57	--	1
1,1,2-Trichloroethane	ND		ug/kg	57	--	1
Tetrachloroethene	ND		ug/kg	29	--	1
Chlorobenzene	ND		ug/kg	29	--	1
Trichlorofluoromethane	ND		ug/kg	230	--	1
1,2-Dichloroethane	ND		ug/kg	57	--	1
1,1,1-Trichloroethane	ND		ug/kg	29	--	1
Bromodichloromethane	ND		ug/kg	29	--	1
trans-1,3-Dichloropropene	ND		ug/kg	57	--	1
cis-1,3-Dichloropropene	ND		ug/kg	29	--	1
1,3-Dichloropropene, Total	ND		ug/kg	29	--	1
1,1-Dichloropropene	ND		ug/kg	29	--	1
Bromoform	ND		ug/kg	230	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	29	--	1
Benzene	320		ug/kg	29	--	1
Toluene	ND		ug/kg	57	--	1
Ethylbenzene	110		ug/kg	57	--	1
Chloromethane	ND		ug/kg	230	--	1
Bromomethane	ND		ug/kg	110	--	1
Vinyl chloride	ND		ug/kg	57	--	1
Chloroethane	ND		ug/kg	110	--	1
1,1-Dichloroethene	ND		ug/kg	57	--	1
trans-1,2-Dichloroethene	ND		ug/kg	86	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 Date Collected: 08/06/20 13:45

Client ID: B-106 12.5-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	29	--	1
1,2-Dichlorobenzene	ND		ug/kg	110	--	1
1,3-Dichlorobenzene	ND		ug/kg	110	--	1
1,4-Dichlorobenzene	ND		ug/kg	110	--	1
Methyl tert butyl ether	140		ug/kg	110	--	1
p/m-Xylene	12000		ug/kg	110	--	1
o-Xylene	68		ug/kg	57	--	1
Xylenes, Total	12000		ug/kg	57	--	1
cis-1,2-Dichloroethene	ND		ug/kg	57	--	1
1,2-Dichloroethene, Total	ND		ug/kg	57	--	1
Dibromomethane	ND		ug/kg	110	--	1
1,2,3-Trichloropropane	ND		ug/kg	110	--	1
Styrene	ND		ug/kg	57	--	1
Dichlorodifluoromethane	ND		ug/kg	570	--	1
Acetone	ND		ug/kg	570	--	1
Carbon disulfide	ND		ug/kg	570	--	1
Methyl ethyl ketone	ND		ug/kg	570	--	1
Methyl isobutyl ketone	ND		ug/kg	570	--	1
2-Hexanone	ND		ug/kg	570	--	1
Bromochloromethane	ND		ug/kg	110	--	1
Tetrahydrofuran	ND		ug/kg	230	--	1
2,2-Dichloropropane	ND		ug/kg	110	--	1
1,2-Dibromoethane	ND		ug/kg	57	--	1
1,3-Dichloropropane	ND		ug/kg	110	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	29	--	1
Bromobenzene	ND		ug/kg	110	--	1
n-Butylbenzene	170		ug/kg	57	--	1
sec-Butylbenzene	140		ug/kg	57	--	1
tert-Butylbenzene	ND		ug/kg	110	--	1
o-Chlorotoluene	ND		ug/kg	110	--	1
p-Chlorotoluene	ND		ug/kg	110	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	170	--	1
Hexachlorobutadiene	ND		ug/kg	230	--	1
Isopropylbenzene	790		ug/kg	57	--	1
p-Isopropyltoluene	120		ug/kg	57	--	1
Naphthalene	1400		ug/kg	230	--	1
n-Propylbenzene	1900		ug/kg	57	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	110	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	110	--	1
1,3,5-Trimethylbenzene	2000		ug/kg	110	--	1
1,2,4-Trimethylbenzene	14000		ug/kg	110	--	1
Diethyl ether	ND		ug/kg	110	--	1
Diisopropyl Ether	ND		ug/kg	110	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	110	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	110	--	1
1,4-Dioxane	ND		ug/kg	4600	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	102		70-130
4-Bromofluorobenzene	100		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D2
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 13:25
Analyst: AD
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	350000		ug/kg	6100	--	50

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	116		70-130
Dibromofluoromethane	97		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 00:24
Analyst: JC
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	6100	--	20
1,1-Dichloroethane	ND		ug/kg	1200	--	20
Chloroform	ND		ug/kg	1800	--	20
Carbon tetrachloride	ND		ug/kg	1200	--	20
1,2-Dichloropropane	ND		ug/kg	1200	--	20
Dibromochloromethane	ND		ug/kg	1200	--	20
1,1,2-Trichloroethane	ND		ug/kg	1200	--	20
Tetrachloroethene	ND		ug/kg	610	--	20
Chlorobenzene	ND		ug/kg	610	--	20
Trichlorofluoromethane	ND		ug/kg	4900	--	20
1,2-Dichloroethane	ND		ug/kg	1200	--	20
1,1,1-Trichloroethane	ND		ug/kg	610	--	20
Bromodichloromethane	ND		ug/kg	610	--	20
trans-1,3-Dichloropropene	ND		ug/kg	1200	--	20
cis-1,3-Dichloropropene	ND		ug/kg	610	--	20
1,3-Dichloropropene, Total	ND		ug/kg	610	--	20
1,1-Dichloropropene	ND		ug/kg	610	--	20
Bromoform	ND		ug/kg	4900	--	20
1,1,2,2-Tetrachloroethane	ND		ug/kg	610	--	20
Benzene	ND		ug/kg	610	--	20
Toluene	ND		ug/kg	1200	--	20
Ethylbenzene	3700		ug/kg	1200	--	20
Chloromethane	ND		ug/kg	4900	--	20
Bromomethane	ND		ug/kg	2400	--	20
Vinyl chloride	ND		ug/kg	1200	--	20
Chloroethane	ND		ug/kg	2400	--	20
1,1-Dichloroethene	ND		ug/kg	1200	--	20
trans-1,2-Dichloroethene	ND		ug/kg	1800	--	20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D Date Collected: 08/06/20 14:10
Client ID: B-102 13-15 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	610	--	20
1,2-Dichlorobenzene	ND		ug/kg	2400	--	20
1,3-Dichlorobenzene	ND		ug/kg	2400	--	20
1,4-Dichlorobenzene	ND		ug/kg	2400	--	20
Methyl tert butyl ether	ND		ug/kg	2400	--	20
p/m-Xylene	61000		ug/kg	2400	--	20
o-Xylene	ND		ug/kg	1200	--	20
Xylenes, Total	61000		ug/kg	1200	--	20
cis-1,2-Dichloroethene	ND		ug/kg	1200	--	20
1,2-Dichloroethene, Total	ND		ug/kg	1200	--	20
Dibromomethane	ND		ug/kg	2400	--	20
1,2,3-Trichloropropane	ND		ug/kg	2400	--	20
Styrene	ND		ug/kg	1200	--	20
Dichlorodifluoromethane	ND		ug/kg	12000	--	20
Acetone	ND		ug/kg	12000	--	20
Carbon disulfide	ND		ug/kg	12000	--	20
Methyl ethyl ketone	ND		ug/kg	12000	--	20
Methyl isobutyl ketone	ND		ug/kg	12000	--	20
2-Hexanone	ND		ug/kg	12000	--	20
Bromochloromethane	ND		ug/kg	2400	--	20
Tetrahydrofuran	ND		ug/kg	4900	--	20
2,2-Dichloropropane	ND		ug/kg	2400	--	20
1,2-Dibromoethane	ND		ug/kg	1200	--	20
1,3-Dichloropropane	ND		ug/kg	2400	--	20
1,1,1,2-Tetrachloroethane	ND		ug/kg	610	--	20
Bromobenzene	ND		ug/kg	2400	--	20
n-Butylbenzene	21000		ug/kg	1200	--	20
sec-Butylbenzene	8200		ug/kg	1200	--	20
tert-Butylbenzene	ND		ug/kg	2400	--	20
o-Chlorotoluene	ND		ug/kg	2400	--	20
p-Chlorotoluene	ND		ug/kg	2400	--	20
1,2-Dibromo-3-chloropropane	ND		ug/kg	3600	--	20
Hexachlorobutadiene	ND		ug/kg	4900	--	20
Isopropylbenzene	10000		ug/kg	1200	--	20
p-Isopropyltoluene	5700		ug/kg	1200	--	20
Naphthalene	63000		ug/kg	4900	--	20
n-Propylbenzene	38000		ug/kg	1200	--	20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D Date Collected: 08/06/20 14:10

Client ID: B-102 13-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2400	--	20
1,2,4-Trichlorobenzene	ND		ug/kg	2400	--	20
1,3,5-Trimethylbenzene	72000		ug/kg	2400	--	20
1,2,4-Trimethylbenzene	430000	E	ug/kg	2400	--	20
Diethyl ether	ND		ug/kg	2400	--	20
Diisopropyl Ether	ND		ug/kg	2400	--	20
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2400	--	20
Tertiary-Amyl Methyl Ether	ND		ug/kg	2400	--	20
1,4-Dioxane	ND		ug/kg	97000	--	20

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	86		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	99		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 00:50
Analyst: JC
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.8	--	1
1,1-Dichloroethane	ND		ug/kg	0.75	--	1
Chloroform	ND		ug/kg	1.1	--	1
Carbon tetrachloride	ND		ug/kg	0.75	--	1
1,2-Dichloropropane	ND		ug/kg	0.75	--	1
Dibromochloromethane	ND		ug/kg	0.75	--	1
1,1,2-Trichloroethane	ND		ug/kg	0.75	--	1
Tetrachloroethene	ND		ug/kg	0.38	--	1
Chlorobenzene	ND		ug/kg	0.38	--	1
Trichlorofluoromethane	ND		ug/kg	3.0	--	1
1,2-Dichloroethane	ND		ug/kg	0.75	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.38	--	1
Bromodichloromethane	ND		ug/kg	0.38	--	1
trans-1,3-Dichloropropene	ND		ug/kg	0.75	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.38	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.38	--	1
1,1-Dichloropropene	ND		ug/kg	0.38	--	1
Bromoform	ND		ug/kg	3.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.38	--	1
Benzene	ND		ug/kg	0.38	--	1
Toluene	ND		ug/kg	0.75	--	1
Ethylbenzene	ND		ug/kg	0.75	--	1
Chloromethane	ND		ug/kg	3.0	--	1
Bromomethane	ND		ug/kg	1.5	--	1
Vinyl chloride	ND		ug/kg	0.75	--	1
Chloroethane	ND		ug/kg	1.5	--	1
1,1-Dichloroethene	ND		ug/kg	0.75	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.1	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09 Date Collected: 08/06/20 15:05

Client ID: B-108 15-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.38	--	1
1,2-Dichlorobenzene	ND		ug/kg	1.5	--	1
1,3-Dichlorobenzene	ND		ug/kg	1.5	--	1
1,4-Dichlorobenzene	ND		ug/kg	1.5	--	1
Methyl tert butyl ether	ND		ug/kg	1.5	--	1
p/m-Xylene	ND		ug/kg	1.5	--	1
o-Xylene	ND		ug/kg	0.75	--	1
Xylenes, Total	ND		ug/kg	0.75	--	1
cis-1,2-Dichloroethene	ND		ug/kg	0.75	--	1
1,2-Dichloroethene, Total	ND		ug/kg	0.75	--	1
Dibromomethane	ND		ug/kg	1.5	--	1
1,2,3-Trichloropropane	ND		ug/kg	1.5	--	1
Styrene	ND		ug/kg	0.75	--	1
Dichlorodifluoromethane	ND		ug/kg	7.5	--	1
Acetone	ND		ug/kg	19	--	1
Carbon disulfide	ND		ug/kg	7.5	--	1
Methyl ethyl ketone	ND		ug/kg	7.5	--	1
Methyl isobutyl ketone	ND		ug/kg	7.5	--	1
2-Hexanone	ND		ug/kg	7.5	--	1
Bromochloromethane	ND		ug/kg	1.5	--	1
Tetrahydrofuran	ND		ug/kg	3.0	--	1
2,2-Dichloropropane	ND		ug/kg	1.5	--	1
1,2-Dibromoethane	ND		ug/kg	0.75	--	1
1,3-Dichloropropane	ND		ug/kg	1.5	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.38	--	1
Bromobenzene	ND		ug/kg	1.5	--	1
n-Butylbenzene	ND		ug/kg	0.75	--	1
sec-Butylbenzene	ND		ug/kg	0.75	--	1
tert-Butylbenzene	ND		ug/kg	1.5	--	1
o-Chlorotoluene	ND		ug/kg	1.5	--	1
p-Chlorotoluene	ND		ug/kg	1.5	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.2	--	1
Hexachlorobutadiene	ND		ug/kg	3.0	--	1
Isopropylbenzene	ND		ug/kg	0.75	--	1
p-Isopropyltoluene	ND		ug/kg	0.75	--	1
Naphthalene	ND		ug/kg	3.0	--	1
n-Propylbenzene	ND		ug/kg	0.75	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09 Date Collected: 08/06/20 15:05

Client ID: B-108 15-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	1.5	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.5	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.5	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.5	--	1
Diethyl ether	ND		ug/kg	1.5	--	1
Diisopropyl Ether	ND		ug/kg	1.5	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	1.5	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	1.5	--	1
1,4-Dioxane	ND		ug/kg	60	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	102		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00
Client ID: TRIP BLANK Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 21:21
Analyst: JC
Percent Solids: Results reported on an 'AS RECEIVED' basis.

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	250	--	1
1,1-Dichloroethane	ND		ug/kg	50	--	1
Chloroform	ND		ug/kg	75	--	1
Carbon tetrachloride	ND		ug/kg	50	--	1
1,2-Dichloropropane	ND		ug/kg	50	--	1
Dibromochloromethane	ND		ug/kg	50	--	1
1,1,2-Trichloroethane	ND		ug/kg	50	--	1
Tetrachloroethene	ND		ug/kg	25	--	1
Chlorobenzene	ND		ug/kg	25	--	1
Trichlorofluoromethane	ND		ug/kg	200	--	1
1,2-Dichloroethane	ND		ug/kg	50	--	1
1,1,1-Trichloroethane	ND		ug/kg	25	--	1
Bromodichloromethane	ND		ug/kg	25	--	1
trans-1,3-Dichloropropene	ND		ug/kg	50	--	1
cis-1,3-Dichloropropene	ND		ug/kg	25	--	1
1,3-Dichloropropene, Total	ND		ug/kg	25	--	1
1,1-Dichloropropene	ND		ug/kg	25	--	1
Bromoform	ND		ug/kg	200	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--	1
Benzene	ND		ug/kg	25	--	1
Toluene	ND		ug/kg	50	--	1
Ethylbenzene	ND		ug/kg	50	--	1
Chloromethane	ND		ug/kg	200	--	1
Bromomethane	ND		ug/kg	100	--	1
Vinyl chloride	ND		ug/kg	50	--	1
Chloroethane	ND		ug/kg	100	--	1
1,1-Dichloroethene	ND		ug/kg	50	--	1
trans-1,2-Dichloroethene	ND		ug/kg	75	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	25	--	1
1,2-Dichlorobenzene	ND		ug/kg	100	--	1
1,3-Dichlorobenzene	ND		ug/kg	100	--	1
1,4-Dichlorobenzene	ND		ug/kg	100	--	1
Methyl tert butyl ether	ND		ug/kg	100	--	1
p/m-Xylene	ND		ug/kg	100	--	1
o-Xylene	ND		ug/kg	50	--	1
Xylenes, Total	ND		ug/kg	50	--	1
cis-1,2-Dichloroethene	ND		ug/kg	50	--	1
1,2-Dichloroethene, Total	ND		ug/kg	50	--	1
Dibromomethane	ND		ug/kg	100	--	1
1,2,3-Trichloropropane	ND		ug/kg	100	--	1
Styrene	ND		ug/kg	50	--	1
Dichlorodifluoromethane	ND		ug/kg	500	--	1
Acetone	ND		ug/kg	500	--	1
Carbon disulfide	ND		ug/kg	500	--	1
Methyl ethyl ketone	ND		ug/kg	500	--	1
Methyl isobutyl ketone	ND		ug/kg	500	--	1
2-Hexanone	ND		ug/kg	500	--	1
Bromochloromethane	ND		ug/kg	100	--	1
Tetrahydrofuran	ND		ug/kg	200	--	1
2,2-Dichloropropane	ND		ug/kg	100	--	1
1,2-Dibromoethane	ND		ug/kg	50	--	1
1,3-Dichloropropane	ND		ug/kg	100	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--	1
Bromobenzene	ND		ug/kg	100	--	1
n-Butylbenzene	ND		ug/kg	50	--	1
sec-Butylbenzene	ND		ug/kg	50	--	1
tert-Butylbenzene	ND		ug/kg	100	--	1
o-Chlorotoluene	ND		ug/kg	100	--	1
p-Chlorotoluene	ND		ug/kg	100	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--	1
Hexachlorobutadiene	ND		ug/kg	200	--	1
Isopropylbenzene	ND		ug/kg	50	--	1
p-Isopropyltoluene	ND		ug/kg	50	--	1
Naphthalene	ND		ug/kg	200	--	1
n-Propylbenzene	ND		ug/kg	50	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10
Client ID: TRIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 00:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	100	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	100	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	100	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	100	--	1
Diethyl ether	ND		ug/kg	100	--	1
Diisopropyl Ether	ND		ug/kg	100	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--	1
1,4-Dioxane	ND		ug/kg	4000	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	91		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	101		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00
Client ID: TRIP BLANK Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 21:47
Analyst: JC
Percent Solids: Results reported on an 'AS RECEIVED' basis.

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.0	--	1
1,1-Dichloroethane	ND		ug/kg	1.0	--	1
Chloroform	ND		ug/kg	1.5	--	1
Carbon tetrachloride	ND		ug/kg	1.0	--	1
1,2-Dichloropropane	ND		ug/kg	1.0	--	1
Dibromochloromethane	ND		ug/kg	1.0	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.0	--	1
Tetrachloroethene	ND		ug/kg	0.50	--	1
Chlorobenzene	ND		ug/kg	0.50	--	1
Trichlorofluoromethane	ND		ug/kg	4.0	--	1
1,2-Dichloroethane	ND		ug/kg	1.0	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.50	--	1
Bromodichloromethane	ND		ug/kg	0.50	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--	1
1,1-Dichloropropene	ND		ug/kg	0.50	--	1
Bromoform	ND		ug/kg	4.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--	1
Benzene	ND		ug/kg	0.50	--	1
Toluene	ND		ug/kg	1.0	--	1
Ethylbenzene	3.5		ug/kg	1.0	--	1
Chloromethane	ND		ug/kg	4.0	--	1
Bromomethane	ND		ug/kg	2.0	--	1
Vinyl chloride	ND		ug/kg	1.0	--	1
Chloroethane	ND		ug/kg	2.0	--	1
1,1-Dichloroethene	ND		ug/kg	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	0.52		ug/kg	0.50	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.0	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.0	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.0	--	1
Methyl tert butyl ether	ND		ug/kg	2.0	--	1
p/m-Xylene	16		ug/kg	2.0	--	1
o-Xylene	2.0		ug/kg	1.0	--	1
Xylenes, Total	18		ug/kg	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--	1
Dibromomethane	ND		ug/kg	2.0	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.0	--	1
Styrene	ND		ug/kg	1.0	--	1
Dichlorodifluoromethane	ND		ug/kg	10	--	1
Acetone	ND		ug/kg	25	--	1
Carbon disulfide	ND		ug/kg	10	--	1
Methyl ethyl ketone	ND		ug/kg	10	--	1
Methyl isobutyl ketone	ND		ug/kg	10	--	1
2-Hexanone	ND		ug/kg	10	--	1
Bromochloromethane	ND		ug/kg	2.0	--	1
Tetrahydrofuran	ND		ug/kg	4.0	--	1
2,2-Dichloropropane	ND		ug/kg	2.0	--	1
1,2-Dibromoethane	ND		ug/kg	1.0	--	1
1,3-Dichloropropane	ND		ug/kg	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--	1
Bromobenzene	ND		ug/kg	2.0	--	1
n-Butylbenzene	ND		ug/kg	1.0	--	1
sec-Butylbenzene	ND		ug/kg	1.0	--	1
tert-Butylbenzene	ND		ug/kg	2.0	--	1
o-Chlorotoluene	ND		ug/kg	2.0	--	1
p-Chlorotoluene	ND		ug/kg	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--	1
Hexachlorobutadiene	ND		ug/kg	4.0	--	1
Isopropylbenzene	ND		ug/kg	1.0	--	1
p-Isopropyltoluene	ND		ug/kg	1.0	--	1
Naphthalene	ND		ug/kg	4.0	--	1
n-Propylbenzene	1.3		ug/kg	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--	1
1,2,4-Trimethylbenzene	3.1		ug/kg	2.0	--	1
Diethyl ether	ND		ug/kg	2.0	--	1
Diisopropyl Ether	ND		ug/kg	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--	1
1,4-Dioxane	ND		ug/kg	80	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	102		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	98		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 08:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:34
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11 Date Collected: 08/06/20 08:00

Client ID: EQUIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 08:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	106		70-130
Toluene-d8	97		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	105		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	102		70-130
Toluene-d8	98		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	105		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
Methylene chloride	ND		ug/kg	250	--
1,1-Dichloroethane	ND		ug/kg	50	--
Chloroform	ND		ug/kg	75	--
Carbon tetrachloride	ND		ug/kg	50	--
1,2-Dichloropropane	ND		ug/kg	50	--
Dibromochloromethane	ND		ug/kg	50	--
1,1,2-Trichloroethane	ND		ug/kg	50	--
Tetrachloroethene	ND		ug/kg	25	--
Chlorobenzene	ND		ug/kg	25	--
Trichlorofluoromethane	ND		ug/kg	200	--
1,2-Dichloroethane	ND		ug/kg	50	--
1,1,1-Trichloroethane	ND		ug/kg	25	--
Bromodichloromethane	ND		ug/kg	25	--
trans-1,3-Dichloropropene	ND		ug/kg	50	--
cis-1,3-Dichloropropene	ND		ug/kg	25	--
1,3-Dichloropropene, Total	ND		ug/kg	25	--
1,1-Dichloropropene	ND		ug/kg	25	--
Bromoform	ND		ug/kg	200	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--
Benzene	ND		ug/kg	25	--
Toluene	ND		ug/kg	50	--
Ethylbenzene	ND		ug/kg	50	--
Chloromethane	ND		ug/kg	200	--
Bromomethane	ND		ug/kg	100	--
Vinyl chloride	ND		ug/kg	50	--
Chloroethane	ND		ug/kg	100	--
1,1-Dichloroethene	ND		ug/kg	50	--
trans-1,2-Dichloroethene	ND		ug/kg	75	--
Trichloroethene	ND		ug/kg	25	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
1,2-Dichlorobenzene	ND		ug/kg	100	--
1,3-Dichlorobenzene	ND		ug/kg	100	--
1,4-Dichlorobenzene	ND		ug/kg	100	--
Methyl tert butyl ether	ND		ug/kg	100	--
p/m-Xylene	ND		ug/kg	100	--
o-Xylene	ND		ug/kg	50	--
Xylenes, Total	ND		ug/kg	50	--
cis-1,2-Dichloroethene	ND		ug/kg	50	--
1,2-Dichloroethene, Total	ND		ug/kg	50	--
Dibromomethane	ND		ug/kg	100	--
1,2,3-Trichloropropane	ND		ug/kg	100	--
Styrene	ND		ug/kg	50	--
Dichlorodifluoromethane	ND		ug/kg	500	--
Acetone	ND		ug/kg	500	--
Carbon disulfide	ND		ug/kg	500	--
Methyl ethyl ketone	ND		ug/kg	500	--
Methyl isobutyl ketone	ND		ug/kg	500	--
2-Hexanone	ND		ug/kg	500	--
Bromochloromethane	ND		ug/kg	100	--
Tetrahydrofuran	ND		ug/kg	200	--
2,2-Dichloropropane	ND		ug/kg	100	--
1,2-Dibromoethane	ND		ug/kg	50	--
1,3-Dichloropropane	ND		ug/kg	100	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--
Bromobenzene	ND		ug/kg	100	--
n-Butylbenzene	ND		ug/kg	50	--
sec-Butylbenzene	ND		ug/kg	50	--
tert-Butylbenzene	ND		ug/kg	100	--
o-Chlorotoluene	ND		ug/kg	100	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
p-Chlorotoluene	ND		ug/kg	100	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--
Hexachlorobutadiene	ND		ug/kg	200	--
Isopropylbenzene	ND		ug/kg	50	--
p-Isopropyltoluene	ND		ug/kg	50	--
Naphthalene	ND		ug/kg	200	--
n-Propylbenzene	ND		ug/kg	50	--
1,2,3-Trichlorobenzene	ND		ug/kg	100	--
1,2,4-Trichlorobenzene	ND		ug/kg	100	--
1,3,5-Trimethylbenzene	ND		ug/kg	100	--
1,2,4-Trimethylbenzene	ND		ug/kg	100	--
Diethyl ether	ND		ug/kg	100	--
Diisopropyl Ether	ND		ug/kg	100	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--
1,4-Dioxane	ND		ug/kg	4000	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	97		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
Methylene chloride	ND		ug/kg	250	--
1,1-Dichloroethane	ND		ug/kg	50	--
Chloroform	ND		ug/kg	75	--
Carbon tetrachloride	ND		ug/kg	50	--
1,2-Dichloropropane	ND		ug/kg	50	--
Dibromochloromethane	ND		ug/kg	50	--
1,1,2-Trichloroethane	ND		ug/kg	50	--
Tetrachloroethene	ND		ug/kg	25	--
Chlorobenzene	ND		ug/kg	25	--
Trichlorofluoromethane	ND		ug/kg	200	--
1,2-Dichloroethane	ND		ug/kg	50	--
1,1,1-Trichloroethane	ND		ug/kg	25	--
Bromodichloromethane	ND		ug/kg	25	--
trans-1,3-Dichloropropene	ND		ug/kg	50	--
cis-1,3-Dichloropropene	ND		ug/kg	25	--
1,3-Dichloropropene, Total	ND		ug/kg	25	--
1,1-Dichloropropene	ND		ug/kg	25	--
Bromoform	ND		ug/kg	200	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--
Benzene	ND		ug/kg	25	--
Toluene	ND		ug/kg	50	--
Ethylbenzene	ND		ug/kg	50	--
Chloromethane	ND		ug/kg	200	--
Bromomethane	ND		ug/kg	100	--
Vinyl chloride	ND		ug/kg	50	--
Chloroethane	ND		ug/kg	100	--
1,1-Dichloroethene	ND		ug/kg	50	--
trans-1,2-Dichloroethene	ND		ug/kg	75	--
Trichloroethene	ND		ug/kg	25	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
1,2-Dichlorobenzene	ND		ug/kg	100	--
1,3-Dichlorobenzene	ND		ug/kg	100	--
1,4-Dichlorobenzene	ND		ug/kg	100	--
Methyl tert butyl ether	ND		ug/kg	100	--
p/m-Xylene	ND		ug/kg	100	--
o-Xylene	ND		ug/kg	50	--
Xylenes, Total	ND		ug/kg	50	--
cis-1,2-Dichloroethene	ND		ug/kg	50	--
1,2-Dichloroethene, Total	ND		ug/kg	50	--
Dibromomethane	ND		ug/kg	100	--
1,2,3-Trichloropropane	ND		ug/kg	100	--
Styrene	ND		ug/kg	50	--
Dichlorodifluoromethane	ND		ug/kg	500	--
Acetone	ND		ug/kg	500	--
Carbon disulfide	ND		ug/kg	500	--
Methyl ethyl ketone	ND		ug/kg	500	--
Methyl isobutyl ketone	ND		ug/kg	500	--
2-Hexanone	ND		ug/kg	500	--
Bromochloromethane	ND		ug/kg	100	--
Tetrahydrofuran	ND		ug/kg	200	--
2,2-Dichloropropane	ND		ug/kg	100	--
1,2-Dibromoethane	ND		ug/kg	50	--
1,3-Dichloropropane	ND		ug/kg	100	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--
Bromobenzene	ND		ug/kg	100	--
n-Butylbenzene	ND		ug/kg	50	--
sec-Butylbenzene	ND		ug/kg	50	--
tert-Butylbenzene	ND		ug/kg	100	--
o-Chlorotoluene	ND		ug/kg	100	--

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
p-Chlorotoluene	ND		ug/kg	100	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--
Hexachlorobutadiene	ND		ug/kg	200	--
Isopropylbenzene	ND		ug/kg	50	--
p-Isopropyltoluene	ND		ug/kg	50	--
Naphthalene	ND		ug/kg	200	--
n-Propylbenzene	ND		ug/kg	50	--
1,2,3-Trichlorobenzene	ND		ug/kg	100	--
1,2,4-Trichlorobenzene	ND		ug/kg	100	--
1,3,5-Trimethylbenzene	ND		ug/kg	100	--
1,2,4-Trimethylbenzene	ND		ug/kg	100	--
Diethyl ether	ND		ug/kg	100	--
Diisopropyl Ether	ND		ug/kg	100	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--
1,4-Dioxane	ND		ug/kg	4000	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	93		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
Methylene chloride	ND		ug/kg	5.0	--
1,1-Dichloroethane	ND		ug/kg	1.0	--
Chloroform	ND		ug/kg	1.5	--
Carbon tetrachloride	ND		ug/kg	1.0	--
1,2-Dichloropropane	ND		ug/kg	1.0	--
Dibromochloromethane	ND		ug/kg	1.0	--
1,1,2-Trichloroethane	ND		ug/kg	1.0	--
Tetrachloroethene	ND		ug/kg	0.50	--
Chlorobenzene	ND		ug/kg	0.50	--
Trichlorofluoromethane	ND		ug/kg	4.0	--
1,2-Dichloroethane	ND		ug/kg	1.0	--
1,1,1-Trichloroethane	ND		ug/kg	0.50	--
Bromodichloromethane	ND		ug/kg	0.50	--
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--
1,1-Dichloropropene	ND		ug/kg	0.50	--
Bromoform	ND		ug/kg	4.0	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--
Benzene	ND		ug/kg	0.50	--
Toluene	ND		ug/kg	1.0	--
Ethylbenzene	ND		ug/kg	1.0	--
Chloromethane	ND		ug/kg	4.0	--
Bromomethane	ND		ug/kg	2.0	--
Vinyl chloride	ND		ug/kg	1.0	--
Chloroethane	ND		ug/kg	2.0	--
1,1-Dichloroethene	ND		ug/kg	1.0	--
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--
Trichloroethene	ND		ug/kg	0.50	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	--
1,3-Dichlorobenzene	ND		ug/kg	2.0	--
1,4-Dichlorobenzene	ND		ug/kg	2.0	--
Methyl tert butyl ether	ND		ug/kg	2.0	--
p/m-Xylene	ND		ug/kg	2.0	--
o-Xylene	ND		ug/kg	1.0	--
Xylenes, Total	ND		ug/kg	1.0	--
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--
Dibromomethane	ND		ug/kg	2.0	--
1,2,3-Trichloropropane	ND		ug/kg	2.0	--
Styrene	ND		ug/kg	1.0	--
Dichlorodifluoromethane	ND		ug/kg	10	--
Acetone	ND		ug/kg	25	--
Carbon disulfide	ND		ug/kg	10	--
Methyl ethyl ketone	ND		ug/kg	10	--
Methyl isobutyl ketone	ND		ug/kg	10	--
2-Hexanone	ND		ug/kg	10	--
Bromochloromethane	ND		ug/kg	2.0	--
Tetrahydrofuran	ND		ug/kg	4.0	--
2,2-Dichloropropane	ND		ug/kg	2.0	--
1,2-Dibromoethane	ND		ug/kg	1.0	--
1,3-Dichloropropane	ND		ug/kg	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--
Bromobenzene	ND		ug/kg	2.0	--
n-Butylbenzene	ND		ug/kg	1.0	--
sec-Butylbenzene	ND		ug/kg	1.0	--
tert-Butylbenzene	ND		ug/kg	2.0	--
o-Chlorotoluene	ND		ug/kg	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
p-Chlorotoluene	ND		ug/kg	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--
Hexachlorobutadiene	ND		ug/kg	4.0	--
Isopropylbenzene	ND		ug/kg	1.0	--
p-Isopropyltoluene	ND		ug/kg	1.0	--
Naphthalene	ND		ug/kg	4.0	--
n-Propylbenzene	ND		ug/kg	1.0	--
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	--
Diethyl ether	ND		ug/kg	2.0	--
Diisopropyl Ether	ND		ug/kg	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--
1,4-Dioxane	ND		ug/kg	80	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	93		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
Methylene chloride	ND		ug/kg	5.0	--
1,1-Dichloroethane	ND		ug/kg	1.0	--
Chloroform	ND		ug/kg	1.5	--
Carbon tetrachloride	ND		ug/kg	1.0	--
1,2-Dichloropropane	ND		ug/kg	1.0	--
Dibromochloromethane	ND		ug/kg	1.0	--
1,1,2-Trichloroethane	ND		ug/kg	1.0	--
Tetrachloroethene	ND		ug/kg	0.50	--
Chlorobenzene	ND		ug/kg	0.50	--
Trichlorofluoromethane	ND		ug/kg	4.0	--
1,2-Dichloroethane	ND		ug/kg	1.0	--
1,1,1-Trichloroethane	ND		ug/kg	0.50	--
Bromodichloromethane	ND		ug/kg	0.50	--
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--
1,1-Dichloropropene	ND		ug/kg	0.50	--
Bromoform	ND		ug/kg	4.0	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--
Benzene	ND		ug/kg	0.50	--
Toluene	ND		ug/kg	1.0	--
Ethylbenzene	ND		ug/kg	1.0	--
Chloromethane	ND		ug/kg	4.0	--
Bromomethane	ND		ug/kg	2.0	--
Vinyl chloride	ND		ug/kg	1.0	--
Chloroethane	ND		ug/kg	2.0	--
1,1-Dichloroethene	ND		ug/kg	1.0	--
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--
Trichloroethene	ND		ug/kg	0.50	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	--
1,3-Dichlorobenzene	ND		ug/kg	2.0	--
1,4-Dichlorobenzene	ND		ug/kg	2.0	--
Methyl tert butyl ether	ND		ug/kg	2.0	--
p/m-Xylene	ND		ug/kg	2.0	--
o-Xylene	ND		ug/kg	1.0	--
Xylenes, Total	ND		ug/kg	1.0	--
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--
Dibromomethane	ND		ug/kg	2.0	--
1,2,3-Trichloropropane	ND		ug/kg	2.0	--
Styrene	ND		ug/kg	1.0	--
Dichlorodifluoromethane	ND		ug/kg	10	--
Acetone	ND		ug/kg	25	--
Carbon disulfide	ND		ug/kg	10	--
Methyl ethyl ketone	ND		ug/kg	10	--
Methyl isobutyl ketone	ND		ug/kg	10	--
2-Hexanone	ND		ug/kg	10	--
Bromochloromethane	ND		ug/kg	2.0	--
Tetrahydrofuran	ND		ug/kg	4.0	--
2,2-Dichloropropane	ND		ug/kg	2.0	--
1,2-Dibromoethane	ND		ug/kg	1.0	--
1,3-Dichloropropane	ND		ug/kg	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--
Bromobenzene	ND		ug/kg	2.0	--
n-Butylbenzene	ND		ug/kg	1.0	--
sec-Butylbenzene	ND		ug/kg	1.0	--
tert-Butylbenzene	ND		ug/kg	2.0	--
o-Chlorotoluene	ND		ug/kg	2.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
p-Chlorotoluene	ND		ug/kg	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--
Hexachlorobutadiene	ND		ug/kg	4.0	--
Isopropylbenzene	ND		ug/kg	1.0	--
p-Isopropyltoluene	ND		ug/kg	1.0	--
Naphthalene	ND		ug/kg	4.0	--
n-Propylbenzene	ND		ug/kg	1.0	--
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	--
Diethyl ether	ND		ug/kg	2.0	--
Diisopropyl Ether	ND		ug/kg	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--
1,4-Dioxane	ND		ug/kg	80	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	97		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Methylene chloride	120		110		70-130	9		20
1,1-Dichloroethane	120		120		70-130	0		20
Chloroform	110		100		70-130	10		20
Carbon tetrachloride	100		100		70-130	0		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	92		96		70-130	4		20
1,1,2-Trichloroethane	100		110		70-130	10		20
Tetrachloroethene	110		110		70-130	0		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	120		120		70-130	0		20
1,2-Dichloroethane	110		110		70-130	0		20
1,1,1-Trichloroethane	110		110		70-130	0		20
Bromodichloromethane	99		100		70-130	1		20
trans-1,3-Dichloropropene	92		97		70-130	5		20
cis-1,3-Dichloropropene	97		98		70-130	1		20
1,1-Dichloropropene	96		97		70-130	1		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	100		110		70-130	10		20
Benzene	100		100		70-130	0		20
Toluene	110		100		70-130	10		20
Ethylbenzene	110		110		70-130	0		20
Chloromethane	94		90		70-130	4		20
Bromomethane	75		82		70-130	9		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Vinyl chloride	120		120		70-130	0		20
Chloroethane	120		120		70-130	0		20
1,1-Dichloroethene	120		120		70-130	0		20
trans-1,2-Dichloroethene	120		110		70-130	9		20
Trichloroethene	110		110		70-130	0		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	100		100		70-130	0		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	100		110		70-130	10		20
p/m-Xylene	110		110		70-130	0		20
o-Xylene	105		105		70-130	0		20
cis-1,2-Dichloroethene	110		100		70-130	10		20
Dibromomethane	110		110		70-130	0		20
1,2,3-Trichloropropane	100		110		70-130	10		20
Styrene	110		110		70-130	0		20
Dichlorodifluoromethane	100		100		70-130	0		20
Acetone	120		130		70-130	8		20
Carbon disulfide	110		110		70-130	0		20
Methyl ethyl ketone	100		100		70-130	0		20
Methyl isobutyl ketone	99		100		70-130	1		20
2-Hexanone	94		99		70-130	5		20
Bromochloromethane	110		100		70-130	10		20
Tetrahydrofuran	100		110		70-130	10		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
2,2-Dichloropropane	100		100		70-130	0		20
1,2-Dibromoethane	98		100		70-130	2		20
1,3-Dichloropropane	100		100		70-130	0		20
1,1,1,2-Tetrachloroethane	96		99		70-130	3		20
Bromobenzene	99		100		70-130	1		20
n-Butylbenzene	110		110		70-130	0		20
sec-Butylbenzene	120		110		70-130	9		20
tert-Butylbenzene	110		110		70-130	0		20
o-Chlorotoluene	110		110		70-130	0		20
p-Chlorotoluene	100		100		70-130	0		20
1,2-Dibromo-3-chloropropane	88		94		70-130	7		20
Hexachlorobutadiene	120		110		70-130	9		20
Isopropylbenzene	110		110		70-130	0		20
p-Isopropyltoluene	110		110		70-130	0		20
Naphthalene	97		100		70-130	3		20
n-Propylbenzene	110		110		70-130	0		20
1,2,3-Trichlorobenzene	100		100		70-130	0		20
1,2,4-Trichlorobenzene	100		100		70-130	0		20
1,3,5-Trimethylbenzene	100		100		70-130	0		20
1,2,4-Trimethylbenzene	100		100		70-130	0		20
Diethyl ether	110		120		70-130	9		20
Diisopropyl Ether	110		110		70-130	0		20
Ethyl-Tert-Butyl-Ether	100		110		70-130	10		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Tertiary-Amyl Methyl Ether	94		98		70-130	4		20
1,4-Dioxane	100		102		70-130	2		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	100		101		70-130
Toluene-d8	98		100		70-130
4-Bromofluorobenzene	97		95		70-130
Dibromofluoromethane	99		97		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Methylene chloride	92		84		70-130	9		20
1,1-Dichloroethane	84		83		70-130	1		20
Chloroform	89		91		70-130	2		20
Carbon tetrachloride	87		90		70-130	3		20
1,2-Dichloropropane	89		90		70-130	1		20
Dibromochloromethane	91		94		70-130	3		20
1,1,2-Trichloroethane	84		88		70-130	5		20
Tetrachloroethene	78		81		70-130	4		20
Chlorobenzene	90		88		70-130	2		20
Trichlorofluoromethane	87		86		70-130	1		20
1,2-Dichloroethane	82		83		70-130	1		20
1,1,1-Trichloroethane	84		86		70-130	2		20
Bromodichloromethane	89		94		70-130	5		20
trans-1,3-Dichloropropene	80		86		70-130	7		20
cis-1,3-Dichloropropene	91		91		70-130	0		20
1,1-Dichloropropene	89		86		70-130	3		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	89		91		70-130	2		20
Benzene	89		88		70-130	1		20
Toluene	84		88		70-130	5		20
Ethylbenzene	90		89		70-130	1		20
Chloromethane	87		86		70-130	1		20
Bromomethane	107		102		70-130	5		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Vinyl chloride	78		76		70-130	3		20
Chloroethane	84		84		70-130	0		20
1,1-Dichloroethene	94		87		70-130	8		20
trans-1,2-Dichloroethene	104		95		70-130	9		20
Trichloroethene	83		81		70-130	2		20
1,2-Dichlorobenzene	93		89		70-130	4		20
1,3-Dichlorobenzene	92		86		70-130	7		20
1,4-Dichlorobenzene	91		86		70-130	6		20
Methyl tert butyl ether	101		94		70-130	7		20
p/m-Xylene	83		86		70-130	4		20
o-Xylene	92		100		70-130	8		20
cis-1,2-Dichloroethene	88		90		70-130	2		20
Dibromomethane	90		94		70-130	4		20
1,2,3-Trichloropropane	83		83		70-130	0		20
Styrene	83		89		70-130	7		20
Dichlorodifluoromethane	89		85		70-130	5		20
Acetone	94		96		70-130	2		20
Carbon disulfide	79		73		70-130	8		20
Methyl ethyl ketone	85		89		70-130	5		20
Methyl isobutyl ketone	79		85		70-130	7		20
2-Hexanone	88		88		70-130	0		20
Bromochloromethane	94		96		70-130	2		20
Tetrahydrofuran	84		90		70-130	7		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
2,2-Dichloropropane	86		86		70-130	0		20
1,2-Dibromoethane	96		94		70-130	2		20
1,3-Dichloropropane	85		89		70-130	5		20
1,1,1,2-Tetrachloroethane	87		88		70-130	1		20
Bromobenzene	94		95		70-130	1		20
n-Butylbenzene	86		78		70-130	10		20
sec-Butylbenzene	101		97		70-130	4		20
tert-Butylbenzene	100		96		70-130	4		20
o-Chlorotoluene	92		87		70-130	6		20
p-Chlorotoluene	90		85		70-130	6		20
1,2-Dibromo-3-chloropropane	91		94		70-130	3		20
Hexachlorobutadiene	91		87		70-130	4		20
Isopropylbenzene	99		103		70-130	4		20
p-Isopropyltoluene	98		92		70-130	6		20
Naphthalene	98		98		70-130	0		20
n-Propylbenzene	92		88		70-130	4		20
1,2,3-Trichlorobenzene	93		87		70-130	7		20
1,2,4-Trichlorobenzene	92		83		70-130	10		20
1,3,5-Trimethylbenzene	93		89		70-130	4		20
1,2,4-Trimethylbenzene	94		88		70-130	7		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	89		88		70-130	1		20
Ethyl-Tert-Butyl-Ether	88		87		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Tertiary-Amyl Methyl Ether	92		92		70-130	0		20
1,4-Dioxane	123		117		70-130	5		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	88		89		70-130
Toluene-d8	93		99		70-130
4-Bromofluorobenzene	98		103		70-130
Dibromofluoromethane	98		101		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Methylene chloride	85		89		70-130	5		20
1,1-Dichloroethane	83		88		70-130	6		20
Chloroform	86		90		70-130	5		20
Carbon tetrachloride	86		90		70-130	5		20
1,2-Dichloropropane	87		92		70-130	6		20
Dibromochloromethane	94		99		70-130	5		20
1,1,2-Trichloroethane	80		92		70-130	14		20
Tetrachloroethene	80		88		70-130	10		20
Chlorobenzene	90		94		70-130	4		20
Trichlorofluoromethane	87		93		70-130	7		20
1,2-Dichloroethane	83		89		70-130	7		20
1,1,1-Trichloroethane	83		86		70-130	4		20
Bromodichloromethane	87		94		70-130	8		20
trans-1,3-Dichloropropene	82		94		70-130	14		20
cis-1,3-Dichloropropene	92		98		70-130	6		20
1,1-Dichloropropene	87		92		70-130	6		20
Bromoform	85		88		70-130	3		20
1,1,2,2-Tetrachloroethane	87		92		70-130	6		20
Benzene	88		93		70-130	6		20
Toluene	82		95		70-130	15		20
Ethylbenzene	92		96		70-130	4		20
Chloromethane	88		87		70-130	1		20
Bromomethane	120		119		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Vinyl chloride	83		86		70-130	4		20
Chloroethane	90		96		70-130	6		20
1,1-Dichloroethene	86		89		70-130	3		20
trans-1,2-Dichloroethene	96		99		70-130	3		20
Trichloroethene	83		88		70-130	6		20
1,2-Dichlorobenzene	94		109		70-130	15		20
1,3-Dichlorobenzene	96		102		70-130	6		20
1,4-Dichlorobenzene	97		100		70-130	3		20
Methyl tert butyl ether	92		100		70-130	8		20
p/m-Xylene	91		94		70-130	3		20
o-Xylene	99		101		70-130	2		20
cis-1,2-Dichloroethene	87		92		70-130	6		20
Dibromomethane	87		96		70-130	10		20
1,2,3-Trichloropropane	80		85		70-130	6		20
Styrene	89		92		70-130	3		20
Dichlorodifluoromethane	88		90		70-130	2		20
Acetone	89		99		70-130	11		20
Carbon disulfide	74		78		70-130	5		20
Methyl ethyl ketone	84		91		70-130	8		20
Methyl isobutyl ketone	77		89		70-130	14		20
2-Hexanone	82		90		70-130	9		20
Bromochloromethane	92		96		70-130	4		20
Tetrahydrofuran	83		93		70-130	11		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
2,2-Dichloropropane	89		94		70-130	5		20
1,2-Dibromoethane	91		99		70-130	8		20
1,3-Dichloropropane	86		94		70-130	9		20
1,1,1,2-Tetrachloroethane	88		93		70-130	6		20
Bromobenzene	95		94		70-130	1		20
n-Butylbenzene	90		102		70-130	13		20
sec-Butylbenzene	101		106		70-130	5		20
tert-Butylbenzene	98		98		70-130	0		20
o-Chlorotoluene	93		94		70-130	1		20
p-Chlorotoluene	93		94		70-130	1		20
1,2-Dibromo-3-chloropropane	93		111		70-130	18		20
Hexachlorobutadiene	82		105		70-130	**25**	Q	20
Isopropylbenzene	97		99		70-130	2		20
p-Isopropyltoluene	100		108		70-130	8		20
Naphthalene	88		117		70-130	**28**	Q	20
n-Propylbenzene	93		94		70-130	1		20
1,2,3-Trichlorobenzene	88		114		70-130	**26**	Q	20
1,2,4-Trichlorobenzene	92		119		70-130	**26**	Q	20
1,3,5-Trimethylbenzene	94		94		70-130	0		20
1,2,4-Trimethylbenzene	95		101		70-130	6		20
Diethyl ether	91		100		70-130	9		20
Diisopropyl Ether	87		92		70-130	6		20
Ethyl-Tert-Butyl-Ether	86		92		70-130	7		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Tertiary-Amyl Methyl Ether	89		96		70-130	8		20
1,4-Dioxane	102		112		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	87		90		70-130
Toluene-d8	91		100		70-130
4-Bromofluorobenzene	100		96		70-130
Dibromofluoromethane	97		98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Methylene chloride	85		89		70-130	5		20
1,1-Dichloroethane	83		88		70-130	6		20
Chloroform	86		90		70-130	5		20
Carbon tetrachloride	86		90		70-130	5		20
1,2-Dichloropropane	87		92		70-130	6		20
Dibromochloromethane	94		99		70-130	5		20
1,1,2-Trichloroethane	80		92		70-130	14		20
Tetrachloroethene	80		88		70-130	10		20
Chlorobenzene	90		94		70-130	4		20
Trichlorofluoromethane	87		93		70-130	7		20
1,2-Dichloroethane	83		89		70-130	7		20
1,1,1-Trichloroethane	83		86		70-130	4		20
Bromodichloromethane	87		94		70-130	8		20
trans-1,3-Dichloropropene	82		94		70-130	14		20
cis-1,3-Dichloropropene	92		98		70-130	6		20
1,1-Dichloropropene	87		92		70-130	6		20
Bromoform	85		88		70-130	3		20
1,1,2,2-Tetrachloroethane	87		92		70-130	6		20
Benzene	88		93		70-130	6		20
Toluene	82		95		70-130	15		20
Ethylbenzene	92		96		70-130	4		20
Chloromethane	88		87		70-130	1		20
Bromomethane	120		119		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Vinyl chloride	83		86		70-130	4		20
Chloroethane	90		96		70-130	6		20
1,1-Dichloroethene	86		89		70-130	3		20
trans-1,2-Dichloroethene	96		99		70-130	3		20
Trichloroethene	83		88		70-130	6		20
1,2-Dichlorobenzene	94		109		70-130	15		20
1,3-Dichlorobenzene	96		102		70-130	6		20
1,4-Dichlorobenzene	97		100		70-130	3		20
Methyl tert butyl ether	92		100		70-130	8		20
p/m-Xylene	91		94		70-130	3		20
o-Xylene	99		101		70-130	2		20
cis-1,2-Dichloroethene	87		92		70-130	6		20
Dibromomethane	87		96		70-130	10		20
1,2,3-Trichloropropane	80		85		70-130	6		20
Styrene	89		92		70-130	3		20
Dichlorodifluoromethane	88		90		70-130	2		20
Acetone	89		99		70-130	11		20
Carbon disulfide	74		78		70-130	5		20
Methyl ethyl ketone	84		91		70-130	8		20
Methyl isobutyl ketone	77		89		70-130	14		20
2-Hexanone	82		90		70-130	9		20
Bromochloromethane	92		96		70-130	4		20
Tetrahydrofuran	83		93		70-130	11		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 09-10 Batch: WG1400902-3 WG1400902-4								
2,2-Dichloropropane	89		94		70-130	5		20
1,2-Dibromoethane	91		99		70-130	8		20
1,3-Dichloropropane	86		94		70-130	9		20
1,1,1,2-Tetrachloroethane	88		93		70-130	6		20
Bromobenzene	95		94		70-130	1		20
n-Butylbenzene	90		102		70-130	13		20
sec-Butylbenzene	101		106		70-130	5		20
tert-Butylbenzene	98		98		70-130	0		20
o-Chlorotoluene	93		94		70-130	1		20
p-Chlorotoluene	93		94		70-130	1		20
1,2-Dibromo-3-chloropropane	93		111		70-130	18		20
Hexachlorobutadiene	82		105		70-130	**25**	Q	20
Isopropylbenzene	97		99		70-130	2		20
p-Isopropyltoluene	100		108		70-130	8		20
Naphthalene	88		117		70-130	**28**	Q	20
n-Propylbenzene	93		94		70-130	1		20
1,2,3-Trichlorobenzene	88		114		70-130	**26**	Q	20
1,2,4-Trichlorobenzene	92		119		70-130	**26**	Q	20
1,3,5-Trimethylbenzene	94		94		70-130	0		20
1,2,4-Trimethylbenzene	95		101		70-130	6		20
Diethyl ether	91		100		70-130	9		20
Diisopropyl Ether	87		92		70-130	6		20
Ethyl-Tert-Butyl-Ether	86		92		70-130	7		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Tertiary-Amyl Methyl Ether	89		96		70-130	8		20
1,4-Dioxane	102		112		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	87		90		70-130
Toluene-d8	91		100		70-130
4-Bromofluorobenzene	101		95		70-130
Dibromofluoromethane	97		98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 05-06		Batch: WG1401019-3 WG1401019-4					
Methylene chloride	92		84		70-130	9		20
1,1-Dichloroethane	84		83		70-130	1		20
Chloroform	89		91		70-130	2		20
Carbon tetrachloride	87		90		70-130	3		20
1,2-Dichloropropane	89		90		70-130	1		20
Dibromochloromethane	91		94		70-130	3		20
1,1,2-Trichloroethane	84		88		70-130	5		20
Tetrachloroethene	78		81		70-130	4		20
Chlorobenzene	90		88		70-130	2		20
Trichlorofluoromethane	87		86		70-130	1		20
1,2-Dichloroethane	82		83		70-130	1		20
1,1,1-Trichloroethane	84		86		70-130	2		20
Bromodichloromethane	89		94		70-130	5		20
trans-1,3-Dichloropropene	80		86		70-130	7		20
cis-1,3-Dichloropropene	91		91		70-130	0		20
1,1-Dichloropropene	89		86		70-130	3		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	89		91		70-130	2		20
Benzene	89		88		70-130	1		20
Toluene	84		88		70-130	5		20
Ethylbenzene	90		89		70-130	1		20
Chloromethane	87		86		70-130	1		20
Bromomethane	107		102		70-130	5		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 05-06 Batch: WG1401019-3 WG1401019-4								
Vinyl chloride	78		76		70-130	3		20
Chloroethane	84		84		70-130	0		20
1,1-Dichloroethene	94		87		70-130	8		20
trans-1,2-Dichloroethene	104		95		70-130	9		20
Trichloroethene	83		81		70-130	2		20
1,2-Dichlorobenzene	93		89		70-130	4		20
1,3-Dichlorobenzene	92		86		70-130	7		20
1,4-Dichlorobenzene	91		86		70-130	6		20
Methyl tert butyl ether	101		94		70-130	7		20
p/m-Xylene	83		86		70-130	4		20
o-Xylene	92		100		70-130	8		20
cis-1,2-Dichloroethene	88		90		70-130	2		20
Dibromomethane	90		94		70-130	4		20
1,2,3-Trichloropropane	83		83		70-130	0		20
Styrene	83		89		70-130	7		20
Dichlorodifluoromethane	89		85		70-130	5		20
Acetone	94		96		70-130	2		20
Carbon disulfide	79		73		70-130	8		20
Methyl ethyl ketone	85		89		70-130	5		20
Methyl isobutyl ketone	79		85		70-130	7		20
2-Hexanone	88		88		70-130	0		20
Bromochloromethane	94		96		70-130	2		20
Tetrahydrofuran	84		90		70-130	7		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 05-06		Batch: WG1401019-3 WG1401019-4					
2,2-Dichloropropane	86		86		70-130	0		20
1,2-Dibromoethane	96		94		70-130	2		20
1,3-Dichloropropane	85		89		70-130	5		20
1,1,1,2-Tetrachloroethane	87		88		70-130	1		20
Bromobenzene	94		95		70-130	1		20
n-Butylbenzene	86		78		70-130	10		20
sec-Butylbenzene	101		97		70-130	4		20
tert-Butylbenzene	100		96		70-130	4		20
o-Chlorotoluene	92		87		70-130	6		20
p-Chlorotoluene	90		85		70-130	6		20
1,2-Dibromo-3-chloropropane	91		94		70-130	3		20
Hexachlorobutadiene	91		87		70-130	4		20
Isopropylbenzene	99		103		70-130	4		20
p-Isopropyltoluene	98		92		70-130	6		20
Naphthalene	98		98		70-130	0		20
n-Propylbenzene	92		88		70-130	4		20
1,2,3-Trichlorobenzene	93		87		70-130	7		20
1,2,4-Trichlorobenzene	92		83		70-130	10		20
1,3,5-Trimethylbenzene	93		89		70-130	4		20
1,2,4-Trimethylbenzene	94		88		70-130	7		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	89		88		70-130	1		20
Ethyl-Tert-Butyl-Ether	88		87		70-130	1		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 05-06 Batch: WG1401019-3 WG1401019-4								
Tertiary-Amyl Methyl Ether	92		92		70-130	0		20
1,4-Dioxane	123		117		70-130	5		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	88		89		70-130
Toluene-d8	93		99		70-130
4-Bromofluorobenzene	98		103		70-130
Dibromofluoromethane	98		101		70-130

PETROLEUM HYDROCARBONS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-01	Date Collected:	08/06/20 09:00
Client ID:	B-101 15-18	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 15:27		
Analyst:	BAD		
Percent Solids:	86%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	7.32		mg/kg	5.72	--	1
C9-C12 Aliphatics	52.4		mg/kg	5.72	--	1
C9-C10 Aromatics	45.8		mg/kg	5.72	--	1
C5-C8 Aliphatics, Adjusted	7.32		mg/kg	5.72	--	1
C9-C12 Aliphatics, Adjusted	6.19		mg/kg	5.72	--	1
Benzene	ND		mg/kg	0.114	--	1
Toluene	ND		mg/kg	0.114	--	1
Ethylbenzene	ND		mg/kg	0.114	--	1
p/m-Xylene	0.149		mg/kg	0.114	--	1
o-Xylene	0.225		mg/kg	0.114	--	1
Methyl tert butyl ether	ND		mg/kg	0.057	--	1
Naphthalene	0.366		mg/kg	0.229	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	101		70-130
2,5-Dibromotoluene-FID	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-01 D	Date Collected:	08/06/20 09:00
Client ID:	B-101 15-18	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 19:08	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	86%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	160		mg/kg	38.6	--	5
C19-C36 Aliphatics	5540		mg/kg	38.6	--	5
C11-C22 Aromatics	570		mg/kg	38.6	--	5
C11-C22 Aromatics, Adjusted	568		mg/kg	38.6	--	5
Naphthalene	2.06		mg/kg	1.93	--	5
2-Methylnaphthalene	ND		mg/kg	1.93	--	5
Acenaphthylene	ND		mg/kg	1.93	--	5
Acenaphthene	ND		mg/kg	1.93	--	5
Fluorene	ND		mg/kg	1.93	--	5
Phenanthrene	ND		mg/kg	1.93	--	5
Anthracene	ND		mg/kg	1.93	--	5
Fluoranthene	ND		mg/kg	1.93	--	5
Pyrene	ND		mg/kg	1.93	--	5
Benzo(a)anthracene	ND		mg/kg	1.93	--	5
Chrysene	ND		mg/kg	1.93	--	5
Benzo(b)fluoranthene	ND		mg/kg	1.93	--	5
Benzo(k)fluoranthene	ND		mg/kg	1.93	--	5
Benzo(a)pyrene	ND		mg/kg	1.93	--	5
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	1.93	--	5
Dibenzo(a,h)anthracene	ND		mg/kg	1.93	--	5
Benzo(ghi)perylene	ND		mg/kg	1.93	--	5

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 D
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	54		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	65		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-02	Date Collected:	08/06/20 09:50
Client ID:	B-105 12.5-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 04:41	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	89%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	15.8		mg/kg	7.48	--	1
C19-C36 Aliphatics	23.0		mg/kg	7.48	--	1
C11-C22 Aromatics	20.8		mg/kg	7.48	--	1
C11-C22 Aromatics, Adjusted	18.7		mg/kg	7.48	--	1
Naphthalene	1.50		mg/kg	0.374	--	1
2-Methylnaphthalene	0.540		mg/kg	0.374	--	1
Acenaphthylene	ND		mg/kg	0.374	--	1
Acenaphthene	ND		mg/kg	0.374	--	1
Fluorene	ND		mg/kg	0.374	--	1
Phenanthrene	ND		mg/kg	0.374	--	1
Anthracene	ND		mg/kg	0.374	--	1
Fluoranthene	ND		mg/kg	0.374	--	1
Pyrene	ND		mg/kg	0.374	--	1
Benzo(a)anthracene	ND		mg/kg	0.374	--	1
Chrysene	ND		mg/kg	0.374	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.374	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.374	--	1
Benzo(a)pyrene	ND		mg/kg	0.374	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.374	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.374	--	1
Benzo(ghi)perylene	ND		mg/kg	0.374	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	67		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	73		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-02 D	Date Collected:	08/06/20 09:50
Client ID:	B-105 12.5-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 15:58		
Analyst:	BAD		
Percent Solids:	89%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	208		mg/kg	23.9	--	5
C9-C12 Aliphatics	608		mg/kg	23.9	--	5
C9-C10 Aromatics	416		mg/kg	23.9	--	5
C5-C8 Aliphatics, Adjusted	207		mg/kg	23.9	--	5
C9-C12 Aliphatics, Adjusted	109		mg/kg	23.9	--	5
Benzene	0.745		mg/kg	0.478	--	5
Toluene	ND		mg/kg	0.478	--	5
Ethylbenzene	14.1		mg/kg	0.478	--	5
p/m-Xylene	57.7		mg/kg	0.478	--	5
o-Xylene	11.3		mg/kg	0.478	--	5
Methyl tert butyl ether	ND		mg/kg	0.239	--	5
Naphthalene	17.2		mg/kg	0.957	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**146**	Q	70-130
2,5-Dibromotoluene-FID	114		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 05:06	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/20/20
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	17.9		mg/kg	7.22	--	1
C19-C36 Aliphatics	19.9		mg/kg	7.22	--	1
C11-C22 Aromatics	15.3		mg/kg	7.22	--	1
C11-C22 Aromatics, Adjusted	13.8		mg/kg	7.22	--	1
Naphthalene	1.15		mg/kg	0.361	--	1
2-Methylnaphthalene	0.389		mg/kg	0.361	--	1
Acenaphthylene	ND		mg/kg	0.361	--	1
Acenaphthene	ND		mg/kg	0.361	--	1
Fluorene	ND		mg/kg	0.361	--	1
Phenanthrene	ND		mg/kg	0.361	--	1
Anthracene	ND		mg/kg	0.361	--	1
Fluoranthene	ND		mg/kg	0.361	--	1
Pyrene	ND		mg/kg	0.361	--	1
Benzo(a)anthracene	ND		mg/kg	0.361	--	1
Chrysene	ND		mg/kg	0.361	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.361	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.361	--	1
Benzo(a)pyrene	ND		mg/kg	0.361	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.361	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.361	--	1
Benzo(ghi)perylene	ND		mg/kg	0.361	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**25**	Q	40-140
o-Terphenyl	**20**	Q	40-140
2-Fluorobiphenyl	70		40-140
2-Bromonaphthalene	75		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03 RE	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/21/20 18:09
Analytical Date:	08/22/20 12:43	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	43.1		mg/kg	7.14	--	1
C19-C36 Aliphatics	38.0		mg/kg	7.14	--	1
C11-C22 Aromatics	35.1		mg/kg	7.14	--	1
C11-C22 Aromatics, Adjusted	33.2		mg/kg	7.14	--	1
Naphthalene	ND		mg/kg	0.357	--	1
2-Methylnaphthalene	1.96		mg/kg	0.357	--	1
Acenaphthylene	ND		mg/kg	0.357	--	1
Acenaphthene	ND		mg/kg	0.357	--	1
Fluorene	ND		mg/kg	0.357	--	1
Phenanthrene	ND		mg/kg	0.357	--	1
Anthracene	ND		mg/kg	0.357	--	1
Fluoranthene	ND		mg/kg	0.357	--	1
Pyrene	ND		mg/kg	0.357	--	1
Benzo(a)anthracene	ND		mg/kg	0.357	--	1
Chrysene	ND		mg/kg	0.357	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.357	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.357	--	1
Benzo(a)pyrene	ND		mg/kg	0.357	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.357	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.357	--	1
Benzo(ghi)perylene	ND		mg/kg	0.357	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 RE
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	58		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03 D	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 16:59		
Analyst:	BAD		
Percent Solids:	90%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	99.4		mg/kg	20.2	--	4
C9-C12 Aliphatics	429		mg/kg	20.2	--	4
C9-C10 Aromatics	293		mg/kg	20.2	--	4
C5-C8 Aliphatics, Adjusted	99.4		mg/kg	20.2	--	4
C9-C12 Aliphatics, Adjusted	73.5		mg/kg	20.2	--	4
Benzene	ND		mg/kg	0.405	--	4
Toluene	ND		mg/kg	0.405	--	4
Ethylbenzene	9.70		mg/kg	0.405	--	4
p/m-Xylene	45.2		mg/kg	0.405	--	4
o-Xylene	7.40		mg/kg	0.405	--	4
Methyl tert butyl ether	ND		mg/kg	0.202	--	4
Naphthalene	13.8		mg/kg	0.810	--	4

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**137**	Q	70-130
2,5-Dibromotoluene-FID	110		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-04	Date Collected:	08/06/20 10:45
Client ID:	B-107 8-10	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 18:00		
Analyst:	BAD		
Percent Solids:	91%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	37.2		mg/kg	5.30	--	1
C9-C12 Aliphatics	51.6		mg/kg	5.30	--	1
C9-C10 Aromatics	35.8		mg/kg	5.30	--	1
C5-C8 Aliphatics, Adjusted	35.7		mg/kg	5.30	--	1
C9-C12 Aliphatics, Adjusted	11.1		mg/kg	5.30	--	1
Benzene	0.643		mg/kg	0.106	--	1
Toluene	0.572		mg/kg	0.106	--	1
Ethylbenzene	0.862		mg/kg	0.106	--	1
p/m-Xylene	2.70		mg/kg	0.106	--	1
o-Xylene	1.05		mg/kg	0.106	--	1
Methyl tert butyl ether	0.288		mg/kg	0.053	--	1
Naphthalene	0.710		mg/kg	0.212	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	93		70-130
2,5-Dibromotoluene-FID	85		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-04 D	Date Collected:	08/06/20 10:45
Client ID:	B-107 8-10	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 20:22	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	91%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	672		mg/kg	144	--	20
C19-C36 Aliphatics	21200		mg/kg	144	--	20
C11-C22 Aromatics	6620		mg/kg	144	--	20
C11-C22 Aromatics, Adjusted	6620		mg/kg	144	--	20
Naphthalene	ND		mg/kg	7.18	--	20
2-Methylnaphthalene	ND		mg/kg	7.18	--	20
Acenaphthylene	ND		mg/kg	7.18	--	20
Acenaphthene	ND		mg/kg	7.18	--	20
Fluorene	ND		mg/kg	7.18	--	20
Phenanthrene	ND		mg/kg	7.18	--	20
Anthracene	ND		mg/kg	7.18	--	20
Fluoranthene	ND		mg/kg	7.18	--	20
Pyrene	7.26		mg/kg	7.18	--	20
Benzo(a)anthracene	ND		mg/kg	7.18	--	20
Chrysene	ND		mg/kg	7.18	--	20
Benzo(b)fluoranthene	ND		mg/kg	7.18	--	20
Benzo(k)fluoranthene	ND		mg/kg	7.18	--	20
Benzo(a)pyrene	ND		mg/kg	7.18	--	20
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	7.18	--	20
Dibenzo(a,h)anthracene	ND		mg/kg	7.18	--	20
Benzo(ghi)perylene	ND		mg/kg	7.18	--	20

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 D
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**0**	Q	40-140
o-Terphenyl	**0**	Q	40-140
2-Fluorobiphenyl	110		40-140
2-Bromonaphthalene	114		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-05	Date Collected:	08/06/20 11:30
Client ID:	B-104 10-12	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 18:31		
Analyst:	BAD		
Percent Solids:	88%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	4.68	--	1
C9-C12 Aliphatics	ND		mg/kg	4.68	--	1
C9-C10 Aromatics	ND		mg/kg	4.68	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	4.68	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	4.68	--	1
Benzene	ND		mg/kg	0.094	--	1
Toluene	ND		mg/kg	0.094	--	1
Ethylbenzene	ND		mg/kg	0.094	--	1
p/m-Xylene	ND		mg/kg	0.094	--	1
o-Xylene	ND		mg/kg	0.094	--	1
Methyl tert butyl ether	ND		mg/kg	0.047	--	1
Naphthalene	ND		mg/kg	0.187	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**158**	Q	70-130
2,5-Dibromotoluene-FID	**145**	Q	70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-05	Date Collected:	08/06/20 11:30
Client ID:	B-104 10-12	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/20/20 11:35
Analytical Date:	08/22/20 08:58	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/20/20
Percent Solids:	88%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.51	--	1
C19-C36 Aliphatics	ND		mg/kg	7.51	--	1
C11-C22 Aromatics	ND		mg/kg	7.51	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.51	--	1
Naphthalene	ND		mg/kg	0.375	--	1
2-Methylnaphthalene	ND		mg/kg	0.375	--	1
Acenaphthylene	ND		mg/kg	0.375	--	1
Acenaphthene	ND		mg/kg	0.375	--	1
Fluorene	ND		mg/kg	0.375	--	1
Phenanthrene	ND		mg/kg	0.375	--	1
Anthracene	ND		mg/kg	0.375	--	1
Fluoranthene	ND		mg/kg	0.375	--	1
Pyrene	ND		mg/kg	0.375	--	1
Benzo(a)anthracene	ND		mg/kg	0.375	--	1
Chrysene	ND		mg/kg	0.375	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.375	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.375	--	1
Benzo(a)pyrene	ND		mg/kg	0.375	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.375	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.375	--	1
Benzo(ghi)perylene	ND		mg/kg	0.375	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	61		40-140
o-Terphenyl	74		40-140
2-Fluorobiphenyl	85		40-140
2-Bromonaphthalene	88		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-06	Date Collected:	08/06/20 13:00
Client ID:	B-103 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/21/20 21:56		
Analyst:	BAD		
Percent Solids:	81%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	7.22	--	1
C9-C12 Aliphatics	10.5		mg/kg	7.22	--	1
C9-C10 Aromatics	9.13		mg/kg	7.22	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	7.22	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	7.22	--	1
Benzene	0.171		mg/kg	0.144	--	1
Toluene	1.03		mg/kg	0.144	--	1
Ethylbenzene	ND		mg/kg	0.144	--	1
p/m-Xylene	1.34		mg/kg	0.144	--	1
o-Xylene	0.148		mg/kg	0.144	--	1
Methyl tert butyl ether	0.144		mg/kg	0.072	--	1
Naphthalene	0.386		mg/kg	0.289	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	120		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-06 D	Date Collected:	08/06/20 13:00
Client ID:	B-103 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:08	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	81%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	70.4		mg/kg	40.7	--	5
C19-C36 Aliphatics	3130		mg/kg	40.7	--	5
C11-C22 Aromatics	1060		mg/kg	40.7	--	5
C11-C22 Aromatics, Adjusted	1060		mg/kg	40.7	--	5
Naphthalene	ND		mg/kg	2.04	--	5
2-Methylnaphthalene	ND		mg/kg	2.04	--	5
Acenaphthylene	ND		mg/kg	2.04	--	5
Acenaphthene	ND		mg/kg	2.04	--	5
Fluorene	ND		mg/kg	2.04	--	5
Phenanthrene	ND		mg/kg	2.04	--	5
Anthracene	ND		mg/kg	2.04	--	5
Fluoranthene	ND		mg/kg	2.04	--	5
Pyrene	ND		mg/kg	2.04	--	5
Benzo(a)anthracene	ND		mg/kg	2.04	--	5
Chrysene	ND		mg/kg	2.04	--	5
Benzo(b)fluoranthene	ND		mg/kg	2.04	--	5
Benzo(k)fluoranthene	ND		mg/kg	2.04	--	5
Benzo(a)pyrene	ND		mg/kg	2.04	--	5
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	2.04	--	5
Dibenzo(a,h)anthracene	ND		mg/kg	2.04	--	5
Benzo(ghi)perylene	ND		mg/kg	2.04	--	5

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 D
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	69		40-140
o-Terphenyl	58		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-07	Date Collected:	08/06/20 13:45
Client ID:	B-106 12.5-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/21/20 22:26		
Analyst:	BAD		
Percent Solids:	79%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	16.8		mg/kg	5.74	--	1
C9-C12 Aliphatics	47.3		mg/kg	5.74	--	1
C9-C10 Aromatics	36.9		mg/kg	5.74	--	1
C5-C8 Aliphatics, Adjusted	16.2		mg/kg	5.74	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.74	--	1
Benzene	0.414		mg/kg	0.115	--	1
Toluene	ND		mg/kg	0.115	--	1
Ethylbenzene	ND		mg/kg	0.115	--	1
p/m-Xylene	10.8		mg/kg	0.115	--	1
o-Xylene	ND		mg/kg	0.115	--	1
Methyl tert butyl ether	0.203		mg/kg	0.057	--	1
Naphthalene	1.28		mg/kg	0.229	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**143**	Q	70-130
2,5-Dibromotoluene-FID	124		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-07 D	Date Collected:	08/06/20 13:45
Client ID:	B-106 12.5-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:33	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	79%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	118		mg/kg	16.3	--	2
C19-C36 Aliphatics	2320		mg/kg	16.3	--	2
C11-C22 Aromatics	294		mg/kg	16.3	--	2
C11-C22 Aromatics, Adjusted	292		mg/kg	16.3	--	2
Naphthalene	1.41		mg/kg	0.813	--	2
2-Methylnaphthalene	0.972		mg/kg	0.813	--	2
Acenaphthylene	ND		mg/kg	0.813	--	2
Acenaphthene	ND		mg/kg	0.813	--	2
Fluorene	ND		mg/kg	0.813	--	2
Phenanthrene	ND		mg/kg	0.813	--	2
Anthracene	ND		mg/kg	0.813	--	2
Fluoranthene	ND		mg/kg	0.813	--	2
Pyrene	ND		mg/kg	0.813	--	2
Benzo(a)anthracene	ND		mg/kg	0.813	--	2
Chrysene	ND		mg/kg	0.813	--	2
Benzo(b)fluoranthene	ND		mg/kg	0.813	--	2
Benzo(k)fluoranthene	ND		mg/kg	0.813	--	2
Benzo(a)pyrene	ND		mg/kg	0.813	--	2
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.813	--	2
Dibenzo(a,h)anthracene	ND		mg/kg	0.813	--	2
Benzo(ghi)perylene	ND		mg/kg	0.813	--	2

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 D
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	59		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	71		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/20/20 20:03
Analyst: BAD
Percent Solids: 85%

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	467		mg/kg	60.8	--	10
C9-C12 Aliphatics	1570		mg/kg	60.8	--	10
C9-C10 Aromatics	1220		mg/kg	60.8	--	10
C5-C8 Aliphatics, Adjusted	467		mg/kg	60.8	--	10
C9-C12 Aliphatics, Adjusted	290		mg/kg	60.8	--	10
Benzene	ND		mg/kg	1.22	--	10
Toluene	ND		mg/kg	1.22	--	10
Ethylbenzene	ND		mg/kg	1.22	--	10
p/m-Xylene	51.4		mg/kg	1.22	--	10
o-Xylene	9.07		mg/kg	1.22	--	10
Methyl tert butyl ether	ND		mg/kg	0.608	--	10
Naphthalene	47.8		mg/kg	2.43	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	103		70-130
2,5-Dibromotoluene-FID	**67**	Q	70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-08 D	Date Collected:	08/06/20 14:10
Client ID:	B-102 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:58	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	85%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	606		mg/kg	15.0	--	2
C19-C36 Aliphatics	1740		mg/kg	15.0	--	2
C11-C22 Aromatics	382		mg/kg	15.0	--	2
C11-C22 Aromatics, Adjusted	366		mg/kg	15.0	--	2
Naphthalene	ND		mg/kg	0.752	--	2
2-Methylnaphthalene	15.6		mg/kg	0.752	--	2
Acenaphthylene	ND		mg/kg	0.752	--	2
Acenaphthene	ND		mg/kg	0.752	--	2
Fluorene	ND		mg/kg	0.752	--	2
Phenanthrene	ND		mg/kg	0.752	--	2
Anthracene	ND		mg/kg	0.752	--	2
Fluoranthene	ND		mg/kg	0.752	--	2
Pyrene	ND		mg/kg	0.752	--	2
Benzo(a)anthracene	ND		mg/kg	0.752	--	2
Chrysene	ND		mg/kg	0.752	--	2
Benzo(b)fluoranthene	ND		mg/kg	0.752	--	2
Benzo(k)fluoranthene	ND		mg/kg	0.752	--	2
Benzo(a)pyrene	ND		mg/kg	0.752	--	2
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.752	--	2
Dibenzo(a,h)anthracene	ND		mg/kg	0.752	--	2
Benzo(ghi)perylene	ND		mg/kg	0.752	--	2

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	50		40-140
2-Fluorobiphenyl	73		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-09	Date Collected:	08/06/20 15:05
Client ID:	B-108 15-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 21:04		
Analyst:	BAD		
Percent Solids:	91%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	4.40	--	1
C9-C12 Aliphatics	ND		mg/kg	4.40	--	1
C9-C10 Aromatics	ND		mg/kg	4.40	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	4.40	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	4.40	--	1
Benzene	ND		mg/kg	0.088	--	1
Toluene	ND		mg/kg	0.088	--	1
Ethylbenzene	ND		mg/kg	0.088	--	1
p/m-Xylene	ND		mg/kg	0.088	--	1
o-Xylene	ND		mg/kg	0.088	--	1
Methyl tert butyl ether	ND		mg/kg	0.044	--	1
Naphthalene	ND		mg/kg	0.176	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**143**	Q	70-130
2,5-Dibromotoluene-FID	129		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-09	Date Collected:	08/06/20 15:05
Client ID:	B-108 15-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/20/20 20:08
Analytical Date:	08/21/20 09:35	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	91%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.05	--	1
C19-C36 Aliphatics	ND		mg/kg	7.05	--	1
C11-C22 Aromatics	ND		mg/kg	7.05	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.05	--	1
Naphthalene	ND		mg/kg	0.352	--	1
2-Methylnaphthalene	ND		mg/kg	0.352	--	1
Acenaphthylene	ND		mg/kg	0.352	--	1
Acenaphthene	ND		mg/kg	0.352	--	1
Fluorene	ND		mg/kg	0.352	--	1
Phenanthrene	ND		mg/kg	0.352	--	1
Anthracene	ND		mg/kg	0.352	--	1
Fluoranthene	ND		mg/kg	0.352	--	1
Pyrene	ND		mg/kg	0.352	--	1
Benzo(a)anthracene	ND		mg/kg	0.352	--	1
Chrysene	ND		mg/kg	0.352	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.352	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.352	--	1
Benzo(a)pyrene	ND		mg/kg	0.352	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.352	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.352	--	1
Benzo(ghi)perylene	ND		mg/kg	0.352	--	1

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	58		40-140
o-Terphenyl	54		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	69		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/21/20 03:03
Analyst: MEO

Extraction Method: EPA 3546
Extraction Date: 08/19/20 20:08
Cleanup Method: EPH-04-1
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-09 Batch: WG1400704-1					
C9-C18 Aliphatics	ND		mg/kg	6.34	--
C19-C36 Aliphatics	ND		mg/kg	6.34	--
C11-C22 Aromatics	ND		mg/kg	6.34	--
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.34	--
Naphthalene	ND		mg/kg	0.317	--
2-Methylnaphthalene	ND		mg/kg	0.317	--
Acenaphthylene	ND		mg/kg	0.317	--
Acenaphthene	ND		mg/kg	0.317	--
Fluorene	ND		mg/kg	0.317	--
Phenanthrene	ND		mg/kg	0.317	--
Anthracene	ND		mg/kg	0.317	--
Fluoranthene	ND		mg/kg	0.317	--
Pyrene	ND		mg/kg	0.317	--
Benzo(a)anthracene	ND		mg/kg	0.317	--
Chrysene	ND		mg/kg	0.317	--
Benzo(b)fluoranthene	ND		mg/kg	0.317	--
Benzo(k)fluoranthene	ND		mg/kg	0.317	--
Benzo(a)pyrene	ND		mg/kg	0.317	--
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.317	--
Dibenzo(a,h)anthracene	ND		mg/kg	0.317	--
Benzo(ghi)perylene	ND		mg/kg	0.317	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	54		40-140
o-Terphenyl	42		40-140
2-Fluorobiphenyl	56		40-140
2-Bromonaphthalene	58		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/20/20 11:05
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-05,07-09 Batch: WG1401086-4					
C5-C8 Aliphatics	ND		mg/kg	5.00	--
C9-C12 Aliphatics	ND		mg/kg	5.00	--
C9-C10 Aromatics	ND		mg/kg	5.00	--
C5-C8 Aliphatics, Adjusted	ND		mg/kg	5.00	--
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.00	--
Benzene	ND		mg/kg	0.100	--
Toluene	ND		mg/kg	0.100	--
Ethylbenzene	ND		mg/kg	0.100	--
p/m-Xylene	ND		mg/kg	0.100	--
o-Xylene	ND		mg/kg	0.100	--
Methyl tert butyl ether	ND		mg/kg	0.050	--
Naphthalene	ND		mg/kg	0.200	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	116		70-130
2,5-Dibromotoluene-FID	106		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/22/20 12:18
Analyst: LL

Extraction Method: EPA 3546
Extraction Date: 08/21/20 18:09
Cleanup Method: EPH-04-1
Cleanup Date: 08/22/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 03 Batch: WG1401675-1					
C9-C18 Aliphatics	ND		mg/kg	6.57	--
C19-C36 Aliphatics	ND		mg/kg	6.57	--
C11-C22 Aromatics	ND		mg/kg	6.57	--
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.57	--
Naphthalene	ND		mg/kg	0.328	--
2-Methylnaphthalene	ND		mg/kg	0.328	--
Acenaphthylene	ND		mg/kg	0.328	--
Acenaphthene	ND		mg/kg	0.328	--
Fluorene	ND		mg/kg	0.328	--
Phenanthrene	ND		mg/kg	0.328	--
Anthracene	ND		mg/kg	0.328	--
Fluoranthene	ND		mg/kg	0.328	--
Pyrene	ND		mg/kg	0.328	--
Benzo(a)anthracene	ND		mg/kg	0.328	--
Chrysene	ND		mg/kg	0.328	--
Benzo(b)fluoranthene	ND		mg/kg	0.328	--
Benzo(k)fluoranthene	ND		mg/kg	0.328	--
Benzo(a)pyrene	ND		mg/kg	0.328	--
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.328	--
Dibenzo(a,h)anthracene	ND		mg/kg	0.328	--
Benzo(ghi)perylene	ND		mg/kg	0.328	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	66		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/21/20 10:47
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 06 Batch: WG1401799-4					
C5-C8 Aliphatics	ND		mg/kg	5.00	--
C9-C12 Aliphatics	ND		mg/kg	5.00	--
C9-C10 Aromatics	ND		mg/kg	5.00	--
C5-C8 Aliphatics, Adjusted	ND		mg/kg	5.00	--
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.00	--
Benzene	ND		mg/kg	0.100	--
Toluene	ND		mg/kg	0.100	--
Ethylbenzene	ND		mg/kg	0.100	--
p/m-Xylene	ND		mg/kg	0.100	--
o-Xylene	ND		mg/kg	0.100	--
Methyl tert butyl ether	ND		mg/kg	0.050	--
Naphthalene	ND		mg/kg	0.200	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	126		70-130
2,5-Dibromotoluene-FID	108		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-09 Batch: WG1400704-2 WG1400704-3								
C9-C18 Aliphatics	67		59		40-140	13		25
C19-C36 Aliphatics	77		69		40-140	11		25
C11-C22 Aromatics	62		59		40-140	5		25
Naphthalene	49		46		40-140	6		25
2-Methylnaphthalene	52		51		40-140	2		25
Acenaphthylene	51		52		40-140	2		25
Acenaphthene	56		58		40-140	4		25
Fluorene	57		59		40-140	3		25
Phenanthrene	59		60		40-140	2		25
Anthracene	64		64		40-140	0		25
Fluoranthene	62		62		40-140	0		25
Pyrene	62		61		40-140	2		25
Benzo(a)anthracene	63		62		40-140	2		25
Chrysene	62		58		40-140	7		25
Benzo(b)fluoranthene	70		69		40-140	1		25
Benzo(k)fluoranthene	56		53		40-140	6		25
Benzo(a)pyrene	62		60		40-140	3		25
Indeno(1,2,3-cd)Pyrene	60		57		40-140	5		25
Dibenzo(a,h)anthracene	46		41		40-140	11		25
Benzo(ghi)perylene	51		45		40-140	13		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-09 Batch: WG1400704-2 WG1400704-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	66		57		40-140
o-Terphenyl	51		51		40-140
2-Fluorobiphenyl	63		63		40-140
2-Bromonaphthalene	65		66		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-05,07-09 Batch: WG1401086-2 WG1401086-3								
C5-C8 Aliphatics	98		109		70-130	11		25
C9-C12 Aliphatics	94		107		70-130	13		25
C9-C10 Aromatics	96		109		70-130	13		25
Benzene	98		108		70-130	10		25
Toluene	98		109		70-130	11		25
Ethylbenzene	101		113		70-130	11		25
p/m-Xylene	99		111		70-130	12		25
o-Xylene	98		112		70-130	13		25
Methyl tert butyl ether	104		116		70-130	11		25
Naphthalene	95		108		70-130	13		25
1,2,4-Trimethylbenzene	96		109		70-130	13		25
Pentane	95		104		70-130	9		25
2-Methylpentane	100		110		70-130	10		25
2,2,4-Trimethylpentane	96		107		70-130	11		25
n-Nonane	94		106		30-130	12		25
n-Decane	94		106		70-130	12		25
n-Butylcyclohexane	94		108		70-130	13		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	98		112		70-130
2,5-Dibromotoluene-FID	88		101		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 03 Batch: WG1401675-2 WG1401675-3								
C9-C18 Aliphatics	57		59		40-140	3		25
C19-C36 Aliphatics	77		78		40-140	1		25
C11-C22 Aromatics	63		65		40-140	3		25
Naphthalene	58		60		40-140	3		25
2-Methylnaphthalene	61		63		40-140	3		25
Acenaphthylene	60		62		40-140	3		25
Acenaphthene	63		66		40-140	5		25
Fluorene	64		66		40-140	3		25
Phenanthrene	64		65		40-140	2		25
Anthracene	62		65		40-140	5		25
Fluoranthene	66		67		40-140	2		25
Pyrene	64		65		40-140	2		25
Benzo(a)anthracene	61		63		40-140	3		25
Chrysene	54		57		40-140	5		25
Benzo(b)fluoranthene	72		74		40-140	3		25
Benzo(k)fluoranthene	51		53		40-140	4		25
Benzo(a)pyrene	58		61		40-140	5		25
Indeno(1,2,3-cd)Pyrene	59		61		40-140	3		25
Dibenzo(a,h)anthracene	42		45		40-140	7		25
Benzo(ghi)perylene	56		59		40-140	5		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 03 Batch: WG1401675-2 WG1401675-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	64		64		40-140
o-Terphenyl	61		58		40-140
2-Fluorobiphenyl	64		66		40-140
2-Bromonaphthalene	67		69		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 06 Batch: WG1401799-2 WG1401799-3								
C5-C8 Aliphatics	112		113		70-130	1		25
C9-C12 Aliphatics	110		112		70-130	2		25
C9-C10 Aromatics	121		122		70-130	1		25
Benzene	121		122		70-130	1		25
Toluene	121		122		70-130	1		25
Ethylbenzene	125		126		70-130	1		25
p/m-Xylene	122		124		70-130	2		25
o-Xylene	123		124		70-130	1		25
Methyl tert butyl ether	130		130		70-130	0		25
Naphthalene	119		119		70-130	0		25
1,2,4-Trimethylbenzene	121		122		70-130	1		25
Pentane	108		109		70-130	1		25
2-Methylpentane	112		114		70-130	2		25
2,2,4-Trimethylpentane	111		112		70-130	1		25
n-Nonane	110		111		30-130	1		25
n-Decane	110		111		70-130	1		25
n-Butylcyclohexane	111		112		70-130	1		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	124		126		70-130
2,5-Dibromotoluene-FID	106		108		70-130

PCBS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 D
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:02
Analyst: CW
Percent Solids: 86%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	189	--	5	A
Aroclor 1221	ND		ug/kg	189	--	5	A
Aroclor 1232	ND		ug/kg	189	--	5	A
Aroclor 1242	ND		ug/kg	189	--	5	A
Aroclor 1248	ND		ug/kg	189	--	5	A
Aroclor 1254	ND		ug/kg	189	--	5	A
Aroclor 1260	ND		ug/kg	189	--	5	A
Aroclor 1262	ND		ug/kg	189	--	5	A
Aroclor 1268	ND		ug/kg	189	--	5	A
PCBs, Total	ND		ug/kg	189	--	5	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	66		30-150	B
Decachlorobiphenyl	69		30-150	B
2,4,5,6-Tetrachloro-m-xylene	66		30-150	A
Decachlorobiphenyl	64		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:33
Analyst: CW
Percent Solids: 89%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	36.2	--	1	A
Aroclor 1221	ND		ug/kg	36.2	--	1	A
Aroclor 1232	ND		ug/kg	36.2	--	1	A
Aroclor 1242	ND		ug/kg	36.2	--	1	A
Aroclor 1248	ND		ug/kg	36.2	--	1	A
Aroclor 1254	ND		ug/kg	36.2	--	1	A
Aroclor 1260	ND		ug/kg	36.2	--	1	B
Aroclor 1262	ND		ug/kg	36.2	--	1	A
Aroclor 1268	ND		ug/kg	36.2	--	1	A
PCBs, Total	ND		ug/kg	36.2	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	49		30-150	B
Decachlorobiphenyl	59		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	54		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:40
Analyst: CW
Percent Solids: 90%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	36.2	--	1	A
Aroclor 1221	ND		ug/kg	36.2	--	1	A
Aroclor 1232	ND		ug/kg	36.2	--	1	A
Aroclor 1242	ND		ug/kg	36.2	--	1	A
Aroclor 1248	ND		ug/kg	36.2	--	1	A
Aroclor 1254	ND		ug/kg	36.2	--	1	A
Aroclor 1260	ND		ug/kg	36.2	--	1	B
Aroclor 1262	ND		ug/kg	36.2	--	1	A
Aroclor 1268	ND		ug/kg	36.2	--	1	A
PCBs, Total	ND		ug/kg	36.2	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	55		30-150	B
Decachlorobiphenyl	64		30-150	B
2,4,5,6-Tetrachloro-m-xylene	59		30-150	A
Decachlorobiphenyl	60		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 D
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:23
Analyst: CW
Percent Solids: 91%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	730	--	20	A
Aroclor 1221	ND		ug/kg	730	--	20	A
Aroclor 1232	ND		ug/kg	730	--	20	A
Aroclor 1242	ND		ug/kg	730	--	20	A
Aroclor 1248	ND		ug/kg	730	--	20	A
Aroclor 1254	ND		ug/kg	730	--	20	A
Aroclor 1260	ND		ug/kg	730	--	20	A
Aroclor 1262	ND		ug/kg	730	--	20	A
Aroclor 1268	ND		ug/kg	730	--	20	A
PCBs, Total	ND		ug/kg	730	--	20	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	B
Decachlorobiphenyl	**0**	Q	30-150	B
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	A
Decachlorobiphenyl	**0**	Q	30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:55
Analyst: CW
Percent Solids: 88%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	37.6	--	1	A
Aroclor 1221	ND		ug/kg	37.6	--	1	A
Aroclor 1232	ND		ug/kg	37.6	--	1	A
Aroclor 1242	ND		ug/kg	37.6	--	1	A
Aroclor 1248	ND		ug/kg	37.6	--	1	A
Aroclor 1254	ND		ug/kg	37.6	--	1	A
Aroclor 1260	ND		ug/kg	37.6	--	1	A
Aroclor 1262	ND		ug/kg	37.6	--	1	A
Aroclor 1268	ND		ug/kg	37.6	--	1	A
PCBs, Total	ND		ug/kg	37.6	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	49		30-150	B
Decachlorobiphenyl	70		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	61		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 D
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:30
Analyst: CW
Percent Solids: 81%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	802	--	20	A
Aroclor 1221	ND		ug/kg	802	--	20	A
Aroclor 1232	ND		ug/kg	802	--	20	A
Aroclor 1242	ND		ug/kg	802	--	20	A
Aroclor 1248	ND		ug/kg	802	--	20	A
Aroclor 1254	ND		ug/kg	802	--	20	A
Aroclor 1260	3980		ug/kg	802	--	20	B
Aroclor 1262	ND		ug/kg	802	--	20	A
Aroclor 1268	ND		ug/kg	802	--	20	A
PCBs, Total	3980		ug/kg	802	--	20	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	B
Decachlorobiphenyl	**0**	Q	30-150	B
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	A
Decachlorobiphenyl	**0**	Q	30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:09
Analyst: CW
Percent Solids: 79%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	41.5	--	1	A
Aroclor 1221	ND		ug/kg	41.5	--	1	A
Aroclor 1232	ND		ug/kg	41.5	--	1	A
Aroclor 1242	ND		ug/kg	41.5	--	1	A
Aroclor 1248	ND		ug/kg	41.5	--	1	A
Aroclor 1254	ND		ug/kg	41.5	--	1	A
Aroclor 1260	155	P	ug/kg	41.5	--	1	B
Aroclor 1262	ND		ug/kg	41.5	--	1	A
Aroclor 1268	ND		ug/kg	41.5	--	1	A
PCBs, Total	155		ug/kg	41.5	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	54		30-150	B
Decachlorobiphenyl	67		30-150	B
2,4,5,6-Tetrachloro-m-xylene	58		30-150	A
Decachlorobiphenyl	52		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:17
Analyst: CW
Percent Solids: 85%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	38.3	--	1	A
Aroclor 1221	ND		ug/kg	38.3	--	1	A
Aroclor 1232	ND		ug/kg	38.3	--	1	A
Aroclor 1242	ND		ug/kg	38.3	--	1	A
Aroclor 1248	200		ug/kg	38.3	--	1	A
Aroclor 1254	105		ug/kg	38.3	--	1	B
Aroclor 1260	132		ug/kg	38.3	--	1	B
Aroclor 1262	ND		ug/kg	38.3	--	1	A
Aroclor 1268	ND		ug/kg	38.3	--	1	A
PCBs, Total	437		ug/kg	38.3	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	50		30-150	B
Decachlorobiphenyl	66		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	50		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:24
Analyst: CW
Percent Solids: 91%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	35.8	--	1	A
Aroclor 1221	ND		ug/kg	35.8	--	1	A
Aroclor 1232	ND		ug/kg	35.8	--	1	A
Aroclor 1242	ND		ug/kg	35.8	--	1	A
Aroclor 1248	ND		ug/kg	35.8	--	1	A
Aroclor 1254	ND		ug/kg	35.8	--	1	A
Aroclor 1260	ND		ug/kg	35.8	--	1	A
Aroclor 1262	ND		ug/kg	35.8	--	1	A
Aroclor 1268	ND		ug/kg	35.8	--	1	A
PCBs, Total	ND		ug/kg	35.8	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	50		30-150	B
Decachlorobiphenyl	66		30-150	B
2,4,5,6-Tetrachloro-m-xylene	55		30-150	A
Decachlorobiphenyl	60		30-150	A

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8082A
Analytical Date: 08/20/20 08:49
Analyst: CW

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Column
MCP Polychlorinated Biphenyls - Westborough Lab for sample(s): 01-09 Batch: WG1400671-1						
Aroclor 1016	ND		ug/kg	32.6	--	A
Aroclor 1221	ND		ug/kg	32.6	--	A
Aroclor 1232	ND		ug/kg	32.6	--	A
Aroclor 1242	ND		ug/kg	32.6	--	A
Aroclor 1248	ND		ug/kg	32.6	--	A
Aroclor 1254	ND		ug/kg	32.6	--	A
Aroclor 1260	ND		ug/kg	32.6	--	A
Aroclor 1262	ND		ug/kg	32.6	--	A
Aroclor 1268	ND		ug/kg	32.6	--	A
PCBs, Total	ND		ug/kg	32.6	--	A

Surrogate	%Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	64		30-150	B
Decachlorobiphenyl	71		30-150	B
2,4,5,6-Tetrachloro-m-xylene	62		30-150	A
Decachlorobiphenyl	66		30-150	A

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits	Column
MCP Polychlorinated Biphenyls - Westborough Lab Associated sample(s): 01-09 Batch: WG1400671-2 WG1400671-3									
Aroclor 1016	64		66		40-140	3		30	A
Aroclor 1260	61		62		40-140	2		30	A

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	63		64		30-150	B
Decachlorobiphenyl	72		70		30-150	B
2,4,5,6-Tetrachloro-m-xylene	62		63		30-150	A
Decachlorobiphenyl	66		66		30-150	A

METALS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 86%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Arsenic, Total	11.3		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Beryllium, Total	0.511		mg/kg	0.228	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Chromium, Total	26.3		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Copper, Total	8.32		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Lead, Total	31.1		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.085	--	1	08/20/20 05:00	08/20/20 16:40	EPA 7471B	97,7471B	AL
Nickel, Total	15.8		mg/kg	1.14	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Zinc, Total	48.1		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Arsenic, Total	6.19		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Beryllium, Total	0.484		mg/kg	0.222	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Chromium, Total	35.1		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Copper, Total	9.45		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Lead, Total	12.9		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.082	--	1	08/20/20 05:00	08/20/20 16:57	EPA 7471B	97,7471B	AL
Nickel, Total	22.6		mg/kg	1.11	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Zinc, Total	48.2		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Arsenic, Total	6.18		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Beryllium, Total	0.509		mg/kg	0.216	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Chromium, Total	33.6		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Copper, Total	10.3		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Lead, Total	11.3		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:07	EPA 7471B	97,7471B	AL
Nickel, Total	20.2		mg/kg	1.08	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Zinc, Total	39.6		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	9.01		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Arsenic, Total	49.6		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Beryllium, Total	0.364		mg/kg	0.214	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Cadmium, Total	1.57		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Chromium, Total	20.8		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Copper, Total	982		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Lead, Total	477		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Mercury, Total	2.92		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:10	EPA 7471B	97,7471B	AL
Nickel, Total	17.4		mg/kg	1.07	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Selenium, Total	11.5		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Zinc, Total	501		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 88%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Arsenic, Total	7.91		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Beryllium, Total	0.986		mg/kg	0.224	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Chromium, Total	47.8		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Copper, Total	14.8		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Lead, Total	5.68		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.083	--	1	08/20/20 05:00	08/20/20 17:14	EPA 7471B	97,7471B	AL
Nickel, Total	31.4		mg/kg	1.12	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Zinc, Total	38.5		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Arsenic, Total	10.8		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Beryllium, Total	0.394		mg/kg	0.243	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Cadmium, Total	2.00		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Chromium, Total	26.1		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Copper, Total	23.8		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Lead, Total	169		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.089	--	1	08/20/20 05:00	08/20/20 17:17	EPA 7471B	97,7471B	AL
Nickel, Total	15.1		mg/kg	1.22	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Zinc, Total	60.9		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Arsenic, Total	14.5		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Beryllium, Total	0.573		mg/kg	0.243	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Chromium, Total	31.1		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Copper, Total	5.80		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Lead, Total	108		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.092	--	1	08/20/20 05:00	08/20/20 17:20	EPA 7471B	97,7471B	AL
Nickel, Total	14.1		mg/kg	1.21	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Zinc, Total	34.6		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Arsenic, Total	6.26		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Beryllium, Total	0.602		mg/kg	0.226	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Chromium, Total	31.5		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Copper, Total	7.60		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Lead, Total	40.4		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.087	--	1	08/20/20 05:00	08/20/20 17:23	EPA 7471B	97,7471B	AL
Nickel, Total	17.4		mg/kg	1.13	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Zinc, Total	39.6		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Arsenic, Total	7.08		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Beryllium, Total	0.634		mg/kg	0.213	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Chromium, Total	22.7		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Copper, Total	7.94		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Lead, Total	3.66		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:27	EPA 7471B	97,7471B	AL
Nickel, Total	15.8		mg/kg	1.06	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Zinc, Total	21.6		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-09 Batch: WG1400770-1										
Antimony, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Arsenic, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Beryllium, Total	ND		mg/kg	0.200	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Chromium, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Copper, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Lead, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Nickel, Total	ND		mg/kg	1.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Selenium, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Silver, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Thallium, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Zinc, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD

Prep Information

Digestion Method: EPA 3050B

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-09 Batch: WG1400772-1										
Mercury, Total	ND		mg/kg	0.083	--	1	08/20/20 05:00	08/20/20 16:31	97,7471B	AL

Prep Information

Digestion Method: EPA 7471B

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 Batch: WG1400770-2 WG1400770-3 SRM Lot Number: D109-540								
Antimony, Total	171		140		19-250	20		30
Arsenic, Total	99		93		70-130	6		30
Beryllium, Total	109		96		75-125	13		30
Cadmium, Total	114		94		75-125	19		30
Chromium, Total	99		89		70-130	11		30
Copper, Total	95		88		75-125	8		30
Lead, Total	89		86		72-128	3		30
Nickel, Total	107		94		70-130	13		30
Selenium, Total	104		95		68-132	9		30
Silver, Total	93		86		68-131	8		30
Thallium, Total	104		95		68-131	9		30
Zinc, Total	95		88		70-130	8		30
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 Batch: WG1400772-2 WG1400772-3 SRM Lot Number: D109-540								
Mercury, Total	99		91		60-140	8		30

Matrix Spike Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 15-18 QC Batch ID: WG1400770-4 WG1400770-5 QC Sample: L2033722-01 Client ID: B-101												
Antimony, Total	ND	45.5	36.4	80		35.4	79		75-125	3		35
Arsenic, Total	11.3	10.9	17.4	**56**	Q	18.6	**68**	Q	75-125	7		35
Beryllium, Total	0.511	4.55	4.37	85		4.23	83		75-125	3		35
Cadmium, Total	ND	4.64	3.90	84		3.95	86		75-125	1		35
Chromium, Total	26.3	18.2	38.3	**66**	Q	45.4	106		75-125	17		35
Copper, Total	8.32	22.8	26.3	79		29.1	92		75-125	10		35
Lead, Total	31.1	46.4	61.8	**66**	Q	70.5	86		75-125	13		35
Nickel, Total	15.8	45.5	49.7	**74**	Q	50.5	77		75-125	2		35
Selenium, Total	ND	10.9	9.37	86		9.55	88		75-125	2		35
Silver, Total	ND	27.3	23.1	84		23.6	88		75-125	2		35
Thallium, Total	ND	10.9	7.00	**64**	Q	7.74	**72**	Q	75-125	10		35
Zinc, Total	48.1	45.5	75.6	**60**	Q	80.9	**73**	Q	75-125	7		35
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 15-18 QC Batch ID: WG1400772-4 WG1400772-5 QC Sample: L2033722-01 Client ID: B-101												
Mercury, Total	ND	0.171	0.178	104		0.184	109		75-125	3		35

Project Name: LUNENBURG
Project Number: 6893

Lab Serial Dilution Analysis
Batch Quality Control

Lab Number: L2033722
Report Date: 08/25/20

Parameter	Native Sample	Serial Dilution	Units	% D	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 QC Batch ID: WG1400770-6 QC Sample: L2033722-01 Client ID: B-101 15-18						
Chromium, Total	26.3	30.5	mg/kg	16		20

INORGANICS
&
MISCELLANEOUS

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	85.5		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	88.8		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.6		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	87.7		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	81.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	79.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	85.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.9		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Lab Duplicate Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-09 QC Batch ID: WG1400703-1 QC Sample: L2033722-01 Client ID: B-101 15-18						
Solids, Total	85.5	85.7	%	0		20

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
C	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-01A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-01B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-01C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-01D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-01E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-01F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-01G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-02A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-02B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-02C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-02D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-02E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-02F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-02G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-03A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-03B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-03C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-03D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-03E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SB-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-03F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-03G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-04A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-04B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-04C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-04D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-04E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-04F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-04G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-05A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-05B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-05C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-05D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-05E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-05F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-05G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-06A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-06B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-06C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-06D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-06E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-06F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-06G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-07A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-07B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-07C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-07D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-07E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-07F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-07G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-08A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-08B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-08C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-08D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-08E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-08F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-08G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-09A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-09B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-09C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-09D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-09E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SB-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-09F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-09G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-11A	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)
L2033722-11B	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)
L2033722-11C	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)

*Values in parentheses indicate holding time in days

Project Name:	LUNENBURG	**Lab Number:**	L2033722
Project Number:	6893	**Report Date:**	08/25/20

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2033722
Project Number:	6893	**Report Date:**	08/25/20

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2033722
Project Number:	6893	**Report Date:**	08/25/20

Data Qualifiers

Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2033722
Project Number:	6893	**Report Date:**	08/25/20

REFERENCES

97 EPA Test Methods (SW-846) with QC Requirements & Performance Standards for the Analysis of EPA SW-846 Methods under the Massachusetts Contingency Plan, WSC-CAM-IIA, IIB, IIIA, IIIB, IIIC, IIID, VA, VB, VC, VIA, VIB, VIIIA and VIIIB, July 2010.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

131 Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), MassDEP, February 2018, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of VPH under the Massachusetts Contingency Plan, WSC-CAM-IVA, June 1, 2018.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

Date Rec'd in Lab: 8/19/20

ALPHA Job #: L2033722

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Bohler Group
Address: 701 George Washington Hwy
Lincoln, RI 02865
Phone: 401.333.2382
Email: jmcloughlin@bohler-inc.com

Project Information

Project Name: Lunenburg
Project Location: Lunenburg, MA
Project #: 6893
Project Manager: Joe McLoughlin
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☒ ADEx ☒ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☒ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☒ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:
VOC LL Frozen 8/6/20 @ 6:00 PM

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☒8260 ☐624 ☐524.2	SVOC: ☐ABN ☐PAH	METALS: ☐MCP 13 ☐MCP 14 ☐RCP 15	METALS: ☐RCRA5 ☐RCRA8 ☐PP13	EPH: ☒Ranges & Targets ☐Ranges Only	VPH: ☒Ranges & Targets ☐Ranges Only	☒PCB ☐PEST	TPH: ☐Quant Only ☐Fingerprint	Sample Comments	TOTAL # BOTTLES
33722-01	B-101 15-18	8/6/20	9:00	Soil	SN	X			X	X	X	X			7
02	B-105 12.5-17.5		9:50	Soil	SN	X			X	X	X	X			7
03	Dup		10:15	Soil	SN	X			X	X	X	X			7
04	B-107 8-10		10:45	Soil	SN	X			X	X	X	X			7
05	B-104 10-12		11:30	Soil	SN	X			X	X	X	X			7
06	B-103 13-15		1:00	Soil	SN	X			X	X	X	X			7
07	B-106 12.5-15		1:45	Soil	SN	X			X	X	X	X			7
08	B-102 13-15		2:10	Soil	SN	X			X	X	X	X			7
09	B-108 13-17.5		3:05	Soil	SN	X			X	X	X	X			7
10	Trip Blank		—	—	SN	X									1

CHAIN OF CUSTODY

PAGE 2 OF 2

Date Rec'd in Lab: 8/19/20

ALPHA Job #: L2033722

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: Beta Group
Address: 701 George Washington Hwy
Lincoln, RI 02865
Phone: 401.333.2382
Email: jmclaughlin@beta-inc.com

Additional Project Information:

Project Information

Project Name: Lunenburg
Project Location: Lunenburg, MA
Project #: 6853
Project Manager: Joe McLaughlin
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☑ ADEx ☑ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☑ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☑ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: VOC: ☑ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do; Sample Comments	TOTAL # BOTTLES
33722-11	Equip Blank	8/6/20	8:00	-	SN	X									3

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type	V																		
Preservative	F																		

Relinquished By:	Date/Time	Received By:	Date/Time
SKM	8/19/20 8am	SKM	8/19/20 11:00
SAN	8/19/20 11:30	AAL	8/19/20 11:30
MGM	8/19/20	WGM	8/19/20 14:20

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400899-5	**Lab File ID**	: V17200819N04
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/19/20 19:35

Client Sample No.	Lab Sample ID	Analysis Date
WG1400899-3LCS	WG1400899-3	08/19/20 18:17
WG1400899-4LCSD	WG1400899-4	08/19/20 18:43
TRIP BLANK	L2033722-10	08/19/20 21:21
B-101 15-18	L2033722-01	08/19/20 22:13
B-105 12.5-17.5	L2033722-02D	08/19/20 22:39
DUP	L2033722-03D	08/19/20 23:05
B-107 8-10	L2033722-04	08/19/20 23:32
B-106 12.5-15	L2033722-07	08/19/20 23:58
B-102 13-15	L2033722-08D	08/20/20 00:24

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400902-5	**Lab File ID**	: V17200819N04
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/19/20 19:35

Client Sample No.	Lab Sample ID	Analysis Date
WG1400902-3LCS	WG1400902-3	08/19/20 18:17
WG1400902-4LCSD	WG1400902-4	08/19/20 18:43
TRIP BLANK	L2033722-10	08/19/20 21:47
B-108 15-17.5	L2033722-09	08/20/20 00:50

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400764-5	**Lab File ID**	: VJ2008189N04
Instrument ID	: JACK		
Matrix	: WATER	**Analysis Date**	: 08/19/20 20:07

Client Sample No.	Lab Sample ID	Analysis Date
WG1400764-3LCS	WG1400764-3	08/19/20 18:48
WG1400764-4LCSD	WG1400764-4	08/19/20 19:14
EQUIP BLANK	L2033722-11	08/19/20 20:34

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1401019-5	**Lab File ID**	: V17200820A05
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/20/20 07:18

Client Sample No.	Lab Sample ID	Analysis Date
WG1401019-3LCS	WG1401019-3	08/20/20 05:33
WG1401019-4LCSD	WG1401019-4	08/20/20 05:59
B-104 10-12	L2033722-05	08/20/20 07:44
B-103 13-15	L2033722-06	08/20/20 08:10

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400899-12	**Lab File ID**	: V17200820A05
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/20/20 07:18

Client Sample No.	Lab Sample ID	Analysis Date
WG1400899-10LCS	WG1400899-10	08/20/20 05:33
WG1400899-11LCSD	WG1400899-11	08/20/20 05:59
DUP	L2033722-03D2	08/20/20 12:32
B-102 13-15	L2033722-08D2	08/20/20 13:25
B-105 12.5-17.5	L2033722-02D2	08/20/20 13:58

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	87	0
Dichlorodifluoromethane	0.19	0.167	-	12.1	20	80	-.01
Chloromethane	0.196	0.171	-	12.8	20	84	-.02
Vinyl chloride	0.508	0.422	-	16.9	20	73	0
Bromomethane	40	48.025	-	-20.1*	20	104	-.01
Chloroethane	0.454	0.41	-	9.7	20	84	-.01
Trichlorofluoromethane	1.028	0.894	-	13	20	78	0
Ethyl ether	0.297	0.27	-	9.1	20	81	0
1,1-Dichloroethene	0.195	0.168	-	13.8	20	79	0
Carbon disulfide	0.569	0.424	-	25.5*	20	70	-.01
Freon-113	0.213	0.149	-	30*	20	63	-.01
Acrolein	0.01052	0.00801*	-	23.9*	20	68	0
Methylene chloride	0.231	0.197	-	14.7	20	82	0
Acetone	40	35.436	-	11.4	20	73	-.01
trans-1,2-Dichloroethene	0.215	0.207	-	3.7	20	88	-.01
Methyl acetate	0.066	0.054*	-	18.2	20	72	-.01
Methyl tert-butyl ether	0.418	0.385	-	7.9	20	81	0
tert-Butyl alcohol	0.01122	0.00959*	-	14.5	20	75	-.01
Diisopropyl ether	0.46	0.401	-	12.8	20	75	0
1,1-Dichloroethane	0.362	0.301	-	16.9	20	75	0
Halothane	0.182	0.16	-	12.1	20	79	0
Acrylonitrile	0.032	0.029*	-	9.4	20	77	0
Ethyl tert-butyl ether	0.486	0.418	-	14	20	74	0
Vinyl acetate	0.292	0.254	-	13	20	73	0
cis-1,2-Dichloroethene	0.261	0.228	-	12.6	20	78	0
2,2-Dichloropropane	0.309	0.275	-	11	20	81	0
Bromochloromethane	0.116	0.106	-	8.6	20	82	0
Cyclohexane	0.275	0.203	-	26.2*	20	62	0
Chloroform	0.4	0.342	-	14.5	20	78	0
Ethyl acetate	0.099	0.084	-	15.2	20	73	0
Carbon tetrachloride	0.31	0.267	-	13.9	20	76	0
Tetrahydrofuran	40	33.322	-	16.7	20	69	-.01
Dibromofluoromethane	0.262	0.254	-	3.1	20	86	0
1,1,1-Trichloroethane	0.353	0.292	-	17.3	20	75	0
2-Butanone	40	33.652	-	15.9	20	70	0
1,1-Dichloropropene	0.273	0.238	-	12.8	20	76	0
Benzene	0.871	0.768	-	11.8	20	79	0
tert-Amyl methyl ether	0.462	0.41	-	11.3	20	75	0
1,2-Dichloroethane-d4	0.217	0.19	-	12.4	20	80	0
1,2-Dichloroethane	0.231	0.192	-	16.9	20	75	0
Methyl cyclohexane	0.363	0.266	-	26.7*	20	64	0
Trichloroethene	0.256	0.212	-	17.2	20	77	0
Dibromomethane	0.119	0.104	-	12.6	20	77	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.17	-	12.8	20	77	0
2-Chloroethyl vinyl ether	0.08	0.074	-	7.5	20	78	0
Bromodichloromethane	0.291	0.255	-	12.4	20	77	0
1,4-Dioxane	0.00132	0.00134*	-	-1.5	20	85	0
cis-1,3-Dichloropropene	0.31	0.285	-	8.1	20	76	0
Chlorobenzene-d5	1	1	-	0	20	95	0
Toluene-d8	1.245	1.128	-	9.4	20	84	0
Toluene	0.746	0.612	-	18	20	79	0
4-Methyl-2-pentanone	40	30.804	-	23*	20	78	0
Tetrachloroethene	0.349	0.281	-	19.5	20	84	0
trans-1,3-Dichloropropene	0.351	0.288	-	17.9	20	75	0
Ethyl methacrylate	0.23	0.188	-	18.3	20	80	0
1,1,2-Trichloroethane	0.185	0.149	-	19.5	20	77	0
Chlorodibromomethane	0.275	0.259	-	5.8	20	90	0
1,3-Dichloropropane	0.346	0.299	-	13.6	20	82	0
1,2-Dibromoethane	0.206	0.188	-	8.7	20	85	0
2-Hexanone	0.079	0.065*	-	17.7	20	78	0
Chlorobenzene	0.897	0.81	-	9.7	20	90	0
Ethylbenzene	1.399	1.289	-	7.9	20	86	0
1,1,1,2-Tetrachloroethane	0.327	0.288	-	11.9	20	87	0
p/m Xylene	0.605	0.551	-	8.9	20	88	0
o Xylene	0.515	0.509	-	1.2	20	86	0
Styrene	80	71.511	-	10.6	20	83	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	91	0
Bromoform	0.342	0.292	-	14.6	20	82	0
Isopropylbenzene	2.555	2.486	-	2.7	20	85	0
4-Bromofluorobenzene	0.703	0.707	-	-0.6	20	92	0
Bromobenzene	0.653	0.618	-	5.4	20	91	0
n-Propylbenzene	3.154	2.92	-	7.4	20	85	0
1,4-Dichlorobutane	0.513	0.432	-	15.8	20	79	0
1,1,2,2-Tetrachloroethane	0.481	0.417	-	13.3	20	81	0
4-Ethyltoluene	2.46	2.503	-	-1.7	20	89	0
2-Chlorotoluene	1.753	1.633	-	6.8	20	85	0
1,3,5-Trimethylbenzene	2.268	2.132	-	6	20	84	0
1,2,3-Trichloropropane	0.377	0.302	-	19.9	20	76	0
trans-1,4-Dichloro-2-buten	0.097	0.084	-	13.4	20	75	0
4-Chlorotoluene	1.793	1.674	-	6.6	20	84	0
tert-Butylbenzene	1.876	1.841	-	1.9	20	85	0
1,2,4-Trimethylbenzene	2.199	2.094	-	4.8	20	83	0
sec-Butylbenzene	2.765	2.782	-	-0.6	20	87	0
p-Isopropyltoluene	2.465	2.463	-	0.1	20	85	0
1,3-Dichlorobenzene	1.395	1.335	-	4.3	20	89	0
1,4-Dichlorobenzene	1.383	1.336	-	3.4	20	90	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.484	-	-3.3	20	90	0
n-Butylbenzene	2.374	2.137	-	10	20	78	0
1,2-Dichlorobenzene	1.235	1.164	-	5.7	20	87	0
1,2,4,5-Tetramethylbenzene	40	34.577	-	13.6	20	88	0
1,2-Dibromo-3-chloropropan	0.068	0.063	-	7.4	20	82	0
1,3,5-Trichlorobenzene	0.874	0.859	-	1.7	20	90	0
Hexachlorobutadiene	0.363	0.296	-	18.5	20	75	0
1,2,4-Trichlorobenzene	0.728	0.673	-	7.6	20	83	0
Naphthalene	1.459	1.291	-	11.5	20	77	0
1,2,3-Trichlorobenzene	0.657	0.58	-	11.7	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/19/20 18:17
Lab File ID	: V17200819N01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1400902-2	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	87	0
Dichlorodifluoromethane	0.19	0.167	-	12.1	20	80	-.01
Chloromethane	0.196	0.171	-	12.8	20	84	-.02
Vinyl chloride	0.508	0.422	-	16.9	20	73	0
Bromomethane	40	48.025	-	-20.1*	20	104	-.01
Chloroethane	0.454	0.41	-	9.7	20	84	-.01
Trichlorofluoromethane	1.028	0.894	-	13	20	78	0
Ethyl ether	0.297	0.27	-	9.1	20	81	0
1,1-Dichloroethene	0.195	0.168	-	13.8	20	79	0
Carbon disulfide	0.569	0.424	-	25.5*	20	70	-.01
Freon-113	0.213	0.149	-	30*	20	63	-.01
Acrolein	0.01052	0.00801*	-	23.9*	20	68	0
Methylene chloride	0.231	0.197	-	14.7	20	82	0
Acetone	40	35.436	-	11.4	20	73	-.01
trans-1,2-Dichloroethene	0.215	0.207	-	3.7	20	88	-.01
Methyl acetate	0.066	0.054*	-	18.2	20	72	-.01
Methyl tert-butyl ether	0.418	0.385	-	7.9	20	81	0
tert-Butyl alcohol	0.01122	0.00959*	-	14.5	20	75	-.01
Diisopropyl ether	0.46	0.401	-	12.8	20	75	0
1,1-Dichloroethane	0.362	0.301	-	16.9	20	75	0
Halothane	0.182	0.16	-	12.1	20	79	0
Acrylonitrile	0.032	0.029*	-	9.4	20	77	0
Ethyl tert-butyl ether	0.486	0.418	-	14	20	74	0
Vinyl acetate	0.292	0.254	-	13	20	73	0
cis-1,2-Dichloroethene	0.261	0.228	-	12.6	20	78	0
2,2-Dichloropropane	0.309	0.275	-	11	20	81	0
Bromochloromethane	0.116	0.106	-	8.6	20	82	0
Cyclohexane	0.275	0.203	-	26.2*	20	62	0
Chloroform	0.4	0.342	-	14.5	20	78	0
Ethyl acetate	0.099	0.084	-	15.2	20	73	0
Carbon tetrachloride	0.31	0.267	-	13.9	20	76	0
Tetrahydrofuran	40	33.322	-	16.7	20	69	-.01
Dibromofluoromethane	0.262	0.254	-	3.1	20	86	0
1,1,1-Trichloroethane	0.353	0.292	-	17.3	20	75	0
2-Butanone	40	33.652	-	15.9	20	70	0
1,1-Dichloropropene	0.273	0.238	-	12.8	20	76	0
Benzene	0.871	0.768	-	11.8	20	79	0
tert-Amyl methyl ether	0.462	0.41	-	11.3	20	75	0
1,2-Dichloroethane-d4	0.217	0.19	-	12.4	20	80	0
1,2-Dichloroethane	0.231	0.192	-	16.9	20	75	0
Methyl cyclohexane	0.363	0.266	-	26.7*	20	64	0
Trichloroethene	0.256	0.212	-	17.2	20	77	0
Dibromomethane	0.119	0.104	-	12.6	20	77	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400902-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.17	-	12.8	20	77	0
2-Chloroethyl vinyl ether	0.08	0.074	-	7.5	20	78	0
Bromodichloromethane	0.291	0.255	-	12.4	20	77	0
1,4-Dioxane	0.00132	0.00134*	-	-1.5	20	85	0
cis-1,3-Dichloropropene	0.31	0.285	-	8.1	20	76	0
Chlorobenzene-d5	1	1	-	0	20	95	0
Toluene-d8	1.245	1.128	-	9.4	20	84	0
Toluene	0.746	0.612	-	18	20	79	0
4-Methyl-2-pentanone	40	30.804	-	23*	20	78	0
Tetrachloroethene	0.349	0.281	-	19.5	20	84	0
trans-1,3-Dichloropropene	0.351	0.288	-	17.9	20	75	0
Ethyl methacrylate	0.23	0.188	-	18.3	20	80	0
1,1,2-Trichloroethane	0.185	0.149	-	19.5	20	77	0
Chlorodibromomethane	0.275	0.259	-	5.8	20	90	0
1,3-Dichloropropane	0.346	0.299	-	13.6	20	82	0
1,2-Dibromoethane	0.206	0.188	-	8.7	20	85	0
2-Hexanone	0.079	0.065*	-	17.7	20	78	0
Chlorobenzene	0.897	0.81	-	9.7	20	90	0
Ethylbenzene	1.399	1.289	-	7.9	20	86	0
1,1,1,2-Tetrachloroethane	0.327	0.288	-	11.9	20	87	0
p/m Xylene	0.605	0.551	-	8.9	20	88	0
o Xylene	0.515	0.509	-	1.2	20	86	0
Styrene	80	71.511	-	10.6	20	83	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	91	0
Bromoform	0.342	0.292	-	14.6	20	82	0
Isopropylbenzene	2.555	2.486	-	2.7	20	85	0
4-Bromofluorobenzene	0.703	0.707	-	-0.6	20	92	0
Bromobenzene	0.653	0.618	-	5.4	20	91	0
n-Propylbenzene	3.154	2.92	-	7.4	20	85	0
1,4-Dichlorobutane	0.513	0.432	-	15.8	20	79	0
1,1,2,2-Tetrachloroethane	0.481	0.417	-	13.3	20	81	0
4-Ethyltoluene	2.46	2.503	-	-1.7	20	89	0
2-Chlorotoluene	1.753	1.633	-	6.8	20	85	0
1,3,5-Trimethylbenzene	2.268	2.132	-	6	20	84	0
1,2,3-Trichloropropane	0.377	0.302	-	19.9	20	76	0
trans-1,4-Dichloro-2-buten	0.097	0.084	-	13.4	20	75	0
4-Chlorotoluene	1.793	1.674	-	6.6	20	84	0
tert-Butylbenzene	1.876	1.841	-	1.9	20	85	0
1,2,4-Trimethylbenzene	2.199	2.094	-	4.8	20	83	0
sec-Butylbenzene	2.765	2.782	-	-0.6	20	87	0
p-Isopropyltoluene	2.465	2.463	-	0.1	20	85	0
1,3-Dichlorobenzene	1.395	1.335	-	4.3	20	89	0
1,4-Dichlorobenzene	1.383	1.336	-	3.4	20	90	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400902-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.484	-	-3.3	20	90	0
n-Butylbenzene	2.374	2.137	-	10	20	78	0
1,2-Dichlorobenzene	1.235	1.164	-	5.7	20	87	0
1,2,4,5-Tetramethylbenzene	40	34.577	-	13.6	20	88	0
1,2-Dibromo-3-chloropropan	0.068	0.063	-	7.4	20	82	0
1,3,5-Trichlorobenzene	0.874	0.859	-	1.7	20	90	0
Hexachlorobutadiene	0.363	0.296	-	18.5	20	75	0
1,2,4-Trichlorobenzene	0.728	0.673	-	7.6	20	83	0
Naphthalene	1.459	1.291	-	11.5	20	77	0
1,2,3-Trichlorobenzene	0.657	0.58	-	11.7	20	80	0

*** Value outside of QC limits.**

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: JACK		**Calibration Date**	: 08/19/20 18:48	
Lab File ID	: VJ2008189N01		**Init. Calib. Date(s)**	: 08/12/20	08/12/20
Sample No	: WG1400764-2		**Init. Calib. Times**	: 11:51	15:40
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	93	0
Dichlorodifluoromethane	0.719	0.739	-	-2.8	20	90	0
Chloromethane	1.153	1.086	-	5.8	20	83	0
Vinyl chloride	1.008	1.246	-	-23.6*	20	103	0
Bromomethane	10	7.549	-	24.5*	20	66	0
Chloroethane	10	12.018	-	-20.2*	20	110	0
Trichlorofluoromethane	0.995	1.243	-	-24.9*	20	102	0
Ethyl ether	0.41	0.466	-	-13.7	20	102	0
1,1-Dichloroethene	0.691	0.831	-	-20.3*	20	103	0
Carbon disulfide	1.649	1.868	-	-13.3	20	101	0
Freon-113	0.675	0.852	-	-26.2*	20	104	0
Acrolein	0.069	0.078	-	-13	20	107	0
Methylene chloride	0.816	0.954	-	-16.9	20	105	0
Acetone	10	12.432	-	-24.3*	20	113	0
trans-1,2-Dichloroethene	0.706	0.833	-	-18	20	107	0
Methyl acetate	0.477	0.569	-	-19.3	20	109	0
Methyl tert-butyl ether	1.968	2.079	-	-5.6	20	97	0
tert-Butyl alcohol	0.061	0.064	-	-4.9	20	99	-.01
Diisopropyl ether	3.172	3.42	-	-7.8	20	99	0
1,1-Dichloroethane	1.631	1.898	-	-16.4	20	102	0
Halothane	0.526	0.585	-	-11.2	20	97	0
Acrylonitrile	0.232	0.244	-	-5.2	20	97	0
Ethyl tert-butyl ether	2.669	2.787	-	-4.4	20	94	0
Vinyl acetate	1.949	2.077	-	-6.6	20	97	0
cis-1,2-Dichloroethene	0.955	1.032	-	-8.1	20	98	0
2,2-Dichloropropane	1.309	1.343	-	-2.6	20	89	0
Bromochloromethane	0.345	0.37	-	-7.2	20	96	0
Cyclohexane	1.799	2.1	-	-16.7	20	97	0
Chloroform	1.513	1.615	-	-6.7	20	96	-.01
Ethyl acetate	0.742	0.747	-	-0.7	20	97	0
Carbon tetrachloride	0.945	0.976	-	-3.3	20	88	-.01
Tetrahydrofuran	0.263	0.271	-	-3	20	93	-.01
Dibromofluoromethane	0.211	0.209	-	0.9	20	91	0
1,1,1-Trichloroethane	1.238	1.343	-	-8.5	20	95	0
2-Butanone	0.313	0.318	-	-1.6	20	99	0
1,1-Dichloropropene	1.641	1.579	-	3.8	20	86	0
Benzene	3.876	4.103	-	-5.9	20	96	0
tert-Amyl methyl ether	2.358	2.221	-	5.8	20	87	0
1,2-Dichloroethane-d4	0.294	0.293	-	0.3	20	96	0
1,2-Dichloroethane	1.151	1.227	-	-6.6	20	95	0
Methyl cyclohexane	1.467	1.833	-	-24.9*	20	102	0
Trichloroethene	0.858	0.966	-	-12.6	20	99	0
Dibromomethane	0.432	0.461	-	-6.7	20	97	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: JACK	**Calibration Date**	: 08/19/20 18:48
Lab File ID	: VJ2008189N01	**Init. Calib. Date(s)**	: 08/12/20 08/12/20
Sample No	: WG1400764-2	**Init. Calib. Times**	: 11:51 15:40
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	1.01	1.077	-	-6.6	20	97	0
2-Chloroethyl vinyl ether	0.341	0.298	-	12.6	20	80	0
Bromodichloromethane	1.117	1.11	-	0.6	20	91	0
1,4-Dioxane	0.00655	0.00653*	-	0.3	20	89	-.01
cis-1,3-Dichloropropene	1.622	1.579	-	2.7	20	86	0
Chlorobenzene-d5	1	1	-	0	20	93	0
Toluene-d8	1.396	1.369	-	1.9	20	92	0
Toluene	3.191	3.4	-	-6.5	20	95	0
4-Methyl-2-pentanone	0.352	0.347	-	1.4	20	89	0
Tetrachloroethene	1.075	1.221	-	-13.6	20	100	0
trans-1,3-Dichloropropene	1.772	1.627	-	8.2	20	84	0
Ethyl methacrylate	1.414	1.344	-	5	20	88	0
1,1,2-Trichloroethane	0.831	0.868	-	-4.5	20	97	0
Chlorodibromomethane	0.88	0.807	-	8.3	20	87	0
1,3-Dichloropropane	1.807	1.848	-	-2.3	20	96	0
1,2-Dibromoethane	0.858	0.845	-	1.5	20	92	0
2-Hexanone	0.681	0.64	-	6	20	89	0
Chlorobenzene	3.149	3.291	-	-4.5	20	94	0
Ethylbenzene	5.982	6.46	-	-8	20	96	0
1,1,1,2-Tetrachloroethane	0.976	0.933	-	4.4	20	89	0
p/m Xylene	2.175	2.393	-	-10	20	95	0
o Xylene	2.032	2.166	-	-6.6	20	93	0
Styrene	3.432	3.737	-	-8.9	20	94	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	96	0
Bromoform	0.973	0.835	-	14.2	20	80	0
Isopropylbenzene	10.958	12.042	-	-9.9	20	97	0
4-Bromofluorobenzene	1.098	1.066	-	2.9	20	94	0
Bromobenzene	2.391	2.36	-	1.3	20	91	0
n-Propylbenzene	13.147	14.73	-	-12	20	100	0
1,4-Dichlorobutane	3.729	3.797	-	-1.8	20	94	0
1,1,2,2-Tetrachloroethane	2.174	2.301	-	-5.8	20	98	0
4-Ethyltoluene	9.915	10.932	-	-10.3	20	99	0
2-Chlorotoluene	9.099	9.693	-	-6.5	20	98	0
1,3,5-Trimethylbenzene	8.821	9.299	-	-5.4	20	96	0
1,2,3-Trichloropropane	1.883	1.941	-	-3.1	20	96	0
trans-1,4-Dichloro-2-buten	0.678	0.619	-	8.7	20	88	0
4-Chlorotoluene	8.598	9.003	-	-4.7	20	97	0
tert-Butylbenzene	6.734	7.482	-	-11.1	20	99	0
1,2,4-Trimethylbenzene	8.467	8.967	-	-5.9	20	99	0
sec-Butylbenzene	9.169	10.764	-	-17.4	20	103	0
p-Isopropyltoluene	7.772	8.563	-	-10.2	20	101	0
1,3-Dichlorobenzene	4.581	4.722	-	-3.1	20	96	0
1,4-Dichlorobenzene	4.594	4.801	-	-4.5	20	98	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: JACK		**Calibration Date**	: 08/19/20 18:48	
Lab File ID	: VJ2008189N01		**Init. Calib. Date(s)**	: 08/12/20	08/12/20
Sample No	: WG1400764-2		**Init. Calib. Times**	: 11:51	15:40
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	4.265	4.627	-	-8.5	20	101	0
n-Butylbenzene	6.543	7.493	-	-14.5	20	109	0
1,2-Dichlorobenzene	4.285	4.456	-	-4	20	97	0
1,2,4,5-Tetramethylbenzene	6.521	6.853	-	-5.1	20	96	0
1,2-Dibromo-3-chloropropan	0.267	0.236	-	11.6	20	82	0
1,3,5-Trichlorobenzene	2.364	2.424	-	-2.5	20	98	0
Hexachlorobutadiene	0.703	0.811	-	-15.4	20	105	0
1,2,4-Trichlorobenzene	2.105	2.167	-	-2.9	20	100	0
Naphthalene	5.281	5.145	-	2.6	20	95	0
1,2,3-Trichlorobenzene	1.88	1.924	-	-2.3	20	100	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/20/20 05:33
Lab File ID	: V17200820A01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1401019-2	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	91	0
Dichlorodifluoromethane	0.19	0.169	-	11.1	20	85	0
Chloromethane	0.196	0.17	-	13.3	20	87	-.02
Vinyl chloride	0.508	0.398	-	21.7*	20	73	0
Bromomethane	40	42.887	-	-7.2	20	98	0
Chloroethane	0.454	0.379	-	16.5	20	81	-.01
Trichlorofluoromethane	1.028	0.891	-	13.3	20	82	0
Ethyl ether	0.297	0.252	-	15.2	20	79	0
1,1-Dichloroethene	0.195	0.183	-	6.2	20	91	0
Carbon disulfide	0.569	0.452	-	20.6*	20	79	0
Freon-113	0.213	0.158	-	25.8*	20	71	-.01
Acrolein	0.01052	0.00873*	-	17	20	78	0
Methylene chloride	0.231	0.214	-	7.4	20	93	0
Acetone	40	37.812	-	5.5	20	82	-.01
trans-1,2-Dichloroethene	0.215	0.223	-	-3.7	20	99	0
Methyl acetate	0.066	0.059*	-	10.6	20	82	-.01
Methyl tert-butyl ether	0.418	0.424	-	-1.4	20	93	0
tert-Butyl alcohol	0.011	0.011*	-	0	20	92	0
Diisopropyl ether	0.46	0.409	-	11.1	20	80	0
1,1-Dichloroethane	0.362	0.304	-	16	20	79	0
Halothane	0.182	0.162	-	11	20	84	0
Acrylonitrile	0.032	0.029*	-	9.4	20	81	-.01
Ethyl tert-butyl ether	0.486	0.427	-	12.1	20	79	0
Vinyl acetate	0.292	0.256	-	12.3	20	78	0
cis-1,2-Dichloroethene	0.261	0.23	-	11.9	20	82	0
2,2-Dichloropropane	0.309	0.266	-	13.9	20	82	0
Bromochloromethane	0.116	0.11	-	5.2	20	89	0
Cyclohexane	0.275	0.208	-	24.4*	20	67	0
Chloroform	0.4	0.357	-	10.8	20	86	0
Ethyl acetate	0.099	0.085	-	14.1	20	78	0
Carbon tetrachloride	0.31	0.269	-	13.2	20	81	0
Tetrahydrofuran	40	33.776	-	15.6	20	73	-.02
Dibromofluoromethane	0.262	0.256	-	2.3	20	91	0
1,1,1-Trichloroethane	0.353	0.295	-	16.4	20	79	0
2-Butanone	40	33.995	-	15	20	74	-.01
1,1-Dichloropropene	0.273	0.242	-	11.4	20	81	0
Benzene	0.871	0.773	-	11.3	20	83	0
tert-Amyl methyl ether	0.462	0.424	-	8.2	20	81	0
1,2-Dichloroethane-d4	0.217	0.191	-	12	20	84	0
1,2-Dichloroethane	0.231	0.191	-	17.3	20	78	0
Methyl cyclohexane	0.363	0.27	-	25.6*	20	68	0
Trichloroethene	0.256	0.212	-	17.2	20	81	0
Dibromomethane	0.119	0.106	-	10.9	20	83	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1401019-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.173	-	11.3	20	83	0
2-Chloroethyl vinyl ether	0.08	0.078	-	2.5	20	86	0
Bromodichloromethane	0.291	0.26	-	10.7	20	83	0
1,4-Dioxane	0.00132	0.00162*	-	-22.7*	20	108	0
cis-1,3-Dichloropropene	0.31	0.283	-	8.7	20	80	0
Chlorobenzene-d5	1	1	-	0	20	99	0
Toluene-d8	1.245	1.156	-	7.1	20	89	0
Toluene	0.746	0.627	-	16	20	84	0
4-Methyl-2-pentanone	40	31.505	-	21.2*	20	82	0
Tetrachloroethene	0.349	0.274	-	21.5*	20	85	0
trans-1,3-Dichloropropene	0.351	0.281	-	19.9	20	76	0
Ethyl methacrylate	0.23	0.199	-	13.5	20	88	0
1,1,2-Trichloroethane	0.185	0.156	-	15.7	20	84	0
Chlorodibromomethane	0.275	0.25	-	9.1	20	90	0
1,3-Dichloropropane	0.346	0.295	-	14.7	20	84	0
1,2-Dibromoethane	0.206	0.198	-	3.9	20	93	0
2-Hexanone	0.079	0.07*	-	11.4	20	86	0
Chlorobenzene	0.897	0.802	-	10.6	20	93	0
Ethylbenzene	1.399	1.264	-	9.6	20	88	0
1,1,1,2-Tetrachloroethane	0.327	0.285	-	12.8	20	89	0
p/m Xylene	0.605	0.504	-	16.7	20	84	0
o Xylene	0.515	0.473	-	8.2	20	83	0
Styrene	80	66.19	-	17.3	20	79	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	85	0
Bromoform	0.342	0.296	-	13.5	20	78	0
Isopropylbenzene	2.555	2.54	-	0.6	20	82	0
4-Bromofluorobenzene	0.703	0.692	-	1.6	20	85	0
Bromobenzene	0.653	0.615	-	5.8	20	85	0
n-Propylbenzene	3.154	2.912	-	7.7	20	79	0
1,4-Dichlorobutane	0.513	0.444	-	13.5	20	76	0
1,1,2,2-Tetrachloroethane	0.481	0.428	-	11	20	78	0
4-Ethyltoluene	2.46	2.452	-	0.3	20	82	0
2-Chlorotoluene	1.753	1.606	-	8.4	20	78	0
1,3,5-Trimethylbenzene	2.268	2.103	-	7.3	20	78	0
1,2,3-Trichloropropane	0.377	0.314	-	16.7	20	74	0
trans-1,4-Dichloro-2-buten	0.097	0.082	-	15.5	20	69	0
4-Chlorotoluene	1.793	1.607	-	10.4	20	76	0
tert-Butylbenzene	1.876	1.879	-	-0.2	20	81	0
1,2,4-Trimethylbenzene	2.199	2.057	-	6.5	20	77	0
sec-Butylbenzene	2.765	2.785	-	-0.7	20	82	0
p-Isopropyltoluene	2.465	2.424	-	1.7	20	78	0
1,3-Dichlorobenzene	1.395	1.28	-	8.2	20	80	0
1,4-Dichlorobenzene	1.383	1.259	-	9	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1401019-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.398	-	2.7	20	79	0
n-Butylbenzene	2.374	2.033	-	14.4	20	70	0
1,2-Dichlorobenzene	1.235	1.147	-	7.1	20	80	0
1,2,4,5-Tetramethylbenzene	40	33.966	-	15.1	20	81	0
1,2-Dibromo-3-chloropropan	0.068	0.062	-	8.8	20	76	0
1,3,5-Trichlorobenzene	0.874	0.773	-	11.6	20	76	0
Hexachlorobutadiene	0.363	0.331	-	8.8	20	79	0
1,2,4-Trichlorobenzene	0.728	0.668	-	8.2	20	77	0
Naphthalene	1.459	1.433	-	1.8	20	80	0
1,2,3-Trichlorobenzene	0.657	0.611	-	7	20	79	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-9		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	91	0
Dichlorodifluoromethane	0.19	0.169	-	11.1	20	85	0
Chloromethane	0.196	0.17	-	13.3	20	87	-.02
Vinyl chloride	0.508	0.398	-	21.7*	20	73	0
Bromomethane	40	42.887	-	-7.2	20	98	0
Chloroethane	0.454	0.379	-	16.5	20	81	-.01
Trichlorofluoromethane	1.028	0.891	-	13.3	20	82	0
Ethyl ether	0.297	0.252	-	15.2	20	79	0
1,1-Dichloroethene	0.195	0.183	-	6.2	20	91	0
Carbon disulfide	0.569	0.452	-	20.6*	20	79	0
Freon-113	0.213	0.158	-	25.8*	20	71	-.01
Acrolein	0.01052	0.00873*	-	17	20	78	0
Methylene chloride	0.231	0.214	-	7.4	20	93	0
Acetone	40	37.812	-	5.5	20	82	-.01
trans-1,2-Dichloroethene	0.215	0.223	-	-3.7	20	99	0
Methyl acetate	0.066	0.059*	-	10.6	20	82	-.01
Methyl tert-butyl ether	0.418	0.424	-	-1.4	20	93	0
tert-Butyl alcohol	0.011	0.011*	-	0	20	92	0
Diisopropyl ether	0.46	0.409	-	11.1	20	80	0
1,1-Dichloroethane	0.362	0.304	-	16	20	79	0
Halothane	0.182	0.162	-	11	20	84	0
Acrylonitrile	0.032	0.029*	-	9.4	20	81	-.01
Ethyl tert-butyl ether	0.486	0.427	-	12.1	20	79	0
Vinyl acetate	0.292	0.256	-	12.3	20	78	0
cis-1,2-Dichloroethene	0.261	0.23	-	11.9	20	82	0
2,2-Dichloropropane	0.309	0.266	-	13.9	20	82	0
Bromochloromethane	0.116	0.11	-	5.2	20	89	0
Cyclohexane	0.275	0.208	-	24.4*	20	67	0
Chloroform	0.4	0.357	-	10.8	20	86	0
Ethyl acetate	0.099	0.085	-	14.1	20	78	0
Carbon tetrachloride	0.31	0.269	-	13.2	20	81	0
Tetrahydrofuran	40	33.776	-	15.6	20	73	-.02
Dibromofluoromethane	0.262	0.256	-	2.3	20	91	0
1,1,1-Trichloroethane	0.353	0.295	-	16.4	20	79	0
2-Butanone	40	33.995	-	15	20	74	-.01
1,1-Dichloropropene	0.273	0.242	-	11.4	20	81	0
Benzene	0.871	0.773	-	11.3	20	83	0
tert-Amyl methyl ether	0.462	0.424	-	8.2	20	81	0
1,2-Dichloroethane-d4	0.217	0.191	-	12	20	84	0
1,2-Dichloroethane	0.231	0.191	-	17.3	20	78	0
Methyl cyclohexane	0.363	0.27	-	25.6*	20	68	0
Trichloroethene	0.256	0.212	-	17.2	20	81	0
Dibromomethane	0.119	0.106	-	10.9	20	83	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/20/20 05:33
Lab File ID	: V17200820A01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1400899-9	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.173	-	11.3	20	83	0
2-Chloroethyl vinyl ether	0.08	0.078	-	2.5	20	86	0
Bromodichloromethane	0.291	0.26	-	10.7	20	83	0
1,4-Dioxane	0.00132	0.00162*	-	-22.7*	20	108	0
cis-1,3-Dichloropropene	0.31	0.283	-	8.7	20	80	0
Chlorobenzene-d5	1	1	-	0	20	99	0
Toluene-d8	1.245	1.156	-	7.1	20	89	0
Toluene	0.746	0.627	-	16	20	84	0
4-Methyl-2-pentanone	40	31.505	-	21.2*	20	82	0
Tetrachloroethene	0.349	0.274	-	21.5*	20	85	0
trans-1,3-Dichloropropene	0.351	0.281	-	19.9	20	76	0
Ethyl methacrylate	0.23	0.199	-	13.5	20	88	0
1,1,2-Trichloroethane	0.185	0.156	-	15.7	20	84	0
Chlorodibromomethane	0.275	0.25	-	9.1	20	90	0
1,3-Dichloropropane	0.346	0.295	-	14.7	20	84	0
1,2-Dibromoethane	0.206	0.198	-	3.9	20	93	0
2-Hexanone	0.079	0.07*	-	11.4	20	86	0
Chlorobenzene	0.897	0.802	-	10.6	20	93	0
Ethylbenzene	1.399	1.264	-	9.6	20	88	0
1,1,1,2-Tetrachloroethane	0.327	0.285	-	12.8	20	89	0
p/m Xylene	0.605	0.504	-	16.7	20	84	0
o Xylene	0.515	0.473	-	8.2	20	83	0
Styrene	80	66.19	-	17.3	20	79	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	85	0
Bromoform	0.342	0.296	-	13.5	20	78	0
Isopropylbenzene	2.555	2.54	-	0.6	20	82	0
4-Bromofluorobenzene	0.703	0.692	-	1.6	20	85	0
Bromobenzene	0.653	0.615	-	5.8	20	85	0
n-Propylbenzene	3.154	2.912	-	7.7	20	79	0
1,4-Dichlorobutane	0.513	0.444	-	13.5	20	76	0
1,1,2,2-Tetrachloroethane	0.481	0.428	-	11	20	78	0
4-Ethyltoluene	2.46	2.452	-	0.3	20	82	0
2-Chlorotoluene	1.753	1.606	-	8.4	20	78	0
1,3,5-Trimethylbenzene	2.268	2.103	-	7.3	20	78	0
1,2,3-Trichloropropane	0.377	0.314	-	16.7	20	74	0
trans-1,4-Dichloro-2-buten	0.097	0.082	-	15.5	20	69	0
4-Chlorotoluene	1.793	1.607	-	10.4	20	76	0
tert-Butylbenzene	1.876	1.879	-	-0.2	20	81	0
1,2,4-Trimethylbenzene	2.199	2.057	-	6.5	20	77	0
sec-Butylbenzene	2.765	2.785	-	-0.7	20	82	0
p-Isopropyltoluene	2.465	2.424	-	1.7	20	78	0
1,3-Dichlorobenzene	1.395	1.28	-	8.2	20	80	0
1,4-Dichlorobenzene	1.383	1.259	-	9	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-9		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.398	-	2.7	20	79	0
n-Butylbenzene	2.374	2.033	-	14.4	20	70	0
1,2-Dichlorobenzene	1.235	1.147	-	7.1	20	80	0
1,2,4,5-Tetramethylbenzene	40	33.966	-	15.1	20	81	0
1,2-Dibromo-3-chloropropan	0.068	0.062	-	8.8	20	76	0
1,3,5-Trichlorobenzene	0.874	0.773	-	11.6	20	76	0
Hexachlorobutadiene	0.363	0.331	-	8.8	20	79	0
1,2,4-Trichlorobenzene	0.728	0.668	-	8.2	20	77	0
Naphthalene	1.459	1.433	-	1.8	20	80	0
1,2,3-Trichlorobenzene	0.657	0.611	-	7	20	79	0

* Value outside of QC limits.

Appendix F

Modified Tier II Data Validation

Modified Tier II Data Validation

January 8, 2021

Former L&M Service
925 Massachusetts Avenue
Lunenburg, Massachusetts

Prepared For:

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A Laboratory Certificates

1.0 Introduction

As part of a Phase II Environmental Site Assessment, BETA Group, Inc. (BETA) has conducted a modified Tier II data validation of the chemical analytical data collected from soil, groundwater, and building materials at the Former L&M Service property at 925 Massachusetts Avenue in Lunenburg, Massachusetts (the Site), in accordance with US Environmental Protection Agency (EPA) *Guidance on Data Verification and Data Validation* (December 2002) and the EPA New England *Environmental Data Review Program Guidance* (April 2013). The modified Tier II data validation includes a general review of sample receipt, analysis, and the ability of the instruments to recover the elements or compounds that were analyzed. Laboratory analytical reports were obtained from Alpha Analytical Inc. (Alpha) of Wesborough, Massachusetts, EMSL Analytical, Inc. (EMSL) of Woburn, Massachusetts, and New England Testing Laboratory, Inc. (NETLab). The modified Tier II data validation does not evaluate the levels of constituents detected in the samples nor does it address compliance or response actions associated with the results.

2.0 Background

This property consists of 0.191 acres of land located approximately 400 feet west of the Lunenburg Center. The Town has initiated a tax-taking foreclosure from the current owner, L&M Service Center, Inc., which should be completed in 2020. An abandoned gasoline and automotive service station that formerly operated as Kelly's Citgo Service Station occupies the Site. This facility sold gasoline and conducted automotive repair at the Site. Reports indicate that Site has been a gasoline/repair station since circa 1918.

Records indicate two 10,000-gallon gasoline underground storage tanks (USTs), one 4,000-gallon diesel fuel UST, and one 500-gallon fuel oil UST exist at the Site. Records also indicate that three gasoline USTs and one waste oil UST were removed from the Site in the 1980s. The Site is listed as a release site (Tier ID) with the Massachusetts Department of Environmental Protection (MassDEP) under release tracking number 2-16390. Historic environmental investigations have focused on petroleum associated with USTs at the Site. However, plans and reports indicate that the Site also conducted automotive repair which could have involved the generation of hazardous waste. Historic plans indicate floor drains and a hydraulic lift were located in the garage building and an on-site septic system existed west of the site building. These features could involve hazardous materials and provide routes of entry into the subsurface.

3.0 Laboratory Data Review

3.1 General Considerations

A modified Tier II data validation was performed in accordance with EPA *Guidance on Data Verification and Data Validation* and the EPA *New England Environmental Data Review Program Guidance.* The modified Tier II data validation includes a general review of sample receipt, analysis, and the ability of the instruments to recover the elements or compounds that were analyzed.

A summary of the Tier II data validation is presented in Table 1. This table identifies the following information:

- Analytical report number
- Sample medium (soil, sediment, soil-gas, groundwater, and surface water)
- Sample identification
- Sample collection date
- Statement of whether a Massachusetts Contingency Plan (MCP) Analytical Method Report Certification was provided
- Statement of whether presumptive certainty was obtained
- Analytical method
- Analysis of data and holding time
- Sample preservation and temperature upon receipt at the laboratory
- Reporting limit issues
- Results of method blank analyses (i.e., were any target analytes detected)
- Identification of analysis and results of laboratory control sample/laboratory control sample duplicate (LCS/LCSD) samples
- Any other reported data quality issue identified in the laboratory report
- Identification of qualifications to the data, based on above.

A review of the chain of custody form, and the laboratory results (including the narrative) was performed to identify deviations or exceptions to standard methods. Compliance with MassDEP Compendium of Analytical Methods (CAM) presumptive certainty requirements are also discussed.

3.2 Specific Considerations

3.2.1 Sample Correctness and Completeness

Two (2) groups of samples were submitted to Alpha for analysis of soil and groundwater samples. The following details the samples submitted to Alpha:

- Eight (8) soil samples were submitted for analysis of volatile organic compounds (VOCs) by EPA Method 8260C/5035, and the hold time for this type of sample is fourteen (14) days.
- Eight (8) soil samples were submitted for analysis of extractable petroleum hydrocarbons (EPH) with target polynuclear aromatic hydrocarbons (PAHs) by MassDEP methodology (December 2019 –Revision 2.1) and volatile petroleum hydrocarbons (VPH) with target VOCs by MassDEP methodology (February 2018 –Revision 2.1). The hold time for these types of samples is fourteen (14) and twenty-eight (28) days respectively.

- Eight (8) soil samples were submitted for analysis of polychlorinated biphenyls (PCBs) by EPA Method 8082A, and the hold time for these samples is fourteen (14) days.
- Eight (8) soil samples were submitted for analysis of 13 Priority Pollutant Metals by EPA Method 6010C/7471B, and the hold time for these samples is one-hundred and eighty (180) days.
- Five (5) groundwater samples were submitted for analysis of VOCs by EPA Method 8260C, and the hold time for these samples is fourteen (14) days.
- Five (5) groundwater samples were submitted for analysis of total 13 Priority Pollutant Metals by EPA Method 6010C/7471B, and the hold time for these samples is one-hundred and eighty (180) days.
- Five (5) groundwater samples were submitted for analysis of polychlorinated biphenyls (PCBs) by EPA Method 8082A, and the hold time for these samples is fourteen (14) days.
- Five (5) groundwater samples were submitted for analysis of EPH with target PAHs by MassDEP methodology (December 2019 –Revision 2.1) and VPH with target VOCs by method MassDEP methodology (February 2018 –Revision 2.1), and the hold times for these samples are fourteen (14) days.

One (1) group of samples were submitted to EMSL for analysis of building material samples. The following details the samples submitted to EMSL:

- Thirty-nine (39) building material samples were submitted for analysis of asbestos by Polarized Light Microscopy method 600/R-93/116.

One (1) group of samples were submitted to NETLab for analysis of building material samples. The following details the samples submitted to NETLab:

- Four (4) building material samples were submitted for analysis of polychlorinated biphenyls (PCBs) by EPA Method 8082A and the hold time for these samples is fourteen (14) days.

Based on a review of the chain of custody forms against the laboratory reports, sample identifications were correctly transcribed to the laboratory report and all required samples were analyzed by the correct method.

3.2.2 Sample Preservation and Holding Times

The dates of sample collection, sample extraction, and sample analysis were evaluated to determine if analyses were performed within method-specified time limits. The methods used to preserve and store the samples were also reviewed.

MassDEP CAM requirements were identified for each of the analyses and matrices. All samples were analyzed within the CAM holding time, and most analyses were started promptly after sample receipt.

Samples were submitted to Alpha under the following conditions:

- Soil VOC samples were collected in four (4), 40-milliliter (mL) vials. Two vials were preserved with a pre-measured amount of methanol (MeOH). The other two vials contained deionized water and were frozen within 24 hours of collection.
- Soil total metals and PCB samples were collected in unpreserved eight (8) ounce amber glass jars.

- Soil VPH samples were collected in two (2), 40-mL vials. Each vial was preserved with a pre-measured amount of MeOH.
    - From Alpha Report L2033722, samples L2033722-02, -05, -07, and -09 (B-105 12.5-17.5, B-104 10-12, B-106 12.5-15, and B-108 15-17.5) were submitted outside the recommended 1:1 methanol to soil ratio, due to the amount of soil provided in these vials.
- Soil EPH samples were collected in unpreserved eight (8) ounce amber glass jars.
- Soil Total Solid samples were collected in unpreserved two (2) ounce plastic bottles.
- Aqueous VOC samples were collected in two (2), 40-mL vials. Each vial was preserved with a pre-measured amount of hydrochloric acid (HCl).
- Aqueous total metals samples were collected in 500 mL plastic bottles preserved with nitric acid (HNO_3).
- Aqueous VPH samples were collected in three (3), 40-mL vials. Each vial was preserved with a pre-measured amount of hydrochloric acid (HCl).
- Aqueous EPH samples were collected in two (2), 1,000-mL amber bottles. Each bottle was preserved with a pre-measured amount of hydrochloric acid (HCl).
- Aqueous PCB samples were collected in two (2), 120-mL unpreserved amber bottles.

Samples were submitted to Alpha between 0 and 4 ºC.

According to the MassDEP Guidance *Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data in Support of Response Actions Conducted Under the Massachusetts Contingency Plan (MCP)*, samples submitted in a cooler, on ice, and below 6 °C are acceptable. According to these guidelines, all samples were submitted at an acceptable temperature.

All samples submitted to Alpha were analyzed within allowable holding times.

3.2.3 Reporting Limit Issues

The CAM-required reporting limits were not met in the sample sets:

- Alpha L2033722:
    - One or more of the target analytes from samples L2033722-01 through -04, -07, -08, and -10 (B-101 15-18, B-105 12.5-17.5, DUP, B-107 8-10, B-106 12.5-15, B-102 13-15, and TRIP BLANK) did not achieve the requested CAM reporting limits for High-Level VOCs.
    - One or more of the target analytes from samples L2033722-02, -03, and -08 (B-105 12.5-17.5, DUP, and B-102 13-15) did not achieve the requested CAM reporting limits for VPH.
    - One or more of the target analytes from samples L2033722-01, -04, and -06 (B-101 15-18, B-107 8-10, and B-103 13-15) did not achieve the requested CAM reporting limits for EPH.
    - One or more of the target analytes from samples L2033722-01, -04, and -06 (B-101 15-18, B-107 8-10, and B-103 13-15) did not achieve the requested CAM reporting limits for PCBs.
        - Samples L2033722-01 and -04 (B-101 15-18 and B-107 8-10) have elevated detection limits due to the dilution required by the elevated concentrations of target PCB compounds in the samples.

- Alpha L2034373:
    - One or more of the target analytes from samples L2034373-01 through -06 (MW-101, MW-105, MW-104, MW-103, MW-102, and DUP) did not achieve the requested CAM reporting limits for EPH.
    - One or more of the target analytes from samples L2034373-04 and -05 (MW-103 and MW-102) did not achieve the requested CAM reporting limits for VPH.

3.2.4 Method Blanks

The laboratory method blank data were reviewed to identify possible sampling and laboratory artifacts. Method blanks were analyzed for each set of samples for all analytical methods. None of the method blanks contained detectable concentrations. With the exception of PCBs in Alpha report L2034373, the percent recovery for each method blank was within the acceptance criteria for each analysis.

In the method blank for PCBs in groundwater (L2304373), the %recovery for Decachlorobiphenyl was below the acceptance criteria in Column A. The %recovery in Column B was acceptable. This result does not affect the usability of the data.

3.2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

The results of the MS/MSD sample analysis were reviewed to identify deviations for acceptance criteria. The following samples were submitted for MS/MSD analysis:

- One sample from Alpha sample set L2033722 for metals.

The acceptance criteria for percent recovery (% Recovery) of a spiked compound varies by compound and matrix. The following MS/MSD recoveries were outside of their respective acceptance criteria:

- The chromium, lead, and nickel MS and arsenic, thallium, and zinc MS/MSD recoveries for samples L2033722-01 through 09 (B-101 15-18, B-105 12.5-17.5, DUP, B-107 8-10, B-104 10-12, B-103 13-15, B-106 12.5-15, B-102 13-15, and B-108 15-17.5) were below the acceptance limit (75-125%).
    - The MS were reanalyzed, and the recoveries were still unacceptable for arsenic, chromium, lead, nickel, thallium and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable, however, and therefore, no further action was taken. In these samples, there is the potential for matrix interference with regards to these metals.
    - The MSD were reanalyzed, and the recoveries were still unacceptable for arsenic, thallium, and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable, however, and therefore, no further action was taken. In these samples, there is the potential for matrix interference with regards to these metals.
- None of the remaining MS/MSD recoveries were outside of their respective acceptance criteria.

3.2.6 Laboratory Control/Laboratory Control Duplicate (LCS/LCSD) Samples

Results of the LCS/LCSD sample analysis were reviewed to identify any % Recovery (%R) and relative percent difference (RPD) outside of the method-specified limits. LCS/LCSD samples were completed as part of the sets of samples submitted for to Alpha and one set of samples sent to NETLab (PCB only). LCS/LCSD analysis is not part of the asbestos analysis procedure.

Of the three sets of samples, LCS/LCSD samples in two of the three sets had one or more analytes outside of the acceptable criteria range, or above the acceptable RPD limit.

The incidents are described below:

- Batch Sample WG1400899-3/4 – Alpha Report L2033722:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The RPD for 4 out of the 71 analytes were outside the control limits. Hexachlorobutadiene (25%), Naphthalene (28%), 1,2,3-Trichlorobenzene (26%), and 1,2,4-Trichlorobenzene (26%) were above the 20% RPD criteria.
- Batch Sample WG1400902-3/4 – Alpha Report L2033722:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The RPD for 4 out of the 71 analytes were outside the control limits. Hexachlorobutadiene (25%), Naphthalene (28%), 1,2,3-Trichlorobenzene (26%), and 1,2,4-Trichlorobenzene (26%) were above the 20% RPD criteria.
- Batch Sample WG1402996-3/4 – Alpha Report L2034373:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The RPD for 1 out of the 71 analytes was outside the control limits. Naphthalene (21%) was above the 20% RPD criteria.
- Batch Sample WG1402001-2/3 – Alpha Report L2034373:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The RPD for 1 out of the 20 analytes was outside the control limits. C19-C36 Aliphatics (31%) was above the 25% RPD criteria.
- Batch Sample WG1403212-2/3 – Alpha Report L2034373:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The RPD for 1 out of the 20 analytes was outside the control limits. C19-C36 Aliphatics (27%) was above the 25% RPD criteria.
- Batch Sample WG1401976-2/3 – Alpha Report L2034373:
  - The %Rs and RPDs were within the laboratory control limits with the following exceptions:
    - The %R for Surrogates in the LCS were outside the control limits. Decachlorobiphenyl Column A (29%) and Decachlorobiphenyl Column B (28%) were below the range of 30-150%.

3.2.7 Surrogate Samples

The constituents analyzed as surrogate compounds and the analytical recoveries of the surrogates were reviewed to identify any results outside of the method-specified limits.

For soil and aqueous samples analyzed for VOCs, the surrogate analytes are: 1,2 Dichloroethane-d4, Toluene-d8, 4-Bromofluorobenzene, and Dibromofluoromethane. The %Recovery acceptance range is between 70-130%. The surrogate %Recovery was within acceptance range.
For soil and aqueous samples analyzed for VPH, the surrogate analyte is 2,5-Dibromotoluene analyzed by a photoionization detector (PID) and flame ionization detector (FID). The %Recovery acceptance range is between 70-130%.

- Alpha Report L2033722:
  - The recoveries in sample L2033722-05 (B-104 10-12) for 2,5-Dibromotoluene-PID (158%) and 2,5-Dibromotoluene-FID (145%) was above the acceptable range. The laboratory concluded that the results are potentially high bias biased. The recovery in sample L2033722-02 (B-105 12.5-17.5) for 2,5-Dibromotoluene-PID (146%) was above

the acceptable range. The laboratory concluded that the results are potentially high bias biased.
    - The recovery in sample L2033722-03 (DUP) for 2,5-Dibromotoluene-PID (137%) was above the acceptable range. The laboratory concluded that the results are potentially high bias biased.
    - The recovery in sample L2033722-07 (B-106 12.5-15) for 2,5-Dibromotoluene-PID (143%) was above the acceptable range. The laboratory concluded that the results are potentially high bias biased.
    - The recovery in sample L2033722-09 (B-108 15-17.5) for 2,5-Dibromotoluene-PID (143%) was above the acceptable range. The laboratory concluded that the results are potentially high bias biased.
    - The recovery in sample L2033722-08 (B-102 13-15) for 2,5-Dibromotoluene-FID (67%) was below the acceptable range. The laboratory concluded that the results are potentially low bias biased.

The other surrogate %Recoveries were within acceptance range.

For soil and aqueous samples analyzed for EPH, the surrogate analytes are: Chloro-Octadecane, o-Terphenyl, 2-Fluorobiphenyl, and 2-Bromonaphthalene. The %Recovery acceptance range in between 40-140%.

- Alpha Report L2033722:
    - The recoveries in sample L2033722-03 (DUP) for Chloro-Octadecane (25%) and o-Terphenyl (20%) were below the acceptable range. The laboratory concluded that the results are potentially low bias biased.
    - The recoveries in sample L2033722-04 (B-107 8-10) for Chloro-Octadecane (0%) and o-Terphenyl (0%) were below the acceptable range. The laboratory concluded that the results are potentially low bias biased.
- Alpha Report L2034373:
    - The recovery in sample L2034373-01 (MW-101) for Chloro-Octadecane (29%) was below the acceptable range. The recovery was reanalyzed and remained below the acceptable range (30%). The laboratory concluded that the results are potentially low bias biased.

The other surrogate %Recoveries were within acceptance range.

For soil and aqueous samples analyzed for PCBs, the surrogate analytes are: 2,4,5,6-Tetrachloro-m-xylene (B), Decachlorobiphenyl (B), 2,4,5,6-Tetrachloro-m-xylene (A), and Decachlorobiphenyl (A). The %Recovery acceptance range is between 30-150%. The %Recovery acceptance range is between 40-140%.

- Alpha Report L2033722:
    - The recoveries in sample L2033722-04 (B-107 8-10) were 0% for 2,4,5,6-Tetrachloro-m-xylene (A), 2,4,5,6-Tetrachloro-m-xylene (B), Decachlorobiphenyl (A), and Decachlorobiphenyl (B) which were below the acceptable range. These low %Recoveries were due to required dilution.
    - The recoveries in sample L2033722-06 (B-103 13-15) were 0% for 2,4,5,6-Tetrachloro-m-xylene (A), 2,4,5,6-Tetrachloro-m-xylene (B), Decachlorobiphenyl (A), and Decachlorobiphenyl (B) which were below the acceptable range. These low %Recoveries were due to required dilution.

The other surrogate %Recoveries were within acceptance range.

For building material samples analyzed for PCBS in NETLab Report 0H05010, the surrogate analytes are 2,4,5,6-Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCBP). The %Recovery acceptance ranges are between 30-100% and 30-105&, respectively. The surrogate %Recoveries were within acceptance range.

3.2.8 Target Compound Identification

No issues of target compound identification were reported for any of the analyses.

3.2.9 Duplicate Samples

Two (2) duplicate samples were submitted for laboratory analysis. The QAPP required duplicate samples to be submitted at a rate of at least 5%. This requirement was met for the matrices samples, groundwater and soil.

The RPD was calculated between the primary samples and the duplicate for each analyte that was detected in the samples. This comparison is shown in Tables 1 and 2. Acceptable field duplicates typically have a RPD less than or equal to 30-50%.

- DUP (L2033722-03) was analyzed for the identical analytes that the primary samples were submitted for in soil (VOCs, VPH, EPH, PCBs, Metals, and Total Solids).
    - The RPD was calculated for twelve VOC compounds, Ethylbenzene (28.6%), p/m-Xylene (19.7%), o-Xylene (38.8%), Total Xylenes (22.5%), n-Butylbenzene (34.7%), sec-Butylbenzene (14.3%), p-Isopropyltoluene (39.5%), Naphthalene (45.2%), n-Propylbenzene (43.1%), and 1,2,4-Trimethylbenzene (20.4%), which are within the acceptable range. Isopropylbenzene (53.8%) and 1,3,5-Trimethylbenzene (63.6%) are above the acceptable range and are suspect to potential contamination and bias.
    - The RPD was calculated for seven VPH compounds, C9-C10 Aromatics (34.7%), C9-C12 Aliphatics Adjusted (38.9%), Ethylbenzene (37%), p/m-Xylene (24.3%), o-Xylene (41.7%), and Naphthalene (21.9%), which are within the acceptable range. C5-C8 Aliphatics Adjusted (70.2%) is above the acceptable range and may be suspect to potential contamination and bias.
    - The RPD was calculated for four EPH compounds, C19-C36 Aliphatics (49.2%), within acceptable range, while C9-C18 Aliphatics (92.7%), C11-C22 Aromatics Adjusted (55.9%), and 2-Methylnaphthalene (113.6%) are above acceptable range. These three compounds may be suspect to potential contamination and bias.
    - The RPD was not calculated for PCBs as concentrations were not detected above the reporting limits.
    - The RPD was calculated for seven metals and ranged from 0.2% to 19.6%, within acceptable range.
    - The RPD was calculated for total solids (1.7%).
- DUP (L2034373-06) was analyzed for the identical analytes that the primary samples were submitted for in groundwater (VOCs, VPH, EPH, PCBs, and Metals). The calculated RPDs listed below are within the acceptable range.
    - The RPD was calculated for four VOC compounds, p/m-Xylene (6.4%),o-Xylene (4.4%), Total Xylenes (8.7%), and 1,2,4-Trimethylbenzene (5.1%).
    - The RPD was calculated for two VPH compounds, p/m-Xylene (9.2%) and o-Xylene (10.9%).
    - The RPD was not calculated for EPH as concentrations were not detected above the reporting limits.
    - The RPD was not calculated for PCBs as concentrations were not detected above the reporting limits.

- The RPD was calculated for two metals and ranged from 0.0% to 20%.

Overall, it is difficult to create a true duplicate from soil samples.

3.2.10 Trip Blanks

In total, two laboratory-prepared trip blanks were submitted for laboratory analysis of VOCs.

Sample L2033722-10 (TRIP BLANK) resulted in detections of low-level VOCs (ethylbenzene, trichloroethene, p/m-xylene, o-xylene, total xylenes, n-propylbenzene, and 1,2,4-trimethylbenzene) above the reporting limits. Alpha Labs verified the sample as being labeled correctly by the laboratory, and the analysis prior illustrated there was no potential for carry over of samples. Therefore, detections of these VOCs in the soil samples and the trip blank may not be suspect. Results detected in the soil samples that do not correlate to the detections in the trip blank are suspect as possible contamination.

There were no compounds reported above the method detection limits for the remaining trip blank.

3.2.11 Equipment Blanks

In total, two (2) equipment blanks were collected in the field from re-usable equipment used for sampling. The equipment was cleaned and rinsed as per the BETA Equipment Decontamination SOP with methanol, Alconox, and deionized water. No analytes were detected in the equipment blanks.

3.2.12 Chromatogram Review

No chromatograms were provided by the laboratories.

3.2.13 Calibration Review

Each laboratory report was reviewed for calibration issues. Alpha details calibration problems in the laboratory case narrative.

Alpha report L2033722

- Volatile 8260C incidents:
  - The initial calibration, associated with L2033722-01 through -10 (B-101 15-18, B-105 12.5-17.5, DUP, B-107 8-10, B-104 10-12, B-103 13-15, B-106 12.5-15, B-102 13-15, B-108 15-17.5, and TRIP BLANK), utilized a quadratic fit for styrene.
  - The minimum response factor of 0.0065 was not met for 1,4-dioxane in the initial calibration analyzed from L2033722-11 (EQUIP BLANK), as well as the average response factor for 1,4-dioxane.
  - From samples L2033722-01 through -10 (B-101 15-18, B-105 12.5-17.5, DUP, B-107 8-10, B-104 10-12, B-103 13-15, B-106 12.5-15, B-102 13-15, B-108 15-17.5, and TRIP BLANK), the minimum response factor for 2-hexanone (0.0647), 1,2-dibromo-3-chloropropane (0.0410), and 1,4-dioxane (0.0009) were not met in the initial calibration on the lowest calibration standard. The average response factor for 2-hexanone and 1,4-dioxane were not met as well.
  - The continuing calibration verification standard with the samples listed above, as well as L2033722-11 (EQUIP BLANK), was outside the acceptance criteria but were within method allowances.

- A Matrix Spike/Matrix Spike Duplicate analysis was to be performed on L2033722-01; however, the dilution required by the native sample would have caused the spike compounds to be diluted below the range of calibration, and therefore, the analysis was not completed.

Alpha report L2034373

- Volatile 8260C incidents:
  - The minimum response factor of 0.0021 was not met for 1,4-dioxane in the initial calibration analyzed from L2034373-01 through -08 (MW-101, MW-105, MW-104, MW-103, MW-102, DUP, EQUIP BLANK, and TRIP BLANK), as well as the average response factor for 1,4-dioxane.
  - The continuing calibration verification standard with the samples listed above was outside the acceptance criteria but were within method allowances.

NETLab detailed any calibration problem in the laboratory case narrative. In each report, NETLab stated, "The results for the associated calibration, method blank and laboratory control samples (LCS) were within method specified quality control requirements and allowances."

EMSL did not have a need for calibration for the asbestos analysis.

3.3 Data Usability

The evaluation of the usability of the data presented in the previous section includes:

- Reported deviations from standard operating procedures
- Reporting limits relative to action thresholds
- Potential occurrence of false negatives or false positives at target analytes concentrations
- Physical sample representativeness
- Data set completeness

The above factors are considered with regard to the analytical portion of the data review. Information on field aspects of the data usability assessment, such as adherence to standard sample collection procedures, should be reviewed separately and considered in concert with this review.

3.3.1 Deviations from Standard Operating Procedure

No deviations from laboratory standard operating procedures were noted in the analytical reports. Alpha and NETLab used CAM-approved methods and quality control. EMSL used appropriate quality control for the asbestos samples.

Field operating procedures adhered to the standard protocols submitted with the QAPP which included BETA's standard operating procedures for field notes, soil sample collection, low flow sample collection, soil headspace analysis, equipment decontamination, water level measurement, and groundwater monitoring well installation and development.

The data usability has not been adversely affected by deviations from the laboratory operating procedures or the field operating procedures.

3.3.2 Reporting Limits

The reporting limit issues identified in Section 3.2.3 have not affected the usability of the data.

3.3.3 Potential Occurrence of False Negatives and False Positives

3.3.4 Physical Sample Representativeness

The analytical laboratory reports did not indicate any physical problems or anomalies in the samples.

3.3.5 Data set completeness

Overall, the data for the soil, groundwater, and building materials is complete. No duplicate asbestos samples were taken; however, this does not affect the usability or completeness of the data.

4.0 Overall Data Usability

Based on the Tier II data review of the laboratory data for the Phase II Environmental Site Assessment for 925 Massachusetts Avenue, it is concluded that the data for the Site are usable for their intended purpose of site characterization and identifying environmental concerns that may impact the environmental integrity of the site. The most likely future use of the Site is re-occupancy of the current Site building.

No unusual trends or anomalies were noted in the data, no significant analytical data gaps were identified, and no gross failures in sample handling, storage, preservation, or analysis occurred.

Some data were qualified as estimated as a result of data quality limitations, such as recovery of surrogate compounds outside of acceptance criteria or analytes exceeding calibration levels. Use of these data for critical decisions should be accompanied by a review of these limitations to ensure that the reported results appropriately represent site conditions.

In addition, some factors suggest possible limits to the data but did not result in data qualification, such as the inclusion of dilution practices. Future work should consider using trip blanks to determine if there is cross-contamination during shipment to the lab.

While there is the possibility of cross-contamination, these factors do not affect the usability of the data for assessment purposes but should be kept in mind if using the data for critical decisions. Table 3 should also be made available to data users to identify these other limitations that do not result in data qualification.

Tables

Table 1
Soil Analytical Results
925 Massachusetts Avenue, Lunenburg, Massachusetts

LOCATION	B-101 15-18		B-105 12.5-17.5		DUP		B-107 8-10		B-104 10-12		B-103 13-15		B-106 12.5-15		B-102 13-15		B-108 15-17.5		TRIP BLANK		MassDEP	Relative Percent
SAMPLING DATE	8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		8/6/2020		RCS-1	Difference (RPD)
Extractable Petroleum Hydrocarbons, milligrams per kilogram (mg/Kg)																						
C9-C18 Aliphatics	**160**		**15.8**		**43.1**		**672**		7.51	U	**70.4**		**118**		**606**		7.05	U	-		1,000	92.7%
C19-C36 Aliphatics	**5,540**		**23**		**38**		**21,200**		7.51	U	**3,130**		**2320**		**1740**		7.05	U	-		3,000	49.2%
C11-C22 Aromatics, Adjusted	**568**		**18.7**		**33.2**		**6,620**		7.51	U	**1,060**		**292**		**366**		7.05	U	-		1,000	55.9%
Naphthalene	**2.06**		**1.5**		0.357	U	7.18	U	0.375	U	2.04	U	**1.41**		0.752	U	0.352	U	-		4	-
2-Methylnaphthalene	1.93	U	**0.54**		**1.96**		7.18	U	0.375	U	2.04	U	**0.972**		**15.6**		0.352	U	-		0.7	113.6%
Pyrene	1.93	U	0.374	U	0.357	U	**7.26**		0.375	U	2.04	U	0.813	U	0.752	U	0.352	U	-		1,000	-
General Chemistry																						
Solids, Total	85.5		88.8		90.3		90.6		87.7		81.3		79.3		85.3		90.9		-		NE	1.7%
Polychlorinated Biphenyls, mg/Kg																						
Aroclor 1248	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	0.802	U	0.0415	U	**0.2**		0.0358	U	-		1	-
Aroclor 1254	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	0.802	U	0.0415	U	**0.105**		0.0358	U	-		1	-
Aroclor 1260	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	**3.98**		**0.155**	P	**0.132**		0.0358	U	-		1	-
PCBs, Total	0.189	U	0.0362	U	0.0362	U	0.73	U	0.0376	U	**3.98**		**0.155**		**0.437**		0.0358	U	-		1	-
Total Metals, mg/Kg																						
Antimony	2.28	U	2.22	U	2.16	U	**9.01**		2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		20	-
Arsenic	**11.3**		**6.19**		**6.18**		**49.6**		**7.91**		**10.8**		**14.5**		**6.26**		**7.08**		-		20	0.2%
Beryllium	**0.511**		**0.484**		**0.509**		**0.364**		**0.986**		**0.394**		**0.573**		**0.602**		**0.634**		-		90	5.0%
Cadmium	0.456	U	0.444	U	0.432	U	**1.57**		0.448	U	**2**		0.485	U	0.453	U	0.426	U	-		70	-
Chromium	**26.3**		**35.1**		**33.6**		**20.8**		**47.8**		**26.1**		**31.1**		**31.5**		**22.7**		-		100	4.4%
Copper	**8.32**		**9.45**		**10.3**		**982**		**14.8**		**23.8**		**5.8**		**7.6**		**7.94**		-		1,000	8.6%
Lead	**31.1**		**12.9**		**11.3**		**477**		**5.68**		**169**		**108**		**40.4**		**3.66**		-		200	13.2%
Mercury	0.085	U	0.082	U	0.08	U	**2.92**		0.083	U	0.089	U	0.092	U	0.087	U	0.08	U	-		20	-
Nickel	**15.8**		**22.6**		**20.2**		**17.4**		**31.4**		**15.1**		**14.1**		**17.4**		**15.8**		-		600	11.2%
Selenium	2.28	U	2.22	U	2.16	U	**11.5**		2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		400	-
Silver	0.456	U	0.444	U	0.432	U	0.428	U	0.448	U	0.487	U	0.485	U	0.453	U	0.426	U	-		100	-
Thallium	2.28	U	2.22	U	2.16	U	2.14	U	2.24	U	2.43	U	2.43	U	2.26	U	2.13	U	-		8	-
Zinc	**48.1**		**48.2**		**39.6**		**501**		**38.5**		**60.9**		**34.6**		**39.6**		**21.6**		-		1,000	19.6%
Volatile Organic Compounds, mg/Kg																						
Benzene	0.028	U	0.12	U	0.063	U	**0.55**		0.00039	U	**0.0052**		**0.32**		0.61	U	0.00038	U	0.0005	U	2	-
Toluene	0.057	U	0.24	U	0.13	U	**0.52**		0.00079	U	**0.019**		0.057	U	1.2	U	0.00075	U	0.001	U	30	-
Ethylbenzene	0.057	U	**10**		**7.5**		**0.7**		0.00079	U	**0.0015**		**0.11**		**3.7**		0.00075	U	**0.0035**		40	28.6%
Trichloroethene	0.028	U	0.12	U	0.063	U	0.026	U	0.00039	U	0.00054	U	0.029	U	0.61	U	0.00038	U	**0.00052**		0.3	-
Methyl tert butyl ether	0.11	U	0.48	U	0.25	U	0.1	U	0.0016	U	0.034		**0.14**		2.4	U	0.0015	U	0.002	U	0.1	-
p/m-Xylene	**0.17**		**67**		**55**		**2.6**		0.0016	U	0.019		**12**		**61**		0.0015	U	**0.016**		100	19.7%
o-Xylene	**0.15**		**12**		**8.1**		**1**		0.00079	U	0.0023		**0.068**		1.2	U	0.00075	U	**0.002**		100	38.8%
Xylenes, Total	**0.32**		**79**		**63**		**3.6**		0.00079	U	0.021		**12**		**61**		0.00075	U	**0.018**		100	22.5%
Acetone	0.57	U	2.4	U	1.3	U	**0.77**		**0.031**		**0.18**		0.57	U	12	U	0.019	U	0.025	U	6	-
Methyl ethyl ketone	0.57	U	2.4	U	1.3	U	0.53	U	0.0079	U	**0.04**		0.57	U	12	U	0.0075	U	0.01	U	4	-
n-Butylbenzene	**0.17**		**4.4**		**3.1**		**0.098**		0.00079	U	0.0011	U	**0.17**		**21**		0.00075	U	0.001	U	NE	34.7%
sec-Butylbenzene	**0.066**		**1.5**		**1.3**		**0.089**		0.00079	U	0.0011	U	**0.14**		**8.2**		0.00075	U	0.001	U	NE	14.3%
Isopropylbenzene	**0.062**		**3.3**		**1.9**		**0.11**		0.00079	U	0.0011	U	**0.79**		**10**		0.00075	U	0.001	U	1,000	53.8%
p-Isopropyltoluene	**0.07**		**0.94**		**0.63**		**0.15**		0.00079	U	0.0011	U	**0.12**		**5.7**		0.00075	U	0.001	U	100	39.5%
Naphthalene	0.23	U	**19**		**12**		**0.88**		0.0032	U	0.0043	U	**1.4**		**63**		0.003	U	0.004	U	4	45.2%
n-Propylbenzene	**0.19**		**11**		**7.1**		**0.22**		0.00079	U	0.0011	U	**1.9**		**38**		0.00075	U	**0.0013**		100	43.1%
1,3,5-Trimethylbenzene	**0.43**		**29**		**15**		**1.1**		0.0016	U	0.0022	U	**2**		**72**		0.0015	U	0.002	U	10	63.6%
1,2,4-Trimethylbenzene	**1.2**		**92**		**75**		**2.2**		0.0016	U	**0.011**		**14**		**350**		0.0015	U	**0.0031**		1,000	20.4%
Volatile Petroleum Hydrocarbons, mg/Kg																						
C9-C10 Aromatics	**45.8**		**416**		**293**		**35.8**		4.68	U	**9.13**		**36.9**		**1,220**		4.4	U	-		100	34.7%
C5-C8 Aliphatics, Adjusted	**7.32**		**207**		**99.4**		**35.7**		4.68	U	7.22	U	**16.2**		**467**		4.4	U	-		100	70.2%
C9-C12 Aliphatics, Adjusted	**6.19**		**109**		**73.5**		**11.1**		4.68	U	7.22	U	5.74	U	**290**		4.4	U	-		1,000	38.9%
Benzene	0.114	U	**0.745**		0.405	U	**0.643**		0.094	U	**0.171**		**0.414**		1.22	U	0.088	U	-		2	-
Toluene	0.114	U	0.478	U	0.405	U	**0.572**		0.094	U	**1.03**		0.115	U	1.22	U	0.088	U	-		30	-
Ethylbenzene	0.114	U	**14.1**		**9.7**		**0.862**		0.094	U	0.144	U	0.115	U	1.22	U	0.088	U	-		40	37.0%
p/m-Xylene	**0.149**		**57.7**		**45.2**		**2.7**		0.094	U	**1.34**		**10.8**		**51.4**		0.088	U	-		100	24.3%
o-Xylene	**0.225**		**11.3**		**7.4**		**1.05**		0.094	U	**0.148**		0.115	U	**9.07**		0.088	U	-		100	41.7%
Methyl tert butyl ether	0.057	U	0.239	U	0.202	U	**0.288**		0.047	U	**0.144**		**0.203**		0.608	U	0.044	U	-		0.1	-
Naphthalene	**0.366**		**17.2**		**13.8**		**0.71**		0.187	U	**0.386**		**1.28**		**47.8**		0.176	U	-		4	21.9%

Notes
BOLD - compound detected
BOLD and Shaded - compound detected above regulatory standard
U - Not detected above listed detection limit.
NE - Standard not established
Shaded - outside of RPD acceptable range

Table 2
Groundwater Analytical Results
925 Massachusetts Avenue, Lunenburg, Massachusetts

LOCATION	MW-101	MW-105	MW-104	MW-103	MW-102	DUP	EQUIP BLANK	TRIP BLANK	MassDEP	Relative Percent
SAMPLING DATE	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/21/2020	8/18/2020	RCGW-2	Difference (RPD)
Extractable Petroleum Hydrocarbons, mg/L										
C9-C18 Aliphatics	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	5	-
C19-C36 Aliphatics	**0.499**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	50	-
C11-C22 Aromatics, Adjusted	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	-	-	5	-
Naphthalene	0.01 U	0.01 U	0.01 U	**0.0305**	**0.0431**	0.01 U	-	-	0.7	-
Polychlorinated Biphenyls, mg/L										
Aroclor 1260	0.00025 U	0.00025 U	0.00025 U	**0.000407**	0.00025 U	0.00025 U	-	-	0.005	-
PCBs, Total	ND	ND	ND	**0.000407**	ND	ND	-	-	0.005	-
Total Metals, mg/L										
Antimony	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	-	-	8	-
Arsenic	**0.0074**	**0.019**	**0.0077**	**0.0229**	**0.0218**	**0.0063**	-	-	0.9	20.0%
Beryllium	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	-	0.2	-
Cadmium	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	-	-	0.004	-
Chromium	**0.042**	**0.088**	0.01 U	**0.018**	0.01 U	0.01 U	-	-	0.3	-
Copper	**0.016**	**0.037**	0.01 U	**0.011**	0.01 U	0.01 U	-	-	100	-
Lead	0.01 U	**0.025**	0.01 U	0.01 U	0.01 U	0.01 U	-	-	0.01	-
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	-	-	0.02	-
Nickel	**0.032**	**0.066**	**0.04**	0.025 U	0.025 U	**0.04**	-	-	0.2	0.0%
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	-	-	0.1	-
Silver	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	-	-	0.007	-
Thallium	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	-	-	3	-
Zinc	0.05 U	**0.078**	0.05 U	0.05 U	0.05 U	0.05 U	-	-	0.8	-
Volatile Organic Compounds, mg/L										
Benzene	0.0005 U	0.0005 U	0.0005 U	**0.01**	**0.017**	0.0005 U	0.0005 U	0.0005 U	1	-
Toluene	0.001 U	0.001 U	0.001 U	**0.0036**	**0.0063**	0.001 U	0.001 U	0.001 U	40	-
Ethylbenzene	**0.0037**	**0.0053**	0.001 U	**0.28**	**0.69**	0.001 U	0.001 U	0.001 U	5	-
Methyl tert butyl ether	0.002 U	0.002 U	0.002 U	**0.0065**	**0.0056**	0.002 U	0.002 U	0.002 U	50	-
p/m-Xylene	**0.11**	**0.11**	**0.0097**	**1**	**2.5**	**0.0091**	0.002 U	0.002 U	3	6.4%
o-Xylene	**0.04**	**0.032**	**0.0023**	**0.0094**	**0.016**	**0.0022**	0.001 U	0.001 U	3	4.4%
Xylenes, Total	**0.15**	**0.14**	**0.012**	**1**	**2.5**	**0.011**	0.001 U	0.001 U	3	8.7%
Acetone	**0.011**	0.005 U	0.005 U	**0.0061**	0.005 U	0.005 U	0.005 U	0.005 U	50	-
1,2-Dibromoethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002	-
n-Butylbenzene	0.002 U	0.002 U	0.002 U	0.002 U	**0.0026**	0.002 U	0.002 U	0.002 U	NE	-
sec-Butylbenzene	0.002 U	0.002 U	0.002 U	0.002 U	**0.0029**	0.002 U	0.002 U	0.002 U	NE	-
Isopropylbenzene	0.002 U	0.002 U	0.002 U	**0.017**	**0.029**	0.002 U	0.002 U	0.002 U	100	-
Naphthalene	**0.0071**	**0.0033**	0.002 U	**0.05**	**0.085**	0.002 U	0.002 U	0.002 U	0.7	-
n-Propylbenzene	0.002 U	0.002 U	0.002 U	**0.034**	**0.058**	0.002 U	0.002 U	0.002 U	10	-
1,3,5-Trimethylbenzene	**0.017**	**0.012**	0.002 U	**0.05**	**0.086**	0.002 U	0.002 U	0.002 U	1	-
1,2,4-Trimethylbenzene	**0.041**	**0.031**	**0.004**	**0.18**	**0.42**	**0.0038**	0.002 U	0.002 U	100	5.1%
Volatile Petroleum Hydrocarbons, mg/L										
C9-C10 Aromatics	**0.22**	**0.101**	0.1 U	**0.634**	**1.45**	0.1 U	-	-	4	-
C5-C8 Aliphatics, Adjusted	0.1 U	0.1 U	0.1 U	0.4 U	1 U	0.1 U	-	-	3	-
C9-C12 Aliphatics, Adjusted	0.1 U	0.1 U	0.1 U	0.4 U	1 U	0.1 U	-	-	5	-
Benzene	0.002 U	0.002 U	0.002 U	0.008 U	0.02 U	0.002 U	-	-	1	-
Toluene	0.002 U	0.002 U	0.002 U	0.008 U	0.02 U	0.002 U	-	-	40	-
Ethylbenzene	**0.00262**	**0.00372**	0.002 U	0.298	**0.707**	0.002 U	-	-	5	-
p/m-Xylene	**0.118**	**0.0907**	**0.00912**	**1.16**	**2.71**	**0.01**	-	-	3	9.2%
o-Xylene	**0.0415**	**0.0278**	0.002 U	0.008 U	0.02 U	**0.00223**	-	-	3	10.9%
Methyl tert butyl ether	0.003 U	0.003 U	0.003 U	0.012 U	0.03 U	0.003 U	-	-	50	-
Naphthalene	**0.00841**	0.004 U	0.004 U	**0.0408**	**0.0942**	0.004 U	-	-	0.7	-

Notes
BOLD - compound detected
BOLD and Shaded - compound detected above regulatory standard
U - Not detected above listed detection limit.
NE - Standard not established
Shaded - outside of RPD acceptable range

Figures

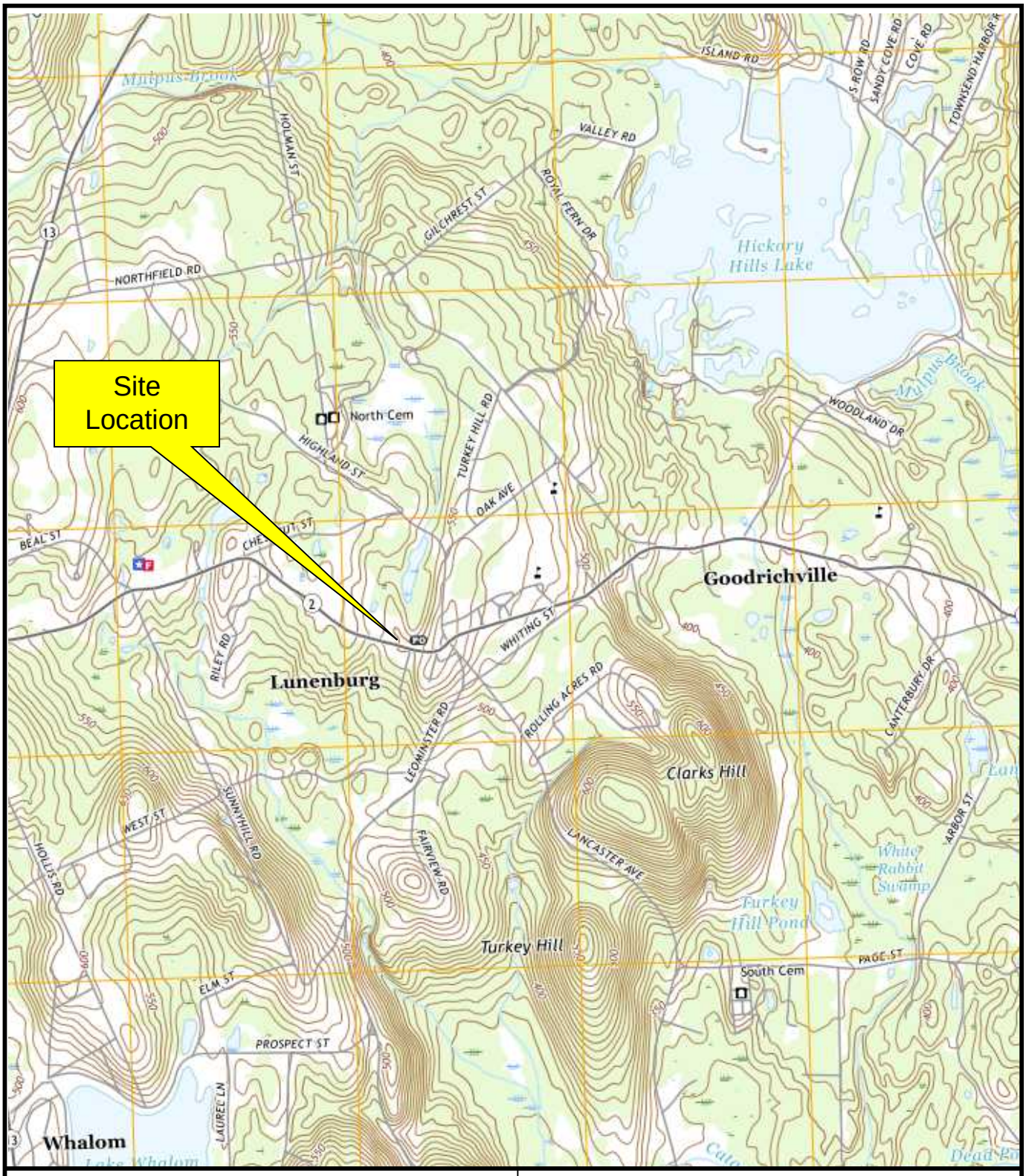
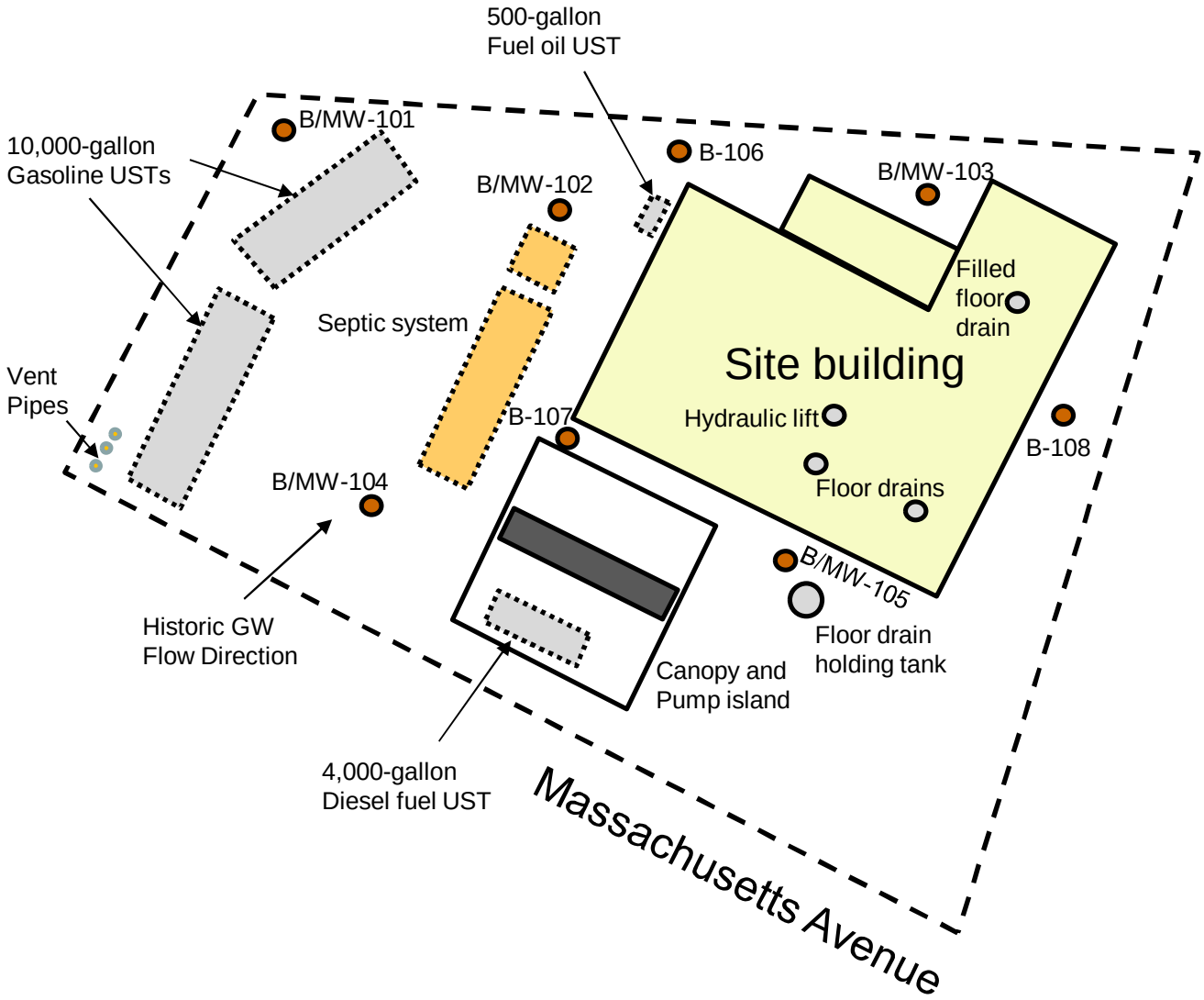


Figure 1: Site Locus

925 Massachusetts Avenue
Lunenburg, Massachusetts

www.BETA-Inc.com



Base plan: 1997 Enstrat plan
Not to scale
Feature locations estimated based on historic plans and surface features

Figure 2: Site Plan

925 Massachusetts Avenue
Lunenburg, Massachusetts

www.BETA-Inc.com

Appendix A - Laboratory Certificates

ANALYTICAL REPORT

Lab Number:	L2033722
Client:	Beta Group, Inc. 701 George Washington Highway Lincoln, RI 02865
ATTN:	Joe McLoughlin
Phone:	(401) 333-2382
Project Name:	LUNENBURG
Project Number:	6893
Report Date:	08/25/20

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2033722-01	B-101 15-18	SOIL	LUNENBURG, MA	08/06/20 09:00	08/19/20
L2033722-02	B-105 12.5-17.5	SOIL	LUNENBURG, MA	08/06/20 09:50	08/19/20
L2033722-03	DUP	SOIL	LUNENBURG, MA	08/06/20 10:15	08/19/20
L2033722-04	B-107 8-10	SOIL	LUNENBURG, MA	08/06/20 10:45	08/19/20
L2033722-05	B-104 10-12	SOIL	LUNENBURG, MA	08/06/20 11:30	08/19/20
L2033722-06	B-103 13-15	SOIL	LUNENBURG, MA	08/06/20 13:00	08/19/20
L2033722-07	B-106 12.5-15	SOIL	LUNENBURG, MA	08/06/20 13:45	08/19/20
L2033722-08	B-102 13-15	SOIL	LUNENBURG, MA	08/06/20 14:10	08/19/20
L2033722-09	B-108 15-17.5	SOIL	LUNENBURG, MA	08/06/20 15:05	08/19/20
L2033722-10	TRIP BLANK	SOIL	LUNENBURG, MA	08/06/20 00:00	08/19/20
L2033722-11	EQUIP BLANK	WATER	LUNENBURG, MA	08/06/20 08:00	08/19/20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

MADEP MCP Response Action Analytical Report Certification

This form provides certifications for all samples performed by MCP methods. Please refer to the Sample Results and Container Information sections of this report for specification of MCP methods used for each analysis. The following questions pertain only to MCP Analytical Methods.

An affirmative response to questions A through F is required for "Presumptive Certainty" status		
A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	YES
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	YES
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	YES
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?"	YES
E a.	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	YES
E b.	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	N/A
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	YES

A response to questions G, H and I is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	NO
H	Were all QC performance standards specified in the CAM protocol(s) achieved?	NO
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	NO

For any questions answered "No", please refer to the case narrative section on the following page(s).

Please note that sample matrix information is located in the Sample Results section of this report.

Project Name:	LUNENBURG	**Lab Number:**	L2033722
Project Number:	6893	**Report Date:**	08/25/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: LUNENBURG **Lab Number:** L2033722
Project Number: 6893 **Report Date:** 08/25/20

Case Narrative (continued)

MCP Related Narratives

Sample Receipt

The samples were received at the laboratory below the required temperature range. The samples were transported to the laboratory in a cooler with ice and were not received frozen.

Volatile Organics

L2033722-10: The Low Level Trip Blank has a result for ethylbenzene, trichloroethene, p/m-xylene, o-xylene, total xylenes, n-propylbenzene, and 1,2,4-trimethylbenzene present above the reporting limit. The sample was verified as being labeled correctly by the laboratory and the previous analysis showed there was no potential for carry over.

The initial calibration, associated with L2033722-01 through -10, utilized a quadratic fit for styrene.

In reference to question G:

L2033722-01 through -04, -07, -08, and -10 High Level: One or more of the target analytes did not achieve the requested CAM reporting limits.

In reference to question H:

The initial calibration, associated with L2033722-11, did not meet the method required minimum response factor on the lowest calibration standard for 1,4-dioxane (0.0065), as well as the average response factor for 1,4-dioxane.

The initial calibration, associated with L2033722-01 through -10, did not meet the method required minimum response factor on the lowest calibration standard for 2-hexanone (0.0647), 1,2-dibromo-3-chloropropane (0.0410), and 1,4-dioxane (0.0009), as well as the average response factor for 2-hexanone and 1,4-dioxane.

The continuing calibration standards, associated with L2033722-01 through -11, are outside the acceptance criteria for several compounds; however, they are within overall method allowances. A copy of the continuing calibration standards is included as an addendum to this report.

VPH

L2033722-02, -05, -07, and -09: The sample was outside the recommended 1:1 methanol:soil ratio, due to

Project Name: LUNENBURG **Lab Number:** L2033722
Project Number: 6893 **Report Date:** 08/25/20

Case Narrative (continued)

the amount of soil provided in the sample vial.
In reference to question G:
L2033722-02, -03, and -08: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-02: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (146%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (138%). The results of the original analysis are reported.
L2033722-03: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (137%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (153%). The results of the original analysis are reported.
L2033722-07: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-pid (143%); however, re-analysis achieved similar results: 2,5-dibromotoluene-pid (154%). The results of the second analysis are reported.
L2033722-08: The surrogate recovery was outside the acceptance criteria for 2,5-dibromotoluene-fid (67%); however, re-analysis achieved similar results: 2,5-dibromotoluene-fid (61%). The results of the original analysis are reported.

EPH
WG1400704: An MS/MSD, performed on L2033722-01, was not analyzed because the dilution required by the native sample would have caused the spike compounds to be diluted below the range of calibration.
In reference to question G:
L2033722-01, -04, and -06: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-03: The surrogate recoveries were outside the acceptance criteria for chloro-octadecane (25%) and o-terphenyl (20%); however, the criteria was achieved upon re-extraction outside of holding time. The results

Project Name: LUNENBURG **Lab Number:** L2033722
Project Number: 6893 **Report Date:** 08/25/20

Case Narrative (continued)

of both extractions are reported; however, all associated compounds are considered to have a potential bias.
L2033722-04: The surrogate recoveries are below the acceptance criteria for chloro-octadecane (0%) and o-terphenyl (0%) due to the dilution required to quantitate the sample. Re-extraction was not required; therefore, the results of the original analysis are reported.

PCBs
L2033722-01 and -04: The sample has elevated detection limits due to the dilution required by the sample matrix.
In reference to question G:
L2033722-01, -04, and -06: One or more of the target analytes did not achieve the requested CAM reporting limits.
In reference to question H:
L2033722-04 and -06: The surrogate recoveries are below the acceptance criteria for 2,4,5,6-tetrachloro-m-xylene (0%) and decachlorobiphenyl (0%) due to the dilution required to quantitate the sample. Re-extraction was not required; therefore, the results of the original analysis are reported.

Total Metals
In reference to question H:
The WG1400770-4 MS recoveries, performed on L2033722-01, are outside the acceptance criteria for arsenic (56%), chromium (66%), lead (66%), nickel (74%), thallium (64%) and zinc (60%). Re-analysis of the MS yielded unacceptable recoveries for arsenic, chromium, lead, nickel, thallium and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable; therefore, no further action was taken.
The WG1400770-5 MSD recoveries, performed on L2033722-01, are outside the acceptance criteria for arsenic (68%), thallium (72%) and zinc (73%). Re-analysis of the MSD yielded unacceptable recoveries for arsenic, thallium and zinc in the range of 30-74% or >125%. The LCS recoveries are acceptable; therefore, no further action was taken.
In reference to question I:

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Case Narrative (continued)

All samples were analyzed for a subset of MCP analytes per client request.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Michelle M. Morris

Title: Technical Director/Representative

Date: 08/25/20

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
MCP Volatile Organics by EPA 5035 High - Westborough Lab								
8260C	Batch QC	WG1400899-4	Hexachlorobutadiene	LCSD	25	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	Naphthalene	LCSD	28	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	1,2,3-Trichlorobenzene	LCSD	26	20	01-04,07-08,10	non-directional bias
8260C	Batch QC	WG1400899-4	1,2,4-Trichlorobenzene	LCSD	26	20	01-04,07-08,10	non-directional bias
MCP Volatile Organics by EPA 5035 Low - Westborough Lab								
8260C	Batch QC	WG1400902-4	Hexachlorobutadiene	LCSD	25	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	Naphthalene	LCSD	28	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	1,2,3-Trichlorobenzene	LCSD	26	20	09-10	non-directional bias
8260C	Batch QC	WG1400902-4	1,2,4-Trichlorobenzene	LCSD	26	20	09-10	non-directional bias
Extractable Petroleum Hydrocarbons - Westborough Lab								
EPH-19-2.1	DUP	L2033722-03	Chloro-Octadecane	Surrogate	25	40-140	-	potential low bias
EPH-19-2.1	DUP	L2033722-03	o-Terphenyl	Surrogate	20	40-140	-	potential low bias
EPH-19-2.1	B-107 8-10	L2033722-04 D	Chloro-Octadecane	Surrogate	0	40-140	-	- - not applicable - -
EPH-19-2.1	B-107 8-10	L2033722-04 D	o-Terphenyl	Surrogate	0	40-140	-	- - not applicable - -
Volatile Petroleum Hydrocarbons - Westborough Lab								
VPH-18-2.1	B-105 12.5-17.5	L2033722-02 D	2,5-Dibromotoluene-PID	Surrogate	146	70-130	-	potential high bias
VPH-18-2.1	DUP	L2033722-03 D	2,5-Dibromotoluene-PID	Surrogate	137	70-130	-	potential high bias
VPH-18-2.1	B-104 10-12	L2033722-05	2,5-Dibromotoluene-PID	Surrogate	158	70-130	-	potential high bias
VPH-18-2.1	B-104 10-12	L2033722-05	2,5-Dibromotoluene-FID	Surrogate	145	70-130	-	potential high bias
VPH-18-2.1	B-106 12.5-15	L2033722-07	2,5-Dibromotoluene-PID	Surrogate	143	70-130	-	potential high bias
VPH-18-2.1	B-102 13-15	L2033722-08 D	2,5-Dibromotoluene-FID	Surrogate	67	70-130	-	potential low bias
VPH-18-2.1	B-108 15-17.5	L2033722-09	2,5-Dibromotoluene-PID	Surrogate	143	70-130	-	potential high bias
MCP Polychlorinated Biphenyls - Westborough Lab								
8082A	B-107 8-10	L2033722-04 D	2,4,5,6-Tetrachloro-m-xylene (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-107 8-10	L2033722-04 D	2,4,5,6-Tetrachloro-m-xylene (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-107 8-10	L2033722-04 D	Decachlorobiphenyl (A)	Surrogate	0	30-150	-	- - not applicable - -

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
8082A	B-107 8-10	L2033722-04 D	Decachlorobiphenyl (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	2,4,5,6-Tetrachloro-m-xylene (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	2,4,5,6-Tetrachloro-m-xylene (B)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	Decachlorobiphenyl (A)	Surrogate	0	30-150	-	- - not applicable - -
8082A	B-103 13-15	L2033722-06 D	Decachlorobiphenyl (B)	Surrogate	0	30-150	-	- - not applicable - -
MCP Total Metals - Mansfield Lab								
6010D	Batch QC (L2033722-01)	WG1400770-4	Arsenic, Total	MS	56	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Chromium, Total	MS	66	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Lead, Total	MS	66	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Nickel, Total	MS	74	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Thallium, Total	MS	64	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-4	Zinc, Total	MS	60	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Arsenic, Total	MSD	68	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Thallium, Total	MSD	72	75-125	01-09	potential low bias
6010D	Batch QC (L2033722-01)	WG1400770-5	Zinc, Total	MSD	73	75-125	01-09	potential low bias

ORGANICS

VOLATILES

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 22:13
Analyst: JC
Percent Solids: 86%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	280	--	1
1,1-Dichloroethane	ND		ug/kg	57	--	1
Chloroform	ND		ug/kg	86	--	1
Carbon tetrachloride	ND		ug/kg	57	--	1
1,2-Dichloropropane	ND		ug/kg	57	--	1
Dibromochloromethane	ND		ug/kg	57	--	1
1,1,2-Trichloroethane	ND		ug/kg	57	--	1
Tetrachloroethene	ND		ug/kg	28	--	1
Chlorobenzene	ND		ug/kg	28	--	1
Trichlorofluoromethane	ND		ug/kg	230	--	1
1,2-Dichloroethane	ND		ug/kg	57	--	1
1,1,1-Trichloroethane	ND		ug/kg	28	--	1
Bromodichloromethane	ND		ug/kg	28	--	1
trans-1,3-Dichloropropene	ND		ug/kg	57	--	1
cis-1,3-Dichloropropene	ND		ug/kg	28	--	1
1,3-Dichloropropene, Total	ND		ug/kg	28	--	1
1,1-Dichloropropene	ND		ug/kg	28	--	1
Bromoform	ND		ug/kg	230	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	28	--	1
Benzene	ND		ug/kg	28	--	1
Toluene	ND		ug/kg	57	--	1
Ethylbenzene	ND		ug/kg	57	--	1
Chloromethane	ND		ug/kg	230	--	1
Bromomethane	ND		ug/kg	110	--	1
Vinyl chloride	ND		ug/kg	57	--	1
Chloroethane	ND		ug/kg	110	--	1
1,1-Dichloroethene	ND		ug/kg	57	--	1
trans-1,2-Dichloroethene	ND		ug/kg	86	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 Date Collected: 08/06/20 09:00

Client ID: B-101 15-18 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	28	--	1
1,2-Dichlorobenzene	ND		ug/kg	110	--	1
1,3-Dichlorobenzene	ND		ug/kg	110	--	1
1,4-Dichlorobenzene	ND		ug/kg	110	--	1
Methyl tert butyl ether	ND		ug/kg	110	--	1
p/m-Xylene	170		ug/kg	110	--	1
o-Xylene	150		ug/kg	57	--	1
Xylenes, Total	320		ug/kg	57	--	1
cis-1,2-Dichloroethene	ND		ug/kg	57	--	1
1,2-Dichloroethene, Total	ND		ug/kg	57	--	1
Dibromomethane	ND		ug/kg	110	--	1
1,2,3-Trichloropropane	ND		ug/kg	110	--	1
Styrene	ND		ug/kg	57	--	1
Dichlorodifluoromethane	ND		ug/kg	570	--	1
Acetone	ND		ug/kg	570	--	1
Carbon disulfide	ND		ug/kg	570	--	1
Methyl ethyl ketone	ND		ug/kg	570	--	1
Methyl isobutyl ketone	ND		ug/kg	570	--	1
2-Hexanone	ND		ug/kg	570	--	1
Bromochloromethane	ND		ug/kg	110	--	1
Tetrahydrofuran	ND		ug/kg	230	--	1
2,2-Dichloropropane	ND		ug/kg	110	--	1
1,2-Dibromoethane	ND		ug/kg	57	--	1
1,3-Dichloropropane	ND		ug/kg	110	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	28	--	1
Bromobenzene	ND		ug/kg	110	--	1
n-Butylbenzene	170		ug/kg	57	--	1
sec-Butylbenzene	66		ug/kg	57	--	1
tert-Butylbenzene	ND		ug/kg	110	--	1
o-Chlorotoluene	ND		ug/kg	110	--	1
p-Chlorotoluene	ND		ug/kg	110	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	170	--	1
Hexachlorobutadiene	ND		ug/kg	230	--	1
Isopropylbenzene	62		ug/kg	57	--	1
p-Isopropyltoluene	70		ug/kg	57	--	1
Naphthalene	ND		ug/kg	230	--	1
n-Propylbenzene	190		ug/kg	57	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 Date Collected: 08/06/20 09:00

Client ID: B-101 15-18 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	110	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	110	--	1
1,3,5-Trimethylbenzene	430		ug/kg	110	--	1
1,2,4-Trimethylbenzene	1200		ug/kg	110	--	1
Diethyl ether	ND		ug/kg	110	--	1
Diisopropyl Ether	ND		ug/kg	110	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	110	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	110	--	1
1,4-Dioxane	ND		ug/kg	4600	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	93		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50
Client ID: B-105 12.5-17.5 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 13:58
Analyst: AD
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	1200	--	5
1,1-Dichloroethane	ND		ug/kg	240	--	5
Chloroform	ND		ug/kg	360	--	5
Carbon tetrachloride	ND		ug/kg	240	--	5
1,2-Dichloropropane	ND		ug/kg	240	--	5
Dibromochloromethane	ND		ug/kg	240	--	5
1,1,2-Trichloroethane	ND		ug/kg	240	--	5
Tetrachloroethene	ND		ug/kg	120	--	5
Chlorobenzene	ND		ug/kg	120	--	5
Trichlorofluoromethane	ND		ug/kg	960	--	5
1,2-Dichloroethane	ND		ug/kg	240	--	5
1,1,1-Trichloroethane	ND		ug/kg	120	--	5
Bromodichloromethane	ND		ug/kg	120	--	5
trans-1,3-Dichloropropene	ND		ug/kg	240	--	5
cis-1,3-Dichloropropene	ND		ug/kg	120	--	5
1,3-Dichloropropene, Total	ND		ug/kg	120	--	5
1,1-Dichloropropene	ND		ug/kg	120	--	5
Bromoform	ND		ug/kg	960	--	5
1,1,2,2-Tetrachloroethane	ND		ug/kg	120	--	5
Benzene	ND		ug/kg	120	--	5
Toluene	ND		ug/kg	240	--	5
Ethylbenzene	10000		ug/kg	240	--	5
Chloromethane	ND		ug/kg	960	--	5
Bromomethane	ND		ug/kg	480	--	5
Vinyl chloride	ND		ug/kg	240	--	5
Chloroethane	ND		ug/kg	480	--	5
1,1-Dichloroethene	ND		ug/kg	240	--	5
trans-1,2-Dichloroethene	ND		ug/kg	360	--	5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	120	--	5
1,2-Dichlorobenzene	ND		ug/kg	480	--	5
1,3-Dichlorobenzene	ND		ug/kg	480	--	5
1,4-Dichlorobenzene	ND		ug/kg	480	--	5
Methyl tert butyl ether	ND		ug/kg	480	--	5
p/m-Xylene	67000		ug/kg	480	--	5
o-Xylene	12000		ug/kg	240	--	5
Xylenes, Total	79000		ug/kg	240	--	5
cis-1,2-Dichloroethene	ND		ug/kg	240	--	5
1,2-Dichloroethene, Total	ND		ug/kg	240	--	5
Dibromomethane	ND		ug/kg	480	--	5
1,2,3-Trichloropropane	ND		ug/kg	480	--	5
Styrene	ND		ug/kg	240	--	5
Dichlorodifluoromethane	ND		ug/kg	2400	--	5
Acetone	ND		ug/kg	2400	--	5
Carbon disulfide	ND		ug/kg	2400	--	5
Methyl ethyl ketone	ND		ug/kg	2400	--	5
Methyl isobutyl ketone	ND		ug/kg	2400	--	5
2-Hexanone	ND		ug/kg	2400	--	5
Bromochloromethane	ND		ug/kg	480	--	5
Tetrahydrofuran	ND		ug/kg	960	--	5
2,2-Dichloropropane	ND		ug/kg	480	--	5
1,2-Dibromoethane	ND		ug/kg	240	--	5
1,3-Dichloropropane	ND		ug/kg	480	--	5
1,1,1,2-Tetrachloroethane	ND		ug/kg	120	--	5
Bromobenzene	ND		ug/kg	480	--	5
n-Butylbenzene	4400		ug/kg	240	--	5
sec-Butylbenzene	1500		ug/kg	240	--	5
tert-Butylbenzene	ND		ug/kg	480	--	5
o-Chlorotoluene	ND		ug/kg	480	--	5
p-Chlorotoluene	ND		ug/kg	480	--	5
1,2-Dibromo-3-chloropropane	ND		ug/kg	720	--	5
Hexachlorobutadiene	ND		ug/kg	960	--	5
Isopropylbenzene	3300		ug/kg	240	--	5
p-Isopropyltoluene	940		ug/kg	240	--	5
Naphthalene	19000		ug/kg	960	--	5
n-Propylbenzene	11000		ug/kg	240	--	5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D2 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	480	--	5
1,2,4-Trichlorobenzene	ND		ug/kg	480	--	5
1,3,5-Trimethylbenzene	29000		ug/kg	480	--	5
1,2,4-Trimethylbenzene	96000	E	ug/kg	480	--	5
Diethyl ether	ND		ug/kg	480	--	5
Diisopropyl Ether	ND		ug/kg	480	--	5
Ethyl-Tert-Butyl-Ether	ND		ug/kg	480	--	5
Tertiary-Amyl Methyl Ether	ND		ug/kg	480	--	5
1,4-Dioxane	ND		ug/kg	19000	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	86		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	119		70-130
Dibromofluoromethane	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 D
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 22:39
Analyst: JC
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	92000		ug/kg	960	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	107		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15
Client ID: DUP Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 12:32
Analyst: JC
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	630	--	2.5
1,1-Dichloroethane	ND		ug/kg	130	--	2.5
Chloroform	ND		ug/kg	190	--	2.5
Carbon tetrachloride	ND		ug/kg	130	--	2.5
1,2-Dichloropropane	ND		ug/kg	130	--	2.5
Dibromochloromethane	ND		ug/kg	130	--	2.5
1,1,2-Trichloroethane	ND		ug/kg	130	--	2.5
Tetrachloroethene	ND		ug/kg	63	--	2.5
Chlorobenzene	ND		ug/kg	63	--	2.5
Trichlorofluoromethane	ND		ug/kg	510	--	2.5
1,2-Dichloroethane	ND		ug/kg	130	--	2.5
1,1,1-Trichloroethane	ND		ug/kg	63	--	2.5
Bromodichloromethane	ND		ug/kg	63	--	2.5
trans-1,3-Dichloropropene	ND		ug/kg	130	--	2.5
cis-1,3-Dichloropropene	ND		ug/kg	63	--	2.5
1,3-Dichloropropene, Total	ND		ug/kg	63	--	2.5
1,1-Dichloropropene	ND		ug/kg	63	--	2.5
Bromoform	ND		ug/kg	510	--	2.5
1,1,2,2-Tetrachloroethane	ND		ug/kg	63	--	2.5
Benzene	ND		ug/kg	63	--	2.5
Toluene	ND		ug/kg	130	--	2.5
Ethylbenzene	7500		ug/kg	130	--	2.5
Chloromethane	ND		ug/kg	510	--	2.5
Bromomethane	ND		ug/kg	250	--	2.5
Vinyl chloride	ND		ug/kg	130	--	2.5
Chloroethane	ND		ug/kg	250	--	2.5
1,1-Dichloroethene	ND		ug/kg	130	--	2.5
trans-1,2-Dichloroethene	ND		ug/kg	190	--	2.5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15

Client ID: DUP Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	63	--	2.5
1,2-Dichlorobenzene	ND		ug/kg	250	--	2.5
1,3-Dichlorobenzene	ND		ug/kg	250	--	2.5
1,4-Dichlorobenzene	ND		ug/kg	250	--	2.5
Methyl tert butyl ether	ND		ug/kg	250	--	2.5
p/m-Xylene	55000		ug/kg	250	--	2.5
o-Xylene	8100		ug/kg	130	--	2.5
Xylenes, Total	63000		ug/kg	130	--	2.5
cis-1,2-Dichloroethene	ND		ug/kg	130	--	2.5
1,2-Dichloroethene, Total	ND		ug/kg	130	--	2.5
Dibromomethane	ND		ug/kg	250	--	2.5
1,2,3-Trichloropropane	ND		ug/kg	250	--	2.5
Styrene	ND		ug/kg	130	--	2.5
Dichlorodifluoromethane	ND		ug/kg	1300	--	2.5
Acetone	ND		ug/kg	1300	--	2.5
Carbon disulfide	ND		ug/kg	1300	--	2.5
Methyl ethyl ketone	ND		ug/kg	1300	--	2.5
Methyl isobutyl ketone	ND		ug/kg	1300	--	2.5
2-Hexanone	ND		ug/kg	1300	--	2.5
Bromochloromethane	ND		ug/kg	250	--	2.5
Tetrahydrofuran	ND		ug/kg	510	--	2.5
2,2-Dichloropropane	ND		ug/kg	250	--	2.5
1,2-Dibromoethane	ND		ug/kg	130	--	2.5
1,3-Dichloropropane	ND		ug/kg	250	--	2.5
1,1,1,2-Tetrachloroethane	ND		ug/kg	63	--	2.5
Bromobenzene	ND		ug/kg	250	--	2.5
n-Butylbenzene	3100		ug/kg	130	--	2.5
sec-Butylbenzene	1300		ug/kg	130	--	2.5
tert-Butylbenzene	ND		ug/kg	250	--	2.5
o-Chlorotoluene	ND		ug/kg	250	--	2.5
p-Chlorotoluene	ND		ug/kg	250	--	2.5
1,2-Dibromo-3-chloropropane	ND		ug/kg	380	--	2.5
Hexachlorobutadiene	ND		ug/kg	510	--	2.5
Isopropylbenzene	1900		ug/kg	130	--	2.5
p-Isopropyltoluene	630		ug/kg	130	--	2.5
Naphthalene	12000		ug/kg	510	--	2.5
n-Propylbenzene	7100		ug/kg	130	--	2.5

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D2 Date Collected: 08/06/20 10:15

Client ID: DUP Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	250	--	2.5
1,2,4-Trichlorobenzene	ND		ug/kg	250	--	2.5
1,3,5-Trimethylbenzene	15000		ug/kg	250	--	2.5
1,2,4-Trimethylbenzene	80000	E	ug/kg	250	--	2.5
Diethyl ether	ND		ug/kg	250	--	2.5
Diisopropyl Ether	ND		ug/kg	250	--	2.5
Ethyl-Tert-Butyl-Ether	ND		ug/kg	250	--	2.5
Tertiary-Amyl Methyl Ether	ND		ug/kg	250	--	2.5
1,4-Dioxane	ND		ug/kg	10000	--	2.5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	96		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 D
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:05
Analyst: JC
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	75000		ug/kg	510	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	102		70-130
Dibromofluoromethane	94		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45
Client ID: B-107 8-10 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:32
Analyst: JC
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	260	--	1
1,1-Dichloroethane	ND		ug/kg	53	--	1
Chloroform	ND		ug/kg	79	--	1
Carbon tetrachloride	ND		ug/kg	53	--	1
1,2-Dichloropropane	ND		ug/kg	53	--	1
Dibromochloromethane	ND		ug/kg	53	--	1
1,1,2-Trichloroethane	ND		ug/kg	53	--	1
Tetrachloroethene	ND		ug/kg	26	--	1
Chlorobenzene	ND		ug/kg	26	--	1
Trichlorofluoromethane	ND		ug/kg	210	--	1
1,2-Dichloroethane	ND		ug/kg	53	--	1
1,1,1-Trichloroethane	ND		ug/kg	26	--	1
Bromodichloromethane	ND		ug/kg	26	--	1
trans-1,3-Dichloropropene	ND		ug/kg	53	--	1
cis-1,3-Dichloropropene	ND		ug/kg	26	--	1
1,3-Dichloropropene, Total	ND		ug/kg	26	--	1
1,1-Dichloropropene	ND		ug/kg	26	--	1
Bromoform	ND		ug/kg	210	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	26	--	1
Benzene	550		ug/kg	26	--	1
Toluene	520		ug/kg	53	--	1
Ethylbenzene	700		ug/kg	53	--	1
Chloromethane	ND		ug/kg	210	--	1
Bromomethane	ND		ug/kg	100	--	1
Vinyl chloride	ND		ug/kg	53	--	1
Chloroethane	ND		ug/kg	100	--	1
1,1-Dichloroethene	ND		ug/kg	53	--	1
trans-1,2-Dichloroethene	ND		ug/kg	79	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45

Client ID: B-107 8-10 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	26	--	1
1,2-Dichlorobenzene	ND		ug/kg	100	--	1
1,3-Dichlorobenzene	ND		ug/kg	100	--	1
1,4-Dichlorobenzene	ND		ug/kg	100	--	1
Methyl tert butyl ether	ND		ug/kg	100	--	1
p/m-Xylene	2600		ug/kg	100	--	1
o-Xylene	1000		ug/kg	53	--	1
Xylenes, Total	3600		ug/kg	53	--	1
cis-1,2-Dichloroethene	ND		ug/kg	53	--	1
1,2-Dichloroethene, Total	ND		ug/kg	53	--	1
Dibromomethane	ND		ug/kg	100	--	1
1,2,3-Trichloropropane	ND		ug/kg	100	--	1
Styrene	ND		ug/kg	53	--	1
Dichlorodifluoromethane	ND		ug/kg	530	--	1
Acetone	770		ug/kg	530	--	1
Carbon disulfide	ND		ug/kg	530	--	1
Methyl ethyl ketone	ND		ug/kg	530	--	1
Methyl isobutyl ketone	ND		ug/kg	530	--	1
2-Hexanone	ND		ug/kg	530	--	1
Bromochloromethane	ND		ug/kg	100	--	1
Tetrahydrofuran	ND		ug/kg	210	--	1
2,2-Dichloropropane	ND		ug/kg	100	--	1
1,2-Dibromoethane	ND		ug/kg	53	--	1
1,3-Dichloropropane	ND		ug/kg	100	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	26	--	1
Bromobenzene	ND		ug/kg	100	--	1
n-Butylbenzene	98		ug/kg	53	--	1
sec-Butylbenzene	89		ug/kg	53	--	1
tert-Butylbenzene	ND		ug/kg	100	--	1
o-Chlorotoluene	ND		ug/kg	100	--	1
p-Chlorotoluene	ND		ug/kg	100	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	160	--	1
Hexachlorobutadiene	ND		ug/kg	210	--	1
Isopropylbenzene	110		ug/kg	53	--	1
p-Isopropyltoluene	150		ug/kg	53	--	1
Naphthalene	880		ug/kg	210	--	1
n-Propylbenzene	220		ug/kg	53	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 Date Collected: 08/06/20 10:45

Client ID: B-107 8-10 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	100	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	100	--	1
1,3,5-Trimethylbenzene	1100		ug/kg	100	--	1
1,2,4-Trimethylbenzene	2200		ug/kg	100	--	1
Diethyl ether	ND		ug/kg	100	--	1
Diisopropyl Ether	ND		ug/kg	100	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--	1
1,4-Dioxane	ND		ug/kg	4200	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	91		70-130
4-Bromofluorobenzene	115		70-130
Dibromofluoromethane	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:44
Analyst: JC
Percent Solids: 88%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.9	--	1
1,1-Dichloroethane	ND		ug/kg	0.79	--	1
Chloroform	ND		ug/kg	1.2	--	1
Carbon tetrachloride	ND		ug/kg	0.79	--	1
1,2-Dichloropropane	ND		ug/kg	0.79	--	1
Dibromochloromethane	ND		ug/kg	0.79	--	1
1,1,2-Trichloroethane	ND		ug/kg	0.79	--	1
Tetrachloroethene	ND		ug/kg	0.39	--	1
Chlorobenzene	ND		ug/kg	0.39	--	1
Trichlorofluoromethane	ND		ug/kg	3.2	--	1
1,2-Dichloroethane	ND		ug/kg	0.79	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.39	--	1
Bromodichloromethane	ND		ug/kg	0.39	--	1
trans-1,3-Dichloropropene	ND		ug/kg	0.79	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.39	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.39	--	1
1,1-Dichloropropene	ND		ug/kg	0.39	--	1
Bromoform	ND		ug/kg	3.2	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.39	--	1
Benzene	ND		ug/kg	0.39	--	1
Toluene	ND		ug/kg	0.79	--	1
Ethylbenzene	ND		ug/kg	0.79	--	1
Chloromethane	ND		ug/kg	3.2	--	1
Bromomethane	ND		ug/kg	1.6	--	1
Vinyl chloride	ND		ug/kg	0.79	--	1
Chloroethane	ND		ug/kg	1.6	--	1
1,1-Dichloroethene	ND		ug/kg	0.79	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.2	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.39	--	1
1,2-Dichlorobenzene	ND		ug/kg	1.6	--	1
1,3-Dichlorobenzene	ND		ug/kg	1.6	--	1
1,4-Dichlorobenzene	ND		ug/kg	1.6	--	1
Methyl tert butyl ether	ND		ug/kg	1.6	--	1
p/m-Xylene	ND		ug/kg	1.6	--	1
o-Xylene	ND		ug/kg	0.79	--	1
Xylenes, Total	ND		ug/kg	0.79	--	1
cis-1,2-Dichloroethene	ND		ug/kg	0.79	--	1
1,2-Dichloroethene, Total	ND		ug/kg	0.79	--	1
Dibromomethane	ND		ug/kg	1.6	--	1
1,2,3-Trichloropropane	ND		ug/kg	1.6	--	1
Styrene	ND		ug/kg	0.79	--	1
Dichlorodifluoromethane	ND		ug/kg	7.9	--	1
Acetone	31		ug/kg	20	--	1
Carbon disulfide	ND		ug/kg	7.9	--	1
Methyl ethyl ketone	ND		ug/kg	7.9	--	1
Methyl isobutyl ketone	ND		ug/kg	7.9	--	1
2-Hexanone	ND		ug/kg	7.9	--	1
Bromochloromethane	ND		ug/kg	1.6	--	1
Tetrahydrofuran	ND		ug/kg	3.2	--	1
2,2-Dichloropropane	ND		ug/kg	1.6	--	1
1,2-Dibromoethane	ND		ug/kg	0.79	--	1
1,3-Dichloropropane	ND		ug/kg	1.6	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.39	--	1
Bromobenzene	ND		ug/kg	1.6	--	1
n-Butylbenzene	ND		ug/kg	0.79	--	1
sec-Butylbenzene	ND		ug/kg	0.79	--	1
tert-Butylbenzene	ND		ug/kg	1.6	--	1
o-Chlorotoluene	ND		ug/kg	1.6	--	1
p-Chlorotoluene	ND		ug/kg	1.6	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.4	--	1
Hexachlorobutadiene	ND		ug/kg	3.2	--	1
Isopropylbenzene	ND		ug/kg	0.79	--	1
p-Isopropyltoluene	ND		ug/kg	0.79	--	1
Naphthalene	ND		ug/kg	3.2	--	1
n-Propylbenzene	ND		ug/kg	0.79	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	1.6	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.6	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.6	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.6	--	1
Diethyl ether	ND		ug/kg	1.6	--	1
Diisopropyl Ether	ND		ug/kg	1.6	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	1.6	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	1.6	--	1
1,4-Dioxane	ND		ug/kg	63	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	114		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 08:10
Analyst: JC
Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.4	--	1
1,1-Dichloroethane	ND		ug/kg	1.1	--	1
Chloroform	ND		ug/kg	1.6	--	1
Carbon tetrachloride	ND		ug/kg	1.1	--	1
1,2-Dichloropropane	ND		ug/kg	1.1	--	1
Dibromochloromethane	ND		ug/kg	1.1	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.1	--	1
Tetrachloroethene	ND		ug/kg	0.54	--	1
Chlorobenzene	ND		ug/kg	0.54	--	1
Trichlorofluoromethane	ND		ug/kg	4.3	--	1
1,2-Dichloroethane	ND		ug/kg	1.1	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.54	--	1
Bromodichloromethane	ND		ug/kg	0.54	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.1	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.54	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.54	--	1
1,1-Dichloropropene	ND		ug/kg	0.54	--	1
Bromoform	ND		ug/kg	4.3	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.54	--	1
Benzene	5.2		ug/kg	0.54	--	1
Toluene	19		ug/kg	1.1	--	1
Ethylbenzene	1.5		ug/kg	1.1	--	1
Chloromethane	ND		ug/kg	4.3	--	1
Bromomethane	ND		ug/kg	2.2	--	1
Vinyl chloride	ND		ug/kg	1.1	--	1
Chloroethane	ND		ug/kg	2.2	--	1
1,1-Dichloroethene	ND		ug/kg	1.1	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.6	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 Date Collected: 08/06/20 13:00

Client ID: B-103 13-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.54	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.2	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.2	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.2	--	1
Methyl tert butyl ether	34		ug/kg	2.2	--	1
p/m-Xylene	19		ug/kg	2.2	--	1
o-Xylene	2.3		ug/kg	1.1	--	1
Xylenes, Total	21		ug/kg	1.1	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.1	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.1	--	1
Dibromomethane	ND		ug/kg	2.2	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.2	--	1
Styrene	ND		ug/kg	1.1	--	1
Dichlorodifluoromethane	ND		ug/kg	11	--	1
Acetone	180		ug/kg	27	--	1
Carbon disulfide	ND		ug/kg	11	--	1
Methyl ethyl ketone	40		ug/kg	11	--	1
Methyl isobutyl ketone	ND		ug/kg	11	--	1
2-Hexanone	ND		ug/kg	11	--	1
Bromochloromethane	ND		ug/kg	2.2	--	1
Tetrahydrofuran	ND		ug/kg	4.3	--	1
2,2-Dichloropropane	ND		ug/kg	2.2	--	1
1,2-Dibromoethane	ND		ug/kg	1.1	--	1
1,3-Dichloropropane	ND		ug/kg	2.2	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.54	--	1
Bromobenzene	ND		ug/kg	2.2	--	1
n-Butylbenzene	ND		ug/kg	1.1	--	1
sec-Butylbenzene	ND		ug/kg	1.1	--	1
tert-Butylbenzene	ND		ug/kg	2.2	--	1
o-Chlorotoluene	ND		ug/kg	2.2	--	1
p-Chlorotoluene	ND		ug/kg	2.2	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.2	--	1
Hexachlorobutadiene	ND		ug/kg	4.3	--	1
Isopropylbenzene	ND		ug/kg	1.1	--	1
p-Isopropyltoluene	ND		ug/kg	1.1	--	1
Naphthalene	ND		ug/kg	4.3	--	1
n-Propylbenzene	ND		ug/kg	1.1	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.2	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.2	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.2	--	1
1,2,4-Trimethylbenzene	11		ug/kg	2.2	--	1
Diethyl ether	ND		ug/kg	2.2	--	1
Diisopropyl Ether	ND		ug/kg	2.2	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.2	--	1
Tertiary-Amyl Methyl Ether	3.8		ug/kg	2.2	--	1
1,4-Dioxane	ND		ug/kg	86	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	103		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 Date Collected: 08/06/20 13:45
Client ID: B-106 12.5-15 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 23:58
Analyst: JC
Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	290	--	1
1,1-Dichloroethane	ND		ug/kg	57	--	1
Chloroform	ND		ug/kg	86	--	1
Carbon tetrachloride	ND		ug/kg	57	--	1
1,2-Dichloropropane	ND		ug/kg	57	--	1
Dibromochloromethane	ND		ug/kg	57	--	1
1,1,2-Trichloroethane	ND		ug/kg	57	--	1
Tetrachloroethene	ND		ug/kg	29	--	1
Chlorobenzene	ND		ug/kg	29	--	1
Trichlorofluoromethane	ND		ug/kg	230	--	1
1,2-Dichloroethane	ND		ug/kg	57	--	1
1,1,1-Trichloroethane	ND		ug/kg	29	--	1
Bromodichloromethane	ND		ug/kg	29	--	1
trans-1,3-Dichloropropene	ND		ug/kg	57	--	1
cis-1,3-Dichloropropene	ND		ug/kg	29	--	1
1,3-Dichloropropene, Total	ND		ug/kg	29	--	1
1,1-Dichloropropene	ND		ug/kg	29	--	1
Bromoform	ND		ug/kg	230	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	29	--	1
Benzene	320		ug/kg	29	--	1
Toluene	ND		ug/kg	57	--	1
Ethylbenzene	110		ug/kg	57	--	1
Chloromethane	ND		ug/kg	230	--	1
Bromomethane	ND		ug/kg	110	--	1
Vinyl chloride	ND		ug/kg	57	--	1
Chloroethane	ND		ug/kg	110	--	1
1,1-Dichloroethene	ND		ug/kg	57	--	1
trans-1,2-Dichloroethene	ND		ug/kg	86	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 Date Collected: 08/06/20 13:45

Client ID: B-106 12.5-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	29	--	1
1,2-Dichlorobenzene	ND		ug/kg	110	--	1
1,3-Dichlorobenzene	ND		ug/kg	110	--	1
1,4-Dichlorobenzene	ND		ug/kg	110	--	1
Methyl tert butyl ether	140		ug/kg	110	--	1
p/m-Xylene	12000		ug/kg	110	--	1
o-Xylene	68		ug/kg	57	--	1
Xylenes, Total	12000		ug/kg	57	--	1
cis-1,2-Dichloroethene	ND		ug/kg	57	--	1
1,2-Dichloroethene, Total	ND		ug/kg	57	--	1
Dibromomethane	ND		ug/kg	110	--	1
1,2,3-Trichloropropane	ND		ug/kg	110	--	1
Styrene	ND		ug/kg	57	--	1
Dichlorodifluoromethane	ND		ug/kg	570	--	1
Acetone	ND		ug/kg	570	--	1
Carbon disulfide	ND		ug/kg	570	--	1
Methyl ethyl ketone	ND		ug/kg	570	--	1
Methyl isobutyl ketone	ND		ug/kg	570	--	1
2-Hexanone	ND		ug/kg	570	--	1
Bromochloromethane	ND		ug/kg	110	--	1
Tetrahydrofuran	ND		ug/kg	230	--	1
2,2-Dichloropropane	ND		ug/kg	110	--	1
1,2-Dibromoethane	ND		ug/kg	57	--	1
1,3-Dichloropropane	ND		ug/kg	110	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	29	--	1
Bromobenzene	ND		ug/kg	110	--	1
n-Butylbenzene	170		ug/kg	57	--	1
sec-Butylbenzene	140		ug/kg	57	--	1
tert-Butylbenzene	ND		ug/kg	110	--	1
o-Chlorotoluene	ND		ug/kg	110	--	1
p-Chlorotoluene	ND		ug/kg	110	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	170	--	1
Hexachlorobutadiene	ND		ug/kg	230	--	1
Isopropylbenzene	790		ug/kg	57	--	1
p-Isopropyltoluene	120		ug/kg	57	--	1
Naphthalene	1400		ug/kg	230	--	1
n-Propylbenzene	1900		ug/kg	57	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	110	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	110	--	1
1,3,5-Trimethylbenzene	2000		ug/kg	110	--	1
1,2,4-Trimethylbenzene	14000		ug/kg	110	--	1
Diethyl ether	ND		ug/kg	110	--	1
Diisopropyl Ether	ND		ug/kg	110	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	110	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	110	--	1
1,4-Dioxane	ND		ug/kg	4600	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	102		70-130
4-Bromofluorobenzene	100		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D2
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 13:25
Analyst: AD
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,4-Trimethylbenzene	350000		ug/kg	6100	--	50

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	116		70-130
Dibromofluoromethane	97		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 00:24
Analyst: JC
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	6100	--	20
1,1-Dichloroethane	ND		ug/kg	1200	--	20
Chloroform	ND		ug/kg	1800	--	20
Carbon tetrachloride	ND		ug/kg	1200	--	20
1,2-Dichloropropane	ND		ug/kg	1200	--	20
Dibromochloromethane	ND		ug/kg	1200	--	20
1,1,2-Trichloroethane	ND		ug/kg	1200	--	20
Tetrachloroethene	ND		ug/kg	610	--	20
Chlorobenzene	ND		ug/kg	610	--	20
Trichlorofluoromethane	ND		ug/kg	4900	--	20
1,2-Dichloroethane	ND		ug/kg	1200	--	20
1,1,1-Trichloroethane	ND		ug/kg	610	--	20
Bromodichloromethane	ND		ug/kg	610	--	20
trans-1,3-Dichloropropene	ND		ug/kg	1200	--	20
cis-1,3-Dichloropropene	ND		ug/kg	610	--	20
1,3-Dichloropropene, Total	ND		ug/kg	610	--	20
1,1-Dichloropropene	ND		ug/kg	610	--	20
Bromoform	ND		ug/kg	4900	--	20
1,1,2,2-Tetrachloroethane	ND		ug/kg	610	--	20
Benzene	ND		ug/kg	610	--	20
Toluene	ND		ug/kg	1200	--	20
Ethylbenzene	3700		ug/kg	1200	--	20
Chloromethane	ND		ug/kg	4900	--	20
Bromomethane	ND		ug/kg	2400	--	20
Vinyl chloride	ND		ug/kg	1200	--	20
Chloroethane	ND		ug/kg	2400	--	20
1,1-Dichloroethene	ND		ug/kg	1200	--	20
trans-1,2-Dichloroethene	ND		ug/kg	1800	--	20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D Date Collected: 08/06/20 14:10
Client ID: B-102 13-15 Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	610	--	20
1,2-Dichlorobenzene	ND		ug/kg	2400	--	20
1,3-Dichlorobenzene	ND		ug/kg	2400	--	20
1,4-Dichlorobenzene	ND		ug/kg	2400	--	20
Methyl tert butyl ether	ND		ug/kg	2400	--	20
p/m-Xylene	61000		ug/kg	2400	--	20
o-Xylene	ND		ug/kg	1200	--	20
Xylenes, Total	61000		ug/kg	1200	--	20
cis-1,2-Dichloroethene	ND		ug/kg	1200	--	20
1,2-Dichloroethene, Total	ND		ug/kg	1200	--	20
Dibromomethane	ND		ug/kg	2400	--	20
1,2,3-Trichloropropane	ND		ug/kg	2400	--	20
Styrene	ND		ug/kg	1200	--	20
Dichlorodifluoromethane	ND		ug/kg	12000	--	20
Acetone	ND		ug/kg	12000	--	20
Carbon disulfide	ND		ug/kg	12000	--	20
Methyl ethyl ketone	ND		ug/kg	12000	--	20
Methyl isobutyl ketone	ND		ug/kg	12000	--	20
2-Hexanone	ND		ug/kg	12000	--	20
Bromochloromethane	ND		ug/kg	2400	--	20
Tetrahydrofuran	ND		ug/kg	4900	--	20
2,2-Dichloropropane	ND		ug/kg	2400	--	20
1,2-Dibromoethane	ND		ug/kg	1200	--	20
1,3-Dichloropropane	ND		ug/kg	2400	--	20
1,1,1,2-Tetrachloroethane	ND		ug/kg	610	--	20
Bromobenzene	ND		ug/kg	2400	--	20
n-Butylbenzene	21000		ug/kg	1200	--	20
sec-Butylbenzene	8200		ug/kg	1200	--	20
tert-Butylbenzene	ND		ug/kg	2400	--	20
o-Chlorotoluene	ND		ug/kg	2400	--	20
p-Chlorotoluene	ND		ug/kg	2400	--	20
1,2-Dibromo-3-chloropropane	ND		ug/kg	3600	--	20
Hexachlorobutadiene	ND		ug/kg	4900	--	20
Isopropylbenzene	10000		ug/kg	1200	--	20
p-Isopropyltoluene	5700		ug/kg	1200	--	20
Naphthalene	63000		ug/kg	4900	--	20
n-Propylbenzene	38000		ug/kg	1200	--	20

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D Date Collected: 08/06/20 14:10

Client ID: B-102 13-15 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2400	--	20
1,2,4-Trichlorobenzene	ND		ug/kg	2400	--	20
1,3,5-Trimethylbenzene	72000		ug/kg	2400	--	20
1,2,4-Trimethylbenzene	430000	E	ug/kg	2400	--	20
Diethyl ether	ND		ug/kg	2400	--	20
Diisopropyl Ether	ND		ug/kg	2400	--	20
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2400	--	20
Tertiary-Amyl Methyl Ether	ND		ug/kg	2400	--	20
1,4-Dioxane	ND		ug/kg	97000	--	20

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	86		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	99		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/20/20 00:50
Analyst: JC
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.8	--	1
1,1-Dichloroethane	ND		ug/kg	0.75	--	1
Chloroform	ND		ug/kg	1.1	--	1
Carbon tetrachloride	ND		ug/kg	0.75	--	1
1,2-Dichloropropane	ND		ug/kg	0.75	--	1
Dibromochloromethane	ND		ug/kg	0.75	--	1
1,1,2-Trichloroethane	ND		ug/kg	0.75	--	1
Tetrachloroethene	ND		ug/kg	0.38	--	1
Chlorobenzene	ND		ug/kg	0.38	--	1
Trichlorofluoromethane	ND		ug/kg	3.0	--	1
1,2-Dichloroethane	ND		ug/kg	0.75	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.38	--	1
Bromodichloromethane	ND		ug/kg	0.38	--	1
trans-1,3-Dichloropropene	ND		ug/kg	0.75	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.38	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.38	--	1
1,1-Dichloropropene	ND		ug/kg	0.38	--	1
Bromoform	ND		ug/kg	3.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.38	--	1
Benzene	ND		ug/kg	0.38	--	1
Toluene	ND		ug/kg	0.75	--	1
Ethylbenzene	ND		ug/kg	0.75	--	1
Chloromethane	ND		ug/kg	3.0	--	1
Bromomethane	ND		ug/kg	1.5	--	1
Vinyl chloride	ND		ug/kg	0.75	--	1
Chloroethane	ND		ug/kg	1.5	--	1
1,1-Dichloroethene	ND		ug/kg	0.75	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.1	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09 Date Collected: 08/06/20 15:05

Client ID: B-108 15-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.38	--	1
1,2-Dichlorobenzene	ND		ug/kg	1.5	--	1
1,3-Dichlorobenzene	ND		ug/kg	1.5	--	1
1,4-Dichlorobenzene	ND		ug/kg	1.5	--	1
Methyl tert butyl ether	ND		ug/kg	1.5	--	1
p/m-Xylene	ND		ug/kg	1.5	--	1
o-Xylene	ND		ug/kg	0.75	--	1
Xylenes, Total	ND		ug/kg	0.75	--	1
cis-1,2-Dichloroethene	ND		ug/kg	0.75	--	1
1,2-Dichloroethene, Total	ND		ug/kg	0.75	--	1
Dibromomethane	ND		ug/kg	1.5	--	1
1,2,3-Trichloropropane	ND		ug/kg	1.5	--	1
Styrene	ND		ug/kg	0.75	--	1
Dichlorodifluoromethane	ND		ug/kg	7.5	--	1
Acetone	ND		ug/kg	19	--	1
Carbon disulfide	ND		ug/kg	7.5	--	1
Methyl ethyl ketone	ND		ug/kg	7.5	--	1
Methyl isobutyl ketone	ND		ug/kg	7.5	--	1
2-Hexanone	ND		ug/kg	7.5	--	1
Bromochloromethane	ND		ug/kg	1.5	--	1
Tetrahydrofuran	ND		ug/kg	3.0	--	1
2,2-Dichloropropane	ND		ug/kg	1.5	--	1
1,2-Dibromoethane	ND		ug/kg	0.75	--	1
1,3-Dichloropropane	ND		ug/kg	1.5	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.38	--	1
Bromobenzene	ND		ug/kg	1.5	--	1
n-Butylbenzene	ND		ug/kg	0.75	--	1
sec-Butylbenzene	ND		ug/kg	0.75	--	1
tert-Butylbenzene	ND		ug/kg	1.5	--	1
o-Chlorotoluene	ND		ug/kg	1.5	--	1
p-Chlorotoluene	ND		ug/kg	1.5	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.2	--	1
Hexachlorobutadiene	ND		ug/kg	3.0	--	1
Isopropylbenzene	ND		ug/kg	0.75	--	1
p-Isopropyltoluene	ND		ug/kg	0.75	--	1
Naphthalene	ND		ug/kg	3.0	--	1
n-Propylbenzene	ND		ug/kg	0.75	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09 Date Collected: 08/06/20 15:05

Client ID: B-108 15-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	1.5	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.5	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.5	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.5	--	1
Diethyl ether	ND		ug/kg	1.5	--	1
Diisopropyl Ether	ND		ug/kg	1.5	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	1.5	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	1.5	--	1
1,4-Dioxane	ND		ug/kg	60	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	102		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00
Client ID: TRIP BLANK Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 21:21
Analyst: JC
Percent Solids: Results reported on an 'AS RECEIVED' basis.

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Methylene chloride	ND		ug/kg	250	--	1
1,1-Dichloroethane	ND		ug/kg	50	--	1
Chloroform	ND		ug/kg	75	--	1
Carbon tetrachloride	ND		ug/kg	50	--	1
1,2-Dichloropropane	ND		ug/kg	50	--	1
Dibromochloromethane	ND		ug/kg	50	--	1
1,1,2-Trichloroethane	ND		ug/kg	50	--	1
Tetrachloroethene	ND		ug/kg	25	--	1
Chlorobenzene	ND		ug/kg	25	--	1
Trichlorofluoromethane	ND		ug/kg	200	--	1
1,2-Dichloroethane	ND		ug/kg	50	--	1
1,1,1-Trichloroethane	ND		ug/kg	25	--	1
Bromodichloromethane	ND		ug/kg	25	--	1
trans-1,3-Dichloropropene	ND		ug/kg	50	--	1
cis-1,3-Dichloropropene	ND		ug/kg	25	--	1
1,3-Dichloropropene, Total	ND		ug/kg	25	--	1
1,1-Dichloropropene	ND		ug/kg	25	--	1
Bromoform	ND		ug/kg	200	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--	1
Benzene	ND		ug/kg	25	--	1
Toluene	ND		ug/kg	50	--	1
Ethylbenzene	ND		ug/kg	50	--	1
Chloromethane	ND		ug/kg	200	--	1
Bromomethane	ND		ug/kg	100	--	1
Vinyl chloride	ND		ug/kg	50	--	1
Chloroethane	ND		ug/kg	100	--	1
1,1-Dichloroethene	ND		ug/kg	50	--	1
trans-1,2-Dichloroethene	ND		ug/kg	75	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
Trichloroethene	ND		ug/kg	25	--	1
1,2-Dichlorobenzene	ND		ug/kg	100	--	1
1,3-Dichlorobenzene	ND		ug/kg	100	--	1
1,4-Dichlorobenzene	ND		ug/kg	100	--	1
Methyl tert butyl ether	ND		ug/kg	100	--	1
p/m-Xylene	ND		ug/kg	100	--	1
o-Xylene	ND		ug/kg	50	--	1
Xylenes, Total	ND		ug/kg	50	--	1
cis-1,2-Dichloroethene	ND		ug/kg	50	--	1
1,2-Dichloroethene, Total	ND		ug/kg	50	--	1
Dibromomethane	ND		ug/kg	100	--	1
1,2,3-Trichloropropane	ND		ug/kg	100	--	1
Styrene	ND		ug/kg	50	--	1
Dichlorodifluoromethane	ND		ug/kg	500	--	1
Acetone	ND		ug/kg	500	--	1
Carbon disulfide	ND		ug/kg	500	--	1
Methyl ethyl ketone	ND		ug/kg	500	--	1
Methyl isobutyl ketone	ND		ug/kg	500	--	1
2-Hexanone	ND		ug/kg	500	--	1
Bromochloromethane	ND		ug/kg	100	--	1
Tetrahydrofuran	ND		ug/kg	200	--	1
2,2-Dichloropropane	ND		ug/kg	100	--	1
1,2-Dibromoethane	ND		ug/kg	50	--	1
1,3-Dichloropropane	ND		ug/kg	100	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--	1
Bromobenzene	ND		ug/kg	100	--	1
n-Butylbenzene	ND		ug/kg	50	--	1
sec-Butylbenzene	ND		ug/kg	50	--	1
tert-Butylbenzene	ND		ug/kg	100	--	1
o-Chlorotoluene	ND		ug/kg	100	--	1
p-Chlorotoluene	ND		ug/kg	100	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--	1
Hexachlorobutadiene	ND		ug/kg	200	--	1
Isopropylbenzene	ND		ug/kg	50	--	1
p-Isopropyltoluene	ND		ug/kg	50	--	1
Naphthalene	ND		ug/kg	200	--	1
n-Propylbenzene	ND		ug/kg	50	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10
Client ID: TRIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 00:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 High - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	100	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	100	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	100	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	100	--	1
Diethyl ether	ND		ug/kg	100	--	1
Diisopropyl Ether	ND		ug/kg	100	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--	1
1,4-Dioxane	ND		ug/kg	4000	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	91		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	101		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00
Client ID: TRIP BLANK Date Received: 08/19/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/19/20 21:47
Analyst: JC
Percent Solids: Results reported on an 'AS RECEIVED' basis.

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.0	--	1
1,1-Dichloroethane	ND		ug/kg	1.0	--	1
Chloroform	ND		ug/kg	1.5	--	1
Carbon tetrachloride	ND		ug/kg	1.0	--	1
1,2-Dichloropropane	ND		ug/kg	1.0	--	1
Dibromochloromethane	ND		ug/kg	1.0	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.0	--	1
Tetrachloroethene	ND		ug/kg	0.50	--	1
Chlorobenzene	ND		ug/kg	0.50	--	1
Trichlorofluoromethane	ND		ug/kg	4.0	--	1
1,2-Dichloroethane	ND		ug/kg	1.0	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.50	--	1
Bromodichloromethane	ND		ug/kg	0.50	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--	1
1,1-Dichloropropene	ND		ug/kg	0.50	--	1
Bromoform	ND		ug/kg	4.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--	1
Benzene	ND		ug/kg	0.50	--	1
Toluene	ND		ug/kg	1.0	--	1
Ethylbenzene	3.5		ug/kg	1.0	--	1
Chloromethane	ND		ug/kg	4.0	--	1
Bromomethane	ND		ug/kg	2.0	--	1
Vinyl chloride	ND		ug/kg	1.0	--	1
Chloroethane	ND		ug/kg	2.0	--	1
1,1-Dichloroethene	ND		ug/kg	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	0.52		ug/kg	0.50	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.0	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.0	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.0	--	1
Methyl tert butyl ether	ND		ug/kg	2.0	--	1
p/m-Xylene	16		ug/kg	2.0	--	1
o-Xylene	2.0		ug/kg	1.0	--	1
Xylenes, Total	18		ug/kg	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--	1
Dibromomethane	ND		ug/kg	2.0	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.0	--	1
Styrene	ND		ug/kg	1.0	--	1
Dichlorodifluoromethane	ND		ug/kg	10	--	1
Acetone	ND		ug/kg	25	--	1
Carbon disulfide	ND		ug/kg	10	--	1
Methyl ethyl ketone	ND		ug/kg	10	--	1
Methyl isobutyl ketone	ND		ug/kg	10	--	1
2-Hexanone	ND		ug/kg	10	--	1
Bromochloromethane	ND		ug/kg	2.0	--	1
Tetrahydrofuran	ND		ug/kg	4.0	--	1
2,2-Dichloropropane	ND		ug/kg	2.0	--	1
1,2-Dibromoethane	ND		ug/kg	1.0	--	1
1,3-Dichloropropane	ND		ug/kg	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--	1
Bromobenzene	ND		ug/kg	2.0	--	1
n-Butylbenzene	ND		ug/kg	1.0	--	1
sec-Butylbenzene	ND		ug/kg	1.0	--	1
tert-Butylbenzene	ND		ug/kg	2.0	--	1
o-Chlorotoluene	ND		ug/kg	2.0	--	1
p-Chlorotoluene	ND		ug/kg	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--	1
Hexachlorobutadiene	ND		ug/kg	4.0	--	1
Isopropylbenzene	ND		ug/kg	1.0	--	1
p-Isopropyltoluene	ND		ug/kg	1.0	--	1
Naphthalene	ND		ug/kg	4.0	--	1
n-Propylbenzene	1.3		ug/kg	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-10 Date Collected: 08/06/20 00:00

Client ID: TRIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--	1
1,2,4-Trimethylbenzene	3.1		ug/kg	2.0	--	1
Diethyl ether	ND		ug/kg	2.0	--	1
Diisopropyl Ether	ND		ug/kg	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--	1
1,4-Dioxane	ND		ug/kg	80	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	102		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	98		70-130

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 08:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:34
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11 Date Collected: 08/06/20 08:00

Client ID: EQUIP BLANK Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-11
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 08:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	106		70-130
Toluene-d8	97		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	105		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 20:07
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 11 Batch: WG1400764-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	102		70-130
Toluene-d8	98		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	105		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
Methylene chloride	ND		ug/kg	250	--
1,1-Dichloroethane	ND		ug/kg	50	--
Chloroform	ND		ug/kg	75	--
Carbon tetrachloride	ND		ug/kg	50	--
1,2-Dichloropropane	ND		ug/kg	50	--
Dibromochloromethane	ND		ug/kg	50	--
1,1,2-Trichloroethane	ND		ug/kg	50	--
Tetrachloroethene	ND		ug/kg	25	--
Chlorobenzene	ND		ug/kg	25	--
Trichlorofluoromethane	ND		ug/kg	200	--
1,2-Dichloroethane	ND		ug/kg	50	--
1,1,1-Trichloroethane	ND		ug/kg	25	--
Bromodichloromethane	ND		ug/kg	25	--
trans-1,3-Dichloropropene	ND		ug/kg	50	--
cis-1,3-Dichloropropene	ND		ug/kg	25	--
1,3-Dichloropropene, Total	ND		ug/kg	25	--
1,1-Dichloropropene	ND		ug/kg	25	--
Bromoform	ND		ug/kg	200	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--
Benzene	ND		ug/kg	25	--
Toluene	ND		ug/kg	50	--
Ethylbenzene	ND		ug/kg	50	--
Chloromethane	ND		ug/kg	200	--
Bromomethane	ND		ug/kg	100	--
Vinyl chloride	ND		ug/kg	50	--
Chloroethane	ND		ug/kg	100	--
1,1-Dichloroethene	ND		ug/kg	50	--
trans-1,2-Dichloroethene	ND		ug/kg	75	--
Trichloroethene	ND		ug/kg	25	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
1,2-Dichlorobenzene	ND		ug/kg	100	--
1,3-Dichlorobenzene	ND		ug/kg	100	--
1,4-Dichlorobenzene	ND		ug/kg	100	--
Methyl tert butyl ether	ND		ug/kg	100	--
p/m-Xylene	ND		ug/kg	100	--
o-Xylene	ND		ug/kg	50	--
Xylenes, Total	ND		ug/kg	50	--
cis-1,2-Dichloroethene	ND		ug/kg	50	--
1,2-Dichloroethene, Total	ND		ug/kg	50	--
Dibromomethane	ND		ug/kg	100	--
1,2,3-Trichloropropane	ND		ug/kg	100	--
Styrene	ND		ug/kg	50	--
Dichlorodifluoromethane	ND		ug/kg	500	--
Acetone	ND		ug/kg	500	--
Carbon disulfide	ND		ug/kg	500	--
Methyl ethyl ketone	ND		ug/kg	500	--
Methyl isobutyl ketone	ND		ug/kg	500	--
2-Hexanone	ND		ug/kg	500	--
Bromochloromethane	ND		ug/kg	100	--
Tetrahydrofuran	ND		ug/kg	200	--
2,2-Dichloropropane	ND		ug/kg	100	--
1,2-Dibromoethane	ND		ug/kg	50	--
1,3-Dichloropropane	ND		ug/kg	100	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--
Bromobenzene	ND		ug/kg	100	--
n-Butylbenzene	ND		ug/kg	50	--
sec-Butylbenzene	ND		ug/kg	50	--
tert-Butylbenzene	ND		ug/kg	100	--
o-Chlorotoluene	ND		ug/kg	100	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 02-03,08 Batch: WG1400899-12					
p-Chlorotoluene	ND		ug/kg	100	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--
Hexachlorobutadiene	ND		ug/kg	200	--
Isopropylbenzene	ND		ug/kg	50	--
p-Isopropyltoluene	ND		ug/kg	50	--
Naphthalene	ND		ug/kg	200	--
n-Propylbenzene	ND		ug/kg	50	--
1,2,3-Trichlorobenzene	ND		ug/kg	100	--
1,2,4-Trichlorobenzene	ND		ug/kg	100	--
1,3,5-Trimethylbenzene	ND		ug/kg	100	--
1,2,4-Trimethylbenzene	ND		ug/kg	100	--
Diethyl ether	ND		ug/kg	100	--
Diisopropyl Ether	ND		ug/kg	100	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--
1,4-Dioxane	ND		ug/kg	4000	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	97		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
Methylene chloride	ND		ug/kg	250	--
1,1-Dichloroethane	ND		ug/kg	50	--
Chloroform	ND		ug/kg	75	--
Carbon tetrachloride	ND		ug/kg	50	--
1,2-Dichloropropane	ND		ug/kg	50	--
Dibromochloromethane	ND		ug/kg	50	--
1,1,2-Trichloroethane	ND		ug/kg	50	--
Tetrachloroethene	ND		ug/kg	25	--
Chlorobenzene	ND		ug/kg	25	--
Trichlorofluoromethane	ND		ug/kg	200	--
1,2-Dichloroethane	ND		ug/kg	50	--
1,1,1-Trichloroethane	ND		ug/kg	25	--
Bromodichloromethane	ND		ug/kg	25	--
trans-1,3-Dichloropropene	ND		ug/kg	50	--
cis-1,3-Dichloropropene	ND		ug/kg	25	--
1,3-Dichloropropene, Total	ND		ug/kg	25	--
1,1-Dichloropropene	ND		ug/kg	25	--
Bromoform	ND		ug/kg	200	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	25	--
Benzene	ND		ug/kg	25	--
Toluene	ND		ug/kg	50	--
Ethylbenzene	ND		ug/kg	50	--
Chloromethane	ND		ug/kg	200	--
Bromomethane	ND		ug/kg	100	--
Vinyl chloride	ND		ug/kg	50	--
Chloroethane	ND		ug/kg	100	--
1,1-Dichloroethene	ND		ug/kg	50	--
trans-1,2-Dichloroethene	ND		ug/kg	75	--
Trichloroethene	ND		ug/kg	25	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
1,2-Dichlorobenzene	ND		ug/kg	100	--
1,3-Dichlorobenzene	ND		ug/kg	100	--
1,4-Dichlorobenzene	ND		ug/kg	100	--
Methyl tert butyl ether	ND		ug/kg	100	--
p/m-Xylene	ND		ug/kg	100	--
o-Xylene	ND		ug/kg	50	--
Xylenes, Total	ND		ug/kg	50	--
cis-1,2-Dichloroethene	ND		ug/kg	50	--
1,2-Dichloroethene, Total	ND		ug/kg	50	--
Dibromomethane	ND		ug/kg	100	--
1,2,3-Trichloropropane	ND		ug/kg	100	--
Styrene	ND		ug/kg	50	--
Dichlorodifluoromethane	ND		ug/kg	500	--
Acetone	ND		ug/kg	500	--
Carbon disulfide	ND		ug/kg	500	--
Methyl ethyl ketone	ND		ug/kg	500	--
Methyl isobutyl ketone	ND		ug/kg	500	--
2-Hexanone	ND		ug/kg	500	--
Bromochloromethane	ND		ug/kg	100	--
Tetrahydrofuran	ND		ug/kg	200	--
2,2-Dichloropropane	ND		ug/kg	100	--
1,2-Dibromoethane	ND		ug/kg	50	--
1,3-Dichloropropane	ND		ug/kg	100	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	25	--
Bromobenzene	ND		ug/kg	100	--
n-Butylbenzene	ND		ug/kg	50	--
sec-Butylbenzene	ND		ug/kg	50	--
tert-Butylbenzene	ND		ug/kg	100	--
o-Chlorotoluene	ND		ug/kg	100	--

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 High - Westborough Lab for sample(s): 01-04,07-08,10 Batch: WG1400899-5					
p-Chlorotoluene	ND		ug/kg	100	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	150	--
Hexachlorobutadiene	ND		ug/kg	200	--
Isopropylbenzene	ND		ug/kg	50	--
p-Isopropyltoluene	ND		ug/kg	50	--
Naphthalene	ND		ug/kg	200	--
n-Propylbenzene	ND		ug/kg	50	--
1,2,3-Trichlorobenzene	ND		ug/kg	100	--
1,2,4-Trichlorobenzene	ND		ug/kg	100	--
1,3,5-Trimethylbenzene	ND		ug/kg	100	--
1,2,4-Trimethylbenzene	ND		ug/kg	100	--
Diethyl ether	ND		ug/kg	100	--
Diisopropyl Ether	ND		ug/kg	100	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	100	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	100	--
1,4-Dioxane	ND		ug/kg	4000	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	93		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
Methylene chloride	ND		ug/kg	5.0	--
1,1-Dichloroethane	ND		ug/kg	1.0	--
Chloroform	ND		ug/kg	1.5	--
Carbon tetrachloride	ND		ug/kg	1.0	--
1,2-Dichloropropane	ND		ug/kg	1.0	--
Dibromochloromethane	ND		ug/kg	1.0	--
1,1,2-Trichloroethane	ND		ug/kg	1.0	--
Tetrachloroethene	ND		ug/kg	0.50	--
Chlorobenzene	ND		ug/kg	0.50	--
Trichlorofluoromethane	ND		ug/kg	4.0	--
1,2-Dichloroethane	ND		ug/kg	1.0	--
1,1,1-Trichloroethane	ND		ug/kg	0.50	--
Bromodichloromethane	ND		ug/kg	0.50	--
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--
1,1-Dichloropropene	ND		ug/kg	0.50	--
Bromoform	ND		ug/kg	4.0	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--
Benzene	ND		ug/kg	0.50	--
Toluene	ND		ug/kg	1.0	--
Ethylbenzene	ND		ug/kg	1.0	--
Chloromethane	ND		ug/kg	4.0	--
Bromomethane	ND		ug/kg	2.0	--
Vinyl chloride	ND		ug/kg	1.0	--
Chloroethane	ND		ug/kg	2.0	--
1,1-Dichloroethene	ND		ug/kg	1.0	--
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--
Trichloroethene	ND		ug/kg	0.50	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	--
1,3-Dichlorobenzene	ND		ug/kg	2.0	--
1,4-Dichlorobenzene	ND		ug/kg	2.0	--
Methyl tert butyl ether	ND		ug/kg	2.0	--
p/m-Xylene	ND		ug/kg	2.0	--
o-Xylene	ND		ug/kg	1.0	--
Xylenes, Total	ND		ug/kg	1.0	--
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--
Dibromomethane	ND		ug/kg	2.0	--
1,2,3-Trichloropropane	ND		ug/kg	2.0	--
Styrene	ND		ug/kg	1.0	--
Dichlorodifluoromethane	ND		ug/kg	10	--
Acetone	ND		ug/kg	25	--
Carbon disulfide	ND		ug/kg	10	--
Methyl ethyl ketone	ND		ug/kg	10	--
Methyl isobutyl ketone	ND		ug/kg	10	--
2-Hexanone	ND		ug/kg	10	--
Bromochloromethane	ND		ug/kg	2.0	--
Tetrahydrofuran	ND		ug/kg	4.0	--
2,2-Dichloropropane	ND		ug/kg	2.0	--
1,2-Dibromoethane	ND		ug/kg	1.0	--
1,3-Dichloropropane	ND		ug/kg	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--
Bromobenzene	ND		ug/kg	2.0	--
n-Butylbenzene	ND		ug/kg	1.0	--
sec-Butylbenzene	ND		ug/kg	1.0	--
tert-Butylbenzene	ND		ug/kg	2.0	--
o-Chlorotoluene	ND		ug/kg	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/19/20 19:35
Analyst: AD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 09-10 Batch: WG1400902-5					
p-Chlorotoluene	ND		ug/kg	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--
Hexachlorobutadiene	ND		ug/kg	4.0	--
Isopropylbenzene	ND		ug/kg	1.0	--
p-Isopropyltoluene	ND		ug/kg	1.0	--
Naphthalene	ND		ug/kg	4.0	--
n-Propylbenzene	ND		ug/kg	1.0	--
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	--
Diethyl ether	ND		ug/kg	2.0	--
Diisopropyl Ether	ND		ug/kg	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--
1,4-Dioxane	ND		ug/kg	80	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	93		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
Methylene chloride	ND		ug/kg	5.0	--
1,1-Dichloroethane	ND		ug/kg	1.0	--
Chloroform	ND		ug/kg	1.5	--
Carbon tetrachloride	ND		ug/kg	1.0	--
1,2-Dichloropropane	ND		ug/kg	1.0	--
Dibromochloromethane	ND		ug/kg	1.0	--
1,1,2-Trichloroethane	ND		ug/kg	1.0	--
Tetrachloroethene	ND		ug/kg	0.50	--
Chlorobenzene	ND		ug/kg	0.50	--
Trichlorofluoromethane	ND		ug/kg	4.0	--
1,2-Dichloroethane	ND		ug/kg	1.0	--
1,1,1-Trichloroethane	ND		ug/kg	0.50	--
Bromodichloromethane	ND		ug/kg	0.50	--
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--
1,1-Dichloropropene	ND		ug/kg	0.50	--
Bromoform	ND		ug/kg	4.0	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--
Benzene	ND		ug/kg	0.50	--
Toluene	ND		ug/kg	1.0	--
Ethylbenzene	ND		ug/kg	1.0	--
Chloromethane	ND		ug/kg	4.0	--
Bromomethane	ND		ug/kg	2.0	--
Vinyl chloride	ND		ug/kg	1.0	--
Chloroethane	ND		ug/kg	2.0	--
1,1-Dichloroethene	ND		ug/kg	1.0	--
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--
Trichloroethene	ND		ug/kg	0.50	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	--
1,3-Dichlorobenzene	ND		ug/kg	2.0	--
1,4-Dichlorobenzene	ND		ug/kg	2.0	--
Methyl tert butyl ether	ND		ug/kg	2.0	--
p/m-Xylene	ND		ug/kg	2.0	--
o-Xylene	ND		ug/kg	1.0	--
Xylenes, Total	ND		ug/kg	1.0	--
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--
Dibromomethane	ND		ug/kg	2.0	--
1,2,3-Trichloropropane	ND		ug/kg	2.0	--
Styrene	ND		ug/kg	1.0	--
Dichlorodifluoromethane	ND		ug/kg	10	--
Acetone	ND		ug/kg	25	--
Carbon disulfide	ND		ug/kg	10	--
Methyl ethyl ketone	ND		ug/kg	10	--
Methyl isobutyl ketone	ND		ug/kg	10	--
2-Hexanone	ND		ug/kg	10	--
Bromochloromethane	ND		ug/kg	2.0	--
Tetrahydrofuran	ND		ug/kg	4.0	--
2,2-Dichloropropane	ND		ug/kg	2.0	--
1,2-Dibromoethane	ND		ug/kg	1.0	--
1,3-Dichloropropane	ND		ug/kg	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--
Bromobenzene	ND		ug/kg	2.0	--
n-Butylbenzene	ND		ug/kg	1.0	--
sec-Butylbenzene	ND		ug/kg	1.0	--
tert-Butylbenzene	ND		ug/kg	2.0	--
o-Chlorotoluene	ND		ug/kg	2.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/20/20 07:18
Analyst: JC

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 05-06 Batch: WG1401019-5					
p-Chlorotoluene	ND		ug/kg	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--
Hexachlorobutadiene	ND		ug/kg	4.0	--
Isopropylbenzene	ND		ug/kg	1.0	--
p-Isopropyltoluene	ND		ug/kg	1.0	--
Naphthalene	ND		ug/kg	4.0	--
n-Propylbenzene	ND		ug/kg	1.0	--
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	--
Diethyl ether	ND		ug/kg	2.0	--
Diisopropyl Ether	ND		ug/kg	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--
1,4-Dioxane	ND		ug/kg	80	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	88		70-130
Toluene-d8	94		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	97		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Methylene chloride	120		110		70-130	9		20
1,1-Dichloroethane	120		120		70-130	0		20
Chloroform	110		100		70-130	10		20
Carbon tetrachloride	100		100		70-130	0		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	92		96		70-130	4		20
1,1,2-Trichloroethane	100		110		70-130	10		20
Tetrachloroethene	110		110		70-130	0		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	120		120		70-130	0		20
1,2-Dichloroethane	110		110		70-130	0		20
1,1,1-Trichloroethane	110		110		70-130	0		20
Bromodichloromethane	99		100		70-130	1		20
trans-1,3-Dichloropropene	92		97		70-130	5		20
cis-1,3-Dichloropropene	97		98		70-130	1		20
1,1-Dichloropropene	96		97		70-130	1		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	100		110		70-130	10		20
Benzene	100		100		70-130	0		20
Toluene	110		100		70-130	10		20
Ethylbenzene	110		110		70-130	0		20
Chloromethane	94		90		70-130	4		20
Bromomethane	75		82		70-130	9		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Vinyl chloride	120		120		70-130	0		20
Chloroethane	120		120		70-130	0		20
1,1-Dichloroethene	120		120		70-130	0		20
trans-1,2-Dichloroethene	120		110		70-130	9		20
Trichloroethene	110		110		70-130	0		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	100		100		70-130	0		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	100		110		70-130	10		20
p/m-Xylene	110		110		70-130	0		20
o-Xylene	105		105		70-130	0		20
cis-1,2-Dichloroethene	110		100		70-130	10		20
Dibromomethane	110		110		70-130	0		20
1,2,3-Trichloropropane	100		110		70-130	10		20
Styrene	110		110		70-130	0		20
Dichlorodifluoromethane	100		100		70-130	0		20
Acetone	120		130		70-130	8		20
Carbon disulfide	110		110		70-130	0		20
Methyl ethyl ketone	100		100		70-130	0		20
Methyl isobutyl ketone	99		100		70-130	1		20
2-Hexanone	94		99		70-130	5		20
Bromochloromethane	110		100		70-130	10		20
Tetrahydrofuran	100		110		70-130	10		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
2,2-Dichloropropane	100		100		70-130	0		20
1,2-Dibromoethane	98		100		70-130	2		20
1,3-Dichloropropane	100		100		70-130	0		20
1,1,1,2-Tetrachloroethane	96		99		70-130	3		20
Bromobenzene	99		100		70-130	1		20
n-Butylbenzene	110		110		70-130	0		20
sec-Butylbenzene	120		110		70-130	9		20
tert-Butylbenzene	110		110		70-130	0		20
o-Chlorotoluene	110		110		70-130	0		20
p-Chlorotoluene	100		100		70-130	0		20
1,2-Dibromo-3-chloropropane	88		94		70-130	7		20
Hexachlorobutadiene	120		110		70-130	9		20
Isopropylbenzene	110		110		70-130	0		20
p-Isopropyltoluene	110		110		70-130	0		20
Naphthalene	97		100		70-130	3		20
n-Propylbenzene	110		110		70-130	0		20
1,2,3-Trichlorobenzene	100		100		70-130	0		20
1,2,4-Trichlorobenzene	100		100		70-130	0		20
1,3,5-Trimethylbenzene	100		100		70-130	0		20
1,2,4-Trimethylbenzene	100		100		70-130	0		20
Diethyl ether	110		120		70-130	9		20
Diisopropyl Ether	110		110		70-130	0		20
Ethyl-Tert-Butyl-Ether	100		110		70-130	10		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 11 Batch: WG1400764-3 WG1400764-4								
Tertiary-Amyl Methyl Ether	94		98		70-130	4		20
1,4-Dioxane	100		102		70-130	2		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	100		101		70-130
Toluene-d8	98		100		70-130
4-Bromofluorobenzene	97		95		70-130
Dibromofluoromethane	99		97		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Methylene chloride	92		84		70-130	9		20
1,1-Dichloroethane	84		83		70-130	1		20
Chloroform	89		91		70-130	2		20
Carbon tetrachloride	87		90		70-130	3		20
1,2-Dichloropropane	89		90		70-130	1		20
Dibromochloromethane	91		94		70-130	3		20
1,1,2-Trichloroethane	84		88		70-130	5		20
Tetrachloroethene	78		81		70-130	4		20
Chlorobenzene	90		88		70-130	2		20
Trichlorofluoromethane	87		86		70-130	1		20
1,2-Dichloroethane	82		83		70-130	1		20
1,1,1-Trichloroethane	84		86		70-130	2		20
Bromodichloromethane	89		94		70-130	5		20
trans-1,3-Dichloropropene	80		86		70-130	7		20
cis-1,3-Dichloropropene	91		91		70-130	0		20
1,1-Dichloropropene	89		86		70-130	3		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	89		91		70-130	2		20
Benzene	89		88		70-130	1		20
Toluene	84		88		70-130	5		20
Ethylbenzene	90		89		70-130	1		20
Chloromethane	87		86		70-130	1		20
Bromomethane	107		102		70-130	5		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Vinyl chloride	78		76		70-130	3		20
Chloroethane	84		84		70-130	0		20
1,1-Dichloroethene	94		87		70-130	8		20
trans-1,2-Dichloroethene	104		95		70-130	9		20
Trichloroethene	83		81		70-130	2		20
1,2-Dichlorobenzene	93		89		70-130	4		20
1,3-Dichlorobenzene	92		86		70-130	7		20
1,4-Dichlorobenzene	91		86		70-130	6		20
Methyl tert butyl ether	101		94		70-130	7		20
p/m-Xylene	83		86		70-130	4		20
o-Xylene	92		100		70-130	8		20
cis-1,2-Dichloroethene	88		90		70-130	2		20
Dibromomethane	90		94		70-130	4		20
1,2,3-Trichloropropane	83		83		70-130	0		20
Styrene	83		89		70-130	7		20
Dichlorodifluoromethane	89		85		70-130	5		20
Acetone	94		96		70-130	2		20
Carbon disulfide	79		73		70-130	8		20
Methyl ethyl ketone	85		89		70-130	5		20
Methyl isobutyl ketone	79		85		70-130	7		20
2-Hexanone	88		88		70-130	0		20
Bromochloromethane	94		96		70-130	2		20
Tetrahydrofuran	84		90		70-130	7		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
2,2-Dichloropropane	86		86		70-130	0		20
1,2-Dibromoethane	96		94		70-130	2		20
1,3-Dichloropropane	85		89		70-130	5		20
1,1,1,2-Tetrachloroethane	87		88		70-130	1		20
Bromobenzene	94		95		70-130	1		20
n-Butylbenzene	86		78		70-130	10		20
sec-Butylbenzene	101		97		70-130	4		20
tert-Butylbenzene	100		96		70-130	4		20
o-Chlorotoluene	92		87		70-130	6		20
p-Chlorotoluene	90		85		70-130	6		20
1,2-Dibromo-3-chloropropane	91		94		70-130	3		20
Hexachlorobutadiene	91		87		70-130	4		20
Isopropylbenzene	99		103		70-130	4		20
p-Isopropyltoluene	98		92		70-130	6		20
Naphthalene	98		98		70-130	0		20
n-Propylbenzene	92		88		70-130	4		20
1,2,3-Trichlorobenzene	93		87		70-130	7		20
1,2,4-Trichlorobenzene	92		83		70-130	10		20
1,3,5-Trimethylbenzene	93		89		70-130	4		20
1,2,4-Trimethylbenzene	94		88		70-130	7		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	89		88		70-130	1		20
Ethyl-Tert-Butyl-Ether	88		87		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 02-03,08 Batch: WG1400899-10 WG1400899-11								
Tertiary-Amyl Methyl Ether	92		92		70-130	0		20
1,4-Dioxane	123		117		70-130	5		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	88		89		70-130
Toluene-d8	93		99		70-130
4-Bromofluorobenzene	98		103		70-130
Dibromofluoromethane	98		101		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Methylene chloride	85		89		70-130	5		20
1,1-Dichloroethane	83		88		70-130	6		20
Chloroform	86		90		70-130	5		20
Carbon tetrachloride	86		90		70-130	5		20
1,2-Dichloropropane	87		92		70-130	6		20
Dibromochloromethane	94		99		70-130	5		20
1,1,2-Trichloroethane	80		92		70-130	14		20
Tetrachloroethene	80		88		70-130	10		20
Chlorobenzene	90		94		70-130	4		20
Trichlorofluoromethane	87		93		70-130	7		20
1,2-Dichloroethane	83		89		70-130	7		20
1,1,1-Trichloroethane	83		86		70-130	4		20
Bromodichloromethane	87		94		70-130	8		20
trans-1,3-Dichloropropene	82		94		70-130	14		20
cis-1,3-Dichloropropene	92		98		70-130	6		20
1,1-Dichloropropene	87		92		70-130	6		20
Bromoform	85		88		70-130	3		20
1,1,2,2-Tetrachloroethane	87		92		70-130	6		20
Benzene	88		93		70-130	6		20
Toluene	82		95		70-130	15		20
Ethylbenzene	92		96		70-130	4		20
Chloromethane	88		87		70-130	1		20
Bromomethane	120		119		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Vinyl chloride	83		86		70-130	4		20
Chloroethane	90		96		70-130	6		20
1,1-Dichloroethene	86		89		70-130	3		20
trans-1,2-Dichloroethene	96		99		70-130	3		20
Trichloroethene	83		88		70-130	6		20
1,2-Dichlorobenzene	94		109		70-130	15		20
1,3-Dichlorobenzene	96		102		70-130	6		20
1,4-Dichlorobenzene	97		100		70-130	3		20
Methyl tert butyl ether	92		100		70-130	8		20
p/m-Xylene	91		94		70-130	3		20
o-Xylene	99		101		70-130	2		20
cis-1,2-Dichloroethene	87		92		70-130	6		20
Dibromomethane	87		96		70-130	10		20
1,2,3-Trichloropropane	80		85		70-130	6		20
Styrene	89		92		70-130	3		20
Dichlorodifluoromethane	88		90		70-130	2		20
Acetone	89		99		70-130	11		20
Carbon disulfide	74		78		70-130	5		20
Methyl ethyl ketone	84		91		70-130	8		20
Methyl isobutyl ketone	77		89		70-130	14		20
2-Hexanone	82		90		70-130	9		20
Bromochloromethane	92		96		70-130	4		20
Tetrahydrofuran	83		93		70-130	11		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
2,2-Dichloropropane	89		94		70-130	5		20
1,2-Dibromoethane	91		99		70-130	8		20
1,3-Dichloropropane	86		94		70-130	9		20
1,1,1,2-Tetrachloroethane	88		93		70-130	6		20
Bromobenzene	95		94		70-130	1		20
n-Butylbenzene	90		102		70-130	13		20
sec-Butylbenzene	101		106		70-130	5		20
tert-Butylbenzene	98		98		70-130	0		20
o-Chlorotoluene	93		94		70-130	1		20
p-Chlorotoluene	93		94		70-130	1		20
1,2-Dibromo-3-chloropropane	93		111		70-130	18		20
Hexachlorobutadiene	82		105		70-130	**25**	Q	20
Isopropylbenzene	97		99		70-130	2		20
p-Isopropyltoluene	100		108		70-130	8		20
Naphthalene	88		117		70-130	**28**	Q	20
n-Propylbenzene	93		94		70-130	1		20
1,2,3-Trichlorobenzene	88		114		70-130	**26**	Q	20
1,2,4-Trichlorobenzene	92		119		70-130	**26**	Q	20
1,3,5-Trimethylbenzene	94		94		70-130	0		20
1,2,4-Trimethylbenzene	95		101		70-130	6		20
Diethyl ether	91		100		70-130	9		20
Diisopropyl Ether	87		92		70-130	6		20
Ethyl-Tert-Butyl-Ether	86		92		70-130	7		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 High - Westborough Lab Associated sample(s): 01-04,07-08,10 Batch: WG1400899-3 WG1400899-4								
Tertiary-Amyl Methyl Ether	89		96		70-130	8		20
1,4-Dioxane	102		112		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	87		90		70-130
Toluene-d8	91		100		70-130
4-Bromofluorobenzene	100		96		70-130
Dibromofluoromethane	97		98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
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Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Methylene chloride	85		89		70-130	5		20
1,1-Dichloroethane	83		88		70-130	6		20
Chloroform	86		90		70-130	5		20
Carbon tetrachloride	86		90		70-130	5		20
1,2-Dichloropropane	87		92		70-130	6		20
Dibromochloromethane	94		99		70-130	5		20
1,1,2-Trichloroethane	80		92		70-130	14		20
Tetrachloroethene	80		88		70-130	10		20
Chlorobenzene	90		94		70-130	4		20
Trichlorofluoromethane	87		93		70-130	7		20
1,2-Dichloroethane	83		89		70-130	7		20
1,1,1-Trichloroethane	83		86		70-130	4		20
Bromodichloromethane	87		94		70-130	8		20
trans-1,3-Dichloropropene	82		94		70-130	14		20
cis-1,3-Dichloropropene	92		98		70-130	6		20
1,1-Dichloropropene	87		92		70-130	6		20
Bromoform	85		88		70-130	3		20
1,1,2,2-Tetrachloroethane	87		92		70-130	6		20
Benzene	88		93		70-130	6		20
Toluene	82		95		70-130	15		20
Ethylbenzene	92		96		70-130	4		20
Chloromethane	88		87		70-130	1		20
Bromomethane	120		119		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Vinyl chloride	83		86		70-130	4		20
Chloroethane	90		96		70-130	6		20
1,1-Dichloroethene	86		89		70-130	3		20
trans-1,2-Dichloroethene	96		99		70-130	3		20
Trichloroethene	83		88		70-130	6		20
1,2-Dichlorobenzene	94		109		70-130	15		20
1,3-Dichlorobenzene	96		102		70-130	6		20
1,4-Dichlorobenzene	97		100		70-130	3		20
Methyl tert butyl ether	92		100		70-130	8		20
p/m-Xylene	91		94		70-130	3		20
o-Xylene	99		101		70-130	2		20
cis-1,2-Dichloroethene	87		92		70-130	6		20
Dibromomethane	87		96		70-130	10		20
1,2,3-Trichloropropane	80		85		70-130	6		20
Styrene	89		92		70-130	3		20
Dichlorodifluoromethane	88		90		70-130	2		20
Acetone	89		99		70-130	11		20
Carbon disulfide	74		78		70-130	5		20
Methyl ethyl ketone	84		91		70-130	8		20
Methyl isobutyl ketone	77		89		70-130	14		20
2-Hexanone	82		90		70-130	9		20
Bromochloromethane	92		96		70-130	4		20
Tetrahydrofuran	83		93		70-130	11		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 09-10 Batch: WG1400902-3 WG1400902-4								
2,2-Dichloropropane	89		94		70-130	5		20
1,2-Dibromoethane	91		99		70-130	8		20
1,3-Dichloropropane	86		94		70-130	9		20
1,1,1,2-Tetrachloroethane	88		93		70-130	6		20
Bromobenzene	95		94		70-130	1		20
n-Butylbenzene	90		102		70-130	13		20
sec-Butylbenzene	101		106		70-130	5		20
tert-Butylbenzene	98		98		70-130	0		20
o-Chlorotoluene	93		94		70-130	1		20
p-Chlorotoluene	93		94		70-130	1		20
1,2-Dibromo-3-chloropropane	93		111		70-130	18		20
Hexachlorobutadiene	82		105		70-130	**25**	Q	20
Isopropylbenzene	97		99		70-130	2		20
p-Isopropyltoluene	100		108		70-130	8		20
Naphthalene	88		117		70-130	**28**	Q	20
n-Propylbenzene	93		94		70-130	1		20
1,2,3-Trichlorobenzene	88		114		70-130	**26**	Q	20
1,2,4-Trichlorobenzene	92		119		70-130	**26**	Q	20
1,3,5-Trimethylbenzene	94		94		70-130	0		20
1,2,4-Trimethylbenzene	95		101		70-130	6		20
Diethyl ether	91		100		70-130	9		20
Diisopropyl Ether	87		92		70-130	6		20
Ethyl-Tert-Butyl-Ether	86		92		70-130	7		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 09-10		Batch: WG1400902-3 WG1400902-4					
Tertiary-Amyl Methyl Ether	89		96		70-130	8		20
1,4-Dioxane	102		112		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	87		90		70-130
Toluene-d8	91		100		70-130
4-Bromofluorobenzene	101		95		70-130
Dibromofluoromethane	97		98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
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Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 05-06		Batch: WG1401019-3 WG1401019-4					
Methylene chloride	92		84		70-130	9		20
1,1-Dichloroethane	84		83		70-130	1		20
Chloroform	89		91		70-130	2		20
Carbon tetrachloride	87		90		70-130	3		20
1,2-Dichloropropane	89		90		70-130	1		20
Dibromochloromethane	91		94		70-130	3		20
1,1,2-Trichloroethane	84		88		70-130	5		20
Tetrachloroethene	78		81		70-130	4		20
Chlorobenzene	90		88		70-130	2		20
Trichlorofluoromethane	87		86		70-130	1		20
1,2-Dichloroethane	82		83		70-130	1		20
1,1,1-Trichloroethane	84		86		70-130	2		20
Bromodichloromethane	89		94		70-130	5		20
trans-1,3-Dichloropropene	80		86		70-130	7		20
cis-1,3-Dichloropropene	91		91		70-130	0		20
1,1-Dichloropropene	89		86		70-130	3		20
Bromoform	86		91		70-130	6		20
1,1,2,2-Tetrachloroethane	89		91		70-130	2		20
Benzene	89		88		70-130	1		20
Toluene	84		88		70-130	5		20
Ethylbenzene	90		89		70-130	1		20
Chloromethane	87		86		70-130	1		20
Bromomethane	107		102		70-130	5		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 05-06 Batch: WG1401019-3 WG1401019-4								
Vinyl chloride	78		76		70-130	3		20
Chloroethane	84		84		70-130	0		20
1,1-Dichloroethene	94		87		70-130	8		20
trans-1,2-Dichloroethene	104		95		70-130	9		20
Trichloroethene	83		81		70-130	2		20
1,2-Dichlorobenzene	93		89		70-130	4		20
1,3-Dichlorobenzene	92		86		70-130	7		20
1,4-Dichlorobenzene	91		86		70-130	6		20
Methyl tert butyl ether	101		94		70-130	7		20
p/m-Xylene	83		86		70-130	4		20
o-Xylene	92		100		70-130	8		20
cis-1,2-Dichloroethene	88		90		70-130	2		20
Dibromomethane	90		94		70-130	4		20
1,2,3-Trichloropropane	83		83		70-130	0		20
Styrene	83		89		70-130	7		20
Dichlorodifluoromethane	89		85		70-130	5		20
Acetone	94		96		70-130	2		20
Carbon disulfide	79		73		70-130	8		20
Methyl ethyl ketone	85		89		70-130	5		20
Methyl isobutyl ketone	79		85		70-130	7		20
2-Hexanone	88		88		70-130	0		20
Bromochloromethane	94		96		70-130	2		20
Tetrahydrofuran	84		90		70-130	7		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
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Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 05-06		Batch: WG1401019-3 WG1401019-4					
2,2-Dichloropropane	86		86		70-130	0		20
1,2-Dibromoethane	96		94		70-130	2		20
1,3-Dichloropropane	85		89		70-130	5		20
1,1,1,2-Tetrachloroethane	87		88		70-130	1		20
Bromobenzene	94		95		70-130	1		20
n-Butylbenzene	86		78		70-130	10		20
sec-Butylbenzene	101		97		70-130	4		20
tert-Butylbenzene	100		96		70-130	4		20
o-Chlorotoluene	92		87		70-130	6		20
p-Chlorotoluene	90		85		70-130	6		20
1,2-Dibromo-3-chloropropane	91		94		70-130	3		20
Hexachlorobutadiene	91		87		70-130	4		20
Isopropylbenzene	99		103		70-130	4		20
p-Isopropyltoluene	98		92		70-130	6		20
Naphthalene	98		98		70-130	0		20
n-Propylbenzene	92		88		70-130	4		20
1,2,3-Trichlorobenzene	93		87		70-130	7		20
1,2,4-Trichlorobenzene	92		83		70-130	10		20
1,3,5-Trimethylbenzene	93		89		70-130	4		20
1,2,4-Trimethylbenzene	94		88		70-130	7		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	89		88		70-130	1		20
Ethyl-Tert-Butyl-Ether	88		87		70-130	1		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 05-06 Batch: WG1401019-3 WG1401019-4								
Tertiary-Amyl Methyl Ether	92		92		70-130	0		20
1,4-Dioxane	123		117		70-130	5		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	88		89		70-130
Toluene-d8	93		99		70-130
4-Bromofluorobenzene	98		103		70-130
Dibromofluoromethane	98		101		70-130

PETROLEUM HYDROCARBONS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-01	Date Collected:	08/06/20 09:00
Client ID:	B-101 15-18	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 15:27		
Analyst:	BAD		
Percent Solids:	86%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	7.32		mg/kg	5.72	--	1
C9-C12 Aliphatics	52.4		mg/kg	5.72	--	1
C9-C10 Aromatics	45.8		mg/kg	5.72	--	1
C5-C8 Aliphatics, Adjusted	7.32		mg/kg	5.72	--	1
C9-C12 Aliphatics, Adjusted	6.19		mg/kg	5.72	--	1
Benzene	ND		mg/kg	0.114	--	1
Toluene	ND		mg/kg	0.114	--	1
Ethylbenzene	ND		mg/kg	0.114	--	1
p/m-Xylene	0.149		mg/kg	0.114	--	1
o-Xylene	0.225		mg/kg	0.114	--	1
Methyl tert butyl ether	ND		mg/kg	0.057	--	1
Naphthalene	0.366		mg/kg	0.229	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	101		70-130
2,5-Dibromotoluene-FID	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-01 D	Date Collected:	08/06/20 09:00
Client ID:	B-101 15-18	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 19:08	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	86%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	160		mg/kg	38.6	--	5
C19-C36 Aliphatics	5540		mg/kg	38.6	--	5
C11-C22 Aromatics	570		mg/kg	38.6	--	5
C11-C22 Aromatics, Adjusted	568		mg/kg	38.6	--	5
Naphthalene	2.06		mg/kg	1.93	--	5
2-Methylnaphthalene	ND		mg/kg	1.93	--	5
Acenaphthylene	ND		mg/kg	1.93	--	5
Acenaphthene	ND		mg/kg	1.93	--	5
Fluorene	ND		mg/kg	1.93	--	5
Phenanthrene	ND		mg/kg	1.93	--	5
Anthracene	ND		mg/kg	1.93	--	5
Fluoranthene	ND		mg/kg	1.93	--	5
Pyrene	ND		mg/kg	1.93	--	5
Benzo(a)anthracene	ND		mg/kg	1.93	--	5
Chrysene	ND		mg/kg	1.93	--	5
Benzo(b)fluoranthene	ND		mg/kg	1.93	--	5
Benzo(k)fluoranthene	ND		mg/kg	1.93	--	5
Benzo(a)pyrene	ND		mg/kg	1.93	--	5
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	1.93	--	5
Dibenzo(a,h)anthracene	ND		mg/kg	1.93	--	5
Benzo(ghi)perylene	ND		mg/kg	1.93	--	5

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 D
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	54		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	65		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-02	Date Collected:	08/06/20 09:50
Client ID:	B-105 12.5-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 04:41	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	89%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	15.8		mg/kg	7.48	--	1
C19-C36 Aliphatics	23.0		mg/kg	7.48	--	1
C11-C22 Aromatics	20.8		mg/kg	7.48	--	1
C11-C22 Aromatics, Adjusted	18.7		mg/kg	7.48	--	1
Naphthalene	1.50		mg/kg	0.374	--	1
2-Methylnaphthalene	0.540		mg/kg	0.374	--	1
Acenaphthylene	ND		mg/kg	0.374	--	1
Acenaphthene	ND		mg/kg	0.374	--	1
Fluorene	ND		mg/kg	0.374	--	1
Phenanthrene	ND		mg/kg	0.374	--	1
Anthracene	ND		mg/kg	0.374	--	1
Fluoranthene	ND		mg/kg	0.374	--	1
Pyrene	ND		mg/kg	0.374	--	1
Benzo(a)anthracene	ND		mg/kg	0.374	--	1
Chrysene	ND		mg/kg	0.374	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.374	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.374	--	1
Benzo(a)pyrene	ND		mg/kg	0.374	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.374	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.374	--	1
Benzo(ghi)perylene	ND		mg/kg	0.374	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02 Date Collected: 08/06/20 09:50

Client ID: B-105 12.5-17.5 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	67		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	73		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-02 D	Date Collected:	08/06/20 09:50
Client ID:	B-105 12.5-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 15:58		
Analyst:	BAD		
Percent Solids:	89%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	208		mg/kg	23.9	--	5
C9-C12 Aliphatics	608		mg/kg	23.9	--	5
C9-C10 Aromatics	416		mg/kg	23.9	--	5
C5-C8 Aliphatics, Adjusted	207		mg/kg	23.9	--	5
C9-C12 Aliphatics, Adjusted	109		mg/kg	23.9	--	5
Benzene	0.745		mg/kg	0.478	--	5
Toluene	ND		mg/kg	0.478	--	5
Ethylbenzene	14.1		mg/kg	0.478	--	5
p/m-Xylene	57.7		mg/kg	0.478	--	5
o-Xylene	11.3		mg/kg	0.478	--	5
Methyl tert butyl ether	ND		mg/kg	0.239	--	5
Naphthalene	17.2		mg/kg	0.957	--	5

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**146**	Q	70-130
2,5-Dibromotoluene-FID	114		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 05:06	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/20/20
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	17.9		mg/kg	7.22	--	1
C19-C36 Aliphatics	19.9		mg/kg	7.22	--	1
C11-C22 Aromatics	15.3		mg/kg	7.22	--	1
C11-C22 Aromatics, Adjusted	13.8		mg/kg	7.22	--	1
Naphthalene	1.15		mg/kg	0.361	--	1
2-Methylnaphthalene	0.389		mg/kg	0.361	--	1
Acenaphthylene	ND		mg/kg	0.361	--	1
Acenaphthene	ND		mg/kg	0.361	--	1
Fluorene	ND		mg/kg	0.361	--	1
Phenanthrene	ND		mg/kg	0.361	--	1
Anthracene	ND		mg/kg	0.361	--	1
Fluoranthene	ND		mg/kg	0.361	--	1
Pyrene	ND		mg/kg	0.361	--	1
Benzo(a)anthracene	ND		mg/kg	0.361	--	1
Chrysene	ND		mg/kg	0.361	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.361	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.361	--	1
Benzo(a)pyrene	ND		mg/kg	0.361	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.361	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.361	--	1
Benzo(ghi)perylene	ND		mg/kg	0.361	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**25**	Q	40-140
o-Terphenyl	**20**	Q	40-140
2-Fluorobiphenyl	70		40-140
2-Bromonaphthalene	75		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03 RE	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/21/20 18:09
Analytical Date:	08/22/20 12:43	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	43.1		mg/kg	7.14	--	1
C19-C36 Aliphatics	38.0		mg/kg	7.14	--	1
C11-C22 Aromatics	35.1		mg/kg	7.14	--	1
C11-C22 Aromatics, Adjusted	33.2		mg/kg	7.14	--	1
Naphthalene	ND		mg/kg	0.357	--	1
2-Methylnaphthalene	1.96		mg/kg	0.357	--	1
Acenaphthylene	ND		mg/kg	0.357	--	1
Acenaphthene	ND		mg/kg	0.357	--	1
Fluorene	ND		mg/kg	0.357	--	1
Phenanthrene	ND		mg/kg	0.357	--	1
Anthracene	ND		mg/kg	0.357	--	1
Fluoranthene	ND		mg/kg	0.357	--	1
Pyrene	ND		mg/kg	0.357	--	1
Benzo(a)anthracene	ND		mg/kg	0.357	--	1
Chrysene	ND		mg/kg	0.357	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.357	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.357	--	1
Benzo(a)pyrene	ND		mg/kg	0.357	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.357	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.357	--	1
Benzo(ghi)perylene	ND		mg/kg	0.357	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03 RE
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	58		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-03 D	Date Collected:	08/06/20 10:15
Client ID:	DUP	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 16:59		
Analyst:	BAD		
Percent Solids:	90%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	99.4		mg/kg	20.2	--	4
C9-C12 Aliphatics	429		mg/kg	20.2	--	4
C9-C10 Aromatics	293		mg/kg	20.2	--	4
C5-C8 Aliphatics, Adjusted	99.4		mg/kg	20.2	--	4
C9-C12 Aliphatics, Adjusted	73.5		mg/kg	20.2	--	4
Benzene	ND		mg/kg	0.405	--	4
Toluene	ND		mg/kg	0.405	--	4
Ethylbenzene	9.70		mg/kg	0.405	--	4
p/m-Xylene	45.2		mg/kg	0.405	--	4
o-Xylene	7.40		mg/kg	0.405	--	4
Methyl tert butyl ether	ND		mg/kg	0.202	--	4
Naphthalene	13.8		mg/kg	0.810	--	4

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**137**	Q	70-130
2,5-Dibromotoluene-FID	110		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-04	Date Collected:	08/06/20 10:45
Client ID:	B-107 8-10	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 18:00		
Analyst:	BAD		
Percent Solids:	91%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	37.2		mg/kg	5.30	--	1
C9-C12 Aliphatics	51.6		mg/kg	5.30	--	1
C9-C10 Aromatics	35.8		mg/kg	5.30	--	1
C5-C8 Aliphatics, Adjusted	35.7		mg/kg	5.30	--	1
C9-C12 Aliphatics, Adjusted	11.1		mg/kg	5.30	--	1
Benzene	0.643		mg/kg	0.106	--	1
Toluene	0.572		mg/kg	0.106	--	1
Ethylbenzene	0.862		mg/kg	0.106	--	1
p/m-Xylene	2.70		mg/kg	0.106	--	1
o-Xylene	1.05		mg/kg	0.106	--	1
Methyl tert butyl ether	0.288		mg/kg	0.053	--	1
Naphthalene	0.710		mg/kg	0.212	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	93		70-130
2,5-Dibromotoluene-FID	85		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-04 D	Date Collected:	08/06/20 10:45
Client ID:	B-107 8-10	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/21/20 20:22	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	91%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	672		mg/kg	144	--	20
C19-C36 Aliphatics	21200		mg/kg	144	--	20
C11-C22 Aromatics	6620		mg/kg	144	--	20
C11-C22 Aromatics, Adjusted	6620		mg/kg	144	--	20
Naphthalene	ND		mg/kg	7.18	--	20
2-Methylnaphthalene	ND		mg/kg	7.18	--	20
Acenaphthylene	ND		mg/kg	7.18	--	20
Acenaphthene	ND		mg/kg	7.18	--	20
Fluorene	ND		mg/kg	7.18	--	20
Phenanthrene	ND		mg/kg	7.18	--	20
Anthracene	ND		mg/kg	7.18	--	20
Fluoranthene	ND		mg/kg	7.18	--	20
Pyrene	7.26		mg/kg	7.18	--	20
Benzo(a)anthracene	ND		mg/kg	7.18	--	20
Chrysene	ND		mg/kg	7.18	--	20
Benzo(b)fluoranthene	ND		mg/kg	7.18	--	20
Benzo(k)fluoranthene	ND		mg/kg	7.18	--	20
Benzo(a)pyrene	ND		mg/kg	7.18	--	20
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	7.18	--	20
Dibenzo(a,h)anthracene	ND		mg/kg	7.18	--	20
Benzo(ghi)perylene	ND		mg/kg	7.18	--	20

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 D
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**0**	Q	40-140
o-Terphenyl	**0**	Q	40-140
2-Fluorobiphenyl	110		40-140
2-Bromonaphthalene	114		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-05	Date Collected:	08/06/20 11:30
Client ID:	B-104 10-12	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 18:31		
Analyst:	BAD		
Percent Solids:	88%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	4.68	--	1
C9-C12 Aliphatics	ND		mg/kg	4.68	--	1
C9-C10 Aromatics	ND		mg/kg	4.68	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	4.68	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	4.68	--	1
Benzene	ND		mg/kg	0.094	--	1
Toluene	ND		mg/kg	0.094	--	1
Ethylbenzene	ND		mg/kg	0.094	--	1
p/m-Xylene	ND		mg/kg	0.094	--	1
o-Xylene	ND		mg/kg	0.094	--	1
Methyl tert butyl ether	ND		mg/kg	0.047	--	1
Naphthalene	ND		mg/kg	0.187	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**158**	Q	70-130
2,5-Dibromotoluene-FID	**145**	Q	70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-05	Date Collected:	08/06/20 11:30
Client ID:	B-104 10-12	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/20/20 11:35
Analytical Date:	08/22/20 08:58	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/20/20
Percent Solids:	88%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.51	--	1
C19-C36 Aliphatics	ND		mg/kg	7.51	--	1
C11-C22 Aromatics	ND		mg/kg	7.51	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.51	--	1
Naphthalene	ND		mg/kg	0.375	--	1
2-Methylnaphthalene	ND		mg/kg	0.375	--	1
Acenaphthylene	ND		mg/kg	0.375	--	1
Acenaphthene	ND		mg/kg	0.375	--	1
Fluorene	ND		mg/kg	0.375	--	1
Phenanthrene	ND		mg/kg	0.375	--	1
Anthracene	ND		mg/kg	0.375	--	1
Fluoranthene	ND		mg/kg	0.375	--	1
Pyrene	ND		mg/kg	0.375	--	1
Benzo(a)anthracene	ND		mg/kg	0.375	--	1
Chrysene	ND		mg/kg	0.375	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.375	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.375	--	1
Benzo(a)pyrene	ND		mg/kg	0.375	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.375	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.375	--	1
Benzo(ghi)perylene	ND		mg/kg	0.375	--	1

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05 Date Collected: 08/06/20 11:30

Client ID: B-104 10-12 Date Received: 08/19/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	61		40-140
o-Terphenyl	74		40-140
2-Fluorobiphenyl	85		40-140
2-Bromonaphthalene	88		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-06	Date Collected:	08/06/20 13:00
Client ID:	B-103 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/21/20 21:56		
Analyst:	BAD		
Percent Solids:	81%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	7.22	--	1
C9-C12 Aliphatics	10.5		mg/kg	7.22	--	1
C9-C10 Aromatics	9.13		mg/kg	7.22	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	7.22	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	7.22	--	1
Benzene	0.171		mg/kg	0.144	--	1
Toluene	1.03		mg/kg	0.144	--	1
Ethylbenzene	ND		mg/kg	0.144	--	1
p/m-Xylene	1.34		mg/kg	0.144	--	1
o-Xylene	0.148		mg/kg	0.144	--	1
Methyl tert butyl ether	0.144		mg/kg	0.072	--	1
Naphthalene	0.386		mg/kg	0.289	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	120		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-06 D	Date Collected:	08/06/20 13:00
Client ID:	B-103 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:08	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	81%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	70.4		mg/kg	40.7	--	5
C19-C36 Aliphatics	3130		mg/kg	40.7	--	5
C11-C22 Aromatics	1060		mg/kg	40.7	--	5
C11-C22 Aromatics, Adjusted	1060		mg/kg	40.7	--	5
Naphthalene	ND		mg/kg	2.04	--	5
2-Methylnaphthalene	ND		mg/kg	2.04	--	5
Acenaphthylene	ND		mg/kg	2.04	--	5
Acenaphthene	ND		mg/kg	2.04	--	5
Fluorene	ND		mg/kg	2.04	--	5
Phenanthrene	ND		mg/kg	2.04	--	5
Anthracene	ND		mg/kg	2.04	--	5
Fluoranthene	ND		mg/kg	2.04	--	5
Pyrene	ND		mg/kg	2.04	--	5
Benzo(a)anthracene	ND		mg/kg	2.04	--	5
Chrysene	ND		mg/kg	2.04	--	5
Benzo(b)fluoranthene	ND		mg/kg	2.04	--	5
Benzo(k)fluoranthene	ND		mg/kg	2.04	--	5
Benzo(a)pyrene	ND		mg/kg	2.04	--	5
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	2.04	--	5
Dibenzo(a,h)anthracene	ND		mg/kg	2.04	--	5
Benzo(ghi)perylene	ND		mg/kg	2.04	--	5

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 D
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	69		40-140
o-Terphenyl	58		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-07	Date Collected:	08/06/20 13:45
Client ID:	B-106 12.5-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/21/20 22:26		
Analyst:	BAD		
Percent Solids:	79%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	16.8		mg/kg	5.74	--	1
C9-C12 Aliphatics	47.3		mg/kg	5.74	--	1
C9-C10 Aromatics	36.9		mg/kg	5.74	--	1
C5-C8 Aliphatics, Adjusted	16.2		mg/kg	5.74	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.74	--	1
Benzene	0.414		mg/kg	0.115	--	1
Toluene	ND		mg/kg	0.115	--	1
Ethylbenzene	ND		mg/kg	0.115	--	1
p/m-Xylene	10.8		mg/kg	0.115	--	1
o-Xylene	ND		mg/kg	0.115	--	1
Methyl tert butyl ether	0.203		mg/kg	0.057	--	1
Naphthalene	1.28		mg/kg	0.229	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**143**	Q	70-130
2,5-Dibromotoluene-FID	124		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-07 D	Date Collected:	08/06/20 13:45
Client ID:	B-106 12.5-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:33	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	79%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	118		mg/kg	16.3	--	2
C19-C36 Aliphatics	2320		mg/kg	16.3	--	2
C11-C22 Aromatics	294		mg/kg	16.3	--	2
C11-C22 Aromatics, Adjusted	292		mg/kg	16.3	--	2
Naphthalene	1.41		mg/kg	0.813	--	2
2-Methylnaphthalene	0.972		mg/kg	0.813	--	2
Acenaphthylene	ND		mg/kg	0.813	--	2
Acenaphthene	ND		mg/kg	0.813	--	2
Fluorene	ND		mg/kg	0.813	--	2
Phenanthrene	ND		mg/kg	0.813	--	2
Anthracene	ND		mg/kg	0.813	--	2
Fluoranthene	ND		mg/kg	0.813	--	2
Pyrene	ND		mg/kg	0.813	--	2
Benzo(a)anthracene	ND		mg/kg	0.813	--	2
Chrysene	ND		mg/kg	0.813	--	2
Benzo(b)fluoranthene	ND		mg/kg	0.813	--	2
Benzo(k)fluoranthene	ND		mg/kg	0.813	--	2
Benzo(a)pyrene	ND		mg/kg	0.813	--	2
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.813	--	2
Dibenzo(a,h)anthracene	ND		mg/kg	0.813	--	2
Benzo(ghi)perylene	ND		mg/kg	0.813	--	2

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07 D
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	59		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	71		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/20/20 20:03
Analyst: BAD
Percent Solids: 85%

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1 +/- 25%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	467		mg/kg	60.8	--	10
C9-C12 Aliphatics	1570		mg/kg	60.8	--	10
C9-C10 Aromatics	1220		mg/kg	60.8	--	10
C5-C8 Aliphatics, Adjusted	467		mg/kg	60.8	--	10
C9-C12 Aliphatics, Adjusted	290		mg/kg	60.8	--	10
Benzene	ND		mg/kg	1.22	--	10
Toluene	ND		mg/kg	1.22	--	10
Ethylbenzene	ND		mg/kg	1.22	--	10
p/m-Xylene	51.4		mg/kg	1.22	--	10
o-Xylene	9.07		mg/kg	1.22	--	10
Methyl tert butyl ether	ND		mg/kg	0.608	--	10
Naphthalene	47.8		mg/kg	2.43	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	103		70-130
2,5-Dibromotoluene-FID	**67**	Q	70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-08 D	Date Collected:	08/06/20 14:10
Client ID:	B-102 13-15	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/19/20 20:08
Analytical Date:	08/22/20 13:58	Cleanup Method1:	EPH-04-1
Analyst:	LL	Cleanup Date1:	08/22/20
Percent Solids:	85%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	606		mg/kg	15.0	--	2
C19-C36 Aliphatics	1740		mg/kg	15.0	--	2
C11-C22 Aromatics	382		mg/kg	15.0	--	2
C11-C22 Aromatics, Adjusted	366		mg/kg	15.0	--	2
Naphthalene	ND		mg/kg	0.752	--	2
2-Methylnaphthalene	15.6		mg/kg	0.752	--	2
Acenaphthylene	ND		mg/kg	0.752	--	2
Acenaphthene	ND		mg/kg	0.752	--	2
Fluorene	ND		mg/kg	0.752	--	2
Phenanthrene	ND		mg/kg	0.752	--	2
Anthracene	ND		mg/kg	0.752	--	2
Fluoranthene	ND		mg/kg	0.752	--	2
Pyrene	ND		mg/kg	0.752	--	2
Benzo(a)anthracene	ND		mg/kg	0.752	--	2
Chrysene	ND		mg/kg	0.752	--	2
Benzo(b)fluoranthene	ND		mg/kg	0.752	--	2
Benzo(k)fluoranthene	ND		mg/kg	0.752	--	2
Benzo(a)pyrene	ND		mg/kg	0.752	--	2
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.752	--	2
Dibenzo(a,h)anthracene	ND		mg/kg	0.752	--	2
Benzo(ghi)perylene	ND		mg/kg	0.752	--	2

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08 D
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	50		40-140
2-Fluorobiphenyl	73		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-09	Date Collected:	08/06/20 15:05
Client ID:	B-108 15-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/20/20 21:04		
Analyst:	BAD		
Percent Solids:	91%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Covering the Soil
Methanol ratio:	1:1.4

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	4.40	--	1
C9-C12 Aliphatics	ND		mg/kg	4.40	--	1
C9-C10 Aromatics	ND		mg/kg	4.40	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	4.40	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	4.40	--	1
Benzene	ND		mg/kg	0.088	--	1
Toluene	ND		mg/kg	0.088	--	1
Ethylbenzene	ND		mg/kg	0.088	--	1
p/m-Xylene	ND		mg/kg	0.088	--	1
o-Xylene	ND		mg/kg	0.088	--	1
Methyl tert butyl ether	ND		mg/kg	0.044	--	1
Naphthalene	ND		mg/kg	0.176	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	**143**	Q	70-130
2,5-Dibromotoluene-FID	129		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID:	L2033722-09	Date Collected:	08/06/20 15:05
Client ID:	B-108 15-17.5	Date Received:	08/19/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/20/20 20:08
Analytical Date:	08/21/20 09:35	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/20/20
Percent Solids:	91%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.05	--	1
C19-C36 Aliphatics	ND		mg/kg	7.05	--	1
C11-C22 Aromatics	ND		mg/kg	7.05	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.05	--	1
Naphthalene	ND		mg/kg	0.352	--	1
2-Methylnaphthalene	ND		mg/kg	0.352	--	1
Acenaphthylene	ND		mg/kg	0.352	--	1
Acenaphthene	ND		mg/kg	0.352	--	1
Fluorene	ND		mg/kg	0.352	--	1
Phenanthrene	ND		mg/kg	0.352	--	1
Anthracene	ND		mg/kg	0.352	--	1
Fluoranthene	ND		mg/kg	0.352	--	1
Pyrene	ND		mg/kg	0.352	--	1
Benzo(a)anthracene	ND		mg/kg	0.352	--	1
Chrysene	ND		mg/kg	0.352	--	1
Benzo(b)fluoranthene	ND		mg/kg	0.352	--	1
Benzo(k)fluoranthene	ND		mg/kg	0.352	--	1
Benzo(a)pyrene	ND		mg/kg	0.352	--	1
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.352	--	1
Dibenzo(a,h)anthracene	ND		mg/kg	0.352	--	1
Benzo(ghi)perylene	ND		mg/kg	0.352	--	1

Project Name: LUNENBURG
Lab Number: L2033722
Project Number: 6893
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	58		40-140
o-Terphenyl	54		40-140
2-Fluorobiphenyl	67		40-140
2-Bromonaphthalene	69		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/21/20 03:03
Analyst: MEO

Extraction Method: EPA 3546
Extraction Date: 08/19/20 20:08
Cleanup Method: EPH-04-1
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-09 Batch: WG1400704-1					
C9-C18 Aliphatics	ND		mg/kg	6.34	--
C19-C36 Aliphatics	ND		mg/kg	6.34	--
C11-C22 Aromatics	ND		mg/kg	6.34	--
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.34	--
Naphthalene	ND		mg/kg	0.317	--
2-Methylnaphthalene	ND		mg/kg	0.317	--
Acenaphthylene	ND		mg/kg	0.317	--
Acenaphthene	ND		mg/kg	0.317	--
Fluorene	ND		mg/kg	0.317	--
Phenanthrene	ND		mg/kg	0.317	--
Anthracene	ND		mg/kg	0.317	--
Fluoranthene	ND		mg/kg	0.317	--
Pyrene	ND		mg/kg	0.317	--
Benzo(a)anthracene	ND		mg/kg	0.317	--
Chrysene	ND		mg/kg	0.317	--
Benzo(b)fluoranthene	ND		mg/kg	0.317	--
Benzo(k)fluoranthene	ND		mg/kg	0.317	--
Benzo(a)pyrene	ND		mg/kg	0.317	--
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.317	--
Dibenzo(a,h)anthracene	ND		mg/kg	0.317	--
Benzo(ghi)perylene	ND		mg/kg	0.317	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	54		40-140
o-Terphenyl	42		40-140
2-Fluorobiphenyl	56		40-140
2-Bromonaphthalene	58		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/20/20 11:05
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-05,07-09 Batch: WG1401086-4					
C5-C8 Aliphatics	ND		mg/kg	5.00	--
C9-C12 Aliphatics	ND		mg/kg	5.00	--
C9-C10 Aromatics	ND		mg/kg	5.00	--
C5-C8 Aliphatics, Adjusted	ND		mg/kg	5.00	--
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.00	--
Benzene	ND		mg/kg	0.100	--
Toluene	ND		mg/kg	0.100	--
Ethylbenzene	ND		mg/kg	0.100	--
p/m-Xylene	ND		mg/kg	0.100	--
o-Xylene	ND		mg/kg	0.100	--
Methyl tert butyl ether	ND		mg/kg	0.050	--
Naphthalene	ND		mg/kg	0.200	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	116		70-130
2,5-Dibromotoluene-FID	106		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/22/20 12:18
Analyst: LL

Extraction Method: EPA 3546
Extraction Date: 08/21/20 18:09
Cleanup Method: EPH-04-1
Cleanup Date: 08/22/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 03 Batch: WG1401675-1					
C9-C18 Aliphatics	ND		mg/kg	6.57	--
C19-C36 Aliphatics	ND		mg/kg	6.57	--
C11-C22 Aromatics	ND		mg/kg	6.57	--
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.57	--
Naphthalene	ND		mg/kg	0.328	--
2-Methylnaphthalene	ND		mg/kg	0.328	--
Acenaphthylene	ND		mg/kg	0.328	--
Acenaphthene	ND		mg/kg	0.328	--
Fluorene	ND		mg/kg	0.328	--
Phenanthrene	ND		mg/kg	0.328	--
Anthracene	ND		mg/kg	0.328	--
Fluoranthene	ND		mg/kg	0.328	--
Pyrene	ND		mg/kg	0.328	--
Benzo(a)anthracene	ND		mg/kg	0.328	--
Chrysene	ND		mg/kg	0.328	--
Benzo(b)fluoranthene	ND		mg/kg	0.328	--
Benzo(k)fluoranthene	ND		mg/kg	0.328	--
Benzo(a)pyrene	ND		mg/kg	0.328	--
Indeno(1,2,3-cd)Pyrene	ND		mg/kg	0.328	--
Dibenzo(a,h)anthracene	ND		mg/kg	0.328	--
Benzo(ghi)perylene	ND		mg/kg	0.328	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	66		40-140
2-Bromonaphthalene	70		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/21/20 10:47
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 06 Batch: WG1401799-4					
C5-C8 Aliphatics	ND		mg/kg	5.00	--
C9-C12 Aliphatics	ND		mg/kg	5.00	--
C9-C10 Aromatics	ND		mg/kg	5.00	--
C5-C8 Aliphatics, Adjusted	ND		mg/kg	5.00	--
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.00	--
Benzene	ND		mg/kg	0.100	--
Toluene	ND		mg/kg	0.100	--
Ethylbenzene	ND		mg/kg	0.100	--
p/m-Xylene	ND		mg/kg	0.100	--
o-Xylene	ND		mg/kg	0.100	--
Methyl tert butyl ether	ND		mg/kg	0.050	--
Naphthalene	ND		mg/kg	0.200	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	126		70-130
2,5-Dibromotoluene-FID	108		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-09 Batch: WG1400704-2 WG1400704-3								
C9-C18 Aliphatics	67		59		40-140	13		25
C19-C36 Aliphatics	77		69		40-140	11		25
C11-C22 Aromatics	62		59		40-140	5		25
Naphthalene	49		46		40-140	6		25
2-Methylnaphthalene	52		51		40-140	2		25
Acenaphthylene	51		52		40-140	2		25
Acenaphthene	56		58		40-140	4		25
Fluorene	57		59		40-140	3		25
Phenanthrene	59		60		40-140	2		25
Anthracene	64		64		40-140	0		25
Fluoranthene	62		62		40-140	0		25
Pyrene	62		61		40-140	2		25
Benzo(a)anthracene	63		62		40-140	2		25
Chrysene	62		58		40-140	7		25
Benzo(b)fluoranthene	70		69		40-140	1		25
Benzo(k)fluoranthene	56		53		40-140	6		25
Benzo(a)pyrene	62		60		40-140	3		25
Indeno(1,2,3-cd)Pyrene	60		57		40-140	5		25
Dibenzo(a,h)anthracene	46		41		40-140	11		25
Benzo(ghi)perylene	51		45		40-140	13		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-09 Batch: WG1400704-2 WG1400704-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	66		57		40-140
o-Terphenyl	51		51		40-140
2-Fluorobiphenyl	63		63		40-140
2-Bromonaphthalene	65		66		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-05,07-09 Batch: WG1401086-2 WG1401086-3								
C5-C8 Aliphatics	98		109		70-130	11		25
C9-C12 Aliphatics	94		107		70-130	13		25
C9-C10 Aromatics	96		109		70-130	13		25
Benzene	98		108		70-130	10		25
Toluene	98		109		70-130	11		25
Ethylbenzene	101		113		70-130	11		25
p/m-Xylene	99		111		70-130	12		25
o-Xylene	98		112		70-130	13		25
Methyl tert butyl ether	104		116		70-130	11		25
Naphthalene	95		108		70-130	13		25
1,2,4-Trimethylbenzene	96		109		70-130	13		25
Pentane	95		104		70-130	9		25
2-Methylpentane	100		110		70-130	10		25
2,2,4-Trimethylpentane	96		107		70-130	11		25
n-Nonane	94		106		30-130	12		25
n-Decane	94		106		70-130	12		25
n-Butylcyclohexane	94		108		70-130	13		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	98		112		70-130
2,5-Dibromotoluene-FID	88		101		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 03 Batch: WG1401675-2 WG1401675-3								
C9-C18 Aliphatics	57		59		40-140	3		25
C19-C36 Aliphatics	77		78		40-140	1		25
C11-C22 Aromatics	63		65		40-140	3		25
Naphthalene	58		60		40-140	3		25
2-Methylnaphthalene	61		63		40-140	3		25
Acenaphthylene	60		62		40-140	3		25
Acenaphthene	63		66		40-140	5		25
Fluorene	64		66		40-140	3		25
Phenanthrene	64		65		40-140	2		25
Anthracene	62		65		40-140	5		25
Fluoranthene	66		67		40-140	2		25
Pyrene	64		65		40-140	2		25
Benzo(a)anthracene	61		63		40-140	3		25
Chrysene	54		57		40-140	5		25
Benzo(b)fluoranthene	72		74		40-140	3		25
Benzo(k)fluoranthene	51		53		40-140	4		25
Benzo(a)pyrene	58		61		40-140	5		25
Indeno(1,2,3-cd)Pyrene	59		61		40-140	3		25
Dibenzo(a,h)anthracene	42		45		40-140	7		25
Benzo(ghi)perylene	56		59		40-140	5		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 03 Batch: WG1401675-2 WG1401675-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	64		64		40-140
o-Terphenyl	61		58		40-140
2-Fluorobiphenyl	64		66		40-140
2-Bromonaphthalene	67		69		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 06 Batch: WG1401799-2 WG1401799-3								
C5-C8 Aliphatics	112		113		70-130	1		25
C9-C12 Aliphatics	110		112		70-130	2		25
C9-C10 Aromatics	121		122		70-130	1		25
Benzene	121		122		70-130	1		25
Toluene	121		122		70-130	1		25
Ethylbenzene	125		126		70-130	1		25
p/m-Xylene	122		124		70-130	2		25
o-Xylene	123		124		70-130	1		25
Methyl tert butyl ether	130		130		70-130	0		25
Naphthalene	119		119		70-130	0		25
1,2,4-Trimethylbenzene	121		122		70-130	1		25
Pentane	108		109		70-130	1		25
2-Methylpentane	112		114		70-130	2		25
2,2,4-Trimethylpentane	111		112		70-130	1		25
n-Nonane	110		111		30-130	1		25
n-Decane	110		111		70-130	1		25
n-Butylcyclohexane	111		112		70-130	1		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	124		126		70-130
2,5-Dibromotoluene-FID	106		108		70-130

PCBS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01 D
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:02
Analyst: CW
Percent Solids: 86%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	189	--	5	A
Aroclor 1221	ND		ug/kg	189	--	5	A
Aroclor 1232	ND		ug/kg	189	--	5	A
Aroclor 1242	ND		ug/kg	189	--	5	A
Aroclor 1248	ND		ug/kg	189	--	5	A
Aroclor 1254	ND		ug/kg	189	--	5	A
Aroclor 1260	ND		ug/kg	189	--	5	A
Aroclor 1262	ND		ug/kg	189	--	5	A
Aroclor 1268	ND		ug/kg	189	--	5	A
PCBs, Total	ND		ug/kg	189	--	5	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	66		30-150	B
Decachlorobiphenyl	69		30-150	B
2,4,5,6-Tetrachloro-m-xylene	66		30-150	A
Decachlorobiphenyl	64		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:33
Analyst: CW
Percent Solids: 89%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	36.2	--	1	A
Aroclor 1221	ND		ug/kg	36.2	--	1	A
Aroclor 1232	ND		ug/kg	36.2	--	1	A
Aroclor 1242	ND		ug/kg	36.2	--	1	A
Aroclor 1248	ND		ug/kg	36.2	--	1	A
Aroclor 1254	ND		ug/kg	36.2	--	1	A
Aroclor 1260	ND		ug/kg	36.2	--	1	B
Aroclor 1262	ND		ug/kg	36.2	--	1	A
Aroclor 1268	ND		ug/kg	36.2	--	1	A
PCBs, Total	ND		ug/kg	36.2	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	49		30-150	B
Decachlorobiphenyl	59		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	54		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:40
Analyst: CW
Percent Solids: 90%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	36.2	--	1	A
Aroclor 1221	ND		ug/kg	36.2	--	1	A
Aroclor 1232	ND		ug/kg	36.2	--	1	A
Aroclor 1242	ND		ug/kg	36.2	--	1	A
Aroclor 1248	ND		ug/kg	36.2	--	1	A
Aroclor 1254	ND		ug/kg	36.2	--	1	A
Aroclor 1260	ND		ug/kg	36.2	--	1	B
Aroclor 1262	ND		ug/kg	36.2	--	1	A
Aroclor 1268	ND		ug/kg	36.2	--	1	A
PCBs, Total	ND		ug/kg	36.2	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	55		30-150	B
Decachlorobiphenyl	64		30-150	B
2,4,5,6-Tetrachloro-m-xylene	59		30-150	A
Decachlorobiphenyl	60		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04 D
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:23
Analyst: CW
Percent Solids: 91%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	730	--	20	A
Aroclor 1221	ND		ug/kg	730	--	20	A
Aroclor 1232	ND		ug/kg	730	--	20	A
Aroclor 1242	ND		ug/kg	730	--	20	A
Aroclor 1248	ND		ug/kg	730	--	20	A
Aroclor 1254	ND		ug/kg	730	--	20	A
Aroclor 1260	ND		ug/kg	730	--	20	A
Aroclor 1262	ND		ug/kg	730	--	20	A
Aroclor 1268	ND		ug/kg	730	--	20	A
PCBs, Total	ND		ug/kg	730	--	20	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	B
Decachlorobiphenyl	**0**	Q	30-150	B
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	A
Decachlorobiphenyl	**0**	Q	30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 09:55
Analyst: CW
Percent Solids: 88%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	37.6	--	1	A
Aroclor 1221	ND		ug/kg	37.6	--	1	A
Aroclor 1232	ND		ug/kg	37.6	--	1	A
Aroclor 1242	ND		ug/kg	37.6	--	1	A
Aroclor 1248	ND		ug/kg	37.6	--	1	A
Aroclor 1254	ND		ug/kg	37.6	--	1	A
Aroclor 1260	ND		ug/kg	37.6	--	1	A
Aroclor 1262	ND		ug/kg	37.6	--	1	A
Aroclor 1268	ND		ug/kg	37.6	--	1	A
PCBs, Total	ND		ug/kg	37.6	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	49		30-150	B
Decachlorobiphenyl	70		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	61		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06 D
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 15:30
Analyst: CW
Percent Solids: 81%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	802	--	20	A
Aroclor 1221	ND		ug/kg	802	--	20	A
Aroclor 1232	ND		ug/kg	802	--	20	A
Aroclor 1242	ND		ug/kg	802	--	20	A
Aroclor 1248	ND		ug/kg	802	--	20	A
Aroclor 1254	ND		ug/kg	802	--	20	A
Aroclor 1260	3980		ug/kg	802	--	20	B
Aroclor 1262	ND		ug/kg	802	--	20	A
Aroclor 1268	ND		ug/kg	802	--	20	A
PCBs, Total	3980		ug/kg	802	--	20	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	B
Decachlorobiphenyl	**0**	Q	30-150	B
2,4,5,6-Tetrachloro-m-xylene	**0**	Q	30-150	A
Decachlorobiphenyl	**0**	Q	30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:09
Analyst: CW
Percent Solids: 79%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	41.5	--	1	A
Aroclor 1221	ND		ug/kg	41.5	--	1	A
Aroclor 1232	ND		ug/kg	41.5	--	1	A
Aroclor 1242	ND		ug/kg	41.5	--	1	A
Aroclor 1248	ND		ug/kg	41.5	--	1	A
Aroclor 1254	ND		ug/kg	41.5	--	1	A
Aroclor 1260	155	P	ug/kg	41.5	--	1	B
Aroclor 1262	ND		ug/kg	41.5	--	1	A
Aroclor 1268	ND		ug/kg	41.5	--	1	A
PCBs, Total	155		ug/kg	41.5	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	54		30-150	B
Decachlorobiphenyl	67		30-150	B
2,4,5,6-Tetrachloro-m-xylene	58		30-150	A
Decachlorobiphenyl	52		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:17
Analyst: CW
Percent Solids: 85%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	38.3	--	1	A
Aroclor 1221	ND		ug/kg	38.3	--	1	A
Aroclor 1232	ND		ug/kg	38.3	--	1	A
Aroclor 1242	ND		ug/kg	38.3	--	1	A
Aroclor 1248	200		ug/kg	38.3	--	1	A
Aroclor 1254	105		ug/kg	38.3	--	1	B
Aroclor 1260	132		ug/kg	38.3	--	1	B
Aroclor 1262	ND		ug/kg	38.3	--	1	A
Aroclor 1268	ND		ug/kg	38.3	--	1	A
PCBs, Total	437		ug/kg	38.3	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	50		30-150	B
Decachlorobiphenyl	66		30-150	B
2,4,5,6-Tetrachloro-m-xylene	53		30-150	A
Decachlorobiphenyl	50		30-150	A

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/20/20 10:24
Analyst: CW
Percent Solids: 91%

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	35.8	--	1	A
Aroclor 1221	ND		ug/kg	35.8	--	1	A
Aroclor 1232	ND		ug/kg	35.8	--	1	A
Aroclor 1242	ND		ug/kg	35.8	--	1	A
Aroclor 1248	ND		ug/kg	35.8	--	1	A
Aroclor 1254	ND		ug/kg	35.8	--	1	A
Aroclor 1260	ND		ug/kg	35.8	--	1	A
Aroclor 1262	ND		ug/kg	35.8	--	1	A
Aroclor 1268	ND		ug/kg	35.8	--	1	A
PCBs, Total	ND		ug/kg	35.8	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	50		30-150	B
Decachlorobiphenyl	66		30-150	B
2,4,5,6-Tetrachloro-m-xylene	55		30-150	A
Decachlorobiphenyl	60		30-150	A

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8082A
Analytical Date: 08/20/20 08:49
Analyst: CW

Extraction Method: EPA 3546
Extraction Date: 08/19/20 17:59
Cleanup Method: EPA 3665A
Cleanup Date: 08/20/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/20/20

Parameter	Result	Qualifier	Units	RL	MDL	Column
MCP Polychlorinated Biphenyls - Westborough Lab for sample(s): 01-09 Batch: WG1400671-1						
Aroclor 1016	ND		ug/kg	32.6	--	A
Aroclor 1221	ND		ug/kg	32.6	--	A
Aroclor 1232	ND		ug/kg	32.6	--	A
Aroclor 1242	ND		ug/kg	32.6	--	A
Aroclor 1248	ND		ug/kg	32.6	--	A
Aroclor 1254	ND		ug/kg	32.6	--	A
Aroclor 1260	ND		ug/kg	32.6	--	A
Aroclor 1262	ND		ug/kg	32.6	--	A
Aroclor 1268	ND		ug/kg	32.6	--	A
PCBs, Total	ND		ug/kg	32.6	--	A

Surrogate	%Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	64		30-150	B
Decachlorobiphenyl	71		30-150	B
2,4,5,6-Tetrachloro-m-xylene	62		30-150	A
Decachlorobiphenyl	66		30-150	A

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits	Column
MCP Polychlorinated Biphenyls - Westborough Lab Associated sample(s): 01-09 Batch: WG1400671-2 WG1400671-3									
Aroclor 1016	64		66		40-140	3		30	A
Aroclor 1260	61		62		40-140	2		30	A

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	63		64		30-150	B
Decachlorobiphenyl	72		70		30-150	B
2,4,5,6-Tetrachloro-m-xylene	62		63		30-150	A
Decachlorobiphenyl	66		66		30-150	A

METALS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 86%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Arsenic, Total	11.3		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Beryllium, Total	0.511		mg/kg	0.228	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Chromium, Total	26.3		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Copper, Total	8.32		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Lead, Total	31.1		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.085	--	1	08/20/20 05:00	08/20/20 16:40	EPA 7471B	97,7471B	AL
Nickel, Total	15.8		mg/kg	1.14	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.456	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD
Zinc, Total	48.1		mg/kg	2.28	--	1	08/20/20 07:00	08/20/20 14:05	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Arsenic, Total	6.19		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Beryllium, Total	0.484		mg/kg	0.222	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Chromium, Total	35.1		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Copper, Total	9.45		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Lead, Total	12.9		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.082	--	1	08/20/20 05:00	08/20/20 16:57	EPA 7471B	97,7471B	AL
Nickel, Total	22.6		mg/kg	1.11	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.444	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD
Zinc, Total	48.2		mg/kg	2.22	--	1	08/20/20 07:00	08/20/20 14:29	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Arsenic, Total	6.18		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Beryllium, Total	0.509		mg/kg	0.216	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Chromium, Total	33.6		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Copper, Total	10.3		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Lead, Total	11.3		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:07	EPA 7471B	97,7471B	AL
Nickel, Total	20.2		mg/kg	1.08	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.432	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD
Zinc, Total	39.6		mg/kg	2.16	--	1	08/20/20 07:00	08/20/20 14:47	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	9.01		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Arsenic, Total	49.6		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Beryllium, Total	0.364		mg/kg	0.214	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Cadmium, Total	1.57		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Chromium, Total	20.8		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Copper, Total	982		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Lead, Total	477		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Mercury, Total	2.92		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:10	EPA 7471B	97,7471B	AL
Nickel, Total	17.4		mg/kg	1.07	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Selenium, Total	11.5		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.428	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD
Zinc, Total	501		mg/kg	2.14	--	1	08/20/20 07:00	08/20/20 14:52	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 88%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Arsenic, Total	7.91		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Beryllium, Total	0.986		mg/kg	0.224	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Chromium, Total	47.8		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Copper, Total	14.8		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Lead, Total	5.68		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.083	--	1	08/20/20 05:00	08/20/20 17:14	EPA 7471B	97,7471B	AL
Nickel, Total	31.4		mg/kg	1.12	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.448	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD
Zinc, Total	38.5		mg/kg	2.24	--	1	08/20/20 07:00	08/20/20 14:57	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Arsenic, Total	10.8		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Beryllium, Total	0.394		mg/kg	0.243	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Cadmium, Total	2.00		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Chromium, Total	26.1		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Copper, Total	23.8		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Lead, Total	169		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.089	--	1	08/20/20 05:00	08/20/20 17:17	EPA 7471B	97,7471B	AL
Nickel, Total	15.1		mg/kg	1.22	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.487	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD
Zinc, Total	60.9		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:02	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Arsenic, Total	14.5		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Beryllium, Total	0.573		mg/kg	0.243	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Chromium, Total	31.1		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Copper, Total	5.80		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Lead, Total	108		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.092	--	1	08/20/20 05:00	08/20/20 17:20	EPA 7471B	97,7471B	AL
Nickel, Total	14.1		mg/kg	1.21	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.485	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD
Zinc, Total	34.6		mg/kg	2.43	--	1	08/20/20 07:00	08/20/20 15:07	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Arsenic, Total	6.26		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Beryllium, Total	0.602		mg/kg	0.226	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Chromium, Total	31.5		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Copper, Total	7.60		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Lead, Total	40.4		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.087	--	1	08/20/20 05:00	08/20/20 17:23	EPA 7471B	97,7471B	AL
Nickel, Total	17.4		mg/kg	1.13	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.453	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD
Zinc, Total	39.6		mg/kg	2.26	--	1	08/20/20 07:00	08/20/20 16:28	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA
Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Percent Solids: 91%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Arsenic, Total	7.08		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Beryllium, Total	0.634		mg/kg	0.213	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Chromium, Total	22.7		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Copper, Total	7.94		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Lead, Total	3.66		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Mercury, Total	ND		mg/kg	0.080	--	1	08/20/20 05:00	08/20/20 17:27	EPA 7471B	97,7471B	AL
Nickel, Total	15.8		mg/kg	1.06	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Selenium, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Silver, Total	ND		mg/kg	0.426	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Thallium, Total	ND		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD
Zinc, Total	21.6		mg/kg	2.13	--	1	08/20/20 07:00	08/20/20 16:33	EPA 3050B	97,6010D	GD

Project Name: LUNENBURG **Lab Number:** L2033722

Project Number: 6893 **Report Date:** 08/25/20

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-09 Batch: WG1400770-1										
Antimony, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Arsenic, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Beryllium, Total	ND		mg/kg	0.200	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Cadmium, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Chromium, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Copper, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Lead, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Nickel, Total	ND		mg/kg	1.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Selenium, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Silver, Total	ND		mg/kg	0.400	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Thallium, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD
Zinc, Total	ND		mg/kg	2.00	--	1	08/20/20 07:00	08/20/20 13:52	97,6010D	GD

Prep Information

Digestion Method: EPA 3050B

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-09 Batch: WG1400772-1										
Mercury, Total	ND		mg/kg	0.083	--	1	08/20/20 05:00	08/20/20 16:31	97,7471B	AL

Prep Information

Digestion Method: EPA 7471B

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 Batch: WG1400770-2 WG1400770-3 SRM Lot Number: D109-540								
Antimony, Total	171		140		19-250	20		30
Arsenic, Total	99		93		70-130	6		30
Beryllium, Total	109		96		75-125	13		30
Cadmium, Total	114		94		75-125	19		30
Chromium, Total	99		89		70-130	11		30
Copper, Total	95		88		75-125	8		30
Lead, Total	89		86		72-128	3		30
Nickel, Total	107		94		70-130	13		30
Selenium, Total	104		95		68-132	9		30
Silver, Total	93		86		68-131	8		30
Thallium, Total	104		95		68-131	9		30
Zinc, Total	95		88		70-130	8		30
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 Batch: WG1400772-2 WG1400772-3 SRM Lot Number: D109-540								
Mercury, Total	99		91		60-140	8		30

Matrix Spike Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 15-18 QC Batch ID: WG1400770-4 WG1400770-5 QC Sample: L2033722-01 Client ID: B-101												
Antimony, Total	ND	45.5	36.4	80		35.4	79		75-125	3		35
Arsenic, Total	11.3	10.9	17.4	**56**	Q	18.6	**68**	Q	75-125	7		35
Beryllium, Total	0.511	4.55	4.37	85		4.23	83		75-125	3		35
Cadmium, Total	ND	4.64	3.90	84		3.95	86		75-125	1		35
Chromium, Total	26.3	18.2	38.3	**66**	Q	45.4	106		75-125	17		35
Copper, Total	8.32	22.8	26.3	79		29.1	92		75-125	10		35
Lead, Total	31.1	46.4	61.8	**66**	Q	70.5	86		75-125	13		35
Nickel, Total	15.8	45.5	49.7	**74**	Q	50.5	77		75-125	2		35
Selenium, Total	ND	10.9	9.37	86		9.55	88		75-125	2		35
Silver, Total	ND	27.3	23.1	84		23.6	88		75-125	2		35
Thallium, Total	ND	10.9	7.00	**64**	Q	7.74	**72**	Q	75-125	10		35
Zinc, Total	48.1	45.5	75.6	**60**	Q	80.9	**73**	Q	75-125	7		35
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 15-18 QC Batch ID: WG1400772-4 WG1400772-5 QC Sample: L2033722-01 Client ID: B-101												
Mercury, Total	ND	0.171	0.178	104		0.184	109		75-125	3		35

Project Name: LUNENBURG
Project Number: 6893

Lab Serial Dilution Analysis
Batch Quality Control

Lab Number: L2033722
Report Date: 08/25/20

Parameter	Native Sample	Serial Dilution	Units	% D	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-09 QC Batch ID: WG1400770-6 QC Sample: L2033722-01 Client ID: B-101 15-18						
Chromium, Total	26.3	30.5	mg/kg	16		20

INORGANICS
&
MISCELLANEOUS

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-01
Client ID: B-101 15-18
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	85.5		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-02
Client ID: B-105 12.5-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 09:50
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	88.8		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-03
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:15
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-04
Client ID: B-107 8-10
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 10:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.6		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-05
Client ID: B-104 10-12
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 11:30
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	87.7		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-06
Client ID: B-103 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:00
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	81.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-07
Client ID: B-106 12.5-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 13:45
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	79.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-08
Client ID: B-102 13-15
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 14:10
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	85.3		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
Report Date: 08/25/20

SAMPLE RESULTS

Lab ID: L2033722-09
Client ID: B-108 15-17.5
Sample Location: LUNENBURG, MA

Date Collected: 08/06/20 15:05
Date Received: 08/19/20
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	90.9		%	0.100	NA	1	-	08/19/20 19:58	121,2540G	TR

Lab Duplicate Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2033722

Report Date: 08/25/20

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-09 QC Batch ID: WG1400703-1 QC Sample: L2033722-01 Client ID: B-101 15-18						
Solids, Total	85.5	85.7	%	0		20

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2033722
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Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
C	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-01A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-01B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-01C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-01D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-01E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-01F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-01G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-02A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-02B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-02C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-02D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-02E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-02F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-02G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-03A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-03B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)

*Values in parentheses indicate holding time in days

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-03C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-03D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-03E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SB-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-03F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-03G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-04A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-04B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-04C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-04D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-04E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-04F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-04G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-05A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-05B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-05C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-05D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-05E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-05F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-05G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-06A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-06B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-06C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-06D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-06E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-06F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-06G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-07A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-07B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-07C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-07D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-07E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-07F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-07G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-08A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-08B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-08C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-08D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)

*Values in parentheses indicate holding time in days

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2033722-08E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2033722-08F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-08G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-09A	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-09B	Vial MeOH preserved	C	NA		0.3	Y	Absent		VPH-DELUX-18(28),MCP-8260HLW-10(14)
L2033722-09C	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-09D	Vial water preserved	C	NA		0.3	Y	Absent	06-AUG-20 18:00	MCP-8260HLW-10(14)
L2033722-09E	Metals Only-Glass 60mL/2oz unpreserved	C	NA		0.3	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-TL-6010T-10(180),MCP-7471T-10(28),MCP-CD-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SB-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2033722-09F	Plastic 2oz unpreserved for TS	C	NA		0.3	Y	Absent		TS(7)
L2033722-09G	Glass 250ml/8oz unpreserved	C	NA		0.3	Y	Absent		MCP-8082-10(365),EPH-DELUX-20(14)
L2033722-11A	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)
L2033722-11B	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)
L2033722-11C	Vial HCl preserved	C	NA		0.3	Y	Absent		MCP-8260-10(14)

*Values in parentheses indicate holding time in days

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GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

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1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration

Report Format: Data Usability Report

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Data Qualifiers

Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2033722
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REFERENCES

97 EPA Test Methods (SW-846) with QC Requirements & Performance Standards for the Analysis of EPA SW-846 Methods under the Massachusetts Contingency Plan, WSC-CAM-IIA, IIB, IIIA, IIIB, IIIC, IIID, VA, VB, VC, VIA, VIB, VIIIA and VIIIB, July 2010.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

131 Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), MassDEP, February 2018, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of VPH under the Massachusetts Contingency Plan, WSC-CAM-IVA, June 1, 2018.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

Date Rec'd in Lab: 8/19/20

ALPHA Job #: L2033722

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Bohler Group
Address: 701 George Washington Hwy
Lincoln, RI 02865
Phone: 401.333.2382
Email: jmcloughlin@bohler-inc.com

Project Information

Project Name: Lunenburg
Project Location: Lunenburg, MA
Project #: 6893
Project Manager: Joe McLoughlin
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☒ ADEx ☒ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☒ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☒ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:
VOC LL Frozen 8/6/20 @ 6:00 PM

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☒8260 ☐624 ☐524.2	SVOC: ☐ABN ☐PAH	METALS: ☐MCP 13 ☐MCP 14 ☐RCP 15	METALS: ☐RCRA5 ☐RCRA8 ☐PP13	EPH: ☒Ranges & Targets ☐Ranges Only	VPH: ☒Ranges & Targets ☐Ranges Only	☒PCB ☐PEST	TPH: ☐Quant Only ☐Fingerprint	Sample Comments	TOTAL # BOTTLES
33722-01	B-101 15-18	8/6/20	9:00	Soil	SN	X			X	X	X	X			7
02	B-105 12.5-17.5		9:50	Soil	SN	X			X	X	X	X			7
03	Dup		10:15	Soil	SN	X			X	X	X	X			7
04	B-107 8-10		10:45	Soil	SN	X			X	X	X	X			7
05	B-104 10-12		11:30	Soil	SN	X			X	X	X	X			7
06	B-103 13-15		1:00	Soil	SN	X			X	X	X	X			7
07	B-106 12.5-15		1:45	Soil	SN	X			X	X	X	X			7
08	B-102 13-15		2:10	Soil	SN	X			X	X	X	X			7
09	B-108 13-17.5		3:05	Soil	SN	X			X	X	X	X			7
10	Trip Blank		—	—	SN	X									1

CHAIN OF CUSTODY

PAGE 2 OF 2

Date Rec'd in Lab: 8/19/20

ALPHA Job #: L2033722

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: Beta Group
Address: 701 George Washington Hwy
Lincoln, RI 02865
Phone: 401.333.2382
Email: jmclaughlin@beta-inc.com

Additional Project Information:

Project Information

Project Name: Lunenburg
Project Location: Lunenburg, MA
Project #: 6853
Project Manager: Joe McLaughlin
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☑ ADEx ☑ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☑ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☑ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: VOC: ☑ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do; Sample Comments	TOTAL # BOTTLES
33722-11	Equip Blank	8/6/20	8:00	-	SN	X									3

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type	V																		
Preservative	F																		

Relinquished By:	Date/Time	Received By:	Date/Time
SKM	8/19/20 8am	SKM	8/19/20 11:00
SAN	8/19/20 11:30	AAL	8/19/20 11:30
MGM	8/19/20	WGM	8/19/20 14:20

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400899-5	**Lab File ID**	: V17200819N04
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/19/20 19:35

Client Sample No.	Lab Sample ID	Analysis Date
WG1400899-3LCS	WG1400899-3	08/19/20 18:17
WG1400899-4LCSD	WG1400899-4	08/19/20 18:43
TRIP BLANK	L2033722-10	08/19/20 21:21
B-101 15-18	L2033722-01	08/19/20 22:13
B-105 12.5-17.5	L2033722-02D	08/19/20 22:39
DUP	L2033722-03D	08/19/20 23:05
B-107 8-10	L2033722-04	08/19/20 23:32
B-106 12.5-15	L2033722-07	08/19/20 23:58
B-102 13-15	L2033722-08D	08/20/20 00:24

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400902-5	**Lab File ID**	: V17200819N04
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/19/20 19:35

Client Sample No.	Lab Sample ID	Analysis Date
WG1400902-3LCS	WG1400902-3	08/19/20 18:17
WG1400902-4LCSD	WG1400902-4	08/19/20 18:43
TRIP BLANK	L2033722-10	08/19/20 21:47
B-108 15-17.5	L2033722-09	08/20/20 00:50

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400764-5	**Lab File ID**	: VJ2008189N04
Instrument ID	: JACK		
Matrix	: WATER	**Analysis Date**	: 08/19/20 20:07

Client Sample No.	Lab Sample ID	Analysis Date
WG1400764-3LCS	WG1400764-3	08/19/20 18:48
WG1400764-4LCSD	WG1400764-4	08/19/20 19:14
EQUIP BLANK	L2033722-11	08/19/20 20:34

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1401019-5	**Lab File ID**	: V17200820A05
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/20/20 07:18

Client Sample No.	Lab Sample ID	Analysis Date
WG1401019-3LCS	WG1401019-3	08/20/20 05:33
WG1401019-4LCSD	WG1401019-4	08/20/20 05:59
B-104 10-12	L2033722-05	08/20/20 07:44
B-103 13-15	L2033722-06	08/20/20 08:10

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1400899-12	**Lab File ID**	: V17200820A05
Instrument ID	: VOA117		
Matrix	: SOIL	**Analysis Date**	: 08/20/20 07:18

Client Sample No.	Lab Sample ID	Analysis Date
WG1400899-10LCS	WG1400899-10	08/20/20 05:33
WG1400899-11LCSD	WG1400899-11	08/20/20 05:59
DUP	L2033722-03D2	08/20/20 12:32
B-102 13-15	L2033722-08D2	08/20/20 13:25
B-105 12.5-17.5	L2033722-02D2	08/20/20 13:58

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	87	0
Dichlorodifluoromethane	0.19	0.167	-	12.1	20	80	-.01
Chloromethane	0.196	0.171	-	12.8	20	84	-.02
Vinyl chloride	0.508	0.422	-	16.9	20	73	0
Bromomethane	40	48.025	-	-20.1*	20	104	-.01
Chloroethane	0.454	0.41	-	9.7	20	84	-.01
Trichlorofluoromethane	1.028	0.894	-	13	20	78	0
Ethyl ether	0.297	0.27	-	9.1	20	81	0
1,1-Dichloroethene	0.195	0.168	-	13.8	20	79	0
Carbon disulfide	0.569	0.424	-	25.5*	20	70	-.01
Freon-113	0.213	0.149	-	30*	20	63	-.01
Acrolein	0.01052	0.00801*	-	23.9*	20	68	0
Methylene chloride	0.231	0.197	-	14.7	20	82	0
Acetone	40	35.436	-	11.4	20	73	-.01
trans-1,2-Dichloroethene	0.215	0.207	-	3.7	20	88	-.01
Methyl acetate	0.066	0.054*	-	18.2	20	72	-.01
Methyl tert-butyl ether	0.418	0.385	-	7.9	20	81	0
tert-Butyl alcohol	0.01122	0.00959*	-	14.5	20	75	-.01
Diisopropyl ether	0.46	0.401	-	12.8	20	75	0
1,1-Dichloroethane	0.362	0.301	-	16.9	20	75	0
Halothane	0.182	0.16	-	12.1	20	79	0
Acrylonitrile	0.032	0.029*	-	9.4	20	77	0
Ethyl tert-butyl ether	0.486	0.418	-	14	20	74	0
Vinyl acetate	0.292	0.254	-	13	20	73	0
cis-1,2-Dichloroethene	0.261	0.228	-	12.6	20	78	0
2,2-Dichloropropane	0.309	0.275	-	11	20	81	0
Bromochloromethane	0.116	0.106	-	8.6	20	82	0
Cyclohexane	0.275	0.203	-	26.2*	20	62	0
Chloroform	0.4	0.342	-	14.5	20	78	0
Ethyl acetate	0.099	0.084	-	15.2	20	73	0
Carbon tetrachloride	0.31	0.267	-	13.9	20	76	0
Tetrahydrofuran	40	33.322	-	16.7	20	69	-.01
Dibromofluoromethane	0.262	0.254	-	3.1	20	86	0
1,1,1-Trichloroethane	0.353	0.292	-	17.3	20	75	0
2-Butanone	40	33.652	-	15.9	20	70	0
1,1-Dichloropropene	0.273	0.238	-	12.8	20	76	0
Benzene	0.871	0.768	-	11.8	20	79	0
tert-Amyl methyl ether	0.462	0.41	-	11.3	20	75	0
1,2-Dichloroethane-d4	0.217	0.19	-	12.4	20	80	0
1,2-Dichloroethane	0.231	0.192	-	16.9	20	75	0
Methyl cyclohexane	0.363	0.266	-	26.7*	20	64	0
Trichloroethene	0.256	0.212	-	17.2	20	77	0
Dibromomethane	0.119	0.104	-	12.6	20	77	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.17	-	12.8	20	77	0
2-Chloroethyl vinyl ether	0.08	0.074	-	7.5	20	78	0
Bromodichloromethane	0.291	0.255	-	12.4	20	77	0
1,4-Dioxane	0.00132	0.00134*	-	-1.5	20	85	0
cis-1,3-Dichloropropene	0.31	0.285	-	8.1	20	76	0
Chlorobenzene-d5	1	1	-	0	20	95	0
Toluene-d8	1.245	1.128	-	9.4	20	84	0
Toluene	0.746	0.612	-	18	20	79	0
4-Methyl-2-pentanone	40	30.804	-	23*	20	78	0
Tetrachloroethene	0.349	0.281	-	19.5	20	84	0
trans-1,3-Dichloropropene	0.351	0.288	-	17.9	20	75	0
Ethyl methacrylate	0.23	0.188	-	18.3	20	80	0
1,1,2-Trichloroethane	0.185	0.149	-	19.5	20	77	0
Chlorodibromomethane	0.275	0.259	-	5.8	20	90	0
1,3-Dichloropropane	0.346	0.299	-	13.6	20	82	0
1,2-Dibromoethane	0.206	0.188	-	8.7	20	85	0
2-Hexanone	0.079	0.065*	-	17.7	20	78	0
Chlorobenzene	0.897	0.81	-	9.7	20	90	0
Ethylbenzene	1.399	1.289	-	7.9	20	86	0
1,1,1,2-Tetrachloroethane	0.327	0.288	-	11.9	20	87	0
p/m Xylene	0.605	0.551	-	8.9	20	88	0
o Xylene	0.515	0.509	-	1.2	20	86	0
Styrene	80	71.511	-	10.6	20	83	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	91	0
Bromoform	0.342	0.292	-	14.6	20	82	0
Isopropylbenzene	2.555	2.486	-	2.7	20	85	0
4-Bromofluorobenzene	0.703	0.707	-	-0.6	20	92	0
Bromobenzene	0.653	0.618	-	5.4	20	91	0
n-Propylbenzene	3.154	2.92	-	7.4	20	85	0
1,4-Dichlorobutane	0.513	0.432	-	15.8	20	79	0
1,1,2,2-Tetrachloroethane	0.481	0.417	-	13.3	20	81	0
4-Ethyltoluene	2.46	2.503	-	-1.7	20	89	0
2-Chlorotoluene	1.753	1.633	-	6.8	20	85	0
1,3,5-Trimethylbenzene	2.268	2.132	-	6	20	84	0
1,2,3-Trichloropropane	0.377	0.302	-	19.9	20	76	0
trans-1,4-Dichloro-2-buten	0.097	0.084	-	13.4	20	75	0
4-Chlorotoluene	1.793	1.674	-	6.6	20	84	0
tert-Butylbenzene	1.876	1.841	-	1.9	20	85	0
1,2,4-Trimethylbenzene	2.199	2.094	-	4.8	20	83	0
sec-Butylbenzene	2.765	2.782	-	-0.6	20	87	0
p-Isopropyltoluene	2.465	2.463	-	0.1	20	85	0
1,3-Dichlorobenzene	1.395	1.335	-	4.3	20	89	0
1,4-Dichlorobenzene	1.383	1.336	-	3.4	20	90	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.484	-	-3.3	20	90	0
n-Butylbenzene	2.374	2.137	-	10	20	78	0
1,2-Dichlorobenzene	1.235	1.164	-	5.7	20	87	0
1,2,4,5-Tetramethylbenzene	40	34.577	-	13.6	20	88	0
1,2-Dibromo-3-chloropropan	0.068	0.063	-	7.4	20	82	0
1,3,5-Trichlorobenzene	0.874	0.859	-	1.7	20	90	0
Hexachlorobutadiene	0.363	0.296	-	18.5	20	75	0
1,2,4-Trichlorobenzene	0.728	0.673	-	7.6	20	83	0
Naphthalene	1.459	1.291	-	11.5	20	77	0
1,2,3-Trichlorobenzene	0.657	0.58	-	11.7	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/19/20 18:17
Lab File ID	: V17200819N01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1400902-2	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	87	0
Dichlorodifluoromethane	0.19	0.167	-	12.1	20	80	-.01
Chloromethane	0.196	0.171	-	12.8	20	84	-.02
Vinyl chloride	0.508	0.422	-	16.9	20	73	0
Bromomethane	40	48.025	-	-20.1*	20	104	-.01
Chloroethane	0.454	0.41	-	9.7	20	84	-.01
Trichlorofluoromethane	1.028	0.894	-	13	20	78	0
Ethyl ether	0.297	0.27	-	9.1	20	81	0
1,1-Dichloroethene	0.195	0.168	-	13.8	20	79	0
Carbon disulfide	0.569	0.424	-	25.5*	20	70	-.01
Freon-113	0.213	0.149	-	30*	20	63	-.01
Acrolein	0.01052	0.00801*	-	23.9*	20	68	0
Methylene chloride	0.231	0.197	-	14.7	20	82	0
Acetone	40	35.436	-	11.4	20	73	-.01
trans-1,2-Dichloroethene	0.215	0.207	-	3.7	20	88	-.01
Methyl acetate	0.066	0.054*	-	18.2	20	72	-.01
Methyl tert-butyl ether	0.418	0.385	-	7.9	20	81	0
tert-Butyl alcohol	0.01122	0.00959*	-	14.5	20	75	-.01
Diisopropyl ether	0.46	0.401	-	12.8	20	75	0
1,1-Dichloroethane	0.362	0.301	-	16.9	20	75	0
Halothane	0.182	0.16	-	12.1	20	79	0
Acrylonitrile	0.032	0.029*	-	9.4	20	77	0
Ethyl tert-butyl ether	0.486	0.418	-	14	20	74	0
Vinyl acetate	0.292	0.254	-	13	20	73	0
cis-1,2-Dichloroethene	0.261	0.228	-	12.6	20	78	0
2,2-Dichloropropane	0.309	0.275	-	11	20	81	0
Bromochloromethane	0.116	0.106	-	8.6	20	82	0
Cyclohexane	0.275	0.203	-	26.2*	20	62	0
Chloroform	0.4	0.342	-	14.5	20	78	0
Ethyl acetate	0.099	0.084	-	15.2	20	73	0
Carbon tetrachloride	0.31	0.267	-	13.9	20	76	0
Tetrahydrofuran	40	33.322	-	16.7	20	69	-.01
Dibromofluoromethane	0.262	0.254	-	3.1	20	86	0
1,1,1-Trichloroethane	0.353	0.292	-	17.3	20	75	0
2-Butanone	40	33.652	-	15.9	20	70	0
1,1-Dichloropropene	0.273	0.238	-	12.8	20	76	0
Benzene	0.871	0.768	-	11.8	20	79	0
tert-Amyl methyl ether	0.462	0.41	-	11.3	20	75	0
1,2-Dichloroethane-d4	0.217	0.19	-	12.4	20	80	0
1,2-Dichloroethane	0.231	0.192	-	16.9	20	75	0
Methyl cyclohexane	0.363	0.266	-	26.7*	20	64	0
Trichloroethene	0.256	0.212	-	17.2	20	77	0
Dibromomethane	0.119	0.104	-	12.6	20	77	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400902-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.17	-	12.8	20	77	0
2-Chloroethyl vinyl ether	0.08	0.074	-	7.5	20	78	0
Bromodichloromethane	0.291	0.255	-	12.4	20	77	0
1,4-Dioxane	0.00132	0.00134*	-	-1.5	20	85	0
cis-1,3-Dichloropropene	0.31	0.285	-	8.1	20	76	0
Chlorobenzene-d5	1	1	-	0	20	95	0
Toluene-d8	1.245	1.128	-	9.4	20	84	0
Toluene	0.746	0.612	-	18	20	79	0
4-Methyl-2-pentanone	40	30.804	-	23*	20	78	0
Tetrachloroethene	0.349	0.281	-	19.5	20	84	0
trans-1,3-Dichloropropene	0.351	0.288	-	17.9	20	75	0
Ethyl methacrylate	0.23	0.188	-	18.3	20	80	0
1,1,2-Trichloroethane	0.185	0.149	-	19.5	20	77	0
Chlorodibromomethane	0.275	0.259	-	5.8	20	90	0
1,3-Dichloropropane	0.346	0.299	-	13.6	20	82	0
1,2-Dibromoethane	0.206	0.188	-	8.7	20	85	0
2-Hexanone	0.079	0.065*	-	17.7	20	78	0
Chlorobenzene	0.897	0.81	-	9.7	20	90	0
Ethylbenzene	1.399	1.289	-	7.9	20	86	0
1,1,1,2-Tetrachloroethane	0.327	0.288	-	11.9	20	87	0
p/m Xylene	0.605	0.551	-	8.9	20	88	0
o Xylene	0.515	0.509	-	1.2	20	86	0
Styrene	80	71.511	-	10.6	20	83	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	91	0
Bromoform	0.342	0.292	-	14.6	20	82	0
Isopropylbenzene	2.555	2.486	-	2.7	20	85	0
4-Bromofluorobenzene	0.703	0.707	-	-0.6	20	92	0
Bromobenzene	0.653	0.618	-	5.4	20	91	0
n-Propylbenzene	3.154	2.92	-	7.4	20	85	0
1,4-Dichlorobutane	0.513	0.432	-	15.8	20	79	0
1,1,2,2-Tetrachloroethane	0.481	0.417	-	13.3	20	81	0
4-Ethyltoluene	2.46	2.503	-	-1.7	20	89	0
2-Chlorotoluene	1.753	1.633	-	6.8	20	85	0
1,3,5-Trimethylbenzene	2.268	2.132	-	6	20	84	0
1,2,3-Trichloropropane	0.377	0.302	-	19.9	20	76	0
trans-1,4-Dichloro-2-buten	0.097	0.084	-	13.4	20	75	0
4-Chlorotoluene	1.793	1.674	-	6.6	20	84	0
tert-Butylbenzene	1.876	1.841	-	1.9	20	85	0
1,2,4-Trimethylbenzene	2.199	2.094	-	4.8	20	83	0
sec-Butylbenzene	2.765	2.782	-	-0.6	20	87	0
p-Isopropyltoluene	2.465	2.463	-	0.1	20	85	0
1,3-Dichlorobenzene	1.395	1.335	-	4.3	20	89	0
1,4-Dichlorobenzene	1.383	1.336	-	3.4	20	90	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/19/20 18:17	
Lab File ID	: V17200819N01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400902-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.484	-	-3.3	20	90	0
n-Butylbenzene	2.374	2.137	-	10	20	78	0
1,2-Dichlorobenzene	1.235	1.164	-	5.7	20	87	0
1,2,4,5-Tetramethylbenzene	40	34.577	-	13.6	20	88	0
1,2-Dibromo-3-chloropropan	0.068	0.063	-	7.4	20	82	0
1,3,5-Trichlorobenzene	0.874	0.859	-	1.7	20	90	0
Hexachlorobutadiene	0.363	0.296	-	18.5	20	75	0
1,2,4-Trichlorobenzene	0.728	0.673	-	7.6	20	83	0
Naphthalene	1.459	1.291	-	11.5	20	77	0
1,2,3-Trichlorobenzene	0.657	0.58	-	11.7	20	80	0

*** Value outside of QC limits.**

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: JACK		**Calibration Date**	: 08/19/20 18:48	
Lab File ID	: VJ2008189N01		**Init. Calib. Date(s)**	: 08/12/20	08/12/20
Sample No	: WG1400764-2		**Init. Calib. Times**	: 11:51	15:40
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	93	0
Dichlorodifluoromethane	0.719	0.739	-	-2.8	20	90	0
Chloromethane	1.153	1.086	-	5.8	20	83	0
Vinyl chloride	1.008	1.246	-	-23.6*	20	103	0
Bromomethane	10	7.549	-	24.5*	20	66	0
Chloroethane	10	12.018	-	-20.2*	20	110	0
Trichlorofluoromethane	0.995	1.243	-	-24.9*	20	102	0
Ethyl ether	0.41	0.466	-	-13.7	20	102	0
1,1-Dichloroethene	0.691	0.831	-	-20.3*	20	103	0
Carbon disulfide	1.649	1.868	-	-13.3	20	101	0
Freon-113	0.675	0.852	-	-26.2*	20	104	0
Acrolein	0.069	0.078	-	-13	20	107	0
Methylene chloride	0.816	0.954	-	-16.9	20	105	0
Acetone	10	12.432	-	-24.3*	20	113	0
trans-1,2-Dichloroethene	0.706	0.833	-	-18	20	107	0
Methyl acetate	0.477	0.569	-	-19.3	20	109	0
Methyl tert-butyl ether	1.968	2.079	-	-5.6	20	97	0
tert-Butyl alcohol	0.061	0.064	-	-4.9	20	99	-.01
Diisopropyl ether	3.172	3.42	-	-7.8	20	99	0
1,1-Dichloroethane	1.631	1.898	-	-16.4	20	102	0
Halothane	0.526	0.585	-	-11.2	20	97	0
Acrylonitrile	0.232	0.244	-	-5.2	20	97	0
Ethyl tert-butyl ether	2.669	2.787	-	-4.4	20	94	0
Vinyl acetate	1.949	2.077	-	-6.6	20	97	0
cis-1,2-Dichloroethene	0.955	1.032	-	-8.1	20	98	0
2,2-Dichloropropane	1.309	1.343	-	-2.6	20	89	0
Bromochloromethane	0.345	0.37	-	-7.2	20	96	0
Cyclohexane	1.799	2.1	-	-16.7	20	97	0
Chloroform	1.513	1.615	-	-6.7	20	96	-.01
Ethyl acetate	0.742	0.747	-	-0.7	20	97	0
Carbon tetrachloride	0.945	0.976	-	-3.3	20	88	-.01
Tetrahydrofuran	0.263	0.271	-	-3	20	93	-.01
Dibromofluoromethane	0.211	0.209	-	0.9	20	91	0
1,1,1-Trichloroethane	1.238	1.343	-	-8.5	20	95	0
2-Butanone	0.313	0.318	-	-1.6	20	99	0
1,1-Dichloropropene	1.641	1.579	-	3.8	20	86	0
Benzene	3.876	4.103	-	-5.9	20	96	0
tert-Amyl methyl ether	2.358	2.221	-	5.8	20	87	0
1,2-Dichloroethane-d4	0.294	0.293	-	0.3	20	96	0
1,2-Dichloroethane	1.151	1.227	-	-6.6	20	95	0
Methyl cyclohexane	1.467	1.833	-	-24.9*	20	102	0
Trichloroethene	0.858	0.966	-	-12.6	20	99	0
Dibromomethane	0.432	0.461	-	-6.7	20	97	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: JACK	**Calibration Date**	: 08/19/20 18:48
Lab File ID	: VJ2008189N01	**Init. Calib. Date(s)**	: 08/12/20 08/12/20
Sample No	: WG1400764-2	**Init. Calib. Times**	: 11:51 15:40
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	1.01	1.077	-	-6.6	20	97	0
2-Chloroethyl vinyl ether	0.341	0.298	-	12.6	20	80	0
Bromodichloromethane	1.117	1.11	-	0.6	20	91	0
1,4-Dioxane	0.00655	0.00653*	-	0.3	20	89	-.01
cis-1,3-Dichloropropene	1.622	1.579	-	2.7	20	86	0
Chlorobenzene-d5	1	1	-	0	20	93	0
Toluene-d8	1.396	1.369	-	1.9	20	92	0
Toluene	3.191	3.4	-	-6.5	20	95	0
4-Methyl-2-pentanone	0.352	0.347	-	1.4	20	89	0
Tetrachloroethene	1.075	1.221	-	-13.6	20	100	0
trans-1,3-Dichloropropene	1.772	1.627	-	8.2	20	84	0
Ethyl methacrylate	1.414	1.344	-	5	20	88	0
1,1,2-Trichloroethane	0.831	0.868	-	-4.5	20	97	0
Chlorodibromomethane	0.88	0.807	-	8.3	20	87	0
1,3-Dichloropropane	1.807	1.848	-	-2.3	20	96	0
1,2-Dibromoethane	0.858	0.845	-	1.5	20	92	0
2-Hexanone	0.681	0.64	-	6	20	89	0
Chlorobenzene	3.149	3.291	-	-4.5	20	94	0
Ethylbenzene	5.982	6.46	-	-8	20	96	0
1,1,1,2-Tetrachloroethane	0.976	0.933	-	4.4	20	89	0
p/m Xylene	2.175	2.393	-	-10	20	95	0
o Xylene	2.032	2.166	-	-6.6	20	93	0
Styrene	3.432	3.737	-	-8.9	20	94	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	96	0
Bromoform	0.973	0.835	-	14.2	20	80	0
Isopropylbenzene	10.958	12.042	-	-9.9	20	97	0
4-Bromofluorobenzene	1.098	1.066	-	2.9	20	94	0
Bromobenzene	2.391	2.36	-	1.3	20	91	0
n-Propylbenzene	13.147	14.73	-	-12	20	100	0
1,4-Dichlorobutane	3.729	3.797	-	-1.8	20	94	0
1,1,2,2-Tetrachloroethane	2.174	2.301	-	-5.8	20	98	0
4-Ethyltoluene	9.915	10.932	-	-10.3	20	99	0
2-Chlorotoluene	9.099	9.693	-	-6.5	20	98	0
1,3,5-Trimethylbenzene	8.821	9.299	-	-5.4	20	96	0
1,2,3-Trichloropropane	1.883	1.941	-	-3.1	20	96	0
trans-1,4-Dichloro-2-buten	0.678	0.619	-	8.7	20	88	0
4-Chlorotoluene	8.598	9.003	-	-4.7	20	97	0
tert-Butylbenzene	6.734	7.482	-	-11.1	20	99	0
1,2,4-Trimethylbenzene	8.467	8.967	-	-5.9	20	99	0
sec-Butylbenzene	9.169	10.764	-	-17.4	20	103	0
p-Isopropyltoluene	7.772	8.563	-	-10.2	20	101	0
1,3-Dichlorobenzene	4.581	4.722	-	-3.1	20	96	0
1,4-Dichlorobenzene	4.594	4.801	-	-4.5	20	98	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: JACK		**Calibration Date**	: 08/19/20 18:48	
Lab File ID	: VJ2008189N01		**Init. Calib. Date(s)**	: 08/12/20	08/12/20
Sample No	: WG1400764-2		**Init. Calib. Times**	: 11:51	15:40
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	4.265	4.627	-	-8.5	20	101	0
n-Butylbenzene	6.543	7.493	-	-14.5	20	109	0
1,2-Dichlorobenzene	4.285	4.456	-	-4	20	97	0
1,2,4,5-Tetramethylbenzene	6.521	6.853	-	-5.1	20	96	0
1,2-Dibromo-3-chloropropan	0.267	0.236	-	11.6	20	82	0
1,3,5-Trichlorobenzene	2.364	2.424	-	-2.5	20	98	0
Hexachlorobutadiene	0.703	0.811	-	-15.4	20	105	0
1,2,4-Trichlorobenzene	2.105	2.167	-	-2.9	20	100	0
Naphthalene	5.281	5.145	-	2.6	20	95	0
1,2,3-Trichlorobenzene	1.88	1.924	-	-2.3	20	100	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/20/20 05:33
Lab File ID	: V17200820A01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1401019-2	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	91	0
Dichlorodifluoromethane	0.19	0.169	-	11.1	20	85	0
Chloromethane	0.196	0.17	-	13.3	20	87	-.02
Vinyl chloride	0.508	0.398	-	21.7*	20	73	0
Bromomethane	40	42.887	-	-7.2	20	98	0
Chloroethane	0.454	0.379	-	16.5	20	81	-.01
Trichlorofluoromethane	1.028	0.891	-	13.3	20	82	0
Ethyl ether	0.297	0.252	-	15.2	20	79	0
1,1-Dichloroethene	0.195	0.183	-	6.2	20	91	0
Carbon disulfide	0.569	0.452	-	20.6*	20	79	0
Freon-113	0.213	0.158	-	25.8*	20	71	-.01
Acrolein	0.01052	0.00873*	-	17	20	78	0
Methylene chloride	0.231	0.214	-	7.4	20	93	0
Acetone	40	37.812	-	5.5	20	82	-.01
trans-1,2-Dichloroethene	0.215	0.223	-	-3.7	20	99	0
Methyl acetate	0.066	0.059*	-	10.6	20	82	-.01
Methyl tert-butyl ether	0.418	0.424	-	-1.4	20	93	0
tert-Butyl alcohol	0.011	0.011*	-	0	20	92	0
Diisopropyl ether	0.46	0.409	-	11.1	20	80	0
1,1-Dichloroethane	0.362	0.304	-	16	20	79	0
Halothane	0.182	0.162	-	11	20	84	0
Acrylonitrile	0.032	0.029*	-	9.4	20	81	-.01
Ethyl tert-butyl ether	0.486	0.427	-	12.1	20	79	0
Vinyl acetate	0.292	0.256	-	12.3	20	78	0
cis-1,2-Dichloroethene	0.261	0.23	-	11.9	20	82	0
2,2-Dichloropropane	0.309	0.266	-	13.9	20	82	0
Bromochloromethane	0.116	0.11	-	5.2	20	89	0
Cyclohexane	0.275	0.208	-	24.4*	20	67	0
Chloroform	0.4	0.357	-	10.8	20	86	0
Ethyl acetate	0.099	0.085	-	14.1	20	78	0
Carbon tetrachloride	0.31	0.269	-	13.2	20	81	0
Tetrahydrofuran	40	33.776	-	15.6	20	73	-.02
Dibromofluoromethane	0.262	0.256	-	2.3	20	91	0
1,1,1-Trichloroethane	0.353	0.295	-	16.4	20	79	0
2-Butanone	40	33.995	-	15	20	74	-.01
1,1-Dichloropropene	0.273	0.242	-	11.4	20	81	0
Benzene	0.871	0.773	-	11.3	20	83	0
tert-Amyl methyl ether	0.462	0.424	-	8.2	20	81	0
1,2-Dichloroethane-d4	0.217	0.191	-	12	20	84	0
1,2-Dichloroethane	0.231	0.191	-	17.3	20	78	0
Methyl cyclohexane	0.363	0.27	-	25.6*	20	68	0
Trichloroethene	0.256	0.212	-	17.2	20	81	0
Dibromomethane	0.119	0.106	-	10.9	20	83	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1401019-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.173	-	11.3	20	83	0
2-Chloroethyl vinyl ether	0.08	0.078	-	2.5	20	86	0
Bromodichloromethane	0.291	0.26	-	10.7	20	83	0
1,4-Dioxane	0.00132	0.00162*	-	-22.7*	20	108	0
cis-1,3-Dichloropropene	0.31	0.283	-	8.7	20	80	0
Chlorobenzene-d5	1	1	-	0	20	99	0
Toluene-d8	1.245	1.156	-	7.1	20	89	0
Toluene	0.746	0.627	-	16	20	84	0
4-Methyl-2-pentanone	40	31.505	-	21.2*	20	82	0
Tetrachloroethene	0.349	0.274	-	21.5*	20	85	0
trans-1,3-Dichloropropene	0.351	0.281	-	19.9	20	76	0
Ethyl methacrylate	0.23	0.199	-	13.5	20	88	0
1,1,2-Trichloroethane	0.185	0.156	-	15.7	20	84	0
Chlorodibromomethane	0.275	0.25	-	9.1	20	90	0
1,3-Dichloropropane	0.346	0.295	-	14.7	20	84	0
1,2-Dibromoethane	0.206	0.198	-	3.9	20	93	0
2-Hexanone	0.079	0.07*	-	11.4	20	86	0
Chlorobenzene	0.897	0.802	-	10.6	20	93	0
Ethylbenzene	1.399	1.264	-	9.6	20	88	0
1,1,1,2-Tetrachloroethane	0.327	0.285	-	12.8	20	89	0
p/m Xylene	0.605	0.504	-	16.7	20	84	0
o Xylene	0.515	0.473	-	8.2	20	83	0
Styrene	80	66.19	-	17.3	20	79	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	85	0
Bromoform	0.342	0.296	-	13.5	20	78	0
Isopropylbenzene	2.555	2.54	-	0.6	20	82	0
4-Bromofluorobenzene	0.703	0.692	-	1.6	20	85	0
Bromobenzene	0.653	0.615	-	5.8	20	85	0
n-Propylbenzene	3.154	2.912	-	7.7	20	79	0
1,4-Dichlorobutane	0.513	0.444	-	13.5	20	76	0
1,1,2,2-Tetrachloroethane	0.481	0.428	-	11	20	78	0
4-Ethyltoluene	2.46	2.452	-	0.3	20	82	0
2-Chlorotoluene	1.753	1.606	-	8.4	20	78	0
1,3,5-Trimethylbenzene	2.268	2.103	-	7.3	20	78	0
1,2,3-Trichloropropane	0.377	0.314	-	16.7	20	74	0
trans-1,4-Dichloro-2-buten	0.097	0.082	-	15.5	20	69	0
4-Chlorotoluene	1.793	1.607	-	10.4	20	76	0
tert-Butylbenzene	1.876	1.879	-	-0.2	20	81	0
1,2,4-Trimethylbenzene	2.199	2.057	-	6.5	20	77	0
sec-Butylbenzene	2.765	2.785	-	-0.7	20	82	0
p-Isopropyltoluene	2.465	2.424	-	1.7	20	78	0
1,3-Dichlorobenzene	1.395	1.28	-	8.2	20	80	0
1,4-Dichlorobenzene	1.383	1.259	-	9	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1401019-2		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.398	-	2.7	20	79	0
n-Butylbenzene	2.374	2.033	-	14.4	20	70	0
1,2-Dichlorobenzene	1.235	1.147	-	7.1	20	80	0
1,2,4,5-Tetramethylbenzene	40	33.966	-	15.1	20	81	0
1,2-Dibromo-3-chloropropan	0.068	0.062	-	8.8	20	76	0
1,3,5-Trichlorobenzene	0.874	0.773	-	11.6	20	76	0
Hexachlorobutadiene	0.363	0.331	-	8.8	20	79	0
1,2,4-Trichlorobenzene	0.728	0.668	-	8.2	20	77	0
Naphthalene	1.459	1.433	-	1.8	20	80	0
1,2,3-Trichlorobenzene	0.657	0.611	-	7	20	79	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-9		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	91	0
Dichlorodifluoromethane	0.19	0.169	-	11.1	20	85	0
Chloromethane	0.196	0.17	-	13.3	20	87	-.02
Vinyl chloride	0.508	0.398	-	21.7*	20	73	0
Bromomethane	40	42.887	-	-7.2	20	98	0
Chloroethane	0.454	0.379	-	16.5	20	81	-.01
Trichlorofluoromethane	1.028	0.891	-	13.3	20	82	0
Ethyl ether	0.297	0.252	-	15.2	20	79	0
1,1-Dichloroethene	0.195	0.183	-	6.2	20	91	0
Carbon disulfide	0.569	0.452	-	20.6*	20	79	0
Freon-113	0.213	0.158	-	25.8*	20	71	-.01
Acrolein	0.01052	0.00873*	-	17	20	78	0
Methylene chloride	0.231	0.214	-	7.4	20	93	0
Acetone	40	37.812	-	5.5	20	82	-.01
trans-1,2-Dichloroethene	0.215	0.223	-	-3.7	20	99	0
Methyl acetate	0.066	0.059*	-	10.6	20	82	-.01
Methyl tert-butyl ether	0.418	0.424	-	-1.4	20	93	0
tert-Butyl alcohol	0.011	0.011*	-	0	20	92	0
Diisopropyl ether	0.46	0.409	-	11.1	20	80	0
1,1-Dichloroethane	0.362	0.304	-	16	20	79	0
Halothane	0.182	0.162	-	11	20	84	0
Acrylonitrile	0.032	0.029*	-	9.4	20	81	-.01
Ethyl tert-butyl ether	0.486	0.427	-	12.1	20	79	0
Vinyl acetate	0.292	0.256	-	12.3	20	78	0
cis-1,2-Dichloroethene	0.261	0.23	-	11.9	20	82	0
2,2-Dichloropropane	0.309	0.266	-	13.9	20	82	0
Bromochloromethane	0.116	0.11	-	5.2	20	89	0
Cyclohexane	0.275	0.208	-	24.4*	20	67	0
Chloroform	0.4	0.357	-	10.8	20	86	0
Ethyl acetate	0.099	0.085	-	14.1	20	78	0
Carbon tetrachloride	0.31	0.269	-	13.2	20	81	0
Tetrahydrofuran	40	33.776	-	15.6	20	73	-.02
Dibromofluoromethane	0.262	0.256	-	2.3	20	91	0
1,1,1-Trichloroethane	0.353	0.295	-	16.4	20	79	0
2-Butanone	40	33.995	-	15	20	74	-.01
1,1-Dichloropropene	0.273	0.242	-	11.4	20	81	0
Benzene	0.871	0.773	-	11.3	20	83	0
tert-Amyl methyl ether	0.462	0.424	-	8.2	20	81	0
1,2-Dichloroethane-d4	0.217	0.191	-	12	20	84	0
1,2-Dichloroethane	0.231	0.191	-	17.3	20	78	0
Methyl cyclohexane	0.363	0.27	-	25.6*	20	68	0
Trichloroethene	0.256	0.212	-	17.2	20	81	0
Dibromomethane	0.119	0.106	-	10.9	20	83	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2033722
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: VOA117	**Calibration Date**	: 08/20/20 05:33
Lab File ID	: V17200820A01	**Init. Calib. Date(s)**	: 07/10/20 07/10/20
Sample No	: WG1400899-9	**Init. Calib. Times**	: 17:00 20:28
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.195	0.173	-	11.3	20	83	0
2-Chloroethyl vinyl ether	0.08	0.078	-	2.5	20	86	0
Bromodichloromethane	0.291	0.26	-	10.7	20	83	0
1,4-Dioxane	0.00132	0.00162*	-	-22.7*	20	108	0
cis-1,3-Dichloropropene	0.31	0.283	-	8.7	20	80	0
Chlorobenzene-d5	1	1	-	0	20	99	0
Toluene-d8	1.245	1.156	-	7.1	20	89	0
Toluene	0.746	0.627	-	16	20	84	0
4-Methyl-2-pentanone	40	31.505	-	21.2*	20	82	0
Tetrachloroethene	0.349	0.274	-	21.5*	20	85	0
trans-1,3-Dichloropropene	0.351	0.281	-	19.9	20	76	0
Ethyl methacrylate	0.23	0.199	-	13.5	20	88	0
1,1,2-Trichloroethane	0.185	0.156	-	15.7	20	84	0
Chlorodibromomethane	0.275	0.25	-	9.1	20	90	0
1,3-Dichloropropane	0.346	0.295	-	14.7	20	84	0
1,2-Dibromoethane	0.206	0.198	-	3.9	20	93	0
2-Hexanone	0.079	0.07*	-	11.4	20	86	0
Chlorobenzene	0.897	0.802	-	10.6	20	93	0
Ethylbenzene	1.399	1.264	-	9.6	20	88	0
1,1,1,2-Tetrachloroethane	0.327	0.285	-	12.8	20	89	0
p/m Xylene	0.605	0.504	-	16.7	20	84	0
o Xylene	0.515	0.473	-	8.2	20	83	0
Styrene	80	66.19	-	17.3	20	79	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	85	0
Bromoform	0.342	0.296	-	13.5	20	78	0
Isopropylbenzene	2.555	2.54	-	0.6	20	82	0
4-Bromofluorobenzene	0.703	0.692	-	1.6	20	85	0
Bromobenzene	0.653	0.615	-	5.8	20	85	0
n-Propylbenzene	3.154	2.912	-	7.7	20	79	0
1,4-Dichlorobutane	0.513	0.444	-	13.5	20	76	0
1,1,2,2-Tetrachloroethane	0.481	0.428	-	11	20	78	0
4-Ethyltoluene	2.46	2.452	-	0.3	20	82	0
2-Chlorotoluene	1.753	1.606	-	8.4	20	78	0
1,3,5-Trimethylbenzene	2.268	2.103	-	7.3	20	78	0
1,2,3-Trichloropropane	0.377	0.314	-	16.7	20	74	0
trans-1,4-Dichloro-2-buten	0.097	0.082	-	15.5	20	69	0
4-Chlorotoluene	1.793	1.607	-	10.4	20	76	0
tert-Butylbenzene	1.876	1.879	-	-0.2	20	81	0
1,2,4-Trimethylbenzene	2.199	2.057	-	6.5	20	77	0
sec-Butylbenzene	2.765	2.785	-	-0.7	20	82	0
p-Isopropyltoluene	2.465	2.424	-	1.7	20	78	0
1,3-Dichlorobenzene	1.395	1.28	-	8.2	20	80	0
1,4-Dichlorobenzene	1.383	1.259	-	9	20	80	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2033722	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: VOA117		**Calibration Date**	: 08/20/20 05:33	
Lab File ID	: V17200820A01		**Init. Calib. Date(s)**	: 07/10/20	07/10/20
Sample No	: WG1400899-9		**Init. Calib. Times**	: 17:00	20:28
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.437	1.398	-	2.7	20	79	0
n-Butylbenzene	2.374	2.033	-	14.4	20	70	0
1,2-Dichlorobenzene	1.235	1.147	-	7.1	20	80	0
1,2,4,5-Tetramethylbenzene	40	33.966	-	15.1	20	81	0
1,2-Dibromo-3-chloropropan	0.068	0.062	-	8.8	20	76	0
1,3,5-Trichlorobenzene	0.874	0.773	-	11.6	20	76	0
Hexachlorobutadiene	0.363	0.331	-	8.8	20	79	0
1,2,4-Trichlorobenzene	0.728	0.668	-	8.2	20	77	0
Naphthalene	1.459	1.433	-	1.8	20	80	0
1,2,3-Trichlorobenzene	0.657	0.611	-	7	20	79	0

* Value outside of QC limits.

ANALYTICAL REPORT

Lab Number:	L2034373
Client:	Beta Group, Inc. 701 George Washington Highway Lincoln, RI 02865
ATTN:	Joe McLoughlin
Phone:	(401) 333-2382
Project Name:	LUNENBURG
Project Number:	6893
Report Date:	08/28/20

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Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2034373-01	MW-101	WATER	LUNENBURG, MA	08/21/20 09:10	08/21/20
L2034373-02	MW-105	WATER	LUNENBURG, MA	08/21/20 10:00	08/21/20
L2034373-03	MW-104	WATER	LUNENBURG, MA	08/21/20 10:50	08/21/20
L2034373-04	MW-103	WATER	LUNENBURG, MA	08/21/20 12:10	08/21/20
L2034373-05	MW-102	WATER	LUNENBURG, MA	08/21/20 13:20	08/21/20
L2034373-06	DUP	WATER	LUNENBURG, MA	08/21/20 11:10	08/21/20
L2034373-07	EQUIP BLANK	WATER	LUNENBURG, MA	08/21/20 08:30	08/21/20
L2034373-08	TRIP BLANK	WATER	LUNENBURG, MA	08/18/20 00:00	08/21/20

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

MADEP MCP Response Action Analytical Report Certification

This form provides certifications for all samples performed by MCP methods. Please refer to the Sample Results and Container Information sections of this report for specification of MCP methods used for each analysis. The following questions pertain only to MCP Analytical Methods.

An affirmative response to questions A through F is required for "Presumptive Certainty" status		
A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	YES
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	YES
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	YES
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?"	YES
E a.	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	YES
E b.	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	N/A
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	YES

A response to questions G, H and I is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	NO
H	Were all QC performance standards specified in the CAM protocol(s) achieved?	NO
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	NO

For any questions answered "No", please refer to the case narrative section on the following page(s).

Please note that sample matrix information is located in the Sample Results section of this report.

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: LUNENBURG **Lab Number:** L2034373
Project Number: 6893 **Report Date:** 08/28/20

Case Narrative (continued)

MCP Related Narratives

Volatile Organics

In reference to question H:

The initial calibration, associated with L2034373-01 through -08, did not meet the method required minimum response factor on the lowest calibration standard for 1,4-dioxane (0.0021), as well as the average response factor for acetone and 1,4-dioxane.

The continuing calibration standards, associated with L2034373-01 through -08, are outside the acceptance criteria for several compounds; however, they are within overall method allowances. A copy of the continuing calibration standards is included as an addendum to this report.

EPH

In reference to question G:

L2034373-01 through -06: One or more of the target analytes did not achieve the requested CAM reporting limits.

In reference to question H:

L2034373-01: The surrogate recovery was outside the acceptance criteria for chloro-octadecane (29%); however, re-extraction achieved similar results: chloro-octadecane (30%). The results of both extractions are reported; however, all associated compounds are considered to have a potential bias.

VPH

In reference to question G:

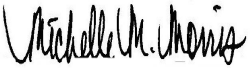
L2034373-04 and -05: One or more of the target analytes did not achieve the requested CAM reporting limits.

Total Metals

In reference to question I:

All samples were analyzed for a subset of MCP analytes per client request.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Michelle M. Morris

Title: Technical Director/Representative Date: 08/28/20

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
MCP Volatile Organics - Westborough Lab								
8260C	Batch QC	WG1402996-4	Naphthalene	LCSD	21	20	01-05,07-08	non-directional bias
Extractable Petroleum Hydrocarbons - Westborough Lab								
EPH-19-2.1	MW-101	L2034373-01	Chloro-Octadecane	Surrogate	29	40-140	-	potential low bias
EPH-19-2.1	MW-101	L2034373-01 RE	Chloro-Octadecane	Surrogate	30	40-140	-	potential low bias
EPH-19-2.1	Batch QC	WG1402001-3	C19-C36 Aliphatics	LCSD	31	25	01-06	non-directional bias
EPH-19-2.1	Batch QC	WG1403212-3	C19-C36 Aliphatics	LCSD	27	25	01	non-directional bias
MCP Polychlorinated Biphenyls - Westborough Lab								
8082A	Laboratory Method Bl	WG1401976-1	Decachlorobiphenyl (A)	Surrogate	24	30-150	-	potential low bias
8082A	Batch QC	WG1401976-2	Decachlorobiphenyl (A)	Surrogate	29	30-150	-	potential low bias
8082A	Batch QC	WG1401976-2	Decachlorobiphenyl (B)	Surrogate	28	30-150	-	potential low bias

ORGANICS

VOLATILES

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 11:23
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	3.7		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 Date Collected: 08/21/20 09:10

Client ID: MW-101 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	110		ug/l	2.0	--	1
o-Xylene	40		ug/l	1.0	--	1
Xylenes, Total	150		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	11		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	7.1		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 Date Collected: 08/21/20 09:10

Client ID: MW-101 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	17		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	41		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	101		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00
Client ID: MW-105 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 10:53
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	5.3		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00

Client ID: MW-105 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	110		ug/l	2.0	--	1
o-Xylene	32		ug/l	1.0	--	1
Xylenes, Total	140		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	3.3		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00

Client ID: MW-105 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	12		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	31		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50
Client ID: MW-104 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 11:53
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50

Client ID: MW-104 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	9.7		ug/l	2.0	--	1
o-Xylene	2.3		ug/l	1.0	--	1
Xylenes, Total	12		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50

Client ID: MW-104 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	4.0		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 12:24
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	10		ug/l	0.50	--	1
Toluene	3.6		ug/l	1.0	--	1
Ethylbenzene	370	E	ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 Date Collected: 08/21/20 12:10

Client ID: MW-103 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	6.5		ug/l	2.0	--	1
p/m-Xylene	1200	E	ug/l	2.0	--	1
o-Xylene	9.4		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	6.1		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	17		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	50		ug/l	2.0	--	1
n-Propylbenzene	34		ug/l	2.0	--	1
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 Date Collected: 08/21/20 12:10

Client ID: MW-103 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	50		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	230	E	ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	100		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	95		70-130
Dibromofluoromethane	90		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 D
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 08:41
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Ethylbenzene	280		ug/l	10	--	10
p/m-Xylene	1000		ug/l	20	--	10
Xylenes, Total	1000		ug/l	1.0	--	10
1,2,4-Trimethylbenzene	180		ug/l	20	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20
Client ID: MW-102 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 12:54
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	17		ug/l	0.50	--	1
Toluene	6.3		ug/l	1.0	--	1
Ethylbenzene	560	E	ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20

Client ID: MW-102 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	5.6		ug/l	2.0	--	1
p/m-Xylene	1500	E	ug/l	2.0	--	1
o-Xylene	16		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	2.6		ug/l	2.0	--	1
sec-Butylbenzene	2.9		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	29		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	85		ug/l	2.0	--	1
n-Propylbenzene	58		ug/l	2.0	--	1
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20

Client ID: MW-102 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	86		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	370	E	ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	107		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	93		70-130
Dibromofluoromethane	85		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 D
Client ID: MW-102
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 09:11
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Ethylbenzene	690		ug/l	10	--	10
p/m-Xylene	2500		ug/l	20	--	10
Xylenes, Total	2500		ug/l	1.0	--	10
1,2,4-Trimethylbenzene	420		ug/l	20	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	99		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10
Client ID: DUP Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 08:11
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10

Client ID: DUP Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	9.1		ug/l	2.0	--	1
o-Xylene	2.2		ug/l	1.0	--	1
Xylenes, Total	11		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10

Client ID: DUP Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	3.8		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	98		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 08:30
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 13:55
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07 Date Collected: 08/21/20 08:30

Client ID: EQUIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07 Date Collected: 08/21/20 08:30

Client ID: EQUIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	104		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00
Client ID: TRIP BLANK Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 09:52
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00

Client ID: TRIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00

Client ID: TRIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	105		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	104		70-130
Dibromofluoromethane	98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
Methylene chloride	110		100		70-130	10		20
1,1-Dichloroethane	110		100		70-130	10		20
Chloroform	100		97		70-130	3		20
Carbon tetrachloride	92		93		70-130	1		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	86		88		70-130	2		20
1,1,2-Trichloroethane	94		95		70-130	1		20
Tetrachloroethene	100		97		70-130	3		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	92		90		70-130	2		20
1,2-Dichloroethane	95		92		70-130	3		20
1,1,1-Trichloroethane	96		94		70-130	2		20
Bromodichloromethane	91		92		70-130	1		20
trans-1,3-Dichloropropene	86		86		70-130	0		20
cis-1,3-Dichloropropene	95		95		70-130	0		20
1,1-Dichloropropene	100		98		70-130	2		20
Bromoform	98		92		70-130	6		20
1,1,2,2-Tetrachloroethane	110		100		70-130	10		20
Benzene	110		100		70-130	10		20
Toluene	100		98		70-130	2		20
Ethylbenzene	99		96		70-130	3		20
Chloromethane	130		120		70-130	8		20
Bromomethane	85		87		70-130	2		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
Vinyl chloride	99		98		70-130	1		20
Chloroethane	100		100		70-130	0		20
1,1-Dichloroethene	88		87		70-130	1		20
trans-1,2-Dichloroethene	100		100		70-130	0		20
Trichloroethene	100		98		70-130	2		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	110		100		70-130	10		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	90		90		70-130	0		20
p/m-Xylene	90		90		70-130	0		20
o-Xylene	85		90		70-130	6		20
cis-1,2-Dichloroethene	100		100		70-130	0		20
Dibromomethane	94		92		70-130	2		20
1,2,3-Trichloropropane	110		100		70-130	10		20
Styrene	90		90		70-130	0		20
Dichlorodifluoromethane	85		84		70-130	1		20
Acetone	110		110		70-130	0		20
Carbon disulfide	88		88		70-130	0		20
Methyl ethyl ketone	120		120		70-130	0		20
Methyl isobutyl ketone	91		92		70-130	1		20
2-Hexanone	100		100		70-130	0		20
Bromochloromethane	100		100		70-130	0		20
Tetrahydrofuran	120		120		70-130	0		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
2,2-Dichloropropane	93		90		70-130	3		20
1,2-Dibromoethane	91		92		70-130	1		20
1,3-Dichloropropane	93		93		70-130	0		20
1,1,1,2-Tetrachloroethane	94		95		70-130	1		20
Bromobenzene	120		100		70-130	18		20
n-Butylbenzene	100		110		70-130	10		20
sec-Butylbenzene	110		100		70-130	10		20
tert-Butylbenzene	110		100		70-130	10		20
o-Chlorotoluene	110		100		70-130	10		20
p-Chlorotoluene	100		98		70-130	2		20
1,2-Dibromo-3-chloropropane	100		91		70-130	9		20
Hexachlorobutadiene	120		120		70-130	0		20
Isopropylbenzene	120		100		70-130	18		20
p-Isopropyltoluene	100		100		70-130	0		20
Naphthalene	89		110		70-130	**21**	Q	20
n-Propylbenzene	110		100		70-130	10		20
1,2,3-Trichlorobenzene	94		110		70-130	16		20
1,2,4-Trichlorobenzene	92		110		70-130	18		20
1,3,5-Trimethylbenzene	87		100		70-130	14		20
1,2,4-Trimethylbenzene	87		100		70-130	14		20
Diethyl ether	85		84		70-130	1		20
Diisopropyl Ether	130		130		70-130	0		20
Ethyl-Tert-Butyl-Ether	98		97		70-130	1		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab	Associated sample(s): 01-05,07-08		Batch: WG1402996-3 WG1402996-4					
Tertiary-Amyl Methyl Ether	89		89		70-130	0		20
1,4-Dioxane	112		102		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	92		91		70-130
Toluene-d8	101		101		70-130
4-Bromofluorobenzene	112		101		70-130
Dibromofluoromethane	99		98		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Methylene chloride	110		100		70-130	10		20
1,1-Dichloroethane	110		110		70-130	0		20
Chloroform	99		99		70-130	0		20
Carbon tetrachloride	94		95		70-130	1		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	89		91		70-130	2		20
1,1,2-Trichloroethane	94		95		70-130	1		20
Tetrachloroethene	100		100		70-130	0		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	90		92		70-130	2		20
1,2-Dichloroethane	94		92		70-130	2		20
1,1,1-Trichloroethane	96		95		70-130	1		20
Bromodichloromethane	93		93		70-130	0		20
trans-1,3-Dichloropropene	88		88		70-130	0		20
cis-1,3-Dichloropropene	97		97		70-130	0		20
1,1-Dichloropropene	99		99		70-130	0		20
Bromoform	94		94		70-130	0		20
1,1,2,2-Tetrachloroethane	100		100		70-130	0		20
Benzene	100		100		70-130	0		20
Toluene	100		100		70-130	0		20
Ethylbenzene	98		98		70-130	0		20
Chloromethane	120		120		70-130	0		20
Bromomethane	82		80		70-130	2		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Vinyl chloride	95		96		70-130	1		20
Chloroethane	98		100		70-130	2		20
1,1-Dichloroethene	87		89		70-130	2		20
trans-1,2-Dichloroethene	100		100		70-130	0		20
Trichloroethene	99		100		70-130	1		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	100		100		70-130	0		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	93		93		70-130	0		20
p/m-Xylene	95		95		70-130	0		20
o-Xylene	90		95		70-130	5		20
cis-1,2-Dichloroethene	100		100		70-130	0		20
Dibromomethane	94		94		70-130	0		20
1,2,3-Trichloropropane	100		99		70-130	1		20
Styrene	90		90		70-130	0		20
Dichlorodifluoromethane	84		84		70-130	0		20
Acetone	110		110		70-130	0		20
Carbon disulfide	87		89		70-130	2		20
Methyl ethyl ketone	120		110		70-130	9		20
Methyl isobutyl ketone	92		90		70-130	2		20
2-Hexanone	100		100		70-130	0		20
Bromochloromethane	100		100		70-130	0		20
Tetrahydrofuran	120		120		70-130	0		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
2,2-Dichloropropane	94		93		70-130	1		20
1,2-Dibromoethane	92		93		70-130	1		20
1,3-Dichloropropane	94		92		70-130	2		20
1,1,1,2-Tetrachloroethane	96		97		70-130	1		20
Bromobenzene	110		110		70-130	0		20
n-Butylbenzene	110		110		70-130	0		20
sec-Butylbenzene	100		100		70-130	0		20
tert-Butylbenzene	100		100		70-130	0		20
o-Chlorotoluene	110		100		70-130	10		20
p-Chlorotoluene	98		98		70-130	0		20
1,2-Dibromo-3-chloropropane	92		93		70-130	1		20
Hexachlorobutadiene	120		130		70-130	8		20
Isopropylbenzene	100		100		70-130	0		20
p-Isopropyltoluene	100		110		70-130	10		20
Naphthalene	110		110		70-130	0		20
n-Propylbenzene	100		100		70-130	0		20
1,2,3-Trichlorobenzene	110		120		70-130	9		20
1,2,4-Trichlorobenzene	110		120		70-130	9		20
1,3,5-Trimethylbenzene	99		100		70-130	1		20
1,2,4-Trimethylbenzene	100		100		70-130	0		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	130		130		70-130	0		20
Ethyl-Tert-Butyl-Ether	100		100		70-130	0		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Tertiary-Amyl Methyl Ether	93		92		70-130	1		20
1,4-Dioxane	90		92		70-130	2		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	91		89		70-130
Toluene-d8	100		99		70-130
4-Bromofluorobenzene	100		100		70-130
Dibromofluoromethane	97		98		70-130

PETROLEUM HYDROCARBONS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 13:55
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	405		ug/l	100	--	1
C9-C10 Aromatics	220		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	2.62		ug/l	2.00	--	1
p/m-Xylene	118		ug/l	2.00	--	1
o-Xylene	41.5		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	8.41		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	107		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-01	Date Collected:	08/21/20 09:10
Client ID:	MW-101	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/26/20 13:00	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/26/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Extractable Petroleum Hydrocarbons - Westborough Lab

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	541		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Lab Number: L2034373
Project Number: 6893
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**29**	Q	40-140
o-Terphenyl	54		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-01 RE	Date Collected:	08/21/20 09:10
Client ID:	MW-101	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/26/20 15:47
Analytical Date:	08/27/20 09:46	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/27/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	499		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Lab Number: L2034373
Project Number: 6893
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 RE
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**30**	Q	40-140
o-Terphenyl	59		40-140
2-Fluorobiphenyl	72		40-140
2-Bromonaphthalene	75		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 14:25
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	238		ug/l	100	--	1
C9-C10 Aromatics	101		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	3.72		ug/l	2.00	--	1
p/m-Xylene	90.7		ug/l	2.00	--	1
o-Xylene	27.8		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	105		70-130
2,5-Dibromotoluene-FID	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-02	Date Collected:	08/21/20 10:00
Client ID:	MW-105	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 07:53	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	53		40-140
o-Terphenyl	55		40-140
2-Fluorobiphenyl	58		40-140
2-Bromonaphthalene	60		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 14:56
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	ND		ug/l	100	--	1
C9-C10 Aromatics	ND		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	ND		ug/l	2.00	--	1
p/m-Xylene	9.12		ug/l	2.00	--	1
o-Xylene	ND		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	108		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-03	Date Collected:	08/21/20 10:50
Client ID:	MW-104	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 08:18	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	56		40-140
o-Terphenyl	60		40-140
2-Fluorobiphenyl	64		40-140
2-Bromonaphthalene	66		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-04	Date Collected:	08/21/20 12:10
Client ID:	MW-103	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 08:43	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	30.5		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	55		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	71		40-140
2-Bromonaphthalene	73		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 D
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 15:26
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	400	--	4
C9-C12 Aliphatics	2300		ug/l	400	--	4
C9-C10 Aromatics	634		ug/l	400	--	4
C5-C8 Aliphatics, Adjusted	ND		ug/l	400	--	4
C9-C12 Aliphatics, Adjusted	ND		ug/l	400	--	4
Benzene	ND		ug/l	8.00	--	4
Toluene	ND		ug/l	8.00	--	4
Ethylbenzene	298		ug/l	8.00	--	4
p/m-Xylene	1160		ug/l	8.00	--	4
o-Xylene	ND		ug/l	8.00	--	4
Methyl tert butyl ether	ND		ug/l	12.0	--	4
Naphthalene	40.8		ug/l	16.0	--	4

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	109		70-130
2,5-Dibromotoluene-FID	102		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-05	Date Collected:	08/21/20 13:20
Client ID:	MW-102	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 09:08	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	43.1		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	46		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	64		40-140
2-Bromonaphthalene	66		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-05 D	Date Collected:	08/21/20 13:20
Client ID:	MW-102	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/27/20 15:56		
Analyst:	BAD		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	1000	--	10
C9-C12 Aliphatics	5340		ug/l	1000	--	10
C9-C10 Aromatics	1450		ug/l	1000	--	10
C5-C8 Aliphatics, Adjusted	ND		ug/l	1000	--	10
C9-C12 Aliphatics, Adjusted	ND		ug/l	1000	--	10
Benzene	ND		ug/l	20.0	--	10
Toluene	ND		ug/l	20.0	--	10
Ethylbenzene	707		ug/l	20.0	--	10
p/m-Xylene	2710		ug/l	20.0	--	10
o-Xylene	ND		ug/l	20.0	--	10
Methyl tert butyl ether	ND		ug/l	30.0	--	10
Naphthalene	94.2		ug/l	40.0	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	97		70-130
2,5-Dibromotoluene-FID	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 16:26
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	ND		ug/l	100	--	1
C9-C10 Aromatics	ND		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	ND		ug/l	2.00	--	1
p/m-Xylene	10.0		ug/l	2.00	--	1
o-Xylene	2.23		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	106		70-130
2,5-Dibromotoluene-FID	102		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-06	Date Collected:	08/21/20 11:10
Client ID:	DUP	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 09:33	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Extractable Petroleum Hydrocarbons - Westborough Lab

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	64		40-140
o-Terphenyl	60		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	71		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/25/20 07:04
Analyst: SC

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 18:26
Cleanup Method: EPH-04-1
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-06 Batch: WG1402001-1					
C9-C18 Aliphatics	ND		ug/l	100	--
C19-C36 Aliphatics	ND		ug/l	100	--
C11-C22 Aromatics	ND		ug/l	100	--
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--
Naphthalene	ND		ug/l	10.0	--
2-Methylnaphthalene	ND		ug/l	10.0	--
Acenaphthylene	ND		ug/l	10.0	--
Acenaphthene	ND		ug/l	10.0	--
Fluorene	ND		ug/l	10.0	--
Phenanthrene	ND		ug/l	10.0	--
Anthracene	ND		ug/l	10.0	--
Fluoranthene	ND		ug/l	10.0	--
Pyrene	ND		ug/l	10.0	--
Benzo(a)anthracene	ND		ug/l	10.0	--
Chrysene	ND		ug/l	10.0	--
Benzo(b)fluoranthene	ND		ug/l	10.0	--
Benzo(k)fluoranthene	ND		ug/l	10.0	--
Benzo(a)pyrene	ND		ug/l	10.0	--
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--
Benzo(ghi)perylene	ND		ug/l	10.0	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	64		40-140
o-Terphenyl	57		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/27/20 09:21
Analyst: MEO

Extraction Method: EPA 3510C
Extraction Date: 08/26/20 15:47
Cleanup Method: EPH-04-1
Cleanup Date: 08/27/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01 Batch: WG1403212-1					
C9-C18 Aliphatics	ND		ug/l	100	--
C19-C36 Aliphatics	ND		ug/l	100	--
C11-C22 Aromatics	ND		ug/l	100	--
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--
Naphthalene	ND		ug/l	10.0	--
2-Methylnaphthalene	ND		ug/l	10.0	--
Acenaphthylene	ND		ug/l	10.0	--
Acenaphthene	ND		ug/l	10.0	--
Fluorene	ND		ug/l	10.0	--
Phenanthrene	ND		ug/l	10.0	--
Anthracene	ND		ug/l	10.0	--
Fluoranthene	ND		ug/l	10.0	--
Pyrene	ND		ug/l	10.0	--
Benzo(a)anthracene	ND		ug/l	10.0	--
Chrysene	ND		ug/l	10.0	--
Benzo(b)fluoranthene	ND		ug/l	10.0	--
Benzo(k)fluoranthene	ND		ug/l	10.0	--
Benzo(a)pyrene	ND		ug/l	10.0	--
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--
Benzo(ghi)perylene	ND		ug/l	10.0	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	57		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 10:53
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-06 Batch: WG1404116-4					
C5-C8 Aliphatics	ND		ug/l	100	--
C9-C12 Aliphatics	ND		ug/l	100	--
C9-C10 Aromatics	ND		ug/l	100	--
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--
Benzene	ND		ug/l	2.00	--
Toluene	ND		ug/l	2.00	--
Ethylbenzene	ND		ug/l	2.00	--
p/m-Xylene	ND		ug/l	2.00	--
o-Xylene	ND		ug/l	2.00	--
Methyl tert butyl ether	ND		ug/l	3.00	--
Naphthalene	ND		ug/l	4.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	101		70-130
2,5-Dibromotoluene-FID	96		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1402001-2 WG1402001-3								
C9-C18 Aliphatics	61		67		40-140	9		25
C19-C36 Aliphatics	70		96		40-140	**31**	Q	25
C11-C22 Aromatics	68		69		40-140	1		25
Naphthalene	56		49		40-140	13		25
2-Methylnaphthalene	62		54		40-140	14		25
Acenaphthylene	62		55		40-140	12		25
Acenaphthene	68		61		40-140	11		25
Fluorene	68		64		40-140	6		25
Phenanthrene	69		69		40-140	0		25
Anthracene	69		70		40-140	1		25
Fluoranthene	72		78		40-140	8		25
Pyrene	71		77		40-140	8		25
Benzo(a)anthracene	68		75		40-140	10		25
Chrysene	63		69		40-140	9		25
Benzo(b)fluoranthene	79		87		40-140	10		25
Benzo(k)fluoranthene	55		60		40-140	9		25
Benzo(a)pyrene	64		70		40-140	9		25
Indeno(1,2,3-cd)Pyrene	64		68		40-140	6		25
Dibenzo(a,h)anthracene	61		66		40-140	8		25
Benzo(ghi)perylene	56		60		40-140	7		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1402001-2 WG1402001-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	68		69		40-140
o-Terphenyl	56		57		40-140
2-Fluorobiphenyl	60		63		40-140
2-Bromonaphthalene	62		65		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01 Batch: WG1403212-2 WG1403212-3								
C9-C18 Aliphatics	58		47		40-140	21		25
C19-C36 Aliphatics	87		66		40-140	**27**	Q	25
C11-C22 Aromatics	66		59		40-140	11		25
Naphthalene	56		51		40-140	9		25
2-Methylnaphthalene	61		55		40-140	10		25
Acenaphthylene	60		54		40-140	11		25
Acenaphthene	66		58		40-140	13		25
Fluorene	66		60		40-140	10		25
Phenanthrene	66		60		40-140	10		25
Anthracene	67		60		40-140	11		25
Fluoranthene	71		64		40-140	10		25
Pyrene	68		61		40-140	11		25
Benzo(a)anthracene	68		60		40-140	13		25
Chrysene	67		59		40-140	13		25
Benzo(b)fluoranthene	76		68		40-140	11		25
Benzo(k)fluoranthene	57		50		40-140	13		25
Benzo(a)pyrene	66		57		40-140	15		25
Indeno(1,2,3-cd)Pyrene	64		54		40-140	17		25
Dibenzo(a,h)anthracene	57		50		40-140	13		25
Benzo(ghi)perylene	60		51		40-140	16		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01 Batch: WG1403212-2 WG1403212-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	62		44		40-140
o-Terphenyl	59		54		40-140
2-Fluorobiphenyl	63		61		40-140
2-Bromonaphthalene	65		63		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1404116-2 WG1404116-3								
C5-C8 Aliphatics	103		107		70-130	4		25
C9-C12 Aliphatics	106		110		70-130	4		25
C9-C10 Aromatics	111		114		70-130	3		25
Benzene	110		115		70-130	4		25
Toluene	110		114		70-130	4		25
Ethylbenzene	110		114		70-130	4		25
p/m-Xylene	111		114		70-130	3		25
o-Xylene	111		115		70-130	4		25
Methyl tert butyl ether	115		121		70-130	5		25
Naphthalene	116		121		70-130	4		25
1,2,4-Trimethylbenzene	111		114		70-130	3		25
Pentane	103		106		70-130	3		25
2-Methylpentane	104		109		70-130	5		25
2,2,4-Trimethylpentane	104		108		70-130	4		25
n-Nonane	107		111		30-130	4		25
n-Decane	104		107		70-130	3		25
n-Butylcyclohexane	108		112		70-130	4		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	111		113		70-130
2,5-Dibromotoluene-FID	105		105		70-130

PCBS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 12:55
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	79		30-150	A
Decachlorobiphenyl	53		30-150	A
2,4,5,6-Tetrachloro-m-xylene	73		30-150	B
Decachlorobiphenyl	55		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:03
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	B
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	78		30-150	A
Decachlorobiphenyl	49		30-150	A
2,4,5,6-Tetrachloro-m-xylene	70		30-150	B
Decachlorobiphenyl	48		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:10
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	87		30-150	A
Decachlorobiphenyl	57		30-150	A
2,4,5,6-Tetrachloro-m-xylene	80		30-150	B
Decachlorobiphenyl	59		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:18
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	0.407		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	0.407		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	83		30-150	A
Decachlorobiphenyl	47		30-150	A
2,4,5,6-Tetrachloro-m-xylene	73		30-150	B
Decachlorobiphenyl	49		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:25
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	84		30-150	A
Decachlorobiphenyl	47		30-150	A
2,4,5,6-Tetrachloro-m-xylene	76		30-150	B
Decachlorobiphenyl	53		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:32
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	73		30-150	A
Decachlorobiphenyl	43		30-150	A
2,4,5,6-Tetrachloro-m-xylene	61		30-150	B
Decachlorobiphenyl	44		30-150	B

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:17
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Column
MCP Polychlorinated Biphenyls - Westborough Lab for sample(s): 01-06 Batch: WG1401976-1						
Aroclor 1016	ND		ug/l	0.250	--	A
Aroclor 1221	ND		ug/l	0.250	--	A
Aroclor 1232	ND		ug/l	0.250	--	A
Aroclor 1242	ND		ug/l	0.250	--	A
Aroclor 1248	ND		ug/l	0.250	--	A
Aroclor 1254	ND		ug/l	0.250	--	A
Aroclor 1260	ND		ug/l	0.250	--	A
Aroclor 1262	ND		ug/l	0.250	--	A
Aroclor 1268	ND		ug/l	0.250	--	A
PCBs, Total	ND		ug/l	0.250	--	A

Surrogate	%Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	75		30-150	A
Decachlorobiphenyl	**24**	Q	30-150	A
2,4,5,6-Tetrachloro-m-xylene	69		30-150	B
Decachlorobiphenyl	30		30-150	B

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits	Column
MCP Polychlorinated Biphenyls - Westborough Lab Associated sample(s): 01-06 Batch: WG1401976-2 WG1401976-3									
Aroclor 1016	75		75		40-140	1		20	A
Aroclor 1260	52		59		40-140	12		20	A

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	82		80		30-150	A
Decachlorobiphenyl	**29**	Q	32		30-150	A
2,4,5,6-Tetrachloro-m-xylene	72		70		30-150	B
Decachlorobiphenyl	**28**	Q	34		30-150	B

METALS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0074		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Chromium, Total	0.042		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Copper, Total	0.016		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:05	EPA 7470A	97,7470A	EW
Nickel, Total	0.032		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0190		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Chromium, Total	0.088		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Copper, Total	0.037		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Lead, Total	0.025		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:15	EPA 7470A	97,7470A	EW
Nickel, Total	0.066		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Zinc, Total	0.078		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0077		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:19	EPA 7470A	97,7470A	EW
Nickel, Total	0.040		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0229		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Chromium, Total	0.018		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Copper, Total	0.011		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:22	EPA 7470A	97,7470A	EW
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0218		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:25	EPA 7470A	97,7470A	EW
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0063		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:29	EPA 7470A	97,7470A	EW
Nickel, Total	0.040		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-06 Batch: WG1402225-1										
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Arsenic, Total	ND		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-06 Batch: WG1402226-1										
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 19:26	97,7470A	EW

Prep Information

Digestion Method: EPA 7470A

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-06 Batch: WG1402225-2 WG1402225-3								
Antimony, Total	93		103		80-120	10		20
Arsenic, Total	104		108		80-120	4		20
Beryllium, Total	96		102		80-120	6		20
Cadmium, Total	102		106		80-120	4		20
Chromium, Total	94		99		80-120	5		20
Copper, Total	96		101		80-120	5		20
Lead, Total	102		105		80-120	3		20
Nickel, Total	92		96		80-120	4		20
Selenium, Total	100		105		80-120	5		20
Silver, Total	98		102		80-120	4		20
Thallium, Total	96		100		80-120	4		20
Zinc, Total	102		106		80-120	4		20
MCP Total Metals - Mansfield Lab Associated sample(s): 01-06 Batch: WG1402226-2 WG1402226-3								
Mercury, Total	97		98		80-120	1		20

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-01A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-01H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-01I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-01J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-01K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-02A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-02H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-02I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-02J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-02K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-03A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-03H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-03I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-03J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-03K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-04A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-04E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-04F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-04G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-04H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-04I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-04J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-04K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-05A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-05H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-05I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-7470T-10(28),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-05J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-05K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-06A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-06E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-06F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-06G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-06H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-06I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-7470T-10(28),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-06J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-06K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-07A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-07B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-07C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)

*Values in parentheses indicate holding time in days

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

Data Qualifiers

Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

REFERENCES

97 EPA Test Methods (SW-846) with QC Requirements & Performance Standards for the Analysis of EPA SW-846 Methods under the Massachusetts Contingency Plan, WSC-CAM-IIA, IIB, IIIA, IIIB, IIIC, IIID, VA, VB, VC, VIA, VIB, VIIIA and VIIIB, July 2010.

131 Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), MassDEP, February 2018, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of VPH under the Massachusetts Contingency Plan, WSC-CAM-IVA, June 1, 2018.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/21/20

ALPHA Job #: L2034373

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Bete Group
Address: 701 George Washington Hwy, Lincoln, RI 02865
Phone: 401.333.2382
Email: jmcloughlin@bete-inc.com

Project Information

Project Name: 525 Massachusetts Ave
Project Location: Lunenburg, MA
Project #: 6893
Project Manager: Joe McLaughlin
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Additional Project Information:

Report Information - Data Deliverables

☑ ADEx ☑ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☑ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☑ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☑ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☑ Ranges & Targets ☐ Ranges Only	☑ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Sample Comments	TOTAL # BOTTLES
34373-01	MW-101	8/21/20	9:10	GW	SN	X			X	X	X	X			11
-02	MW-105		10:00		SN	X			X	X	X	X			11
-03	MW-104		10:50		SN	X			X	X	X	X			11
-04	MW-103		12:10		SN	X			X	X	X	X			11
-05	MW-102		1:20		SN	X			X	X	X	X			11
-06	Dup		11:10		SN	X			X	X	X	X			11
-07	Equip Blank		8:30		SN	X									3
-08	Trip Blank		—		SN	X									2
Container Type						V			P	A	V	A			
Preservative						B			C	B	B	A			

SAMPLE INFO
Filtration ☐ Field ☐ Lab to do
Preservation ☐ Lab to do

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
SN	8/21/20 14:40	AKL	8/21/20 14:40

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1402996-5	**Lab File ID**	: VQ200826B05
Instrument ID	: QUIMBY		
Matrix	: WATER	**Analysis Date**	: 08/26/20 05:50

Client Sample No.	Lab Sample ID	Analysis Date
WG1402996-3LCS	WG1402996-3	08/26/20 03:49
WG1402996-4LCSD	WG1402996-4	08/26/20 04:50
TRIP BLANK	L2034373-08	08/26/20 09:52
MW-105	L2034373-02	08/26/20 10:53
MW-101	L2034373-01	08/26/20 11:23
MW-104	L2034373-03	08/26/20 11:53
MW-103	L2034373-04	08/26/20 12:24
MW-102	L2034373-05	08/26/20 12:54
EQUIP BLANK	L2034373-07	08/26/20 13:55

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1403442-5	**Lab File ID**	: VQ200827A04
Instrument ID	: QUIMBY		
Matrix	: WATER	**Analysis Date**	: 08/27/20 06:40

Client Sample No.	Lab Sample ID	Analysis Date
WG1403442-3LCS	WG1403442-3	08/27/20 05:09
WG1403442-4LCSD	WG1403442-4	08/27/20 05:39
DUP	L2034373-06	08/27/20 08:11
MW-103	L2034373-04D	08/27/20 08:41
MW-102	L2034373-05D	08/27/20 09:11

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/26/20 03:49	
Lab File ID	: VQ200826B01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1402996-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	74	0
Dichlorodifluoromethane	0.437	0.37	-	15.3	20	67	0
Chloromethane	0.6	0.78	-	-30*	20	104	0
Vinyl chloride	0.546	0.541	-	0.9	20	79	0
Bromomethane	0.273	0.232	-	15	20	66	0
Chloroethane	0.31	0.318	-	-2.6	20	75	0
Trichlorofluoromethane	0.66	0.604	-	8.5	20	72	0
Ethyl ether	0.188	0.16	-	14.9	20	65	0
1,1-Dichloroethene	0.397	0.351	-	11.6	20	70	0
Carbon disulfide	0.945	0.836	-	11.5	20	70	0
Freon-113	0.394	0.362	-	8.1	20	76	0
Methylene chloride	0.422	0.45	-	-6.6	20	82	0
Acetone	10	10.97	-	-9.7	20	76	0
trans-1,2-Dichloroethene	0.438	0.446	-	-1.8	20	79	0
Methyl acetate	0.203	0.255	-	-25.6*	20	100	0
Methyl tert-butyl ether	0.937	0.848	-	9.5	20	68	0
tert-Butyl alcohol	0.026	0.019*	-	26.9*	20	59	0
Diisopropyl ether	1.579	2.033	-	-28.8*	20	101	0
1,1-Dichloroethane	0.907	0.99	-	-9.2	20	84	0
Halothane	0.348	0.353	-	-1.4	20	79	0
Acrylonitrile	0.09	0.104	-	-15.6	20	91	0
Ethyl tert-butyl ether	1.364	1.33	-	2.5	20	75	0
Vinyl acetate	0.868	1.083	-	-24.8*	20	96	0
cis-1,2-Dichloroethene	0.516	0.524	-	-1.6	20	77	0
2,2-Dichloropropane	0.793	0.735	-	7.3	20	75	0
Bromochloromethane	0.197	0.201	-	-2	20	74	0
Cyclohexane	0.946	1.133	-	-19.8	20	105	0
Chloroform	0.812	0.808	-	0.5	20	76	0
Ethyl acetate	0.295	0.342	-	-15.9	20	93	0
Carbon tetrachloride	0.689	0.63	-	8.6	20	72	0
Tetrahydrofuran	0.098	0.117	-	-19.4	20	93	0
Dibromofluoromethane	0.236	0.233	-	1.3	20	72	0
1,1,1-Trichloroethane	0.784	0.751	-	4.2	20	75	0
2-Butanone	0.122	0.142	-	-16.4	20	96	0
1,1-Dichloropropene	0.691	0.695	-	-0.6	20	81	0
Benzene	1.886	2.014	-	-6.8	20	82	0
tert-Amyl methyl ether	1.057	0.941	-	11	20	67	0
1,2-Dichloroethane-d4	0.271	0.25	-	7.7	20	70	0
1,2-Dichloroethane	0.569	0.542	-	4.7	20	72	0
Methyl cyclohexane	0.873	0.928	-	-6.3	20	93	0
Trichloroethene	0.505	0.506	-	-0.2	20	79	0
Dibromomethane	0.221	0.207	-	6.3	20	70	0
1,2-Dichloropropane	0.47	0.522	-	-11.1	20	85	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: QUIMBY	**Calibration Date**	: 08/26/20 03:49
Lab File ID	: VQ200826B01	**Init. Calib. Date(s)**	: 08/19/20 08/19/20
Sample No	: WG1402996-2	**Init. Calib. Times**	: 07:07 11:41
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Bromodichloromethane	0.596	0.543	-	8.9	20	69	0
1,4-Dioxane	0.00209	0.00236*	-	-12.9	20	85	0
cis-1,3-Dichloropropene	0.743	0.709	-	4.6	20	72	0
Chlorobenzene-d5	1	1	-	0	20	76	0
Toluene-d8	1.31	1.319	-	-0.7	20	78	0
Toluene	1.574	1.609	-	-2.2	20	83	0
4-Methyl-2-pentanone	0.126	0.115	-	8.7	20	71	0
Tetrachloroethene	0.641	0.643	-	-0.3	20	84	0
trans-1,3-Dichloropropene	0.811	0.698	-	13.9	20	68	0
Ethyl methacrylate	0.506	0.438	-	13.4	20	69	0
1,1,2-Trichloroethane	0.327	0.309	-	5.5	20	74	0
Chlorodibromomethane	0.48	0.414	-	13.8	20	66	0
1,3-Dichloropropane	0.719	0.67	-	6.8	20	73	0
1,2-Dibromoethane	0.379	0.346	-	8.7	20	71	0
2-Hexanone	0.234	0.243	-	-3.8	20	85	0
Chlorobenzene	1.637	1.693	-	-3.4	20	81	0
Ethylbenzene	3.069	3.037	-	1	20	82	0
1,1,1,2-Tetrachloroethane	0.561	0.53	-	5.5	20	74	0
p/m Xylene	1.112	0.98	-	11.9	20	74	0
o Xylene	0.991	0.864	-	12.8	20	72	0
Styrene	1.649	1.474	-	10.6	20	72	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	64	0
Bromoform	0.594	0.58	-	2.4	20	60	0
Isopropylbenzene	6.581	7.679	-	-16.7	20	80	0
4-Bromofluorobenzene	1.146	1.282	-	-11.9	20	69	0
Bromobenzene	1.387	1.665	-	-20	20	76	0
n-Propylbenzene	6.985	7.407	-	-6	20	75	0
1,4-Dichlorobutane	1.58	2.048	-	-29.6*	20	83	0
1,1,2,2-Tetrachloroethane	0.902	1.03	-	-14.2	20	72	0
4-Ethyltoluene	5.084	4.9	-	3.6	20	68	0
2-Chlorotoluene	4.474	4.902	-	-9.6	20	76	0
1,3,5-Trimethylbenzene	3.767	3.274	-	13.1	20	61	0
1,2,3-Trichloropropane	0.797	0.902	-	-13.2	20	71	0
trans-1,4-Dichloro-2-buten	0.309	0.354	-	-14.6	20	76	0
4-Chlorotoluene	4.117	4.143	-	-0.6	20	68	0
tert-Butylbenzene	4.15	4.517	-	-8.8	20	77	0
1,2,4-Trimethylbenzene	3.497	3.056	-	12.6	20	60	0
sec-Butylbenzene	5.586	6.019	-	-7.8	20	77	0
p-Isopropyltoluene	4.358	4.384	-	-0.6	20	72	0
1,3-Dichlorobenzene	2.419	2.578	-	-6.6	20	71	0
1,4-Dichlorobenzene	2.339	2.385	-	-2	20	68	0
p-Diethylbenzene	2.218	2.188	-	1.4	20	71	0
n-Butylbenzene	3.373	3.394	-	-0.6	20	73	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/26/20 03:49	
Lab File ID	: VQ200826B01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1402996-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichlorobenzene	2.13	2.217	-	-4.1	20	68	0
1,2,4,5-Tetramethylbenzene	10	11.582	-	-15.8	20	70	0
1,2-Dibromo-3-chloropropan	0.136	0.135	-	0.7	20	62	0
1,3,5-Trichlorobenzene	1.034	0.979	-	5.3	20	61	0
Hexachlorobutadiene	0.624	0.784	-	-25.6*	20	94	0
1,2,4-Trichlorobenzene	0.881	0.813	-	7.7	20	58	0
Naphthalene	1.496	1.334	-	10.8	20	52	0
1,2,3-Trichlorobenzene	0.748	0.705	-	5.7	20	59	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/27/20 05:09	
Lab File ID	: VQ200827A01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1403442-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	80	0
Dichlorodifluoromethane	0.437	0.366	-	16.2	20	71	0
Chloromethane	0.6	0.738	-	-23*	20	106	0
Vinyl chloride	0.546	0.519	-	4.9	20	82	0
Bromomethane	0.273	0.224	-	17.9	20	69	0
Chloroethane	0.31	0.304	-	1.9	20	78	0
Trichlorofluoromethane	0.66	0.596	-	9.7	20	76	0
Ethyl ether	0.188	0.16	-	14.9	20	70	0
1,1-Dichloroethene	0.397	0.345	-	13.1	20	74	0
Carbon disulfide	0.945	0.825	-	12.7	20	74	0
Methylene chloride	0.422	0.448	-	-6.2	20	88	0
Acetone	10	11.155	-	-11.5	20	83	0
trans-1,2-Dichloroethene	0.438	0.45	-	-2.7	20	86	0
Methyl tert-butyl ether	0.937	0.874	-	6.7	20	75	0
Diisopropyl ether	1.579	2.064	-	-30.7*	20	110	0
1,1-Dichloroethane	0.907	0.978	-	-7.8	20	90	0
Ethyl tert-butyl ether	1.364	1.361	-	0.2	20	82	0
cis-1,2-Dichloroethene	0.516	0.528	-	-2.3	20	84	0
2,2-Dichloropropane	0.793	0.741	-	6.6	20	82	0
Bromochloromethane	0.197	0.204	-	-3.6	20	82	0
Chloroform	0.812	0.801	-	1.4	20	81	0
Carbon tetrachloride	0.689	0.648	-	6	20	80	0
Tetrahydrofuran	0.098	0.12	-	-22.4*	20	103	0
Dibromofluoromethane	0.236	0.228	-	3.4	20	76	0
1,1,1-Trichloroethane	0.784	0.75	-	4.3	20	81	0
2-Butanone	0.122	0.144	-	-18	20	104	0
1,1-Dichloropropene	0.691	0.687	-	0.6	20	86	0
Benzene	1.886	1.997	-	-5.9	20	87	0
tert-Amyl methyl ether	1.057	0.981	-	7.2	20	76	0
1,2-Dichloroethane-d4	0.271	0.247	-	8.9	20	74	0
1,2-Dichloroethane	0.569	0.533	-	6.3	20	76	0
Trichloroethene	0.505	0.502	-	0.6	20	84	0
Dibromomethane	0.221	0.208	-	5.9	20	75	0
1,2-Dichloropropane	0.47	0.521	-	-10.9	20	91	0
Bromodichloromethane	0.596	0.556	-	6.7	20	77	0
1,4-Dioxane	0.00209	0.00188*	-	10	20	73	0
cis-1,3-Dichloropropene	0.743	0.719	-	3.2	20	79	0
Chlorobenzene-d5	1	1	-	0	20	82	0
Toluene-d8	1.31	1.309	-	0.1	20	84	0
Toluene	1.574	1.57	-	0.3	20	88	0
4-Methyl-2-pentanone	0.126	0.116	-	7.9	20	77	0
Tetrachloroethene	0.641	0.643	-	-0.3	20	91	0
trans-1,3-Dichloropropene	0.811	0.714	-	12	20	75	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: QUIMBY	**Calibration Date**	: 08/27/20 05:09
Lab File ID	: VQ200827A01	**Init. Calib. Date(s)**	: 08/19/20 08/19/20
Sample No	: WG1403442-2	**Init. Calib. Times**	: 07:07 11:41
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,1,2-Trichloroethane	0.327	0.31	-	5.2	20	80	0
Chlorodibromomethane	0.48	0.425	-	11.5	20	74	0
1,3-Dichloropropane	0.719	0.673	-	6.4	20	79	0
1,2-Dibromoethane	0.379	0.348	-	8.2	20	77	0
2-Hexanone	0.234	0.239	-	-2.1	20	90	0
Chlorobenzene	1.637	1.654	-	-1	20	86	0
Ethylbenzene	3.069	3.005	-	2.1	20	88	0
1,1,1,2-Tetrachloroethane	0.561	0.538	-	4.1	20	81	0
p/m Xylene	1.112	1.036	-	6.8	20	84	0
o Xylene	0.991	0.921	-	7.1	20	83	0
Styrene	1.649	1.513	-	8.2	20	80	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	78	0
Bromoform	0.594	0.557	-	6.2	20	71	0
Isopropylbenzene	6.581	6.873	-	-4.4	20	88	0
4-Bromofluorobenzene	1.146	1.143	-	0.3	20	76	0
Bromobenzene	1.387	1.488	-	-7.3	20	84	0
n-Propylbenzene	6.985	7.01	-	-0.4	20	87	0
1,1,2,2-Tetrachloroethane	0.902	0.918	-	-1.8	20	79	0
2-Chlorotoluene	4.474	4.844	-	-8.3	20	92	0
1,3,5-Trimethylbenzene	3.767	3.733	-	0.9	20	86	0
1,2,3-Trichloropropane	0.797	0.805	-	-1	20	78	0
4-Chlorotoluene	4.117	4.045	-	1.7	20	82	0
tert-Butylbenzene	4.15	4.256	-	-2.6	20	90	0
1,2,4-Trimethylbenzene	3.497	3.522	-	-0.7	20	85	0
sec-Butylbenzene	5.586	5.762	-	-3.2	20	91	0
p-Isopropyltoluene	4.358	4.538	-	-4.1	20	92	0
1,3-Dichlorobenzene	2.419	2.548	-	-5.3	20	86	0
1,4-Dichlorobenzene	2.339	2.36	-	-0.9	20	82	0
n-Butylbenzene	3.373	3.674	-	-8.9	20	97	0
1,2-Dichlorobenzene	2.13	2.179	-	-2.3	20	83	0
1,2-Dibromo-3-chloropropan	0.136	0.125	-	8.1	20	71	0
Hexachlorobutadiene	0.624	0.772	-	-23.7*	20	114	0
1,2,4-Trichlorobenzene	0.881	0.991	-	-12.5	20	87	0
Naphthalene	1.496	1.644	-	-9.9	20	79	0
1,2,3-Trichlorobenzene	0.748	0.843	-	-12.7	20	86	0

* Value outside of QC limits.

SMITH & WESSEL ASSOCIATES, INC.
HAZARDOUS BUILDING MATERIALS AND AIR QUALITY SPECIALISTS

INSPECTION REPORT FOR
Asbestos-Containing Building Materials, Lead-Based Paint, Polychlorinated Biphenyls and Mercury Containing Components

Former Citgo Service Station
925 Massachusetts Avenue
Lunenburg, Massachusetts



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Project 20118

August 7, 2020

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INTRODUCTION

Beta Group, Inc. (Beta) retained Smith & Wessel Associates, Inc. (SWA) to conduct inspections for asbestos-containing building materials (ACBM), lead-based paint (LBP), polychlorinated biphenyls (PCBs) and mercury containing components at the former Citgo Service Station located at 925 Massachusetts Avenue in Lunenburg, Massachusetts on August 3, 2020. The assessment was conducted as part of a pre-demolition due diligence survey.

Asbestos

The purpose of the inspection was to evaluate the types, locations, and extent of suspect ACM and provide appropriate recommendations for its abatement or management. SWA's inspection addressed both friable materials (materials that can be easily crumbled, crushed, or pulverized by hand pressure) and non-friable suspect materials. SWA performed the inspection in accordance with the EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAP), Title 40 CFR Part 61, for suspect asbestos-containing building materials (ACBM) as practical. SWA identified several suspect materials at the site that were sampled and analyzed for asbestos content. However, if any suspect materials are identified at later dates that are not addressed in this report, they must be assumed to be ACBM unless appropriate sampling and analysis demonstrate otherwise.

SWA identified non-friable ACBM at the site in the form of the following materials:

• Metal wall panel seam sealant	• 9" x 9" floor tile
• Rolled tar mop roof	

Lead-Based Paint

The purpose of the Lead-Based Paint (LBP) inspection was to evaluate the types, locations, and extent of suspect LBP in the building, to evaluate potential hazards associated with LBP, and to provide appropriate recommendations for its abatement and management.

The United States Department of Housing and Urban Development (HUD) has established a standard for lead-based paint, as tested using an X-ray Fluorescence Analyzer (XRFA), of 1.0 milligram per square centimeter (mg/cm^2). Although this standard only applies to housing funded by the federal government, it is a useful reference concentration for assessing hazards associated with lead in paint in other settings. Thus, when paint contains greater than 1.0 mg/cm^2, special care should be taken when conducting activities that impact these paints.

The lead content of paints surveyed at the site were between <0.1-2.6 mg/cm^2 as

measured with an X-ray Fluorescence Analyzer (XRFA). If LBP are impacted by demolition in a manner that may generate dust or fumes, compliance with Occupational Safety and Health Administration (OSHA) regulations regarding worker exposure to lead may be necessary. Additionally, United States Environmental Protection Agency (EPA) and Massachusetts Department of Environmental (DEP) regulations relative to waste disposal may apply.

PCBs

SWA's investigation for PCBs in light fixture ballasts and electrical equipment was visual only. Typically, ballasts and electrical equipment installed after 1978 do not contain PCBs and are marked as such. Ballasts and electrical equipment that do not have the "No PCBs" wording on the label are assumed to contain PCBs. SWA inspected the labels on representative ballasts and equipment throughout the building; the representative ballasts inspected contained the "No PCBs" wording on their affixed labels and therefore are assumed to not contain PCBs in capacitor oils. However, SWA observed two one-gallon electric panel expansion tanks in the mechanical room suspected of containing PCB transformer oil.

SWA also collected samples of metal wall panel seam sealant, garage door caulking, garage door glazing, and metal window glazing for laboratory analysis to determine the concentration of PCBs. Analytical results indicate that no PCB constituents were identified in the compositions of those materials sampled.

Mercury Filled Fluorescent Light Fixtures

SWA observed fluorescent light bulbs that must be collected and recycled in accordance with the "Universal Waste" regulatory requirements. The fluorescent bulbs are located throughout the building, including 13 (4') and 8 (8') fluorescent bulbs. SWA also observed one heat regulating thermostat with mercury tube in the service center office.

Exclusions

While SWA endeavored to conduct a thorough, comprehensive inspection, some exclusions are warranted. Because our inspection addressed a limited number of areas, it is possible that the locations that we inspected were not fully representative of materials found in other areas. Our inspection included building areas only; no assessment of soil, debris, or subterranean areas was conducted. Additional limitations may have impacted our ability to inspect all locations such as poor lighting, height constraints, unusual building features, occupancy, and stored materials that block access to suspect materials. Stored goods, debris, and building materials that were removed and were either stored or loose were not inspected, but if observed were assessed and quantified.

SWA does not guarantee that all suspect roof materials were identified. Typically, roofs were applied in multiple layers and were repaired over the years. The full extent of suspect roof materials will not be known until the entire roof system is removed.

While SWA followed industry standards during the inspection, we do not warrant that all

suspect hazardous building materials were identified in or on the building and shall not be held liable related to future abatement costs related to hazardous materials that are either not discovered or not appropriately characterized. This is due in part to inherent problems with every building inspection, such as, but not limited to:

- Seemingly homogeneous materials that are not in fact homogeneous;
- Seemingly representative locations that are not in fact representative;
- Layered materials that are not uniformly present or are isolated;
- Materials that are present and accessible but were not considered to be hazardous,
- Materials that are present in an isolated and limited quantity; and
- Material that is present in locations that are unsafe or otherwise difficult to access.

Client acknowledges that SWA's inspection is inherently limited and all hazardous materials may only become apparent during the course of future renovation or demolition. During the course of future renovation/demolition work, it is likely that additional hazardous materials or materials suspected of being hazardous will be identified. Such materials should be assumed to be hazardous unless appropriate evaluation or sampling and analysis demonstrate otherwise. Contracts, specifications and plans should advise contractors to conduct controlled demolition work and stop immediately should any hazardous building materials be encountered during the course of their work.

1.0 ASBESTOS CONTAINING BUILDING MATERIALS

1.1 Scope of Work

SWA's certified Asbestos Inspectors, Ted Sherry (Cert. # AI-032572) and Robert Arcese (Cert. # AI-900917), performed the asbestos inspection of readily accessible and observable areas throughout the interior and exterior of the building. SWA inspected for the following types of suspect ACBM:

- Thermal system insulation (TSI), such as insulation on pipes, boilers, tanks and related equipment;
- Surfacing material, acoustical and decorative plasters, fireproofing and other sprayed or trowel applications; and
- Miscellaneous materials, such as window caulking, wallboard, floor tile, adhesives, and other building materials that are not TSI or surfacing materials.

To determine the asbestos content of suspect ACBM, SWA collected and analyzed representative bulk samples by extracting a small but representative portion of suspect material from the substrate. The samples, typically measuring one cubic centimeter, were collected using a variety of methods. The extracted samples were then placed into labeled, individual sealed plastic bags for transport to the laboratory.

EMSL Analytical, Inc. (EMSL) of Woburn, Massachusetts, a fully accredited asbestos analytical laboratory, analyzed the bulk samples utilizing Polarized Light Microscopy (PLM) in accordance with the requirements of 40 CFR Part 763, Subpart F, Appendix A (see Appendix A of this report). Because PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials, when a negative result is obtained by PLM (less than one percent asbestos), the laboratory was instructed to analyze the sample by Transmission Electron Microscopy (TEM) to confirm the results.

For each homogeneous sampling group, the laboratory analyzed samples until a positive result was obtained (i.e. greater than one percent asbestos) or until all samples were analyzed. If one sample indicates an asbestos content greater than one percent, the entire homogenous area must be considered to be an ACBM even if one or more samples in the group indicates an asbestos content of less than one percent.

1.2 Regulatory Guidance

The United States Environmental Protection Agency (EPA), Occupational Health & Safety Administration (OSHA), Massachusetts Department of Labor Standards (MA DLS) and Massachusetts Department of Environmental Protection (MA DEP) are responsible for regulating the release of asbestos into the environment and protecting

workers from exposure to airborne asbestos fibers.

OSHA and MA DLS are responsible for the health and safety of workers who may be exposed in connection with their jobs including custodial activities, renovation work, and asbestos abatement. These agencies specify requirements for the work practices and engineering controls that must be utilized during asbestos abatement projects. They also require that ACBM be repaired, removed, or otherwise appropriately abated before maintenance, renovation, or demolition work disturbs them. Thermal system insulation, surfacing materials, and floor tile installed before 1980 must be presumed to be ACBM unless appropriate inspection and sampling analysis prove otherwise.

The EPA and MA DEP are responsible for developing and enforcing regulations necessary to protect the general public from airborne contaminants that are known to be hazardous to human health. They regulate ACBM associated with renovation, demolition, and asbestos abatement projects via NESHAP Title 40 CFR Part 61 regulation and MA DEP 310 CMR 7.15. These regulations require that buildings be inspected for ACBM prior to renovation/demolition projects. They stipulate that all friable ACBM as well as non-friable ACBM that are in poor condition or will be made friable by renovation or demolition activity be removed or otherwise appropriately abated before they are disturbed.

1.3 Findings

SWA identified the following friable and non-friable ***suspect*** ACBM:

• Cement plaster	• Duct work seam sealant
• Gypsum board	• Garage door glazing
• Metal wall panel seam sealant	• Metal window glazing
• 9″ x 9″ floor tile and underlying mastic	• Three-tab shingle
• 2' x 4' ceiling tiles	• Garage door caulking
• Wooden ceiling panel adhesive	• Rolled tar mop roof
• Cove base	• Wall panel glue
• Cove base adhesive	• Textured paint

SWA collected a total of thirty-nine representative bulk samples of the above materials to determine asbestos content, of which thirty-six were analyzed using PLM. Three of the samples did not require analysis as the first sample in the homogeneous sampling group tested positive for asbestos (i.e. contain greater than one percent asbestos). In addition, the black mastic underlying the white 9″ x 9″ floor tile in each bathroom were further analyzed using the TEM EPA NOB method.

SWA has listed in **Table 1**, the location and estimated quantity, by square foot (sf), linear foot (lf), or other appropriate unit, of each type of ACBM identified at the site.

Table 1 • List of Materials Testing Positive for Asbestos			
Type of Material	**Location**	**Quantity**	**Sample number**
Gray and beige metal wall panel seam sealant	Rear storage container abutting main building	52 lf	03A
White 9″ x 9″ floor tile	Service center bathroom and side bathroom	60 sf	04A
Black rolled tar mop roof *(varying degrees of weatherization and vegetation growth require pre-abatement management)*	Roof along rear storage container and lower level garage storage	600 sf	16A

In **Table 2**, SWA has listed all materials that tested negative for asbestos, including the locations where these materials were observed and the corresponding bulk sample reference number(s). The sample numbers presented in **bold** were further analyzed using the TEM EPA NOB method.

Table 2 • List of Materials Testing Negative for Asbestos		
Type of Material	**Location**	**Sample No.**
Gray cement plaster	Garage ceiling	01A, 01B, 01C
White and gray gypsum board	Garage and adjacent mechanical room	02A, 02B, 02C
Black mastic associated with white 9″ x 9″ floor tile	Service center bathroom and side bathroom	**05A, 05B**
White 2' x 4' ceiling tiles	Suspended ceiling in service center	06A, 06B
Tan wooden ceiling panel adhesive	Hard ceiling in service center	07A, 07B
Red 6″ cove base	Service center, office space, and bathrooms	08A, 08B
Black cove base adhesive associated with red 6″ cove base	Service center, office space, and bathrooms	09A, 09B
Gray duct seam sealant	Mechanical room between supply plenum offset starting collar	10A, 10B
White garage door glazing	Exterior garage door	11A, 11B
White metal window glazing	Side garage window	12A, 12B
Black three-tab shingle	First layer throughout roof	13A, 13B
Black three-tab shingle	Second layer throughout roof	14A, 14B
White garage door caulking	Exterior garage door between metal frame and masonry	15A, 15B

Table 2 • List of Materials Testing Negative for Asbestos		
Type of Material	**Location**	**Sample No.**
Tan wall panel glue	Beneath wall panel in each bathroom	17A, 17B
White textured paint	Exterior cinderblock wall along east side	18A, 18B

1.4 Conclusions and Recommendations

On the basis of our findings, SWA offers the following conclusions and recommendations:

1. Non-friable ACBM were identified at the site. ACBM that will be impacted by renovation or demolition work must be removed before they are disturbed. SWA recommends that this work be conducted in accordance with a project design as prepared by a Massachusetts licensed Asbestos Abatement Project Designer due to the damage associated with the roof. ***This report is not intended for use as an abatement design.***

2. During the course of renovation or demolition work, it is possible that additional suspect ACBM will be encountered. Contractors should be apprised to conduct any such work in a controlled manner. If suspect materials that have not been sampled are encountered, they should be assumed to contain asbestos, unless appropriate sampling and analysis indicates otherwise.

1.5 Cost Estimate

In **Table 3**, SWA has provided estimates of abatement costs associated with all identified ACBM in the inspected areas. These estimates are based on current industry standards that may fluctuate rapidly based on a variety of factors: the prevailing economic climate, seasonal differences, union labor considerations, scale of the abatement, occupancy of the building, and so on. SWA recommends that qualified abatement contractors be solicited to determine actual pricing involved. In addition to pricing for abatement, SWA has considered anticipated industrial hygiene costs associated with abatement, including air monitoring and oversight of the abatement.

Table 3 • Estimated Costs for Removal of ACBM		
Type of Material	**Quantity/Unit cost ($)**	**Total Cost ($)**
Gray and beige metal wall panel seam sealant	52 lf @ 20/lf	1,040.
White 9″ x 9″ floor tile	60 sf @ 20/sf	1,200.
Black tar mop adhesive	600 sf @ 5/sf	3,000.
	Total Contractor Abatement Cost	$ 5,240.
	Total Industrial Hygiene Fee	1,500
	Total Fee	**$ 6,740.**

2.0 LEAD-BASED PAINTS

2.1 Scope of Work

SWA's accredited lead-based paint inspector tested representative painted surfaces throughout the building. SWA analyzed paints for lead content using the XRFA following the manufacturer's instructions for initial calibration and operation. The XRFA uses a radioactive source to excite the electrons of lead atoms (if present) in paint. As the lead atom electrons return to their normal state, they emit x-rays that are measured by the XRFA, then processed and the results converted to milligrams of lead per square centimeter of sampled surface area. On most substrates, the XRFA is precise to +0.1 mg/cm^2.

Surfaces tested included, but were not limited to floors, walls, ceilings, windows, doors, casings/jambs, trim, columns, overhead canopies, and other miscellaneous surfaces.

2.2 Regulatory Guidance

In all areas where LBP is disturbed by renovation work and where components covered by LBP are disposed of, applicable OSHA and EPA regulations apply.

OSHA

Renovation or demolition activities that disturb surfaces that contain lead must be conducted in accordance with the OSHA regulation 29 CFR 1926.62 "Lead Exposure in Construction: Interim Final Rule." This regulation requires that a site-specific health and safety plan be prepared before conducting activities that create airborne lead emissions. Such a plan should include the identification of lead components, an exposure assessment, and, if applicable, the required work procedures and personnel protection to be used.

An exposure assessment in the form of personal air monitoring must be performed if there is the potential for employees to be exposed to lead due to the renovation or demolition activity. If demolition is being conducted that will disturb lead-based paints, the employer must assume that employee exposure is in excess of the Permissible Exposure Limit (PEL) of 50 micrograms per cubic meter of air ($\mu g/m^3$) until the exposure assessment is completed. If the PEL is exceeded, employees are required to use half-face mask respirators with HEPA filter cartridges. Furthermore, a written respirator program is required per 29 CFR 1910.134. The lead standard also requires the following protective measures be taken until the exposure assessment is completed:

- Isolation of the work area;
- appropriate personal protective clothing and equipment;
- change areas and hand washing facilities;
- biological monitoring; and
- training

The results of the initial exposure assessment will determine the protective measures that must be followed for the remainder of the project. OSHA may allow air-monitoring data from previous projects conducted under conditions closely resembling the present project to be used for the exposure assessment. If the exposure assessment indicates that exposure levels are below the Action Level of 30 μ/m^3, there are no additional requirements under the standard if the conditions remain the same.

EPA

In addition to the worker protection requirements stipulated by OSHA, MA DEP and the EPA regulate the disposal of wastes that are potentially hazardous. Such wastes may include paint chips and residue generated during abatement or repainting work, or whole components, such as wood windows, doors, and trim that are coated with LBP and that are disposed of as the result of renovation or demolition work. Metal components are not regulated if they will be recycled and not disposed of in a landfill.

To determine the required method for disposing of permeable items coated with LBP, the MA DEP and the EPA require representative sampling of the debris to determine the quantity of lead that would be expected to leach into the environment if the debris were disposed of in a landfill. The representative sample(s) must be analyzed by the Toxicity Characteristic Leaching Process (TCLP). If the result of this procedure indicates that the sample leaches a lead concentration below five parts per million (ppm), the debris is not regulated and can be disposed of in a traditional construction landfill. However, the debris must be disposed of as hazardous waste if the TCLP result exceeds 5 ppm. To minimize the total volume of hazardous waste, segregating hazardous from non-hazardous waste is advisable.

HUD

HUD has established a standard for lead-based paint, as tested using an XRF analyzer, of 1.0 mg/cm^2. Although this standard only applies to housing funded by the federal government, it is a useful reference concentration for assessing hazards associated with lead in paint in other settings. Thus, when paint contains greater than 1.0 mg/cm^2, special care should be taken when conducting activities that impact these paints. When conducting abrasive blasting, torch burning, or similar activities that generate significant dust or fume, hazards can be caused even at concentrations below the HUD standard.

2.3 Findings

Analysis of painted surfaces throughout the site indicate that lead levels were between <0.1-2.6 mg/cm^2. **Table 4** below outlines surfaces coated with lead-based paint, but refer to Appendix B for the results of comprehensive testing.

Table 4 • Summary of Surfaces Coated With Elevated Lead Paint				
Location	**Substrate**	**Color**	**Component**	**Quantity**
Roof	Wood	Red	Wood block trim	180 sf
Roof	Metal	Green	Cupola	16 sf
Exterior	Wood	White	West side bathroom door	1 door

2.4 Conclusions and Recommendations

Based on our findings, SWA offers the following conclusions and recommendations:

1. Limited lead-based paint coated components were identified at the site. Handling or impacting components that are covered by LBP require compliance with the OSHA lead standard. To minimize exposure to airborne dust or fumes, torch burning, cutting, grinding, or similar high impact work on components covered by LBP should be avoided. Such work would need to be conducted by properly trained workers using appropriate worker protection and engineering controls.

2. TCLP testing of materials representing the waste stream will be necessary to determine proper disposal methods and satisfy the chosen landfill.

3. If suspect painted components are identified during demolition of the building that are not addressed in this report, they must be assumed to contain LBP until further testing indicates otherwise.

2.5 Cost Estimate

SWA estimates that costs associated with OSHA and EPA compliance relative to lead paint at approximately **$2,000** for this site. *If all lead paint coated components were to be de-leaded at the site or if the composite TCLP test failed, the costs would be increased substantially.*

3.0 POLYCHLORINATED BIPHENYLS (PCBs)

3.1 Scope of Work

SWA's investigation for PCBs in light fixture ballasts and electrical equipment was visual only. Typically, ballasts and electrical equipment installed after 1978 do not contain PCBs and are marked as such. Ballasts and electrical equipment that do not have the "No PCBs" wording on the label are assumed to contain PCBs.

SWA also collected samples of metal wall panel seam sealant, garage door caulking, garage door glazing, and metal window glazing for laboratory analysis to determine the concentration of PCBs. Sample collection occurred in locations that appeared to be representative of those materials throughout the building. A minimum five gram piece of material was taken from the substrate, placed into labeled individual sealed containers.

The samples were labeled and the sample number and description were recorded on a field data sheet and delivered using appropriate chain-of-custody to NetLab of West Warwick, Rhode Island, for analysis. NetLab employed EPA method SW846 utilizing sample extraction method 8081 and analytical method 8028, gas chromatography, to analyze the samples (see Appendix C of this report).

3.2 Background/Regulatory Guidance

According to the EPA, PCBs are toxic and persistent chemicals that were used primarily as insulating fluid in heavy-duty electrical equipment. They were also utilized in a wide variety of products including paints, caulks, light fixture ballast, oils, plastics, adhesives, tapes, carbonless copy paper, floor finishes and related products. Because PCBs are suspected carcinogens and may cause other adverse health effects, the EPA banned their manufacture and installation starting in 1979.

Any materials containing PCBs equal to or greater than 50 parts per million (ppm) are regulated under the Toxic Substance Control Act and the PCB regulation found at 40 CFR Part 761. Further, EPA policy, as described in "Current Best Practices for PCBs in Caulk Fact Sheet" updated in September, 2009, is that PCBs at concentrations greater than 50 ppm are not authorized for use and must be removed and properly disposed of.

Additionally, where <50 ppm caulk or PCB remediation waste is present, it may be regulated for removal and/or cleanup unless the <50 ppm PCB caulk meets the definition of an Excluded PCB Product as defined under 40 CFR Part 761.3. Excluded products would include those legally installed before October 1, 1984 and the resulting PCBs concentration is not the result of dilution or leaks or spills from other products. Thus, if a formerly installed PCB caulk containing greater than 50 ppm had been removed and replaced by a non-PCB caulk, the non-PCB caulk could be contaminated from the residue of the former caulk. In this instance, if the non-PCB caulk tested at a concentration above

one ppm, it would be regulated as PCB containing.

Further, because PCBs may have leached into surrounding substrates, such as brick, CMU, and cement, or may have degraded and contaminated adjacent soil, assessment of masonry and soils is necessary on instances where PCBs are present in caulk or other building materials. Where analysis indicates contaminant concentrations above one ppm in masonry or soils, remedial actions are required.

3.3 Findings

SWA inspected the labels on representative ballasts throughout the building; the representative ballasts inspected all exhibited the "No PCBs" wording on their affixed labels and therefore are assumed not to contain PCBs in their capacitor oils. SWA observed two one-gallon electric panel expansion tanks in the mechanical room suspected of containing PCB transformer oil (>2 ppm).

Analytical results indicate that of those suspect materials sampled and analyzed, none were determined to contain PCBs.

- White garage door glazing (PCB-01) – Exterior garage door on wooden sash, None Detected
- White garage door caulking (PCB-02) – Exterior garage door on wooden frame, None Detected
- Beige metal wall panel seam sealant (PCB-03) – Rear storage container along wall and ceiling seam, None Detected
- White garage window glazing (PCB-04) – East side garage window on metal sash, None Detected

3.4 Conclusions and Recommendations

Based on our observations, we conclude the following:

1. Prior to renovation or demolition, all ballasts must be inspected for the “No PCB” wording on their affixed label to determine appropriate segregation and recycling requirements. The ballasts that do not contain the "No PCBs" wording on the affixed label are assumed to contain PCB oils and must be segregated for proper disposal/recycling.

2. The transformers containing suspect PCB oil should be properly characterized, drained, and handled by workers that have received OSHA 24-Hour Hazardous Waste and Emergency Operations (HAZWOPER) under the supervision of a foreperson OSHA 24-Hour Hazardous Waste and Emergency Operations (HAZWOPER) in compliance with 29 CFR 1910.120.

3. No PCBs were identified in those building materials sampled and analyzed at the site. If suspect materials are uncovered at later dates that are not explicitly

addressed in this report, they must be assumed to contain PCBs until further testing indicates otherwise.

3.5 Cost Estimate

Based on our findings, the cost to assess all ballasts for the ″No PCB″ wording and properly characterize, drain, and handle for the disposal of PCB transformer fluid should not exceed **$3,000**.

4.0 MERCURY COMPONENTS

4.1 Scope of Work

SWA's inspector observed fluorescent light bulbs and a thermostat suspected of containing mercury throughout the building. Typically when fluorescent light fixtures, thermostats, or electrical switches will be removed and disposed of, SWA makes a conservative assumption that they contain mercury and should be handled as a regulated waste. These materials are classified as "Universal Wastes" and must be appropriately handled and packaged for disposal or recycling.

4.2 Findings

SWA observed fluorescent light bulbs that if impacted by renovations must be collected and recycled in accordance with the "Universal Waste" regulatory requirements. The fluorescent bulbs are located throughout the building. SWA estimates that there are 13 (4') and 8 (8') fluorescent bulbs that would require recycling during renovations. Also, one heat regulating thermostat with internal mercury tube was identified in the service center office.

4.3 Conclusions and Recommendations

Based on our observations, SWA offers the following conclusions and recommendations.

1. Prior to being impacted, all fluorescent light bulbs and mercury tube must be collected and properly packaged for disposal or recycling in a facility permitted to accept mercury containing waste.

4.4 Cost Estimate

Based on our findings, the cost to collect and recycle/dispose of mercury containing fluorescent bulbs at this site should not exceed $750.

APPENDIX A

Certificates of Asbestos Bulk Sample Analysis
(PLM & TEM)

EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132005249
Customer ID:	SMIT50B
Customer PO:	
Project ID:	

Attention:	Rob Arcese	**Phone:**	(978) 346-4800
	Smith & Wessel Associates, Inc.	**Fax:**	(978) 346-7265
	188 Greenville Street	**Received Date:**	08/04/2020 11:00 AM
	Spencer, MA 01562	**Analysis Date:**	08/07/2020
		Collected Date:	

Project: 20118/Former Gas Station; 925 Massachusetts Ave; Lunenburg, MA

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
01A *132005249-0001*	1st Floor Garage Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
01B *132005249-0002*	1st Floor Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
01C *132005249-0003*	1st Floor Garage Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02A *132005249-0004*	1st Floor Garage - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02B *132005249-0005*	1st Floor Mech. Room Garage - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02C *132005249-0006*	1st Floor Mech. Room - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
03A *132005249-0007*	1st Floor Rear Storage Container - Beige & Gray Metal Wall Panel Seam Sealant	Gray Non-Fibrous Homogeneous		95% Non-fibrous (Other)	5% Chrysotile
03B *132005249-0008*	1st Floor Rear Storage Container - Beige & Gray Metal Wall Panel Seam Sealant				Positive Stop (Not Analyzed)
04A *132005249-0009*	1st Floor Bathroom - White 9"x9" Floor Tile	White Non-Fibrous Homogeneous		95% Non-fibrous (Other)	5% Chrysotile
04B *132005249-0010*	1st Floor Rear Bathroom - White 9"x9" Floor Tile				Positive Stop (Not Analyzed)
05A *132005249-0011*	1st Floor Bathroom - Black Mastic	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
05B *132005249-0012*	1st Floor Rear Bathroom - Black Mastic	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
06A *132005249-0013*	1st Floor Office Lobby - White 2'x4' Suspended Ceiling Tiles	Gray/White Fibrous Homogeneous	50% Cellulose 30% Min. Wool	20% Non-fibrous (Other)	None Detected

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
Customer ID: SMIT50B
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
06B *132005249-0014*	1st Floor Office Lobby - White 2'x4' Suspended Ceiling Tiles	Gray/White Non-Fibrous Homogeneous	50% Cellulose 30% Min. Wool	20% Non-fibrous (Other)	None Detected
07A *132005249-0015*	1st Floor Office Lobby - Tan Ceiling Panel Adhesive	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
07B *132005249-0016*	1st Floor Office Lobby - Tan Ceiling Panel Adhesive	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08A *132005249-0017*	1st Floor Office Lobby - Red Cove Base	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08B *132005249-0018*	1st Floor Office Lobby - Red Cove Base	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
09A *132005249-0019*	1st Floor Office Bathroom - Black Cove Base Adhesive	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
09B *132005249-0020*	1st Floor Office Bathroom - Black Cove Base Adhesive	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10A *132005249-0021*	1st Floor Mech. Room @ Supply Plenum - Gray Duct Work Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10B *132005249-0022*	1st Floor Mech. Room @ Supply Plenum - Gray Duct Work Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11A *132005249-0023*	1st Floor - White Garage Door Glazing	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11B *132005249-0024*	1st Floor - White Garage Door Glazing	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12A *132005249-0025*	1st Floor Garage Side Window - White Metal Window Glazing	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12B *132005249-0026*	1st Floor Garage Side Window - White Metal Window Glazing	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
13A *132005249-0027*	Ext. Roof - Black 3-Tab Shingle - 1st Layer	Black Fibrous Homogeneous	15% Glass	85% Non-fibrous (Other)	None Detected
13B *132005249-0028*	Ext. Roof - Black 3-Tab Shingle - 1st Layer	Black Fibrous Homogeneous	15% Glass	85% Non-fibrous (Other)	None Detected
14A *132005249-0029*	Ext. Roof - Black 3-Tab Shingle - 2nd Layer	Black Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
14B *132005249-0030*	Ext. Roof - Black 3-Tab Shingle - 2nd Layer	Black Non-Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
15A *132005249-0031*	Ext. Garage - White Garage Door Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
Customer ID: SMIT50B
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
15B *132005249-0032*	Ext. Garage - White Garage Door Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
16A *132005249-0033*	Ext. Roof Rear Storage Container - Black Tar Mop Roof	Black Non-Fibrous Homogeneous	25% Cellulose	70% Non-fibrous (Other)	5% Chrysotile
16B *132005249-0034*	Ext. Roof Rear Storage Container - Black Tar Mop Roof				Positive Stop (Not Analyzed)
17A *132005249-0035*	1st Floor Office Bathroom - Tan Wall Panel Glue	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
17B *132005249-0036*	1st Floor Rear Bathroom - Tan Wall Panel Glue	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18A *132005249-0037*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18B *132005249-0038*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18C *132005249-0039*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Analyst(s)
Kevin Pine (36)

Steve Grise, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-139, VT AL998919, Maine Bulk Asbestos LB-0039

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
Customer ID: SMIT50B
Customer PO:
Project ID:

Attention: Rob Arcese
Smith & Wessel Associates, Inc.
188 Greenville Street
Spencer, MA 01562

Phone: (978) 346-4800
Fax: (978) 346-7265
Received Date: 08/04/2020 11:00 AM
Analysis Date: 08/19/2020
Collected Date:

Project: 20118/Former Gas Station; 925 Massachusetts Ave; Lunenburg, MA

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

Sample ID	Description	Appearance	% Matrix Material	% Non-Asbestos Fibers	Asbestos Types
05A *132005249-0011*	1st Floor Bathroom - Black Mastic	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected
05B *132005249-0012*	1st Floor Rear Bathroom - Black Mastic	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected

Analyst(s)

Matthew Conley (2)

Steve Grise, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. EMSL recommends that samples reported as none detected or <1% undergo additional analysis via PLM to avoid the possibility of false negatives.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA

Initial report from: 08/19/2020 11:25:28

APPENDIX B

Results of Testing for Lead-Based Paint (LBP)

Lead Based Paint Testing Results Former Citgo Service Station 925 Massachusetts Avenue Lunenburg, MA				
Location	**Substrate**	**Color**	**Component**	**Result mg/cm^2**
Exterior	Concrete	White	Wall	<0.1
	Wood	White	Wall	<0.1
	Wood	White	Window frame	<0.1
	Metal	White	Window sash	0.5
	Cinderblock	White	Wall	<0.1
	Concrete	White	Foundation wall	<0.1
	Brick	Brown	Façade lower wall	<0.1
	Wood	White	West side bathroom door	**3.9**
	Metal	Brown	Canopy guard rail	<0.1
	Metal	Gray	Canopy dunnage curb protector	<0.1
	Metal	Gray	Canopy support column	<0.1
	Metal	White	Upper canopy soffit and trim	<0.1
Roof	Wood	Red	Wood block trim	**2.6**
	Metal	Green	Cupola	**2.5**
Garage	Cinderblock	Red	Interior wall	<0.1
	Plaster	Red	Interior wall	<0.1
	Plaster	White	Interior wall and ceiling	<0.1
	Cinderblock	White	Interior wall and ceiling	<0.1
	Wood	White	Shelving unit	<0.1
	Wood	White	Garage door frame	0.2
	Concrete	Yellow	Floor	<0.1
Service center	Wood	Brown	Door frame	0.1
	Wood	Pink	Wall	<0.1
	Wood	Tan	Door	0.1

Note: All testing was conducted using a NITON XLS-303A. Limit of detection = 0.1 mg/cm^2.

APPENDIX C

PCB Analytical Results

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 0H05010
Client Project: 925 Massachusetts Ave, Lunenburg, MA

Report Date: 12-August-2020

Prepared for:

Robert Arcese
Smith & Wessel Associates
515 Wildlife Glen
Bradenton, FL 34209



Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 08/05/20. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 0H05010. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
0H05010-01	PCB-01	Solid (Misc)	08/03/2020	08/05/2020
0H05010-02	PCB-02	Solid (Misc)	08/03/2020	08/05/2020
0H05010-03	PCB-03	Solid (Misc)	08/03/2020	08/05/2020
0H05010-04	PCB-04	Solid (Misc)	08/03/2020	08/05/2020

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

PCB-01 (Lab Number: 0H05010-01)

Analysis	Method
PCBs	EPA 8082A

PCB-02 (Lab Number: 0H05010-02)

Analysis	Method
PCBs	EPA 8082A

PCB-03 (Lab Number: 0H05010-03)

Analysis	Method
PCBs	EPA 8082A

PCB-04 (Lab Number: 0H05010-04)

Analysis	Method
PCBs	EPA 8082A

Method References

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA

Case Narrative

Sample Receipt:

The samples associated with this work order were received in appropriately cooled and preserved containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Exceptions: None

Analysis:

All samples were prepared and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control requirements and allowances. Results for all soil samples, unless otherwise indicated, are reported on a dry weight basis. Samples were extracted via EPA 3540C - Soxhlet.

Exceptions: None

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-01

Lab Number: 0H05010-01 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		161	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		161	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*49.6%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*51.3%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-02

Lab Number: 0H05010-02 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		172	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		172	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*53.3%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*60.8%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-03

Lab Number: 0H05010-03 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		189	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		189	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*46.7%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*51.0%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-04

Lab Number: 0H05010-04 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		157	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		157	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*49.8%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*52.2%*	*30-105*	08/07/20	08/12/20

Quality Control

Polychlorinated Biphenyls (PCBs)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B0H0291 - EPA 3540C										
Blank (B0H0291-BLK1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	ND		200	ug/kg						
Aroclor-1221	ND		200	ug/kg						
Aroclor-1232	ND		200	ug/kg						
Aroclor-1242	ND		200	ug/kg						
Aroclor-1248	ND		200	ug/kg						
Aroclor-1254	ND		200	ug/kg						
Aroclor-1260	ND		200	ug/kg						
Aroclor-1262	ND		200	ug/kg						
Aroclor-1268	ND		200	ug/kg						
PCBs (Total)	ND		200	ug/kg						
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*67.0*	ug/kg	*80.0*		*83.7*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*75.1*	ug/kg	*80.0*		*93.9*	*30-105*		
LCS (B0H0291-BS1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	793		200	ug/kg	1000		79.3	64-112		
Aroclor-1260	964		200	ug/kg	1000		96.4	59.4-124		
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*64.4*	ug/kg	*80.0*		*80.5*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*76.2*	ug/kg	*80.0*		*95.2*	*30-105*		
LCS Dup (B0H0291-BSD1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	847		200	ug/kg	1000		84.7	64-112	6.53	20
Aroclor-1260	955		200	ug/kg	1000		95.5	59.4-124	0.986	20
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*74.6*	ug/kg	*80.0*		*93.2*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*74.0*	ug/kg	*80.0*		*92.5*	*30-105*		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

0 H 0 5010;

Site: 925 Massachusetts Ave, Lunenburg, MA

		Location
PCB-01	Garage door glazing	Ext. Garage door glazing (sash)
PCB-02	Garage door caulking	Ext. Garage door (wood frame)
PCB-03	Container seam sealant	Rear storage container wall/ceiling seam
PCB-04	Garage window glazing	Metal garage window (sash)

Chain-of-custody

Relinquished by Robert Arcese Date 8/3/20 Time 16:00

Received by _____ Date 8/5/20 Time FedEx

Analysis requested: PCBs

Turnaround time: 5-days

Total # of samples 4

Analysis for PCBs via EPA's SW-846 Method 3540C/8082 SOXHLET Extraction

MassDEP Analytical Protocol Certification Form

Laboratory Name: New England Testing Laboratory, Inc.	Project #:
Project Location: Lunenburg, MA	RTN:

This Form provides certifications for the following data set: list Laboratory Sample ID Number(s):
0H05010

Matrices: ☐ Groundwater/Surface Water ☐ Soil/Sediment ☐ Drinking Water ☐ Air ☒ Other: Solid

CAM Protocol (check all that apply below):

8260 VOC CAM II A ☐	7470/7471 Hg CAM III B ☐	MassDEP VPH (GC/PID/FID) CAM IV A ☐	8082 PCB CAM V A ☒	9014 Total Cyanide/PAC CAM VI A ☐	6860 Perchlorate CAM VIII B ☐
8270 SVOC CAM II B ☐	7010 Metals CAM III C ☐	MassDEP VPH (GC/MS) CAM IV C ☐	8081 Pesticides CAM V B ☐	7196 Hex Cr CAM VI B ☐	MassDEP APH CAM IX A ☐
6010 Metals CAM III A ☐	6020 Metals CAM III D ☐	MassDEP EPH CAM IV B ☐	8151 Herbicides CAM V C ☐	8330 Explosives CAM VIII A ☐	TO-15 VOC CAM IX B ☐

Affirmative Responses to Questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	☒ Yes ☐ No
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	☒ Yes ☐ No
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	☒ Yes ☐ No
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	☒ Yes ☐ No
E	VPH, EPH, APH, and TO-15 only a. VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications). b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	☐ Yes ☐ No ☐ Yes ☐ No
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	☒ Yes ☐ No

Responses to Questions G, H and I below are required for "Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	☒ Yes ☐ No[1]

***Data User Note:** Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.*

H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	☒ Yes ☐ No[1]
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	☒ Yes ☐ No[1]

[1] *All negative responses must be addressed in an attached laboratory narrative.*

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, is accurate and complete.

Signature: _____ **Position:** Laboratory Director

Printed Name: Richard Warila **Date**: 8/12/2020

APPENDIX D

Site Photographs



Figure 1. Gas station façade



Figure 2. West perimeter wall from the parking lot



Figure 3. Gas station canopy and three fuel dispensers



Figure 4. Delaminating cement ceiling plaster in the rear garage storage space



Figure 5. Red cove base in the office and common lobby space



Figure 6. Hard ceiling panel adhesive above suspended ceiling in the office and common lobby space



Figure 7. 12” x 12” floor tile and associated mastic adhesive in the office bathroom



Figure 8. Garage and rear storage space



Figure 9. 1-gallon transformers suspected of containing PCB transformer oils in the mechanical room



Figure 10. Exposed lathing and ceiling joists in the attic



Figure 11. Additional view of exposed lathing from missing floor boards in the attic

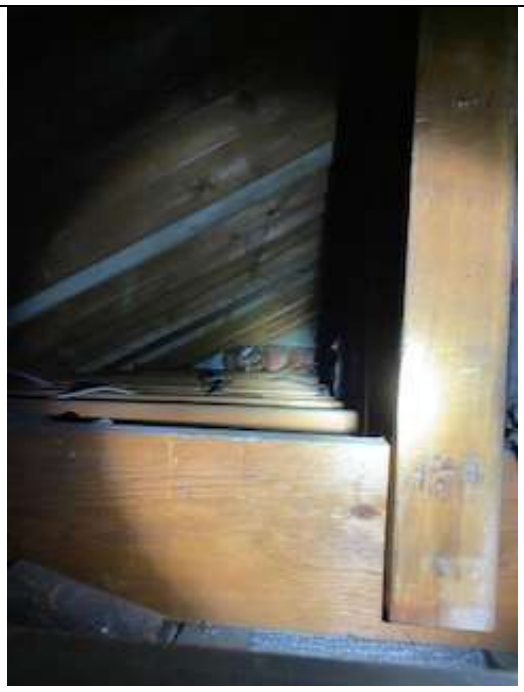


Figure 12. Roof rafters and truss in the attic with no suspect ACM or vermiculite insulation



Figure 13. Exposed CMU with no infill or insulating material



Figure 14. Garage doors with suspect ACM/PCB glazing and caulking



Figure 14. Tar mop roof with overgrown vegetation damaging the wood decking, fascia, and eave



Figure 15. 12" x 12" floor tile and associated mastic adhesive in the rear bathroom



Figure 16. Textured paint over CMU exterior wall (multiple layers collected as single grab sample)

Appendix G

Groundwater Certificates of Analysis

ANALYTICAL REPORT

Lab Number:	L2034373
Client:	Beta Group, Inc. 701 George Washington Highway Lincoln, RI 02865
ATTN:	Joe McLoughlin
Phone:	(401) 333-2382
Project Name:	LUNENBURG
Project Number:	6893
Report Date:	08/28/20

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2034373-01	MW-101	WATER	LUNENBURG, MA	08/21/20 09:10	08/21/20
L2034373-02	MW-105	WATER	LUNENBURG, MA	08/21/20 10:00	08/21/20
L2034373-03	MW-104	WATER	LUNENBURG, MA	08/21/20 10:50	08/21/20
L2034373-04	MW-103	WATER	LUNENBURG, MA	08/21/20 12:10	08/21/20
L2034373-05	MW-102	WATER	LUNENBURG, MA	08/21/20 13:20	08/21/20
L2034373-06	DUP	WATER	LUNENBURG, MA	08/21/20 11:10	08/21/20
L2034373-07	EQUIP BLANK	WATER	LUNENBURG, MA	08/21/20 08:30	08/21/20
L2034373-08	TRIP BLANK	WATER	LUNENBURG, MA	08/18/20 00:00	08/21/20

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

MADEP MCP Response Action Analytical Report Certification

This form provides certifications for all samples performed by MCP methods. Please refer to the Sample Results and Container Information sections of this report for specification of MCP methods used for each analysis. The following questions pertain only to MCP Analytical Methods.

An affirmative response to questions A through F is required for "Presumptive Certainty" status		
A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	YES
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	YES
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	YES
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?"	YES
E a.	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	YES
E b.	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	N/A
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	YES

A response to questions G, H and I is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	NO
H	Were all QC performance standards specified in the CAM protocol(s) achieved?	NO
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	NO

For any questions answered "No", please refer to the case narrative section on the following page(s).

Please note that sample matrix information is located in the Sample Results section of this report.

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: LUNENBURG **Lab Number:** L2034373
Project Number: 6893 **Report Date:** 08/28/20

Case Narrative (continued)

MCP Related Narratives

Volatile Organics

In reference to question H:

The initial calibration, associated with L2034373-01 through -08, did not meet the method required minimum response factor on the lowest calibration standard for 1,4-dioxane (0.0021), as well as the average response factor for acetone and 1,4-dioxane.

The continuing calibration standards, associated with L2034373-01 through -08, are outside the acceptance criteria for several compounds; however, they are within overall method allowances. A copy of the continuing calibration standards is included as an addendum to this report.

EPH

In reference to question G:

L2034373-01 through -06: One or more of the target analytes did not achieve the requested CAM reporting limits.

In reference to question H:

L2034373-01: The surrogate recovery was outside the acceptance criteria for chloro-octadecane (29%); however, re-extraction achieved similar results: chloro-octadecane (30%). The results of both extractions are reported; however, all associated compounds are considered to have a potential bias.

VPH

In reference to question G:

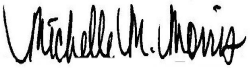
L2034373-04 and -05: One or more of the target analytes did not achieve the requested CAM reporting limits.

Total Metals

In reference to question I:

All samples were analyzed for a subset of MCP analytes per client request.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Michelle M. Morris

Title: Technical Director/Representative Date: 08/28/20

QC OUTLIER SUMMARY REPORT

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
MCP Volatile Organics - Westborough Lab								
8260C	Batch QC	WG1402996-4	Naphthalene	LCSD	21	20	01-05,07-08	non-directional bias
Extractable Petroleum Hydrocarbons - Westborough Lab								
EPH-19-2.1	MW-101	L2034373-01	Chloro-Octadecane	Surrogate	29	40-140	-	potential low bias
EPH-19-2.1	MW-101	L2034373-01 RE	Chloro-Octadecane	Surrogate	30	40-140	-	potential low bias
EPH-19-2.1	Batch QC	WG1402001-3	C19-C36 Aliphatics	LCSD	31	25	01-06	non-directional bias
EPH-19-2.1	Batch QC	WG1403212-3	C19-C36 Aliphatics	LCSD	27	25	01	non-directional bias
MCP Polychlorinated Biphenyls - Westborough Lab								
8082A	Laboratory Method Bl	WG1401976-1	Decachlorobiphenyl (A)	Surrogate	24	30-150	-	potential low bias
8082A	Batch QC	WG1401976-2	Decachlorobiphenyl (A)	Surrogate	29	30-150	-	potential low bias
8082A	Batch QC	WG1401976-2	Decachlorobiphenyl (B)	Surrogate	28	30-150	-	potential low bias

ORGANICS

VOLATILES

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 11:23
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	3.7		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 Date Collected: 08/21/20 09:10

Client ID: MW-101 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	110		ug/l	2.0	--	1
o-Xylene	40		ug/l	1.0	--	1
Xylenes, Total	150		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	11		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	7.1		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 Date Collected: 08/21/20 09:10

Client ID: MW-101 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	17		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	41		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	101		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00
Client ID: MW-105 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 10:53
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	5.3		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00

Client ID: MW-105 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	110		ug/l	2.0	--	1
o-Xylene	32		ug/l	1.0	--	1
Xylenes, Total	140		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	3.3		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02 Date Collected: 08/21/20 10:00

Client ID: MW-105 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	12		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	31		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50
Client ID: MW-104 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 11:53
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50

Client ID: MW-104 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	9.7		ug/l	2.0	--	1
o-Xylene	2.3		ug/l	1.0	--	1
Xylenes, Total	12		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03 Date Collected: 08/21/20 10:50

Client ID: MW-104 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	4.0		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	103		70-130
Dibromofluoromethane	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 12:24
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	10		ug/l	0.50	--	1
Toluene	3.6		ug/l	1.0	--	1
Ethylbenzene	370	E	ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 Date Collected: 08/21/20 12:10

Client ID: MW-103 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	6.5		ug/l	2.0	--	1
p/m-Xylene	1200	E	ug/l	2.0	--	1
o-Xylene	9.4		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	6.1		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	17		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	50		ug/l	2.0	--	1
n-Propylbenzene	34		ug/l	2.0	--	1
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 Date Collected: 08/21/20 12:10

Client ID: MW-103 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	50		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	230	E	ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	100		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	95		70-130
Dibromofluoromethane	90		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 D
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 08:41
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Ethylbenzene	280		ug/l	10	--	10
p/m-Xylene	1000		ug/l	20	--	10
Xylenes, Total	1000		ug/l	1.0	--	10
1,2,4-Trimethylbenzene	180		ug/l	20	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20
Client ID: MW-102 Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 12:54
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	17		ug/l	0.50	--	1
Toluene	6.3		ug/l	1.0	--	1
Ethylbenzene	560	E	ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20

Client ID: MW-102 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	5.6		ug/l	2.0	--	1
p/m-Xylene	1500	E	ug/l	2.0	--	1
o-Xylene	16		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	2.6		ug/l	2.0	--	1
sec-Butylbenzene	2.9		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	29		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	85		ug/l	2.0	--	1
n-Propylbenzene	58		ug/l	2.0	--	1
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 Date Collected: 08/21/20 13:20

Client ID: MW-102 Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	86		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	370	E	ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	107		70-130
Toluene-d8	101		70-130
4-Bromofluorobenzene	93		70-130
Dibromofluoromethane	85		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05 D
Client ID: MW-102
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 09:11
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Ethylbenzene	690		ug/l	10	--	10
p/m-Xylene	2500		ug/l	20	--	10
Xylenes, Total	2500		ug/l	1.0	--	10
1,2,4-Trimethylbenzene	420		ug/l	20	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	99		70-130
Dibromofluoromethane	95		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10
Client ID: DUP Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/27/20 08:11
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10

Client ID: DUP Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	9.1		ug/l	2.0	--	1
o-Xylene	2.2		ug/l	1.0	--	1
Xylenes, Total	11		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06 Date Collected: 08/21/20 11:10

Client ID: DUP Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	3.8		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	101		70-130
Dibromofluoromethane	98		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07
Client ID: EQUIP BLANK
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 08:30
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 13:55
Analyst: TMS

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07 Date Collected: 08/21/20 08:30

Client ID: EQUIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-07 Date Collected: 08/21/20 08:30

Client ID: EQUIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	91		70-130
Toluene-d8	99		70-130
4-Bromofluorobenzene	104		70-130
Dibromofluoromethane	96		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00
Client ID: TRIP BLANK Date Received: 08/21/20
Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8260C
Analytical Date: 08/26/20 09:52
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Methylene chloride	ND		ug/l	2.0	--	1
1,1-Dichloroethane	ND		ug/l	1.0	--	1
Chloroform	ND		ug/l	1.0	--	1
Carbon tetrachloride	ND		ug/l	1.0	--	1
1,2-Dichloropropane	ND		ug/l	1.0	--	1
Dibromochloromethane	ND		ug/l	1.0	--	1
1,1,2-Trichloroethane	ND		ug/l	1.0	--	1
Tetrachloroethene	ND		ug/l	1.0	--	1
Chlorobenzene	ND		ug/l	1.0	--	1
Trichlorofluoromethane	ND		ug/l	2.0	--	1
1,2-Dichloroethane	ND		ug/l	1.0	--	1
1,1,1-Trichloroethane	ND		ug/l	1.0	--	1
Bromodichloromethane	ND		ug/l	1.0	--	1
trans-1,3-Dichloropropene	ND		ug/l	0.40	--	1
cis-1,3-Dichloropropene	ND		ug/l	0.40	--	1
1,3-Dichloropropene, Total	ND		ug/l	0.40	--	1
1,1-Dichloropropene	ND		ug/l	2.0	--	1
Bromoform	ND		ug/l	2.0	--	1
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Benzene	ND		ug/l	0.50	--	1
Toluene	ND		ug/l	1.0	--	1
Ethylbenzene	ND		ug/l	1.0	--	1
Chloromethane	ND		ug/l	2.0	--	1
Bromomethane	ND		ug/l	2.0	--	1
Vinyl chloride	ND		ug/l	1.0	--	1
Chloroethane	ND		ug/l	2.0	--	1
1,1-Dichloroethene	ND		ug/l	1.0	--	1
trans-1,2-Dichloroethene	ND		ug/l	1.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00

Client ID: TRIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
Trichloroethene	ND		ug/l	1.0	--	1
1,2-Dichlorobenzene	ND		ug/l	1.0	--	1
1,3-Dichlorobenzene	ND		ug/l	1.0	--	1
1,4-Dichlorobenzene	ND		ug/l	1.0	--	1
Methyl tert butyl ether	ND		ug/l	2.0	--	1
p/m-Xylene	ND		ug/l	2.0	--	1
o-Xylene	ND		ug/l	1.0	--	1
Xylenes, Total	ND		ug/l	1.0	--	1
cis-1,2-Dichloroethene	ND		ug/l	1.0	--	1
1,2-Dichloroethene, Total	ND		ug/l	1.0	--	1
Dibromomethane	ND		ug/l	2.0	--	1
1,2,3-Trichloropropane	ND		ug/l	2.0	--	1
Styrene	ND		ug/l	1.0	--	1
Dichlorodifluoromethane	ND		ug/l	2.0	--	1
Acetone	ND		ug/l	5.0	--	1
Carbon disulfide	ND		ug/l	2.0	--	1
Methyl ethyl ketone	ND		ug/l	5.0	--	1
Methyl isobutyl ketone	ND		ug/l	5.0	--	1
2-Hexanone	ND		ug/l	5.0	--	1
Bromochloromethane	ND		ug/l	2.0	--	1
Tetrahydrofuran	ND		ug/l	2.0	--	1
2,2-Dichloropropane	ND		ug/l	2.0	--	1
1,2-Dibromoethane	ND		ug/l	2.0	--	1
1,3-Dichloropropane	ND		ug/l	2.0	--	1
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--	1
Bromobenzene	ND		ug/l	2.0	--	1
n-Butylbenzene	ND		ug/l	2.0	--	1
sec-Butylbenzene	ND		ug/l	2.0	--	1
tert-Butylbenzene	ND		ug/l	2.0	--	1
o-Chlorotoluene	ND		ug/l	2.0	--	1
p-Chlorotoluene	ND		ug/l	2.0	--	1
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--	1
Hexachlorobutadiene	ND		ug/l	0.60	--	1
Isopropylbenzene	ND		ug/l	2.0	--	1
p-Isopropyltoluene	ND		ug/l	2.0	--	1
Naphthalene	ND		ug/l	2.0	--	1
n-Propylbenzene	ND		ug/l	2.0	--	1

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-08 Date Collected: 08/18/20 00:00

Client ID: TRIP BLANK Date Received: 08/21/20

Sample Location: LUNENBURG, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--	1
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--	1
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--	1
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--	1
Diethyl ether	ND		ug/l	2.0	--	1
Diisopropyl Ether	ND		ug/l	2.0	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--	1
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--	1
1,4-Dioxane	ND		ug/l	250	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	89		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/26/20 05:50
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 01-05,07-08 Batch: WG1402996-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	105		70-130
Dibromofluoromethane	99		70-130

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
Methylene chloride	ND		ug/l	2.0	--
1,1-Dichloroethane	ND		ug/l	1.0	--
Chloroform	ND		ug/l	1.0	--
Carbon tetrachloride	ND		ug/l	1.0	--
1,2-Dichloropropane	ND		ug/l	1.0	--
Dibromochloromethane	ND		ug/l	1.0	--
1,1,2-Trichloroethane	ND		ug/l	1.0	--
Tetrachloroethene	ND		ug/l	1.0	--
Chlorobenzene	ND		ug/l	1.0	--
Trichlorofluoromethane	ND		ug/l	2.0	--
1,2-Dichloroethane	ND		ug/l	1.0	--
1,1,1-Trichloroethane	ND		ug/l	1.0	--
Bromodichloromethane	ND		ug/l	1.0	--
trans-1,3-Dichloropropene	ND		ug/l	0.40	--
cis-1,3-Dichloropropene	ND		ug/l	0.40	--
1,3-Dichloropropene, Total	ND		ug/l	0.40	--
1,1-Dichloropropene	ND		ug/l	2.0	--
Bromoform	ND		ug/l	2.0	--
1,1,2,2-Tetrachloroethane	ND		ug/l	1.0	--
Benzene	ND		ug/l	0.50	--
Toluene	ND		ug/l	1.0	--
Ethylbenzene	ND		ug/l	1.0	--
Chloromethane	ND		ug/l	2.0	--
Bromomethane	ND		ug/l	2.0	--
Vinyl chloride	ND		ug/l	1.0	--
Chloroethane	ND		ug/l	2.0	--
1,1-Dichloroethene	ND		ug/l	1.0	--
trans-1,2-Dichloroethene	ND		ug/l	1.0	--
Trichloroethene	ND		ug/l	1.0	--

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
1,2-Dichlorobenzene	ND		ug/l	1.0	--
1,3-Dichlorobenzene	ND		ug/l	1.0	--
1,4-Dichlorobenzene	ND		ug/l	1.0	--
Methyl tert butyl ether	ND		ug/l	2.0	--
p/m-Xylene	ND		ug/l	2.0	--
o-Xylene	ND		ug/l	1.0	--
Xylenes, Total	ND		ug/l	1.0	--
cis-1,2-Dichloroethene	ND		ug/l	1.0	--
1,2-Dichloroethene, Total	ND		ug/l	1.0	--
Dibromomethane	ND		ug/l	2.0	--
1,2,3-Trichloropropane	ND		ug/l	2.0	--
Styrene	ND		ug/l	1.0	--
Dichlorodifluoromethane	ND		ug/l	2.0	--
Acetone	ND		ug/l	5.0	--
Carbon disulfide	ND		ug/l	2.0	--
Methyl ethyl ketone	ND		ug/l	5.0	--
Methyl isobutyl ketone	ND		ug/l	5.0	--
2-Hexanone	ND		ug/l	5.0	--
Bromochloromethane	ND		ug/l	2.0	--
Tetrahydrofuran	ND		ug/l	2.0	--
2,2-Dichloropropane	ND		ug/l	2.0	--
1,2-Dibromoethane	ND		ug/l	2.0	--
1,3-Dichloropropane	ND		ug/l	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/l	1.0	--
Bromobenzene	ND		ug/l	2.0	--
n-Butylbenzene	ND		ug/l	2.0	--
sec-Butylbenzene	ND		ug/l	2.0	--
tert-Butylbenzene	ND		ug/l	2.0	--
o-Chlorotoluene	ND		ug/l	2.0	--

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/27/20 06:40
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics - Westborough Lab for sample(s): 04-06 Batch: WG1403442-5					
p-Chlorotoluene	ND		ug/l	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/l	2.0	--
Hexachlorobutadiene	ND		ug/l	0.60	--
Isopropylbenzene	ND		ug/l	2.0	--
p-Isopropyltoluene	ND		ug/l	2.0	--
Naphthalene	ND		ug/l	2.0	--
n-Propylbenzene	ND		ug/l	2.0	--
1,2,3-Trichlorobenzene	ND		ug/l	2.0	--
1,2,4-Trichlorobenzene	ND		ug/l	2.0	--
1,3,5-Trimethylbenzene	ND		ug/l	2.0	--
1,2,4-Trimethylbenzene	ND		ug/l	2.0	--
Diethyl ether	ND		ug/l	2.0	--
Diisopropyl Ether	ND		ug/l	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/l	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/l	2.0	--
1,4-Dioxane	ND		ug/l	250	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	90		70-130
Toluene-d8	100		70-130
4-Bromofluorobenzene	104		70-130
Dibromofluoromethane	98		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
Methylene chloride	110		100		70-130	10		20
1,1-Dichloroethane	110		100		70-130	10		20
Chloroform	100		97		70-130	3		20
Carbon tetrachloride	92		93		70-130	1		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	86		88		70-130	2		20
1,1,2-Trichloroethane	94		95		70-130	1		20
Tetrachloroethene	100		97		70-130	3		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	92		90		70-130	2		20
1,2-Dichloroethane	95		92		70-130	3		20
1,1,1-Trichloroethane	96		94		70-130	2		20
Bromodichloromethane	91		92		70-130	1		20
trans-1,3-Dichloropropene	86		86		70-130	0		20
cis-1,3-Dichloropropene	95		95		70-130	0		20
1,1-Dichloropropene	100		98		70-130	2		20
Bromoform	98		92		70-130	6		20
1,1,2,2-Tetrachloroethane	110		100		70-130	10		20
Benzene	110		100		70-130	10		20
Toluene	100		98		70-130	2		20
Ethylbenzene	99		96		70-130	3		20
Chloromethane	130		120		70-130	8		20
Bromomethane	85		87		70-130	2		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
Vinyl chloride	99		98		70-130	1		20
Chloroethane	100		100		70-130	0		20
1,1-Dichloroethene	88		87		70-130	1		20
trans-1,2-Dichloroethene	100		100		70-130	0		20
Trichloroethene	100		98		70-130	2		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	110		100		70-130	10		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	90		90		70-130	0		20
p/m-Xylene	90		90		70-130	0		20
o-Xylene	85		90		70-130	6		20
cis-1,2-Dichloroethene	100		100		70-130	0		20
Dibromomethane	94		92		70-130	2		20
1,2,3-Trichloropropane	110		100		70-130	10		20
Styrene	90		90		70-130	0		20
Dichlorodifluoromethane	85		84		70-130	1		20
Acetone	110		110		70-130	0		20
Carbon disulfide	88		88		70-130	0		20
Methyl ethyl ketone	120		120		70-130	0		20
Methyl isobutyl ketone	91		92		70-130	1		20
2-Hexanone	100		100		70-130	0		20
Bromochloromethane	100		100		70-130	0		20
Tetrahydrofuran	120		120		70-130	0		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 01-05,07-08 Batch: WG1402996-3 WG1402996-4								
2,2-Dichloropropane	93		90		70-130	3		20
1,2-Dibromoethane	91		92		70-130	1		20
1,3-Dichloropropane	93		93		70-130	0		20
1,1,1,2-Tetrachloroethane	94		95		70-130	1		20
Bromobenzene	120		100		70-130	18		20
n-Butylbenzene	100		110		70-130	10		20
sec-Butylbenzene	110		100		70-130	10		20
tert-Butylbenzene	110		100		70-130	10		20
o-Chlorotoluene	110		100		70-130	10		20
p-Chlorotoluene	100		98		70-130	2		20
1,2-Dibromo-3-chloropropane	100		91		70-130	9		20
Hexachlorobutadiene	120		120		70-130	0		20
Isopropylbenzene	120		100		70-130	18		20
p-Isopropyltoluene	100		100		70-130	0		20
Naphthalene	89		110		70-130	**21**	Q	20
n-Propylbenzene	110		100		70-130	10		20
1,2,3-Trichlorobenzene	94		110		70-130	16		20
1,2,4-Trichlorobenzene	92		110		70-130	18		20
1,3,5-Trimethylbenzene	87		100		70-130	14		20
1,2,4-Trimethylbenzene	87		100		70-130	14		20
Diethyl ether	85		84		70-130	1		20
Diisopropyl Ether	130		130		70-130	0		20
Ethyl-Tert-Butyl-Ether	98		97		70-130	1		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab	Associated sample(s): 01-05,07-08		Batch: WG1402996-3 WG1402996-4					
Tertiary-Amyl Methyl Ether	89		89		70-130	0		20
1,4-Dioxane	112		102		70-130	9		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	92		91		70-130
Toluene-d8	101		101		70-130
4-Bromofluorobenzene	112		101		70-130
Dibromofluoromethane	99		98		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Methylene chloride	110		100		70-130	10		20
1,1-Dichloroethane	110		110		70-130	0		20
Chloroform	99		99		70-130	0		20
Carbon tetrachloride	94		95		70-130	1		20
1,2-Dichloropropane	110		110		70-130	0		20
Dibromochloromethane	89		91		70-130	2		20
1,1,2-Trichloroethane	94		95		70-130	1		20
Tetrachloroethene	100		100		70-130	0		20
Chlorobenzene	100		100		70-130	0		20
Trichlorofluoromethane	90		92		70-130	2		20
1,2-Dichloroethane	94		92		70-130	2		20
1,1,1-Trichloroethane	96		95		70-130	1		20
Bromodichloromethane	93		93		70-130	0		20
trans-1,3-Dichloropropene	88		88		70-130	0		20
cis-1,3-Dichloropropene	97		97		70-130	0		20
1,1-Dichloropropene	99		99		70-130	0		20
Bromoform	94		94		70-130	0		20
1,1,2,2-Tetrachloroethane	100		100		70-130	0		20
Benzene	100		100		70-130	0		20
Toluene	100		100		70-130	0		20
Ethylbenzene	98		98		70-130	0		20
Chloromethane	120		120		70-130	0		20
Bromomethane	82		80		70-130	2		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Vinyl chloride	95		96		70-130	1		20
Chloroethane	98		100		70-130	2		20
1,1-Dichloroethene	87		89		70-130	2		20
trans-1,2-Dichloroethene	100		100		70-130	0		20
Trichloroethene	99		100		70-130	1		20
1,2-Dichlorobenzene	100		100		70-130	0		20
1,3-Dichlorobenzene	100		100		70-130	0		20
1,4-Dichlorobenzene	100		100		70-130	0		20
Methyl tert butyl ether	93		93		70-130	0		20
p/m-Xylene	95		95		70-130	0		20
o-Xylene	90		95		70-130	5		20
cis-1,2-Dichloroethene	100		100		70-130	0		20
Dibromomethane	94		94		70-130	0		20
1,2,3-Trichloropropane	100		99		70-130	1		20
Styrene	90		90		70-130	0		20
Dichlorodifluoromethane	84		84		70-130	0		20
Acetone	110		110		70-130	0		20
Carbon disulfide	87		89		70-130	2		20
Methyl ethyl ketone	120		110		70-130	9		20
Methyl isobutyl ketone	92		90		70-130	2		20
2-Hexanone	100		100		70-130	0		20
Bromochloromethane	100		100		70-130	0		20
Tetrahydrofuran	120		120		70-130	0		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
2,2-Dichloropropane	94		93		70-130	1		20
1,2-Dibromoethane	92		93		70-130	1		20
1,3-Dichloropropane	94		92		70-130	2		20
1,1,1,2-Tetrachloroethane	96		97		70-130	1		20
Bromobenzene	110		110		70-130	0		20
n-Butylbenzene	110		110		70-130	0		20
sec-Butylbenzene	100		100		70-130	0		20
tert-Butylbenzene	100		100		70-130	0		20
o-Chlorotoluene	110		100		70-130	10		20
p-Chlorotoluene	98		98		70-130	0		20
1,2-Dibromo-3-chloropropane	92		93		70-130	1		20
Hexachlorobutadiene	120		130		70-130	8		20
Isopropylbenzene	100		100		70-130	0		20
p-Isopropyltoluene	100		110		70-130	10		20
Naphthalene	110		110		70-130	0		20
n-Propylbenzene	100		100		70-130	0		20
1,2,3-Trichlorobenzene	110		120		70-130	9		20
1,2,4-Trichlorobenzene	110		120		70-130	9		20
1,3,5-Trimethylbenzene	99		100		70-130	1		20
1,2,4-Trimethylbenzene	100		100		70-130	0		20
Diethyl ether	85		86		70-130	1		20
Diisopropyl Ether	130		130		70-130	0		20
Ethyl-Tert-Butyl-Ether	100		100		70-130	0		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics - Westborough Lab Associated sample(s): 04-06 Batch: WG1403442-3 WG1403442-4								
Tertiary-Amyl Methyl Ether	93		92		70-130	1		20
1,4-Dioxane	90		92		70-130	2		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	91		89		70-130
Toluene-d8	100		99		70-130
4-Bromofluorobenzene	100		100		70-130
Dibromofluoromethane	97		98		70-130

PETROLEUM HYDROCARBONS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 13:55
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	405		ug/l	100	--	1
C9-C10 Aromatics	220		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	2.62		ug/l	2.00	--	1
p/m-Xylene	118		ug/l	2.00	--	1
o-Xylene	41.5		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	8.41		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	107		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-01	Date Collected:	08/21/20 09:10
Client ID:	MW-101	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/26/20 13:00	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/26/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Extractable Petroleum Hydrocarbons - Westborough Lab

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	541		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Lab Number: L2034373
Project Number: 6893
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**29**	Q	40-140
o-Terphenyl	54		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-01 RE	Date Collected:	08/21/20 09:10
Client ID:	MW-101	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/26/20 15:47
Analytical Date:	08/27/20 09:46	Cleanup Method1:	EPH-04-1
Analyst:	MEO	Cleanup Date1:	08/27/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	499		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Lab Number: L2034373
Project Number: 6893
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01 RE
Client ID: MW-101
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	**30**	Q	40-140
o-Terphenyl	59		40-140
2-Fluorobiphenyl	72		40-140
2-Bromonaphthalene	75		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 14:25
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	238		ug/l	100	--	1
C9-C10 Aromatics	101		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	3.72		ug/l	2.00	--	1
p/m-Xylene	90.7		ug/l	2.00	--	1
o-Xylene	27.8		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	105		70-130
2,5-Dibromotoluene-FID	100		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-02	Date Collected:	08/21/20 10:00
Client ID:	MW-105	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 07:53	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	53		40-140
o-Terphenyl	55		40-140
2-Fluorobiphenyl	58		40-140
2-Bromonaphthalene	60		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 14:56
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	ND		ug/l	100	--	1
C9-C10 Aromatics	ND		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	ND		ug/l	2.00	--	1
p/m-Xylene	9.12		ug/l	2.00	--	1
o-Xylene	ND		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	108		70-130
2,5-Dibromotoluene-FID	104		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-03	Date Collected:	08/21/20 10:50
Client ID:	MW-104	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 08:18	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	56		40-140
o-Terphenyl	60		40-140
2-Fluorobiphenyl	64		40-140
2-Bromonaphthalene	66		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-04	Date Collected:	08/21/20 12:10
Client ID:	MW-103	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 08:43	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	30.5		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	55		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	71		40-140
2-Bromonaphthalene	73		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04 D
Client ID: MW-103
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 15:26
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	400	--	4
C9-C12 Aliphatics	2300		ug/l	400	--	4
C9-C10 Aromatics	634		ug/l	400	--	4
C5-C8 Aliphatics, Adjusted	ND		ug/l	400	--	4
C9-C12 Aliphatics, Adjusted	ND		ug/l	400	--	4
Benzene	ND		ug/l	8.00	--	4
Toluene	ND		ug/l	8.00	--	4
Ethylbenzene	298		ug/l	8.00	--	4
p/m-Xylene	1160		ug/l	8.00	--	4
o-Xylene	ND		ug/l	8.00	--	4
Methyl tert butyl ether	ND		ug/l	12.0	--	4
Naphthalene	40.8		ug/l	16.0	--	4

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	109		70-130
2,5-Dibromotoluene-FID	102		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-05	Date Collected:	08/21/20 13:20
Client ID:	MW-102	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 09:08	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	43.1		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	46		40-140
o-Terphenyl	61		40-140
2-Fluorobiphenyl	64		40-140
2-Bromonaphthalene	66		40-140

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-05 D	Date Collected:	08/21/20 13:20
Client ID:	MW-102	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	08/27/20 15:56		
Analyst:	BAD		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	1000	--	10
C9-C12 Aliphatics	5340		ug/l	1000	--	10
C9-C10 Aromatics	1450		ug/l	1000	--	10
C5-C8 Aliphatics, Adjusted	ND		ug/l	1000	--	10
C9-C12 Aliphatics, Adjusted	ND		ug/l	1000	--	10
Benzene	ND		ug/l	20.0	--	10
Toluene	ND		ug/l	20.0	--	10
Ethylbenzene	707		ug/l	20.0	--	10
p/m-Xylene	2710		ug/l	20.0	--	10
o-Xylene	ND		ug/l	20.0	--	10
Methyl tert butyl ether	ND		ug/l	30.0	--	10
Naphthalene	94.2		ug/l	40.0	--	10

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	97		70-130
2,5-Dibromotoluene-FID	92		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 16:26
Analyst: BAD

Trap: EST, Carbopack B/Carboxen 1000&1001
Analytical Column: Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received: Satisfactory
Aqueous Preservative: Laboratory Provided Preserved Container
Sample Temperature upon receipt: Received on Ice

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		ug/l	100	--	1
C9-C12 Aliphatics	ND		ug/l	100	--	1
C9-C10 Aromatics	ND		ug/l	100	--	1
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--	1
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--	1
Benzene	ND		ug/l	2.00	--	1
Toluene	ND		ug/l	2.00	--	1
Ethylbenzene	ND		ug/l	2.00	--	1
p/m-Xylene	10.0		ug/l	2.00	--	1
o-Xylene	2.23		ug/l	2.00	--	1
Methyl tert butyl ether	ND		ug/l	3.00	--	1
Naphthalene	ND		ug/l	4.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	106		70-130
2,5-Dibromotoluene-FID	102		70-130

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID:	L2034373-06	Date Collected:	08/21/20 11:10
Client ID:	DUP	Date Received:	08/21/20
Sample Location:	LUNENBURG, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 3510C
Analytical Method:	135,EPH-19-2.1	Extraction Date:	08/23/20 18:26
Analytical Date:	08/25/20 09:33	Cleanup Method1:	EPH-04-1
Analyst:	SC	Cleanup Date1:	08/24/20

Quality Control Information

Condition of sample received:	Satisfactory
Aqueous Preservative:	Laboratory Provided Preserved Container
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Extractable Petroleum Hydrocarbons - Westborough Lab

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
C9-C18 Aliphatics	ND		ug/l	100	--	1
C19-C36 Aliphatics	ND		ug/l	100	--	1
C11-C22 Aromatics	ND		ug/l	100	--	1
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--	1
Naphthalene	ND		ug/l	10.0	--	1
2-Methylnaphthalene	ND		ug/l	10.0	--	1
Acenaphthylene	ND		ug/l	10.0	--	1
Acenaphthene	ND		ug/l	10.0	--	1
Fluorene	ND		ug/l	10.0	--	1
Phenanthrene	ND		ug/l	10.0	--	1
Anthracene	ND		ug/l	10.0	--	1
Fluoranthene	ND		ug/l	10.0	--	1
Pyrene	ND		ug/l	10.0	--	1
Benzo(a)anthracene	ND		ug/l	10.0	--	1
Chrysene	ND		ug/l	10.0	--	1
Benzo(b)fluoranthene	ND		ug/l	10.0	--	1
Benzo(k)fluoranthene	ND		ug/l	10.0	--	1
Benzo(a)pyrene	ND		ug/l	10.0	--	1
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--	1
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--	1
Benzo(ghi)perylene	ND		ug/l	10.0	--	1

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Extractable Petroleum Hydrocarbons - Westborough Lab

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	64		40-140
o-Terphenyl	60		40-140
2-Fluorobiphenyl	68		40-140
2-Bromonaphthalene	71		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/25/20 07:04
Analyst: SC

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 18:26
Cleanup Method: EPH-04-1
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-06 Batch: WG1402001-1					
C9-C18 Aliphatics	ND		ug/l	100	--
C19-C36 Aliphatics	ND		ug/l	100	--
C11-C22 Aromatics	ND		ug/l	100	--
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--
Naphthalene	ND		ug/l	10.0	--
2-Methylnaphthalene	ND		ug/l	10.0	--
Acenaphthylene	ND		ug/l	10.0	--
Acenaphthene	ND		ug/l	10.0	--
Fluorene	ND		ug/l	10.0	--
Phenanthrene	ND		ug/l	10.0	--
Anthracene	ND		ug/l	10.0	--
Fluoranthene	ND		ug/l	10.0	--
Pyrene	ND		ug/l	10.0	--
Benzo(a)anthracene	ND		ug/l	10.0	--
Chrysene	ND		ug/l	10.0	--
Benzo(b)fluoranthene	ND		ug/l	10.0	--
Benzo(k)fluoranthene	ND		ug/l	10.0	--
Benzo(a)pyrene	ND		ug/l	10.0	--
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--
Benzo(ghi)perylene	ND		ug/l	10.0	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	64		40-140
o-Terphenyl	57		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/27/20 09:21
Analyst: MEO

Extraction Method: EPA 3510C
Extraction Date: 08/26/20 15:47
Cleanup Method: EPH-04-1
Cleanup Date: 08/27/20

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01 Batch: WG1403212-1					
C9-C18 Aliphatics	ND		ug/l	100	--
C19-C36 Aliphatics	ND		ug/l	100	--
C11-C22 Aromatics	ND		ug/l	100	--
C11-C22 Aromatics, Adjusted	ND		ug/l	100	--
Naphthalene	ND		ug/l	10.0	--
2-Methylnaphthalene	ND		ug/l	10.0	--
Acenaphthylene	ND		ug/l	10.0	--
Acenaphthene	ND		ug/l	10.0	--
Fluorene	ND		ug/l	10.0	--
Phenanthrene	ND		ug/l	10.0	--
Anthracene	ND		ug/l	10.0	--
Fluoranthene	ND		ug/l	10.0	--
Pyrene	ND		ug/l	10.0	--
Benzo(a)anthracene	ND		ug/l	10.0	--
Chrysene	ND		ug/l	10.0	--
Benzo(b)fluoranthene	ND		ug/l	10.0	--
Benzo(k)fluoranthene	ND		ug/l	10.0	--
Benzo(a)pyrene	ND		ug/l	10.0	--
Indeno(1,2,3-cd)Pyrene	ND		ug/l	10.0	--
Dibenzo(a,h)anthracene	ND		ug/l	10.0	--
Benzo(ghi)perylene	ND		ug/l	10.0	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	57		40-140
2-Fluorobiphenyl	65		40-140
2-Bromonaphthalene	67		40-140

Project Name: LUNENBURG **Lab Number:** L2034373

Project Number: 6893 **Report Date:** 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 08/27/20 10:53
Analyst: BAD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-06 Batch: WG1404116-4					
C5-C8 Aliphatics	ND		ug/l	100	--
C9-C12 Aliphatics	ND		ug/l	100	--
C9-C10 Aromatics	ND		ug/l	100	--
C5-C8 Aliphatics, Adjusted	ND		ug/l	100	--
C9-C12 Aliphatics, Adjusted	ND		ug/l	100	--
Benzene	ND		ug/l	2.00	--
Toluene	ND		ug/l	2.00	--
Ethylbenzene	ND		ug/l	2.00	--
p/m-Xylene	ND		ug/l	2.00	--
o-Xylene	ND		ug/l	2.00	--
Methyl tert butyl ether	ND		ug/l	3.00	--
Naphthalene	ND		ug/l	4.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	101		70-130
2,5-Dibromotoluene-FID	96		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1402001-2 WG1402001-3								
C9-C18 Aliphatics	61		67		40-140	9		25
C19-C36 Aliphatics	70		96		40-140	**31**	Q	25
C11-C22 Aromatics	68		69		40-140	1		25
Naphthalene	56		49		40-140	13		25
2-Methylnaphthalene	62		54		40-140	14		25
Acenaphthylene	62		55		40-140	12		25
Acenaphthene	68		61		40-140	11		25
Fluorene	68		64		40-140	6		25
Phenanthrene	69		69		40-140	0		25
Anthracene	69		70		40-140	1		25
Fluoranthene	72		78		40-140	8		25
Pyrene	71		77		40-140	8		25
Benzo(a)anthracene	68		75		40-140	10		25
Chrysene	63		69		40-140	9		25
Benzo(b)fluoranthene	79		87		40-140	10		25
Benzo(k)fluoranthene	55		60		40-140	9		25
Benzo(a)pyrene	64		70		40-140	9		25
Indeno(1,2,3-cd)Pyrene	64		68		40-140	6		25
Dibenzo(a,h)anthracene	61		66		40-140	8		25
Benzo(ghi)perylene	56		60		40-140	7		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1402001-2 WG1402001-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	68		69		40-140
o-Terphenyl	56		57		40-140
2-Fluorobiphenyl	60		63		40-140
2-Bromonaphthalene	62		65		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01 Batch: WG1403212-2 WG1403212-3								
C9-C18 Aliphatics	58		47		40-140	21		25
C19-C36 Aliphatics	87		66		40-140	**27**	Q	25
C11-C22 Aromatics	66		59		40-140	11		25
Naphthalene	56		51		40-140	9		25
2-Methylnaphthalene	61		55		40-140	10		25
Acenaphthylene	60		54		40-140	11		25
Acenaphthene	66		58		40-140	13		25
Fluorene	66		60		40-140	10		25
Phenanthrene	66		60		40-140	10		25
Anthracene	67		60		40-140	11		25
Fluoranthene	71		64		40-140	10		25
Pyrene	68		61		40-140	11		25
Benzo(a)anthracene	68		60		40-140	13		25
Chrysene	67		59		40-140	13		25
Benzo(b)fluoranthene	76		68		40-140	11		25
Benzo(k)fluoranthene	57		50		40-140	13		25
Benzo(a)pyrene	66		57		40-140	15		25
Indeno(1,2,3-cd)Pyrene	64		54		40-140	17		25
Dibenzo(a,h)anthracene	57		50		40-140	13		25
Benzo(ghi)perylene	60		51		40-140	16		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01 Batch: WG1403212-2 WG1403212-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	62		44		40-140
o-Terphenyl	59		54		40-140
2-Fluorobiphenyl	63		61		40-140
2-Bromonaphthalene	65		63		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1404116-2 WG1404116-3								
C5-C8 Aliphatics	103		107		70-130	4		25
C9-C12 Aliphatics	106		110		70-130	4		25
C9-C10 Aromatics	111		114		70-130	3		25
Benzene	110		115		70-130	4		25
Toluene	110		114		70-130	4		25
Ethylbenzene	110		114		70-130	4		25
p/m-Xylene	111		114		70-130	3		25
o-Xylene	111		115		70-130	4		25
Methyl tert butyl ether	115		121		70-130	5		25
Naphthalene	116		121		70-130	4		25
1,2,4-Trimethylbenzene	111		114		70-130	3		25
Pentane	103		106		70-130	3		25
2-Methylpentane	104		109		70-130	5		25
2,2,4-Trimethylpentane	104		108		70-130	4		25
n-Nonane	107		111		30-130	4		25
n-Decane	104		107		70-130	3		25
n-Butylcyclohexane	108		112		70-130	4		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	111		113		70-130
2,5-Dibromotoluene-FID	105		105		70-130

PCBS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 12:55
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	79		30-150	A
Decachlorobiphenyl	53		30-150	A
2,4,5,6-Tetrachloro-m-xylene	73		30-150	B
Decachlorobiphenyl	55		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:03
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	B
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	B

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	78		30-150	A
Decachlorobiphenyl	49		30-150	A
2,4,5,6-Tetrachloro-m-xylene	70		30-150	B
Decachlorobiphenyl	48		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:10
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	87		30-150	A
Decachlorobiphenyl	57		30-150	A
2,4,5,6-Tetrachloro-m-xylene	80		30-150	B
Decachlorobiphenyl	59		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 13:18
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	0.407		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	0.407		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	83		30-150	A
Decachlorobiphenyl	47		30-150	A
2,4,5,6-Tetrachloro-m-xylene	73		30-150	B
Decachlorobiphenyl	49		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:25
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	84		30-150	A
Decachlorobiphenyl	47		30-150	A
2,4,5,6-Tetrachloro-m-xylene	76		30-150	B
Decachlorobiphenyl	53		30-150	B

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA

Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:32
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/l	0.250	--	1	A
Aroclor 1221	ND		ug/l	0.250	--	1	A
Aroclor 1232	ND		ug/l	0.250	--	1	A
Aroclor 1242	ND		ug/l	0.250	--	1	A
Aroclor 1248	ND		ug/l	0.250	--	1	A
Aroclor 1254	ND		ug/l	0.250	--	1	A
Aroclor 1260	ND		ug/l	0.250	--	1	A
Aroclor 1262	ND		ug/l	0.250	--	1	A
Aroclor 1268	ND		ug/l	0.250	--	1	A
PCBs, Total	ND		ug/l	0.250	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	73		30-150	A
Decachlorobiphenyl	43		30-150	A
2,4,5,6-Tetrachloro-m-xylene	61		30-150	B
Decachlorobiphenyl	44		30-150	B

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8082A
Analytical Date: 08/24/20 18:17
Analyst: AWS

Extraction Method: EPA 3510C
Extraction Date: 08/23/20 13:09
Cleanup Method: EPA 3665A
Cleanup Date: 08/23/20
Cleanup Method: EPA 3660B
Cleanup Date: 08/24/20

Parameter	Result	Qualifier	Units	RL	MDL	Column
MCP Polychlorinated Biphenyls - Westborough Lab for sample(s): 01-06 Batch: WG1401976-1						
Aroclor 1016	ND		ug/l	0.250	--	A
Aroclor 1221	ND		ug/l	0.250	--	A
Aroclor 1232	ND		ug/l	0.250	--	A
Aroclor 1242	ND		ug/l	0.250	--	A
Aroclor 1248	ND		ug/l	0.250	--	A
Aroclor 1254	ND		ug/l	0.250	--	A
Aroclor 1260	ND		ug/l	0.250	--	A
Aroclor 1262	ND		ug/l	0.250	--	A
Aroclor 1268	ND		ug/l	0.250	--	A
PCBs, Total	ND		ug/l	0.250	--	A

Surrogate	%Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	75		30-150	A
Decachlorobiphenyl	**24**	Q	30-150	A
2,4,5,6-Tetrachloro-m-xylene	69		30-150	B
Decachlorobiphenyl	30		30-150	B

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits	Column
MCP Polychlorinated Biphenyls - Westborough Lab Associated sample(s): 01-06 Batch: WG1401976-2 WG1401976-3									
Aroclor 1016	75		75		40-140	1		20	A
Aroclor 1260	52		59		40-140	12		20	A

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	82		80		30-150	A
Decachlorobiphenyl	**29**	Q	32		30-150	A
2,4,5,6-Tetrachloro-m-xylene	72		70		30-150	B
Decachlorobiphenyl	**28**	Q	34		30-150	B

METALS

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-01
Client ID: MW-101
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 09:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0074		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Chromium, Total	0.042		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Copper, Total	0.016		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:05	EPA 7470A	97,7470A	EW
Nickel, Total	0.032		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 09:50	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-02
Client ID: MW-105
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:00
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0190		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Chromium, Total	0.088		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Copper, Total	0.037		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Lead, Total	0.025		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:15	EPA 7470A	97,7470A	EW
Nickel, Total	0.066		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE
Zinc, Total	0.078		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:42	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-03
Client ID: MW-104
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 10:50
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Arsenic, Total	0.0077		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:19	EPA 7470A	97,7470A	EW
Nickel, Total	0.040		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 10:47	EPA 3005A	97,6010D	PE

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-04
Client ID: MW-103
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 12:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0229		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Chromium, Total	0.018		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Copper, Total	0.011		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:22	EPA 7470A	97,7470A	EW
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:15	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-05
Client ID: MW-102
Sample Location: LUNENBURG, MA
Date Collected: 08/21/20 13:20
Date Received: 08/21/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0218		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:25	EPA 7470A	97,7470A	EW
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:19	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

SAMPLE RESULTS

Lab ID: L2034373-06
Client ID: DUP
Sample Location: LUNENBURG, MA
Sample Depth:
Matrix: Water

Date Collected: 08/21/20 11:10
Date Received: 08/21/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Arsenic, Total	0.0063		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 20:29	EPA 7470A	97,7470A	EW
Nickel, Total	0.040		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 12:24	EPA 3005A	97,6010D	GD

Project Name: LUNENBURG
Project Number: 6893
Lab Number: L2034373
Report Date: 08/28/20

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-06 Batch: WG1402225-1										
Antimony, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Arsenic, Total	ND		mg/l	0.0050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Beryllium, Total	ND		mg/l	0.005	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Cadmium, Total	ND		mg/l	0.004	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Chromium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Copper, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Lead, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Nickel, Total	ND		mg/l	0.025	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Selenium, Total	ND		mg/l	0.010	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Silver, Total	ND		mg/l	0.007	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Thallium, Total	ND		mg/l	0.020	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE
Zinc, Total	ND		mg/l	0.050	--	1	08/25/20 16:17	08/26/20 08:41	97,6010D	PE

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
MCP Total Metals - Mansfield Lab for sample(s): 01-06 Batch: WG1402226-1										
Mercury, Total	ND		mg/l	0.0002	--	1	08/25/20 16:09	08/25/20 19:26	97,7470A	EW

Prep Information

Digestion Method: EPA 7470A

Lab Control Sample Analysis

Batch Quality Control

Project Name: LUNENBURG

Project Number: 6893

Lab Number: L2034373

Report Date: 08/28/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Total Metals - Mansfield Lab Associated sample(s): 01-06 Batch: WG1402225-2 WG1402225-3								
Antimony, Total	93		103		80-120	10		20
Arsenic, Total	104		108		80-120	4		20
Beryllium, Total	96		102		80-120	6		20
Cadmium, Total	102		106		80-120	4		20
Chromium, Total	94		99		80-120	5		20
Copper, Total	96		101		80-120	5		20
Lead, Total	102		105		80-120	3		20
Nickel, Total	92		96		80-120	4		20
Selenium, Total	100		105		80-120	5		20
Silver, Total	98		102		80-120	4		20
Thallium, Total	96		100		80-120	4		20
Zinc, Total	102		106		80-120	4		20
MCP Total Metals - Mansfield Lab Associated sample(s): 01-06 Batch: WG1402226-2 WG1402226-3								
Mercury, Total	97		98		80-120	1		20

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-01A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-01D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-01G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-01H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-01I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-01J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-01K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-02A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-02D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-02G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-02H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-02I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-TL-6010T-10(180),MCP-CD-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-AG-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-02J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-02K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-03A	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03B	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03C	Vial HCl preserved	A	NA		2.7	Y	Absent		MCP-8260-10(14)
L2034373-03D	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03E	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03F	Vial HCl preserved	A	NA		2.7	Y	Absent		VPH-DELUX-18(14)
L2034373-03G	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-03H	Amber 120ml unpreserved	A	7	7	2.7	Y	Absent		MCP-8082-10-LVI(365)
L2034373-03I	Plastic 250ml HNO3 preserved	A	<2	<2	2.7	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-CU-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-03J	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-03K	Amber 1000ml HCl preserved	A	<2	<2	2.7	Y	Absent		EPH-DELUX-20(14)
L2034373-04A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-04D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-04E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-04F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-04G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-04H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-04I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-AS-6010T-10(180),MCP-7470T-10(28),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-SE-6010T-10(180),MCP-BE-6010T-10(180),MCP-PB-6010T-10(180),MCP-NI-6010T-10(180)
L2034373-04J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-04K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-05A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-05D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-05G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-05H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-05I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-7470T-10(28),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-AG-6010T-10(180),MCP-CU-6010T-10(180),MCP-SB-6010T-10(180),MCP-ZN-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-05J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-05K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-06A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-06D	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-06E	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)

*Values in parentheses indicate holding time in days

Project Name: LUNENBURG
Project Number: 6893

Lab Number: L2034373
Report Date: 08/28/20

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2034373-06F	Vial HCl preserved	B	NA		3.8	Y	Absent		VPH-DELUX-18(14)
L2034373-06G	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-06H	Amber 120ml unpreserved	B	7	7	3.8	Y	Absent		MCP-8082-10-LVI(365)
L2034373-06I	Plastic 250ml HNO3 preserved	B	<2	<2	3.8	Y	Absent		MCP-CR-6010T-10(180),MCP-7470T-10(28),MCP-AS-6010T-10(180),MCP-CD-6010T-10(180),MCP-TL-6010T-10(180),MCP-ZN-6010T-10(180),MCP-CU-6010T-10(180),MCP-AG-6010T-10(180),MCP-SB-6010T-10(180),MCP-BE-6010T-10(180),MCP-SE-6010T-10(180),MCP-NI-6010T-10(180),MCP-PB-6010T-10(180)
L2034373-06J	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-06K	Amber 1000ml HCl preserved	B	<2	<2	3.8	Y	Absent		EPH-DELUX-20(14)
L2034373-07A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-07B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-07C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08A	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08B	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)
L2034373-08C	Vial HCl preserved	B	NA		3.8	Y	Absent		MCP-8260-10(14)

*Values in parentheses indicate holding time in days

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

Data Qualifiers

Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	LUNENBURG	**Lab Number:**	L2034373
Project Number:	6893	**Report Date:**	08/28/20

REFERENCES

97 EPA Test Methods (SW-846) with QC Requirements & Performance Standards for the Analysis of EPA SW-846 Methods under the Massachusetts Contingency Plan, WSC-CAM-IIA, IIB, IIIA, IIIB, IIIC, IIID, VA, VB, VC, VIA, VIB, VIIIA and VIIIB, July 2010.

131 Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), MassDEP, February 2018, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of VPH under the Massachusetts Contingency Plan, WSC-CAM-IVA, June 1, 2018.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/21/20

ALPHA Job #: L2034373

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Bete Group
Address: 701 George Washington Hwy, Lincoln, RI 02865
Phone: 401.333.2382
Email: jmcloughlin@bete-inc.com

Project Information

Project Name: 525 Massachusetts Ave
Project Location: Lunenburg, MA
Project #: 6893
Project Manager: Joe McLaughlin
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Additional Project Information:

Report Information - Data Deliverables

☑ ADEx ☑ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☑ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☑ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☑ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☑ Ranges & Targets ☐ Ranges Only	☑ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Sample Comments	TOTAL # BOTTLES
34373-01	MW-101	8/21/20	9:10	GW	SN	X			X	X	X	X			11
-02	MW-105		10:00		SN	X			X	X	X	X			11
-03	MW-104		10:50		SN	X			X	X	X	X			11
-04	MW-103		12:10		SN	X			X	X	X	X			11
-05	MW-102		1:20		SN	X			X	X	X	X			11
-06	Dup		11:10		SN	X			X	X	X	X			11
-07	Equip Blank		8:30		SN	X									3
-08	Trip Blank		—		SN	X									2
Container Type						V			P	A	V	A			
Preservative						B			C	B	B	A			

SAMPLE INFO
Filtration ☐ Field ☐ Lab to do
Preservation ☐ Lab to do

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
SN	8/21/20 14:40	AKL	8/21/20 14:40

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1402996-5	**Lab File ID**	: VQ200826B05
Instrument ID	: QUIMBY		
Matrix	: WATER	**Analysis Date**	: 08/26/20 05:50

Client Sample No.	Lab Sample ID	Analysis Date
WG1402996-3LCS	WG1402996-3	08/26/20 03:49
WG1402996-4LCSD	WG1402996-4	08/26/20 04:50
TRIP BLANK	L2034373-08	08/26/20 09:52
MW-105	L2034373-02	08/26/20 10:53
MW-101	L2034373-01	08/26/20 11:23
MW-104	L2034373-03	08/26/20 11:53
MW-103	L2034373-04	08/26/20 12:24
MW-102	L2034373-05	08/26/20 12:54
EQUIP BLANK	L2034373-07	08/26/20 13:55

Method Blank Summary
Form 4
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Lab Sample ID	: WG1403442-5	**Lab File ID**	: VQ200827A04
Instrument ID	: QUIMBY		
Matrix	: WATER	**Analysis Date**	: 08/27/20 06:40

Client Sample No.	Lab Sample ID	Analysis Date
WG1403442-3LCS	WG1403442-3	08/27/20 05:09
WG1403442-4LCSD	WG1403442-4	08/27/20 05:39
DUP	L2034373-06	08/27/20 08:11
MW-103	L2034373-04D	08/27/20 08:41
MW-102	L2034373-05D	08/27/20 09:11

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/26/20 03:49	
Lab File ID	: VQ200826B01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1402996-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	74	0
Dichlorodifluoromethane	0.437	0.37	-	15.3	20	67	0
Chloromethane	0.6	0.78	-	-30*	20	104	0
Vinyl chloride	0.546	0.541	-	0.9	20	79	0
Bromomethane	0.273	0.232	-	15	20	66	0
Chloroethane	0.31	0.318	-	-2.6	20	75	0
Trichlorofluoromethane	0.66	0.604	-	8.5	20	72	0
Ethyl ether	0.188	0.16	-	14.9	20	65	0
1,1-Dichloroethene	0.397	0.351	-	11.6	20	70	0
Carbon disulfide	0.945	0.836	-	11.5	20	70	0
Freon-113	0.394	0.362	-	8.1	20	76	0
Methylene chloride	0.422	0.45	-	-6.6	20	82	0
Acetone	10	10.97	-	-9.7	20	76	0
trans-1,2-Dichloroethene	0.438	0.446	-	-1.8	20	79	0
Methyl acetate	0.203	0.255	-	-25.6*	20	100	0
Methyl tert-butyl ether	0.937	0.848	-	9.5	20	68	0
tert-Butyl alcohol	0.026	0.019*	-	26.9*	20	59	0
Diisopropyl ether	1.579	2.033	-	-28.8*	20	101	0
1,1-Dichloroethane	0.907	0.99	-	-9.2	20	84	0
Halothane	0.348	0.353	-	-1.4	20	79	0
Acrylonitrile	0.09	0.104	-	-15.6	20	91	0
Ethyl tert-butyl ether	1.364	1.33	-	2.5	20	75	0
Vinyl acetate	0.868	1.083	-	-24.8*	20	96	0
cis-1,2-Dichloroethene	0.516	0.524	-	-1.6	20	77	0
2,2-Dichloropropane	0.793	0.735	-	7.3	20	75	0
Bromochloromethane	0.197	0.201	-	-2	20	74	0
Cyclohexane	0.946	1.133	-	-19.8	20	105	0
Chloroform	0.812	0.808	-	0.5	20	76	0
Ethyl acetate	0.295	0.342	-	-15.9	20	93	0
Carbon tetrachloride	0.689	0.63	-	8.6	20	72	0
Tetrahydrofuran	0.098	0.117	-	-19.4	20	93	0
Dibromofluoromethane	0.236	0.233	-	1.3	20	72	0
1,1,1-Trichloroethane	0.784	0.751	-	4.2	20	75	0
2-Butanone	0.122	0.142	-	-16.4	20	96	0
1,1-Dichloropropene	0.691	0.695	-	-0.6	20	81	0
Benzene	1.886	2.014	-	-6.8	20	82	0
tert-Amyl methyl ether	1.057	0.941	-	11	20	67	0
1,2-Dichloroethane-d4	0.271	0.25	-	7.7	20	70	0
1,2-Dichloroethane	0.569	0.542	-	4.7	20	72	0
Methyl cyclohexane	0.873	0.928	-	-6.3	20	93	0
Trichloroethene	0.505	0.506	-	-0.2	20	79	0
Dibromomethane	0.221	0.207	-	6.3	20	70	0
1,2-Dichloropropane	0.47	0.522	-	-11.1	20	85	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: QUIMBY	**Calibration Date**	: 08/26/20 03:49
Lab File ID	: VQ200826B01	**Init. Calib. Date(s)**	: 08/19/20 08/19/20
Sample No	: WG1402996-2	**Init. Calib. Times**	: 07:07 11:41
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Bromodichloromethane	0.596	0.543	-	8.9	20	69	0
1,4-Dioxane	0.00209	0.00236*	-	-12.9	20	85	0
cis-1,3-Dichloropropene	0.743	0.709	-	4.6	20	72	0
Chlorobenzene-d5	1	1	-	0	20	76	0
Toluene-d8	1.31	1.319	-	-0.7	20	78	0
Toluene	1.574	1.609	-	-2.2	20	83	0
4-Methyl-2-pentanone	0.126	0.115	-	8.7	20	71	0
Tetrachloroethene	0.641	0.643	-	-0.3	20	84	0
trans-1,3-Dichloropropene	0.811	0.698	-	13.9	20	68	0
Ethyl methacrylate	0.506	0.438	-	13.4	20	69	0
1,1,2-Trichloroethane	0.327	0.309	-	5.5	20	74	0
Chlorodibromomethane	0.48	0.414	-	13.8	20	66	0
1,3-Dichloropropane	0.719	0.67	-	6.8	20	73	0
1,2-Dibromoethane	0.379	0.346	-	8.7	20	71	0
2-Hexanone	0.234	0.243	-	-3.8	20	85	0
Chlorobenzene	1.637	1.693	-	-3.4	20	81	0
Ethylbenzene	3.069	3.037	-	1	20	82	0
1,1,1,2-Tetrachloroethane	0.561	0.53	-	5.5	20	74	0
p/m Xylene	1.112	0.98	-	11.9	20	74	0
o Xylene	0.991	0.864	-	12.8	20	72	0
Styrene	1.649	1.474	-	10.6	20	72	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	64	0
Bromoform	0.594	0.58	-	2.4	20	60	0
Isopropylbenzene	6.581	7.679	-	-16.7	20	80	0
4-Bromofluorobenzene	1.146	1.282	-	-11.9	20	69	0
Bromobenzene	1.387	1.665	-	-20	20	76	0
n-Propylbenzene	6.985	7.407	-	-6	20	75	0
1,4-Dichlorobutane	1.58	2.048	-	-29.6*	20	83	0
1,1,2,2-Tetrachloroethane	0.902	1.03	-	-14.2	20	72	0
4-Ethyltoluene	5.084	4.9	-	3.6	20	68	0
2-Chlorotoluene	4.474	4.902	-	-9.6	20	76	0
1,3,5-Trimethylbenzene	3.767	3.274	-	13.1	20	61	0
1,2,3-Trichloropropane	0.797	0.902	-	-13.2	20	71	0
trans-1,4-Dichloro-2-buten	0.309	0.354	-	-14.6	20	76	0
4-Chlorotoluene	4.117	4.143	-	-0.6	20	68	0
tert-Butylbenzene	4.15	4.517	-	-8.8	20	77	0
1,2,4-Trimethylbenzene	3.497	3.056	-	12.6	20	60	0
sec-Butylbenzene	5.586	6.019	-	-7.8	20	77	0
p-Isopropyltoluene	4.358	4.384	-	-0.6	20	72	0
1,3-Dichlorobenzene	2.419	2.578	-	-6.6	20	71	0
1,4-Dichlorobenzene	2.339	2.385	-	-2	20	68	0
p-Diethylbenzene	2.218	2.188	-	1.4	20	71	0
n-Butylbenzene	3.373	3.394	-	-0.6	20	73	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/26/20 03:49	
Lab File ID	: VQ200826B01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1402996-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichlorobenzene	2.13	2.217	-	-4.1	20	68	0
1,2,4,5-Tetramethylbenzene	10	11.582	-	-15.8	20	70	0
1,2-Dibromo-3-chloropropan	0.136	0.135	-	0.7	20	62	0
1,3,5-Trichlorobenzene	1.034	0.979	-	5.3	20	61	0
Hexachlorobutadiene	0.624	0.784	-	-25.6*	20	94	0
1,2,4-Trichlorobenzene	0.881	0.813	-	7.7	20	58	0
Naphthalene	1.496	1.334	-	10.8	20	52	0
1,2,3-Trichlorobenzene	0.748	0.705	-	5.7	20	59	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.		**Lab Number**	: L2034373	
Project Name	: LUNENBURG		**Project Number**	: 6893	
Instrument ID	: QUIMBY		**Calibration Date**	: 08/27/20 05:09	
Lab File ID	: VQ200827A01		**Init. Calib. Date(s)**	: 08/19/20	08/19/20
Sample No	: WG1403442-2		**Init. Calib. Times**	: 07:07	11:41
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	80	0
Dichlorodifluoromethane	0.437	0.366	-	16.2	20	71	0
Chloromethane	0.6	0.738	-	-23*	20	106	0
Vinyl chloride	0.546	0.519	-	4.9	20	82	0
Bromomethane	0.273	0.224	-	17.9	20	69	0
Chloroethane	0.31	0.304	-	1.9	20	78	0
Trichlorofluoromethane	0.66	0.596	-	9.7	20	76	0
Ethyl ether	0.188	0.16	-	14.9	20	70	0
1,1-Dichloroethene	0.397	0.345	-	13.1	20	74	0
Carbon disulfide	0.945	0.825	-	12.7	20	74	0
Methylene chloride	0.422	0.448	-	-6.2	20	88	0
Acetone	10	11.155	-	-11.5	20	83	0
trans-1,2-Dichloroethene	0.438	0.45	-	-2.7	20	86	0
Methyl tert-butyl ether	0.937	0.874	-	6.7	20	75	0
Diisopropyl ether	1.579	2.064	-	-30.7*	20	110	0
1,1-Dichloroethane	0.907	0.978	-	-7.8	20	90	0
Ethyl tert-butyl ether	1.364	1.361	-	0.2	20	82	0
cis-1,2-Dichloroethene	0.516	0.528	-	-2.3	20	84	0
2,2-Dichloropropane	0.793	0.741	-	6.6	20	82	0
Bromochloromethane	0.197	0.204	-	-3.6	20	82	0
Chloroform	0.812	0.801	-	1.4	20	81	0
Carbon tetrachloride	0.689	0.648	-	6	20	80	0
Tetrahydrofuran	0.098	0.12	-	-22.4*	20	103	0
Dibromofluoromethane	0.236	0.228	-	3.4	20	76	0
1,1,1-Trichloroethane	0.784	0.75	-	4.3	20	81	0
2-Butanone	0.122	0.144	-	-18	20	104	0
1,1-Dichloropropene	0.691	0.687	-	0.6	20	86	0
Benzene	1.886	1.997	-	-5.9	20	87	0
tert-Amyl methyl ether	1.057	0.981	-	7.2	20	76	0
1,2-Dichloroethane-d4	0.271	0.247	-	8.9	20	74	0
1,2-Dichloroethane	0.569	0.533	-	6.3	20	76	0
Trichloroethene	0.505	0.502	-	0.6	20	84	0
Dibromomethane	0.221	0.208	-	5.9	20	75	0
1,2-Dichloropropane	0.47	0.521	-	-10.9	20	91	0
Bromodichloromethane	0.596	0.556	-	6.7	20	77	0
1,4-Dioxane	0.00209	0.00188*	-	10	20	73	0
cis-1,3-Dichloropropene	0.743	0.719	-	3.2	20	79	0
Chlorobenzene-d5	1	1	-	0	20	82	0
Toluene-d8	1.31	1.309	-	0.1	20	84	0
Toluene	1.574	1.57	-	0.3	20	88	0
4-Methyl-2-pentanone	0.126	0.116	-	7.9	20	77	0
Tetrachloroethene	0.641	0.643	-	-0.3	20	91	0
trans-1,3-Dichloropropene	0.811	0.714	-	12	20	75	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: Beta Group, Inc.	**Lab Number**	: L2034373
Project Name	: LUNENBURG	**Project Number**	: 6893
Instrument ID	: QUIMBY	**Calibration Date**	: 08/27/20 05:09
Lab File ID	: VQ200827A01	**Init. Calib. Date(s)**	: 08/19/20 08/19/20
Sample No	: WG1403442-2	**Init. Calib. Times**	: 07:07 11:41
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,1,2-Trichloroethane	0.327	0.31	-	5.2	20	80	0
Chlorodibromomethane	0.48	0.425	-	11.5	20	74	0
1,3-Dichloropropane	0.719	0.673	-	6.4	20	79	0
1,2-Dibromoethane	0.379	0.348	-	8.2	20	77	0
2-Hexanone	0.234	0.239	-	-2.1	20	90	0
Chlorobenzene	1.637	1.654	-	-1	20	86	0
Ethylbenzene	3.069	3.005	-	2.1	20	88	0
1,1,1,2-Tetrachloroethane	0.561	0.538	-	4.1	20	81	0
p/m Xylene	1.112	1.036	-	6.8	20	84	0
o Xylene	0.991	0.921	-	7.1	20	83	0
Styrene	1.649	1.513	-	8.2	20	80	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	78	0
Bromoform	0.594	0.557	-	6.2	20	71	0
Isopropylbenzene	6.581	6.873	-	-4.4	20	88	0
4-Bromofluorobenzene	1.146	1.143	-	0.3	20	76	0
Bromobenzene	1.387	1.488	-	-7.3	20	84	0
n-Propylbenzene	6.985	7.01	-	-0.4	20	87	0
1,1,2,2-Tetrachloroethane	0.902	0.918	-	-1.8	20	79	0
2-Chlorotoluene	4.474	4.844	-	-8.3	20	92	0
1,3,5-Trimethylbenzene	3.767	3.733	-	0.9	20	86	0
1,2,3-Trichloropropane	0.797	0.805	-	-1	20	78	0
4-Chlorotoluene	4.117	4.045	-	1.7	20	82	0
tert-Butylbenzene	4.15	4.256	-	-2.6	20	90	0
1,2,4-Trimethylbenzene	3.497	3.522	-	-0.7	20	85	0
sec-Butylbenzene	5.586	5.762	-	-3.2	20	91	0
p-Isopropyltoluene	4.358	4.538	-	-4.1	20	92	0
1,3-Dichlorobenzene	2.419	2.548	-	-5.3	20	86	0
1,4-Dichlorobenzene	2.339	2.36	-	-0.9	20	82	0
n-Butylbenzene	3.373	3.674	-	-8.9	20	97	0
1,2-Dichlorobenzene	2.13	2.179	-	-2.3	20	83	0
1,2-Dibromo-3-chloropropan	0.136	0.125	-	8.1	20	71	0
Hexachlorobutadiene	0.624	0.772	-	-23.7*	20	114	0
1,2,4-Trichlorobenzene	0.881	0.991	-	-12.5	20	87	0
Naphthalene	1.496	1.644	-	-9.9	20	79	0
1,2,3-Trichlorobenzene	0.748	0.843	-	-12.7	20	86	0

* Value outside of QC limits.

Appendix H

Hazardous Building Material Inspection Report

SMITH & WESSEL ASSOCIATES, INC.
HAZARDOUS BUILDING MATERIALS AND AIR QUALITY SPECIALISTS

INSPECTION REPORT FOR
Asbestos-Containing Building Materials, Lead-Based Paint, Polychlorinated Biphenyls and Mercury Containing Components

Former Citgo Service Station
925 Massachusetts Avenue
Lunenburg, Massachusetts



Prepared for:
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Project 20118

August 7, 2020

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INTRODUCTION

Beta Group, Inc. (Beta) retained Smith & Wessel Associates, Inc. (SWA) to conduct inspections for asbestos-containing building materials (ACBM), lead-based paint (LBP), polychlorinated biphenyls (PCBs) and mercury containing components at the former Citgo Service Station located at 925 Massachusetts Avenue in Lunenburg, Massachusetts on August 3, 2020. The assessment was conducted as part of a pre-demolition due diligence survey.

Asbestos

The purpose of the inspection was to evaluate the types, locations, and extent of suspect ACM and provide appropriate recommendations for its abatement or management. SWA's inspection addressed both friable materials (materials that can be easily crumbled, crushed, or pulverized by hand pressure) and non-friable suspect materials. SWA performed the inspection in accordance with the EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAP), Title 40 CFR Part 61, for suspect asbestos-containing building materials (ACBM) as practical. SWA identified several suspect materials at the site that were sampled and analyzed for asbestos content. However, if any suspect materials are identified at later dates that are not addressed in this report, they must be assumed to be ACBM unless appropriate sampling and analysis demonstrate otherwise.

SWA identified non-friable ACBM at the site in the form of the following materials:

• Metal wall panel seam sealant	• 9" x 9" floor tile
• Rolled tar mop roof	

Lead-Based Paint

The purpose of the Lead-Based Paint (LBP) inspection was to evaluate the types, locations, and extent of suspect LBP in the building, to evaluate potential hazards associated with LBP, and to provide appropriate recommendations for its abatement and management.

The United States Department of Housing and Urban Development (HUD) has established a standard for lead-based paint, as tested using an X-ray Fluorescence Analyzer (XRFA), of 1.0 milligram per square centimeter (mg/cm^2). Although this standard only applies to housing funded by the federal government, it is a useful reference concentration for assessing hazards associated with lead in paint in other settings. Thus, when paint contains greater than 1.0 mg/cm^2, special care should be taken when conducting activities that impact these paints.

The lead content of paints surveyed at the site were between <0.1-2.6 mg/cm^2 as

measured with an X-ray Fluorescence Analyzer (XRFA). If LBP are impacted by demolition in a manner that may generate dust or fumes, compliance with Occupational Safety and Health Administration (OSHA) regulations regarding worker exposure to lead may be necessary. Additionally, United States Environmental Protection Agency (EPA) and Massachusetts Department of Environmental (DEP) regulations relative to waste disposal may apply.

PCBs

SWA's investigation for PCBs in light fixture ballasts and electrical equipment was visual only. Typically, ballasts and electrical equipment installed after 1978 do not contain PCBs and are marked as such. Ballasts and electrical equipment that do not have the "No PCBs" wording on the label are assumed to contain PCBs. SWA inspected the labels on representative ballasts and equipment throughout the building; the representative ballasts inspected contained the "No PCBs" wording on their affixed labels and therefore are assumed to not contain PCBs in capacitor oils. However, SWA observed two one-gallon electric panel expansion tanks in the mechanical room suspected of containing PCB transformer oil.

SWA also collected samples of metal wall panel seam sealant, garage door caulking, garage door glazing, and metal window glazing for laboratory analysis to determine the concentration of PCBs. Analytical results indicate that no PCB constituents were identified in the compositions of those materials sampled.

Mercury Filled Fluorescent Light Fixtures

SWA observed fluorescent light bulbs that must be collected and recycled in accordance with the "Universal Waste" regulatory requirements. The fluorescent bulbs are located throughout the building, including 13 (4') and 8 (8') fluorescent bulbs. SWA also observed one heat regulating thermostat with mercury tube in the service center office.

Exclusions

While SWA endeavored to conduct a thorough, comprehensive inspection, some exclusions are warranted. Because our inspection addressed a limited number of areas, it is possible that the locations that we inspected were not fully representative of materials found in other areas. Our inspection included building areas only; no assessment of soil, debris, or subterranean areas was conducted. Additional limitations may have impacted our ability to inspect all locations such as poor lighting, height constraints, unusual building features, occupancy, and stored materials that block access to suspect materials. Stored goods, debris, and building materials that were removed and were either stored or loose were not inspected, but if observed were assessed and quantified.

SWA does not guarantee that all suspect roof materials were identified. Typically, roofs were applied in multiple layers and were repaired over the years. The full extent of suspect roof materials will not be known until the entire roof system is removed.

While SWA followed industry standards during the inspection, we do not warrant that all

suspect hazardous building materials were identified in or on the building and shall not be held liable related to future abatement costs related to hazardous materials that are either not discovered or not appropriately characterized. This is due in part to inherent problems with every building inspection, such as, but not limited to:

- Seemingly homogeneous materials that are not in fact homogeneous;
- Seemingly representative locations that are not in fact representative;
- Layered materials that are not uniformly present or are isolated;
- Materials that are present and accessible but were not considered to be hazardous,
- Materials that are present in an isolated and limited quantity; and
- Material that is present in locations that are unsafe or otherwise difficult to access.

Client acknowledges that SWA's inspection is inherently limited and all hazardous materials may only become apparent during the course of future renovation or demolition. During the course of future renovation/demolition work, it is likely that additional hazardous materials or materials suspected of being hazardous will be identified. Such materials should be assumed to be hazardous unless appropriate evaluation or sampling and analysis demonstrate otherwise. Contracts, specifications and plans should advise contractors to conduct controlled demolition work and stop immediately should any hazardous building materials be encountered during the course of their work.

1.0 ASBESTOS CONTAINING BUILDING MATERIALS

1.1 Scope of Work

SWA's certified Asbestos Inspectors, Ted Sherry (Cert. # AI-032572) and Robert Arcese (Cert. # AI-900917), performed the asbestos inspection of readily accessible and observable areas throughout the interior and exterior of the building. SWA inspected for the following types of suspect ACBM:

- Thermal system insulation (TSI), such as insulation on pipes, boilers, tanks and related equipment;
- Surfacing material, acoustical and decorative plasters, fireproofing and other sprayed or trowel applications; and
- Miscellaneous materials, such as window caulking, wallboard, floor tile, adhesives, and other building materials that are not TSI or surfacing materials.

To determine the asbestos content of suspect ACBM, SWA collected and analyzed representative bulk samples by extracting a small but representative portion of suspect material from the substrate. The samples, typically measuring one cubic centimeter, were collected using a variety of methods. The extracted samples were then placed into labeled, individual sealed plastic bags for transport to the laboratory.

EMSL Analytical, Inc. (EMSL) of Woburn, Massachusetts, a fully accredited asbestos analytical laboratory, analyzed the bulk samples utilizing Polarized Light Microscopy (PLM) in accordance with the requirements of 40 CFR Part 763, Subpart F, Appendix A (see Appendix A of this report). Because PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials, when a negative result is obtained by PLM (less than one percent asbestos), the laboratory was instructed to analyze the sample by Transmission Electron Microscopy (TEM) to confirm the results.

For each homogeneous sampling group, the laboratory analyzed samples until a positive result was obtained (i.e. greater than one percent asbestos) or until all samples were analyzed. If one sample indicates an asbestos content greater than one percent, the entire homogenous area must be considered to be an ACBM even if one or more samples in the group indicates an asbestos content of less than one percent.

1.2 Regulatory Guidance

The United States Environmental Protection Agency (EPA), Occupational Health & Safety Administration (OSHA), Massachusetts Department of Labor Standards (MA DLS) and Massachusetts Department of Environmental Protection (MA DEP) are responsible for regulating the release of asbestos into the environment and protecting

workers from exposure to airborne asbestos fibers.

OSHA and MA DLS are responsible for the health and safety of workers who may be exposed in connection with their jobs including custodial activities, renovation work, and asbestos abatement. These agencies specify requirements for the work practices and engineering controls that must be utilized during asbestos abatement projects. They also require that ACBM be repaired, removed, or otherwise appropriately abated before maintenance, renovation, or demolition work disturbs them. Thermal system insulation, surfacing materials, and floor tile installed before 1980 must be presumed to be ACBM unless appropriate inspection and sampling analysis prove otherwise.

The EPA and MA DEP are responsible for developing and enforcing regulations necessary to protect the general public from airborne contaminants that are known to be hazardous to human health. They regulate ACBM associated with renovation, demolition, and asbestos abatement projects via NESHAP Title 40 CFR Part 61 regulation and MA DEP 310 CMR 7.15. These regulations require that buildings be inspected for ACBM prior to renovation/demolition projects. They stipulate that all friable ACBM as well as non-friable ACBM that are in poor condition or will be made friable by renovation or demolition activity be removed or otherwise appropriately abated before they are disturbed.

1.3 Findings

SWA identified the following friable and non-friable ***suspect*** ACBM:

• Cement plaster	• Duct work seam sealant
• Gypsum board	• Garage door glazing
• Metal wall panel seam sealant	• Metal window glazing
• 9″ x 9″ floor tile and underlying mastic	• Three-tab shingle
• 2' x 4' ceiling tiles	• Garage door caulking
• Wooden ceiling panel adhesive	• Rolled tar mop roof
• Cove base	• Wall panel glue
• Cove base adhesive	• Textured paint

SWA collected a total of thirty-nine representative bulk samples of the above materials to determine asbestos content, of which thirty-six were analyzed using PLM. Three of the samples did not require analysis as the first sample in the homogeneous sampling group tested positive for asbestos (i.e. contain greater than one percent asbestos). In addition, the black mastic underlying the white 9″ x 9″ floor tile in each bathroom were further analyzed using the TEM EPA NOB method.

SWA has listed in **Table 1**, the location and estimated quantity, by square foot (sf), linear foot (lf), or other appropriate unit, of each type of ACBM identified at the site.

Table 1 • List of Materials Testing Positive for Asbestos			
Type of Material	**Location**	**Quantity**	**Sample number**
Gray and beige metal wall panel seam sealant	Rear storage container abutting main building	52 lf	03A
White 9″ x 9″ floor tile	Service center bathroom and side bathroom	60 sf	04A
Black rolled tar mop roof *(varying degrees of weatherization and vegetation growth require pre-abatement management)*	Roof along rear storage container and lower level garage storage	600 sf	16A

In **Table 2**, SWA has listed all materials that tested negative for asbestos, including the locations where these materials were observed and the corresponding bulk sample reference number(s). The sample numbers presented in **bold** were further analyzed using the TEM EPA NOB method.

Table 2 • List of Materials Testing Negative for Asbestos		
Type of Material	**Location**	**Sample No.**
Gray cement plaster	Garage ceiling	01A, 01B, 01C
White and gray gypsum board	Garage and adjacent mechanical room	02A, 02B, 02C
Black mastic associated with white 9″ x 9″ floor tile	Service center bathroom and side bathroom	**05A, 05B**
White 2' x 4' ceiling tiles	Suspended ceiling in service center	06A, 06B
Tan wooden ceiling panel adhesive	Hard ceiling in service center	07A, 07B
Red 6″ cove base	Service center, office space, and bathrooms	08A, 08B
Black cove base adhesive associated with red 6″ cove base	Service center, office space, and bathrooms	09A, 09B
Gray duct seam sealant	Mechanical room between supply plenum offset starting collar	10A, 10B
White garage door glazing	Exterior garage door	11A, 11B
White metal window glazing	Side garage window	12A, 12B
Black three-tab shingle	First layer throughout roof	13A, 13B
Black three-tab shingle	Second layer throughout roof	14A, 14B
White garage door caulking	Exterior garage door between metal frame and masonry	15A, 15B

Table 2 • List of Materials Testing Negative for Asbestos		
Type of Material	**Location**	**Sample No.**
Tan wall panel glue	Beneath wall panel in each bathroom	17A, 17B
White textured paint	Exterior cinderblock wall along east side	18A, 18B

1.4 Conclusions and Recommendations

On the basis of our findings, SWA offers the following conclusions and recommendations:

1. Non-friable ACBM were identified at the site. ACBM that will be impacted by renovation or demolition work must be removed before they are disturbed. SWA recommends that this work be conducted in accordance with a project design as prepared by a Massachusetts licensed Asbestos Abatement Project Designer due to the damage associated with the roof. ***This report is not intended for use as an abatement design.***

2. During the course of renovation or demolition work, it is possible that additional suspect ACBM will be encountered. Contractors should be apprised to conduct any such work in a controlled manner. If suspect materials that have not been sampled are encountered, they should be assumed to contain asbestos, unless appropriate sampling and analysis indicates otherwise.

1.5 Cost Estimate

In **Table 3**, SWA has provided estimates of abatement costs associated with all identified ACBM in the inspected areas. These estimates are based on current industry standards that may fluctuate rapidly based on a variety of factors: the prevailing economic climate, seasonal differences, union labor considerations, scale of the abatement, occupancy of the building, and so on. SWA recommends that qualified abatement contractors be solicited to determine actual pricing involved. In addition to pricing for abatement, SWA has considered anticipated industrial hygiene costs associated with abatement, including air monitoring and oversight of the abatement.

Table 3 • Estimated Costs for Removal of ACBM		
Type of Material	**Quantity/Unit cost ($)**	**Total Cost ($)**
Gray and beige metal wall panel seam sealant	52 lf @ 20/lf	1,040.
White 9″ x 9″ floor tile	60 sf @ 20/sf	1,200.
Black tar mop adhesive	600 sf @ 5/sf	3,000.
	Total Contractor Abatement Cost	$ 5,240.
	Total Industrial Hygiene Fee	1,500
	Total Fee	**$ 6,740.**

2.0 LEAD-BASED PAINTS

2.1 Scope of Work

SWA's accredited lead-based paint inspector tested representative painted surfaces throughout the building. SWA analyzed paints for lead content using the XRFA following the manufacturer's instructions for initial calibration and operation. The XRFA uses a radioactive source to excite the electrons of lead atoms (if present) in paint. As the lead atom electrons return to their normal state, they emit x-rays that are measured by the XRFA, then processed and the results converted to milligrams of lead per square centimeter of sampled surface area. On most substrates, the XRFA is precise to +0.1 mg/cm^2.

Surfaces tested included, but were not limited to floors, walls, ceilings, windows, doors, casings/jambs, trim, columns, overhead canopies, and other miscellaneous surfaces.

2.2 Regulatory Guidance

In all areas where LBP is disturbed by renovation work and where components covered by LBP are disposed of, applicable OSHA and EPA regulations apply.

OSHA

Renovation or demolition activities that disturb surfaces that contain lead must be conducted in accordance with the OSHA regulation 29 CFR 1926.62 "Lead Exposure in Construction: Interim Final Rule." This regulation requires that a site-specific health and safety plan be prepared before conducting activities that create airborne lead emissions. Such a plan should include the identification of lead components, an exposure assessment, and, if applicable, the required work procedures and personnel protection to be used.

An exposure assessment in the form of personal air monitoring must be performed if there is the potential for employees to be exposed to lead due to the renovation or demolition activity. If demolition is being conducted that will disturb lead-based paints, the employer must assume that employee exposure is in excess of the Permissible Exposure Limit (PEL) of 50 micrograms per cubic meter of air ($\mu g/m^3$) until the exposure assessment is completed. If the PEL is exceeded, employees are required to use half-face mask respirators with HEPA filter cartridges. Furthermore, a written respirator program is required per 29 CFR 1910.134. The lead standard also requires the following protective measures be taken until the exposure assessment is completed:

- Isolation of the work area;
- appropriate personal protective clothing and equipment;
- change areas and hand washing facilities;
- biological monitoring; and
- training

The results of the initial exposure assessment will determine the protective measures that must be followed for the remainder of the project. OSHA may allow air-monitoring data from previous projects conducted under conditions closely resembling the present project to be used for the exposure assessment. If the exposure assessment indicates that exposure levels are below the Action Level of 30 μ/m^3, there are no additional requirements under the standard if the conditions remain the same.

EPA

In addition to the worker protection requirements stipulated by OSHA, MA DEP and the EPA regulate the disposal of wastes that are potentially hazardous. Such wastes may include paint chips and residue generated during abatement or repainting work, or whole components, such as wood windows, doors, and trim that are coated with LBP and that are disposed of as the result of renovation or demolition work. Metal components are not regulated if they will be recycled and not disposed of in a landfill.

To determine the required method for disposing of permeable items coated with LBP, the MA DEP and the EPA require representative sampling of the debris to determine the quantity of lead that would be expected to leach into the environment if the debris were disposed of in a landfill. The representative sample(s) must be analyzed by the Toxicity Characteristic Leaching Process (TCLP). If the result of this procedure indicates that the sample leaches a lead concentration below five parts per million (ppm), the debris is not regulated and can be disposed of in a traditional construction landfill. However, the debris must be disposed of as hazardous waste if the TCLP result exceeds 5 ppm. To minimize the total volume of hazardous waste, segregating hazardous from non-hazardous waste is advisable.

HUD

HUD has established a standard for lead-based paint, as tested using an XRF analyzer, of 1.0 mg/cm^2. Although this standard only applies to housing funded by the federal government, it is a useful reference concentration for assessing hazards associated with lead in paint in other settings. Thus, when paint contains greater than 1.0 mg/cm^2, special care should be taken when conducting activities that impact these paints. When conducting abrasive blasting, torch burning, or similar activities that generate significant dust or fume, hazards can be caused even at concentrations below the HUD standard.

2.3 Findings

Analysis of painted surfaces throughout the site indicate that lead levels were between <0.1-2.6 mg/cm^2. **Table 4** below outlines surfaces coated with lead-based paint, but refer to Appendix B for the results of comprehensive testing.

Table 4 • Summary of Surfaces Coated With Elevated Lead Paint				
Location	**Substrate**	**Color**	**Component**	**Quantity**
Roof	Wood	Red	Wood block trim	180 sf
Roof	Metal	Green	Cupola	16 sf
Exterior	Wood	White	West side bathroom door	1 door

2.4 Conclusions and Recommendations

Based on our findings, SWA offers the following conclusions and recommendations:

1. Limited lead-based paint coated components were identified at the site. Handling or impacting components that are covered by LBP require compliance with the OSHA lead standard. To minimize exposure to airborne dust or fumes, torch burning, cutting, grinding, or similar high impact work on components covered by LBP should be avoided. Such work would need to be conducted by properly trained workers using appropriate worker protection and engineering controls.

2. TCLP testing of materials representing the waste stream will be necessary to determine proper disposal methods and satisfy the chosen landfill.

3. If suspect painted components are identified during demolition of the building that are not addressed in this report, they must be assumed to contain LBP until further testing indicates otherwise.

2.5 Cost Estimate

SWA estimates that costs associated with OSHA and EPA compliance relative to lead paint at approximately **$2,000** for this site. *If all lead paint coated components were to be de-leaded at the site or if the composite TCLP test failed, the costs would be increased substantially.*

3.0 POLYCHLORINATED BIPHENYLS (PCBs)

3.1 Scope of Work

SWA's investigation for PCBs in light fixture ballasts and electrical equipment was visual only. Typically, ballasts and electrical equipment installed after 1978 do not contain PCBs and are marked as such. Ballasts and electrical equipment that do not have the "No PCBs" wording on the label are assumed to contain PCBs.

SWA also collected samples of metal wall panel seam sealant, garage door caulking, garage door glazing, and metal window glazing for laboratory analysis to determine the concentration of PCBs. Sample collection occurred in locations that appeared to be representative of those materials throughout the building. A minimum five gram piece of material was taken from the substrate, placed into labeled individual sealed containers.

The samples were labeled and the sample number and description were recorded on a field data sheet and delivered using appropriate chain-of-custody to NetLab of West Warwick, Rhode Island, for analysis. NetLab employed EPA method SW846 utilizing sample extraction method 8081 and analytical method 8028, gas chromatography, to analyze the samples (see Appendix C of this report).

3.2 Background/Regulatory Guidance

According to the EPA, PCBs are toxic and persistent chemicals that were used primarily as insulating fluid in heavy-duty electrical equipment. They were also utilized in a wide variety of products including paints, caulks, light fixture ballast, oils, plastics, adhesives, tapes, carbonless copy paper, floor finishes and related products. Because PCBs are suspected carcinogens and may cause other adverse health effects, the EPA banned their manufacture and installation starting in 1979.

Any materials containing PCBs equal to or greater than 50 parts per million (ppm) are regulated under the Toxic Substance Control Act and the PCB regulation found at 40 CFR Part 761. Further, EPA policy, as described in "Current Best Practices for PCBs in Caulk Fact Sheet" updated in September, 2009, is that PCBs at concentrations greater than 50 ppm are not authorized for use and must be removed and properly disposed of.

Additionally, where <50 ppm caulk or PCB remediation waste is present, it may be regulated for removal and/or cleanup unless the <50 ppm PCB caulk meets the definition of an Excluded PCB Product as defined under 40 CFR Part 761.3. Excluded products would include those legally installed before October 1, 1984 and the resulting PCBs concentration is not the result of dilution or leaks or spills from other products. Thus, if a formerly installed PCB caulk containing greater than 50 ppm had been removed and replaced by a non-PCB caulk, the non-PCB caulk could be contaminated from the residue of the former caulk. In this instance, if the non-PCB caulk tested at a concentration above

one ppm, it would be regulated as PCB containing.

Further, because PCBs may have leached into surrounding substrates, such as brick, CMU, and cement, or may have degraded and contaminated adjacent soil, assessment of masonry and soils is necessary on instances where PCBs are present in caulk or other building materials. Where analysis indicates contaminant concentrations above one ppm in masonry or soils, remedial actions are required.

3.3 Findings

SWA inspected the labels on representative ballasts throughout the building; the representative ballasts inspected all exhibited the "No PCBs" wording on their affixed labels and therefore are assumed not to contain PCBs in their capacitor oils. SWA observed two one-gallon electric panel expansion tanks in the mechanical room suspected of containing PCB transformer oil (>2 ppm).

Analytical results indicate that of those suspect materials sampled and analyzed, none were determined to contain PCBs.

- White garage door glazing (PCB-01) – Exterior garage door on wooden sash, None Detected
- White garage door caulking (PCB-02) – Exterior garage door on wooden frame, None Detected
- Beige metal wall panel seam sealant (PCB-03) – Rear storage container along wall and ceiling seam, None Detected
- White garage window glazing (PCB-04) – East side garage window on metal sash, None Detected

3.4 Conclusions and Recommendations

Based on our observations, we conclude the following:

1. Prior to renovation or demolition, all ballasts must be inspected for the “No PCB” wording on their affixed label to determine appropriate segregation and recycling requirements. The ballasts that do not contain the "No PCBs" wording on the affixed label are assumed to contain PCB oils and must be segregated for proper disposal/recycling.

2. The transformers containing suspect PCB oil should be properly characterized, drained, and handled by workers that have received OSHA 24-Hour Hazardous Waste and Emergency Operations (HAZWOPER) under the supervision of a foreperson OSHA 24-Hour Hazardous Waste and Emergency Operations (HAZWOPER) in compliance with 29 CFR 1910.120.

3. No PCBs were identified in those building materials sampled and analyzed at the site. If suspect materials are uncovered at later dates that are not explicitly

addressed in this report, they must be assumed to contain PCBs until further testing indicates otherwise.

3.5 Cost Estimate

Based on our findings, the cost to assess all ballasts for the ″No PCB″ wording and properly characterize, drain, and handle for the disposal of PCB transformer fluid should not exceed **$3,000**.

4.0 MERCURY COMPONENTS

4.1 Scope of Work

SWA's inspector observed fluorescent light bulbs and a thermostat suspected of containing mercury throughout the building. Typically when fluorescent light fixtures, thermostats, or electrical switches will be removed and disposed of, SWA makes a conservative assumption that they contain mercury and should be handled as a regulated waste. These materials are classified as "Universal Wastes" and must be appropriately handled and packaged for disposal or recycling.

4.2 Findings

SWA observed fluorescent light bulbs that if impacted by renovations must be collected and recycled in accordance with the "Universal Waste" regulatory requirements. The fluorescent bulbs are located throughout the building. SWA estimates that there are 13 (4') and 8 (8') fluorescent bulbs that would require recycling during renovations. Also, one heat regulating thermostat with internal mercury tube was identified in the service center office.

4.3 Conclusions and Recommendations

Based on our observations, SWA offers the following conclusions and recommendations.

1. Prior to being impacted, all fluorescent light bulbs and mercury tube must be collected and properly packaged for disposal or recycling in a facility permitted to accept mercury containing waste.

4.4 Cost Estimate

Based on our findings, the cost to collect and recycle/dispose of mercury containing fluorescent bulbs at this site should not exceed $750.

APPENDIX A

Certificates of Asbestos Bulk Sample Analysis
(PLM & TEM)

EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132005249
Customer ID:	SMIT50B
Customer PO:	
Project ID:	

Attention:	Rob Arcese	**Phone:**	(978) 346-4800
	Smith & Wessel Associates, Inc.	**Fax:**	(978) 346-7265
	188 Greenville Street	**Received Date:**	08/04/2020 11:00 AM
	Spencer, MA 01562	**Analysis Date:**	08/07/2020
		Collected Date:	

Project: 20118/Former Gas Station; 925 Massachusetts Ave; Lunenburg, MA

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
01A *132005249-0001*	1st Floor Garage Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
01B *132005249-0002*	1st Floor Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
01C *132005249-0003*	1st Floor Garage Rear Storage - Gray Cement Plaster (Ceiling)	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02A *132005249-0004*	1st Floor Garage - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02B *132005249-0005*	1st Floor Mech. Room Garage - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02C *132005249-0006*	1st Floor Mech. Room - White & Gray Gypsum Board	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
03A *132005249-0007*	1st Floor Rear Storage Container - Beige & Gray Metal Wall Panel Seam Sealant	Gray Non-Fibrous Homogeneous		95% Non-fibrous (Other)	5% Chrysotile
03B *132005249-0008*	1st Floor Rear Storage Container - Beige & Gray Metal Wall Panel Seam Sealant				Positive Stop (Not Analyzed)
04A *132005249-0009*	1st Floor Bathroom - White 9"x9" Floor Tile	White Non-Fibrous Homogeneous		95% Non-fibrous (Other)	5% Chrysotile
04B *132005249-0010*	1st Floor Rear Bathroom - White 9"x9" Floor Tile				Positive Stop (Not Analyzed)
05A *132005249-0011*	1st Floor Bathroom - Black Mastic	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
05B *132005249-0012*	1st Floor Rear Bathroom - Black Mastic	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
06A *132005249-0013*	1st Floor Office Lobby - White 2'x4' Suspended Ceiling Tiles	Gray/White Fibrous Homogeneous	50% Cellulose 30% Min. Wool	20% Non-fibrous (Other)	None Detected

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
Customer ID: SMIT50B
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
06B *132005249-0014*	1st Floor Office Lobby - White 2'x4' Suspended Ceiling Tiles	Gray/White Non-Fibrous Homogeneous	50% Cellulose 30% Min. Wool	20% Non-fibrous (Other)	None Detected
07A *132005249-0015*	1st Floor Office Lobby - Tan Ceiling Panel Adhesive	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
07B *132005249-0016*	1st Floor Office Lobby - Tan Ceiling Panel Adhesive	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08A *132005249-0017*	1st Floor Office Lobby - Red Cove Base	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08B *132005249-0018*	1st Floor Office Lobby - Red Cove Base	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
09A *132005249-0019*	1st Floor Office Bathroom - Black Cove Base Adhesive	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
09B *132005249-0020*	1st Floor Office Bathroom - Black Cove Base Adhesive	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10A *132005249-0021*	1st Floor Mech. Room @ Supply Plenum - Gray Duct Work Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10B *132005249-0022*	1st Floor Mech. Room @ Supply Plenum - Gray Duct Work Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11A *132005249-0023*	1st Floor - White Garage Door Glazing	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11B *132005249-0024*	1st Floor - White Garage Door Glazing	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12A *132005249-0025*	1st Floor Garage Side Window - White Metal Window Glazing	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
12B *132005249-0026*	1st Floor Garage Side Window - White Metal Window Glazing	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
13A *132005249-0027*	Ext. Roof - Black 3-Tab Shingle - 1st Layer	Black Fibrous Homogeneous	15% Glass	85% Non-fibrous (Other)	None Detected
13B *132005249-0028*	Ext. Roof - Black 3-Tab Shingle - 1st Layer	Black Fibrous Homogeneous	15% Glass	85% Non-fibrous (Other)	None Detected
14A *132005249-0029*	Ext. Roof - Black 3-Tab Shingle - 2nd Layer	Black Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
14B *132005249-0030*	Ext. Roof - Black 3-Tab Shingle - 2nd Layer	Black Non-Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
15A *132005249-0031*	Ext. Garage - White Garage Door Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
15B *132005249-0032*	Ext. Garage - White Garage Door Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
16A *132005249-0033*	Ext. Roof Rear Storage Container - Black Tar Mop Roof	Black Non-Fibrous Homogeneous	25% Cellulose	70% Non-fibrous (Other)	5% Chrysotile
16B *132005249-0034*	Ext. Roof Rear Storage Container - Black Tar Mop Roof				Positive Stop (Not Analyzed)
17A *132005249-0035*	1st Floor Office Bathroom - Tan Wall Panel Glue	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
17B *132005249-0036*	1st Floor Rear Bathroom - Tan Wall Panel Glue	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18A *132005249-0037*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18B *132005249-0038*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18C *132005249-0039*	Ext. East Perimeter Wall - White Textured Paint	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Analyst(s)
Kevin Pine (36)

Steve Grise, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-139, VT AL998919, Maine Bulk Asbestos LB-0039

Initial report from: 08/07/2020 14:44:37

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EMSL Order: 132005249
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Received Date: 08/04/2020 11:00 AM
Analysis Date: 08/19/2020
Collected Date:

Project: 20118/Former Gas Station; 925 Massachusetts Ave; Lunenburg, MA

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

Sample ID	Description	Appearance	% Matrix Material	% Non-Asbestos Fibers	Asbestos Types
05A *132005249-0011*	1st Floor Bathroom - Black Mastic	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected
05B *132005249-0012*	1st Floor Rear Bathroom - Black Mastic	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected

Analyst(s)

Matthew Conley (2)

Steve Grise, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. EMSL recommends that samples reported as none detected or <1% undergo additional analysis via PLM to avoid the possibility of false negatives.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA

Initial report from: 08/19/2020 11:25:28

APPENDIX B

Results of Testing for Lead-Based Paint (LBP)

Lead Based Paint Testing Results Former Citgo Service Station 925 Massachusetts Avenue Lunenburg, MA				
Location	**Substrate**	**Color**	**Component**	**Result mg/cm^2**
Exterior	Concrete	White	Wall	<0.1
	Wood	White	Wall	<0.1
	Wood	White	Window frame	<0.1
	Metal	White	Window sash	0.5
	Cinderblock	White	Wall	<0.1
	Concrete	White	Foundation wall	<0.1
	Brick	Brown	Façade lower wall	<0.1
	Wood	White	West side bathroom door	**3.9**
	Metal	Brown	Canopy guard rail	<0.1
	Metal	Gray	Canopy dunnage curb protector	<0.1
	Metal	Gray	Canopy support column	<0.1
	Metal	White	Upper canopy soffit and trim	<0.1
Roof	Wood	Red	Wood block trim	**2.6**
	Metal	Green	Cupola	**2.5**
Garage	Cinderblock	Red	Interior wall	<0.1
	Plaster	Red	Interior wall	<0.1
	Plaster	White	Interior wall and ceiling	<0.1
	Cinderblock	White	Interior wall and ceiling	<0.1
	Wood	White	Shelving unit	<0.1
	Wood	White	Garage door frame	0.2
	Concrete	Yellow	Floor	<0.1
Service center	Wood	Brown	Door frame	0.1
	Wood	Pink	Wall	<0.1
	Wood	Tan	Door	0.1

Note: All testing was conducted using a NITON XLS-303A. Limit of detection = 0.1 mg/cm^2.

APPENDIX C

PCB Analytical Results

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 0H05010
Client Project: 925 Massachusetts Ave, Lunenburg, MA

Report Date: 12-August-2020

Prepared for:

Robert Arcese
Smith & Wessel Associates
515 Wildlife Glen
Bradenton, FL 34209



Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 08/05/20. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 0H05010. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
0H05010-01	PCB-01	Solid (Misc)	08/03/2020	08/05/2020
0H05010-02	PCB-02	Solid (Misc)	08/03/2020	08/05/2020
0H05010-03	PCB-03	Solid (Misc)	08/03/2020	08/05/2020
0H05010-04	PCB-04	Solid (Misc)	08/03/2020	08/05/2020

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

PCB-01 (Lab Number: 0H05010-01)

Analysis	Method
PCBs	EPA 8082A

PCB-02 (Lab Number: 0H05010-02)

Analysis	Method
PCBs	EPA 8082A

PCB-03 (Lab Number: 0H05010-03)

Analysis	Method
PCBs	EPA 8082A

PCB-04 (Lab Number: 0H05010-04)

Analysis	Method
PCBs	EPA 8082A

Method References

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA

Case Narrative

Sample Receipt:

The samples associated with this work order were received in appropriately cooled and preserved containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Exceptions: None

Analysis:

All samples were prepared and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control requirements and allowances. Results for all soil samples, unless otherwise indicated, are reported on a dry weight basis. Samples were extracted via EPA 3540C - Soxhlet.

Exceptions: None

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-01

Lab Number: 0H05010-01 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		161	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		161	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		161	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*49.6%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*51.3%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-02

Lab Number: 0H05010-02 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		172	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		172	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		172	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*53.3%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*60.8%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-03

Lab Number: 0H05010-03 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		189	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		189	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		189	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*46.7%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*51.0%*	*30-105*	08/07/20	08/12/20

Results: Polychlorinated Biphenyls (PCBs)

Sample: PCB-04

Lab Number: 0H05010-04 (Non-soil solid, as received basis)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Aroclor-1016	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1221	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1232	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1242	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1248	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1254	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1260	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1262	ND		157	ug/kg	08/07/20	08/12/20
Aroclor-1268	ND		157	ug/kg	08/07/20	08/12/20
PCBs (Total)	ND		157	ug/kg	08/07/20	08/12/20

Surrogate(s)	Recovery%	Limits		
2,4,5,6-Tetrachloro-m-xylene (TCMX)	*49.8%*	*30-100*	08/07/20	08/12/20
Decachlorobiphenyl (DCBP)	*52.2%*	*30-105*	08/07/20	08/12/20

Quality Control

Polychlorinated Biphenyls (PCBs)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B0H0291 - EPA 3540C										
Blank (B0H0291-BLK1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	ND		200	ug/kg						
Aroclor-1221	ND		200	ug/kg						
Aroclor-1232	ND		200	ug/kg						
Aroclor-1242	ND		200	ug/kg						
Aroclor-1248	ND		200	ug/kg						
Aroclor-1254	ND		200	ug/kg						
Aroclor-1260	ND		200	ug/kg						
Aroclor-1262	ND		200	ug/kg						
Aroclor-1268	ND		200	ug/kg						
PCBs (Total)	ND		200	ug/kg						
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*67.0*	ug/kg	*80.0*		*83.7*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*75.1*	ug/kg	*80.0*		*93.9*	*30-105*		
LCS (B0H0291-BS1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	793		200	ug/kg	1000		79.3	64-112		
Aroclor-1260	964		200	ug/kg	1000		96.4	59.4-124		
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*64.4*	ug/kg	*80.0*		*80.5*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*76.2*	ug/kg	*80.0*		*95.2*	*30-105*		
LCS Dup (B0H0291-BSD1)					Prepared: 08/07/20 Analyzed: 08/10/20					
Aroclor-1016	847		200	ug/kg	1000		84.7	64-112	6.53	20
Aroclor-1260	955		200	ug/kg	1000		95.5	59.4-124	0.986	20
Surrogate: 2,4,5,6-Tetrachloro-m-xylene (TCMX)			*74.6*	ug/kg	*80.0*		*93.2*	*30-100*		
Surrogate: Decachlorobiphenyl (DCBP)			*74.0*	ug/kg	*80.0*		*92.5*	*30-105*		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

0 H 0 5010;

Site: 925 Massachusetts Ave, Lunenburg, MA

		Location
PCB-01	Garage door glazing	Ext. Garage door glazing (sash)
PCB-02	Garage door caulking	Ext. Garage door (wood frame)
PCB-03	Container seam sealant	Rear storage container wall/ceiling seam
PCB-04	Garage window glazing	Metal garage window (sash)

Chain-of-custody

Relinquished by Robert Arcese Date 8/3/20 Time 16:00

Received by _____ Date 8/5/20 Time FedEx

Analysis requested: PCBs

Turnaround time: 5-days

Total # of samples 4

Analysis for PCBs via EPA's SW-846 Method 3540C/8082 SOXHLET Extraction

MassDEP Analytical Protocol Certification Form

Laboratory Name: New England Testing Laboratory, Inc.	Project #:
Project Location: Lunenburg, MA	RTN:

This Form provides certifications for the following data set: list Laboratory Sample ID Number(s):
0H05010

Matrices: ☐ Groundwater/Surface Water ☐ Soil/Sediment ☐ Drinking Water ☐ Air ☒ Other: Solid

CAM Protocol (check all that apply below):

8260 VOC CAM II A ☐	7470/7471 Hg CAM III B ☐	MassDEP VPH (GC/PID/FID) CAM IV A ☐	8082 PCB CAM V A ☒	9014 Total Cyanide/PAC CAM VI A ☐	6860 Perchlorate CAM VIII B ☐
8270 SVOC CAM II B ☐	7010 Metals CAM III C ☐	MassDEP VPH (GC/MS) CAM IV C ☐	8081 Pesticides CAM V B ☐	7196 Hex Cr CAM VI B ☐	MassDEP APH CAM IX A ☐
6010 Metals CAM III A ☐	6020 Metals CAM III D ☐	MassDEP EPH CAM IV B ☐	8151 Herbicides CAM V C ☐	8330 Explosives CAM VIII A ☐	TO-15 VOC CAM IX B ☐

Affirmative Responses to Questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	☒ Yes ☐ No
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	☒ Yes ☐ No
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	☒ Yes ☐ No
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	☒ Yes ☐ No
E	VPH, EPH, APH, and TO-15 only a. VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications). b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	☐ Yes ☐ No ☐ Yes ☐ No
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	☒ Yes ☐ No

Responses to Questions G, H and I below are required for "Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	☒ Yes ☐ No[1]

***Data User Note:** Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.*

H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	☒ Yes ☐ No[1]
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	☒ Yes ☐ No[1]

[1] *All negative responses must be addressed in an attached laboratory narrative.*

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, is accurate and complete.

Signature: _____ **Position:** Laboratory Director

Printed Name: Richard Warila **Date**: 8/12/2020

APPENDIX D

Site Photographs



Figure 1. Gas station façade



Figure 2. West perimeter wall from the parking lot



Figure 3. Gas station canopy and three fuel dispensers



Figure 4. Delaminating cement ceiling plaster in the rear garage storage space



Figure 5. Red cove base in the office and common lobby space



Figure 6. Hard ceiling panel adhesive above suspended ceiling in the office and common lobby space



Figure 7. 12” x 12” floor tile and associated mastic adhesive in the office bathroom



Figure 8. Garage and rear storage space



Figure 9. 1-gallon transformers suspected of containing PCB transformer oils in the mechanical room



Figure 10. Exposed lathing and ceiling joists in the attic



Figure 11. Additional view of exposed lathing from missing floor boards in the attic

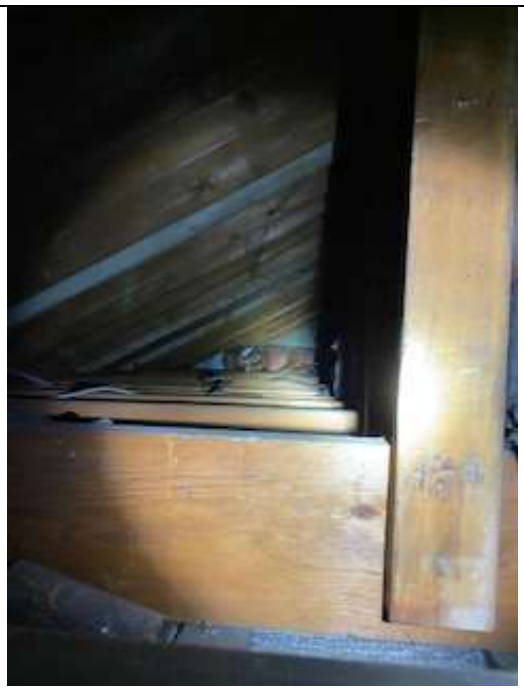


Figure 12. Roof rafters and truss in the attic with no suspect ACM or vermiculite insulation



Figure 13. Exposed CMU with no infill or insulating material



Figure 14. Garage doors with suspect ACM/PCB glazing and caulking



Figure 14. Tar mop roof with overgrown vegetation damaging the wood decking, fascia, and eave



Figure 15. 12" x 12" floor tile and associated mastic adhesive in the rear bathroom



Figure 16. Textured paint over CMU exterior wall (multiple layers collected as single grab sample)

Appendix I

Health and Safety Plan

Health and Safety Plan

925 Massachusetts Avenue
Lunenburg, Massachusetts

August 2020

Prepared for:

Mr. John Hume
Planning and Development
Montachusett Regional Planning Commission
464 Abbott Avenue
Leominster, Massachusetts 01453

Prepared by:

BETA
701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

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1.0 INTRODUCTION

BETA Group, Inc. (BETA) has designed these health and safety procedures, referred collectively as the Health and Safety Plan (HASP), to protect health, safety, public welfare and the environment from potential hazards which may arise during environmental investigation activities that will include drilling and sampling of the soil and groundwater at the 925 Massachusetts Avenue Site. This HASP was developed to comply with the regulations outlined by the Massachusetts Department of Environmental Protection (MassDEP) found in 310 Code of Massachusetts Regulations (CMR) 40.0018 and by the Occupational Safety and Health Administration (OSHA) found in 29 Code of Federal Regulations (CFR) 1910.120. Additionally, this HASP was developed to become the "Written Hazard Communication Program" to inform employers and employees about work hazards and personal protection to reduce illnesses and injury from any unexpected situation.

The scope of these procedures shall include, without limitation, the following:

(a) Measures to protect sensitive human populations from exposure to oil and/or hazardous materials;
(b) Air monitoring activities, if necessary, to protect the public from exposures to gases and air-borne particulates;
(c) Measures that may be necessary to contain oil and/or hazardous materials during the performance of response actions, including:
    1. Measures to control dust and other environmental media (e.g. wetting soils);
    2. Measures to decontaminate vehicles and equipment to minimize the spread of contaminated soil from the disposal site;
    3. Measures to secure on-site excavations and stockpiles of contaminated material; and
    4. Terminating response actions where necessary to protect public health and safety.

A copy of the HASP and all necessary revisions will be maintained on-site with the Site Safety Health Officer (SSHO). All BETA personnel have been trained in the health and safety response procedures presented herein and shall become familiar with the provisions of this plan. A daily "tailgate" meeting will be conducted at the beginning of the day in order to ensure that the workers are made aware of the health and safety issues anticipated for the day.

This HASP has been written for the use of BETA and its employees. Properly trained and experienced BETA subcontractors may also use it as a guidance document. However, BETA does not guarantee the health or safety of any person entering this site.

Due to the potential hazardous nature of this project and the site activities associated therewith, it is not possible to discover, evaluate, and provide protection for all possible hazards, which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury during this project. The health and safety guidelines in this HASP were prepared specifically for this project and should not be used on any other project without prior research by trained health and safety specialists.

REVIEW AND APPROVAL OF HASP

Prepared By:

Scott Nee Signature:_____ Date:_____
Engineer

Approved By:

Joe McLoughlin Signature:_____ Date:_____
Project Manager

John Hume Signature:_____ Date:_____
MRPC

Scott Nee Signature:_____ Date:_____
Site Safety Health Officer

Site Description

LOCATION: 925 Massachusetts Avenue
Lunenburg, Massachusetts

CROSS STREET: Main Street

SITE USAGE: Vacant Building

PAST SITE USAGE: Gasoline Station

SURROUNDING AREA:

_____ Virgin Land _____ Residential _____ Parkland/School

_____ Commercial/Retail ___x__ Industrial _____ Other

ENTRY OBJECTIVES:

__X___Visual/Surficial __X___Test Pits/Identify Contaminated Soil

__X__ Soil Borings/Remediation Wells _____ Monitor Tank/Soil Removal

__X___Sampling Soil/Water _____ Demolition Activities

_____Other – Remedial Work (open soil excavation)

BETA GROUP, INC.

LOCAL EMERGENCY AND PROJECT TELEPHONE NUMBERS

LOCAL EMERGENCY NUMBERS:

	NAME	TELEPHONE NO.
Hospital	UMass Memorial 100 Hospital Road Leominster, MA	911 or (978) 466-2000
Police	Lunenburg Police Department 655 Massachusetts Avenue Lunenburg, MA 01462	911 or (978) 582-4531
Fire	Lunenburg Fire Department 655 Massachusetts Avenue Lunenburg, MA 01462	911 or (978) 582-4033
Poison Control	Massachusetts Poison Control System	(800) 682 - 9211
Chem Trec	Chemical Register	(800) 424 - 9300
DEP Spills/Release	Central Region 8 New Bond Street Worcester, MA	(508) 792-7650

DIRECTIONS TO THE HOSPITAL:
See Attached

1. Start out going **east** on Massachusetts Avenue toward Leominster Road.
2. Turn **right** onto Leominster Road. Continue for 4.3 miles.
3. Turn **right** onto Hamilton Street.
4. Turn **left** on to North Main Street
5. Turn **right** onto Hospital Street.
6. Destination will be on the **left**.

PROJECT PERSONNEL NUMBERS:

ROLE	NAME	CELLPHONE
Site Safety Health Officer	Scott Nee	781-264-3823
Project Manager	Joe McLoughlin	508-212-8717
Client	John Hume	508-272-6146

2.0 SITE DESCRIPTION AND EVALUATION

This HASP was prepared for the Town of Lunenburg, specifically to be utilized during the commencement of field activities which will include, soil borings, environmental testing, and other activities at the Site, located at 925 Massachusetts Avenue. Locations for equipment staging (if necessary), and work zones will be agreed upon by the SSHO and the Project Manager.

Specific activities to be performed during the Project include a site assessment and environmental sampling utilizing a geoprobe drilling rig, and a track mounted rig. **At all times, site personnel must be cognizant of the inherent safety concerns associated with truck and heavy equipment traffic in and around the designated work area.**

3.0 CHEMICAL AND PHYSICAL HAZARDS

POTENTIAL PHYSICAL HAZARDS	YES	NO
Overhead/underground hazards		
Electric power lines	X	
Drainage lines (sewer, water)	X	
Natural Gas Lines	X	
Equipment hazards		
Excavation		
Machinery	X	X
Heat exposure	X	
Cold exposure	X	
Oxygen deficiency		X
Confined space		X
Noise	X	
Ionizing radiation	X	
Non-ionizing radiation (ultraviolet/sun)	X	
Fire/Explosion	X	
Electrical	X	
Biological	X	
Work Surfaces		
Holes/trenches		X
Steep grades	X	
Slippery surfaces	X	
Shoring		X
Traffic	X	

3.1 Physical Hazards

The greatest potential physical hazards at the Site include: uneven terrain, unsafe building conditions, construction equipment, and automobile/street traffic. BETA personnel shall note these hazards at each site location and take necessary precautions. See the Traffic Hazards section below for further discussion of hazards posed by automobile/street traffic. When working around heavy equipment, personnel should wear hard hats and steel toe and shank boots.
Caution will be taken when entering the building and the conditions will be surveyed before personnel enter any floor of the building.

3.2 Heat Stress

During the summer months, warm weather may become a health factor. Personnel working on-site may have to wear protective clothing and respirators, which would increase the chance of workers suffering from heat-related problems. The situation will be monitored periodically on days when the ambient temperature exceeds 60° F. Workers must be briefed on the signs and symptoms of heat-related problems and on preventive measures if work is performed when the ambient temperature exceeds 60° F.

There are three levels of Heat Stress which include the following:

⇒ Heat Cramps;
⇒ Heat Exhaustion; and
⇒ Heat Stroke.

Symptoms for heat cramps include painful muscle spasms. Treatment includes providing liquids with electrolytes. Symptoms for heat exhaustion include weakness, fatigue, dizziness, heavy sweating, headache, nausea, fainting and pale, cool, moist skin. Treatment includes resting in a cool place and providing liquids with electrolytes if the person is conscious; if unconscious, get medical help immediately. Symptoms for heat stroke include very dry, hot skin, mottled blue or red appearance, confusion, convulsions, rapidly rising temperature and unconsciousness. Treatment includes attaining medical attention immediately. **Heat stroke is a life-threatening emergency.**

When tyvek suits are being used and the ambient air temperature exceeds 60° F, then cool liquids will be available on the Site and a cool down area identified on the site for breaks.

3.3 Cold Stress

Cold injury (frostbite and hypothermia) and impaired ability to work are dangers at low temperatures and when the wind-chill factor is low. "Low" temperatures are subjective as hypothermia can develop at temperatures above 32 degrees Fahrenheit. The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age and general health. Allergies, vascular disease, excessive smoking and drinking (alcohol) and use of specific drugs and medicine may enhance the effects of cold exposure. In preventing cold stress, consider these environmental and individual factors:

acclimation, dehydration, salt intake and wind-chill. To guard against cold-stress: wear appropriate clothing; have warm shelter readily available; carefully schedule work and rest periods, and monitor workers' physical conditions.

3.4 Confined Space

A confined space has limited or restricted means of entry or exit, or is large enough for an employee to enter and perform assigned work, is not designed for continuous occupancy by the employee, and has limited ventilation. These spaces may include, but are not limited to underground vaults and underground drain pipes.

Although excavation trenches are not expected at this point, they would be classified as confined spaces, and therefore, entry into the trenches are regulated by the Occupational Safety and Health Administration (OSHA). OSHA standard for confined spaces, Title 29 Code of Federal Regulations Part 1910.0146, effective April 15, 1993, contains the requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces. Typical hazards associated with confined space entries are presented in the 'Sewers, Drains, and Structures' section of this HASP.

The confined space entry procedures are detailed in Appendix C, Confined Space Entry Procedures and Permit. The confined space entry procedures should be reviewed prior to conducting field activities and the confined space entry permit must be reviewed, completed, and signed prior to entering any of underground structures. Confined spaces may contain oxygen deficient atmospheres; air testing with an oxygen sensor will be performed prior to entry of the structures. Entry will be permitted with an oxygen level between 19.5% O_2 and 23.5% O_2.

3.5 Noise

Elevated noise levels may be encountered during the project due to construction equipment. Persons working in close proximity to construction equipment shall wear sufficient hearing protection. This equipment may include foam ear plugs or foam ear muffs. Hand signals must be used for communication in these situations. Hand signals shall be established and practiced prior to donning protective hearing equipment.

3.6 Biological

Biologicals may be encountered in the form of ticks, mosquitoes, reptiles, rodents and poison oak and ivy. Care should be taken when traversing through overgrown areas. BETA personnel should wear long sleeve shirts and pants, work gloves and steel toe and shank boots.

3.7 Traffic Hazards

Personnel should be aware of traffic hazards and take necessary precautions to minimize the risks posed by traffic. This may include, but should not be limited to, reflective safety vests or shirts, traffic cones, hard hats, steel-toe and shank boots. Work is not expected in the street, but Police details will be necessary for work conducted within roadway areas.

3.7 Chemical Exposures

The Site was formerly used as a foundry, and therefore metals are likely at the site. Possible contaminants of concern include, but are not limited to, petroleum hydrocarbons, metals, and asbestos.

Table 1 summarizes chemicals known or suspected to be present on the Site and associated symptoms of acute exposure to such contaminants. Since additional unsuspected hazards may exist at the Site, periodic air quality monitoring and evaluation of site conditions will be performed during all on-site activities.

Table 1
Known Chemical Contaminants, Former Uniroyal Complex

Chemical Contaminants*	Potential Hazards	OSHA PEL	NIOSH REL
Volatile Organics	Toxic by ingestion, inhalation, skin absorption, and eye contact. Irritant to eyes, nose. Headache, dilated pupils, tearing, confusion, dizziness, and nervousness may occur.	benzene: 1 ppm ethylbenzene, toluene, xylenes: 100 ppm Naphthalene: 10 ppm	80 ppm
Petroleum Hydrocarbons	Irritant by to eyes, nose and throat. May cause dizziness, headache, nausea	500 ppm (air)	0.002 mg/m^3
Lead	Harmful if inhaled or ingested. May cause weakness, exhaustion, partial paralysis, and kidney disease	0.015 mg/m^3	Not established
Chromium	Irritant to eyes, skin, and lungs. May require respiratory support.	1 mg/m^3	0.5 mg/m^3

Asbestos	Irritant to eyes and respiratory system. Known carcinogen. Will cause restricted pulmonary function, and potential finger clubbing.	8-hour TWA airborne concentration of 0.1 fiber/cm^3. No worker should be exposed in excess of 1 fiber/cm^3	Asbestos fibers >5 micrometers REL = 100,000 fibers/m^3

Refer to Attachment D for NIOSH Chemical Hazards Guides

3.8 Symptoms of Chemical Exposures

On-site workers should be aware of the specific symptoms of acute chemical exposure listed in Table 3. In general, workers should also be aware of some indications of toxic effects of chemical exposure which are described below:

- Observable by others:
  - Changes in complexion, skin discoloration
  - Lack of coordination
  - Changes in demeanor
  - Excessive salivation, papillary response
  - Changes in speech pattern
- Non-observable by others:
  - Headaches
  - Dizziness
  - Blurred vision
  - Cramps
  - Irritation of eyes, skin, or respiratory tract

All field personnel are required to wear a hard hat, steel toed boots, safety glasses and gloves at all times in the work area. In addition, all field personnel must also be aware of dust and/or particulate generation from vehicle and heavy equipment traffic and the current wind direction. Appropriate respiratory practices should be employed at the discretion of the SSHO.

3.9 Radiation Exposure

An XRF instrument will be used in the field to screen surficial soil samples for metal content. The XRF produces ionizing radiation and will only be used by a trained worker. Proper safety precautions including an exclusion zone around the instrument will be used.

4.0 HEALTH AND SAFETY PLAN RESPONSIBILITIES

All other personnel involved in Site work will have completed the following training:

- 40 hr. Hazardous Waste Operations Training (HAZWOPER);
- 8 hr. Annual HAZWOPER Refresher Training;

All personnel involved in fieldwork activities during this project must have completed an annual physical and received the proper certifications from the occupational health physician for the site contaminants of concern. The SSHO will conduct an initial briefing for all field personnel to discuss health and safety concerns and procedures on a daily basis.

The SSHO will be responsible for all personnel and environmental monitoring, including maintenance of air quality monitoring equipment. The SSHO will oversee the overall HASP. He/she has the authority to stop work or prohibit any personnel from working on the site at any time for not complying with any aspect of the HASP.

The Subcontractor Field Supervisor is responsible for implementing the Plan for his/her own employees. Each person on the site is responsible for his/her own health and safety, as well as assisting others in carrying out the HASP. Any person observed to be in violation of the HASP should be assisted in complying with the Plan, or reported to the SSHO or the Subcontractor Field Supervisor. Any site personnel may shut down field activities if there is a real or perceived immediate danger to life or health.

5.0 SURVEY FOR AND IDENTIFICATION OF UTILITIES

Prior to beginning work on the site or around facilities with buildings or other structures that could be served by or connected to utilities; a search must be conducted by the SSHO and the appropriate utility company, ideally in association with someone familiar with the facility, to identify any overhead, underground, and work zone utilities.

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. The DIG-SAFE number for each of the work sites will be obtained at least 72-hours prior to commencing work. Utilities should be marked or access otherwise restricted to avoid chance of accidental contact. Utilities shall be considered "live" or active until a reliable source has documented them to be otherwise.

6.0 EXCAVATION/TRENCHING SAFETY

The following are the general procedures to be followed during the site work if excavation and trenching is required. These procedures will be adhered to and implemented by the BETA team assigned to this project.

Prior to opening an excavation, a review of the excavation area will be made to prevent, to the extent possible, accidental contact or disturbance of any underground structures. Underground utilities and/or structures will be field-verified prior to uncovering. All known owners of underground utilities in the area involved will be advised of proposed work at least 72 consecutive hours (excluding Saturdays, Sundays, and holidays) prior to the start of excavation work.

A reasonable examination by the SSHO will be made to determine that no recognizable conditions exist which would expose employees to injury before work is permitted in or adjacent to excavations. The SSHO will possess the following qualifications:

1) Knowledge of the OSHA Standard-Excavation/Trenching Standard;

2) Knowledge of OSHA Soils Classifications and Tests-Soil type A, B, or C;

3) Knowledge of Selection and use of Protection (e.g., shoring, sloping and shielding); and

4) Possessing the authority to stop work on a job site if any safety violations occur.

Excavations will be inspected daily by the SSHO before employees are permitted to enter the excavation. Inspection will also occur after any event, which could undermine the methods of slope protection. These events include rain, groundwater flow, and visible signs of slope instability or disturbance of shoring or other protection systems.

Employees who enter excavations 5 feet or more in depth will be protected by a system of shoring, sloping of the ground, benching, or alternate means. Protection for employees who work in excavations less than 5 feet in depth will also be provided when examination by the SSHO indicates that hazardous ground movement may be expected.

Excavated material will be prevented from falling back into the area where employees are working. This will be done by locating the soils at a distance from the edge of the excavation consistent with the character of the material and the nature of the operations. Unless otherwise contained, in no case will the excavated materials be placed closer than 2 feet from the edge of excavation 5 feet or more in depth.

Work in an excavation will at all times be under the supervision of the SSHO who is authorized to modify the shoring or sloping. A convenient and safe means of access will be provided for employees to enter and leave an excavated area. This will consist of a stairway, ladder or ramp securely fastened in place where employees are working.

Air in any excavation area will be tested when oxygen deficiency, explosive conditions, or toxic air contaminants are possible. A combustible gas indicator, oxygen lever meter, and Photo-Ionization Detector (PID) will be calibrated and used to determine the safety of the trench or excavation.

An employee working in the vicinity of operational excavating equipment will be required to work in a safe position such that the employee is not in danger of falling into or otherwise contacting the machine's moving parts.

No excavation work will take place below the level of the base of an adjacent foundation, retaining wall or other structure until it has been determined by the SSHO that such excavation will in no way create a hazard to workers. If excavations, either shoring or bracing, endanger the stability of adjoining buildings or walls underpinning, or some other method affording equivalent protection for workers will be provided as necessary to ensure their safety. All such systems will be inspected daily or more often, as conditions warrant, by the SSHO and the protection effectively maintained.

Accumulations of water in excavations, which endanger the stability of those excavations or pose a hazard to employees, will be controlled before work progresses. Special considerations will be made for excavations adjacent to structures or improvements, or subject to vibration or accumulation of groundwater.

In lieu of a shoring system, the sides or walls of an excavation or trench may be sloped, provided equivalent protection is provided. Where sloping is used as a substitute for shoring, the slope will be 1 horizontal to 1 vertical unless the instability of the soil requires slope flatter than 1 to 1. All sloping or benching must be done in accordance with applicable OSHA regulations for the specific soil conditions.

In hard, compact soil where the depth of the excavation or trench is 8 feet or less, a vertical cut of 3-1/2 feet with sloping of 1 horizontal to 1 vertical is permitted. In hard, compact soil where depth of the excavation or trench is 12 feet or less, a vertical cut of 3-1/2 feet with sloping of 1 horizontal to 1 vertical is permitted.

7.0 GENERAL PROCEDURE FOR HAND TOOLS AND MACHINERY

Only those persons competent by reason of training or experience as approved by the SSHO will perform Work with any tools other than simple hand tools. All hand tools will be kept in good condition and used only for the purposes for which they were designed. Wrenches with sprung jaws, impact tools with mushroomed heads, and wooden handled tools with cracks or splinters are examples of unsafe hand tools. Tools having defects that will impair their strength or render them unsafe will be tagged or made inoperable and removed from service.

Appropriate guards must be in place during operation of all power tools. Guards and safety devices must remain in place on power tools unless removed according to manufacturer's instruction for maintenance by the SSHO and must be replaced before use. Belts, gear, shafts, drums, flywheels, chains or other rotating, reciprocating or moving parts exposed to employees or representing other hazards must be guarded.

Proper PPE must be used when operating power tools or hand tools that may cause projectiles, cuts or abrasions, dust, fumes, or mists, or which pose a risk of harm to arms, legs, or feet if dropped.

Only non-sparking tools will be used in locations where sources of ignition may cause a fire or explosion. Electric power tools must be approved, double insulated or grounded in accordance with 29 CFR 1926.402. Ground fault circuit interrupters will be used where equipment is not otherwise grounded.

Power tools will be inspected, tested and determined to be safe for operation prior to use. Continued periodic inspections or maintenance will be done according to the manufacturers' recommendations.

Rotating or reciprocating portable power tools will have a constant pressure switch that will shut off the power when the operator releases the tool. A portable power tool may have a lock-on control provided that a single motion can turn it off.

Manufacturer's recommended operating pressures for hydraulic hoses, valves, pipes, filters, and other fittings will not be exceeded. All hydraulic or pneumatic tools that are used on or around energized lines or equipment will have non-conducting hoses having adequate strength for the normal operating pressures.

Loose or frayed clothing, loose long hair, finger rings, necklaces, chains, watches, bracelets, or hanging earrings will not be worn when using power tools, working around machinery, or on any site where chemical contamination is possible or has been identified.

These general procedures will be followed during the tasks associated with this phase of the project. The inspection of excavation at the site will be documented with regard to its integrity and safety.

8.0 FIRST AID

If an emergency occurs that requires the use of first aid, the following procedures will be followed:

Eyes - If foreign material gets into the eye(s), the eye(s) should be washed with copious amounts of water for least 15 minutes. Occasionally, the upper and lower lids should be lifted. Medical attention should be sought immediately. An emergency eyewash will be available on-site.

Dermal Contact - If impacted material comes into contact with the skin, the affected area should be promptly washed with soap or mild detergent and flushed well with water. The affected area should be checked for signs of skin irritation. Medical attention should be sought if an unusual appearance or skin sensation is noted.

Clothing Penetration - If impacted material penetrates protective clothing, the protective clothing and underlying clothing should be discarded immediately. Skin should be washed as described above.

Inhalation - If a person inhales impacted air, the person should be immediately moved to a well-ventilated area. If the individual is not noticeably overcome and has no side effects after about 5 minutes, the individual will be allowed to return to work. Artificial resuscitation should be used if breathing has stopped. In such instances, medical attention should be sought after victim has resumed breathing or, if possible, while the individual is being resuscitated.

Ingestion - If an individual ingests impacted materials, their mouth should be flushed with water, but this water should not be swallowed. The local emergency medical center should be contacted. If appropriate, vomiting should be induced by physical means or with syrup of ipecac (DO NOT induce vomiting in unconscious persons). Medical attention should be sought immediately.

Cold Stress – If an individual is observed to be suffering from cold stress, they should seek shelter and replace wet clothing with dry clothing. Do not rub or manipulate extremities. Do not give coffee or alcohol to the individual. Do not put the victim in a shower or bath. Medical attention should be sought immediately.

In accordance with American National Standard Institute (ANSI) - A358.1, a 15-minute flow eyewash station will be maintained at each work site. This will be positioned within 100 feet of the work area and within 10 seconds travel time.

If at any time personnel feel fatigued, dizzy, nauseous, or experience a headache, the individual should be moved to a well-ventilated area and allowed to rest for a least 15 to 30 minutes. If symptoms do not subside, medical attention should be sought immediately.

1. No eating, drinking, or smoking on-site, except in the support zone.

2. Rings, watches, bracelets, necklaces, or other jewelry is prohibited because it could trap chemical contamination or get caught in moving equipment.

3. No facial hair that would interfere with respirator fit.

4. Buddy system at all times in Level C or B environments, or when working around heavy equipment such as backhoes or drill rigs.

9.0 PERSONAL PROTECTIVE EQUIPMENT

All workers will be required to wear proper work attire, work boots and be clean-shaven to allow a proper fit of a respirator, regardless of the level of protection utilized. Any personnel found to be disregarding the personal hygiene-related provisions will be barred from the site. All visitors must supply their own PPE, which meets the requirements of this plan. BETA will not supply safety gear for visitors aside from hard hats and glasses.

Based on an evaluation of the anticipated potential hazards, a personal protection level of the following work zone and/or task has been designated for all persons within the work zones or completing the identified tasks:

- Excavation Worker (inside open excavation): C, contractor's responsibility to upgrade to Level B.
- Soil Management Area Worker: C with downgrade to Modified D.
- Exclusion Zone: C with down grade to a modified D.
- Contaminant Reduction Area: C with down grade to a modified D.
- Support Zone: D.
- Remedial Well Installation and Development: Modified Level D with upgrade to C.
- Tasks Encountering Groundwater: C with down grade to a modified D.

All tasks not identified above are designated as personal protection Level D areas.

Level C protection will be the minimum required protection for the remedial activities within the Exclusion and Contaminant Reduction Zones, and Soil Management Areas, except as noted below. The most hazardous organic contaminant concentrations detected at present are found in the groundwater and saturated soils at the Site within these areas.

PPE includes specialized clothing and apparatus used specifically to reduce exposure of on-site workers to chemical and physical hazards.

Level D Protection

Level D is the minimal amount of protection. Workers will be assigned the appropriate work clothes, footgear and headgear to meet the specific requirements of the work activity assigned to the employee. The work gear will consist of an appropriate, task specific uniform, work boots, and hard hats. Disposable coveralls with impervious gloves and boots or boot coverings will be made available to workers in direct contact with contaminated soil or liquids, if necessary. Level D does not require the use of any respiratory protection. Workers may use respirators to reduce unpleasant odors while working in Level D if they so choose.

Level D personal protection will be accepted for all tasks in which the worker will not encounter groundwater or potentially organic contaminated soils at the Site. If a worker has the potential to contact groundwater or organic contaminated soil via inhalation, skin absorption, ingestion and/or eye contact additional personal protection will be applicable.

A Modified Level D can be used when the risk of organic and/or inorganic material inhalation is minimal, but there is the risk of skin absorption. This level of protection will consist of the normal Level D protection and a "TYVEK" type coverall.

The Contractor must always be equipped to upgrade to additional levels if necessary. Down grading of the specified level of protection will not be made without authorization from the remedial contractor's SSHO or Project Manager. When working in a level of protection, the Contractor must provide the next higher level of protection equipment in case of emergencies.

Level C Protection

If the vapor levels in the work area exceed the Level C action level; respiratory protection will be used. Level C includes the use of:

Full face or half-face air purifying respirators with HEPA/organic vapor cartridges, coveralls, impervious gloves and boots and proper work clothes as required under Level D. Latex gloves will be worn under the impervious work gloves. Gloves and boots will be taped to the coveralls to prevent liquid from entering clothing. If contact is expected to be heavy, liquid resistant coveralls should be worn. It may in some instances be helpful to wear two sets of coveralls to assist in decontamination.

All personnel will don PPE in the support zone, as required, for the required level of protection. Personnel will enter and leave the exclusion zone only by passing through the contamination reduction zone. The SSHO will inspect all personnel for proper use of PPE before entry to the exclusion zone.

Level B and A Protection

Level B includes the use of supplied air, in conjunction with Level C protection. Level A includes the use of supplied air with a fully encapsulating suit. The Certified Industrial Hygienist (CIH) will develop specific measures for using these levels of protection, if the need arises.

BETA Personnel will conduct air monitoring when applicable. Each designated operator will be properly trained in the use of the monitoring equipment. The results of all air monitoring will be recorded and used as the basis for specifying PPE, the SSHO's determination of the need to upgrade/downgrade onsite protective measures and determining if the project should continue operation or be shut down until the hazard has subsided. Monitoring procedures and action levels are documented in Table 2.

Table 2: Monitoring Procedures, Locations and Action Levels

EQUIPMENT	PROTECTION LEVEL	CEILING VALUE	REFERENCE	REQUIRED ACTION
Explosi-meter	NA	>10% LEL	Mfg. Data / 29 CFR 1910.94	Evacuate
Oxygen Monitor	NA	<19% O_2	Mfg. Data / 29 CFR 1910.94	Evacuate
PID/FID (Exclusion and Work Zones)	D	<10ppm TVOC (measured as PCE) or Cartridge Limits	29CFR 1910.1000 or Cartridge Mfg.	None
PID/FID (Exclusion and Work Zones)	D	>10ppm TVOC (measured as PCE) or Cartridge Limits	29CFR 1910.1000 or Cartridge Mfg.	Upgrade to Level C
PID/FID (Work Zones)	C	>25ppm TVOC (measured as PCE) or Cartridge Limits	29CFR 1910.1000 or Cartridge Mfg.	Evacuate[5]
PID/FID (Exclusion Zone)	C	>25ppm TVOC (measured as PCE)	29CFR 1910.1000	Evacuate[5]& Upgrade to Level B[6]
GC or equal (Fence-Line)	NA	<5 ppm		None
GC or equal (Fence-Line)	NA	>5 ppm		Shutdown or take odor control actions[5]

NOTES:
1) FID = Flame-ionization Detector. .
2) NA = Not applicable.
3) PID = Photoionization Detector.
4) If worker is supplied with air.
5) Refer to Soil Management Plan.
6) Contractor to provide equipment requirements in their Health & Safety Plan.

10.0 STANDARD OPERATING PROCEDURES

Accidents and exposures can be prevented during potentially hazardous tasks by following standard operating procedures (SOPs), which have proven to be safe and effective in the past. The following SOPs shall be used throughout the project:

Security of Work Areas

Work areas will be clearly marked by means of fences, barricades, traffic cones and/or banner tape. Caution tape and/or hazard fencing will encompass all soil piles, drummed waste, tanks and other potentially hazardous areas. Vehicles and equipment stored on-site will be locked. Supplies will be stored in the vehicles or trailers at the end of each workday. Any storage areas will also be securely locked.

Site Entry Procedures

All workers at the site will be required to attend an orientation safety meeting. The SSHO will brief all personnel on the provisions of this HASP. All access to work areas containing contaminated materials will be through a controlled access corridor. It is the duty of the SSHO to assure this occurs.

All visitors, including state or government employees, requiring access to the work area to inspect or observe site activities will be required to remain in the support zone unless they can document proper training to allow site entry. Should the visitor(s) verify sufficient training, they will be required to read this plan prior to entering the site. The SSHO or Project Manager will escort visitors. Visitors will be required to use the same level of protection required for workers in the area. Visitors must be briefed by the SSHO on the relevant safety issues.

Confined Space Entry

A confined space has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces may include, but are not limited to cofferdams, underground vaults, tanks, hoppers, storage bins, pits and diked areas, vessels, and silos.

A permit-required confined space is one that meets the definition of confined space and has one or more of these characteristics: (1) contains or has the potential to contain a hazardous atmosphere, (2) contains a material that has the potential for engulfing an entrant, (3) has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section, and/or (4) contains any other recognized serious or health hazards.

It is desirable to ventilate all confined spaces before entry with a blower that has a capacity of 1,000 cubic feet per minute or greater. The blower shall be located to assure exhaust gases are not blown into the confined space. Ventilation of the confined space by means of a blower should be conducted a minimum of five minutes prior to entering. The blower shall continue to operate while workers are in the confined space.

Tests shall be made prior to entering the confined space (pre-testing), to determine the presence of an explosive atmosphere, oxygen levels, hydrogen sulfide, and carbon monoxide with an atmosphere monitor. Atmospheric monitoring will be conducted for all contaminants in a confined space. Oxygen will always be monitored first. The required alarm levels are: 10% LEL; 19.5% oxygen deficiency; 2.5 ppm hydrogen sulfide, and 35 ppm carbon monoxide.

Pretest the confined space by lowering the sampling hose or monitor into the area near the base, for a period of three minutes and observe any alarm conditions, this procedure would then continue to the mid-point of the confined space where the procedure would be repeated. All results of these tests must be recorded and kept on file at the Project Site.

The atmospheric monitor shall be field calibrated according to manufacturers' instructions. The results must be recorded and maintained on an instrument log. The SSHO or one who has been trained by the manufacturer and designated by the SSHO will conduct calibration.

SOPs for confined space entry requiring permits will be in complete accordance with all OSHA standards including 29 CFR 1910.146 (Permit Required Confined Spaces for General Industry).

Dust and Soil Control

All stockpiles of contaminated soil will be covered with polyethylene sheeting to prevent the spread of dust and vapors. Contaminated stockpiles will be bermed to prevent the spread of soil. All haul roads will be kept free of contaminated soil. Watering of haul roads and open areas may be necessary to control dust.

Action levels for the implementation of dust suppression measures and other off-site receptors from the release of airborne contaminants will be based upon U.S. Environmental Protection Agency (EPA) Ambient Air Quality Standards and Massachusetts Allowable Ambient Levels (AALs) and Threshold Effects Exposure Limits (TELs).

11.0 SITE CONTROL MEASURES

Safety fencing and signage will be provided to protect personnel involved with the work and any visitors from potential contact with toxic or hazardous materials at the site. BETA will stake out the limits of the work areas, as required. A fence will be constructed on the perimeter of the work zone to prevent unauthorized personnel, equipment, or vehicles from entering the site. Portions of the work zones not encompassed by a fence will be enclosed by means of barricades, snow fences, traffic cones and/or caution tape.

For the protection of workers, passersby, and the environment, OSHA and the EPA will divide the site of hazardous material handling activities into three zones as recommended. The three work zones to be established in various areas on the site are:

- Exclusion Zone (contamination/hot zone)
- Contamination Reduction Zone (transition/warm zone)
- Support Zone (clean/cold zone)

Exclusion Zone - The Exclusion Zone constitutes the area where active hazardous materials handling is occurring, and where contamination can be expected. Protective clothing and personal protection devices appropriate for conditions observed will be used by all persons in this zone. Air monitoring, construction activities, and the presence of contaminated materials will determine the extent of this zone.

Contamination Reduction Zone - The area between the Exclusion Zone and the Support Zone will serve as the transition area between the contaminated and clean zone. This area will serve to control access to and egress from the Exclusion Zone, and will include equipment and personnel decontamination facilities. This zone serves as the location for donning PPE when entering the Exclusion Zone and for removing PPE and conducting decontamination operations when leaving the Exclusion Zone. Please note that decontamination must not interfere with the treatment or transportation of injured or ill employee who may have life threatening injuries to a medical facility.

Support Zone - The support zone is the outermost area of the site and is considered a non-contaminated or clean area. The support zone contains the office for fields operations, first aid station, and other work and cleanup support. Normal work clothes are appropriate apparel within this zone. Potentially contaminated personnel, clothing, and equipment are not permitted in this zone.

The extent and relative location of the above zones will differ during the project, depending upon site conditions and areas available for work to be conducted.

12.0 CONTINGENCY PLAN

Injury or Illness

If an injury or illness occurs, take the following action: Get First Aid for the person immediately and notify the SSHO. The SSHO is responsible for immediately notifying the Project Manager, and preparing and submitting an Injury/Illness Incident Report within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. If a subcontractor employee is injured, the Subcontractor Field Supervisor will also complete their own injury/illness investigation and submit a copy of their report to the BETA SSHO as well.

The SSHO will assume charge during a medical emergency.

Site Incident

If an incident occurs, take the following action:

Notify the SSHO immediately. The SSHO is responsible for immediately notifying the Project Manager, and preparing and submitting a Site Injury/Incident Report within 24 hours.

BETA GROUP, INC.

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM

(All BETA and subcontractor personnel must sign.)

I acknowledge I have reviewed a copy of the Health and Safety Plan for this project, I understand it, and I agree to comply with all of its provisions. I also understand the Site Health and Safety Officer or other BETA personnel could prohibit me from working on this project for not complying with any aspect of this Health and Safety Plan:

Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date

BETA GROUP, INC.

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